CLIMATE RISK COUNTRY PROFILE

AZERBAIJAN

WORLD BANK GROUP

ADB ASIAN DEVELOPMENT BANK

Graphic Design: Circle Graphics, Reisterstown, MD.

ACKNOWLEDGEMENTS

This profile is part of a series of Climate Risk Country Profiles that are jointly developed by the World Bank Group (WBG) and the Asian Development Bank (ADB). These profiles synthesize the most relevant data and information on climate change, disaster risk reduction, and adaptation actions and policies at the country level. The profile is designed as a quick reference source for development practitioners to better integrate climate resilience in development planning and policy making. This effort is co-led by Veronique Morin (Senior Climate Change Specialist, WBG), Ana E. Bucher (Senior Climate Change Specialist, WBG) and Arghya Sinha Roy (Senior Climate Change Specialist, ADB).

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Climate and climate-related information is largely drawn from the Climate Change Knowledge Portal (CCKP), a WBG online platform with available global climate data and analysis based on the latest Intergovernmental Panel on Climate Change (IPCC) reports and datasets. The team is grateful for all comments and suggestions received from the sector, regional, and country development specialists, as well as climate research scientists and institutions for their advice and guidance on use of climate related datasets.

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FOREWORD

Climate change is a major risk to good development outcomes, and the World Bank Group is committed to playing an important role in helping countries integrate climate action into their core development agendas. The World Bank Group (WBG) and the Asian Development Bank (ADB) are committed to supporting client countries to invest in and build a low-carbon, climate-resilient future, helping them to be better prepared to adapt to current and future climate impacts.

Both institutions are investing in incorporating and systematically managing climate risks in development operations through their individual corporate commitments.

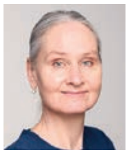
For the World Bank Group: a key aspect of the World Bank Group's Action Plan on Adaptation and Resilience (2019) is to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation and evaluation of development outcomes. For all International Development Association and International Bank for Reconstruction and Development operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the World Bank Group's Climate and Disaster Risk Screening Tool which enables all Bank staff to assess short- and long-term climate and disaster risks in operations and national or sectoral planning processes. This screening tool draws up-to-date and relevant information from the World Bank's Climate Change Knowledge Portal, a comprehensive online 'one-stop shop' for global, regional, and country data related to climate change and development.

For the Asian Development Bank (ADB): its Strategy 2030 identified "tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability" as one of its seven operational priorities. Its Climate Change Operational Framework 2017–2030 identified mainstreaming climate considerations into corporate strategies and policies, sector and thematic operational plans, country programming, and project design, implementation, monitoring, and evaluation of climate change considerations as the foremost institutional measure to deliver its commitments under Strategy 2030. ADB's climate risk management framework requires all projects to undergo climate risk screening at the concept stage and full climate risk and adaptation assessments for projects with medium to high risk.

Recognizing the value of consistent, easy-to-use technical resources for our common client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group and ADB's Sustainable Development and Climate Change Department have worked together to develop this content. Standardizing and pooling expertise facilitates each institution in conducting initial assessments of climate risks and opportunities across sectors within a country, within institutional portfolios across regions, and acts as a global resource for development practitioners.

For common client countries, these profiles are intended to serve as public goods to facilitate upstream country diagnostics, policy dialogue, and strategic planning by providing comprehensive overviews of trends and projected changes in key climate parameters, sector-specific implications, relevant policies and programs, adaptation priorities and opportunities for further actions.

We hope that this combined effort from our institutions will spur deepening of long-term risk management in our client countries and support further cooperation at the operational level.



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KEY MESSAGES

- Temperatures in Azerbaijan are projected to rise at a faster rate than the global average, with potential warming of 4.7°C by the 2090s over the 1986–2005 baseline, under the highest emissions pathway (RCP8.5).
- Maximum and minimum temperatures are projected to rise faster than the global average, which will amplify the impacts on human health, livelihoods, and ecosystems.
- The strongest warming is expected to occur during summer months, with average temperatures between July and September projected to rise by almost 6°C by the 2090s, under the RCP8.5 pathway.
- Increases in temperature of this magnitude could reduce agricultural productivity, exacerbate issues of desertification and soil salinity, and increase demand for irrigation, putting further pressure on the country's water supply.
- A warmer climate would also pose multiple threats to public health in Azerbaijan, increasing the rate of heat-related medical issues in urban areas such as Baku, and lengthening the seasonal window during which malaria occurs.
- There is a risk that the impacts of climate change will be disproportionately felt by those least able to adapt. For example, poorer communities in rural areas are more reliant on rain-fed agriculture, which is likely to be negatively impacted by more frequent droughts.
- Poorer communities are often dependent on poor quality water infrastructure, lack diversified income sources and assets, and will be least able to adapt their livelihoods to disaster risks such as drought and extreme heat.

COUNTRY OVERVIEW

Azerbaijan is the largest of the three countries of the southern Caucasus by area, lying at the boundaries of Europe and Asia. The country is bounded to the east by the Caspian Sea with an 850 km coastline and to the north by the Greater Caucasus mountain range. The country is covered by a substantial river network as part of the Caspian Sea basin.[1] Azerbaijan had an estimated population of 9.9 million in 2018 and has been classified as an upper-middle income country since 2016. This classification reflects the very high GDP per capita growth, which in 2014 stood at over eight times its 2004 level. Economic growth and relative prosperity is primarily as a result of the substantial increase in oil and gas production. The oil and gas sector represented 88% of the country's exports in 2016 (OEC, 2016). In terms of employment, the services sector represented 49.3% of jobs in 2017, followed by the agricultural (36.4%) and industrial (14.4%) sectors. Since the 1990's significant progress has been made on key social indicators, such as the prevalence of poverty, undernourishment, and infant mortality in Azerbaijan (see key indicators in **Table 1**).

Azerbaijan has signed and ratified the Paris Climate Agreement. In its Nationally Determined Contributions (2017), the country has outlined climate change mitigation actions in its energy, oil and gas, residential and commercial, transport, agricultural, and waste sectors. Azerbaijan's NDC is currently under review and an updated NDC is

[1] Ministry of Ecology and Natural Resources (2015). Republic of Azerbaijan. Third National Communication to the UNFCCC on Climate Change. URL: https://unfccc.int/sites/default/files/resource/azenc3.pdf

expected to be released by the end of 2021. Azerbaijan is also planning to align its climate change legislation with the EU standards and to develop industry-specific guidelines for the implementation of the Paris Agreement across various sectors, in particular agriculture and energy sectors. These actions primarily entail technological improvements to reduce the negative environmental impact of various sectors of the economy, together with some regulatory changes and public awareness measures. Additionally, adaptation measures in the areas of agriculture, water supply, forestry, coastal communities, human health and tourism have been identified in the country's Third National Communication to the UNFCCC (NC3) (2015). Azerbaijan has begun its National Adaptation Plan (NAP) process, which is anticipated be in place by 2024. While Azerbaijan's National Communications address a wide range of sectors in relation to projected climate change impacts and related adaptation measures, the NAP will focus on three areas, as defined by the Ministry of Ecology: water, agriculture, and coastal areas.[2] Azerbaijan has also developed and implemented its Nationally Appropriate Mitigation Actions (NAMA), which primarily target three key sectors: energy efficiency in buildings (retrofitting), transport through the modification of transport fleet (introduction of hybrid cars) and eco-driving, and oil industry through capturing and use of associated gas. Azerbaijan's first NAMA projects were piloted with SOCAR (State Oil Company, major GHG emitter) and are being considered for replication across the country and sectors.[3]

TABLE 1. Key indicators

Indicator	Value	Source
Population Undernourished[4]	<2.5% (2017–2019)	FAO, 2020
National Poverty Rate[5]	5.1% (2018)	ADB, 2019
Net Annual Migration Rate[6]	0.01% (2015–2020)	UNDESA, 2019
Infant Mortality Rate (Between Age 0 and 1)[7]	2.1% (2015–2020)	UNDESA, 2019
Average Annual Change in Urban Population[8]	1.58% (2015–2020)	UNDESA, 2018
Dependents per 100 Independent Adults[9]	43.4 (2020)	UNDESA, 2019
Urban Population as % of Total Population[10]	52.9% (2018)	State Statistics Committee of Azerbaijan, 2018
External Debt Ratio to GNI[11]	36.4% (2018)	ADB, 2020
Government Expenditure Ratio to GDP[12]	30.3% (2018)	ADB, 2020

