

# MENAdrought in Jordan: Strengthening capabilities to manage drought risk

## About MENAdrought

Launched in 2018, the MENAdrought project empowers the governments of Jordan, Lebanon and Morocco (countries in the Middle East and North Africa [MENA] region) with the tools to anticipate, prepare for, and mitigate the worst impacts of drought. The project is helping build self-reliance so the three countries can effectively manage the impacts that droughts have on water and food security, and in turn limit the social and economic damage resulting from drought.

Led by the International Water Management Institute (IWMI) with support from the United States Agency for International Development (USAID), MENAdrought pools the resources and expertise of global leaders in the field of drought monitoring, forecasting and management.

MENAdrought uses an approach based on three pillars to improve drought risk management. The pillars are: developing drought monitoring and early warning systems; conducting impact and vulnerability assessments; and elevating the importance of drought mitigation, preparedness and response.



## Water and drought in Jordan

Jordan is one of the most water-scarce countries in the world. With an annual per capita water availability of approximately 100 m<sup>3</sup>, the country's freshwater supplies fall considerably below the global benchmark of 'absolute scarcity' (established at 500 m<sup>3</sup>).

Studies reveal that the 1998–2001 dry period in Jordan was more severe than any other in the past 500 years. Climate change will no doubt lead to more droughts, which will cause significant disruptions in water supply and have a big impact on the agriculture sector and the livelihoods of communities dependent on it. There are about 102,000 farming households in Jordan, of which 85% are smallholders. Nearly a quarter of Jordanians below the poverty line rely on agriculture for their livelihoods.



A drying water pond at the Azraq Basin in Jordan (photo: Seersa Abaza/IWMI).



## Pillar 1: Monitoring and early warning systems

The MENAdrought team first conducted a needs assessment in Jordan to determine various stakeholders' requirements for drought monitoring and management. This assessment identified knowledge gaps about depicting drought onset, progression and termination as well as impacts and sources of vulnerability to drought and their relation to drought management policies and systems.

MENAdrought developed early warning systems in Jordan that indicate current drought conditions and predict rainfall conditions in the upcoming months. These systems enable managers to take actions to help curb the worst impacts of drought. This occurs through a map-based monitoring system using an enhanced Composite Drought Index (eCDI) to detect drought impacts on both irrigated and rainfed agricultural systems, as well as seasonal rainfall forecasting tools.

The eCDI uses remotely sensed and modelled data and includes anomalies of precipitation, vegetation health, root zone soil moisture and day-night land surface temperature as a proxy for evapotranspiration. To produce the eCDI, these indicators were normalized and weighted.

Each month, the system produces eCDI values for every 5x5 km pixel on the map at a national level. Pixels are categorized as 'no drought', 'moderate drought', 'severe drought' or 'exceptional drought' in relation to their percentile value. Monthly drought maps are produced within eight days of the new month.

The MENAdrought team also developed convolutional neural network (CNN) models to improve the outputs of global precipitation forecasts for Jordan. The project's CNN model can accurately forecast rainfall with lead times of 1.5 months in semi-arid to subhumid agroecological zones. This precipitation data could be used in hydrological models to predict streamflow or agricultural models to predict crop yield and production.



## Pillar 2: Assessments of vulnerability to drought

MENAdrought assessed which communities, economic sectors and environments are most impacted by droughts and why they are vulnerable. The project team then examined the economic and social costs of this vulnerability. These studies can help guide drought risk management planning so that interventions target the underlying causes of the vulnerability.

Analysis using the eCDI shows two major drought events in the past two decades in Jordan: 2001 and 2009. The agricultural impacts of the droughts were worst for rainfed systems including cereal-based systems and staple crops for nationwide food security (chickpea, lentils and olives), crop-livestock integrators and pastoralism. The cereal and livestock sub-sectors are the most exposed and sensitive to drought impacts due to the predominance of rainfed and smallholder production systems. The fruit trees sub-sector is also highly sensitive as groundwater is being abstracted above safe levels.

Jordan's underlying chronic water scarcity is a key component of its drought exposure and sensitivity. Renewable water availability per capita is now 60% lower than in 1990.

