Policy Brief

Excessive use of natural resources and sectoral over-reliance are behind Central Asia's vulnerability to compound climate challenges

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Summary

Climate change may have significant implications for water resources in Central Asia, by altering its availability on annual and seasonal scales. Excessive reliance on water resources and low economic productivity of water use, particularly in the southern parts of the region, are the primary reason for Central Asia's high sensitivity to the impacts of climate change. The countries should prioritize increasing water use efficiency across the relevant sectors to reduce their vulnerability to climate change. This is especially true for agriculture, which is by far the largest water consumer. Promoting alternative, less water-intensive sectors of the economy is a pertinent adaptation strategy.

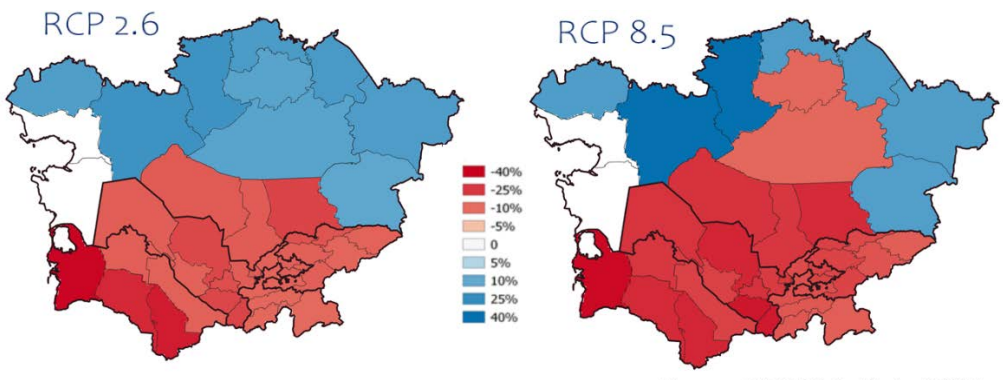
Given the interconnectedness of water and agriculture systems in the region, climate-induced water risks would also elevate hazards to the irrigated crop production. Agriculture is a major pillar of the local economy in many provinces of Central Asia, and climate impacts will be hence magnified by its importance in terms of the share of population engaged and the contribution of the sector to local economies. Diversification of the economy and consequent decline in the socioeconomic importance of agriculture need to become part of the portfolio of adaptation strategies in these subregions.

The Central Asian countries also face a common challenge of maintaining a long-term balance of power demand and supply, given that power consumption is expected to grow by more than half of present generation levels by the middle of the century. The Paris agreement puts an additional burden of carbon reduction, which is particularly relevant to Kazakhstan, Turkmenistan, and Uzbekistan, where electricity generation is significantly more carbon-intensive. Efforts for long-term energy security in Central Asia are challenged by the high energy intensity of their economies. Improving the efficiency of energy use is a crucial and cost-effective first step. National and subnational governments should also prioritize the development of less energy-intensive economic sectors and invest into scaling up the transition to renewable energy.

Water resources of the region are at the frontline of climate change

Climate change will likely alter water resources in Central Asia with contrasting trends across the region (CAREC Institute, 2022). Although subject to high uncertainty, the hydrological projections indicate that river discharge may decrease in the south of the region, which already suffers from a high level of water stress (Karthe et al., 2017). On the other hand, river discharge may increase under climate change in the north of the region, which is generally less dependent on water resources. The shifts in river flows may be more pronounced in the future under both 'pessimistic' and 'optimistic' climate scenarios during the growing season of plants, when water is most needed for irrigation in the south (Figure 1). Most provinces in Turkmenistan, Uzbekistan, and southern Kazakhstan already suffer from high levels of water stress; therefore, any further gap between water availability and demand would have exacerbating implications on water dependent sectors such as agriculture and hydropower.

