IWMI
International Water Management Institute

MENAdrought Project
Technical Fact Sheet

Enhanced Composite Drought Index (eCDI) supports drought early warning

MENAdrought has developed a drought monitoring product that integrates satellite and model data on rainfall, land surface temperature, soil moisture, and vegetation health – all compiled into an enhanced Composite Drought Index (eCDI). The color-coded maps allow decision makers to identify an emerging drought. National agencies run the entire process so that they can make use of the information to direct early mitigation efforts, helping stave off some of the more severe impacts of drought.

About MENAdrought

Launched in 2018, the MENAdrought project empowers the governments of Jordan, Lebanon and Morocco 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.

Developing the enhanced Composite Drought Index (eCDI)

The MENAdrought project is providing countries in the Middle East and North Africa (MENA) region with the tools they need to monitor and predict drought. The team has developed a satellite- and model-based drought early warning system, which is built around an enhanced Composite Drought Index (eCDI).

The first step towards developing the eCDI involved collecting meteorological and vegetation data from satellites, ground observations and computer models. The data sources for the drought indicators were selected based on data availability in terms of timeliness and historical record, and quality. This relatively long time-series was needed to capture the range of conditions and the drought intensity in each area.

The indices used are:

- Standardized Precipitation Index (SPI) with a three-month accumulation period. SPI is used worldwide for detecting and characterizing meteorological droughts. Measuring the SPI across three months can help indicate seasonal effects and is often related to impacts such as reduced soil moisture and diminished flow in waterways.
- Normalized Difference Vegetation Index (NDVI). NDVI is used to estimate the coverage of green vegetation across an area of land and indicates vegetation health.
- Root Zone Soil Moisture Anomaly (SMA). SMA is useful for monitoring agricultural characteristics such as the start of the rainy season, planting dates, and early warnings of yield losses.
- Day/night Land Surface Temperature (LST) amplitude anomaly. LST can be used as a proxy for evapotranspiration and relates strongly to heat stress as well as soil moisture.

Conceptually, combining these indicators is intended to provide a holistic measure of agricultural drought. To produce the eCDI, these indicators are normalized and weighted. The historical data make it possible to assess current conditions against events that have occurred since 2000. The eCDI is ranked into percentiles of drought severity during this period.

Training workshop on the operational enhanced Composite Drought Index (eCDI) at IWMI's office in Cairo, Egypt (*photo*: Louise Sarant).

The eCDI in operational use

The eCDI values for each 5x5 km pixel 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, with most of this process requiring a single software program. These maps are a crucial early warning system that provide the means to detect current conditions that can be precursors to severe drought in the growing season.

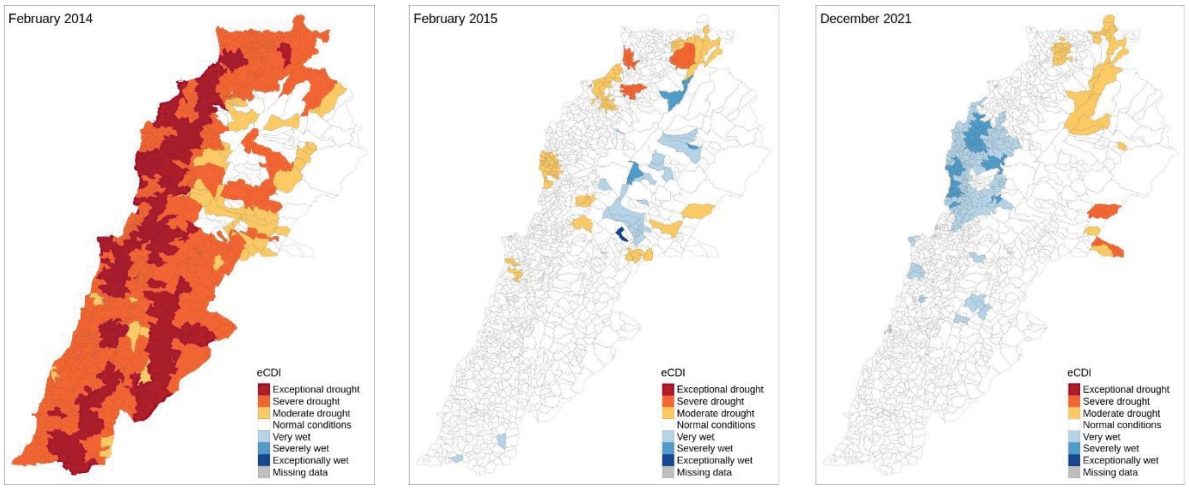
The MENAdrought project team also developed drought thresholds that are used to recommend drought management responses. This enables water and agricultural managers to be better prepared for drought. Specifically, they have defined triggers for drought action plans based on scientific evidence. The drought early warning system is being put into operation within relevant ministries to create long-term sustainability beyond the project life cycle.

Validating the eCDI

The eCDI must be as accurate as possible; droughts are notoriously difficult to identify and characterize in relation to specific impacts. To test the eCDI's ability to detect the impacts of drought on rainfed and irrigated agriculture, and water systems, the MENAdrought project team and national partners evaluated the eCDI as a whole, and individual indices, in multiple ways.

Government agencies were particularly interested in how the eCDI's outputs correlated with rainfed cereal production and yields, especially in comparison with SPI alone. The analyses (where possible) showed that the eCDI was more highly correlated with cereal production and yields than the SPI alone, and that the satellite-derived precipitation information compared favorably with observation data.

Maps produced by the enhanced Composite Drought Index (eCDI) showing drought and wet conditions in Lebanon.
Source: Maps created by Karim Bergaoui, IWMI.



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

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