CPC CASPIAN POLICY CENTER

Is it too late to save Central Asia?
The COP crisis is already here

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Nowhere are the challenges highlighted in the United Nations Climate Conference (COP 28) more more impactful to millions of people than in Central Asia—the sharp end of the climate spear. One third of the region's glaciers have melted, as Central Asia's air temperatures are increasing at twice the global average. Water supply in the region has decreased by more than four times compared to the 1960s. "Soil degradation, regular dust and sand storms, drinking water shortages, air pollution, reductions in biodiversity, sharp declines in [agricultural] yields and much more negatively affect the quality of life for millions of the region's inhabitants," Uzbekistan's President Shavkat Mirziyoyev told COP 28 participants.

About 80% of Turkmenistan now experiences intense dust and sandstorms, further increasing desertification and causing hundreds of millions of dollars in economic losses. Heat waves have become more frequent in Central Asia, along with extended droughts and other extreme weather events. Average temperatures in Bishkek, Kyrgyzstan, have increased 4.3 degrees Fahrenheit since the beginning of the last century. Arguably, water is Central Asia's most critical natural resource, as most of the population and economies of the region depend on water for sustenance, irrigation, and energy. Everywhere water is receding.

Figure 1 — Dust storm in Turkmenistan

"Our glaciers are melting fast," stated Tajikistan's President Emomali Rahmon to the United Nations General Assembly in 2021, highlighting the impact of severe weather on his country and "undermining our efforts to achieve sustainable development." In fact, Central Asia's glaciers are melting faster than the global average and could lose up to 75 percent of their 2015 mass between the years 2050 and 2100 at current rates.

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Kazakhstan, the Kyrgyz Republic and Tajikistan are experiencing accelerated glacial melt along with an increasing incidence of landslides and glacially induced floods, indicating that current glacial predictions may well be optimistic. More than 1,000 glaciers have completely melted in Tajikistan alone in the past few decades.

As a significant portion of Central Asian water resources are located in Tajikistan, the decline of the country's glaciers poses a huge threat to the entire region. Nearly one-third of the region's population lack access to safe water. Turkmenistan is already experiencing absolute water scarcity while Uzbekistan suffers chronic water scarcity, just as upstream Afghanistan is constructing the Qosh Teppe canal which is set to withdraw up to one-third of the water that flows to Central Asia from the Amu Darya river.

According to the latest data revealed at the UN Convention to Combat Desertification (UNCCD), over 20% of the total land area in Central Asia is now degraded and deserted, equivalent to an area almost four times the size of the Kyrgyz Republic (approximately 80 million hectares). This affects an estimated 30% of the region's combined population. Desertification in the region is increasing as water recedes.

Parts of Central Asia face a long-term existential threat of potentially becoming unsustainable to support the region's growing population. Increasing temperatures and decreasing water supplies threaten crops, as well as life in remote regions, prompting migration to already stressed urban areas, exacerbating border tensions over increasingly scarce resources. One in six Central Asians already live in areas with high drought risk, posing a serious threat to the economic and food security and well-being of the 60% of the region's population who depend upon agriculture for income. Kazakhstan's capital city, Astana, in the spring and summer of 2023 experienced a water crisis, with over 600,000 not having access to drinking water. The at-risk proportion of Central Asians due to climate change is growing, rapidly.

While the leaders of all five countries are for the first time working together in discussing water and other formerly taboo-to-discuss challenges, this critical cooperation has been slow in coming. Absent Russia's attention while it is at war with Ukraine, the Central Asian Republics have discovered benefits in cooperation with each other and in presenting a more unified front to the world, particularly on environmental issues. However, this intensified collaboration must actively confront and address a significantly deteriorating environment across the entire region. Water, weather, energy, food, population, and conflicts are interrelated challenges; each is also an independent threat to Central Asia's long-term future.

Cry me a river…

Perhaps Central Asia's greatest enduring legacy comes from the leviathan, Soviet-era river diversion projects that sought to reroute water primarily for agricultural purposes. The Great Fergana and Karakum Canal projects diverted massive quantities from the Amu and Syr Darya rivers for cotton cultivation in Uzbekistan and Turkmenistan, syphoning

the main water supplies to the Aral Sea.
The flow of the two rivers into what once was the fourth-largest inland body of water has essentially been eliminated, resulting in what the European Investment Bank describes as "…one of the worst man-made environmental disasters in the history of the modern world." The surface area of the Aral Sea has been reduced by 75%, with only a little more than 10% of water visible by satellite and the remaining 90% of the "sea" is all sand. Today's desiccation of the Aral Sea began in the 1960s under Stalin's Great Plan for the Transformation of Nature which valued industrial agriculture over environmental concerns.

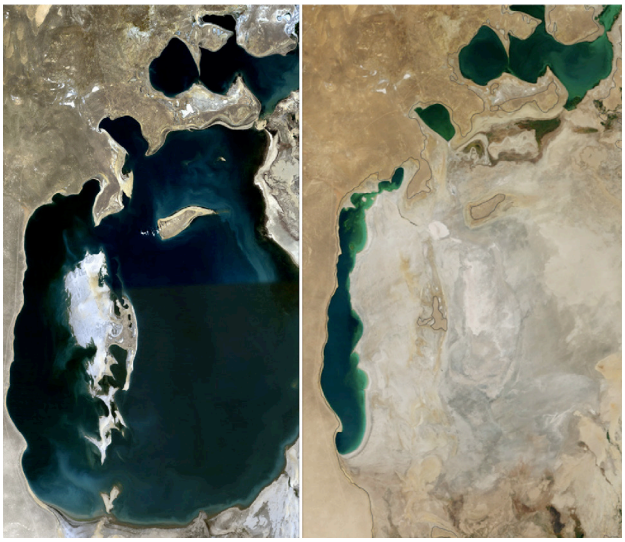

Figure 2 — A comparison of the Aral Sea in 1989 (left) and 2014 (right).

Development of Central Asia's rich soil was a priority for the production of wheat, as well as water-intensive cotton and rice crops. Little thought was given to water conservation, instead it was seen as a resource to exploit to the fullest with little regard to long-term consequences, as agriculture became the region's largest employer and the basis for a large textile industry. That spendthrift attitude towards water continued into the post-Soviet era.
While global warming did not evaporate the Aral Sea, the 1960s technology used to divert feeder flows from the Amu and Syr Darya rivers is just one of a series of Soviet legacies that pose consequential challenges to water sustainability in Central Asia today. With decades of maintenance neglect, unlined canals and leaky pipes remain largely unimproved and in poor condition, tied to the Soviet-era industry of agriculture. Few indigenous incentives to modernize and introduce water-saving technology have been evident on any scale, instead water is administered through conflicting or uncoordinated water management policies.

Moreover, the Central Asian governments are only just now approaching very preliminary discussions of water cooperation when they need to be discussing the introduction of comprehensive and systematized networks for the use of rivers and lakes. And there are no discussions on whether crops like cotton or rice should be grown in the increasingly arid region.

Ageing and in places crumbling irrigation and drainage systems produce soil salinization which, when combined with contamination from toxic dust storms, turn once-fertile land into an unproductive and useless desert. Much of the Soviet legacy infrastructure needs to be replaced, requiring massive investments in infrastructure and construction. Downstream Karakalpakstan in Uzbekistan not only lost its Soviet-era fishery industry when the Aral dried up, but large swathes of the region have turned into an uncultivatable and toxic wasteland.

Inhabitants of this Autonomous Republic have for decades been experiencing

Figure 3 — Moynaq / Uzbekistan - October 28, 2013: Rusty boats under the sun on the former bed of the Aral Sea, now dry and with the shore 180 kilometers away

anomalous high rates of respiratory disease, cancers, liver and other serious ailments, as well as the highest rate of infant mortality in the former-Soviet region. The recession of water from the Aral region has left toxic beaches of sulfates, phosphates, chlorinated hydrocarbons and other toxic substances from the agriculture industry's use of pesticides and fertilizers.

