ERASMUS-EDU-2023-CBHE
Project number: 101129032

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

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LAND MANAGEMENT
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Climate Change of Sustainable Land Management in Central Asia

5.- Climate Extremes, Hazards and Risk

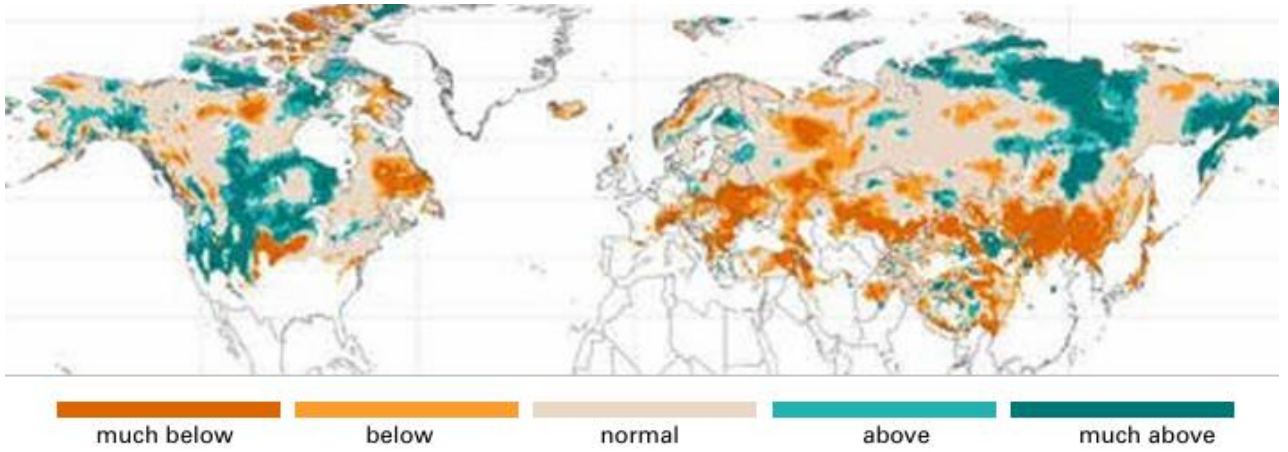
From Climate Hazard to Risk: A Practical Framework

CC-W05-V17



HEATWAVES AND INCREASE EVAPORATIVE DEMAND

- Heatwaves intensify water stress because higher temperatures increase atmospheric water demand.
- Soils, crops, reservoirs and vegetation lose more moisture even when annual rainfall does not change sharply.
- In mountain basins, warm anomalies also reduce snow persistence and shift melt earlier in the year.
- The result is a seasonal mismatch between water availability and peak summer demand.



Map 1. Example of below-normal snow water equivalent in the Northern Hemisphere in March 2023.



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FLOOD RISK IN A WHOLE-CATCHMENT PERSPECTIVE

- A warmer atmosphere can hold more water vapour, which raises the potential for intense precipitation.
- Floods are controlled not only by rainfall, but also by soil moisture, snowmelt timing, land cover and drainage conditions.
- In mountain regions, earlier snowmelt, glacier retreat and unstable proglacial lakes can alter flood mechanisms.



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DROUGHT AS A MULTI-STAGE PROCESS OF WATER SCARITY

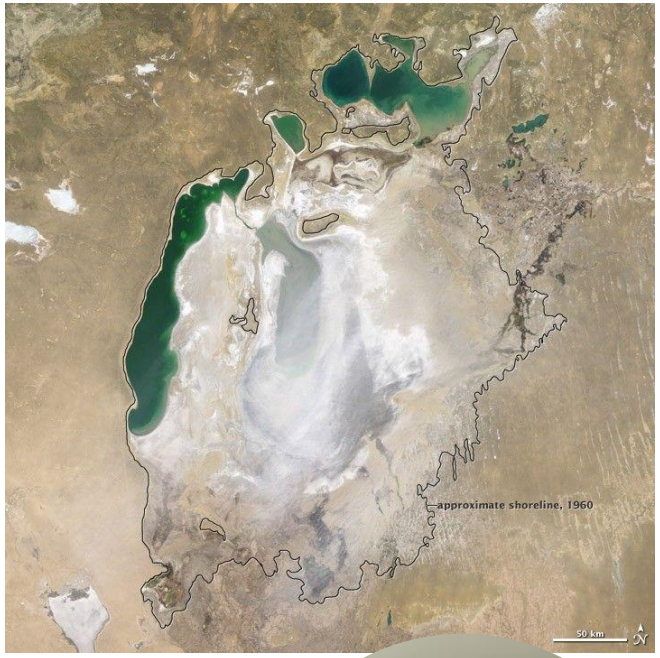
- Drought usually begins as a precipitation deficit, but it develops through soil-moisture loss, reduced river flow, falling reservoir levels and groundwater stress.
- Rising temperature intensifies each stage by increasing atmospheric demand and reducing evaporative cooling.
- A hot drought is therefore a mutually reinforcing process, not simply heat plus low rainfall.
- The result can be crop loss, lower hydropower reliability and wider pressure on water security.



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DUST STORMS AS WATER-RELATED ENVIRONMENTAL HAZARDS

- Dust storms emerge from dry, sparsely vegetated and disturbed surfaces.
- Drought, exposed lake beds, poor irrigation practices and land degradation all increase dust-source activity.
- Dust degrades air quality, reduces visibility, damages crops and can transport salts and pollutants.
- In Central Asia, the Aralkum shows how hydrological failure can become a long-lasting atmospheric and public-health hazard.



Satellite image of dust over the Aral Sea, illust… and exposed sediments create frequent dust h… ry, "Dust Over the Aral Sea



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COMPOUND EVENTS AND CASCADING SYSTEM STRESS

- Heatwaves, droughts, floods and dust storms should not be treated as isolated events.
- Heat raises evaporative demand; drought reduces vegetation and soil moisture; degraded catchments can then respond more severely to intense rainfall.
- Exposed sediments further increase dust activity, creating cascading impacts across sectors.
- A risk-centered approach must therefore recognize interaction, sequencing and feedbacks.



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IMPLICATIONS FOR WATER MANAGEMENT IN CENTRAL ASIA

- 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.



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