INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

CENTRAL ASIA POLICY BRIEF 9 APRIL 2024

Climate Change Effects on Food Security in Tajikistan

Parviz Khakimov, Jovidon Aliev, Timothy S. Thomas, Jarilkasin Ilyasov, Sarah Pechtl, and Shahnila Dunston

Climate change is one of the main challenges for food security in Tajikistan in the medium and long term. Tajikistan's Agri-Food System and Sustainable Development Program (ASDP) for the period up to 2030 defined food and nutrition security as one of six priorities. Additionally, climate change is one of the key obstacles to the achievement of the country's strategic objective defined in the National Development Strategy (NDS) 2016–2030, which is to improve the living standards of the population, and one of the four strategic priorities, which is to ensure food security and access to quality nutrition by 2030.

The effects of climate change on food security in Tajikistan were examined using IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) by simulating climate change and no climate change (baseline) scenarios between 2015 and 2050.

Key findings

- The effects of climate change on food security in Tajikistan are mostly negative:
  - Projections show that by 2050, per capita food availability is going to slightly decline under the climate change scenario compared to no climate change scenario.
  - Similarly, calories per capita availability is projected to fall by about 1.9 percent by 2050 under the climate change scenario.
  - The number of people at risk of hunger in both scenarios are projected to decline. However, considering the effects of climate change, an additional 10 percent of the population will be at risk of hunger by 2050 compared to non-climate change scenario.
  - The number of malnourished children is projected to decrease year-to-year in both scenarios. However, the number of malnourished children is higher in the climate change than in the no climate change scenario. The difference is 4.4 percent by 2050.
  - Climate change will change producer, consumer, and overall welfare in Tajikistan. Producers will gain due to higher prices led by population and income growth, although they are losing own welfare due to yield decline. The loses of consumers exceed the gains of producers; hence, overall welfare will decline due to the effects of climate change.

Recommended actions

- Introduce crops and crop varieties tolerant to low moisture or drought and higher temperatures to ensure food availability in the face of climate change.
- Strengthen the capacity of producers and rural populations in adaptation to climate change and mitigation measures.
- Prioritize climate change adaptation and mitigation measures in the agricultural sector and investment in climate-smart agriculture technologies to minimize the effects of climate change on the country's population and to contribute to the food security agenda.

Introduction

Tajikistan is a small, landlocked, and mountainous country in Central Asia with a relatively open economy. Its population has grown at a faster pace than that of any other country in the Eastern European and Central Asian regions due to its high birth rate. Tajikistan has experienced rapid economic growth, with the main drivers of this growth being remittances and the agricultural sector.

To assesses the vulnerability/resilience of agriculture and food security in Tajikistan to climate change, a study was conducted using the IFPRI's International Model IMPACT. This global partial equilibrium model integrates economic, water, and crop models and simulates national and international agricultural markets, allowing an integrated analysis of changing environmental, biophysical, and socio-economic trends. The model is designed to examine future global food supply, demand, trade, prices, as well as food security. IMPACT covers 56 agricultural commodities, 159 countries, 154 water basins, and 320 food production units.[1]

The main findings regarding the effects of climate change on food security from a policy paper published in 2020 are summarized below.[2]

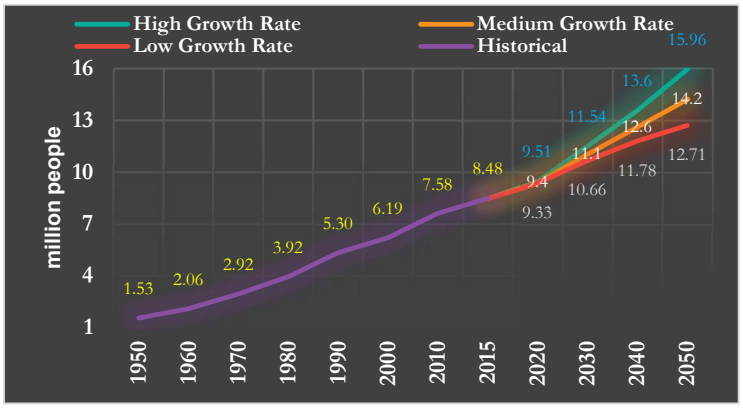
Climate change and recent trends in socio-economic development