Figure 1. Projected relative change in water resources availability by province in Central Asia

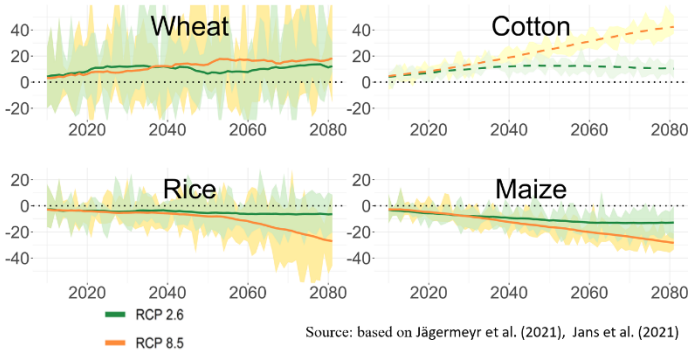


Source: CAREC Institute (2022)

Climate-induced water risks will spill over to irrigated crop production

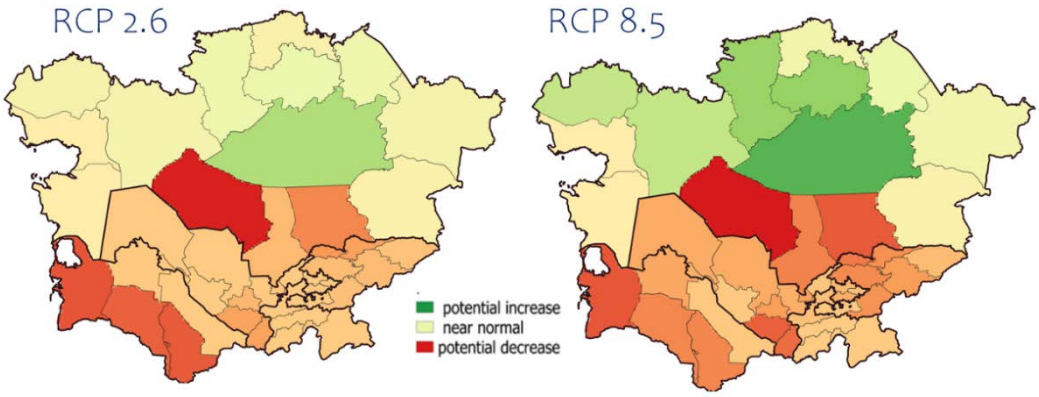
These projected shifts in water availability will have far-reaching consequences for other sectors, with agriculture being most affected by water-related risks. Climate change has heterogenous impacts on the production of major crops grown in the region. The most recent crop yield projections derived from state of the art global crop modelling experiments (Jägermeyr et al., 2021; Jans et al., 2021) indicate that maize, rice, and soybeans will likely experience a decline in productivity, whereas wheat and cotton crops may benefit from rising temperatures and increased CO_2 fertilization (Figure 2). Even so, the potential benefits for cotton and wheat may largely vanish in the southern part of the region: crop productivity here would be constrained by the timely availability of water for irrigation. This would be exacerbated in certain provinces by excessive monocropping, when agriculture is dominated by one crop or a few crops that have either negative prospects under climate change or are water-intensive.

Figure 2. Projected change in productivity of major crops in Central Asia by 2040-2069 under no water constraints



Source: based on Jägermeyr et al. (2021), Jans et al. (2021)

Figure 3. Potential change in agricultural productivity by 2040-2069 based on the current crop structure and water availability across the provinces



