[INFORMATION AND COMMUNICATIONS TECHNOLOGY
AND DISASTER RISK REDUCTION DIVISION]

Managing in-land water disasters in the Aral Sea: sub-regional pathways for adaptation and resilience

An analysis of climate change impact on the Aral Sea transboundary hazard

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About the report

Managing in-land water disasters in the Aral Sea: sub-regional pathways for adaptation and resilience is an analytical research study that brings out comprehensive economic, social and environmental assessment of the Aral Sea catastrophe as well as provides the latest scientific evidence on the climate crisis using a multi-sectoral and multi-disciplinary approach. It also presents a strategic perspective on developing a subregional transboundary cooperation framework to reduce and mitigate disaster risks in inland water basins related to the Aral Sea.

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Photo credits

Cover: a figure of the Aral Sea from unsplash.com.

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Executive summary

The desiccation of the Aral Sea Basin is well studied for its causes and devastating impacts in the surrounding countries, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Over the decades the Aral Sea catastrophe has transformed into a transboundary hazard that has affected the arid and semi-arid regions of Central Asia. It's important to recognise that teleconnections[1] exist between natural resources and natural ecosystem services in a transboundary hazard. While economic and social linkages alter this teleconnection, climate change substantially contributes to the imbalance.

This study 'managing in-land water disasters in the Aral Sea: sub-regional pathways for adaptation and resilience' capitalizes on state-of-the-art climate modelling, data science, geo-spatial tools, digital elevation models and analytics to present the risk in the region. It zooms in on the Aral Sea as a transboundary hazard Fand visualizes the climate risk scenarios in the near (2021-2040) and long-term (2081-2100) perspectives. The study finds that under the Shared Socio-economic Pathways (SSP) 2 (moderate) near-term and SSP 3 (worst-case) long-term, the projected average increase of annual mean temperature is between 1.12 to 4.66°C in Central Asia, including in the Aral Sea. Further, projections show that the average increase of annual consecutive dry days under SSP2 near-term to SSP3 long-term is between 2 to 4 days, while the maximum consecutive dry days increase ranges from 13 to 14 days. With regards to precipitation, the study projects average decrease of maximum 5-day precipitation in June-August under SSP2 near-term to SSP3 long-term to between 1.66 to 4.49 mm in Central Asia. The projected average increase of maximum 5-day precipitation in December to February under SSP2 near-term to SSP3 long-term is between 6.59 to 26.64 mm in Central Asia. As the result, floods are projected to be more severe and prolonged, while droughts are likely to be more frequent and lengthier in the surroundings of the Aral Sea.

The key indicator of climate change in Central Asia is the state of glaciers and snow cover, as well as growing desertification in the region. The changing climate scenarios that characterize the Aral Sea are projected by decrease in summer rainfall, increasing number of dry days and temperature resulting in higher aridity. On contrary, there are likely to be increasing winter rainfall with increasing number of rainy days. The elevation of the Aral Sea also contributes to the changing patterns of the climate scenarios. Further, land use changes and water management practices are likely to result in many clusters of agricultural risk hotspots. It is key to note that warming climate in the Aral Sea does not pose just one risk, but multiple, interacting risks. The complexity of these interactions among multiple drivers of climate and other forms of the risk compounds and cascades in the Aral Sea. Hence, the focus of physical science research for these "compounding" risk is to integrate and understand the multiple interactions among drivers of exposure, vulnerability, and response.

The taxonomy of solutions for climate change adaptation and disaster resilience must recognize the compounding risk scenarios that characterize the Aral Sea. Considering a transboundary hazard – the Aral Sea that represents shared vulnerabilities and risks, adaptation measures must include integration of the climate change scenarios into various medium and long-term plans, programs, etc., both at the national and sub-regional levels. It is in this context that the study introduces a set of adaptation priorities – (i) strengthening multi-hazard risk assessment and early-warning systems; (ii) improving dryland agriculture crop production; (iii) making water resources management more resilient; (iv) nature-based solutions; and (v) making new infrastructure resilient. Derived from its unique compounding and cascading risk profiles, adaptation priorities for managing and mitigating in-land water disasters in the Aral Sea also support simultaneous progress on multiple SDGs (Figure A).

