MAWRED: Modeling and Monitoring Agriculture and Water Resources for Development
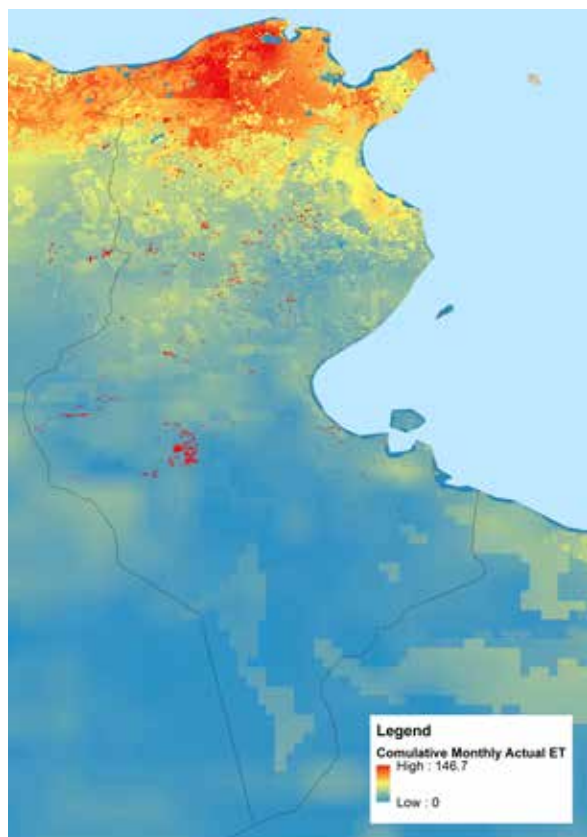

Through the adaption of the latest advances in water models, MAWRED is generating new data to support countries in balancing supply and demand dynamics across their water budgets. This will support efforts to enhance water security across sectors.

Thematic Area: Climate Change Impacts and Management

Purpose: Empower MENA region decision-makers in managing food and water security under current and future climate conditions through the provision of new water, crop and climate data

Geographic Scope: Middle East North Africa: Iraq, Jordan, Palestine, Tunisia and Yemen

Timeline: 2009 - 2015

Funding Agency: United States Agency for International Development (USAID)

Partner: National Aeronautics and Space Administration (NASA)

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Decision-makers in the MENA region need to develop strategic policies and management solutions to meet the challenges of growing water and food insecurity but their efforts are hampered by lack of data. Knowing how much area is under irrigation, what crops are begin cultivated where and how current rainfall and soil moisture conditions compare to historical averages are just some of the questions they need to answer to be able to develop robust and resilient management and operational solutions for the water and agricultural sectors. For strategic planning, there is also an urgent need to understand future conditions of climate, water resource availability and possible changes in crop production to direct new policies and investment frameworks.

In discussions with many decision-makers, whether at the international, national or local business level, it becomes clear that the lack of data hampers planning. It is to address this constraint that the MAWRED program is harnessing the possibilities of cutting edge science, space-based earth observations and computer modeling.

The International Center for Biosaline Agriculture (ICBA) with the support of the United States Agency for International Development (USAID) and in coordination with NASA Goddard Space Flight Center (GSFC) is generating new data and making it available through the MAWRED knowledge hub (www. MAWREDH2O.org) to be accessible to all.

Activities and Outcomes

The activities are centered on data generation in four main key areas vital for water and food security management and policy development. These include **climate, water resources, crop production**, and **drought monitoring and early warning systems**.

