Drought Monitoring and Warning System for the Middle East and North Africa

Adapted From

"Drought Monitoring in the Middle East and North Africa (MENA) Region: Participatory Engagement to Inform Early Warning Systems," by Stephen Russell Fragaszy (National Drought Mitigation Center, University of Nebraska-Lincoln), Theresa Jedd, Nicole Wall, Cody Knutson, Makram Belhaj Fraj, Karim Bergaoui, Mark Svoboda, Michael Hayes, and Rachael McDonnell. Published online in BAMS July, 2020. For the full, citable article, see [DOI:10.1175/BAMS-D-18-0084.1](https://doi.org/10.1175/BAMS-D-18-0084.1).

* A camel grazes on argan trees in the Souss Massa basin of Morocco, where climate stresses result in nomadic herders encroaching on farmers' fields and orchards and cause social strife and dislocation. Photo by Rachael McDonnell

Development and use of effective drought early warning systems require wide stakeholder involvement. At the same time, drought management is inherently political. Often, only a disaster (in the United States, a key event was the Dust Bowl of the 1930s) can provide the political will and therefore policy window to amend and improve drought monitoring and management systems and create new, broad-based coalitions over time.

Such an event may be evident across the Middle East and North Africa (MENA), the world's most water-stressed region: there is evidence in some parts of the region that recent decades have been among the driest in the past millennium. The dual pressures of climate change and demographic growth will make the problem progressively worse.

MENA governments are upgrading their monitoring capabilities that underpin essential drought risk management. We present stakeholder-identified needs to improve drought early warning systems and their linkages to drought governance in the MENA region, specifically in Morocco, Tunisia, Lebanon, and Jordan.

Project structure and participatory approaches

The MENA Regional Drought Management Systems (MENA RDMS) project builds on past Moroccan government–academic collaborations focused on smallholder agricultural systems critical for food security and socio-economic stability. These efforts produced a composite drought indicator (CDI)—a 5×5 km gridded dataset that is the result of combining several indicators (precipitation, vegetation health, soil moisture, and evapotranspiration), that can be used to monitor drought on a monthly or more frequent basis. The CDI was the initial “template” for the MENA RDMS project.

CDI inputs are indicator anomalies for specific pixels, so outputs inherently reflect local drought. MENA countries are customizing the CDI to best reflect their most significant drought impacts; it is not a “one size fits all” metric.

The research included a needs assessment that aimed to help MENA RDMS project partners (1) tailor the CDI to national needs and incorporate it in drought governance structures, and (2) study drought impacts and vulnerabilities to help identify priority impacts, regions, sectors, and populations as well as potential policy avenues.

The assessment started with face-to-face interviews in 2016 with government officials for agriculture, water management, and meteorology; farmers and farmer union officials; and others. Interactive workshops and surveys in each country followed from October 2016 to January 2017. Workshop participants shaped the list of drought impacts identified in the needs assessments. The research occurred during a severe, multiyear regional drought, which strongly increased stakeholder interest in participation.

Results

The broad sample of interviewees resulted in a description of a wide range of impacts that cascade from the meteorological onset of drought into agricultural, hydrological, ecological, and socioeconomic domains.

Stakeholders in each country reported that governmental drought monitoring programs are often supplemented by other organizations. For instance, in Tunisia, farmers’ union representatives have a role in drought

monitoring, and in Morocco, the private sector insurance firm MAMDA assesses drought impacts. Farmers also apply local environmental knowledge to evaluate drought, such as by monitoring pests’ presence, bee activity and honey quality, and bird species’ presence and migration timing. There is a relative lack of information-sharing between government agencies, and also from government to civil society, and in all countries, interviewees desired the creation of a data-sharing platform that would require sharing of open-access data among participating agencies.

Across the project countries, interviewees expressed skepticism about the capacity of remote sensing and modeled data to provide acceptable levels of accuracy, precision, and geographic scale. As such, stakeholders want robust validation of monitoring tools incorporating this type of information to ensure that they accurately reflect the drought impacts they see on the ground. Also, to reflect local conditions more accurately, core agencies have begun to replace remotely sensed data with observed data inputs where possible, especially for precipitation.

Participants uniformly expressed the need to improve engagement between farmers and government agencies. Farmers need useful, tailored drought-related information, and for government to realize that farmers hold critical drought information. This was especially relevant in Lebanon where stakeholders perceive that political decision-makers do not consider drought a significant problem for the country.

Government officials emphasized the need for open-source data and modeling to ensure that the core agencies could produce, update, and continue to shape the CDI. As a result, the project team trains agencies that produce the CDI operationally to ensure simplicity of coding and modeling. Also, the project team developed open-source GIS components and a customized Python-based model, developed automated data acquisition and processing, and shifted some components from Linux to Microsoft operating systems.

Currently, CDI validation assessments involve expert networks that the needs assessments helped form through the participatory engagement processes. These networks are expected to broaden over time.

Interviewees wanted to integrate CDI outputs with wider early-warning systems and

Composite Drought Index for February 2014

Composite Drought Index for January 2016

Composite Drought Index for September 2017

Composite Drought Index for October 2017

MENA CDI for January 2016.

drought management policies. The reported needs, especially developing technical drought definitions and thresholds, clearly link to intervention decision-making. At the workshops, participants indicated priorities including building consensus that CDI values reflect relevant drought impacts and ensuring data and information accessibility.