[2] UNDP (2020). Supporting Azerbaijan to advance their NAP process. Climate Change Adaptation. URL: https://www.adaptation-undp.org/projects/supporting-azerbaijan-advance-their-nap-process
[3] SOCAR (2021). Nationally Appropriate Mitigation Actions for Low-Carbon End-Use Sectors in Azerbaijan. SOCAR-GEF. URL: http://nama.az/index_en.html?#
[4] FAO, IFAD, UNICEF, WFP, WHO (2020). The state of food security and nutrition in the world. Transforming food systems for affordable healthy diets. FAO. Rome. URL: http://www.fao.org/documents/card/en/c/ca9692en/
[5] ADB (2019). Poverty data: Azerbaijan. URL: https://www.adb.org/countries/azerbaijan/poverty [accessed 17/12/20]
[6] UNDESA (2019). World Population Prospects 2019: MIGR/1. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
[7] UNDESA (2019). World Population Prospects 2019: MORT/1-1. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
[8] UNDESA (2019). World Urbanization Prospects 2018: File 6. URL: https://population.un.org/wup/Download/ [accessed 17/12/20]
[9] UNDESA (2019). World Population Prospects 2019: POP/11-A. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
[10] State Statistics Committee of Azerbaijan (2018). URL: https://www.stat.gov.az/ [accessed 12/01/21]
[11] ADB (2020). Key Indicators for Asia and the Pacific 2020. Asian Development Bank. URL: https://www.adb.org/publications/key-indicators-asia-and-pacific-2020
[12] ADB (2020). Key Indicators for Asia and the Pacific 2020. Asian Development Bank. URL: https://www.adb.org/publications/key-indicators-asia-and-pacific-2020

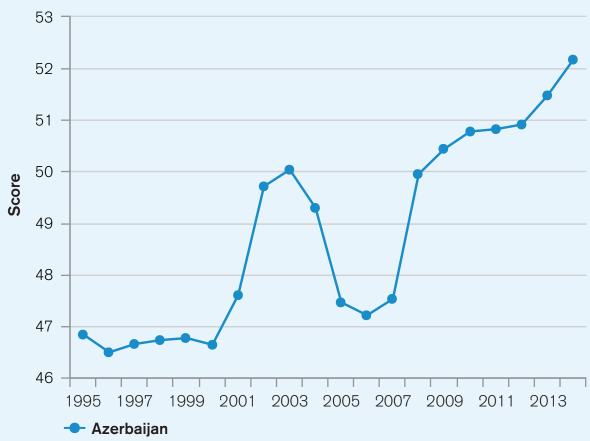
Green, Inclusive and Resilient Recovery

The coronavirus disease (COVID-19) pandemic has led to unprecedented adverse social and economic impacts. Further, the pandemic has demonstrated the compounding impacts of adding yet another shock on top of the multiple challenges that vulnerable populations already face in day-to-day life, with the potential to create devastating health, social, economic and environmental crises that can leave a deep, long-lasting mark. However, as governments take urgent action and lay the foundations for their financial, economic, and social recovery, they have a unique opportunity to create economies that are more sustainable, inclusive and resilient. Short and long-term recovery efforts should prioritize investments that boost jobs and economic activity; have positive impacts on human, social and natural capital; protect biodiversity and ecosystems services; boost resilience; and advance the decarbonization of economies.

This document aims to succinctly summarize the climate risks faced by Azerbaijan. This includes rapid onset and long-term changes in key climate parameters, as well as impacts of these changes on communities, livelihoods and economies, many of which are already underway. This is a high-level synthesis of existing research and analyses, focusing on the geographic domain of Azerbaijan, therefore potentially excluding some international influences and localized impacts. The core data presented is sourced from the database sitting behind the World Bank Group's Climate Change Knowledge Portal (CCKP), incorporating climate projections from the Coupled Model Inter-comparison Project Phase 5 (CMIP5). This document is primarily meant for WBG and ADB staff to inform their climate actions and to direct them to many useful sources of secondary data and research.

Due to a combination of political, geographic, and social factors, Azerbaijan is recognized as vulnerable to climate change impacts, ranked 73rd out of 181 countries in the 2020 ND-GAIN Index.[13] The ND-GAIN Index ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. The more vulnerable a country is the lower their score, while the more ready a country is to improve its resilience the higher it will be. Norway has the highest score and is ranked 1st. **Figure 1** is a time-series plot of the ND-GAIN Index showing Azerbaijan's progress.

FIGURE 1. The ND-GAIN Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. It aims to help businesses and the public sector better prioritize investments for a more efficient response to the immediate global challenges ahead.



[13] University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: https://gain.nd.edu/our-work/country-index/

Climate Baseline

Overview

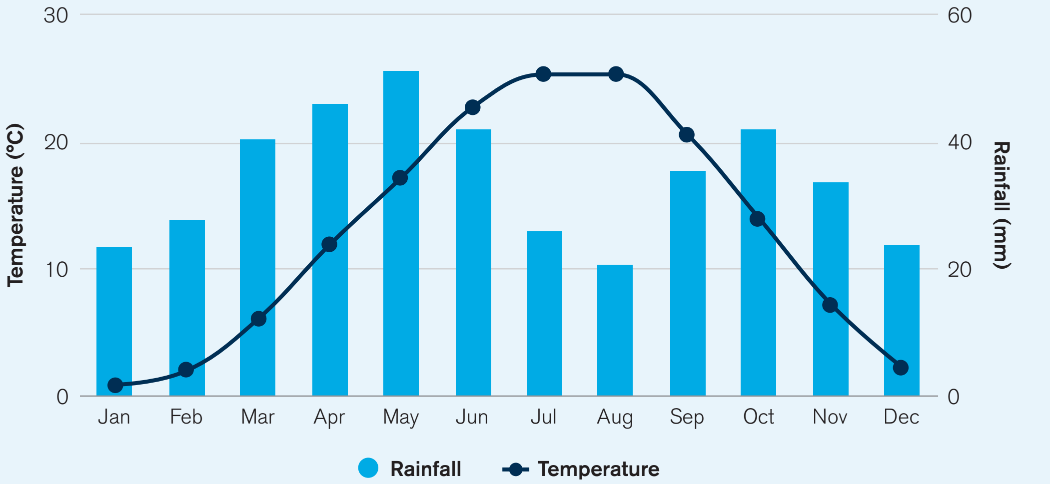
Azerbaijan's climate is highly varied, with different areas of the country containing examples of nine of the world's eleven climate zones. This includes semi-arid zones in the center and east of the country (including the capital, Baku), temperate zones in the north, continental zones in the west, cold and tundra zones, meaning that there are marked variations in average annual temperature and precipitation in different regions. In general, more mountainous parts of Azerbaijan receive higher levels of precipitation and lower average temperatures than the central lowlands and Caspian Sea coast, where the climate is drier and hotter. Azerbaijan experiences hot summers (especially in lowland areas) and moderate winters. Average temperatures for the latest climatology, 1991–2020, ranged between approximately 24°C in the summer months of July and August, and –1°C to 1°C during the winter (December to February). The average monthly temperatures vary significantly between different regions and altitudes across Azerbaijan. Average temperatures in Baku and other parts of the east and southeast reach approximately 27°C during the hottest months of July and August, while temperatures during these months remain between 15°C and 20°C in parts the mountainous north and west. Similarly, during the winter (December to February) temperatures in Baku average between 3°C and 4°C, whereas in western and northern areas average monthly temperatures fall to between –5°C and –10°C.[14]

Average rainfall in Azerbaijan follows a bimodal distribution throughout the months of the year, with average levels above 40 millimeters (mm) per month from April to June, and again in October (**Figure 2**). Precipitation is highest in May and June in the northern and western areas of Azerbaijan, where it can exceed 100 mm per month in places. On the other hand, precipitation in Baku remains below 25 mm per month on average for much of the year (from January to September) and averages only 33 mm in the wettest months of October and November (**Figure 3**).

[14] Ministry of Ecology and Natural Resources (2015). Republic of Azerbaijan. Third National Communication to the UNFCCC on Climate Change. URL: https://unfccc.int/sites/default/files/resource/azenc3.pdf

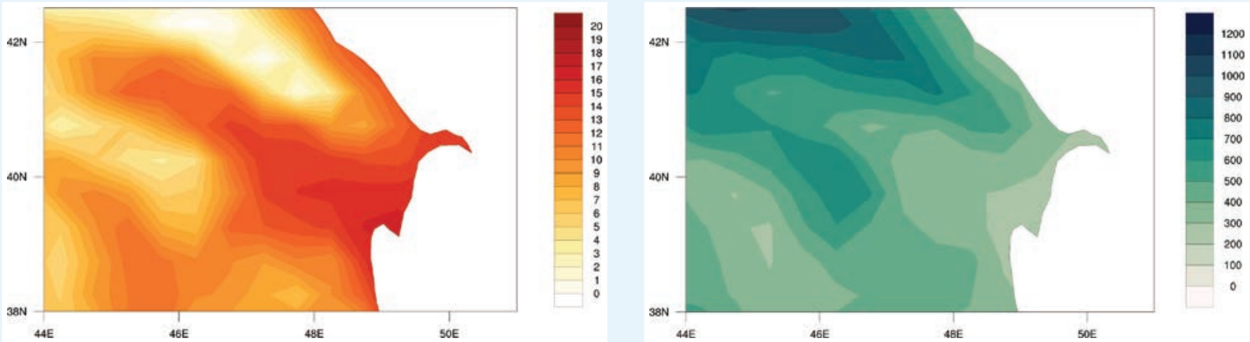
Annual Cycle

FIGURE 2. Average monthly temperature and rainfall in Azerbaijan (1991–2020).[15]



Spatial Variation

FIGURE 3. (Left) annual mean temperature (°C), and (right) annual mean rainfall (mm) in Azerbaijan over the period 1991–2020.



