Spring 2014

DroughtScape- Spring 2014

Kelly Smith

Spring 2014

National Drought Mitigation Center

DROUGHTSCAPE

The Newsletter of the National Drought Mitigation Center

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About the photo

Thanks to photographer Timothy Benson for this photo taken April 7, about 5 miles south of Ropesville, Texas. Hockley County, just west of Lubbock, has been in varying degrees of drought since February 2011.

DIRECTOR'S REPORT

Michael J. Hayes

Drought has strengthened its iron grip on the southern High Plains again in the last few months. Since October 2010, parts of southeastern Colorado, western Kansas, western Oklahoma, the Texas Panhandle, and eastern New Mexico have seen historically low rainfall totals. The impacts have shown up in a variety of ways, but the emerging images of frequent dust storms across the region and the proliferation of tumbleweeds in some locations are kindling comparisons with the Dust Bowl years. The *Denver Post* focused on the dust storms in a feature-length article in early April. Although California may have been a destination for Dust Bowl refugees in the 1930s, it is currently in the midst of its own ongoing historic drought.

The Dust Bowl years were replete with economic hardship, poor soil conservation practices, and searing heat waves across large regions of the country. While we are not at that scale of disaster yet, the dust storms have been an important reminder that we must always remain vigilant related to drought and the fragile ecosystems of the Plains, and that failing to do so threatens peoples' livelihoods. It is a good time to ask, "Are we better prepared now than back then?" It seems like the answer is "yes" in many ways: irrigation, drought-tolerant crop varieties, the Natural Resources Conservation Service, and tools such as the U.S. Drought Monitor. Yet, in the face of the concern coming out of the region, we still need to ask whether any policies or practices inadvertently contributed to the conditions, and how we can help residents of these areas weather this drought and future multiple-year droughts.

These are questions that countries around the world are asking themselves, particularly as they work to implement recommendations from last year's United Nations High Level Drought Policy Meeting, which said that all countries should develop a drought plan. The NDMC has active partnerships with several countries to help enhance monitoring and planning. We had the pleasure of hosting a group of scientists

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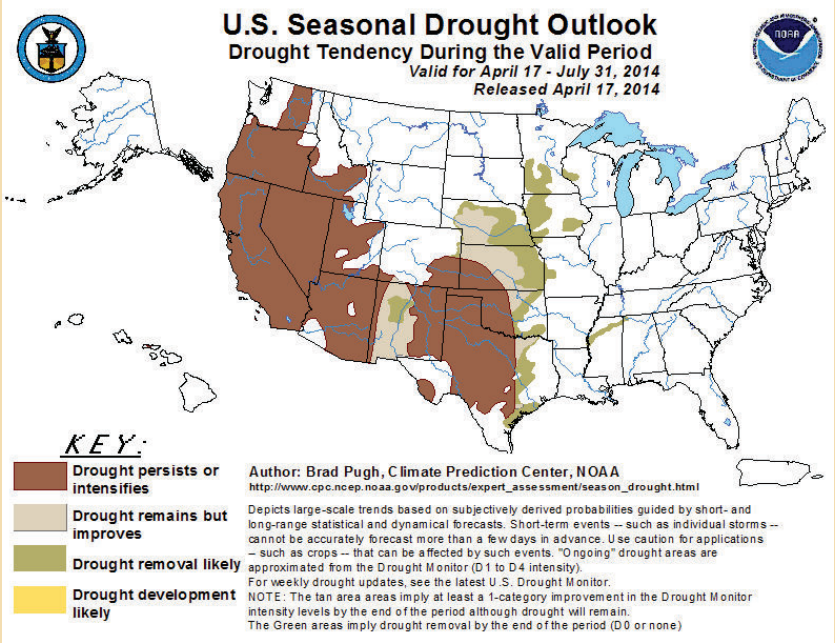

Outlook

Prospects for the Southwest improved on the latest Seasonal Drought Outlook from the Climate Prediction Center. It now shows drought-free areas remaining drought-free, and the western half of New Mexico improving, with the possibility of a drought-free area emerging in the northwest quadrant of the state. Improvement, though not necessarily a complete return to drought-free conditions, is possible over the Pacific Northwest, the Midwest, and portions of the central and southern Plains.