Rain, temperatures and evapotranspiration are critical **climate** factors that influence the availability of water in wadis, in the soil and in our groundwater systems. As a result, gaps in meteorological records occur. Therefore MAWRED scientists have generated new data using modeling from available global datasets representing past and future scenarios. This provides a basis from which to understand normal and wetter/drier, hotter/colder conditions and their impact of water availability, in order to project future use and crop production up to 2050.
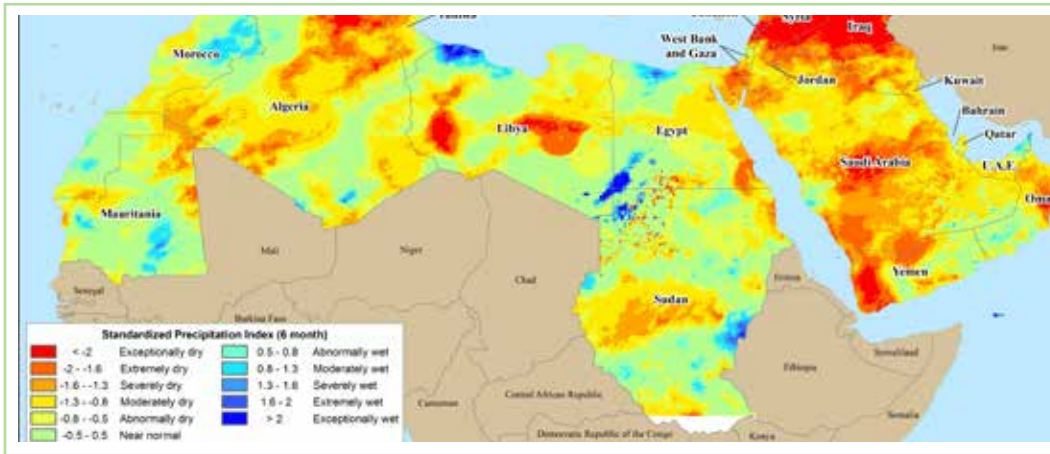
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Data products generated in addition to the standard climate values, will provide key indicators and indices for the region marking conditions such as the number of consecutive dry days and vaporative stress index.

With much of the MENA region being semi-arid or arid, understanding how much **water** is available in the soils and groundwater systems is vital. Under the MAWRED program, models from the US have been adapted to generate new data on the status of various parts of the water cycle including evapotranspiration, soil moisture, and irrigation water use and groundwater levels. These directly support the water budget and allocation decision-making across a country and between sectors.

ICBA is also utilizing these models as a basis for understanding the impacts of **climate change** on water resources with the new atmospheric conditions used as the starting point for the model runs. New insight on the changing nature of key resources such as groundwater, soil moisture, and surface water systems will be generated.

Along these same lines, **crop production** is a vital component of the MENA region's food security as well as of local economies. The livelihoods of millions depend on agriculture either as a source of income or as a way to feed their families. National planning as well as individual farm management can be empowered through the provision of up-to-date data on crop production areas and yields.

Under the **knowledge hub**, ICBA is utilizing a combination of field studies and satellite images to generate new maps of crop production and irrigation areas, to provide decision makers with new insights about the production systems in place. Additionally computer models have been adapted to predict the yields under various environmental and management conditions for key crop species grown in the region such as wheat, pearl millet, sorghum, etc. The model and satellite data sets will be used to produce crop status/yield estimation reports for key countries which are vital to planning for food security in the coming year. These will also be used as a basis for understanding how future crop yields will be affected by a changing climate and other environmental factors.

Threat of drought adds to already water scarce conditions in the MENA region. **Droughts** impact both rainfed and irrigated agricultural lands bringing about losses in yields and directly affecting food availability and rural livelihoods. They also actively stress water resource systems.

At present there are only basic systems in place to alert decision-makers to ongoing drought conditions. This means that the country's ability to act early to mitigate and reduce impacts is limited. New drought monitoring and early warning systems for the MENA region are being established. Thus water, climate and crop data generated through modeling and from satellite based observations can be harnessed. Furthermore, these early warning systems allow local partners to alert water users and farmers of conditions in the near-future.

Under MAWRED program, ICBA scientists are actively involved in **training** scientists and engineers in national centers across the region on how to use the models and the data generated. In some countries the developed models are being transferred to these centers so the work can continue in country as part of everyday operations. In others, the important focus has been training on how to use the data available from the knowledge hub so that the information that continues to be generated at ICBA can be used effectively in local policy and management work.

Future Directions

Since both the public and the private sectors prioritize and respond to long-term certainty, understanding and accounting for changing climate, water and agricultural resource conditions and associated risks is important for future planning. A long-term development plan for MAWRED is therefore in place, centered on creating a regional data and knowledge hub that provides open access data to anyone on a continuous basis.

Furthermore, future ICBA plans to develop the MAWRED program to cover all the countries in detail in the MENA region as well as other countries in regions with similar marginal conditions such as Central Asia and different regions within Africa.