It's crucial for the adaptation priorities of transboundary Aral Sea hazard to be risk with information on the regional specificities. (Figure B). For example, multi-hazard risk assessment and early warning

[1] The word 'teleconnections' in this report has been used to imply all those direct and indirect connections between causes and effects separated by geographical distance in their occurrence in specific context of a transboundary hazard – the Aral Sea.

systems are highly useful in mitigating all types of cropland exposure to multi-hazard, particularly drought, and flood. Early warning monitoring is necessary to plan and reduce the impact of multi-hazard on agriculture, which is directly linked to food security, and the impact of multi-hazard on people. Adaptation priorities to Strengthen Multi-hazard risk assessment and Early warning systems and Improving dryland agriculture crop production have the highest scores for all 5 countries in all the different climate change scenarios, consistent with SSPs.

Figure A – Climate adaptation priorities matrix for the Aral Sea vis-à-vis cluster of SDGs

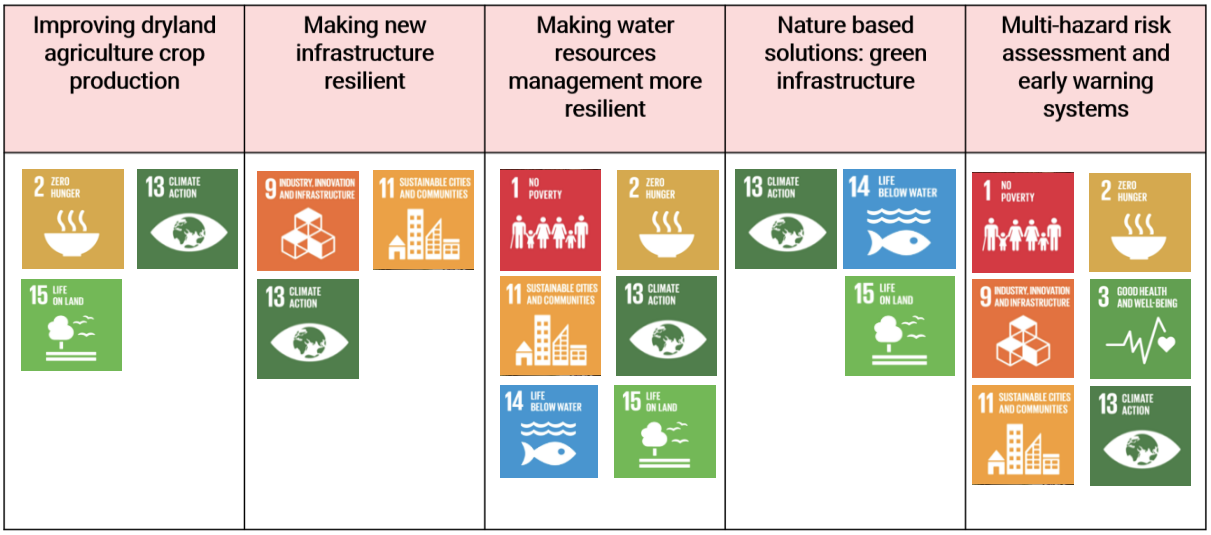
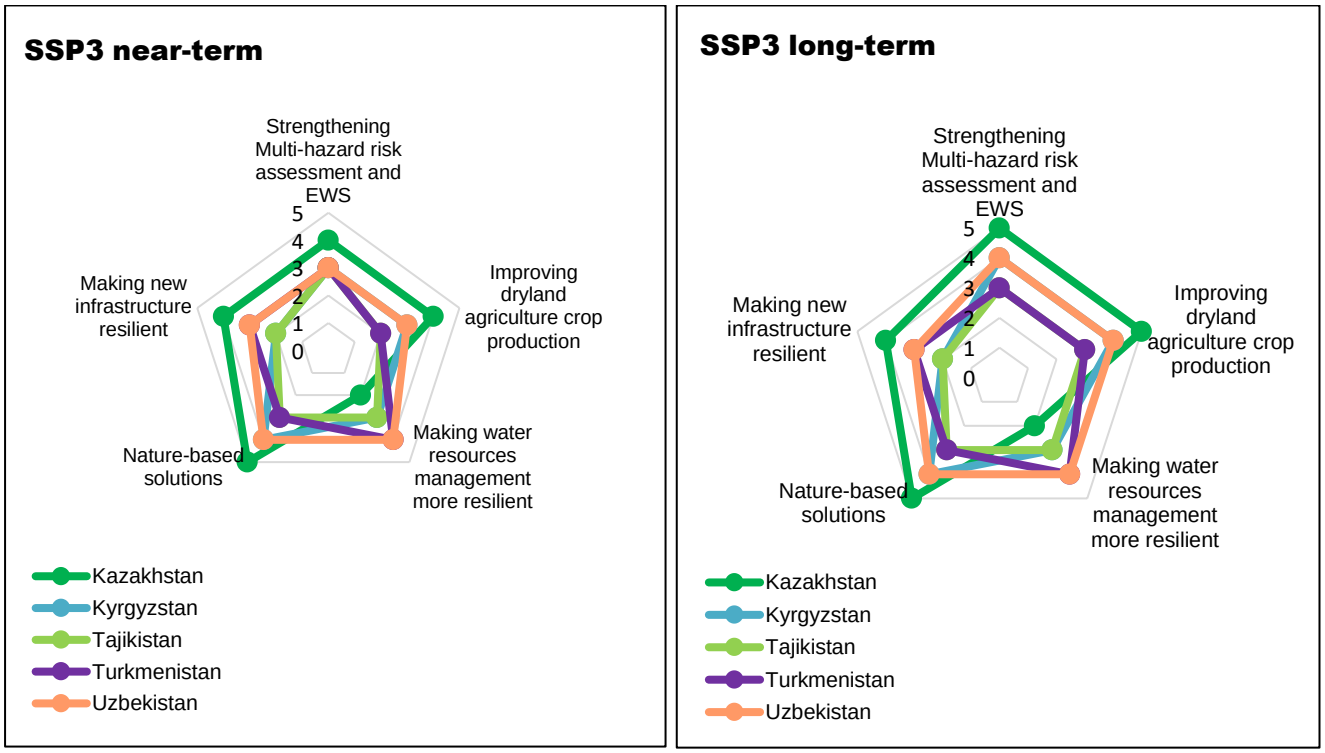