Maps present the coordinates of Azerbaijan: latitude 44°59′09″E – 50°20′24″E and 41°16′36″N – 38°28′10″N.

Key Trends

Temperature

Azerbaijan's NC3 reports an increase in temperatures across the country of 1.3°CC in 2010, relative to the average annual temperatures observed in the period 1961–1990. In Baku, the capital, temperatures during the summer months of June, July and August 2010 were 2.9°CC–3.2°CC higher than the 1961–1990 baseline. This increase in annual average temperatures was more acute in areas of higher altitude (>1,000 meters [m]), where 2010 temperatures were 1.9°CC above their 1961–1990 levels. Increase in temperature was observed mainly during

[15] WBG Climate Change Knowledge Portal (CCKP, 2020). Climate Data: Historical. URL: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-historical

summer season which was about 0.90°CC in Absheron-Gobustan region, 1.10°C in Lesser Caucasus region, 0.80°C in Lankaran-Astara region and 0.90°C in Kura-Araz region. Increase in temperature in Nakhcivan region was observed in summer and autumn seasons (0.80°C). Annual anomaly of temperature was observed mainly in Ganja (1.10°C) and Dashkasan (1.20°C) stations of Lesser Caucasus. In line with these temperature increases, glacial loss over the period 1906–2006 in Azerbaijan was approximately 50%.[16]

Precipitation

Trends in precipitation in Azerbaijan are variable with a degree of uncertainty. The amount of precipitation, seasonal and annual is determined by the interaction of air masses with the landscape and the Caspian Sea. The Southern shore of the Absheron Peninsula and Southeast of Gobustan traditionally receive the minimum average annual precipitation (150–200 mm per year). The Southeastern lowlands of Samur-Davachi, Araz plain of Nakhchivan AR, main parts of Gobustan and Absheron Peninsula precipitation experience less than 300 mm. Precipitation gradually increases from the Caspian Sea to the west and increases up the mountains and can experience as much as 1,400 to 1,600 mm. While the majority of the precipitation coincides with the warm period (April-October), summer months are mostly dry and even the annual precipitation rate in the Lankaran-Astara, a region with abundant precipitation, diminishes by 5–15%.[17]

A Precautionary Approach

Studies published since the last iteration of the IPCC's report (AR5), such as Gasser et al. (2018), have presented evidence which suggests a greater probability that earth will experience medium and high-end warming scenarios than previously estimated.[18] Climate change projections associated with the highest emissions pathway (RCP8.5) are presented here to facilitate decision making which is robust to these risks.

Climate Future

Overview

The main data source for the World Bank Group's Climate Change Knowledge Portal (CCKP) is the Coupled Model Inter-comparison Project Phase 5 (CMIP5) models, which are utilized within the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), providing estimates of future temperature and precipitation. Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. In this analysis RCP2.6 and RCP8.5, the extremes of low and high emissions pathways, are the primary focus RCP2.6 represents a very strong mitigation scenario, whereas RCP8.5 assumes business-as-usual scenario. For more information, please refer to the RCP Database.

[16] Ministry of Ecology and Natural Resources (2015). Republic of Azerbaijan. Third National Communication to the UNFCCC on Climate Change. URL: https://unfccc.int/sites/default/files/resource/azenc3.pdf

[17] Ministry of Ecology and Natural Resources (2015). Republic of Azerbaijan. Third National Communication to the UNFCCC on Climate Change. URL: https://unfccc.int/sites/default/files/resource/azenc3.pdf

[18] Gasser, T., Kechiar, M., Ciais, P., Burke, E. J., Kleinen, T., Zhu, D., . . . Obersteiner, M. (2018). Path-dependent reductions in CO2 emission budgets caused by permafrost carbon release. Nature Geoscience, 11, 830–835. URL: http://pure.iiasa.ac.at/id/eprint/15453/

For Azerbaijan, these models show a trend of consistent warming that varies by emissions scenario. While the projections for precipitation reflect a higher degree of uncertainty, the projected precipitation trends indicate a likely reduction in precipitation throughout the year. An increase in intensity for extreme rainfall events is also likely. **Tables 2** and **3** below, provide information on temperature projections and anomalies for the four RCPs over two distinct time horizons; presented against the reference period of 1986–2005.

TABLE 2. Projected anomaly (changes °C) for maximum, minimum, and average daily temperatures in Azerbaijan for 2040–2059 and 2080–2099, from the reference period of 1986–2005 for all RCPs. The table is showing the median of the CCKP model ensemble and the 10–90th percentiles in brackets[19]

	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
Scenario	**2040–2059**	**2080–2099**	**2040–2059**	**2080–2099**	**2040–2059**	**2080–2099**
RCP2.6	1.3 (–1.1, 3.8)	1.2 (–1.0, 3.8)	1.3 (–0.7, 3.4)	1.2 (–0.6, 3.3)	1.3 (–0.6, 3.1)	1.1 (–0.5, 3.2)
RCP4.5	1.8 (–0.6, 4.2)	2.5 (0.3, 5.2)	1.7 (–0.5, 3.8)	2.3 (0.4, 4.7)	1.7 (–0.3, 3.6)	2.2 (0.3, 4.6)
RCP6.0	1.6 (–0.2, 3.7)	3.2 (1.1, 5.5)	1.6 (0.0, 3.4)	3.1 (1.2, 5.1)	1.5 (–0.2, 3.3)	2.8 (0.9, 4.8)
RCP8.5	2.4 (–0.1, 4.9)	5.0 (2.5, 7.6)	2.3 (0.1, 4.5)	4.7 (2.5, 7.1)	2.2 (0.1, 4.3)	4.6 (2.4, 6.9)

TABLE 3. Projections of average temperature anomaly (°C) in Azerbaijan for different seasons (3-monthly time slices) over different time horizons and emissions pathways, showing the median estimates of the full CCKP model ensemble and the 10th and 90th percentiles in brackets.[18]

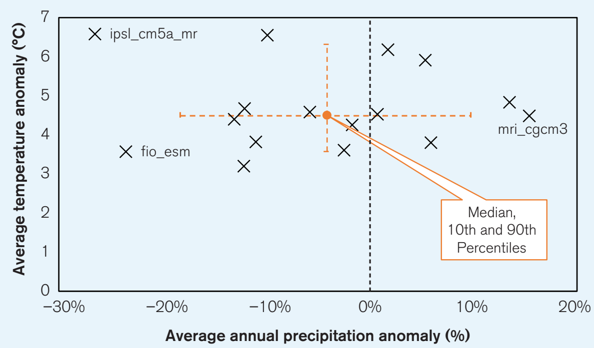
	2040–2059		2080–2099	
Scenario	**Jun–Aug**	**Dec–Feb**	**Jun–Aug**	**Dec–Feb**
RCP2.6	1.5 (–0.3, 4.5)	1.2 (–1.4, 3.1)	1.4 (–0.6, 4.2)	1.2 (–1.0, 3.1)
RCP4.5	2.1 (0.0, 5.2)	1.5 (–1.5, 3.2)	2.8 (1.0, 6.1)	1.9 (–0.4, 4.2)
RCP6.0	1.8 (0.0, 3.8)	1.7 (–0.3, 3.4)	3.5 (1.5, 5.8)	2.8 (0.8, 4.8)
RCP8.5	2.8 (0.8, 6.1)	1.9 (–1.3, 3.7)	5.6 (3.6, 9.0)	4.0 (1.3, 6.1)

[19] WBG Climate Change Knowledge Portal (CCKP, 2020). Climate Data: Projection. URL: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-projections

Model Ensemble

Climate projections presented in this document are derived from datasets available through the CCKP, unless otherwise stated. These datasets are processed outputs of simulations performed by multiple General Circulation Models (GCM) (for further information see Flato et al., 2013).[20] Collectively, these different GCM simulations are referred to as the 'model ensemble'. Due to the differences in the way GCMs represent the key physical processes and interactions within the climate system, projections of future climate conditions can vary widely between different GCMs, this is particularly the case for rainfall related variables and at national and local scales. The range of projections from 16 GCMs for annual average temperature change and annual precipitation change in Azerbaijan under RCP8.5 is shown in **Figure 4**. Spatial representation of future projections of annual temperature and precipitation for mid and late century under RCP8.5 are presented in **Figure 5**.

