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NDMC NATIONAL DROUGHT MITIGATION CENTER
AT THE UNIVERSITY OF NEBRASKA-LINCOLN

DROUGHTSCAPE

QUARTERLY NEWSLETTER

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About the photo

At over 900 square miles, Anza-Borrego Desert State Park, two hours northeast of San Diego, is the second-largest state park in America. This superbloom in March, the largest in nearly 20 years, took place after the drought-busting rains over the winter.

Steve Boland, Flickr

DIRECTOR'S REPORT

This past quarter's activities at the National Drought Mitigation Center cover a variety of projects and issues and highlight our collaboration with several key partners around the world. I hope you will take the time to browse through this latest edition of DroughtScape.

Mark Svoboda

I would like to highlight a couple of features for this edition:

1. Just in case you missed it, we launched our inaugural NDMC Annual Report. It is a great way to look back on the who, what, where, why and when of what we do. Just as I learned when helping compile this report, I hope you will see the depth and diversity of activities, services and research we are involved with at all scales, not just here in Nebraska, but across the nation and the world. This report highlights just "some" of the great work being done by our staff and students, many of whom reading this have worked with us at some point and time. Learn more about it on page 7.

2. As we move into our third decade of existence, it also gives me great pleasure to let you know that coinciding with the release of our annual report, the NDMC launched a newly revised logo and NDMC brand! Our web portal, social media channels, reports (including this one — see the masthead above), tools and email updates will now feature the new logo, which was created with the goal of helping our brand perform well in the digital and social media realms. Even though our logo has changed, the NDMC's commitment to helping society reduce its risk to drought remains the same as does the high-value research, education, outreach and service work we do. It's all about the water, and the new logo reflects our work across the entire hydrological system in helping build a more drought-resilient world.

3. Finally, I would like to draw your attention to the launch of Tunisia's first composite drought indicator as part of establishing their drought early-warning system. The project is in collaboration with our partners at the International Center for Biosaline Agriculture in Dubai, the Water for Food Global Institute here at University of Nebraska, the University of Maryland and NASA's Marshall Space Flight Center in Huntsville, Alabama. The technology training and transfer took place in February, and they launched their first map the following month. It is very exciting and rewarding to see them take ownership in the development of an operational product that will help them detect and respond to drought in the future.

Check back with us later this summer to find out what's new at the NDMC.

Mark Svoboda

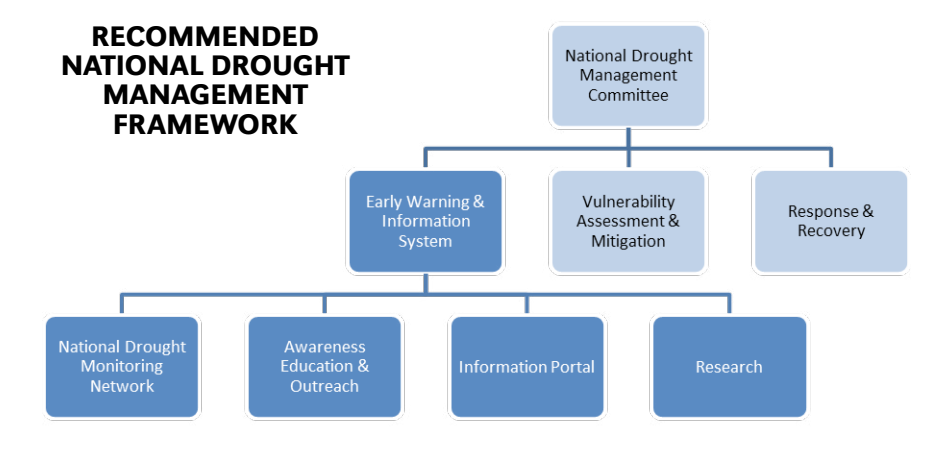
Drought Center helps island nations reduce vulnerability

The National Drought Mitigation Center is working with the Caribbean Institute of Meteorology and Hydrology, the Caribbean Disaster Emergency Management Agency, and the Organization of Eastern Caribbean States to conduct writeshops this spring for four island nations. Each two-day workshop inventories the island nation's progress to date, works with stakeholders to identify logical next steps, and focuses on producing documents that can help shape national policies and practices that reduce vulnerability to drought.

Writeshops were conducted in March for Saint Lucia and Grenada, with more writeshops to be conducted in May for Antigua and Barbuda and Saint Kitts and Nevis. The sessions bring together stakeholders from different sectors, review past drought impacts, and consider how drought monitoring and outlooks can be incorporated into decision making. The 2017 writeshops build on writeshops conducted in 2016.

The Caribbean accounts for seven of the world's top 36 water-stressed countries, according to CIMH and the United Nations Food and Agriculture Organization. The writeshops are consistent with philosophies promoted by the Integrated Drought Management Programme encouraging nations to develop and revise national drought policies.

