ERASMUS-EDU-2023-CBHE
Project number: 101129032

Duration: 36 months
(01/01/2024 – 31/12/2026)

LESLIE
LAND MANAGEMENT
ENVIRONMENT &
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MICRO-CREDENTIAL

Climate Change of Sustainable Land Management in Central Asia

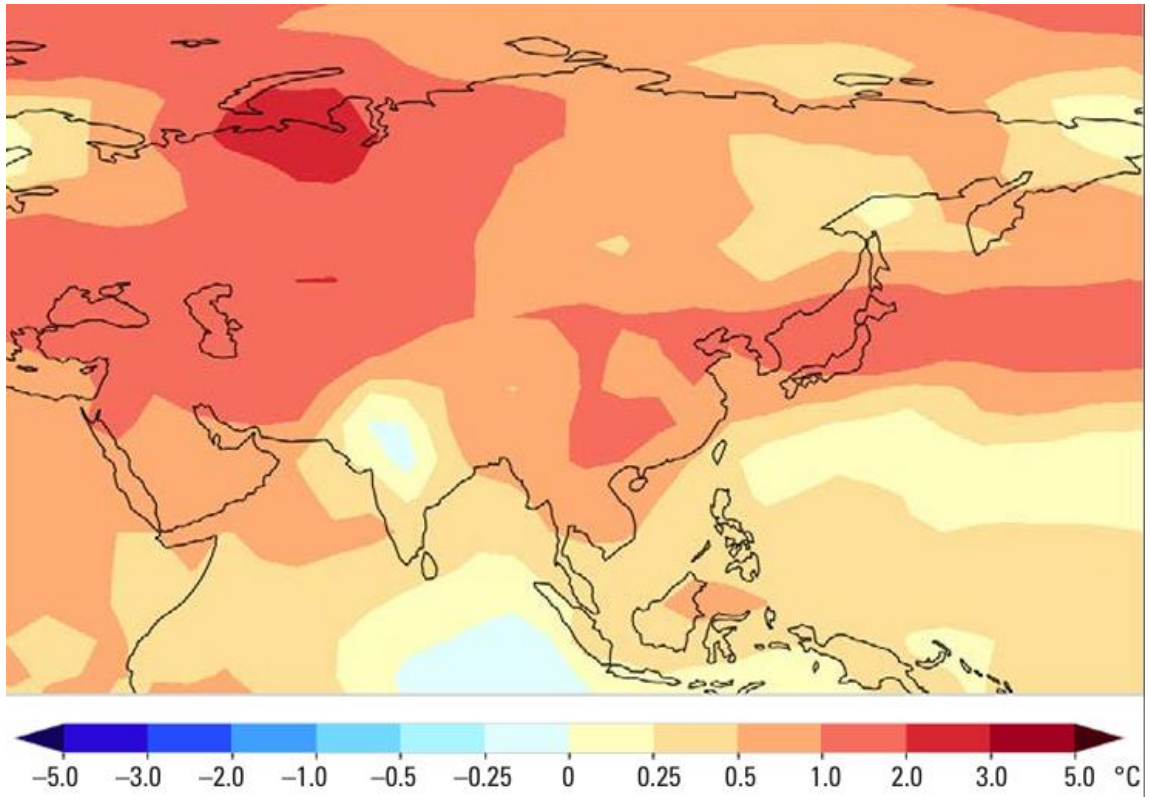
2- Observed Climate Change and attribution

Observed Climate Trends in Central Asia

CC-W02-V08



CENTRAL ASIA IS HIGHLY EXPOSED AT THE CLIMATE-WATER NEXUS



Mean near-surface temperature anomalies across Asia in 2023 relative to the 1991–2020 average, showing pronounced warming across Central Asia within a broader continental pattern. Source: *State of the Climate in Asia 2023*. Geneva (WMO, 2024, Figure 3, p. 8.)

