In 2018, the CAREC Institute has undertaken a joint study with the International Food Policy Research Institute (IFPRI) on review of trends, challenges, and opportunities for agricultural development in the CAREC member countries.

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The study found that the climate change might impact significantly CAREC region's water resources, agricultural productivity, farm incomes, and poverty, particularly as it relates to melting of glaciers due to rising temperature, shortage of rainwater and irrigated farmland, and natural disasters provoked by the climate change, which allegedly might pose threat to public safety.

Some consequences, though, might prove suitable for agriculture in the short term, e.g. glacier melting might increase water flows for irrigation and have positive impact on pasture productivity in most regions. However, in the long term, the authors projected negative impacts, especially during dry seasons. Furthermore, the study suggested that it was difficult to predict future trends in extreme weather events and anomalies, including the prevalence of pestilence and diseases.

Specifically, findings[1] included that in **Kazakhstan**, climate change is projected to produce a faster increase in mean temperature by around 4.6 degrees Celsius by 2085. Higher temperatures are projected to accelerate glacier melt, increasing water availability in the medium-term but causing shortages in the longer term[2]. **In Kyrgyzstan**, faster-melting glaciers are expected to increase surface water flow by 2025, also increasing the risk of periodic flooding[3]. Like Kazakhstan, Kyrgyzstan is also expecting to suffer from longer-term water scarcity. The projected impact of climate change on crop productivity will vary: for instance, wheat, maize, and sugar beet productivity is expected to fall while the productivity of tobacco, rice, cotton, and some horticultural crops is expected to increase. Climate change is also projected to have a positive impact on pasture productivity in most regions, subject to stocking rates[4].

Around 93 percent of **Tajikistan's** territory is covered by mountainous terrain, which is also home to glacial water reserves vital for downstream countries on the Amu Darya river. Temperatures in Tajikistan are expected to increase by around 2 degrees Celsius by 2030. Precipitation is also expected become more erratic and intense. One of the principal dangers of climate change for the Central Asian region is the possibility that these glaciers may disappear, which some observers have projected may occur in 30 to 40 years[5].

Like other Central Asian countries, **Uzbekistan** is also expected to witness an increase in temperature of 2 to 3 degrees by the 2050s, along with added volatility in precipitation patterns. These changes are

[1] Murisic, M., T. Levine, N. Rinnerberger, J. Shah, and J. Srivastava. Kazakhstan - overview of climate change activities. Report No. 85559, World Bank, 2013.
[2] ibid.
[3] Shah, J., T. Levine, J. Srivastava, M. Murisic, and N. Rinnerberger. Kyrgyz Republic - overview of climate change activities. Report No. 85561, World Bank, 2013.
[4] Broka, S., A. Giertz, G. Christensen, C. Hanif, and D., Rubaiza, R. Rasmussen. Kyrgyz Republic: agricultural sector risk assessment. World Bank Group, 2016.
[5] Shah, J. Tajikistan - overview of climate change activities. Report No. 85563, World Bank Group, 2013.

expected to be detrimental to crop and livestock productivity, particularly in the form of damage to harvests caused by extreme weather events that are more likely under this scenario[6].

Likewise, the countries of **the Caucasus** face similar challenges with regards to climate change over this century. A World Bank study revealed that all four major agricultural regions of Azerbaijan will face increasing temperatures unprecedented in the country's recent history. Over the next five decades, the average increase in temperature is expected to be 2.4 degrees Celsius assuming moderate impacts, compared to the 0.6 degree increase observed from 1961 to 2000[7]. Moreover, the study projects that the climate impacts described will be most pronounced from August to October, which is the country's key agricultural production period. Summer temperature increases may reach as high as 4 degrees Celsius in the country's southernmost subtropical agricultural region and precipitation declines are projected to be greatest during the late spring to early autumn[8].

Natural disasters leading to agricultural crises are projected to increase in the region.

…Glaciers may disappear in 30 to 40 years.

Natural disasters leading to agricultural crises are projected to increase in the region. Mirroring the region's wide topographic and climatic diversity, Central Asia and the Caucasus are also prone to variety of natural disasters, including earthquakes, floods, avalanches, mudflows, landslides, extreme weather events, wildfires, and epidemics. Seismic threats have been realized throughout much of the region's modern history and they pose threats to agriculture in addition to public safety.

While many major agricultural zones in Central Asia and the Caucasus are heavily irrigated, droughts pose significant risks for areas depending on rain-fed agriculture such as northern Kazakhstan, where around four-fifths of the country's grain and oilseed crops are produced. Many agricultural zones in Georgia and Azerbaijan are also reliant on rainwater, particularly in mountainous areas. Both countries are located in an area vulnerable to droughts and in the past twenty years have experienced drought episodes that had widespread impacts on agriculture[9].

The region's mountainous areas suffer from a myriad of terrain-related disasters and weather risks. For example, floods occur mostly in the southern and eastern parts of Kazakhstan due to heavy rainfall and snow melt from the area's mountains[10]. Many of Kyrgyzstan and Tajikistan's rural populations reside in areas near mountainous landscapes, making them vulnerable to recurring natural disasters which cause approximately $30 million in damage annually[11] in Kyrgyzstan.

Thorough understanding of the nature and extent of the climate change would be necessary to increase the ability of policymakers to design adaptation and mitigation measures, including budgetary provisions to ensure preparedness.

[6] Sutton, W., J. Srivastava, J. Neumann, P. Droogers, and B. Boehlert. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change: impact assessment and adaptation options. Washington, DC: World Bank, 2013.
[7] Ahouissoussi, N., J. Neumann, J. Srivastava, C. Okan, B. Boehlert, and K. Strzepek. Reducing the vulnerability of Azerbaijan's agricultural systems to climate change. Report No. 87847, World Bank, 2014.
[8] ibid.
[9] ibid.
[10] Broka, S., et al. Kazakhstan: agricultural sector risk assessment. World Bank, 2016.
[11] World Bank. Kyrgyz Republic Partnership Program Snapshot. Washington, DC: World Bank, 2014.