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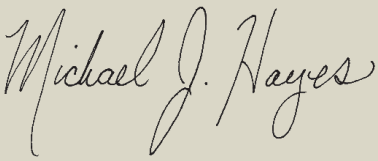
from Brazil for training March 10-14, and helped come up with a prototype for a product similar to the U.S. Drought Monitor for the northeast portion of Brazil. Many countries and regions are interested in the USDM process and the mix of indicators and local feedback from experts it utilizes, so Brazil's example, which is backed by the World Bank, could pave the way for more efforts. We are also working closely with scientists from the Czech Republic, who are developing an agro-climatological monitoring system that includes a tool similar to VegDRI. Mark Svoboda traveled to Turkey in March to help kick off river basin drought planning there, part of that country's move to create a national drought policy, as recommended by the U.N.

While the NDMC has much expertise and many experiences to share related to drought monitoring and planning, issues of scale and locally appropriate solutions are just as pressing in the United States as they are elsewhere. We always appreciate the chance to learn from the diverse experiences of different countries, river basins and communities.



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Drought expands in first quarter of 2014

By Brian Fuchs,
NDMC Climatologist

Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online at http://droughtmonitor.unl.edu. The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: http://www.cpc.ncep.noaa.gov/

Drought

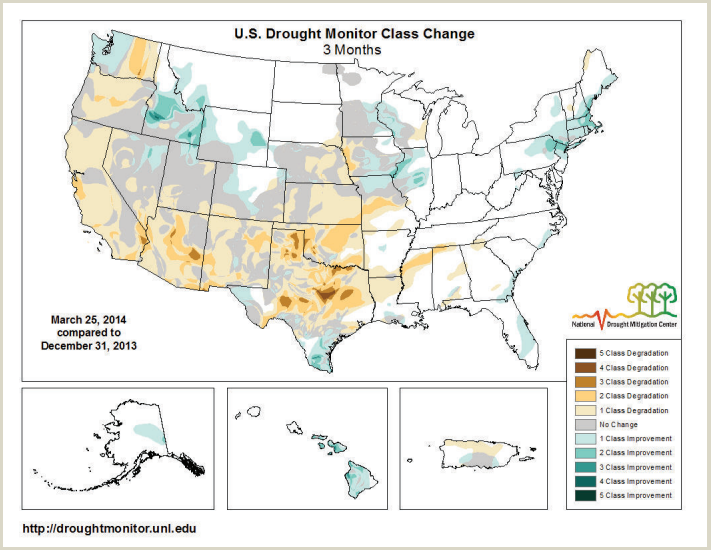
Drought conditions worsened over the contiguous 48 states during the first quarter of 2014, with moderate or worse drought expanding from 30.95 percent on Dec. 31 to 38.27 percent on March 25. This is quite a bit better than it was a year ago, when 51.64 percent of the contiguous United States was in drought. All drought categories intensified during the first three months of 2014. Severe drought increased from 16.67 to 23.09 percent, extreme drought went from 3.96 to 9.70 percent, and exceptional drought increased from 0.37 to 2.09 percent. Most of the degradation took place over California, Nevada, New Mexico, Texas, Oklahoma and western Kansas.

Temperatures

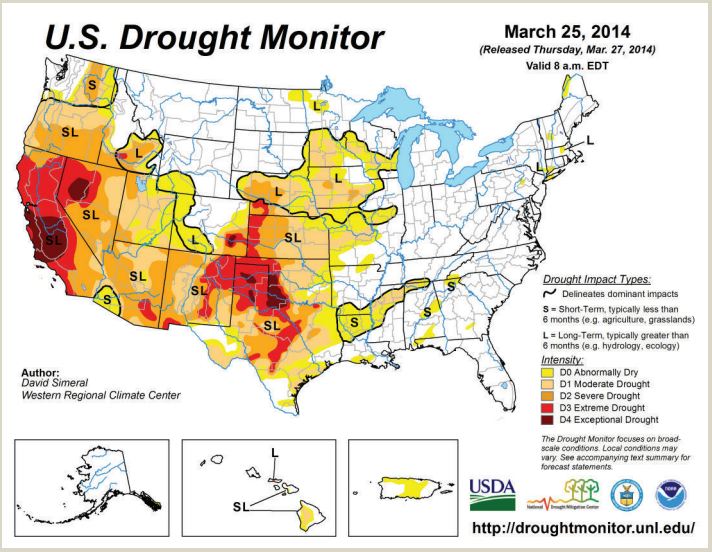
Most of the United States continued to have below-normal temperatures in the first three months of 2014. Exceptions were California, Nevada, Arizona, New Mexico, Utah, southern Oregon, southern Idaho, western Colorado, extreme west Texas, and southern Florida, with temperatures of 2-6 degrees Fahrenheit above normal. The Great Lakes region was the coldest, with temperatures generally 12-15 degrees below normal. The forcing mechanism behind these temperatures was the combination of an atmospheric ridge over the West and a trough over the East.