Dust storms carry soil from the dried-out seabed that contained contaminants found in fertilizers and pesticides across the entire region and beyond. The compounded impacts from the loss of water to Karakalpakstan are a cogent bellwether warning on the potential future unsustainability for habitation in this and other sections of Central Asia.

While the Amu and Syr Darya river waters suffer from diversion projects and poor utilization practices, they are fed by glacial melt and declining glacier packs. Climate change in Central Asia has seen decreased snow and rainfalls, with devastating impact on river flows, glacial recession and river basins. Per capita water supply in the region has decreased by 53% over the last 30 years.

Deglaciation is observable across the broader region. Impacting water supplies and agricultural irrigation, glacier deterioration has a direct bearing on erosion rates and sediment from the flow of mountain rivers normally fed by glaciers and snow. Initially, water levels increase due to rapid glacial melt posing a greater risk of floods, landslides, and glacial lake outbursts, which threaten downstream communities, farms and infrastructure.

As glacier reserves and snow caps are exhausted, further challenges arise from

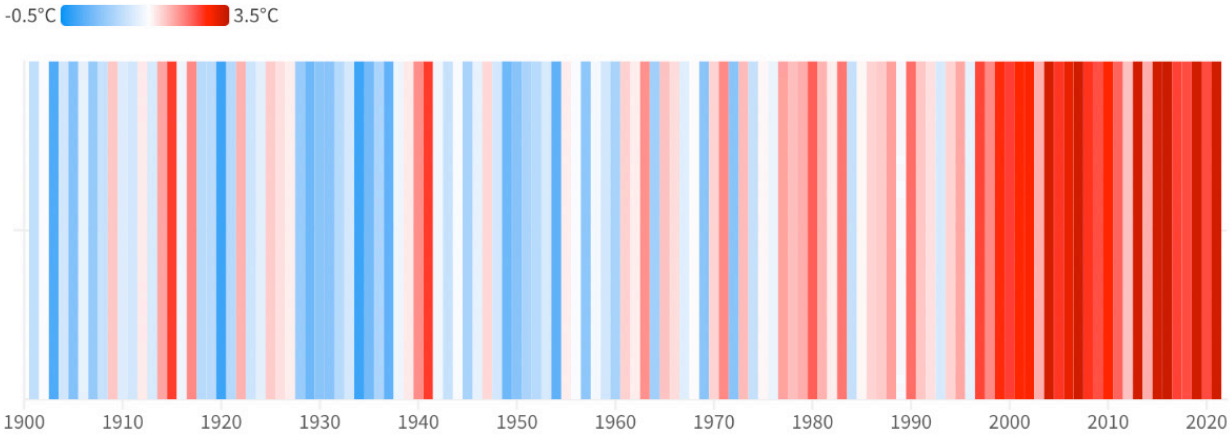

Figure 4 — Average air temperature change in Kyrgyzstan over time. (Central Asian Bureau for Analytical Reporting).

mountains without permanent ice and snow. Not the least of these is reduced hydropower production, just when growing populations need more energy for heating and cooling the effects of the region's weather extremes. It is believed that the tectonic changes to the region's glacial superstructure will further cause increasingly severe complications for downstream communities.

Calm before the storm…

Central Asia's mountain ranges make up a substantial portion of the Tibetan Plateau, known as the earth's Third Pole, due to its largest density of glaciers, permafrost and heavy snow outside the polar region. This large, Asian region has a major impact on global climate by affecting weather patterns and the planet's atmosphere, through its large glacier and snowpack.

Despite histories and traditions of weather resilience, some countries in the Central Asian region are "already experiencing disruptive impacts to hydrology systems that are beyond their historical experience and consistent with the predicted consequences of climate change." The decline of lower-altitude glaciers in Central Asia's Tien Shan and Pamir mountains, where glacial melt-water is essential for water availability, is being exacerbated by accelerated temperature swings that change seasonal ice and snow melt patterns. These atypical fluctuations result in more rapid glacial melt and the rising incidence of landslides, floods and glacial reservoir floods in Kazakhstan, the Kyrgyz Republic and Tajikistan.

As Central Asia's glaciers melt faster than the global average, weather patterns are affected. Spring rains are replacing winter snows and autumn rains are turning to snows later, shortening the region's critical winter's snow season by more than two weeks in the last sixty years. The reduction in Central Asian snow totals produces corresponding rises in overall air temperatures, with the region's mountains serving as beacons of climate change, since warming rates in mountains are twice the rate of the rest of the planet. The lower snowfall rates that Central Asia is experiencing are largely caused by higher surface temperatures from increased greenhouse gas emissions. The transformation and disappearance of Central Asia's glacial and snowpacks

Figure 5 — Carcasses of animals lie on the ground outside the village of Tushchykudyk amid severe drought in Mangistau Region, Kazakhstan July 27, 2021. Picture taken with a drone on July 27, 2021.

have resulted in a self-reinforcing cycle of lower snowfall rates, longer wet and dry seasons, with periods of increased flooding and drought. One aspect of this change to the region's weather patterns is a growing trend of regional heatwaves, with attendant increases and intensified periods of drought that threaten the region's agricultural industry and food supply. The collective impact of several years of severe droughts in Mangistau, Kazakhstan, as an example, resulted in the massive die off in 2021 of the region's horses, cattle and sheep due to high temperatures and the lack of grasses for feed.

The widespread 2021 drought reached from Turkey across the Caucasus and Central Asia, producing prayers for rain and dramatic drops in access to drinking water. Central Asia is now experiencing high levels of water stress, with nearly one-third of the region's population (nearly 22 million people) lacking access to safe drinking water. Aging infrastructure, leaky pipes and declining supply all contribute to the declining water levels and challenges to supply the region's growing population.

In Kazakhstan, more than half of the water grid is currently deemed "substandard," with the government seeking to address in this decade the lack of water availability to the most remote residences in the world's ninth-largest territorial country. Kazakhstan's government pledged the Herculean task of connecting all villages across the country to its water distribution grid by 2026, as part of

a broader agenda to galvanize the economy. Currently, 4,900 villages in Kazakhstan have access to tap water, residents in another 1,395 locations are forced to "find other solutions."

Neighboring Kyrgyzstan's capital, Bishkek, is supplied by dwindling river and groundwater supplies that are not able to recharge due to climactic changes. The 2023 water levels for Bishkek precipitously declined compared to 2022, just as the country experienced record heat. Faced with soaring summer temperatures and not enough water, the city government instituted draconian measures from closing pools and car washes to cutting nighttime water supplies for residential areas surrounding the capital city.

Similar shrinking water volumes are also challenging downstream communities in Uzbekistan and Turkmenistan, as levels of the Amu Darya river in 2023 have declined by an estimated three times over prior years according to local observers. Both countries are categorized as under high stress for fresh water supplies. The intersection of climactic shifts, increasing populations, slow redress of infrastructure needs and lack of funding are forcing hard reckonings for governments across the region and beyond.

Regional Water Hydraulics…

On the eastern flank of the Tibetan Plateau and Central Asia, China accounts for 20% of the world's population but only seven percent of the world's fresh water supplies. The country's continuing unmet needs for water have prompted massive, Soviet-style efforts to transport water to the country's populous north.

Figure 6 — Dead port cranes on the shores of the perishing Aral Sea

Reservoir, tunnel and other water infrastructure projects have displaced rural populations China, causing socio-economic hardships and tensions. These efforts notwithstanding, China's per capita water supply remains approximately at half the U.N. threshold for water scarcity. China experienced a 50% decline in water availability between 1964 and 2020.