— KELLY HELM SMITH, NDMC



Courtesy images

Top: The recommended drought management framework focuses on Drought Early Warning Information Systems.
Left: Facilitating a drought planning workshop in St. Lucia were, left to right, Brian Fuchs, National Drought Mitigation Center; Mike Hayes, University of Nebraska-Lincoln School of Natural Resources; and Roché Mahon and Wazita Scott, Caribbean Institute for Meteorology and Hydrology; and Kelly Smith of the NDMC, not pictured.

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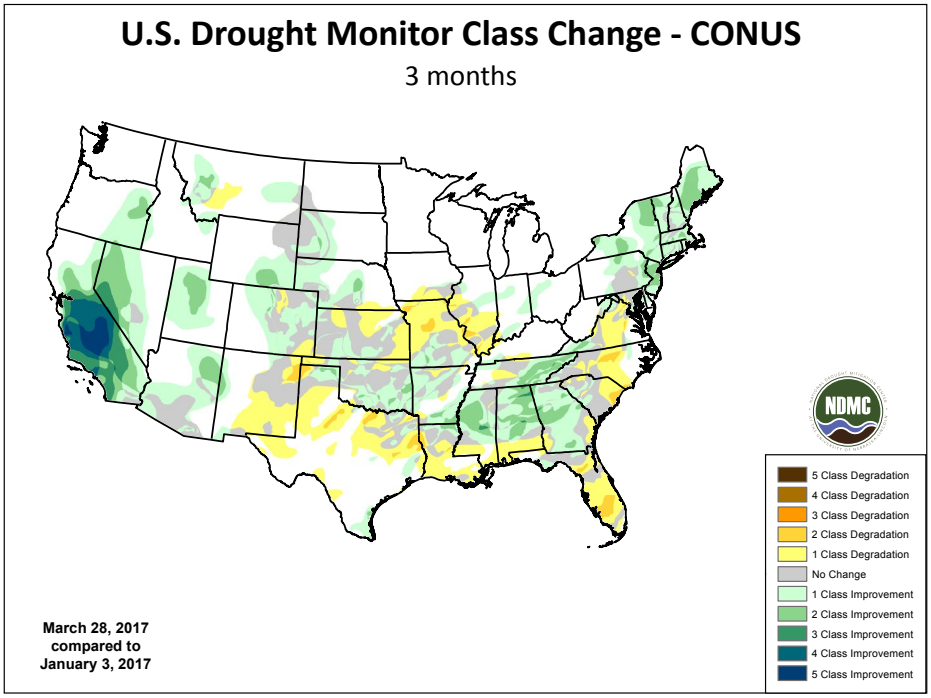
So far in 2017: Above-average precipitation, warmer temps

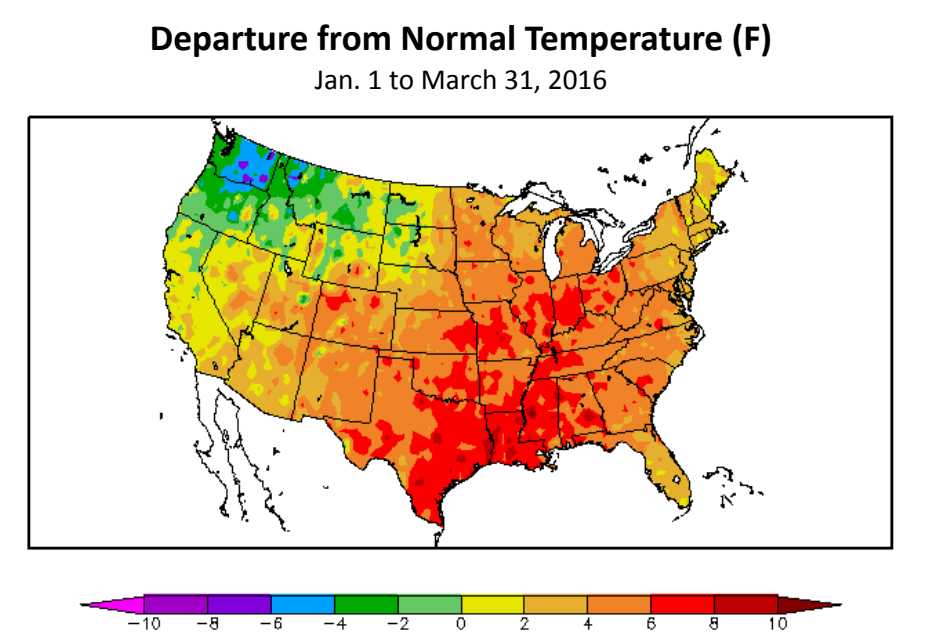
BY BRIAN FUCHS
NATIONAL DROUGHT MITIGATION CENTER CLIMATOLOGIST

Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online: droughtmonitor.unl.edu.