Precipitation

The first quarter of 2014 remained quite dry over much of the Southwest, the Plains states, and especially the southern Plains. This represented the second dry quarter of the 2013-2014 water year. Many of these areas recorded less than 50 percent of normal precipitation for this period, and snow accumulation in the western United States lagged well behind normal. The conditions were especially bad in California. The current water year is running at or below the previous lowest water year of 1976-1977, and this is following two years of below-normal snowpack.



The map above shows changes in the U.S. Drought Monitor from Dec. 31, 2013, to March 25, 2014. By the end of March, D1 had expanded to 38.27 percent of the continental U.S., from 30.95 percent on Dec. 31.



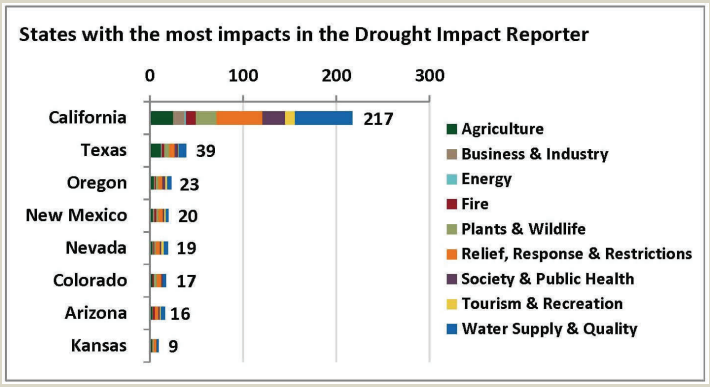
The central and northern Rocky Mountains stood in contrast to many areas of the West, as they received good precipitation. By the end of March, many locations had 130-150 percent of their annual snowpack. Oregon and Washington, after a slow start to the water year, made up some ground as the pattern became favorable for precipitation in these states. In the first quarter, 100-130 percent of normal precipitation was common in these states.

Much of the eastern half of the country experienced dry conditions during the first three months of the year, with many locations recording less than 90 percent of normal precipitation. The wettest areas in the East, recording 110-130 percent of normal precipitation, were Florida, New England, central North Carolina, and parts of the Mid-Atlantic.

Hundreds of thousands of acres left unplanted in California;

By Denise Gutzmer, Drought Impact Specialist

As of mid-April, the Drought Impact Reporter had logged 324 drought impacts for the United States in the first quarter of 2014, with the majority, 217, concerning the state of California. That state's normally wet winter season did not produce the deep snowpack needed to protect agriculture and urban water supplies from the impacts of a third dry year. Food prices across the country were expected to rise throughout the year due to the lack of produce from California. Most of the Southwest and the southern Great Plains were experiencing drought impacts. Texas was also facing the consequences of a few dry years in a row, with the Lower Colorado and other river systems at historic lows. Localized parts of the Plains were enduring Dust Bowl-like conditions.



This chart shows the number of impacts in the Drought Impact Reporter for each of the most-affected states in the first quarter of 2014. The high number of impacts for California reflects the severity of drought there, as well as the state's large area and large population.

Nationwide impacts include commodities

Drought squeezes cattle herd, boosts beef prices

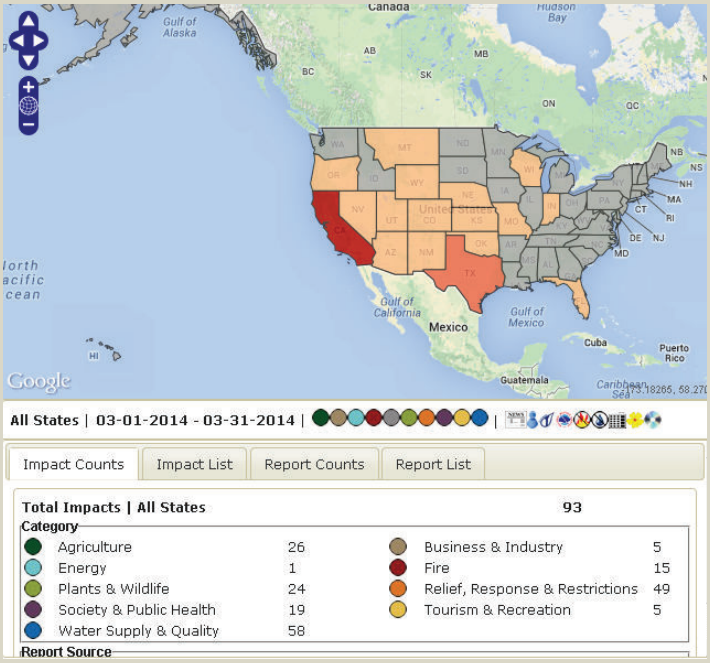
As California livestock producers sell their animals, the national cattle herd continues its gradual decline. It reached 87.7 million head on Jan. 1, 2014, the smallest since 1951, according to the U.S. Department of Agriculture's National Agricultural Statistics Service. As the livestock population shrank, cattle processing facilities and feedlots closed, leading to job losses. Meanwhile, beef prices remained near record highs of $5.35 per pound in January, near the record high of $5.41 set in November 2013.