Figure B – Climate adaptation priorities matrix for the Aral Sea, under the worst-case climate change scenarios



Understanding transboundary risks of the Aral Sea vis-à-vis adaptation priories need to factor in the National Adaptation Plan, National Disaster Risk Reduction strategies, Voluntary National Review, and Nationally Determined Contributions as well as the sectoral (agriculture, water and energy) of all associated countries.

Moving forward, opportunity lies in establishing a sub-regional partnership platform on managing in-land water disasters in the Aral Sea associated with North and Central Asian Multi-Stakeholder Forum on Implementation of Sustainable Development Goals. The fifth session of this forum held in October 2021 discussed the implementation of SDGs 14 and 15 in a changing climate and recommended subregional cooperation mechanisms for addressing transboundary challenges.

The Committee on Disaster Risk Reduction of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) at its 7th session held on 25-27 August 2021 also recommended a scale-up of regional and subregional cooperation strategies on disaster risk reduction and climate resilience to complement national efforts in implementing the 2030 Agenda for Sustainable Development. It's in this context that ESCAP conducted this analytical study as well as companion study on Aral Sea, Central Asian Countries and Climate Change in the 21st Century. Both studies focus on developing regional cooperation mechanism to reduce and mitigate disaster risks in endorheic (inland) water basins related to Aral Sea. The study served as the basis for expert consultation with experts and key stakeholders of the Aral Sea basin during the regional meeting that ESCAP organized on 14 March 2022. Considering ESCAP's mandate and comparative advantage, the experts recommended organizing a policy dialogue on managing the risk of in-land water disasters in the Aral Sea on the side-lines of sixth North and Central Asian Multi-Stakeholder Forum on Implementation of Sustainable Development Goals to shape a subregional cooperation framework with the suggested action plan.