The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: www.cpc.ncep.noaa.gov.



droughtmonitor.unl.edu



Source: High Plains Regional Climate Center

Drought

The winter season stayed wet over much of the West and provided widespread relief to the drought, especially in California, where issues related to the five-year drought finally started to ease. The drought that developed over the Southeast in the fall also started to improve as moisture fell across the region. By the end of March, the amount of drought in the United States had decreased from 18.83 to 8.26 percent of the country. Severe drought improved from 7.21 to 1.28 percent, extreme drought improved from 2.63 to 0.09 percent and exceptional drought was eliminated. This was the first time exceptional drought was not depicted on the U.S. Drought Monitor map since March 2011. On Jan. 1, 2017, just over 119 million people were being affected by drought, and by March's end, that number had decreased to just over 58 million, mainly populations in the eastern United States.

Temperatures

Warmer-than-normal temperatures dominated the country during the quarter with areas from southern Texas north into the Midwest recording temperatures 6 to 8 degrees above normal. Almost all areas east of the Rocky Mountains were warmer than normal during the first quarter. Much of the West was near normal with the Pacific Northwest 4 to 6 degrees cooler than normal.

Precipitation

The West and Central Plains were the wettest areas during the first quarter with areas picking up from 110 percent to 300 percent of normal precipitation. The precipitation

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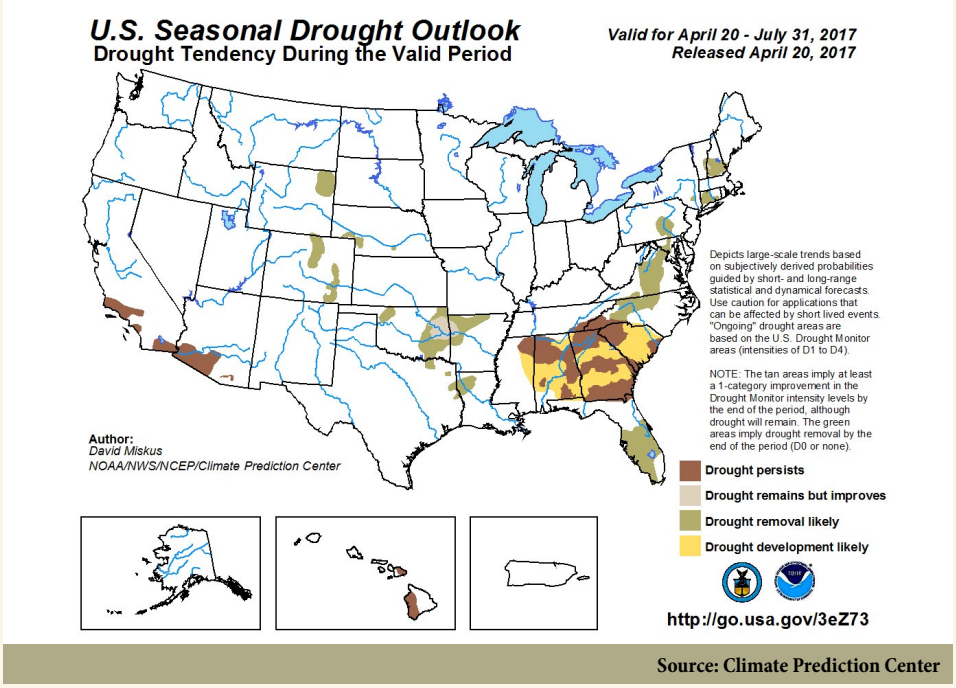
Continued from **page 3**

departures in the wettest areas of western Wyoming and along the Sierra Nevada Mountains were 4 to 8 inches and 16 to 20 inches above normal, respectively. Dryness dominated the Mid-Atlantic south into Florida where 25 percent to 50 percent of normal precipitation was observed. Winter dryness was observed along the Mississippi Valley and in portions of the Dakotas where 50 percent to 70 percent of normal precipitation occurred.

Outlook

Drought conditions that remain in the Southwest will persist through the end of summer, when the effects of the summer monsoon on the region can be evaluated. Through the Plains, much of the drought will be removed with only a few pockets remaining in portions of the Southern Plains. Drought removal is also likely in New England and into the Mid-Atlantic as long-term issues continue to improve. Drought is likely to develop over much of the Southeast with most of Alabama, Georgia and South Carolina anticipating further drought development by the end of summer. Drought will likely be removed from south Florida.



Source: Climate Prediction Center

MONTHLY DROUGHT AND IMPACT SUMMARIES

For a more detailed review of conditions, please visit
drought.unl.edu/newsoutreach/monthlysummary.aspx

DROUGHT IMPACT REPORTER: JANUARY TO MARCH SUMMARY

Winter snows break five-year drought in California

BY DENISE GUTZMER
NATIONAL DROUGHT MITIGATION CENTER DROUGHT IMPACT SPECIALIST

This was the winter Californians had been waiting for to lift the state out of drought, refill reservoirs and end the years-long drought emergency. A record amount of snow piled up in the northern Sierra Nevada after years of meager storms and snowpack, standing in stark contrast to April 2015 when the mountains held little snow. Although storms funneled by atmospheric rivers inundated some parts of the Golden State, causing structural damage, mudslides and the near failure of Oroville Dam, overall the moisture was very welcome after five years of drought.