"Persistent Calif. drought to delay U.S. cattle herd rebuilding," by Theopolis Waters, Reuters, Chicago, March 4.

After bad 2012, ethanol plants have second-best year in 2013

The average ethanol plant in the U.S. lost $7.3 million in 2012, when drought reduced the supply of corn and its price went up, according to a study by the University of Illinois, causing many plants to close or cut back on ethanol production. The average profit for ethanol plants between 2007 and 2013 was $7.4 million. Improved corn production in 2013 sent corn prices lower, leading to the second highest year of average profit for ethanol plants at $23 million.

"Ethanol plants' profits 2nd-highest on record," by Christopher Doering, Gannett Washington Bureau, in the *Des Moines (Iowa) Register,* March 17.



As of mid-April, the Drought Impact Reporter included 93 impacts for the month of March. The distribution of impacts bore a fairly close relationship to the pattern of climatological drought (see page 3). California and Texas, both large, populous states that are in varying degrees of long-term dryness or drought, had the most impacts, but most other western states were also affected.

water supplies tight in TX, CA; habitat affected across West

West copes with hydrologic drought, early fire season, less skiing

Many states in the West were dealing with short water supplies and agricultural and environmental challenges as drought left its mark on the land. Ski resorts and local businesses from Washington to Arizona suffered from the lack of snow.

President Obama met with governors of western states to discuss drought and other matters and assured them that wildfire funding in the future would come from emergency funds, similar to aid for other natural disasters such as earthquakes and hurricanes. Obama also offered ongoing support to governors from the West as they dealt with drought and water issues.

"Gov. John Kitzhaber meets with President Obama on wildfire funding, drought, climate change," by Yuxing Zheng, *Portland Oregonian*, Hillsboro Argus, Oregon Live.com (Oregon), Feb. 24.

Tumbleweeds on the roll

Parts of the western Great Plains from Wyoming south to the Texas Panhandle were dealing with a drought-related plague of tumbleweeds. Rainfall in September 2013 spurred the growth of the Russian thistles, which grew well with little moisture in places where much of the native vegetation was sparse or had died from the drought. Fewer cattle nibbled on the Russian thistle shoots than in previous years, as ranchers had sold livestock due to drought. Abundant tumbleweeds blocked roads and drainage culverts and piled up against fences and homes.

"Tumbleweeds plague drought-stricken American West," by Keith Coffman, Reuters, Denver, Colorado, March 27.

CO plan helped ease feds' worries over Lake Powell power production

Federal officials from the Interior Department and Bureau of Reclamation have been keeping a wary eye on the level of Lake Powell, which was at 39 percent of capacity with a water level about 85 feet above the penstocks (flow control intakes) that feed the turbines in Glen Canyon Dam. If needed, water could be released from the Aspinall Unit of dams on the Gunnison River, in addition to water from Navajo Lake, Flaming Gorge and other sources. Colorado officials have contingency plans to help maintain the level of Lake Powell, on the Utah-Arizona border, to prevent its water level from dropping too far and disrupting power production.

"Big drop of water in Powell," by Gary Harmon, *The Daily Sentinel* (Grand Junction, Colorado), March 26, 2014.

It's elk vs. horse at the watering hole

Elk and feral horses vie for water from a muddy spring in the Mesa Verde National Park in Colorado. About three-quarters of the interactions between the elk and the horses involved the horses chasing the elk away from the water, while about one-quarter of the time, it was the other way around.

"Equine exodus," by Jim Mimiaga, *The Durango Herald* (Colorado), March 25, 2014

Firefighting season off to early start

The Los Pinos Fire Protection District in Ignacio, Colorado, planned to get its two-person seasonal wildland firefighting crew in a week or two early, due to the exceedingly dry conditions and early wildfire activity.