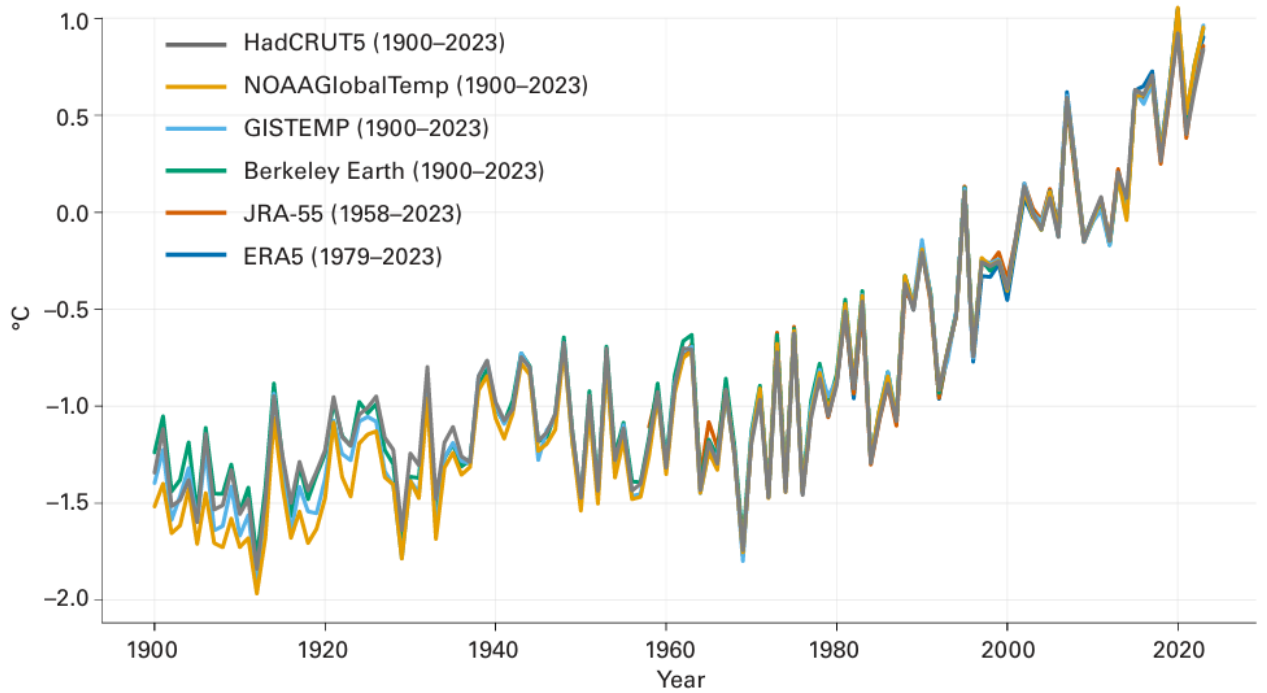
- Large parts of Central Asia are arid to semi-arid.
- Many river basins depend heavily on seasonal snowpack and glacier melt from surrounding mountain systems.
- This creates high exposure to changes in temperature, snow accumulation, melt timing, and glacier mass.
- In this region, climate change rapidly translates into water-security risk.



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ASIA IS WARMING RAPIDLY, WITH DIRECT IMPLICATIONS FOR CENTRAL ASIA

- The WMO reports that Asia is warming faster than the global average.
- Higher background temperatures intensify evaporative demand, glacier melt, and heat stress.
- For Central Asia, climate change affects both the timing of water supply and the pressure on demand.
- Regional impacts must therefore be interpreted within the broader Asian warming context.



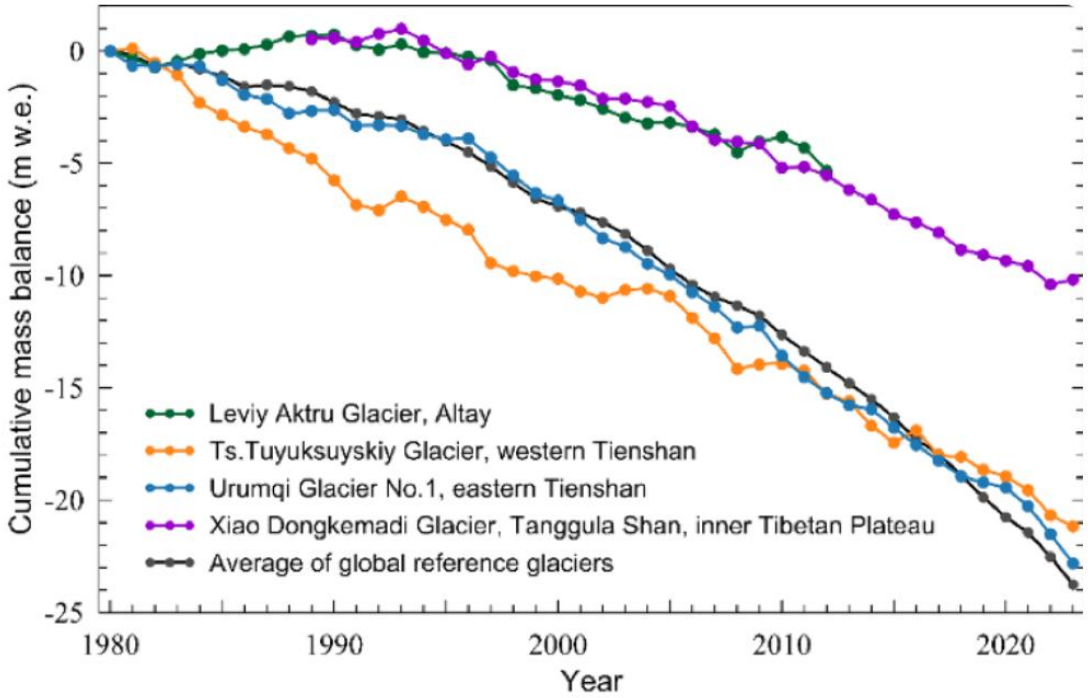
Asia's long-term warming trend relative to the global average. Source: WMO (2024), State of the Climate in Asia 2023.