Consequentially, water insufficiency has aggravated the country's need for energy and food insecurity. China only produces half of the food needed to meet global minimum standards for its population and also needs more water. To meet this critical demand, China is working on plans to divert water from three cross-national rivers (Mekong, Salween, and Brahmaputra, causing tensions with neighbors India and some Southeast Asian countries. In a corresponding move, China has sought additional water supplies from Central Asia.

Despite low reservoir levels, Kyrgyzstan's Cabinet of Ministers Chairman Akylbek Japarov indicated a willingness to export drinking water to China during an August 2023 visit, at the same time as the country

Figure 7 — Toktogul hydroelectric power station on Naryn River, Kyrgyzstan

ceased the flow of Talas River water into southern Kazakhstan. Much of southern Kazakhstan depends upon the Talas and Chui transboundary rivers which originate in the Kyrgyz Republic and are under Kyrgyz management and control. Hydro-rich Bishkek has long seen river waters as an undervalued and strategic commodity.

While Kyrgyz officials cited lack of rain and reduced glacial run-off as reason for the cessation of water to Kazakhstan, Japarov's visit to China produced $1 billion in needed bilateral trade deals for a needy economy. Bishkek's decision resulted in inadequate water supply for farms in southern Kazakhstan and likely contributed to lower harvest yields and lower grain quality from the region. Exports of Kazakhstan's spring and winter wheat crops are expected to suffer, further increasing Kazakh-Kyrgyz river-basin tensions. Kyrgyzstan, reciprocally depends upon Kazakhstan for grain and flour imports.

Using water as a strategic tool is not new in this increasingly water-strapped region. Strained relations between upstream, water-abundant Kyrgyzstan and Tajikistan with downstream, energy-profuse Kazakhstan and Uzbekistan were not uncommon after the break-up of the Soviet Union. Post-Soviet conflicts between the Central Asians challenged Moscow's formerly imposed, symbiotic barter system of water and energy exchanges between the neighboring states.

Clashes over water usage for agriculture and for hydro-power dams were the source of decades of enmity between the region's leaders. Uzbekistan switched off power to Kyrgyzstan and Tajikistan, for instance, when the latter proposed blocking downstream water flows. Bishkek cut summer water supplies to Tashkent, when the latter complained of unpaid winter energy bills.

In some cases, regional clashes bubbled over into armed conflict. Clashes between Uzbekistani and Turkmenistani troops took

place in the late 1990s and early 2000s over water distribution, as well as threatened war between Tashkent and Dushanbe when Tajikistan's President Rahmon announced a decision to build the Rogun hydropower station. These conflicts have largely moderated in recent years, with the creation of some joint management systems for water resources, but have not disappeared completely.

Kyrgyzstan and Tajikistan have a long and aggravated history of border tensions along a shared Ferghana valley border where disputes around a common water-sharing arrangement have triggered regular clashes between rural populations. In 2021, 2022 and 2023 escalating confrontations between the two countries resulted in deaths and widespread displacements of local populations, including charges of war crimes for both sides. A regularization of the conflict has led to military escalation, including purchases of drones by the Kyrgyz from Turkey and by the Tajiks from Iran.

Afghanistan's Insurgent Water Claim

Water stress is also acute in neighboring Afghanistan where substantial temperature rises over twice the global average and severe drought have resulted in significant climate change. Taliban officials are undertaking the construction of the Qosh Teppe canal upstream along the Amu Darya river, threatening to reduce water flows to Uzbekistan, Tajikistan, and Turkmenistan by an estimated 20% to 30%. Envisaged as far back as the 1970s, the Amu Darya project will siphon waters that originate in Afghanistan's Hindu Kush and Pamir highlands for agriculture, and thereby threatening water-intensive cotton production and farming in downstream Uzbekistan and Turkmenistan.

While there is a 1996 existing agreement to share Amu Darya water between the Central Asian republics, Afghanistan is not a signatory. The agreement retains Soviet-era quotas dividing over 80% of the river water between Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Nor is Afghanistan a signatory to the UN Convention on the Protection and Use of Transboundary Watercourses and International Lakes, posing a negotiations challenge now for Central Asian leaders. While the Taliban leadership seek international recognition, such as through negotiating an international water-sharing agreement, Central Asia's leaders have largely maintained only semi-formal relations with Kabul, per broader international practice to deny the government legal recognition.

Figure 8 — Work in progress at the Qosh Teppe Canal

Figure 9 — Work in progress at the Qosh Teppe Canal

The nearly 175-mile, sand-bottomed Qosh Teppe canal is 100-feet wide and eight-feet deep and will run through Afghanistan's Balkh, Jowzjan, and Faryab provinces to irrigate northern agricultural fields and address chronic food shortage problems. However, the canal's construction, along with already declining Amu Darya water flows, have raised concerns in downstream capitals. The river is essential to regional agriculture, but also is the main water source for Turkmenistan's capital, Ashgabat, via the 800-mile KaraKum canal that irrigates over three million acres of land.

Once finished, the Qosh Teppe canal's further reduction of already-diminished downstream flows could pose existential challenges to Turkmenistan's agriculture and some downstream communities, as well as serious consequences for Uzbekistan's Khorezm, Bukhara, Surhandarya and Navoi provinces, and the Republic of Karakalpakstan. Cotton represents approximately 25% of Uzbekistan's and 10% of Turkmenistan's GDPs, with 90% of all water in each of the countries channeled for agricultural use.

While Central Asian leaders do not contest Afghanistan's right to the water, tensions are nevertheless mounting over what will be a consequential change to the regional watershed and cascading transformations to downstream industries and communities. Central Asia's leaderships need to grapple with the undeniably significant future impact of the Qosh Teppe canal to GDPs, employment, industry and community viabilities, alongside the stresses produced by climate change. Central Asia's climate will also be impacted by the canal's reduction in water flow, intensifying water salinity, and increasingly frequent and intense toxic dust storms.

For Uzbekistan, however, there is another overarching imperative. Home to the largest and most dense population in Central Asia, the country's burgeoning population growth is placing significant stresses on existing resources. Uzbekistan's population has rapidly grown from 20 to 36 million between 1991 and 2023; the country's annual birth count increased from half a million in 2000 to almost a million in 2022.

High population growth has meant commensurately increased demands for water and to grow food. But Uzbekistan only produces 20% of the water it uses and is dependent upon supplies from its neighbors. As well, the vast majority of Uzbekistan's water sources come from rivers that are already experiencing decreasing flows, creating a critical and complex calculus for a government seeking to modernize its economy and find work for a growing labor force.

Power plays…

Closely tied to the region's water woes are its energy needs. Over 90% of Kyrgyzstan's and Tajikistan's energy comes from hydropower produced by river and glacier runoff. With climate change and overall rising temperatures in Central Asia, this is a depleting resource for Dushanbe and Bishkek, leaving both capitals particularly vulnerable to the region's increasingly severe and erratic winter weather. The increase in extreme weather in Central Asia has taxed energy grid systems for the entire region, but particularly for those reliant on hydropower and power-sharing agreements with neighbors.

Grid failure during the winter of 2022 produced a massive and total power blackout in Kazakhstan, Kyrgyzstan and Uzbekistan, causing a cascade of failures in the middle of record-breaking cold weather. The failure of the Central Asia unified electric grid forced the automatic shutdown of both the Tashkent and Syrdarya thermal power plants, leaving millions without power or heat.

Figure 10 — With temperatures plunging, many residents of the Uzbek capital, Tashkent, have been spending days without power, heating, and water

One year later, during another historic cold snap, Turkmenistan was forced to suspend heating gas supplies to Uzbekistan, due to record cold temperatures freezing condensate in older gas pipelines. The Turkmen-Uzbek gas arrangement was intended as a backstop to safeguard against the system failures of the year before.