"City gets early blaze," by John Peel, *The Durango Herald* (Colorado), Feb. 25, 2014.

New Mexico chile industry down

Chile growers in New Mexico produced fewer peppers due to water shortages and insufficient laborers to harvest the crop, which is done manually. There were 65,000 tons of chile peppers produced in the state in 2013, roughly 16 percent fewer than in 2012, when the state produced nearly 78,000 tons of the hot pepper.

"New Mexico chile numbers down for 2013," Associated Press, *Santa Fe New Mexican*, March 27.

Nevada drought affects winter sports, range, fish

Fewer visitors came to the Reno area for skiing and other winter sports as snow was in short supply. In February, low river levels in western Nevada led the Nevada Department of Wildlife to begin stocking rivers, streams and lakes in western Nevada earlier than in the last 20 years, before water bodies became too depleted. Years of drought have also taken a toll on rangeland, with resource advisory councils recommending that the U.S. Bureau of Land Management remove wild horses from the land as an emergency response to drought.

"RAC recommends BLM sell excess horses," by Dylan Woolf Harris, *Elko (Nevada) Daily Free Press*, Feb. 14.

"Drought prompts early Truckee River trout stocking," Associated Press, *Tahoe Daily Tribune,* Feb. 12.

"Waiting for more white stuff: Snow still rare for resorts, retailers in challenging season," by Bill O'Driscoll, *Reno (Nevada) Gazette Journal*, Jan. 13.

Focus on California

California's drought affects nation's grocery bill

The California drought garnered much of the media attention during the first quarter of 2014 as the rainy season failed to produce deep snowpack in the Sierra Nevada, threatening water supplies and food production that provides nearly half of the nation's fruit, nuts and vegetables. The California Farm Water Coalition said that farmers could fallow as many as 800,000 acres of land, due to the water shortage, for a potential loss of $7.48 billion. The estimates come from a survey of Central Valley water districts. Job losses in the Valley may exceed 15,000 on-farm and associated jobs.

California endured its third straight bleak winter, waiting for storms that never came, leaving water supplies far short of demand. Governor Jerry Brown urged 20 percent water conservation when he declared a statewide drought emergency on Jan. 17. Many water agencies adopted their own restrictions as the rainy season came to an end with the thin snowpack and low reservoirs offering no hope for decent water deliveries. Numerous cities called for more severe restrictions on water use as local supplies reached critical lows.

State and federal water managers had warned that water deliveries could be miniscule without better snowfall. The snowpack held 32 percent of average water content on April 1, when snow depth is normally near its maximum. Rain and snow in early April brought a modicum of relief. On April 18, officials announced that California's State Water Project would deliver 5 percent of requested allocations -- an increase from zero percent -- and that the Bureau of Reclamation's Central Valley Project would deliver 75 percent of the water requested to agencies in the Sacramento Valley, up from 40 percent, although federal water users south of the Sacramento-San Joaquin Delta were still slated to receive zero percent.

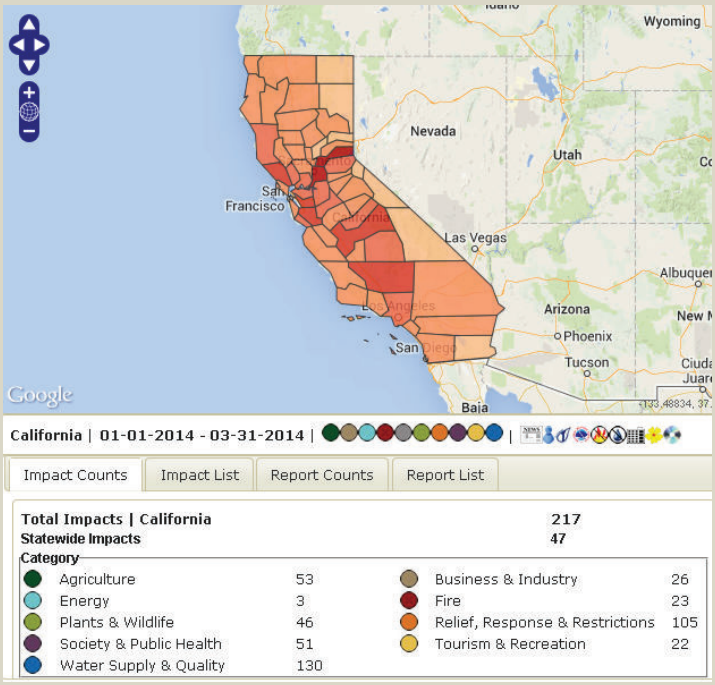
"Drought expected to idle 800,000 acres," *Manteca (California) Bulletin*, March 17.