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GLACIER RETREAT IS A CLEAR WARNING SIGN IN CENTRAL ASIA

Snow cover extent over Asia in 2023 was slightly less than the 1998–2020 average.



Cumulative glacier mass balance in High Mountain Asia, showing sustained long-term ice loss. Source: WMO, State of the Climate in Asia 2023 (2024).

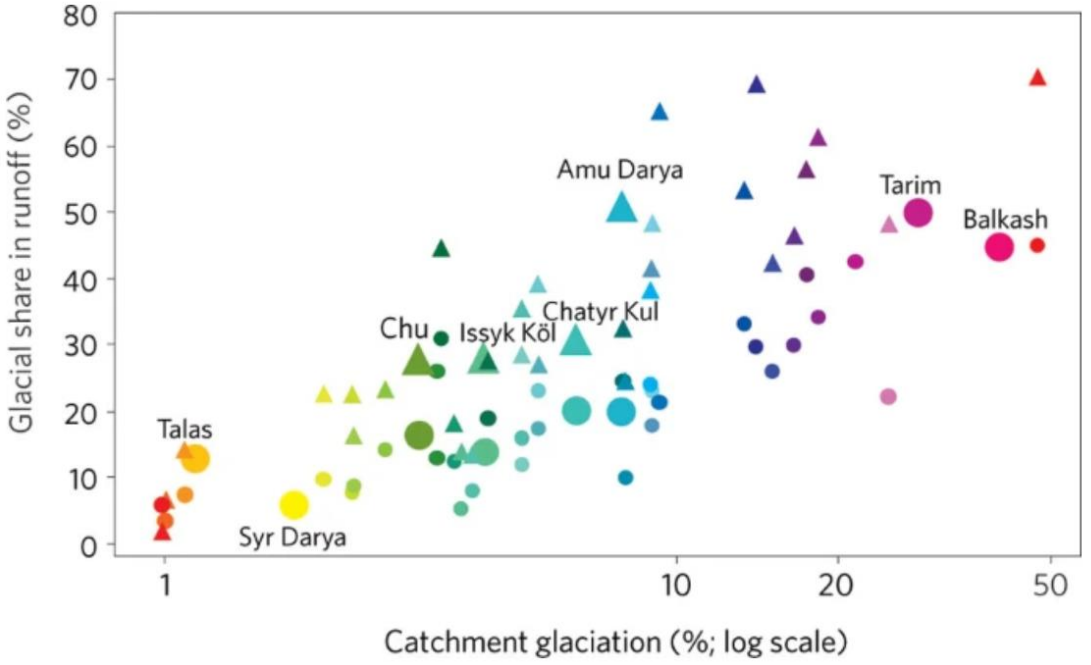
- The WMO reports severe glacier mass loss in the Tien Shan.
- Glacier retreat increases hazards, including glacial lake and slope-instability risks.
- It also threatens the long-term reliability of meltwater for downstream users.
- This is especially important for irrigation, hydropower, and regional water security.



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IN CENTRAL ASIA, WATER TIMING MATTERS AS MUCH AS WATER VOLUME

- Meltwater is especially important in the warm season, when irrigation demand is highest.
- Changes in snowpack and glacier volume can shift the timing and magnitude of runoff.
- A short-term increase in melt does not guarantee long-term water security.
- The core issue is the reliability of seasonal supply under continued warming.