California mostly drought-free

California's drought emergency finally ended April 7, when Gov. Jerry Brown lifted the drought state of emergency in most of the state, while maintaining water reporting requirements and prohibitions on wasteful practices. The drought emergency began in January 2014, with a request for a reduction in water use of 20 percent. In April 2015, Gov. Brown announced mandatory conservation measures of 25 percent at a snow survey where there was no snow to measure, highlighting the intense need to conserve because the snowpack in the Sierra Nevada, which typically provides about one-third of California's water needs, was alarmingly low.

Emergency drinking water projects continued in Fresno, Kings, Tulare and Tuolumne counties due to diminished groundwater supplies. These four counties remained in a drought declaration and were not included

 © 2016 National Drought Mitigation Center

when the drought emergency ended for the rest of the state on April 7. Being under the drought declaration allows these counties to continue receiving technical and financial assistance to pay for bottled water and funding for longer-term solutions.

"California governor lifts drought emergency," by Ian James, The (Palm Springs, Calif.) Desert Sun, April 7, 2017

"Governor's Drought Declaration," California Department of Water Resources (Sacramento, Calif.).

"Gov. Brown declares California drought emergency is over," by Bettina Boxall, Los Angeles Times, April 7, 2017

Governor Brown Lifts Drought Emergency, Retains Prohibition On Wasteful Practices, Office of Governor Edmund G. Brown Jr. (Sacramento, Calif.), April 7, 2017

"State may be drenched, but 'drought' label remains on Valley and it's partly about money," by Marc Benjamin and Robert Rodriguez, The Fresno (Calif.) Bee, April 7, 2017

Deep Sierra Nevada snowpack

The Sierra Nevada snowpack topped out at 164 percent of average water content on March 30, according to electronic sensors. At Phillips Station near Lake Tahoe, a manual snow measurement revealed nearly

DROUGHT IMPACT REPORTER

For more detailed reports, visit **droughtreporter.unl.edu**

8 feet of snow with a water content of 183 percent of normal. Frank Gehrke, chief of the California Cooperative Snow Surveys Program, said snow drifts of up to 20 feet existed at higher elevations in the central and southern Sierra. This end-of-the-season snow measurement is significant because the snow is typically at its deepest and begins melting, sending water to reservoirs throughout the spring and early summer.

While the thick snowpack was desperately needed after years of drought, the amazing depth also brings the possibility of flooding when the snow melts, given that much of the state's soils were saturated after atmospheric rivers sent series of prolific storms.

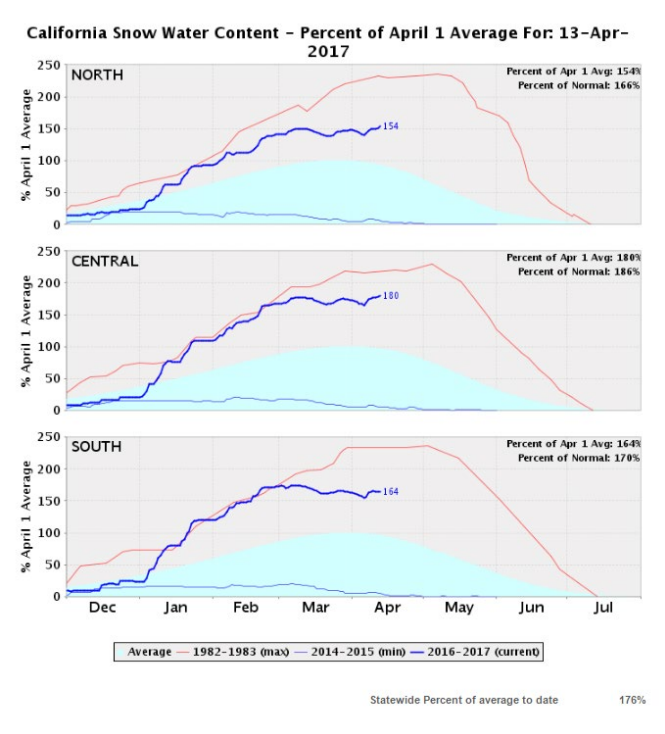
The northern Sierra Nevada set a new snowfall record of 89.7 inches of precipitation spanning a region of eight stations, breaking the previous record of 88.5 inches that fell during the 1982-83 winter season. The measurement began with the start of the water year on Oct. 1 and leaves time for additional snow to push the record even higher before the water year ends.