"Despite Storms, Snowpack Still Far Below Normal," California Department of Water Resources, April 1.

"California Farmers to Get More Water," by Scott Smith, Associated Press, Fresno, Calif., April 18.

Municipal water at risk

In late January, the California Department of Public Health listed 17 communities that had 60 to 120 days' worth of drinking water remaining. The water systems were located in Amador, Fresno, Kern, Madera, Mariposa, Mendocino, Nevada, Placer, Santa Cruz and Sonoma counties and each served 11,000 or fewer people. In mid-February the list was updated to include 10 water systems in Mendocino, Kern,



Zoomed in to California, the Drought Impact Reporter shows the relative distribution of impacts by county for the first quarter of 2014.

Tulare, Yuba, Nevada, Mariposa and Placer that had less than 60 days' worth of water remaining.

"California drought: 17 communities could run out of water within 60 to 120 days, state says," by Paul Rogers, *San Jose Mercury News,* Jan. 28.

"Officials: Ten Communities At Risk of Running Out of Water in 60 Days," by Amy Quinton, Capital Public Radio, Sacramento, California, Feb. 19.

Wildfire activity increased

An uptick in wildfires prompted Cal Fire to hire and train roughly 300 firefighters earlier than usual to be prepared for increased statewide fire activity. Since the start of the year, 875 wildfires have charred 2,350 acres, compared with last year when 300 fires had blackened 1,050 acres by April 1.

"Cal Fire to hire, train seasonal firefighters early due to drought," by Claire Doan, KCRA, Sacramento, California, March 31.

Air quality reduced

Air pollution in California was a bigger problem than it has been in previous winters as drought, low wind speeds and stagnant conditions kept pollutants close to the ground. Air in the San Joaquin Valley exceeded federal standards for fine particulate matter on 66 days and was the most polluted in the state. In the Bay Area, the Air Quality Management District declared 30 "spare the air" days, when residential wood-burning was prohibited. There were only 10 spare the air alerts last winter.

"Drought linked to polluted winter air," by Tony Barboza, *L.A. Times*, March 4.

Texas drought requires balancing urban, ag interests

Long-term drought hits Texas agriculture, water supplies

The Drought Impact Reporter listed 39 impacts for Texas in the first quarter of 2014.

Texas water supplies were in dire straits as years of drought depleted reservoirs, forcing communities to restrict water use and hastily make alternative plans for their water supplies. Cumulatively, the state's reservoirs were lower than they have been in more than 24 years.

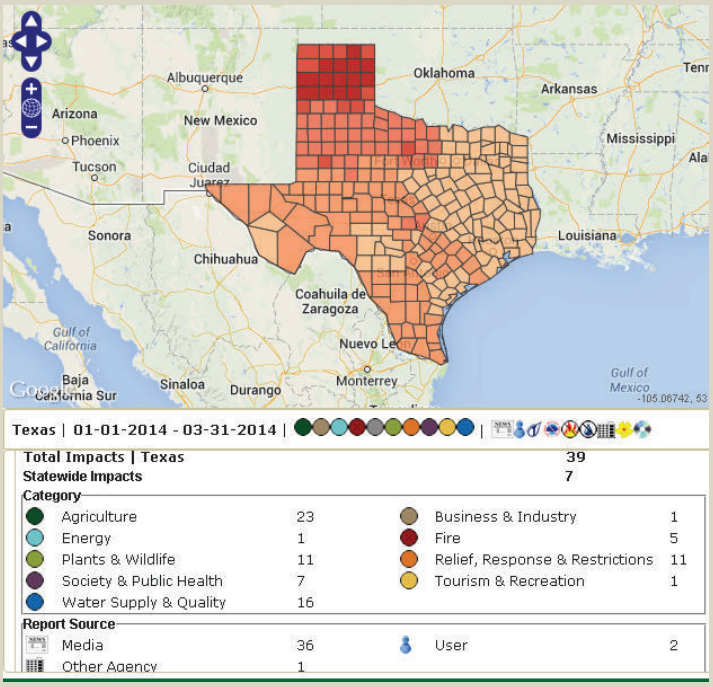
Texas crops and pastures needed rain. Soil moisture remained low, even hampering tilling in the Rolling Plains. Eighty-seven percent of the dryland wheat crop in the High Plains and Rolling Plains of Texas was rated in fair to very poor condition, and pastures were still recovering from years of drought.