Tajikistan has experienced prominent economic growth over the past years. A recovery (growth) of the economy started in 1998[3]. From 1990–1999, the country's GDP and GDP per capita declined by an average of 9.3 and 10.8 percent, respectively, while 2000 onward, they increased by 8 and 5.8 percent, respectively.

Three future country economic development scenarios are proposed in the NDS 2016–2030. In the inertia and industrial scenarios (the first two scenarios), the average rate of GDP growth is expected to be within 4–5 and 6–7 percent annually and the agricultural sector's share of GDP is projected to be within 22.5–23 and 19–19.5 percent, respectively. In the industrial-innovation scenario, the average rate of GDP growth is expected to lie within 8–9 percent and the share of the agricultural sector is estimated at 17–18 percent. Based on analysis of recent economic development trends, this study assumes that the rate of GDP growth, other things being equal, will be within the figures mentioned in the industrial scenario of the NDS for 2016–2030. Further, it is assumed that the average annual GDP growth will remain at the same level until 2050.

Tajikistan population is young, with a high growth rate. The absolute population increased nearly two-fold over the past 30 years, reaching 10 million people in 2023[4]. The United Nations Population Division (UNPD) proposes three scenarios for population growth in Tajikistan: high, medium, or low growth rates (Figure 1). The review and analysis of these scenarios shows that the medium growth rates are most consistent with the country's historical trend of population growth and are in line with the population projection in the NDS 2016–2030. Therefore, medium growth rates were used in the IMPACT modelling exercise.

Figure 1. Projections of population growth in Tajikistan for 2015-2050



Due to the significant effects of population growth and its effect on consumption growth, price increases, expansion of domestic production, and food availability and security, predefined population growth rate was adjusted for in the model.

According to historical data provided by the Climate Change Knowledge Portal for Development Practitioners and Policy Makers (CCKP), average annual precipitation levels might not be significantly different between the periods of 1961–1990 and 1991–2020. However, changes in precipitation levels have taken a more seasonal pattern, which directly affects agricultural activities. While precipitation levels increased in January–February of the 1991–2020 period more than in 1961–1990, the reverse can be observed during March–May. From August onward, precipitation patterns for the two date ranges remain largely the same. Contrary to precipitation data, the average monthly temperature has increased for all months during the 1991–2020 period compared to 1961–1990. Overall, the average annual temperature increased by about 0.64°C from 1991–2020 compared to 1961–1990.

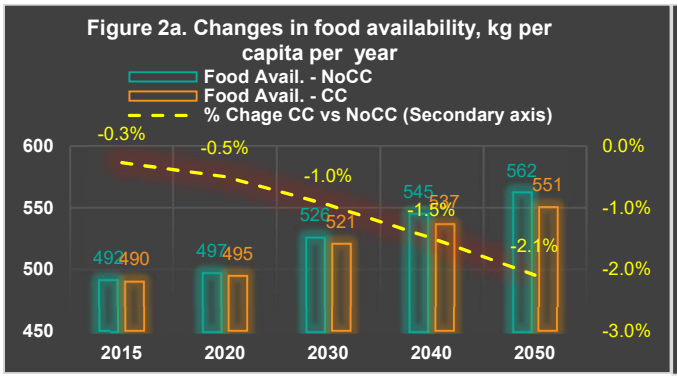
[1] For more details, see Rosegrant et al. 2012.
[2] Parviz Khakimov, Jovidon Aliev, Timothy S. Thomas, Jarilkasin Ilyasov and Shahnila Dunston (2020). Climate change effects on agriculture and food security in Tajikistan. Silk Road: A Journal of Eurasian Development | 2020, https://doi.org/10.16997/srjed.33
[3] Khakimov, 2015
[4] TAJSTAT 2023