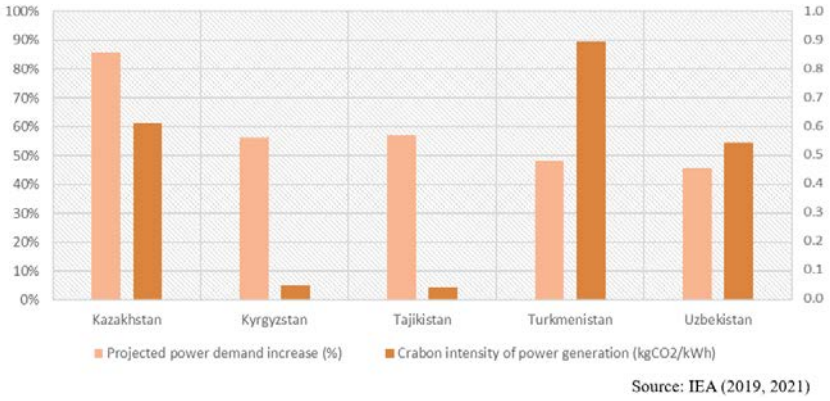
Source: CAREC Institute, 2022

The dual challenge to long-term energy security

Climate-related imperatives impose an additional burden on the region for meeting long-term energy needs. Two major challenges the countries face in the power sector are the continuous growth in demand for electricity, and a need to curb GHG emissions in the sector. As a result of anticipated population and economic growth, energy outlooks indicate that power demand in Central Asia may increase by at least 50 percent by 2050, and by as much as 90 percent in the case of Kazakhstan (IEA, 2021). Compliance with the Paris agreement, on the other hand, necessitates that any incremental growth in generation capacity comes primarily from renewable sources. While the Central Asian countries have made climate commitments in accordance with their updated nationally determined contributions for 2030, they have also expressed the intention to achieve carbon neutrality by the middle of the century, contingent on international assistance. Large-scale

adoption of renewable energy sources will therefore be unavoidable, although a costly task, which would also necessitate technical and financial support from the international community.

Figure 4. Projected electricity demand by 2050 and current carbon intensity of the power sector in Central Asia

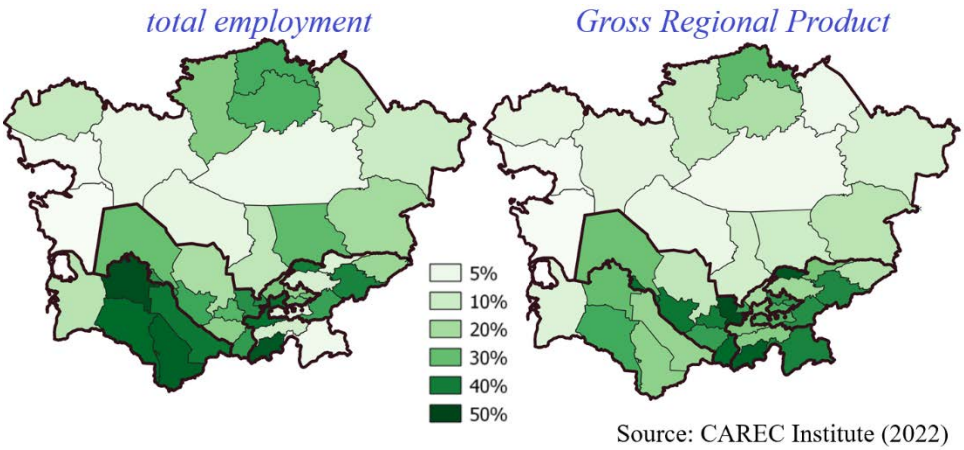


Source: IEA (2019, 2021)

High dependence of the local economies on agriculture and energy sectors determines their high exposure to climate-related challenges

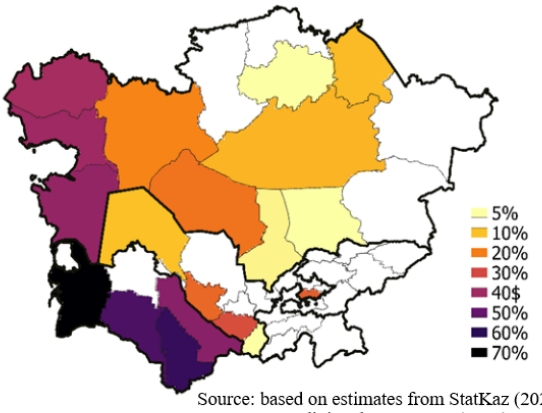
The climate change impacts will be magnified by the major importance of the water and agriculture sectors in the region. For example, in some provinces agriculture accommodates half of total employment and contributes up to 50 percent of the gross regional product (GRP) (Figure 5). The share of agriculture in total employment is particularly high in Turkmenistan, Uzbekistan, and in the south of Tajikistan. In terms of the share of GRP, agriculture stands as an important sector across most provinces in the south of the region, except those that have substantial contributions from mining and fossil fuel extraction industries.