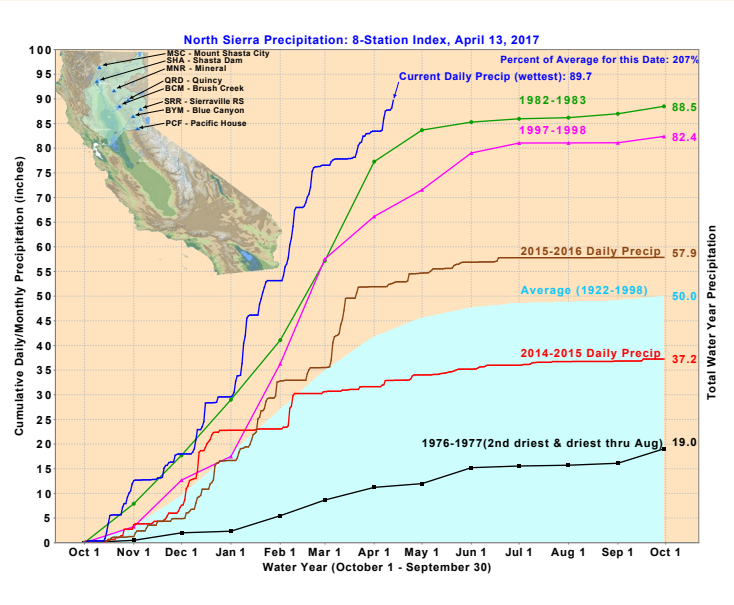
"California's robust mountain snowpack boosts flood concerns," by Scott Smith, Associated Press, Napa Valley (Calif.) Register, March 30, 2017

"Wet winter sets precipitation record in Northern California," by Sarah Parvini, Los Angeles Times, April 13, 2017

CoCoRaHS observers document drought

Our faithful CoCoRaHS observers provided most or even all of the evidence of drought in the eight states with the most drought impacts for the first quarter, apart from California, where media reports accounted for nearly all of the drought info. For North Carolina, all 50 impacts came from CoCoRaHS observers, who described low water levels, hungry/thirsty wildlife, wildfire activity and the need for plant watering. CoCoRaHS folks in other states mentioned many of the same issues.





Courtesy

Precipitation and snows along the Sierra Nevada mountain range have helped pull California out of a five-year drought. These graphs put the precipitation totals in context historically.

Tunisia launches first operational drought monitoring map

SHAWNA RICHTER-RYERSON
NDMC COMMUNICATIONS ASSOCIATE

In December, Chris Poulsen, GIS manager with the National Drought Mitigation Center, traveled to Dubai to help begin the process of converting the Composite Drought Index platform, originally developed by the NDMC, into open source code. In February, a team of scientists from the NDMC and International Center for Biosaline Agriculture helped train and transfer technology to the Tunisian participants from eight agencies on how to plot drought maps by weighting conditions and impacts, and by mid-March, the participants had released their first gridded TCDI, the Tunisian version of the U.S. Drought Monitor's objective blends.

The work is part of a $4 million research effort led by the National Drought Mitigation Center in collaboration with the Dubai-based ICBA. The U.S. Agency for International Development funded the three-year project, which included a research component with the Center for Advanced Land Management Information Technologies and the Robert B. Daugherty Water for Food Global Institute, both at the University of Nebraska.

The technology transfer took place in a three-day workshop in February where participants were able to run scripts and generate the CDI maps on their own laptops, ask questions and interact with developers. Poulsen and John Swigart, drought center geospatial analyst, and two others with ICBA further developed the CDI software during training sessions based on participant feedback.

Swigart fine-tuned the mapping processes and also led the hands-on training for QGIS, an open-source geographic information system software. He also assisted the Tunisians in understanding preliminary interpolation methods – a numerical analysis of data – as well as in methods to check their accuracy. These extrapolation methods were developed to assist the Tunisians with the task of using precipitation data from their existing operational weather stations as an input for their customized drought index.

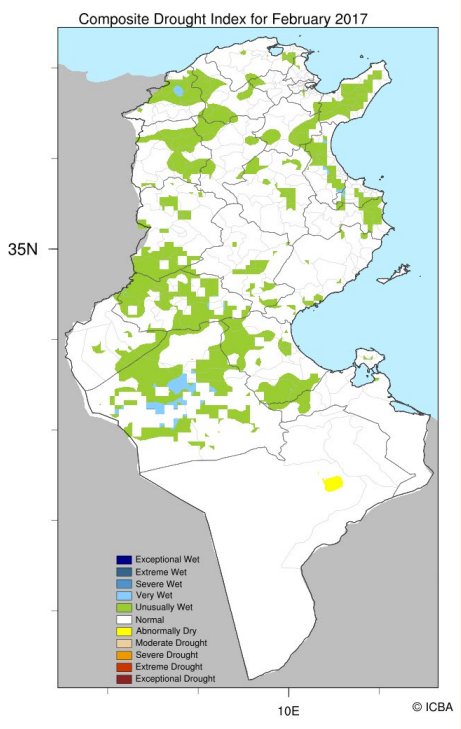
Following the Tunisian workshop, GIS analysts with the NDMC and the ICBA continued to work on various pieces of the CDI process. Swigart automated map tasks, coded the CDI program to eliminate categorization of the input datasets, and added coding to simplify the inclusion of additional datasets.

This was after the initial trip to

Continued on **page 7**

Courtesy images

Experts from the National Drought Mitigation Center and the Center for Advanced Land Management Information Technologies, both at University of Nebraska-Lincoln, and the International Center for Biosaline Agriculture based in Dubai, recently conducted workshops in Tunisia to train representatives on how to build a Composite Drought Index. Shortly after this meeting, Tunisia released its first drought condition map. (BELOW) This is Tunisia's first Composite Drought Index, a map of drought conditions based on data and impacts observed.