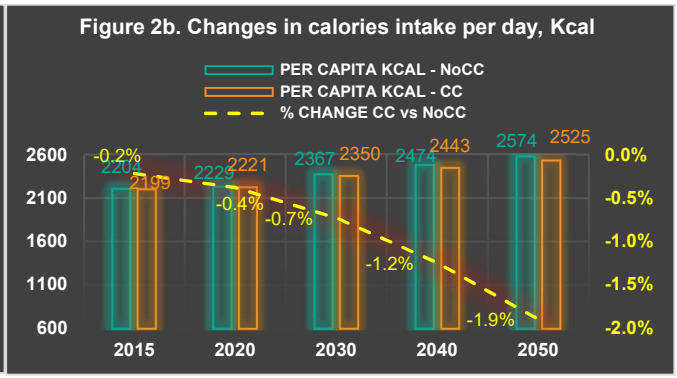
Simulated scenarios and results of analysis

In this analysis, the results of the baseline scenario are compared with the average of the four climatic scenarios[5]. The baseline scenario (Sc1)[6] allows for change in supply and demand factors with no climate change assumption. The Hadgem climatic scenario projects an increase in precipitation levels. The other three climatic models (MIROC, GFDL and IPSL) project precipitation decreases in at least some parts of the country. The scenarios project different levels of change in precipitation in 2050 compared to the base year 2015. All four scenarios project an increase in temperature in both the Amu-Darya and Syr-Darya river basins, with effects varying in both magnitude and location. As it was mentioned above, two important exogenous variables—GDP growth and population growth—were taken into consideration in these analyses, as they directly affect the global demand for food, which in turn indirectly affects most other economic variables in the model.

The findings of the study show that the effect of climate change on food security and population welfare of Tajikistan is mostly negative. By theory, supply will increase in response to demand growth led by population and income growth, but the latter are not the only determinants of a changing production pattern. Global price changes that affect supply globally will also lead to a shift in national supply. However, the effects of climate change will impede this supply increase due to a decline in yields, downward shift in domestic production, as well as continued land degradation and water scarcity. Furthermore, limited natural resources such like arable land and water, are barriers to production growth[7].

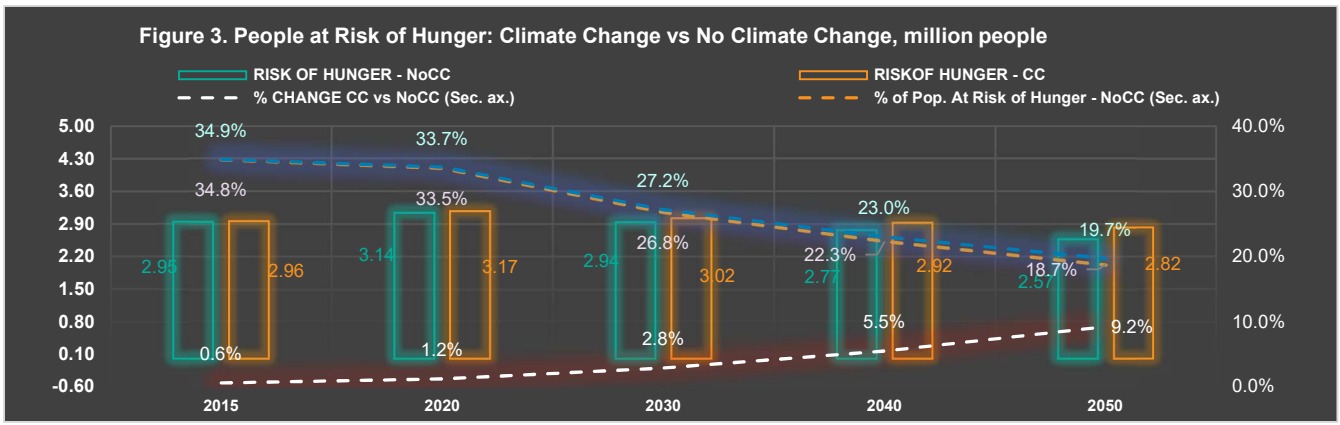
Our estimations show that by 2050 per capita food availability is going to slightly decline under the climate change scenario (Figure 2a). Similarly, calories per capita intake is projected to fall by about 1.9 percent by 2050 under the climate change scenario (Figure 2b).