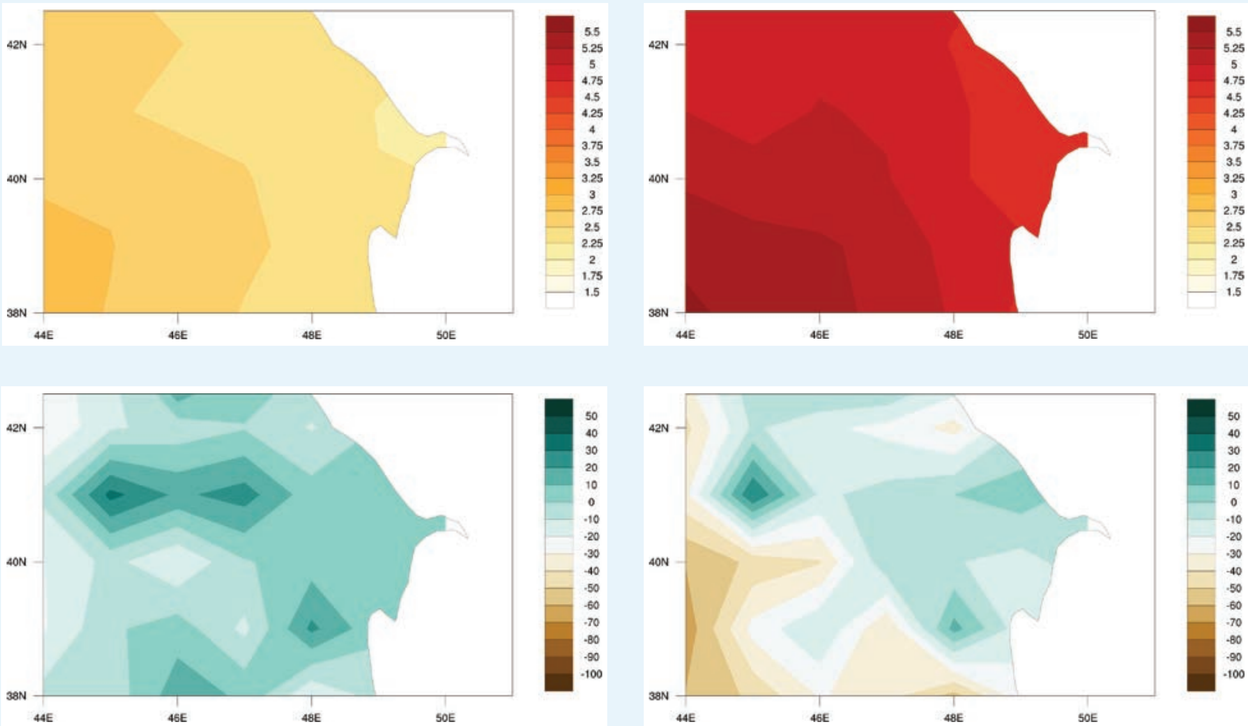
FIGURE 4. 'Projected average temperature anomaly' and 'projected annual rainfall anomaly' in Azerbaijan. Outputs of 16 models within the ensemble simulating RCP8.5 over the period 2080–2099. Models shown represent the subset of models within the ensemble which provide projections across all RCPs and therefore are most robust for comparison.[18] Three models are labelled.



[20] Flato, G., Marotzke, J., Abiodun, B., Braconnot, P., Chou, S. C., Collins, W., . . . Rummukainen, M. (2013). Evaluation of Climate Models. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 741–866. URL: http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf

Spatial Variation

FIGURE 5. CMIP5 ensemble projected change (32 GCMs) in annual temperature (top) and precipitation (bottom) by 2040–2059 (left) and by 2080–2090 (right) relative to 1986–2005 baseline under RCP8.5.[21]



Maps present the coordinates of Azerbaijan: latitude 44°59′09″E – 50°20′24″E and 41°16′36″N – 38°28′10″N.

Temperature

Projections of future temperature change are presented in three primary formats. Shown in **Table 2** are the changes (anomalies) in daily maximum and daily minimum temperatures over the given time period, as well as changes in the average temperature. **Figures 6** and **7** display the annual and monthly average temperature projections. While similar, these three indicators can provide slightly different information. Monthly/annual average temperatures are most commonly used for general estimation of climate change, but the daily maximum and minimum can explain more about how daily life might change in a region, affecting key variables such as the viability of ecosystems, health impacts, productivity of labor, and the yield of crops, which are often disproportionately influenced by temperature extremes.

[21] WBG Climate Change Knowledge Portal (CCKP 2020). Azerbaijan. Climate Data. Projections. URL: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-projections

Temperatures in Azerbaijan are projected to rise by approximately 4.7°C by the 2090s under the RCP8.5 emissions pathway, and by 1.2°C in the RCP2.6 emissions pathway, from the 1986–2005 baseline. The projected increases in temperature in Azerbaijan are above the global average increases, especially in the more extreme emissions scenarios. Temperature rises, as shown in **Table 2**, are even more significant in terms of maximum and minimum temperatures.

FIGURE 6. Historic and projected average annual temperature in Azerbaijan under RCP2.6 (blue) and RCP8.5 (red) estimated by the model ensemble. Shading represents the standard deviation of the model ensemble.[22]

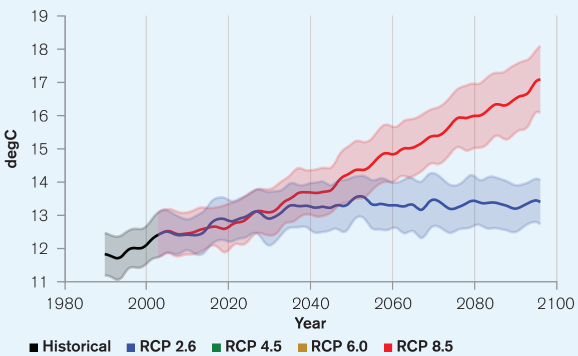
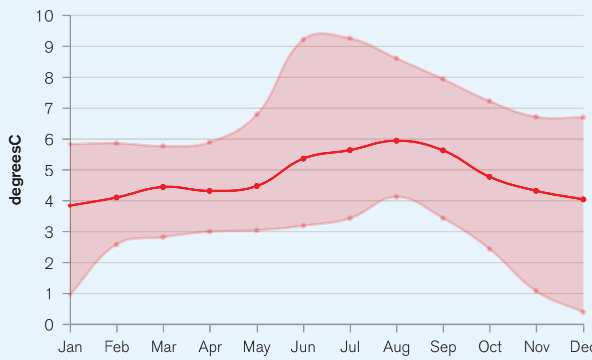


FIGURE 7. Projected change (anomaly) in monthly temperature, shown by month, for Azerbaijan for the period 2080–2099 under RCP8.5. The value shown represents the median of the model ensemble with the shaded areas showing the 10th–90th percentiles.[21]



As shown in **Figure 6**, the projected increases in average temperature are more pronounced during the summer months. This seasonal trend is present in all emissions pathways with the exception of RCP2.6. As seen in **Figure 7,** average temperatures in the RCP8.5 pathway between July and September are forecast to rise by 5.6°C to 5.9°C by the 2090s, compared with a projected rise of between 3.8°C and 4.1°C in the months of December, January and February. The median number of summer days (days with temperature in excess of 25°C) per year is projected to increase from 95 to 151 days by the end of the century, under RCP8.5.

[22] WBG Climate Change Knowledge Portal (CCKP 2020). Azerbaijan. Climate Data. Projections. URL: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-projections

The spatial variation of climate changes in Azerbaijan is complex and further work is required to enhance downscaled models that capture the full range of possible futures projected by the ensemble of global climate models. The large-scale climate models in the CCKP ensemble suggests that the eastern parts of Azerbaijan along the Caspian Sea coast (including the capital and largest city, Baku) will experience less of an increase in annual temperature compared with the western parts of the country. Under the most extreme emissions pathway (RCP8.5), Baku is projected to see annual temperatures rise around 0.6°C less, by the end of the 21st century, than in Gəncə, a large city in the west of the country.

Precipitation

While considerable uncertainty clouds projections of local long-term future precipitation trends, some global trends are evident. The intensity of sub-daily extreme rainfall events appears to be increasing with temperature, a finding supported by evidence from different regions of Asia.[23] However, as this phenomenon is highly dependent on local geographical contexts further research is required to constrain its impact in Azerbaijan. The median level of precipitation ranges between 454 mm and 499 mm in the four emissions pathways, relative to a baseline median of 444 mm per year. There is greater confidence around changes to the future intensity of heavy rainfall events. Increased rainfall events are likely to be experienced in the central and northern areas. These changes match global trends, which suggests the intensity of sub-daily extreme rainfall will increase as temperatures increase, a finding supported by evidence from different regions of Asia.[24]

CLIMATE RELATED NATURAL HAZARDS

Azerbaijan faces significant disaster risk levels and is ranked 61st out of 191 countries by the 2020 Inform Risk Index[25] (**Table 4**). This ranking is driven strongly by the exposure component of risk. Azerbaijan has relatively high exposure to natural hazards such as flooding, including, riverine, flash, and coastal, and relatively low institutional strength to combat increased risks and natural hazard exposure. The country's risk is enhanced particularly by high levels of drought risk (ranked 35th), but also by its moderate levels of flood risk and social vulnerability. The section that follows analyses climate change influences on the exposure component of risk in Azerbaijan. As seen in **Figure 1**, the ND-GAIN Index presents an overall picture of a country's vulnerability and capacity to improve its resilience. In contrast, the Inform Risk Index identifies specific risks across a country to support decisions on prevention, preparedness, response and a country's overall risk management.