While rice farmers on the Lower Colorado River did not expect to get water for this growing season, the Texas Commission on Environmental Quality sealed their fate by postponing a decision on trigger levels for releasing water from lakes Travis and Buchanan. This is the third straight year without water for rice growers.

"Texas Climatologist: New Dust Bowl days not here but could happen," by Robert Burns, Texas A&M AgriLife Extension Service, in Drovers Cattle Network (Lenexa, Kan.), March 26.

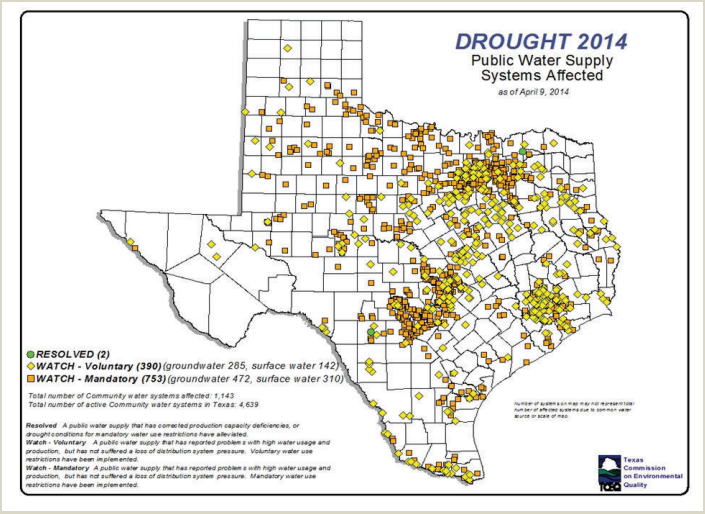
"Rice farmers dealt another blow in ongoing drought," by David Yeomana," KXAN, Austin, Texas, Feb. 26.

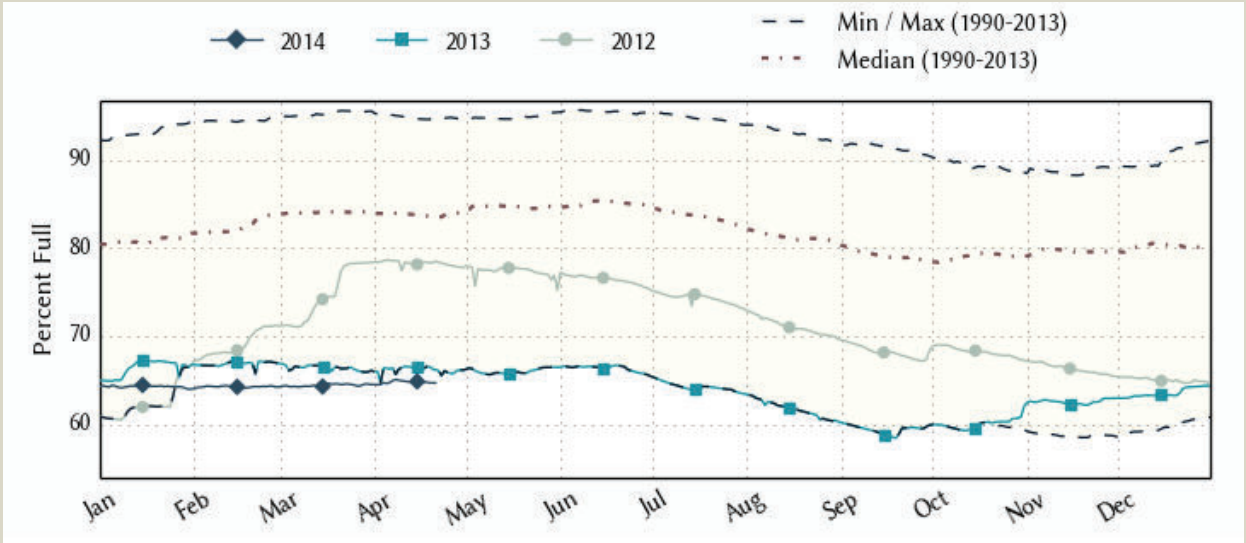
"Wheat crop below average; cotton planting delayed," by Robert Burns, Texas A&M AgriLife Extension Service, in *Abilene Reporter News,* March 23.



The distribution of drought impacts in Texas reflects long, intense drought in the Panhandle.

