ERASMUS-EDU-2023-CBHE
Project number: 101129032

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

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Climate Change of Sustainable Land Management in Central Asia

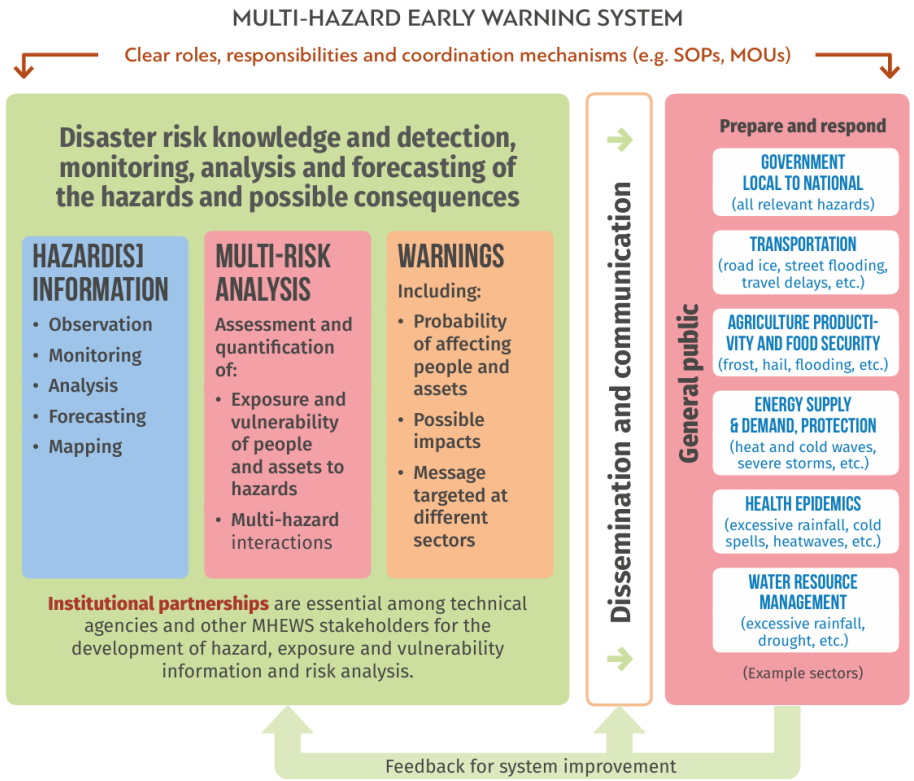
5.- Climate Extremes, Hazards and Risk

Disaster Risk Reduction and Early-Warning Systems

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MONITORING AND EARLY WARNING FOR WATER SECURITY



Schematic of a multi-hazard early warning system. Source: WMO (2018), Multi-hazard Early Warning Systems: A Checklist, page 5.:

- Disaster risk reduction aims to prevent new risks, reduce existing risks and strengthen resilience before disasters occur.
- For water systems, that means planning, monitoring, ecosystem management and resilient infrastructure, not only emergency response.
- The Sendai Framework emphasizes understanding risk, governance, investment and preparedness.
- Monitoring is therefore a core adaptation function, not [illegible]al technical add-on.



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AN EFFECTIVE WARNING SYSTEM MUST FUNCTION END TO END

- An effective early-warning system links risk knowledge, monitoring, forecasting, warning dissemination and response capacity.
- A technically accurate forecast is not enough if communication channels are weak or local action protocols are absent.
- Success depends not only on the right prediction rather than harm reduction
- Early warnings are both a scientific and an institutional system.



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RISK KNOWLEDGE AND LONG-TERM OBSERVATION

- Stream gauges, snow and glacier observations, groundwater records, remote sensing and impact databases improve anticipation of danger.
- Without long-term data, it is difficult to recognize trends, thresholds and seasonal anomalies.
- Monitoring therefore supports both immediate warning and longer-term adaptation planning.
- In mountain and dryland regions, data continuity is especially important.



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DATA SHARING AND EARLY ACTION IN TRANSBOUNDARY BASINS

- Upstream observations often determine downstream risk in shared river basins.
- For this reason, data sharing is both scientifically necessary and politically important.
- Weak cooperation can delay warning, complicate reservoir management and increase downstream exposure.
- Effective early action therefore depends on transboundary coordination as well as national capacity.



Map. Major transboundary river basins in Central Asia, illustrating upstream–downstream dependence in sh re.



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DISASTER RISK REDUCTION BEYOND FORECASTING

- Risk reduction includes land-use planning, ecosystem management, resilient infrastructure and preparedness training.
- The objective is to reduce the conditions that turn hazards into disasters.
- This connects short-term warning to long-term adaptation and development planning.
- The chapter therefore frames early warning as one component of a broader resilience strategy.



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WHY GOVERNANCE DETERMINES PERFORMANCE

- Warning systems require trusted institutions, clear mandates and agreed response procedures.
- Where governance is weak, even good technical information may fail to produce timely action.
- The long-term challenge is therefore institutional capacity, not only better sensors or models.
- Preparedness succeeds when knowledge can be translated into decisions.



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