[23] Westra, S., Fowler, H. J., Evans, J. P., Alexander, L. V., Berg, P., Johnson, F., Kendon, E. J., Lenderink, G., Roberts, N. (2014). Future changes to the intensity and frequency of short-duration extreme rainfall. Reviews of Geophysics, 52, 522–555. URL: https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2014RG000464

[24] Westra, S., Fowler, H. J., Evans, J. P., Alexander, L. V., Berg, P., Johnson, F., Kendon, E. J., Lenderink, G., Roberts, N. (2014). Future changes to the intensity and frequency of short-duration extreme rainfall. Reviews of Geophysics, 52, 522–555. URL: https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2014RG000464

[25] European Commission (2020). INFORM Index for Risk Management. Azerbaijan Country Profile. URL: https://drmkc.jrc.ec.europa.eu/inform-index/Countries/Country-Profile-Map

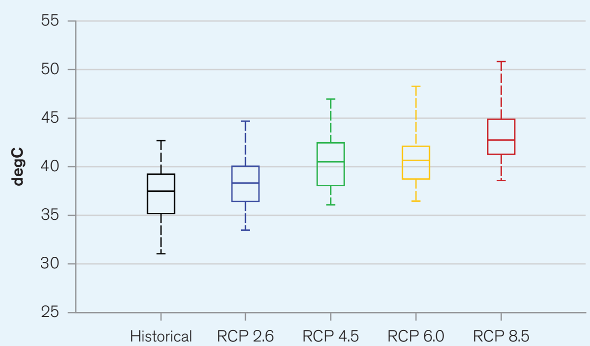
TABLE 4. Selected indicators from the INFORM 2017 Index for Risk Management for Azerbaijan. For the sub-categories of risk (e.g. "Flood") higher scores represent greater risks. Conversely the most at-risk country is ranked 1st. Global average scores are shown in brackets.

Natural Hazards (0–10)	Hazards & Exposures (0–10)	Institutional Strength (0–10)	Socio-Economic Vulnerability (0–10)	Lack of Coping Capacity (0–10)	Overall Inform Risk Level (0–10)	Rank (1–191)
4.9	5.0	6.4	2.2	2.3	4.7	61

Heatwaves

Azerbaijan can experience high maximum temperatures, with an average monthly maximum of around 17°C, however, summer temperatures peak with an average July maximum of 31°C. The current median probability of a heat wave (defined as a period of 3 or more days where the daily temperature is above the long-term 95th percentile of daily mean temperature) is around 2%[21]. The model ensemble projects an increase in the annual probability of a heatwave occurring in Azerbaijan in the 2090s in all emissions pathways, with the probability of a heat wave being significantly higher than its historical (1986–2005) level in all pathways except for RCP4.5. This increase in the probability of heat waves is projected to affect all parts of the country equally. However, to a large extent this rise reflects the impact of general long-term warming, which moves the ambient temperature further away from the baseline upon which heatwave conditions are based. Overall, climate change is likely to mean that heat stress becomes a much more regular occurrence. As shown in **Figure 8**, under three of the four emissions pathways, Azerbaijan is projected to experience temperatures above 40°C on an annual basis by the 2090s.

FIGURE 8. Boxplots showing the historical and projected annual maximum of daily maximum temperatures in Azerbaijan for the period 2080–2099 over four emissions pathways.[21]



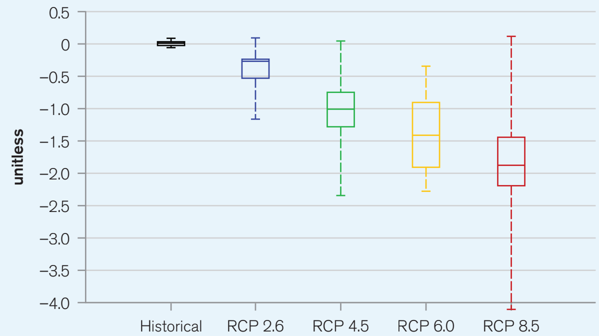
Drought

Two primary types of drought may affect Azerbaijan, meteorological (usually associated with a precipitation deficit) and hydrological (usually associated with a deficit in surface and subsurface water flow, potentially originating in the region's wider river basins). In combination with local land and crop management practices, these may also lead to agricultural drought. At present, Azerbaijan faces an annual median probability of severe meteorological drought of around 2%, as defined by a standardized precipitation evaporation index (SPEI) of less than –2.[26]

[26] WBG Climate Change Knowledge Portal (CCKP, 2020). Climate Data: Historical. URL: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-historical

Naumann et al. (2018) provide a global overview of changes in drought conditions under different warming scenarios.[27] They project large increases in the duration and magnitude of meteorological droughts in West Asia by the end of the 21st century under global warming levels of 1.5°C, 2.0°C and 3.0°C. Droughts of a magnitude that is extremely rare at present in West Asia (100-year droughts) are projected to become 5 to 10 times more common under the same warming scenarios. Similarly, the model ensemble projects a significant increase in the annual probability of experiencing severe drought by the 2090s in all four pathways (**Figure 9**). The projected rise in the probability of severe drought is especially pronounced in the higher emissions pathways, from an observed median of 2% per year from 1986–2005 to a forecast median probability of 73% or 85% by the end of the century for RCP6.0 and RCP8.5, respectively. These estimates reflect a transition to a chronically drought-affected environment in many regions of Azerbaijan, and are likely to contribute to the expansion of arid ecosystems and desertification.

FIGURE 9. Boxplots showing the annual probability of experiencing a 'severe drought' in Azerbaijan (–2 SPEI index) in 2080–2099 under four emissions pathways.[21]



Flood

Azerbaijan experiences frequent flooding, though estimates of the extent of this flooding vary. Flooding typically occurs in late spring and early summer in higher altitude areas of the country (above 1,500 m in altitude), whereas in lower areas, flooding may occur in spring or autumn.[28] The parts of the country at greatest risk of floods are in the central and south-eastern regions,[29] while some parts of the country, such as the south slope of the Greater Caucasus, experience mudflows caused by flooding.[27] Severe flooding occurred in Azerbaijan in 2003, when 30,000 people were affected, resulting in over $70 million in damage. Flooding in 1995 affected 1.5 million people, a far greater proportion of the population than in 2003, and caused approximately $30 million worth of damage.[28] Azerbaijan's water resources depend primarily on two key river basins, that of the Kur and Aras rivers. The future hydrology of their basins, including the greater and lesser Caucasus mountain ranges, will likely determine fluvial flooding trends.

[27] Naumann, G., Alfieri, L., Wyser, K., Mentaschi, L., Betts, R. A., Carrao, H., . . . Feyen, L. (2018). Global Changes in Drought Conditions Under Different Levels of Warming. Geophysical Research Letters, 45(7), 3285–3296. URL: https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2017GL076521

[28] Skøien, J., Salamon, P., Alagic, E., Alobeiaat, A., Andreenko, A., Bari, D., Ciobanu, N., Doroshenko, V., El-Ashmawy, F., Givati, A., Kastrati, B., Kordzakhia, M., Petrosyan, Z., Spalevic, M., Stojov, V., Tuncok, K., Verdiyev, A., Vladikovic, D. & Zaimi, K. (2018). Assessment of the capacity for flood monitoring and early warning in Enlargement and Eastern/ Southern Neighbourhood countries of the European Union, EUR 29073 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-79-77771-4, doi:10.2760/18691, JRC108843. URL: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC108843/kjna29073enn.pdf

[29] GFDRR (2017). Disaster Risk Profile: Azerbaijan. URL: https://www.gfdrr.org/en/publication/disaster-risk-profile-azerbaijan [accessed 14/02/2019]

The World Resources Institute's AQUEDUCT Global Flood Analyzer can be used to establish a baseline level of river flood exposure.[30] As of 2010, assuming protection for up to a 1 in 25-year event, the population annually affected by flooding in Azerbaijan is estimated at 19,200 people and expected annual impact on GDP is estimated at $169 million. Development and climate change are both likely to increase these figures and by 2030, is expected to decrease the annually affected population by 1,100 people, and to have no significant GDP impact under the RCP8.5 emissions pathway (AQUEDUCT Scenario B).

With regard to flash flooding, the model ensemble does not project a significant increase in heavy rainfall: the average largest 5-day cumulative rainfall is not expected to be significantly higher in the 2090s than its current level in any of the four emissions pathways. However, further research is required to constrain future flash flood and landslide potential, as this rainfall projection contradicts global trends of increased rainfall intensity. Azerbaijan currently has pockets of significant landslide risk in its northern and western mountain belts.[31]

CLIMATE CHANGE IMPACTS

Natural Resources

Water

Water supply poses a challenge in Azerbaijan, due to uneven distribution of water resources both seasonally and spatially.[2] In addition to distributional issues, the country's aggregate water resources per capita are relatively low and 70%–75% of this water supply comes from sources that originate outside Azerbaijan's borders.[32] Although uncertainty exists regarding the projected levels of precipitation in Azerbaijan in future decades, increased temperatures are likely to lead to greater evaporation of water resources and reduced river flows, putting pressure on one of Azerbaijan's main sources of freshwater.[2] UNDP (2011) modelling of the impact of climate change on water resources in the South Caucasus, albeit relying on the previous iteration of general circulation models (CMIP3) in which precipitation is expected to fall in all three countries in the region by the end of the century, gives some insight into the downside risks for Azerbaijan.[33] Models projects that by 2100, streamflow will fall by 26%–35% in the Alazani basin on the Georgian border, and by 59%–72% in the Aghstev basin on the Armenian border. Given that water demand is likely to increase with higher temperatures and population growth, they project water shortfalls in the summer months in the Alazani basin.[32]