In general, energy generating systems in Central Asia are old. Most power plants in the region have been operating for more than 30 years, with few to no upgrades or improvements. The hydropower plant powering Almaty, Kazakhstan, was built in 1943. The lack of investment in energy infrastructure across Central Asia stems largely from continued government subsidization of energy costs, resulting in few incentives for energy investment due to overly low tariffs. Central Asia's inefficient utilities have the highest energy consumption per person served.

However, climate change's impact on energy production is a significant compounding factor in declining energy production. Most of Kyrgyzstan's larger hydro-power plants, for instance, were built on the Naryn River and dependent upon its water flow volumes for energy generation. Data since 2019 shows an increase in glacial decline in Kyrgyzstan, along with serious declines in river and reservoir water levels and corresponding declines in hydropower generated.

Comparing hydropower plant output in 2019 with 2022, there was a 17 percent decline recorded in billions of kilowatt hours of hydro-energy generated in Kyrgyzstan. Increasing weather extremes and population growth place further strains on the region's

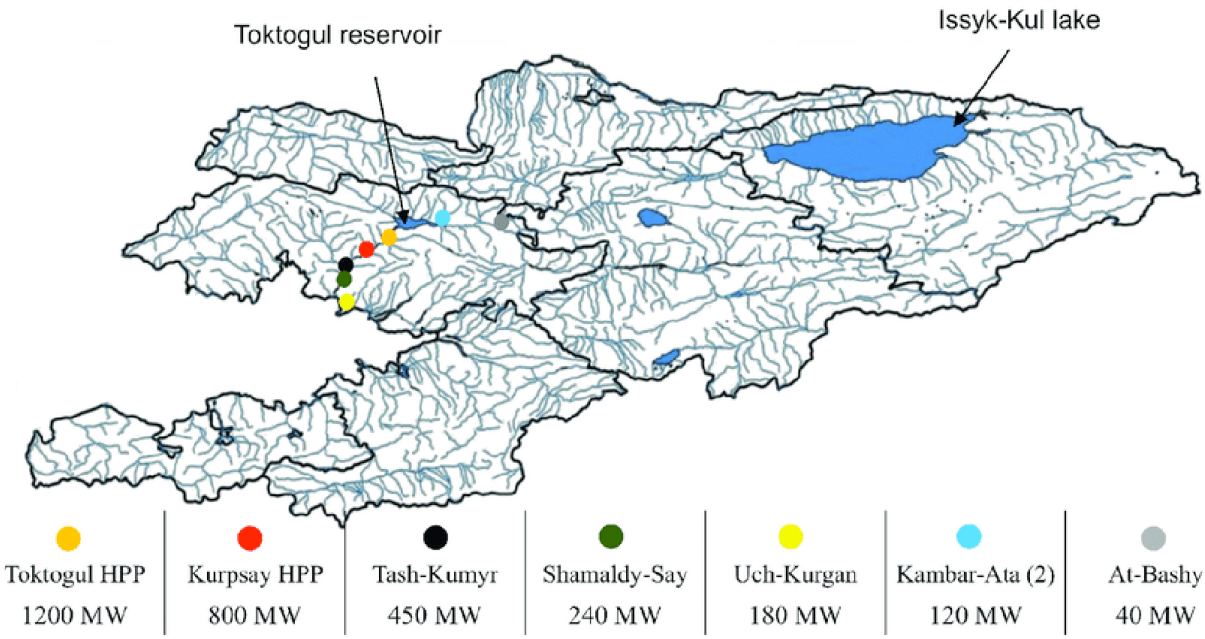

Figure 11 — Kyrgyzstan's water resources.

aging power grids and generation systems. Cold winters (including the 2021-2022 and 2022–2023 winters) demonstrate the increasing vulnerability of energy systems as populations and their demands grow.

The international development community and countries in the region have focused on new energy programs, such as the $1.4 billion, Central Asia-South Asia power project (CASA-1000) funded by a coalition of international donors. Designed to transit surplus hydropower from Kyrgyzstan and Tajikistan across Afghanistan to energy-hungry markets in Pakistan, CASA-1000 provides hope for upstream Central Asian countries to monetize spillway energy for export and to generate funds to both eliminate energy sector import costs and to allow for the refurbishment of power generation, transmission, and distribution infrastructure within each country. However, the Taliban takeover of Afghanistan has placed the partially constructed program in jeopardy, as international donors are generally prescribed from working or investing with the Taliban-run government, dashing hopes for capitalized infrastructure upgrades in Kyrgyzstan and Tajikistan.

Other donors have focused on introducing new and renewable technologies and lowering the region's carbon footprint. All five Central Asian governments have embraced a degree of energy cooperation in order to meet their national and regional priorities for energy security and to secure benefits from regional electricity trade. However, efforts to promote and adopt renewable and clean energy strategies and to implement smart grids will take time and massive investments, while climate-induced temperature swings place huge demands on the region's existing, aging infrastructure. In the interim most countries in the region default to older technologies and using coal, oil, and natural gas as fuel.

Coal combustion remains a major contributor to climate warming in the region,

as coal dust hastens snow melt. Tajikistan, Kyrgyzstan, Uzbekistan, Kazakhstan, and Turkmenistan ranked as the 4th, 7th, 12th, 23rd, and 44th most polluted countries in the world based on air particulate exposure. Central Asian cities are correspondingly hotspots for air pollution worldwide, with clear seasonal patterns in Almaty, Bishkek, and Astana, featuring winter peaks from coal-fired heating, and high levels of both winter and summer pollution in Tashkent and Dushanbe.

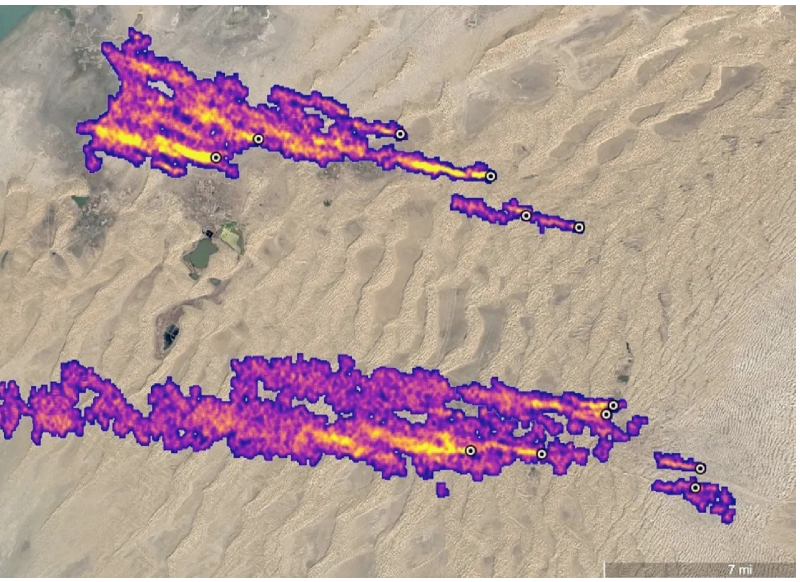

Figure 12 — Methane plumes, some of them stretching for more than 32 kilometers, as detected by NASA's Earth Surface Mineral Dust Source Investigation mission.

Central Asia is also responsible for significant methane emissions, with Turkmenistan, Kazakhstan and Uzbekistan among the world's leading methane emitters. In 2022, satellites detected 184 super-emitter events from Turkmenistan's gas and oil fields. Coal mining and the cattle industry in the region also contribute to the region's methane amounts as well. In 2023, Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan joined the Global Methane Pledge, a COP 28 initiative of the European Union and the United States designed to secure voluntary actions to reduce methane emissions from energy, agriculture and waste.