ICBA

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Dubai in December when Poulsen assisted ICBA personnel with transitioning the CDI process from commercial software into open source equivalents. Poulsen focused on converting data download and preparation scripts for CDI climatological inputs during that trip, and after his return, Poulsen and Swigart adapted the percentile ranking scripts and created final CDI values for the program that would be used by Tunisian experts to generate drought maps for the region. Their final project was creating map templates and map scripts to visualize the CDI products.

Next steps include standing up operational CDI platforms in Jordan and Lebanon (Morocco is already running an operational CDI) and then working with those same countries on validating the CDI and input data used to create the drought index, and also on assessing their social vulnerability to droughts, what political barriers they may face to drought planning and monitoring, and also what opportunities are present. Ultimately, the goal is to have a fully implemented and robust drought risk management system in place for each of the four countries. The development of an operational drought early-warning system via the CDI product is an essential first step in doing just that.

From left, Chris Poulsen, GIS expert with the NDMC; Brian Wardlow, CALMIT director; and Mark Svoboda, drought center director, help lead a training session in Tunisia.

Rachael McDonnell, head of Climate Change Modeling and Adaptation with ICBA, said the interactions among the key stakeholders during these training sessions and workshops have left the project in a good place and primed for the future. Mark Svoboda, director of the NDMC, who also attended and assisted with the training, said that "the applied nature of what we do is one of the most rewarding aspects of projects like this. Helping these countries build capacity and then seeing them actively take ownership of the final process is why we do what we do."

In May, Knutson and Mike Hayes, former drought center director and climatologist with the School of Natural Resources at the University of Nebraska-Lincoln, will travel to Dubai to meet with selected consultants from each country to plan out a path towards completing comprehensive drought vulnerability assessments that will likely include water quality and sanitation concerns. This will be the first step in helping facilitate "train the trainer" vulnerability assessment sessions that likely will continue in Phase II of the project.

— Chris Poulsen, Mark Svoboda, Nicole Wall and Theresa Jedd contributed to this report.

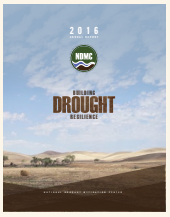
NDMC releases inaugural annual report

The National Drought Mitigation Center released the inaugural edition of its annual report in early March to highlight its varied activities and projects from 2016.

The center hosted or cohosted 188 workshops and 76 events; started or completed 24 projects; and worked in 15 countries around the world.

That's just a small taste.

Each of those projects were conducted with state and federal partners — and with you, stakeholders around the world.



The drought center also used the annual report to unveil its new logo, a freshening of the NDMC brand. The new logo will run on all our products and will help us better represent ourselves in digital and social media outlets.

To access the report — and logo — *click here*.

NADMA Drought Policy

A policy that was drafted in 2012 to ensure the island of Grenada in the southeastern Caribbean Sea would be in a better position to deal with drought soon will be realized. The National Drought Policy Management Agency recently hosted a two-day meeting with National Drought Mitigation Center experts. The writeshop focused on phase two of the National Drought Policy Management planning.

View a video *here*.

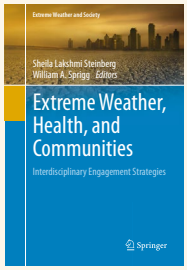
— Courtesy Grenada Broadcasting Network

Chapter focuses on drought and health

"Extreme Weather and Society," published by Springer, includes a chapter dedicated to drought and its effects on health. Written by Mike Hayes, former National Drought Mitigation Center director, and Nicole Wall, drought center outreach and research specialist, the chapter talks about drought and health in the context of public engagement.

Each chapter in the book can be downloaded or purchased independently of the book *here*.

Public health-oriented effects of drought include "those resulting from low water quantities, poor water quality, mental health and stress, dust and windblown agents, and wildlife intrusion," Hayes and Wall wrote.



Springer

Links between disasters such as droughts and humanitarian crises gained more visibility after several high-profile natural disaster events. Now, researchers and leaders in communities in a variety of places around the country are taking a more holistic and proactive approach to building resilient societies by focusing on human, animal and ecosystems, how they relate to one another and affect one another.

"This chapter on drought illustrates how improved early warning and stakeholder engagement ... creates opportunity for iterative dialogues within and between drought and health in the context of public engagement sectors, and between scientists and stakeholders. These opportunities to inform better decision-making will, one hopes, translate into reduced public health impacts resulting from future drought events," they wrote.

The book and its chapters are available in book, PDF and e-book form *here*.

— NDMC

OUTREACH AT ANNUAL WEATHERFEST

Shawna Richter-Ryerson | NDMC

Markéta Poděbradská, graduate research assistant with the National Drought Mitigation Center, engages a group of children during the 17th annual Weatherfest and Central Plains Severe Weather Symposium on April 1, 2017, at Nebraska Innovation Campus. The center used an interactive exercise to teach attendees about drought and its effects on trees.