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30 WRI (2018). AQUEDUCT Global Flood Analyzer. URL: https://floods.wri.org/# [Accessed: 22/11/2018].
31 WHO (2010). Azerbaijan: Landslide Hazard Distribution Map. World Health Organization. URL: http://data.euro.who.int/e-atlas/europe/images/map/azerbaijan/aze-landslides.pdf
32 Ministry of Ecology and Natural Resources (2015). Republic of Azerbaijan. Third National Communication to the UNFCCC on Climate Change. URL: https://unfccc.int/sites/default/files/resource/azenc3.pdf
33 UNDP (2011). Regional climate change impacts study for the South Caucasus region. United Nations Development Programme. URL: https://www.ge.undp.org/content/dam/georgia/docs/publications/GE_SC-CC-2011.pdf

Water shortages are likely to coincide with an increased need for irrigation (due to higher temperatures and changes in length of growing season). This impact will be more severe in certain regions of Azerbaijan, and could reduce crop yields. The effect may be exacerbated if the existing issues in water distribution (such as leaks in the system) are not addressed. Increases in temperature associated with climate change will also lead to more rapid glacial melt, which will increase the risk of downstream flooding, landslides and mudslides.[2] For one of Azerbaijan's major glacial areas, the Gusarchay Basin, glacial area has decreased by approximately 50% over the past century.[31] Increased average temperatures in the coming decades are likely to accelerate the melting process; if this proceeds in line with the projections of glacial mass in other countries, this melting will lead to an initial increase in the flow of related rivers, followed by a longer term reduction in flow by the end of the 21st century.

The Coastal Zone

As of 2015, Azerbaijan's coastal areas were home to approximately 4 million, as well as the country's largest cities, and 75% of its industrial resources.[16] Azerbaijan's capital, Baku which sits on the Caspian Coast, accounted for approximately $39 billion (71%) of the country's GDP in 2015.[28] The Caspian Sea level fell by an average of 6.7cm per year between 1996 and 2015, with recent research finding that evaporation played a dominant role in this sea-level reduction.[34] As average temperatures in the region increase in the coming decades, this decrease in the level of the Caspian Sea is expected to continue.[35] Studies have tended to show declines in the range of 4–5 m by the end of the 21st century.[36] The socioeconomic impact of a fall of this magnitude however, is poorly studied.

Land and Soil

Climate change is projected to impact on the quality of land and soil in Azerbaijan. The country's supply of arable land is already significantly affected by issues of soil erosion, soil salinization, swamping and chemical pollution. The government of Azerbaijan estimates that approximately 42% of the country's territory is negatively affected by soil erosion, while approximately 7% of the country's area is subject to salinization.[16] These processes have contributed to the low productivity that prevails in Azerbaijan's agriculture sector.[2]

The temperature increases that are projected under the model ensemble's warming scenarios are likely to lead to increased soil salinization in Azerbaijan. Higher temperatures and more frequent drought will lead to increased evaporation, with farmers expected to respond by increasing their use of water for irrigation purposes.[16] Given the poor state of drainage systems in parts of the country,[31] the evaporation of this additional irrigation water may speed the process of salinization and damage agricultural productivity. Azerbaijan is prone to desertification, and

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[34] Chen, J. L., Pekker, T., Wilson, C. R., Tapley, B. D., Kostianoy, A. G., Cretaux, J.-F., & Safarov, E. S. (2017). Long-term Caspian Sea level change. Geophysical Research Letters, 44(13), 6993–7001. URL: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017GL073958

[35] Elguindi, N. and Giorgi, F. (2006). Projected changes in the Caspian Sea level for the 21st century based on the latest AOGCM simulations. Geophysical Research Letters, 33(8). URL: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2006GL025943

[36] Renssen, H., Lougheed, B. C., Aerts, J. C. J. H., de Moel, H., Ward, P. J., & Kwadijk, J. C. J. (2007). Simulating long-term Caspian Sea level changes: The impact of Holocene and future climate conditions. Earth and Planetary Science Letters, 261(3), 685–693. URL: https://research.vu.nl/en/publications/simulating-long-term-caspian-sea-level-changes-the-impact-of-holo-3

this phenomenon has been exacerbated in past decades by overgrazing, improper irrigation and farming practices, and the removal of trees.[37] As climate change increases the frequency of drought in the country, the process of desertification may accelerate in the absence of sufficient mitigation measures. One study conducted at the global level highlighted Azerbaijan as a hotspot for the expansion of more arid land covers.[38]

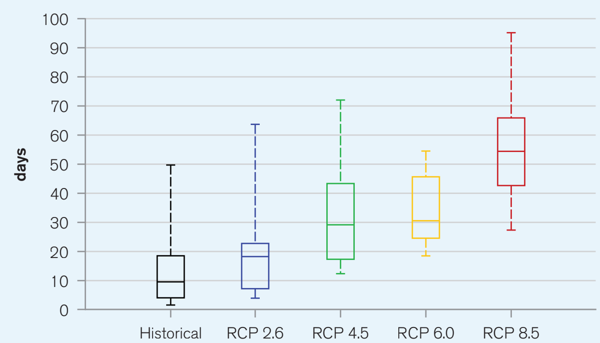
Economic Sectors

Agriculture

Agriculture is an important sector of the Azerbaijan economy, with approximately 58% of land area used for farming and over 36.4% of employment taking place in this sector. Productivity in agriculture, however, is below the national average, so that the sector only accounted for 5.0% of GDP on average from 2013 to 2017. Climate change in Azerbaijan is expected to influence food production via direct and indirect effects on crop growth processes. Direct effects include alterations to carbon dioxide availability, precipitation and temperatures. Indirect effects include impacts on water resource availability and seasonality, soil organic matter transformation, soil erosion, changes in pest profiles and the arrival of invasive species, and decline in arable areas due land degradation and desertification. On an international level, these impacts are expected to damage key staple crop yields, even on lower emissions pathways. Tebaldi and Lobell (2018) estimate 5% and 6% declines in global wheat and maize yields respectively even if the Paris Climate Agreement is met and warming is limited to 1.5°C.[39]

As the projected effects of climate change are realized over the coming decades, greater variability in precipitation, increased probability of drought and increased temperatures are likely to negatively impact the agricultural sector. The increase in the frequency of extreme temperatures over 35°C, as shown below in **Figure 10**, is a particular threat, likely damaging crop yields. In many cases, increased temperatures will also increase crop water demand. One study suggested a potential demand increase of 16% by the 2030s in eastern Azerbaijan.[40] In combination with glacial melting, transboundary competition for water resources, and unpredictable rainfall patterns, there is potential for significant stress on irrigation systems. From the 30%

FIGURE 10. Boxplots showing the model ensemble estimate of the annual number of very hot (Tmax >35°C) days in 2080–2099 under four emissions pathways in Azerbaijan.[21]



[37] Government of Azerbaijan. (2005). NATIONAL ACTION PLAN on Strengthening Capacity to Respond to Challenges of Biodiversity Conservation, Climate Change and Desertification / Land Degradation. URL: https://www.preventionweb.net/files/60655_azerbaijan.pdf [accessed 14/02/2019]

[38] Huang, J., Yu, H., Guan, X., Wang, G., & Guo, R. (2016). Accelerated dryland expansion under climate change. Nature Climate Change, 6(2), 166–171. URL: https://doi.org/10.1038/nclimate2837

[39] Tebaldi, C., & Lobell, D. (2018). Differences, or lack thereof, in wheat and maize yields under three low-warming scenarios. Environmental Research Letters: 13: 065001. URL: https://iopscience.iop.org/article/10.1088/1748-9326/aaba48

[40] Sadat, A. P., Bozorg, H. O., & Miguel, A. M. (2013). Climate Change Impact on Reservoir Performance Indexes in Agricultural Water Supply. Journal of Irrigation and Drainage Engineering, 139(2), 85–97. URL: https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29IR.1943-4774.0000496

of agricultural land area that is irrigated produces over 80% of all agricultural output.[31] This suggests that greater variability in precipitation, increased probability of drought and increased temperatures are likely to exacerbate regional and sectoral inequality in Azerbaijan, by having a disproportionately severe effect on rain-fed agriculture.

In the country's NC3, the Ministry of Ecology and Natural Resources assesses the likely impact of climate change on a number of agricultural subsectors. The cotton subsector, which has suffered from low productivity in recent decades, is expected to benefit from higher temperatures and a longer growing season, although this benefit may be offset by water shortages that are likely to affect irrigation of cotton fields. Subject to securing enough water for irrigation, cotton productivity is expected to rise by 4–5% by the latter decades of the 21st century.

Rising temperatures are projected to lead to significant changes in the altitudes at which winter wheat and vineyards may be planted in Azerbaijan by the end of the 21st century.[31] In practice this will mean that vineyards, which are currently most productive at altitudes of 800–900 m, will become productive at much higher altitudes of 1,400–1,700 m, whereas winter wheat production will become viable above its current range of 1,600–1,800 m. This is likely to reduce Azerbaijan's productivity for these two land uses, because there is a shortage of suitable land at such altitudes relative to the area under cultivation at the current productive altitudes.