Laboring to change

A methane source industry, agriculture is the largest employer in the Central Asia region, employing close to between 25 and 40 percent of the region's workers. The sector accounts for significant portions of GDP in each country and the agriculture industry reflects historic investments and traditions, with few concessions so far to the climate. Vast areas of agricultural land in Central Asia are watered through old and leaky waterways, with crop selection reflecting established choices. As a result, the region continues to grow largely the same water-intensive crops as it did during the Soviet era.

In particular, cotton and rice are two water-intensive crops with dedicated policies, labor, and industries attached which strain the rational use of Central Asia's resources, as 90% of water supplies are utilized in agriculture. Cotton is the main agricultural crop in Uzbekistan, requiring high levels of water usage, resulting in greater pressure on the administration of dwindling water resources. Long-term cotton cultivation is directly and historically linked to the decline of the Aral Sea, increased soil salinization, and the proliferation of toxic dust storms. Yet it remains the nation's key export crop.

The Karakalpakstan region of Uzbekistan, once famous for its bountiful rice production, has experienced a serious decline in water for irrigation. Farmers are expecting a 2.5-

Figure 13 — Uzbek rice crop

fold decrease in rice production in 2023, due to water shortages and soil salinization, though rice is a staple crop and intrinsic part of Uzbek culture. Due to these increasingly harsh realities, Karakalpakstan's residents are starting to migrate out of the region, as incomes from agriculture are literally drying up.

The Government in Tashkent is responding to the water shortage issue by forcing limits on rice cultivation, reducing the area of land to be cultivated with the water-intensive crop. Seeking to ensure, "…the rational distribution of land and water, as well as meeting the needs of the population in cheap and high-quality rice products," the capital has accepted that it cannot continue production at current levels and must reduce cultivation. Key challenges that governments in Central Asia face in rationalizing the use of the region's depleting water resources are both inertia in the agricultural sector and the lack of unified controls.

An estimated 36% of water used in Uzbekistan agriculture is lost in unlined water channels, more is lost due to poor irrigation methods. As a result, 70 percent of crops are watered with outdated methods. Thousands of decades-old and energy-draining pumps also contribute to the country's inefficient irrigation system. To combat these challenges, President Mirziyoyev ordered the concreting of water channels to reduce losses, the procurement

of energy-saving pumps, as well as the use of automated water meters to regulate flow and reduce waste. However, such initiatives will take years to implement.

Reservoir hogs

Time is not on Central Asia's side, but is a critical element in identifying the trend of climate changes taking place in Central Asia. Nowhere is this more evident than in the declining waters of the region's large reservoirs. As already noted, the Aral Sea was once the world's fourth-largest lake, but has now seen its surface area reduced by 75% and the creation instead of over 13 million acres of desert. A similar fate appears to be happening to Kazakhstan's Lake Balkash.

The all-too-familiar vortex produced by climate change and water-intensive agriculture are reducing the world's 14th-largest lake. China is also diverting headwaters that recharge Balkash, due to intensive agriculture, mining and industrial development in the Xinjiang region. Like Afghanistan, China does not belong to any international transboundary water agreements and faces significant water shortfalls in its own territory.

Kazakhstan, in turn, uses most of its Balkash withdrawals for its own agriculture sector and largely unimproved irrigation systems. While Kazakhstan's President Tokayev decries the "rapid shallowing" of the lake, current industrial, agricultural and diplomatic policies are not slowing the decline.

Of greater concern though is the increasingly noticeable decline of the Caspian Sea, the world's largest inland body of water, bordering Azerbaijan, Iran, Kazakhstan, Russia, and Turkmenistan. Caspian recession poses a serious threat to regional industry, trade, and ecosystems. Sightings of black algae and increasing silt in 2023 near Kazakhstan's Aktau seaport led city officials to declare a state of emergency over the grave threat to the region's maritime industry. Reduced snowfall and increased regional droughts are likely causal factors in the sea's decline, but regional officials attribute great significance to Russia's diversions of the Ural and Volga Rivers for agriculture.

A closed water catchment, the Caspian Sea is experiencing the impact of regional climate change which in turn has prompted increased regional water consumption, as well as greater water retention to power increased agricultural and hydroelectric demands in Russia. In their efforts to combat some aspects of climate change and the need for more water, all five littoral Caspian countries are actively engaging in desalinating Caspian water for drinking water and energy, which correspondingly further exacerbates the sea's decline. Kazakhstan alone is set to build nine new desalinization plants to address potable water shortfalls in the Mangystau region.

However, Kazakhstan's section of the Caspian is the shallowest and water levels have already dropped by more than three feet in recent years, with estimates of declines between 30 and 59 feet by the end of the century. Russia's Volga River dams play a significant role in the Caspian Sea's decline and retreat, as well as an increase of coastal lands which jeopardize Kazakhstan's burgeoning ports and shipping

Figure 14 — Caspian maintenance dredging on the Prorva channel.

through the Middle Corridor trade and transit route. Increased dredging to protect shipping is a regular facet of Kazakhstan's port maintenance, as sea waters abate.

Experts believe that, at an average depth of six meters, Kazakhstan's shallow portion of the Caspian Sea is at "clear risk of desiccation by the end of the 21st century." Such a drastic prognosis would have consequential effects on the region's environment and ecosystems, resulting in further climate and weather shifts.

Catching lightning in a bottle…

COP 28 and its attendant agreements and documents are all necessary steps to draw attention to the general condition of the planet's environment, to build awareness on needed changes, and to rally a consensus for action. International diplomacy at that level is an incremental effort.

Central Asia was well received at COP 28 and recently in many international fora, but the region can be overlooked or deprioritized, as its more notable neighbors undergo similar hardships. Pakistan experienced an 80 percent and China a 50 percent decrease in per capita water availability from 1963 to 2019. Turkey's severe water stress and drought resulted in over 50 percent food inflation in 2023, with 60 percent of the country's land now deemed "prone to desertification." Ninety-seven percent of Iran faces drought. Iran and Afghanistan have exchanged gunfire in 2023 over disputed water rights to the Helmand River.

Figure 15 — The former seabed of the Aral Sea. Photo: Yusup Kamalov

The climate challenges in Central Asia may not claim the same global headlines. They should. The five Central Asian republics face a very uncertain future with dangers that are immediate and existential. There is no other way to describe them: declining glaciers and water resources, rapidly increasing temperatures, increasingly violent weather with pronounced periods of drought and floods, toxic dust storms and air pollution, health threats, and food sustainability issues. The region's rapidly growing populations demand more resources and energy often from aging systems built decades ago that rely on dwindling resource bases.

Governments in the region need to embrace massive upgrading of energy generating systems while shifting to new greener technology, as well as the need to reconsider the resource requirements of legacy industries. Each of these considerations is an heroic task, requiring enormous resources and popular support.

Kazakhstan is seeking popular input regarding a potential shift to adding nuclear power to its energy grid. While the country has a disturbing Soviet nuclear history and legacy, it also has ample Uranium resources that could power the country, replacing other energy sources. Uzbekistan is undertaking measures to guarantee energy security for the coming winter, while also upgrading its hydropower systems. Kyrgyz leaders declared a three-year energy emergency, are undertaking major efforts to upgrade hydro-energy systems, and are building social awareness on the need for conservation. Turkmenistan is actively engaging with international specialists to address adaptation to climate change, while

also actively working to reduce its methane footprint. Tajikistan continues to lead its long-term efforts to raise global awareness on the water crisis in the region. However, as populations in the region will face ever-greater stress due to inevitable water and energy shortages, balancing social concerns with critical climate choices will be no mean feat for any of Central Asia's leaders.