Source: Own compilation based on IMPACT model results

The given rate of GDP growth is associated with fewer people being at risk of hunger in both scenarios. Allowing for climate change, the number is projected to decline by 34.5 percent between 2015 and 2050, while it is projected to decline by 40 percent without the effects of climate change (Figure 3). As the graph shows, this is a difference of almost 10 percent of the number of people at risk.



Source: Own compilation based on IMPACT model results

[5] (1) Model for Interdisciplinary Research on Climate (MIROC), developed at the University of Tokyo Center for Climate System Research; (2) Hadley Centre Global Environment Model (Hadgem); UK, (3) Geophysical Fluid Dynamics Laboratory (GFDL), Princeton University; (4) Institute Pierre Simon Laplace (IPSL) Global Climate Modelling Centre (France).
[6] In scenario 1 (SC1), the terms business as usual, baseline scenario and no climate change scenario are used interchangeably.
[7] Khakimov, 2015

Looking ahead

Climate change can be considered as one of the key obstacles to the achievement of the country's strategic objective defined in NDS 2016–2030, which is to improve the living standards of the population, and one of the four strategic priorities, which is to ensure food security and access to quality nutrition in 2030.

The study results reveal that climate change will have adverse effects on the food security of the population. Climate change will negatively affect the demand side through changes in global prices, impacting consumption patterns and impeding efforts to reduce malnutrition and food insecurity. The net trade situation will worsen in both scenarios due to increased domestic demand through population and income growth and the negative effects of climate change on the production of most commodities.

The findings gained from this socio-economic, demographic, agricultural, and climate change analysis lay the foundation for several policy recommendations.

- First, the development of climate change mitigation and adaptation strategies, capacity building, and education for farmers and rural populations should be defined as a strategic priority of the country.
- Second, in light of the limited resources available to invest in climate change adaptation, cooperation in research and development would minimize the costs of climate-change related activities and benefit each country in the Central Asia region.
- Third, it is necessary to introduce and expand water-saving technologies, in addition to more efficient and expanded irrigation.
- Fourth, introducing crops and crop varieties tolerant to low moisture or drought and higher temperatures should be considered as an important component of climate change adaptation strategies.

ACKNOWLEDGMENTS

This research has been funded by the International Food Policy Research Institute (IFPRI), Washington DC, USA.

ABOUT THE AUTHORS

Parviz Khakimov (p.khakimov@cgiar.org), Country Program Leader / Senior Research Fellow, Development Strategy and Governance (DSG) Unit of IFPRI based in Dushanbe, Tajikistan

Jovidon Aliev (j.aliev@cgiar.org), Senior Research Analyst, DSG Unit of IFPRI based in Dushanbe, Tajikistan.

Sarah Pechtl (s.pechtl-nsf@cgiar.org) is a Mickey Leland International Hunger Fellow in the Development Strategy and Governance Division of IFPRI based in Dushanbe, Tajikistan.

Timothy S. Thomas (tim.thomas@cgiar.org), Senior Research Fellow, Foresight and Policy Modelling (FPM) Unit, IFPRI, Washington, DC, USA

Shahnila Dunston (s.dunston@cgiar.org), Senior Research Analyst, FPM Unit, IFPRI, Washington, DC, USA