COUNTRY OVERVIEW

Armenia is a small landlocked country with complex topography. It has a history of drought, significant land degradation and active desertification processes. Frequent landslides, mudflows, floods and other natural hazards negatively impact infrastructure, agriculture and water resources, increasing the country’s vulnerability to climate variability and change. Between 1998 and 2010, weather-related hazards caused losses of $2.8 billion, averaging $450 million per year. Unemployment remains high at 17 percent, while 30 percent of the population lives in poverty. Agriculture is vital to the economy, accounting for 19 percent of GDP and employing 39 percent of the country’s population of 3 million. Agricultural production is vulnerable to increasing temperatures and reduced precipitation, particularly in areas requiring irrigation. River flows are projected to decline with rising temperatures and declining precipitation, reducing freshwater supply. Forests, which cover 11 percent of the country, are at risk due to increased aridity, which reduces growth rates and regeneration, making trees more susceptible to pests, diseases and forest fires. More frequent and longer heatwaves pose health risks, especially to vulnerable populations. (Citations: 1, 13, 14, 17)

CLIMATE PROJECTIONS

1.6 - 2.2°C increase in temperatures by 2050
Uncertain changes in average annual precipitation; 7 - 10 percent decrease in June-September precipitation by 2050
22 - 32 percent increase in extreme rainfall events by 2050

KEY CLIMATE IMPACTS

Infrastructure
Destruction of roads and highways
Damage to human settlements

Agriculture
Reduced crop yields
Damage to crops and livestock
Soil erosion

Human Health
Increased incidence of heat stroke
Increased incidence of malaria

Ecosystems
Loss of biodiversity
Reduced forest productivity

Water Resources
Reduced water supply
Decline in water quality
Reduced hydropower potential

June 2017
This document was prepared under the USAID Climate Change Integration Support (CCIS) Task Order No. AID-OAA-TO-15-00030 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

Armenia’s climate is influenced by the Caucasus Mountains, and ranges from dry sub-tropical to cold alpine. The average annual temperature (1960-2015) is 7.6°C, varying from -8°C in the high mountains to 12 to 14°C in low valleys. The coldest temperatures occur December to February (ranging from -3 to -7°C), and warmest temperatures occur in July and August (averaging about 20°C); though, in low-land areas temperatures can reach 24 to 26°C in July and August, and in high alpine regions temperatures typically do not exceed 10°C. Armenia’s average annual precipitation is 524 mm (1960-2015), over 40 percent occurring April through June; with average annual precipitation of 200 to 250 mm in low-land areas, and 800 to 1,000 mm at higher altitudes. (1, 2, 5, 6, 9,12,19)

HISTORICAL CLIMATE

Observations since 1960 include:

- Between 1960 and 2015, average annual temperature increased by 0.20°C per decade.
- Between 1960 and 2003, the average number of “hot”1 summer days increased by 10.6 percent; “cold”2 summer days per month decreased by 6 percent.
- There was no significant trend in average annual rainfall between 1960 and 2015.

FUTURE CLIMATE

Projected changes by 20503 include:

- An increase in average annual temperature of 1.6° to 2.2°C.
- An increase in the number of “hot” days and nights; a decrease in the number of “cold” days and nights.
- Inconsistent changes in average annual precipitation, but likely reductions of -7 to -10 percent in monthly average precipitation June to September.
- An increase in the number of consecutive dry days4 by 7 to 11 percent.
- An increase in extreme rainfall days5 by 22 to 32 percent.