Discussion

Using multiple engagement methods stimulated different responses. For instance, in the large workshop setting, participants were less willing to admit they struggled to monitor a range of drought indicators. In interviews, however, participants did not hesitate to identify shortcomings in drought monitoring capacities, particularly data access.

MENA government stakeholders have not been very open to public participation in water policy and resource management. However, the participatory research component of this project succeeded primarily because it had strong central agency support and civil society buy-in. The International Drought Monitoring Programme and this specific USAID program were initiated at the request of regional ministers, and civil society organizations in the project countries facilitated participation. Local stakeholders opened the proverbial doors, and without this support, our research would have been severely limited.

* Synthesis of drought monitoring to management components.

Researcher involvement was also key, and the social rapport helped development of relationship networks. The core agencies are now building off the expert networks. For example, the CDI core agencies in Tunisia conducted multisectoral workshops and follow-up regional roadshows to engage local government and civil society organizations.

Interviews typically progressed from household-level food and water security to foreign trade and regional stability issues. In each country, impacts were different, and the impact mitigation interventions varied. However, there has been minimal research in Lebanon on drought impacts, likely due to the paucity of long-term hydrological and agricultural statistics as well as the widespread national perception that because Lebanon is water-rich compared to neighbors, drought effects are minimal.

Perhaps most importantly, few studies thoroughly evaluate the social dislocation drought can cause. In a warmer, drier, more populous MENA region, water security will increasingly connect with broader social stability concerns. Interviewees in all countries described rural outmigration as a major social issue connected to drought. Existing data show that drought is definitively responsible for short- to medium-term internal displacement (especially of young men) to the cities. Unfortunately, though, longer-term impacts have not been assessed rigorously. However,

studies of regional rural outmigration emphasize the role of long-term environmental degradation that drought precipitates: rangeland, soil and groundwater quality degradation, livestock loss, and oasis desiccation.

Over time, agencies hope to incorporate socioeconomic and wider environmental indicators more directly in formal drought monitoring. Impacts on groundwater were also identified as critical, but drought monitoring in the region includes few specific components related to groundwater monitoring.

While contentious drought management topics emerged during the research, we focused on the development of technical drought monitoring tools. Building trust through collaboration on important, but not politically sensitive, issues lays the groundwork and relationships for more effective participatory engagement—or public participation—around politically charged issues such as drought declaration. This separation of technical from other issues will likely inform drought monitoring tool development in other MENA countries and regions where drought management is politically sensitive and relief is primarily a function of the central government. Starting with a focus on drought monitoring may have reduced barriers to collaboration between governmental and nongovernmental stakeholders, effectively increasing stakeholders' acceptance of the collective decisions and approaches.

The primary drought monitoring needs relate to how government officials and other stakeholders share, use, and communicate information rather than to the types and volumes of information generated. These themes connect to wider issues of government provision of information. For example, all the project countries now have “access to information” laws, but their scope and practical implementation vary significantly. With the exception of Jordan, these laws were not in force during our fieldwork, and no interviewees mentioned them explicitly. Given that government agencies develop drought early warning systems and produce the relevant information, these laws are highly relevant to the likelihood of future public provision of that information.

The nascent expert evaluation networks built so far are critical for ongoing development of the CDI, and ultimately more effective drought management systems, policies, and interventions. ●●

BAMS: What would you like readers to learn from this article?

Stephen Fragaszy (National Drought Mitigation Center, University of Nebraska-Lincoln): *I am hopeful that readers see the similarity of types of issues faced by both MENA and OECD countries' governments and therefore the potential for innovations (social, political, technical, etc.) to travel and be adopted in both directions.*

BAMS: How did you become interested in the topic of this article?

SF: *My involvement in this project was a “big break.” I previously studied and worked on water management issues, but this was a major effort in my new field of specialization that built on and integrated many of my previous types of work—applying social research methods, institutional analysis, and stakeholder engagement. So I had been interested in the topic for a while, and I was thrilled to be able to realize that interest in this way and at such scale.*

BAMS: What surprised you the most about the work you document in this article?

SF: *The substantial differences between the countries, even in areas with incredibly similar agro-ecological and socio-economic characteristics. Even with such similar “baseline” or “background” features, the national contexts resulted in surprisingly disparate issues and challenges emerging.*

BAMS: What was the biggest challenge you encountered while doing this work?

SF: *I'll describe two interlinked challenges. The first was the emotion that people brought into the conversations. We did this research in the midst of one of the deepest regional droughts in recent memory. As representatives of organizations, local government, etc., most of the people we engaged with were relatively well off. However, in many cases they were fundamentally distraught at the damages and the prospect of worse to come. Also, they were upset at government responses. The Arab Spring was not a once-off event and was still well underway when we did the fieldwork (and still is underway now). So the political tensions were palpable and ranged from feeling like a moderate undertow to a major riptide depending on the specific location and engagement context.*

BAMS: What's next? How will you follow up?

SF: *The program of work is ongoing and hopefully you will get to read much more in the near future!*

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