Figure 5. Share of the agriculture sector in local employment and GRP in Central Asia



Source: CAREC Institute (2022)

Figure 6. Share of fuel extraction and processing industries in GRP in Central Asia



Source: based on estimates from StatKaz (2022)
Corradini and Dergunova (2012)
CER (2009)

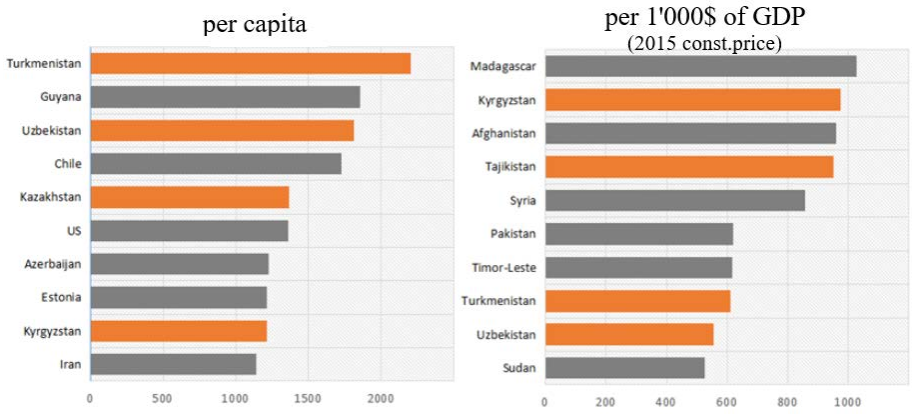
Endowed with large reserves of oil, natural gas, and coal, Central Asia is a large exporter of fossil fuels in the world. While oil and gas export revenues contributed significantly to the economies of Kazakhstan, Turkmenistan, and Uzbekistan during the past two decades, they also exposed them to the *Dutch disease*[1] and made other sectors less competitive and less attractive. The high economic dependence on fossil fuel extraction and processing is particularly evident on a local level, where respective industries contribute more than half of the economic output. It is reasonable to expect that, upon worldwide transition to carbon neutrality and subsequent phaseout of fossil fuels, those provinces would likely experience substantial economic losses.

Given the current high level of socioeconomic reliance on the affected sectors, promoting alternative, less resource-intensive sectors of the economy could be a promising additional adaptation approach. Apart from being a general requirement in the development context, this imperative would also strengthen the structural resilience of local economies to anticipated climate and carbon risks.

The low resource use efficiency is an amplifying factor for vulnerability to climate risks

Excessive use of water resources aggravates the vulnerability of agriculture in the region to climate change impacts. Total water withdrawals per capita in the region are among the highest in the world and economic productivity of water use is among the lowest. Water withdrawals in Turkmenistan and Uzbekistan already exceed total renewable surface water available on an annual basis, which implies a higher usage rate of the return water in the two countries. The countries should prioritize increasing water use efficiency across the sectors as a means of reducing their sensitivity to the adverse impacts of climate change. This is especially true for agriculture, which is by far the largest water consumer.