There is considerable uncertainty surrounding the impact of climate change on summer and winter pasture growth in Azerbaijan.[31] Productivity in this subsector is positively related to soil moisture levels, which may be positively or negatively affected depending on precipitation levels in the coming decades. The increased probability of drought that the model ensemble projects will lead to greater volatility of production in this subsector. Any potential improvement in productivity is likely to be counterbalanced by a lack of suitable land and continuing processes of soil erosion.

A further, and perhaps lesser appreciated influence of climate change on agricultural production is through its impact on the health and productivity of the labor force. Work by Dunne et al. (2013) suggests that labor productivity during peak months has already dropped by 10% as a result of warming, and that a decline of up to 20% might be expected by the 2050s under RCP8.5.[41] In combination, it is highly likely that the above processes will have a considerable impact on national food consumption patterns both through direct impacts on internal agricultural operations, and through impacts on the global supply chain.

Energy

Research has established a reasonably well constrained relationship between heat stress and labor productivity, household consumption patterns, and (by proxy) household living standards.[42] In general terms the impact of an increase in temperature on these indicators depends on whether the temperature rise moves the ambient temperature closer to, or further away from, the optimum temperature range. The optimum range can vary depending on local conditions and adaptations.

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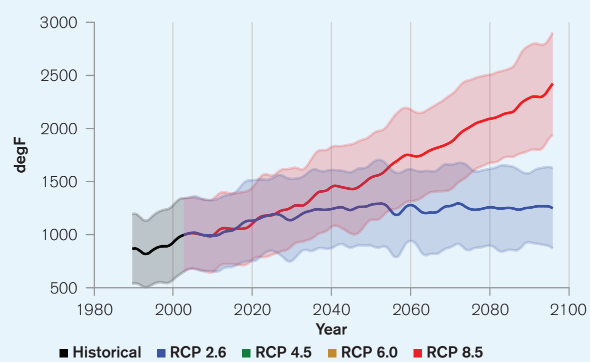
41 Dunne, J. P., Stouffer, R. J., & John, J. G. (2013). Reductions in labour capacity from heat stress under climate warming. Nature Climate Change, 3(6), 563–566. URL: http://www.precaution.org/lib/noaa_reductions_in_labour_capacity_2013.pdf

42 Mani, M., Bandyopadhyay, S., Chonabayashi, S., Markandya, A., Mosier, T. (2018). South Asia's Hotspots: The Impact of Temperature and Precipitation changes on living standards. South Asian Development Matters. World Bank, Washington DC. URL: http://documents.worldbank.org/curated/en/201031531468051189/pdf/128323-PUB-PUBLIC-DOC-DATE-7-9-18.pdf

The effects of temperature rise and heat stress in urban areas are increasingly compounded by the phenomenon of Urban Heat Island effect (UHI). Dark surfaces, residential and industrial sources of heat, an absence of vegetation, and air pollution[43] can push temperatures higher than those of the rural surroundings, commonly anywhere in the range of 0.1°C–3°C in global mega-cities.[44] As well as impacting on human health (see Communities), the temperature peaks that will result from combined UHI and climate change, as well as future urban expansion, are likely to damage the productivity of the service sector economy, both through direct impacts on labor productivity, but also through the additional costs of adaptation. Though there is a lack of research on the extent of the UHI effect in Baku, there is evidence that the city's residents are suffering ill health as a result of extremely high temperatures in the summer months. Research on the period from April to September 2003–2006, indicates that a temperature increase of 1.5°CC in Baku was correlated with an increase in first-aid calls and led to increases of 20%–34% in the number of complaints of blood, respiratory and neural diseases.[31]

Research suggests that on average, a one degree increase in ambient temperature can result in a 0.5%–8.5% increase in electricity demand.[45] Notably, this serves business and residential air-cooling systems. The projected increase in cooling demand is represented in **Figure 11** in cooling degree days. This increase in demand places strain on energy generation systems which is compounded by the heat stress on the energy generation system itself, commonly due to its own cooling requirements, which can reduce its efficiency.[46] The number of cooling degree days (when such cooling systems would be required) is projected to increase significantly in Azerbaijan by the 2090s under RCP8.5. The vulnerability of Azerbaijan's energy sector to the pressures of high heats have been exposed over the 21st century, including outages during the heatwave of 2018.

FIGURE 11. Historic and projected annual cooling degree days in Azerbaijan (cumulative degrees above 65°CF) under RCP2.6 (blue) and RCP8.5 (red). The values shown represent the median of 30+ GCM model ensemble with the shaded areas showing the 10–90th percentiles[21].



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[43] Cao, C., Lee, X., Liu, S., Schultz, N., Xiao, W., Zhang, M., & Zhao, L. (2016). Urban heat islands in China enhanced by haze pollution. Nature Communications, 7, 1–7. URL: https://www.ncbi.nlm.nih.gov/pubmed/27551987

[44] Zhou, D., Zhao, S., Liu, S., Zhang, L., & Zhu, C. (2014). Surface urban heat island in China's 32 major cities: Spatial patterns and drivers. Remote Sensing of Environment, 152, 51–61. URL: https://www.researchgate.net/publication/263283084_Surface_urban_heat_island_in_China's_32_major_cities_Spatial_patterns_and_drivers

[45] Santamouris, M., Cartalis, C., Synnefa, A., & Kolokotsa, D. (2015). On the impact of urban heat island and global warming on the power demand and electricity consumption of buildings—A review. Energy and Buildings, 98, 119–124. URL: https://pdfs.semanticscholar.org/17f8/6e9c161542a7a5acd0ad500f5da9f45a2871.pdf

[46] ADB (2017). Climate Change Profile of Pakistan. Asian Development Bank. URL: https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf

While the majority of energy produced in Azerbaijan comes from fossil fuels, hydroelectric power generation also plays a role in the country's generation capacity. Hydropower accounted for 8% of generation in Azerbaijan in 2016, down from 18% in 2010.[47] While there is little certainty in precipitation forecasts for the coming decades, the accelerated melting of glaciers and increased evaporation have the potential to damage Azerbaijan's capacity to generate energy in this way. Azerbaijan is developing long-term, low-emissions development strategies to enhance its climate-resilience actions within national development plans.[48]

Communities

Poverty and Inequality

Many of the climate changes projected are likely to disproportionately affect the poorest groups in society. Global research also shows a common trend that more unequal countries typically have proportionately more people affected by natural hazards.[49] While Azerbaijan has tended to hold lower levels of income inequality in comparison with its neighbors,[50] high levels of inequality across financial and social outcomes prevails. Climate-related hazards are likely to slow progress in improving the wellbeing of poorer groups, eradicating poverty and malnutrition. Additionally, heavy manual labor jobs are commonly among the lowest paid whilst also being most at risk of productivity losses due to heat stress[51] and poorer businesses are least able to afford air conditioning, an increasing need given the projected increase in cooling days.

In rural areas, poorer farmers and communities are least able to afford local water storage, irrigation infrastructure, and technologies for adaptation. Productivity in agriculture is already below the national average, so that the sector only accounted for 5.0% of GDP on average from 2013 to 2017. Greater variability in precipitation, increased probability of drought and increased temperatures are likely to exacerbate regional and sectoral inequality in Azerbaijan, by having a disproportionately severe effect on rain-fed agriculture. The increase in the frequency of extreme temperatures over 35°C is a particular threat, likely damaging crop yields when occurring during the growing season. Job creation outside of agriculture has been an issue in rural areas of the country,[52] suggesting that those who work in farming may have little recourse to other sources of income in the event of severe weather phenomena or shocks to crop yields.

The poorer and more rural parts of Azerbaijan are also likely to feel the biggest impact from the impact of climate change on water resources. In terms of water and sanitation, in 2009 there was a marked variation in circumstances between urban areas of the country, where 88% have access to sanitation and 96% have piped water, and rural

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47 IEA (2019). Electricity generation by fuel: Azerbaijan 1990–2016. URL: https://www.iea.org/statistics/?country=AZERBAIJAN&year=2016&category=Key%20indicators&indicator=ElecGenByFuel&mode=chart&dataTable=ELECTRICITYANDHEAT [accessed 14/02/2019]

48 Azerbaijan (2019). National Sustainable Energy Action Plan of Azerbaijan. URL: https://unece.org/fileadmin/DAM/project-monitoring/unda/16_17X/E2_A2.3/Action_Plan_of_Azerbaijan-new-03.12.2019.pdf

49 Tselios, V., & Tompkins, E. L. (2019). What causes nations to recover from disasters? An inquiry into the role of wealth, income inequality, and social welfare provisioning. International Journal of Disaster Risk Reduction, 33, 162–180. URL: https://doi.org/https://doi.org/10.1016/j.ijdrr.2018.10.003

50 Habibov, N. (2012). Income inequality and its driving forces in transitional countries: evidence from Armenia, Azerbaijan and Georgia. Journal of Comparative Social Welfare, 28(3), 209–221. URL: https://doi.org/10.1080/17486831.2012.749504

51 Kjellstrom, T., Briggs, D., Freyberg, C., Lemke, B., Otto, M., Hyatt, O. (2016). Heat, human performance, and occupational health: A key issue for the assessment of global climate change impacts. Annual Review of Public Health: 37: 97–112. URL: https://www.ncbi.nlm.nih.gov/pubmed/26989826

52 ADB (2014). Country Partnership Strategy: Azerbaijan, 2014–2018: POVERTY ANALYSIS (SUMMARY) URL: https://www.adb.org/sites/default/files/linked-documents/cps-aze-2014-2018-pa.pdf [accessed 14/02/2019]

areas, where only 40% had access to sanitation and 47% had piped water. These disparities would leave the rural population at greater risk of hardship if the water supply shortages projected by the UNDP (2011) materialize by the middle of the century.[32] The relatively poorer quality water distribution infrastructure in rural areas may also increase the risk of gastrointestinal infections if water quality or consistency of supply begins to deteriorate due to more frequent droughts and reduced river flow.