The tasks they face are not just to slow the region's rapid warming, but to try and put the genie back in the bottle by reversing recent declines and stave off further precipitous declines in the region's glaciers and its water supply. If they are unsuccessful and current trends continue:

- desertification will escalate and claim more arable lands (threatening food supplies and industry),
- deglaciation will continue to accelerate (threatening water supplies, energy grids, and industry),
- weather intensity and unpredictability will further intensify (threatening cities and the region's fragile ecology),
- rural population migration to urban centers in the region will escalate (stressing already stressed infrastructure),
- agriculture and other industry jobs will more rapidly disappear and force economic migration (stressing neighboring states in similar circumstances), and
- conflict for ever-scarcer resources would become more likely.

In short, large parts of Central Asia could become increasingly untenable to sustain human habitation in the foreseeable future. Moreover, the impact of such a Central Asian decline would be felt negatively in global weather, economic, and social patterns. The challenges the region faces are larger than any one country can tackle alone. Regionally, extraordinary cooperation will need to become regular. However, the region and its leaders, along with surrounding countries and the global community will all need to recognize the critical challenges that Central Asia faces and pool efforts, technologies, and resources now, before it is too late.

Figures

1. Daryo, https://daryo.uz/en/2023/04/14/dust-storm-hits-turkmenistan
2. Credit: This work is in the Public Domain, CC0
3. Shutterstock, https://www.shutterstock.com/image-photo/moynaq-uzbekistan-october-28-2013-rusty-1502463374
4. REUTERS/Pavel Mikheyev, https://pictures.reuters.com/archive/KAZAKHSTAN-DROUGHT-RC2XSO9UIQZ3.html
5. https://cabar.asia/en/energy-production-in-kyrgyzstan-declines-how-climate-change-and-glacier-degradation-affect-power-sector
6. Shutterstock, https://www.shutterstock.com/image-photo/dead-port-cranes-on-shores-perishing-1930592744
7. Shutterstock, https://www.shutterstock.com/image-photo/toktogul-hydroelectric-power-station-on-naryn-42748465
8. https://www.alemarahenglish.af/images-of-qosh-tepa-canal-projects-most-recent-developments/
9. https://www.alemarahenglish.af/images-of-qosh-tepa-canal-projects-most-recent-developments/
10. Shutterstock, https://www.shutterstock.com/image-photo/tashkent-uzbekistan-1802-square-winter-snow-1875090379
11. Mehta, Kedar & Ehrenwirth, Mathias & Trinkl, Christoph & Zörner, Wilfried. (2022). Towards Sustainable Community Development through Renewable Energies in Kyrgyzstan: A Detailed Assessment and Outlook. World. 3. 327- 343. 10.3390/world3020018.
12. NASA, https://www.nasa.gov/centers-and-facilities/jpl/methane-super-emitters-mapped-by-nasas-new-earth-space-mission/
13. https://yuz.uz/en/news/v-uzbekistane-naraivayut-proizvodstvo-risa
14. https://www.agro.uz/
15. World Bank Blogs, https://blogs.worldbank.org/europeandcentralasia/rethinking-landscape-restoration-central-asia- improve-lives-and-livelihoods

Endnotes

1. https://www.gazeta.uz/ru/2023/12/01/climate-summit/
2. https://www.azernews.az/region/185503.html
3. https://www.foreign.senate.gov/imo/media/doc/Senate%20Print%20112-10%20Avoiding%20Water%20Wars%20Water%20Scarcity%20and%20Central%20Asia%20Afgahnistan%20and%20Pakistan.pdf
4. See https://indianf.com/heat-wave-exposure-threatens-children-in-europe-central-asia/, also see https://www.osce.org/files/f/documents/5/f/547007.pdf.
5. https://cabar.asia/en/energy-production-in-kyrgyzstan-declines-how-climate-change-and-glacier-degradation-affect-power-sector
6. https://asiaplustj.info/en/news/tajikistan/power/20211027/tajik-leader-suggests-declaring-declare-2025-as-the-international-year-for-glaciers-preservation
7. https://tc.copernicus.org/preprints/tc-2022-244/tc-2022-244.pdf and see https://www.osce.org/files/f/documents/5/f/547007.pdf
8. https://data.worldbank.org/indicator/ER.H2O.INTR.PC
9. https://www.waterdiplomat.org/story/2023/01/unga-approves-president-rahmons-initiative-glacier-preservation
10. https://public.wmo.int/en/our-mandate/climate/wmo-unfccc-cop/cop27/glaciers-and-climate-change
11. https://blogs.worldbank.org/water/central-asia-confluence-global-water-action-and-climate-resilience-dushanbe-conference
12. https://data.worldbank.org/indicator/ER.H2O.INTR.PC/countries?display=default
13. https://www.unccd.int/news-stories/press-releases/over-one-fifth-central-asias-land-degraded-new-un-data-warns
14. https://www.unccd.int/sites/default/files/2023-11/Fact%20sheet%20Central%20Asia%20EN.pdf
15. https://novastan.org/en/kazakhstan/kazakhstan-residents-suffer-from-lack-of-water/
16. “We cannot be content with the fact that the Amu Darya, abounding in water, deposits it without benefit into the Aral Sea while our Samarkand and Bukhara oblast lands are insufficiently irrigated. Our task is to bridle the Syr Darya and Amu Darya, firmly grasp them in our hands, and make their water serve the

interests of socialism, the growth of the material level of the population, and the development of the country," said Uzbek Communist Party's Central Committee First Secretary Usman Iusupov in 1939. https://soviethistory.msu.edu/1985-2/desiccation-of-the-aral-sea/#:~:text=From%201939%20with%20the%20opening,fields%20of%20Soviet%20Uzbekistan%20and