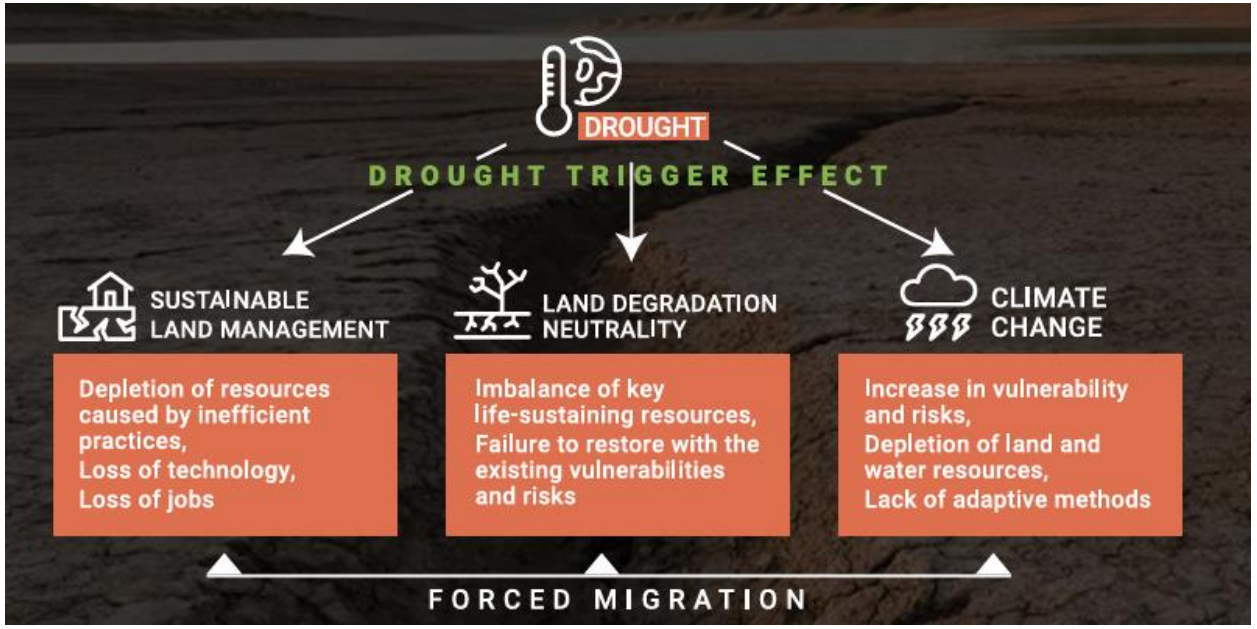
Contribution of glacier and snow melt to runoff in Tien Shan headwaters, showing why seasonal water timing is critical for irrigation and hydropower in Central Asia. Source: *Climate change impacts on glaciers and runoff in Tien Shan (Central Asia)*, Nature Climate Change. (Sorg et al., 2012)



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CLIMATE RISK IN CENTRAL ASIA IS AMPLIFIED BY HEAT, DROUGHT, AND LAND DEGRADATION

- Hotter summers increase evapotranspiration from soils and crops.
- Land degradation reduces resilience to both drought and intense rainfall.
- Climate risks intensify where water stress, irrigation pressure, and land mismanagement already interact.
- This makes climate change both an environmental and a governance challenge.



Interactions between climate change, land degradation, and land-management responses in Central Asia, showing why regional climate risk emerges through connected pressures rather than a single variable. Source: he Nexus Between Climate Change, Land Degradation and Migration in Central Asia (UNCCD, 2023, Figure 4).

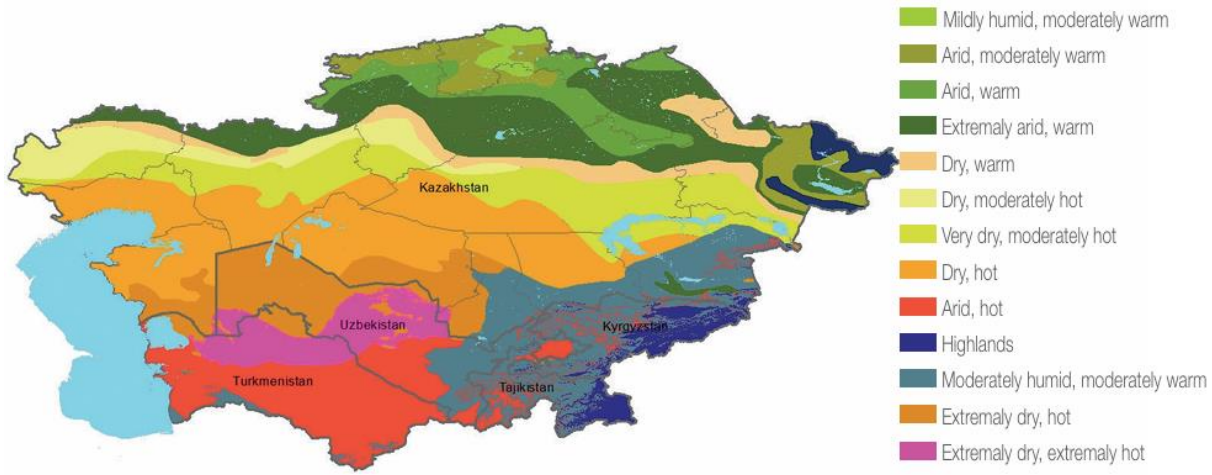


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CENTRAL ASIA SHOWS LOCAL VARIATION, BUT A CONSISTENT REGIONAL TREND

- Some places show wetter conditions in certain seasons, while others show stronger drying pressure.
- That local variation reflects topography, snowpack, circulation, irrigation, and land use.
- Complexity does not mean uncertainty about the broader direction of risk.
- The consistent regional picture is one of warming, glacier loss, and growing water stress.

Map of agroclimatic zoning of Central Asia





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