Gender

An increasing body of research has shown that climate-related disasters have impacted human populations in many areas including agricultural production, food security, water management and public health. The level of impacts and coping strategies of populations depends heavily on their socio-economic status, socio-cultural norms, access to resources, poverty as well as gender. Research has also provided more evidence that the effects are not gender neutral, as women and children are among the highest risk groups. Key factors that account for the differences between women's and men's vulnerability to climate change risks include: gender-based differences in time use; access to assets and credit, treatment by formal institutions, which can constrain women's opportunities, limited access to policy discussions and decision making, and a lack of sex-disaggregated data for policy change.[53]

Human Health

Nutrition

The World Food Program estimate that without adaptation, the risk of hunger and child malnutrition on a global scale could increase by 20% respectively by the 2050s.[54] Work by Springmann et al. (2016) has assessed the potential for excess, climate-related deaths associated with malnutrition.[55] The authors identify two key risk factors that are expected to be the primary drivers: a lack of fruit and vegetables in diets, and health complications caused by increasing prevalence of people underweight. The authors' projections suggest there could be approximately 46.2 climate-related deaths per million population linked to lack of food availability in Azerbaijan by the 2050s under RCP8.5.

There are a number of ways in which climate change may impact food consumption in Azerbaijan. Those parts of the population engaged in non-irrigated farming already have the lowest productivity levels[31] and cannot resort to irrigation in response to higher temperatures, meaning the quality of their food consumption is likely to suffer unless they can find alternative employment. Even in irrigated areas, the potential reduction in water availability and more frequent droughts and extreme temperatures could reduce crop yields. Although the prevalence of undernourishment has fallen in recent years, poorer parts of the population still spent over 60% of their income on food as of 2011, leaving their nutritional intake exposed to swings in food prices. The sharp food price rises of summer 2010 necessitated VAT exemptions from the government in order to keep staple cereal prices within an affordable range and this suggests that poorer Azerbaijanis may be exposed to the more frequent food supply shocks that may occur in the coming decades.

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[53] World Bank Group (2016). Gender Equality, Poverty Reduction, and Inclusive Growth. URL: http://documents1.worldbank.org/curated/en/820851467992505410/pdf/102114-REVISED-PUBLIC-WBG-Gender-Strategy.pdf

[54] WFP (2015). Two minutes on climate change and hunger: A zero hunger world needs climate resilience. The World Food Programme. URL: https://docs.wfp.org/api/documents/WFP-0000009143/download/

[55] Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H. C. J., Gollin, D., . . . Scarborough, P. (2016). Global and regional health effects of future food production under climate change: a modelling study. The Lancet: 387: 1937–1946. URL: https://www.ncbi.nlm.nih.gov/pubmed/26947322

Heat-Related Mortality

Research has placed a threshold of 35°C (wet bulb ambient air temperature) on the human body's ability to regulate temperature, beyond which even a very short period of exposure can present risk of serious ill-health and death.[56] Temperatures significantly lower than the 35°C threshold of 'survivability' can still represent a major threat to human health. Climate change will push global temperatures closer to this temperature 'danger zone' both through slow-onset warming and intensified heat waves. Work by Honda et al. (2014), which utilized the A1B emissions scenario from CMIP3 (most comparable to RCP6.0), estimates that without adaptation, annual heat-related deaths in the Central Asian region, will increase 139% by the 2030s and 301% by the 2050s.[57] The potential reduction in heat-related deaths achievable by pursuing lower emissions pathways is significant, as demonstrated by Mitchell et al. (2018).[58]

The impact of extremely high temperatures on human health has been increasingly evident in Baku, Azerbaijan's capital in recent years. The city is home to approximately one quarter of Azerbaijan's population and is subject to an urban heat island effect and has already seen a rise in the number of summer days with maxima exceeding 35°C, with the population struggling to adapt.[16] Research on the period from April to September 2003–2006 indicates that a temperature increase of 1.5°CC in Baku was correlated with an increase in first-aid calls and led to increases of 20%–34% in the number of complaints of blood, respiratory and neural diseases.[31] Vulnerability to heat-related mortality is set to increase as extreme temperatures and heat waves become more common and as elderly people make up a larger proportion of the country's population.

Disease

The prevalence of malaria in Azerbaijan has been successfully reduced to a very low level through public health interventions, progressing from over 13,000 cases of malaria in 1996 to zero locally-acquired cases in 2013.[59] Nonetheless, Azerbaijan's climate remains suitable for reintroduction of malaria and climate change is likely to increase this risk. Higher air temperatures will allow malaria to affect areas of higher altitude (above 1,600 m) that were previously free from the disease; this is not seen to pose a major risk to public health, however, as only a small proportion of the population lives at such high altitudes.[31]

Of greater concern is the lengthening of the epidemic period of the year that will accompany temperature rises, which will necessitate an increased effort to prevent malaria reoccurring. The number of days during spring and autumn when the average daily temperature exceeded 16°CC (the level favorable to malaria development) has increased already. Data from around the country show increases in the number of such days of between 3% and 26% in the period 1991–2010, relative to the 1961–1990 baseline, with the most pronounced increases occurring in mountainous areas such as Gadabay, Quba and Nakhchivan.[16] The widening of geographic spread and lengthening of the epidemic period of malaria in Azerbaijan are expected to occur as soon as temperature rises exceed 1.5°CC–1.6°CC.[31]

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[56] Im, E. S., Pal, J. S., & Eltahir, E. A. B. (2017). Deadly heat waves projected in the densely populated agricultural regions of South Asia. Science Advances, 3(8), 1–8. URL: https://advances.sciencemag.org/content/3/8/e1603322.full

[57] Honda, Y., Kondo, M., McGregor, G., Kim, H., Guo, Y-L, Hijioka, Y., Yoshikawa, M., Oka, K., Takano, S., Hales, S., Sari Kovats, R. (2014). Heat-related mortality risk model for climate change impact projection. Environmental Health and Preventive Medicine 19: 56–63. URL: https://www.ncbi.nlm.nih.gov/pubmed/23928946

[58] Mitchell, D., Heaviside, C., Schaller, N., Allen, M., Ebi, K. L., Fischer, E. M., . . . Vardoulakis, S. (2018). Extreme heat-related mortality avoided under Paris Agreement goals. Nature Climate Change, 8(7), 551–553. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6181199/

[59] WHO (2019). Vector-borne and parasitic diseases – Azerbaijan. URL: http://www.euro.who.int/en/health-topics/communicable-diseases/vector-borne-and-parasitic-diseases/malaria/country-work/azerbaijan [accessed 14/02/2019]

General acute gastrointestinal infection, which has affected thousands of people in Azerbaijan in recent years, may pose an increasing threat. Rising average temperatures and potential reduction in water supply may exacerbate the issues that lead to gastrointestinal infection, such as improper food storage and poor-quality water supply.[31]

POLICIES AND PROGRAMS

National Adaptation Policies and Strategies

TABLE 4. Key national adaptation policies, plans and agreements

Policy/Strategy/Plan	Status	Document Access
Nationally Determined Contribution (NDC) to Paris Climate Agreement	Submitted	January, 2017
National Communications to the UNFCCC	Three Submitted	Latest: May, 2016
Technology Needs Assessment (TNA)	Completed	July, 2012
National Sustainable Energy Action Plan of Azerbaijan	Adopted	2019

Climate Change Priorities of ADB and the WBG

ADB Country Partnership Strategy

The Asian Development Bank has agreed a Country Partnership Strategy (CPS) with Azerbaijan which covers the period from 2019–2023. Support on tackling climate change is identified as a key focus area as ADB will facilitate implementation of the NDC at national and subnational levels. Efforts will also promote low-carbon interventions in the energy and transport sectors, including phasing out old technologies and equipment. ADB will support the government's aspiration to diversify its energy mix away from mostly gas-based energy generation to more renewable sources (e.g., solar power generation). As part of the support to enhance private sector development, ADB will seek to facilitate policies and initiatives on low-carbon and climate-adaptive goods and technologies.

WBG Country Partnership Framework

Azerbaijan agreed a Country Partnership Framework (CPF) with the World Bank covering the period 2016–2020. While the CPF does not explicitly mention climate change or disaster risk, its third priority engagement area commits to contributing to improved human development outcomes and increased prosperity through better access to water and sanitation, improved quality of the environment, and other health infrastructure and services, that have proven impact on health and social welfare outcomes.

CLIMATE RISK COUNTRY PROFILE

AZERBAIJAN

WORLD BANK GROUP

ADB ASIAN DEVELOPMENT BANK