17. See https://www.eib.org/en/press/news/save-the-aral-sea and also see https://www.newscientist.com/article/dn4637-russia-reviving-massive-river-diversion-plan/
18. https://earth.esa.int/web/earth-watching/image-of-the-week/content/-/article/the-changing-aral-sea/#:~:text=Until%20a%20few%20decades%20ago,remaining%2090%25%20is%20all%20sand
19. Secret CIA reports discuss the potentially devastating impact on the Arctic Ocean, as the Soviets sought to divert northbound feeder rivers away from the Arctic for agriculture. "The Soviets…might sacrifice long-term damage to the world in return for short-term gains for farmers and industry…used nuclear blasts for quick excavation of water projects." The CIA estimates that a 1971 blast in the Soviet Union was testing a nuclear device for canal construction to link the Pechora and Volga Rivers. https://www.washingtonpost.com/archive/lifestyle/1989/09/20/nuclear-bombs-to-divert-soviet-rivers/c9f97617-c653-4b75-b9f6-03c6bc80cf0e/
20. https://soviethistory.msu.edu/1985-2/desiccation-of-the-aral-sea/#:~:text=From%201939%20with%20the%20opening,fields%20of%20Soviet%20Uzbekistan%20and
21. https://www.wired.com/2013/11/jason-larkin-karakalpakstan/
22. Ibid
23. https://soviethistory.msu.edu/1985-2/desiccation-of-the-aral-sea/#:~:text=From%201939%20with%20the%20opening,fields%20of%20Soviet%20Uzbekistan%20and
24. https://www.suez.com/en/africa/news/water-conservation-and-efficient-usage-in-uzbekistan-has-become-a-top-priority-at-the-presidential-level
25. From 1990 to 2015, Afghanistan's glaciers decreased by 15 per cent (1 per cent per year) and could melt by 50 per cent by 2050. In the Panj River Basin (Tajikistan and Afghanistan), current ice reserves are estimated at 479 billion tons, but could decrease by 30–50 per cent by 2050– 2100 due to climate warming. Smaller glaciers at lower elevations, such as in the Hissar Mountains (Tajikistan and Uzbekistan), may totally disappear or shrink drastically. https://www.osce.org/files/f/documents/5/f/547007.pdf
26. https://www.nature.com/articles/s41558-020-0746-8
27. https://www.waterdiplomat.org/story/2023/01/unga-approves-president-rahmons-initiative-glacier-preservation
28. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016EF000514
29. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10641164/
30. https://carececo.org/en/main/activity/mettings/cakik-2023/
31. https://eos.org/research-spotlights/earths-third-pole-and-its-role-in-global-climate#:~:text=Located%20at%20the%20intersection%20of,Mekong%2C%20Yangtze%2C%20and%20Yellow
32. https://www.climatelinks.org/sites/default/files/asset/document/Glacier%20melt%20tool.pdf
33. https://dendrolab.ch/wp-content/uploads/2018/10/Sorg_etal_NCC_2012.pdf
34. https://eurasianet.org/central-asias-shorter-winters-are-whittling-away-glaciers#:~:text=The%20Science%20paper%20confirms%20Central,mass%20by%20the%20year%202100
35. https://tc.copernicus.org/preprints/tc-2022-244/tc-2022-244.pdf
36. Sabine, B. R., Mathieu, G., Olivier, B., Miska, L., Carmen, C., Gregoire, M., Antoine, G.: From white to green: Snow cover loss and increased vegetation productivity in the European Alps, Science, 376, 1119–1122, https://doi.org/10.1126/science.abn6697, 2022.
37. Sun, F., Hall, A., Schwartz, M., Walton, D. B., and Berg, N.: Twenty-First-Century Snowfall and Snowpack Changes over the Southern California Mountains, J. Climate, 29, 91–110, https://doi.org/10.1175/JCLI-D-15-0199.1, 2016.
38. See https://www.sciencedirect.com/science/article/abs/pii/S0012825208000408?via%3Dihub and https://tc.copernicus.org/preprints/tc-2022-244/tc-2022-244.pdf
39. https://reliefweb.int/report/kyrgyzstan/

kyrgyzstan-europe-heatwave-early-action-activation-final-report
40. https://reliefweb.int/report/kyrgyzstan/building-central-asia-drought-information-system-kyrgyzstan-progress-and-way-forward-feasibility-study-enru
41. https://www.reuters.com/world/asia-pacific/heatwave-turns-already-arid-kazakh-steppe-into-mass-grave-horses-2021-08-06/
42. https://www.euronews.com/my-europe/2021/01/14/pray-for-rain-ceremonies-are-useless-turkey-faces-its-most-severe-drought-in-a-decade
43. https://www.fao.org/sustainable-development-goals-data-portal/data/ and https://blogs.worldbank.org/water/central-asia-confluence-global-water-action-and-climate-resilience-dushanbe-conference
44. https://eurasianet.org/kazakhstan-sets-2026-target-for-getting-drinking-water-to-the-regions
45. https://primeminister.kz/ru/news/itogom-ispolneniya-porucheniy-glavy-gosudarstva-dolzhno-stat-znachitelnoe-povyshenie-kachestva-zhizni-kazakhstantsev-alikhan-smailov-23825
46. See https://cabar.asia/en/kyrgyzstan-inevitable-water-crisis
47. https://iwpr.net/global-voices/bishkek-water-shortages-highlight-poor-management
48. https://rus.azathabar.com/a/32443779.html
49. https://sdga2022.github.io/sdga2022/goal-6-clean-water-and-sanitation?cid=ECR_LI_worldbank_EN_EXT&lang=en
50. https://eurasianet.org/kyrgyzstan-capital-citys-water-crisis-nears-critical-point
51. https://www.nationalreview.com/magazine/2023/06/12/chinas-coming-decline/
52. https://sdga2022.github.io/sdga2022/goal-6-clean-water-and-sanitation?cid=ECR_LI_worldbank_EN_EXT&lang=en
53. https://thediplomat.com/2021/10/red-flag-river-and-chinas-downstream-neighbors/
54. https://www.vb.kg/doc/431772_akylbek_japarov_obsydil_s_kitayskimi_investorami_eksport_pitevoy_vody.html
55. https://pressroom.rferl.org/a/32547913.html
56. https://www.eurasiareview.com/28082023-water-issue-in-central-asia-prerequisites-for-emergence-of-conflicts-analysis/
57. See https://www.tazabek.kg/news:1970094 and https://rus.azattyk.org/a/32555092.html
58. https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/low-yields-and-low-grain-quality-wheat-and-barley-kazakhstan-2023-10-09_en
59. https://www.apk-inform.com/en/news/1538200
60. https://www.rferl.org/a/kyrgyz-kazakh-relations-strained-water-cutoff-border-traffic-jam/32563550.html
61. https://climate-diplomacy.org/case-studies/dam-conflict-between-kyrgyzstan-and-uzbekistan
62. https://www.crisisgroup.org/europe-central-asia/central-asia/kazakhstan/end-weaponisation-water-central-asia
63. https://jpia.princeton.edu/sites/g/files/toruqf1661/files/2008-9.pdf
64. https://asiatimes.com/2023/07/kazakhstan-resisting-kyrgyz-pressure-to-break-russian-sanctions/ and https://www.reuters.com/article/centralasia-water-idUSL6E8K793I20120907/
65. In a landmark 2023 agreement between Uzbekistan and the Kyrgyz Republic, the Kempir-Abad reservoir, which was traditionally under the control of Uzbekistan, will be jointly managed equally by both governments to reduce the possibility of conflicts. https://kabar.kg/news/sadyr-zhaparov-prokommentiroval-nedostovernuiu-informatciiu-sviazannuiu-s-vodoi/
66. See https://www.hrw.org/news/2023/05/02/kyrgyzstan/tajikistan-apparent-war-crimes-border-conflict, https://www.usip.org/publications/2021/05/border-clash-between-kyrgyzstan-and-tajikistan-risks-spinning-out-control and https://civil-protection-humanitarian-aid.ec.europa.eu/news-stories/stories/kyrgyzstan-tajikistan-helping-civilians-recover-after-devastating-border-clashes_en
67. https://www.rferl.org/a/majlis-pannier-podcast-drones-military-central-asia/32700305.html
68. https://www.chathamhouse.org/2022/03/climate-change-must-become-part-global-agenda-afghanistan
69. https://www.eurasiareview.com/26042023-afghanistans-water-demands-its-impact-on-central-asia-analysis/
70. https://brill.com/view/journals/cjel/5/1/article-p37_3.xml?language=en
71. Protocol 566: Improvement of the Scheme on Complex Use and Protection of Amu-Darya Water Resources by Scientific & Technical Council, Ministry of Land Reclamation and Water Management of the USSR (1987).
72. https://www.unwater.org/news/frequently-asked-