Figure 7. The world`s largest water withdrawals

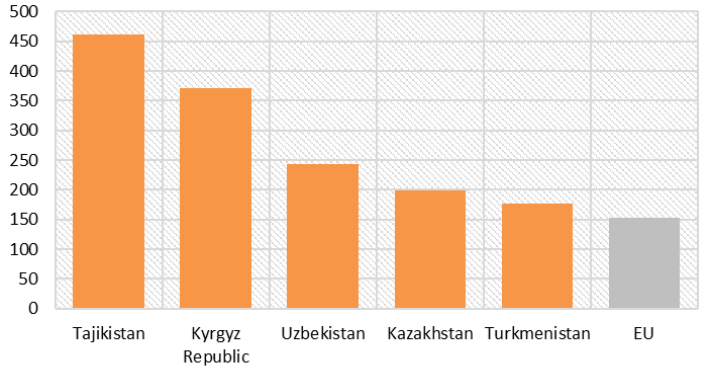


Sources: FAO, AQUASTAT database (2022)
World Bank (2022)

[1] Dutch disease refers to a phenomenon in which the rapid growth of the natural resource sector undermines the development of other sectors, and eventually results in a negative impact on the overall economy of a country(Neo, 2009).

Similarly, energy use in the region is characterized by excessive resource consumption and low economic output. Central Asian countries have a substantially higher ratio of total economic production to total electricity consumption than in the developed nations. This is especially true for Tajikistan and the Kyrgyz Republic, which have one of the world's highest electricity usage per gross domestic product (GDP). Power tariffs are below cost-recovery levels in all countries except Kazakhstan, and electricity generation, transmission, and distribution remain largely under state control. The countries in the region should therefore prioritize the development of less energy-hungry economic sectors. In addition, both the central and local governments should continue to build their capacity for designing and executing sound sectoral policies.

Figure 8. Electricity consumption per GDP (kWh per 1,000 USD, PPP 2017)



Source: IEA (2022), World Bank (2022)

Policy recommendations

Foster climate research in the region and improve early warning systems. Uncertainties in global hydrological projections over the region necessitate further research on the impacts of climate change on water resources. Nevertheless, given that the most rivers in the region are subject to high interannual runoff variations, improvement in early warning systems to existing variability is a good initial and win-win step towards achieving long-term resilience. Current uncertainties and an absence of reliable data make both coping with the consequences of climate-related disasters and adapting economies into a new situation almost impossible. Therefore, setting up reliable early warning systems will be key for reducing climate vulnerabilities at regional, national, and local levels.

Increase efficiency of water use across the main sectors. Excessive reliance on water resources is the primary reason for Central Asia's vulnerability to the impacts of climate change, particularly in its southern region. This reliance is rooted in the low economic productivity of water use. The countries should prioritize increasing water-use efficiency across the sectors as a means of reducing their sensitivity to the adverse impacts of climate change. Any further economic and social activity without optimal water efficiency, particularly in irrigated agriculture, represents a lost opportunity with compounding implications and repercussions for the economy. Serious efforts to reduce water dependency and increase the economic efficiencies of water use will be key adaptation strategies of the economies of Central Asia.

Optimize crop structure and invest in drought-resistant varieties. A reduction in the reliance on monocropping and crop structure optimization could diminish the sensitivity of local agricultural sectors to climate change. This needs to be complemented with careful selection and alignment of crop varieties to changing local climate conditions. The drought-resistance of crop cultivars will likely become one of the important criteria in cropping decisions. Current marketization and the freeing of

agriculture from state control, as well as providing incentives for more adaptive agriculture practices, are the right steps to take towards sustainable cropping in Central Asia.

Diversify the economy and promote less resource-intensive sectors. Given the current high level of economic reliance on agriculture in many parts of the region, scaling and supporting other sectors is an immediate policy imperative. This is equally true for the subregions where local economies are heavily dependent on fossil fuel extraction and processing, and where technological growth and knowledge accumulation in other sectors have been neglected. Reducing the footprints in water, energy, and other resources will enable the economies of the region to become more effective.

Mainstream energy efficiency and renewables as a crucial and cost-effective strategy. Central Asia remains of one the regions of the world with excessive energy consumption and low economic output. By encouraging private sector capital participation in energy management, national and subnational governments should prioritize energy efficiency policies and steer more investments towards renewable energy generation. To realize this, first and foremost, both central and local governments should build their capacity for designing and executing sound sectoral policies and reforms.

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