SECTOR IMPACTS AND VULNERABILITIES

INFRASTRUCTURE

In avalanche-prone areas, abrupt terrain, steep slopes and arid land exposed to heavy rainfall events can result in landslides, flash floods and mudslides. A significant number of settlements and roads, bridges, reservoirs and other infrastructure are in landslide-prone zones where heavy rains can oversaturate unstable ground, resulting in major landslides which have destroyed hundreds of buildings and vital infrastructure, including residential areas, roads, highways and railways. In 2004, landslides caused $43 million in damages. Between 2004 and 2007, mudflows damaged 200 settlements and 600 sites on main transportation routes. In 2009, there were damages of $11.5 to

<table>
<thead>
<tr>
<th>Stressors</th>
<th>Risks</th>
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<tbody>
<tr>
<td>Rising temperatures</td>
<td>Increased flood and mudslide damage to homes, buildings, communication networks and other infrastructure.</td>
</tr>
<tr>
<td>Increased storminess</td>
<td>Increased damage to transportation routes, including roads, highways and railways.</td>
</tr>
</tbody>
</table>

$13 million from landslides and $5.7 to $7.1 million from mudslides. (1, 7, 13, 14)

1 “Hot” day or night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season.
2 “Cold” day or night is defined by the temperature below which 10% of days or night are recorded in current climate of that region or season.
3 Relative to the data from 1986-2015
4 Maximum number of consecutive days per year with less than 1 mm of precipitation.
5 Annual total precipitation when daily precipitation exceeds the 99th percentile of wet day (calculated from days when it precipitated at least 1 mm).
AGRICULTURE

Agriculture accounts for 62 percent of total land use, while 80 percent of crops require irrigation, due in part to desertification. Projected declines in summer precipitation and increases in temperature will increase the need for irrigation and contribute to increasing water scarcity. In recent decades, extreme weather events (e.g., drought, hot dry winds, hail and spring frosts) have become more frequent and extended, reducing crop yields and damaging livestock. From 2000 through 2005, Armenia suffered $107 million in economic losses to the agricultural sector due to drought, frost and floods, threatening rural livelihoods and food security. The Ararat Valley, an important region for agriculture, is also one of the hottest and driest in summer. Wheat, a key cereal crop, is projected to decline in this region by 6 to 8 percent in 2040 to 2050 due to rising temperatures and water stress.

HUMAN HEALTH

A malaria epidemic peaked in the Ararat Valley in 1998 with over 1,000 cases. While Armenia has been malaria-free since 2011, research suggests that malaria may increase in the future as climate conditions change, specifically in the country’s warm temperate forests and dry semiarid and dry tropical climate zones. Over the last thirty years, the duration of heatwaves has significantly increased, most prominently at lower elevations. In the capital, Yerevan, average heatwave duration increased by about 40 days from 1981-2013. Heat stress can have a greater impact on the elderly and those with cardiovascular diseases and other chronic illnesses; it can also disproportionately harm the poor, who frequently lack air conditioning. (4, 7, 11, 14, 18)

ECOSYSTEMS

Due to variation in elevations and climatic zones, Armenia’s ecosystems support rich biodiversity, with most species endemic or rare. Plant and animal species are likely to shift upwards in elevation due to climatic changes, altering both ecosystem structure, habitat biodiversity and ecosystem services. More than 15 percent of Armenia’s higher plant species are in danger of extinction due to projected climate change. Semi-desert and desert areas are projected to expand by 30 percent, which will accelerate desertification. More frequent summer droughts and water stress will reduce the growth rate of trees and increase susceptibility to pests and diseases; this will also create conditions conducive to more frequent and intense wildfires, leading to an estimated 14,000 to 17,000 ha of forest loss by 2030. (1, 7, 15)
WATER RESOURCES
Glacial volume declined by 50 percent since the early 1900s. Higher temperatures will increase evaporation rates and reduce winter snowpack, reducing spring runoff and Armenia’s already limited water resources. Aggregate river flow is projected to decrease by 11.9 percent by 2030 and 37.8 percent by 2100 compared to the 1961-1990 baseline period due to the combined effects of higher temperatures and reduced rainfall. Inflow to Lake Sevan, the largest freshwater lake in Armenia, is projected to decrease by more than 50 million m$^3$ in 2030, by more than 110 million m$^3$ in 2070 and by 190 million m$^3$ in 2100 compared to the current baseline. As a result, the lake’s surface level is expected to recede by 16 cm annually, threatening irrigated agriculture, municipal water supply and hydropower production. Warmer temperatures could lead to shifts in seasonal fish migration, including spawning and feeding areas for the lake’s whitefish. (1, 7, 11, 20)