questions-1992-water-convention
73. https://www.youtube.com/watch?v=GJmitmg4k_w
74. See https://rus.azathabar.com/a/32443779.html, https://cabar.asia/en/water-crisis-looming-uzbekistan-and-turkmenistan-s-imperative-for-the-grand-afghan-canal, and https://www.fpri.org/article/2023/07/new-canal-threatens-the-peace-between-the-taliban-and-central-asia/
75. https://kun.uz/ru/news/2023/02/17/uroven-vody-v-amudare-mojyet-rezko-umenshitsya-chto-predstavlyayet-soboy-kanal-kotoryy-stroyat-taliby
76. See https://unece.org/sustainable-development/news/unece-supports-uzbekistans-strategy-towards-sustainable-practices#:~:text=The%20agri%2Dbusiness%20sector%20in,the%20largest%20source%20of%20employment, https://www.theglobaleconomy.com/Turkmenistan/Share_of_agriculture/, https://progres.online/society/ecology/turkmenistan-issues-and-potential-in-agriculture/#:~:text=The%20main%20consumer%20of%20water,70%25%20of%20all%20freshwater%20withdrawals, and https://kun.uz/en/news/2023/11/30/uzbekistan-switching-to-emergency-mode-of-operation-to-save-water?ysclid=lpqjlo87xe782537575
77. See https://pressroom-rferl-org.cdn.ampproject.org/c/s/pressroom.rferl.org/amp/32641655.html and https://amu.tv/68490/
78. https://thediplomat.com/2023/07/the-talibans-new-canal-threatens-water-security-in-uzbekistan-and-turkmenistan/
79. https://daryo.uz/2021/08/17/ozbekistonning-doimiy-aholisi-soni-30-yil-ichida-qanchaga-osgani-malum-qilindi/?utm_source=@daryo/ and https://stat.uz/uz/rasmiy-statistika/demography-2
80. https://president.uz/ru/lists/view/6894
81. https://thediplomat.com/2023/07/the-talibans-new-canal-threatens-water-security-in-uzbekistan-and-turkmenistan/
82. https://www.iea.org/reports/kyrgyzstan-energy-profile and https://www.mondaq.com/renewables/1194506/hydropower-sector-development-in-central-asia
83. https://www.climate.gov/news-features/understanding-climate/climate-change-mountain-glaciers
84. https://www.undp.org/kazakhstan/press-releases/central-asian-countries-discuss-early-warning-systems-climate-resilience#:~:text=The%20countries%20of%20Central%20Asia,environment%2C%20economy%20and%20human%20health.
85. https://www.reuters.com/world/asia-pacific/power-blackout-hits-kazakhstan-kyrgyzstan-uzbekistan-2022-01-25/
86. https://eurasianet.org/uzbekistan-how-a-power-outage-sent-a-country-into-meltdown
87. https://www.upstreamonline.com/production/turkmenistan-halts-gas-exports-to-energy-starved-uzbekistan/2-1-1388664 and https://www.reuters.com/business/energy/turkmenistan-resumes-gas-supplies-uzbekistan-2023-01-23/
88. https://www.reuters.com/business/energy/uzbekistan-boosts-gas-imports-turkmenistan-winter-source-2022-12-13/
89. https://unicaselaw.com/blog/hydropower?utm_source=mondaq&utm_medium=syndication&utm_term=Energy-and-Natural-Resources&utm_content=articleoriginal&utm_campaign=article
90. Presentation by Amjad Khan, “Water-Energy Nexus Issues in Central Asia,” CAREC Conference (16 May, 2023).
91. https://cabar.asia/en/energy-production-in-kyrgyzstan-declines-how-climate-change-and-glacier-degradation-affect-power-sector
92. Ibid
93. https://www.usaid.gov/fact-sheet/usaid-casa-1000-secretariat-activity-fact-sheet
94. https://www.casa-1000.org/kyrgyzstan/
95. https://www.usaid.gov/central-asia-regional/fact-sheets/usaid-power-central-asia
96. https://thediplomat.com/2023/12/central-asias-great-energy-paradox/
97. See https://www.rferl.org/a/central-asia-coal-power-shortages/31505804.html and https://osce-academy.net/upload/file/CADGAT_data_article_28.pdf
98. https://phys.org/news/2017-02-coal-hastens-arctic.html
99. https://www.iqair.com/us/newsroom/world-air-quality-report-press-release-2022
100. https://www.sciencedirect.com/science/article/abs/pii/S1352231023003278
101. https://methanewatch.kayrros.com/map
102. https://www.statista.com/statistics/1382962/methane-super-emitter-events-worldwide-by-country/#:~:text=Satellites%20detected%20more%20than%201%2C000,from%20oil%20

and%20gas%20fields
103. https://www.epa.gov/cmop/emissions-coal-mining-kazakhstan
104. The Methane Pledge was originally proposed by US Secretary and Special Presidential Envoy for the Environment John Kerry at the time of COP 26. https://www.aljazeera.com/news/2023/12/2/at-cop28-oil-companies-pledge-to-lower-methane-emissions#:~:text=A%20commitment%20by%20117%20countries,%2C%20Canada%2C%20Chile%20and%20Barbados
105. https://www.trade.gov/country-commercial-guides
106. https://kun.uz/en/news/2023/11/30/uzbekistan-switching-to-emergency-mode-of-operation-to-save-water?ysclid=lpqjlo87xe782537575
107. https://www.sciencedirect.com/science/article/abs/pii/S0378377422000828
108. https://eurasianet.org/uzbekistans-losing-battle-against-drought
109. http://tashkenttimes.uz/national/11135-rice-growing-areas-in-karakalpakstan-to-be-reduced-due-to-water-shortage
110. https://www.gazeta.uz/ru/2023/10/20/water/?utm_source=push&utm_medium=telegram
111. https://earth.esa.int/web/earth-watching/image-of-the-week/content/-/article/the-changing-aral-sea/#:~:text=Until%20a%20few%20decades%20ago,remaining%2090%25%20is%20all%20sand
112. https://cabar.asia/en/aral-sea-2-what-is-behind-the-shallowing-of-the-largest-lake-balkhash-in-kazakhstan
113. https://www.riob.org/fr/file/289934/download?token=JnL1FHYX
114. https://eurasianet.org/kazakh-president-bemoans-shrinking-lake-doesnt-mention-chinas-take
115. https://orda.kz/v-kaspijskom-more-pochernela-voda-zhiteli-aktau-byut-trevogu/
116. https://www.inform.kz/ru/poteryaem-li-my-kaspiy-otvet-ministra-ekologii-rk_a4076354
117. https://www.iranintl.com/en/202308071134
118. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7807410/, https://en.trend.az/azerbaijan/society/3794283.html, https://rosatom-europe.com/press-centre/news/114-desalination-facility-named-a-new-product-of-the-russian-nuclear-industry/
119. https://www.azernews.az/region/209251.html
120. https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.6362
121. https://www.cacianalyst.org/publications/analytical-articles/item/13769-decreasing-water-levels-in-the-caspian-sea-causes-and-implications.html
122. https://www.dutchdredging.nl/en/projects/maintenance-dredging/maintenance-dredging-prorva-channel-caspian-sea
123. https://vlast.kz/english/57289-the-caspian-sea-can-have-an-impact-on-the-climate-of-the-northern-hemisphere.html
124. http://wrld.bg/9aQ050P8Zp3
125. https://www.turkeyanalyst.org/publications/turkey-analyst-articles/item/710-climate-change-threatens-turkey's-role-as-a-food-supplier-to-europe-and-the-middle-east.html
126. https://apnews.com/article/iran-afghanistan-clash-water-rights-48324a0cdc9158713a39edae7460cd5e
127. https://www.reuters.com/world/asia-pacific/kazakhstan-hold-referendum-nuclear-plant-construction-president-2023-09-01/
128. https://www.nature.com/articles/d41586-019-01034-8
129. https://www.reuters.com/markets/commodities/russia-starts-gas-supplies-uzbekistan-via-kazakhstan-2023-10-07/ and https://president.uz/en/lists/view/6862
130. https://thediplomat.com/2023/08/kyrgyzstan-declares-an-energy-emergency-and-looks-to-china-for-support/ and https://eurasianet.org/kyrgyzstan-capital-citys-water-crisis-nears-critical-point
131. https://www.undp.org/turkmenistan/press-releases/undp-raises-awareness-water-specialists-issues-related-impact-climate-change-water-resources-turkmenistan and https://interfax.com/newsroom/top-stories/97171/
132. https://www.un.org/en/chronicle/article/water-sustainable-development and https://sdgs.un.org/conferences/water2023