Women are particularly exposed to drought's financial impacts because of their reduced ability to access formal assistance or credit/loans due to their lower rates of asset and land ownership, lower earnings, lower rates of account holding and cultural reasons including requirements for male guarantors.

A case study assessed how drought exposure, sensitivity and coping mechanisms interact with drought impacts on both growers and herders in Azraq, a region that has fragile groundwater-fed wetland and oasis ecosystems that are under national conservation and protection. During drought, smallholder farmers in Azraq can suffer production losses of around 50%. This is primarily due to the lack of adequate storage or processing of produce.



Water well - HRH Prince Ghazi's farming initiative in Jordan (photo: Seersa Abaza/IWMI).





## Pillar 3: Mitigation, preparedness and response

To enhance mitigation, preparedness and response planning, IWMI worked closely with multi-ministerial, interdisciplinary teams with various functions across the Government of Jordan – from technical drought monitoring to policy and management planning. The result is a drought action plan (DAP) that helps government agencies consider what drought impacts are most important for them to address first, from their point of view, and how to do so with the available resources, policy context, and constraints they face.

To develop the DAP, government stakeholders prioritized impacts they wished to address in the first iteration. They chose to focus on water resource degradation, drinking water service quality, livestock and agricultural production, human health and protection of key natural resources. They developed the plan through working sessions and ‘write shops’ that brought together ideas, experiences and insights from many stakeholders.

The insights gained were used to define the Jordan DAP, which outlines the actions, roles and responsibilities needed for effective drought response.

Jordan’s DAP builds on the *Water Sector Policy for Drought Management* and the *National Risk Reduction Strategy*.

The *Policy* established a National Committee for Drought Management (NCDM) from relevant institutions that have authority to make executive decisions and a Drought Management Unit (DMU).

The DAP also involves the National Center for Security and Crisis Management (NCSCM), which has the ultimate authority for managing drought response actions during periods of crisis. The DAP outlines the role of the Drought Technical Committee (DTC), which is an inter-agency multidisciplinary working group that has a range of operational and policy planning roles.

The DAP outlines response actions according to impact type. For drinking water services, response actions focus on customer service and addressing the loss of universal and equitable service delivery during drought periods. For irrigated agriculture, the actions call to rationalize water allocation during drought periods and aim to share the costs between irrigators and other economic sectors. Rainfed and irrigated agriculture actions address yield losses and the livelihoods and poverty of rainfed farmers and pastoralists. DAP actions also seek to minimize degradation to rangelands and forests. Lastly, the DAP has actions to address the risks associated with higher levels of pathogens in water and food and health impacts on children during drought periods.

Finally, the MENAdrought team is advising its partners on which practices and technologies are most effective for increasing resilience to drought and suggest risk finance solutions that could be developed in the future.



Farmers after completing pesticide spraying at the Abu Kishik Farm in Mafraq, Jordan (photo: Seersa Abaza/IWMI).

## Additional reading

Fragaszy, S.R.; Jedd, T.; Wall, N.; Knutson, C.; Belhaj Fraj, M.; Bergaoui, K.; Svoboda, M.; Hayes, M.; McDonnell, R. 2020. Drought monitoring in the Middle East and North Africa (MENA) region: Participatory engagement to inform early warning systems. *Bulletin of the American Meteorological Society (BAMS)* 101(7): E1148–E1173. <https://doi.org/10.1175/BAMS-D-18-0084.1>

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## Partners

**Primary partners:** International Water Management Institute (IWMI); National Drought Mitigation Center, University of Nebraska-Lincoln; Daugherty Water for Food Global Institute, University of Nebraska; Goddard Space Flight Center, National Aeronautics and Space Administration (NASA); and Johns Hopkins University.

**National leader:** Ministry of Water and Irrigation.

**National partners:** Department of Statistics; Jordan Meteorological Department; Ministry of Agriculture; Ministry of Health; Ministry of Environment; National Agricultural Research Center; National Center for Security and Crisis Management; and the University of Jordan.



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