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U2U program wrapping up, brought useful climate tools to farmers

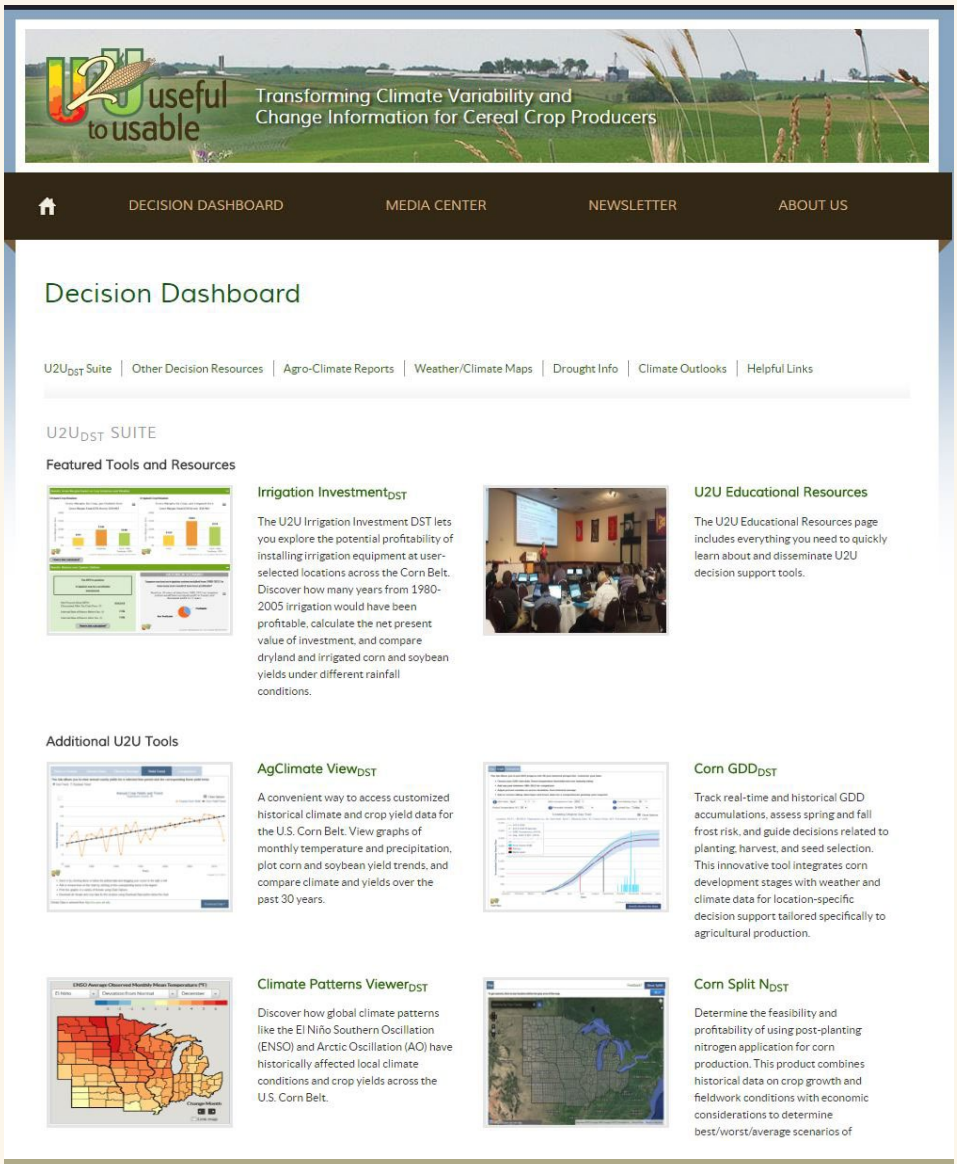
WEST LAFAYETTE, Ind. – Researchers at nine universities and the U.S. Department of Agriculture are celebrating the completion of a six-year, $5 million program that reinvented the way climate scientists connect with farmers.

The *Useful to Usable (U2U) project* aimed to mold existing climate data into relevant products for the agricultural community. Project participants first learned about the type of climate data that farmers employ when making growing decisions on their farms and how they employ that data. The team used those insights to develop products that would help farmers determine what, when and where to plant, as well as how to manage crops to maximize yields with eyes on limiting negative effects on the environment.

Purdue University's Linda Prokopy, a professor of natural resource social science and U2U lead project director, and Melissa Widhalm, U2U project manager, led a team of nearly four dozen faculty, staff and students from partnering universities. Researchers at the National Drought Mitigation Center at the University of Nebraska-Lincoln were some of those partners. Many of the team's findings were published early online in a *special issue of the journal Climate Risk Management* slated for March release.

Researchers started by building relationships with farmers and those they work with to understand how they go about making strategic business decisions. The team found that the best way to reach those farmers was through people who already have their ear — and their respect — such as crop advisors.