POLICY CONTEXT
INSTITUTIONAL FRAMEWORK
The Ministry of Nature Protection formulates and implements policies in environmental protection and sustainable use of natural resources, and is the UNFCCC focal point. Armenia ratified the UNFCCC in 1993 and signed the Paris Agreement in 2016. The country has submitted three national communications, an INDC and first Biennial Update Report. Armenia’s INDC outlines adaptation activities for natural ecosystems; human health; water resource management; agriculture; energy; human settlements and infrastructure; and tourism. (7,8)

NATIONAL STRATEGIES AND PLANS
- Third National Communication to the UNFCCC (2015)
- Intended Nationally Determined Contributions (2015)
- Second National Communication to the UNFCCC (2010)
- Initial National Communication to the UNFCCC (1998)

KEY RESOURCES
2. Climate Service Center Germany. 2016. Climate Fact Sheet: Armenia
7. Republic of Armenia. 2016. Third National Communication to the UNFCCC.
15. UNDP/GEF. 2012. Adaptation to Climate Change Impacts in Mountain Forest Ecosystems of Armenia.
## SELECTED ONGOING EXPERIENCES

<table>
<thead>
<tr>
<th>Selected Program</th>
<th>Amount</th>
<th>Donor</th>
<th>Year</th>
<th>Implementer</th>
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<tbody>
<tr>
<td>Development of Armenia’s Fourth National Communication to the UNFCCC and Second Biennial Report</td>
<td>$1.4 million</td>
<td>GEF</td>
<td>2016-2020</td>
<td>Ministry of Nature Protection</td>
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<td>Participatory Utilization and Resource Efficiency of Water (PURE-Water)</td>
<td>$1.04 million</td>
<td>USAID</td>
<td>2017-2020</td>
<td>The Urban Foundation for Sustainable Development</td>
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<td>De-risking and scaling-up investment in energy efficient building retrofits in Armenia</td>
<td>$29.8 million</td>
<td>Green Climate Fund, Government of Armenia, UNDP</td>
<td>2016-2036</td>
<td>Ministry of Nature Protection</td>
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<td>Second Community Agriculture Resource Management and Competitiveness Project</td>
<td>$42.7 million</td>
<td>World Bank</td>
<td>2014-2020</td>
<td>Agriculture Projects Implementation Unit State Agency of the Ministry of Agriculture</td>
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<tr>
<td>Climate Forum East (CFE) II (Regional Project)</td>
<td>$1.3 million</td>
<td>EU, Austrian Development Agency, Austrian Red Cross Society</td>
<td>2015-2017</td>
<td>Armenian Red Cross Society</td>
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<td>Integrated biodiversity management, South Caucasus (Regional project)</td>
<td>$16 million</td>
<td>German Federal Ministry for Economic Cooperation &amp; Development, Austrian Development Cooperation</td>
<td>2015-2019</td>
<td>Ministry of Territorial Administration and Emergency Situations (Armenia); Ministry of Ecology and Natural Resources (Azerbaijan); Ministry of Environment Protection (Georgia)</td>
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<td>Irrigation System Enhancement Project</td>
<td>$37.5 million</td>
<td>World Bank</td>
<td>2013-2018</td>
<td>Water Sector Development Unit</td>
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<td>Geothermal Exploratory Drilling Project</td>
<td>$10.7 million</td>
<td>World Bank</td>
<td>2015-2019</td>
<td>Armenia Renewable Resources and Energy Efficiency Fund</td>
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<td>Sustainable Management of pastures and forest in Armenia to demonstrate climate change mitigation and adaptation benefits and dividends for local communities</td>
<td>$1.2 million</td>
<td>EU/UNDP</td>
<td>2013-2017</td>
<td>Ministries of Nature Protection and Agriculture, Gegharkunik Regional Administration</td>
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