"It's really important to listen," Prokopy said. "We started at the other end and asked what people want and how to deliver that with scientific credibility. We were able to develop tools that were actually useful to them and usable by them."



The Useful to Usable website offers a suite of web-based tools for crop producers to use.

Cody Knutson, of the drought center, added, "A strength of the U2U project was that it started with the social science — investigating the perceptions and information needs of farmers and crop advisors. Based on that information, the U2U team was able to work together to develop a range of new tools to help farmers make important management decisions."

Those tools cover a wide range of climate issues with which farmers deal. Examples include AgClimate View, which offers users access to historical climate and crop yield data for the Corn Belt, including monthly temperature and precipitation, and plots corn and soybean yield trends; Corn GDD, which gives growers current and historical measurements of heat accumulation that help predict plant development rates and maturity dates; the Corn

Continued on **page 10**

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Split N tool, which helps farmers and advisors manage application of in-field nitrogen to maximize crop yields with the least environmental damage; the Irrigation Investment, which uses historical weather and crop model data along with farm-specific economic data to explore the profitability of installing irrigation equipment across the Corn Belt; and Climate Patterns Viewer, which helps growers make more informed farm management decisions during different phases of the El Niño Southern Oscillation and Arctic Oscillation.

The team was able to take the tools on the road, showcasing them at more than 150 Extension and other events across the Corn Belt, to present them to potential users and listen to feedback to improve those and future tools.

"We wanted to make sure we weren't creating tools that were just ignored," Widhalm said. "Just because the information is out there doesn't mean people are using it."

Many papers were published in a wide range of scientific journals over the course of the project in fields from biophysical and climate sciences to social sciences and economics, but the special issue of "Climate Risk Management" will give the team an opportunity to pull together some of the key elements of U2U. Knutson and Martha Shulski, the Nebraska State Climate Office climatologist, served as guest editors for several of the articles in the special issue.

"This was our chance to really put a lot of the findings from all of the different disciplines in one space so we could show the breadth of the accomplishments of the U2U project," Prokopy said.

The USDA National Institute of Food and Agriculture funded the U2U project. Team members also came from: Purdue University, Iowa State University, Michigan State University, South Dakota State University, University of Illinois, University of Michigan, University of Missouri, High Plains Regional Climate Center at University of Nebraska-Lincoln, University of Wisconsin, and the Midwestern Regional Climate Center.

"It was a wonderful collaboration among a diverse group of scientists that began by asking local ag decision-makers -- what do you need?" Shulski said. "The tools that were developed will not end with the grant; they will live on through the Regional Climate Centers."

This project was supported by an Agriculture and Food Research Initiative Competitive Grant from the USDA National Institute of Food and Agriculture.

— BRIAN WALLHEIMER, FOR USEFUL TO USABLE

Survey finds drought info leads to better decisions

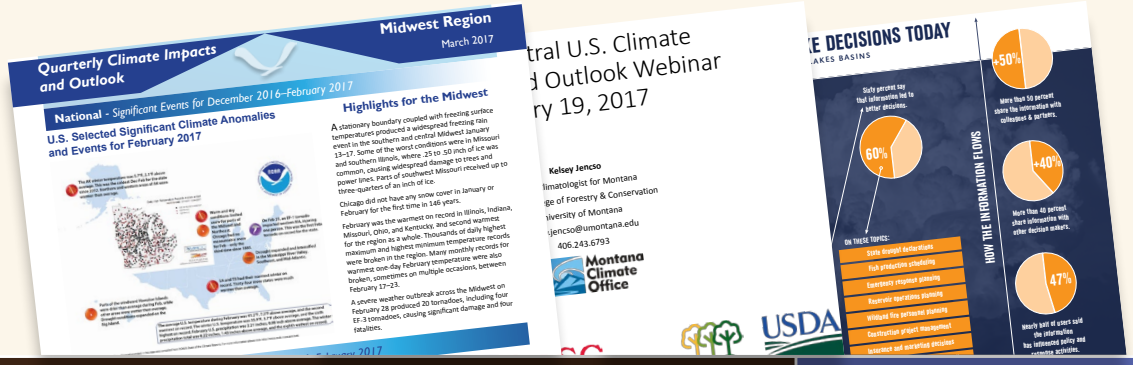
Information from regional Drought Early Warning Systems helped people make better decisions in many sectors, including construction, fish production and agriculture, a recent survey found.

The survey conducted in February assessed the value of drought and climate-related webinars and quarterly climate summaries produced for decision-makers in the Midwest and Missouri River Drought Early Warning Systems and in the Great Lakes Basin. The National Drought Mitigation Center at the University of Nebraska-Lincoln led the survey, which was funded by the National Integrated Drought Information System.

"We appreciate the feedback from the people who read the reports and view the webinars. It helps us understand specific information needs and decision-making contexts, and ultimately keep improving the services," said Tonya Haigh, NDMC project manager and leader of the evaluation.

The *climate summaries*, *webinars* and *survey results* are online.

— TONYA HAIGH, NDMC



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