The map at right from the Texas Department of Environmental Quality shows that as of April 9, 753 public water systems in Texas had implemented mandatory conservation and 390, voluntary, affecting 1,143 systems out of 4,639 in the state. Below, the time series from Water Data for Texas shows resevoir levels for 2014 below last year's historic lows. They were at 64.7 percent as of April 21.



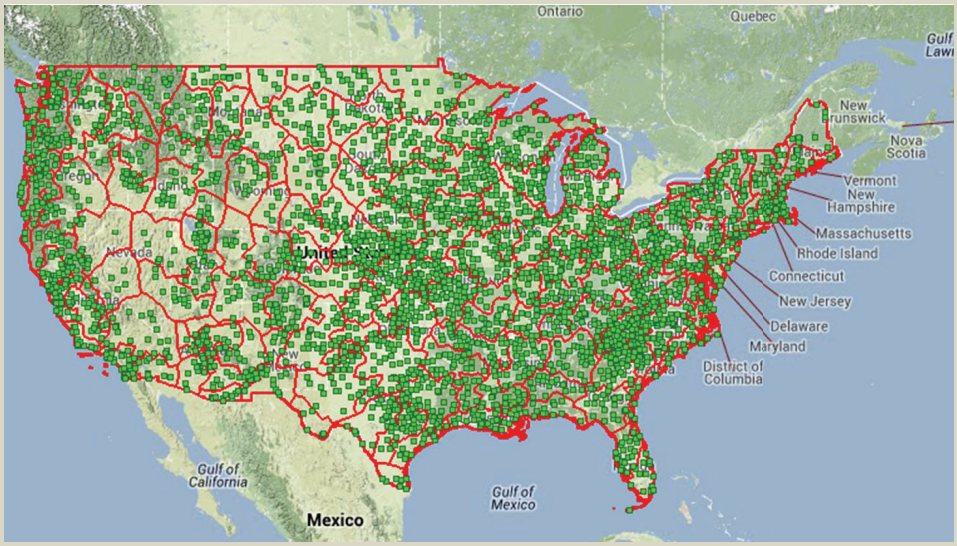


Newly launched Drought Risk Atlas analyzes drought history

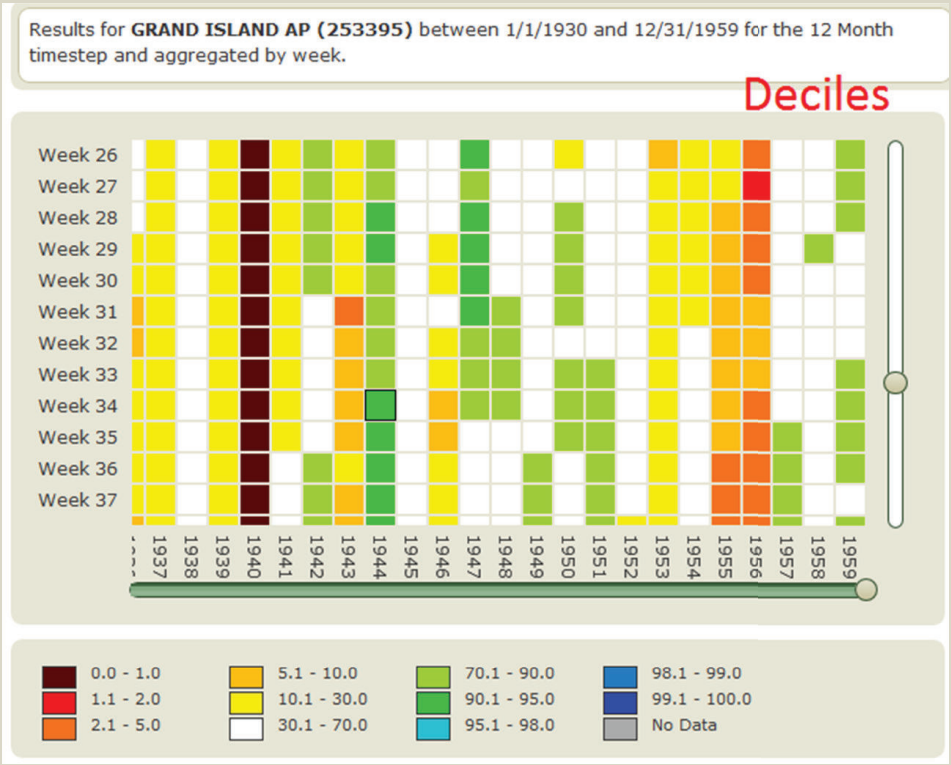
The National Drought Mitigation Center in March unveiled a new online Drought Risk Atlas that provides analysis of data on drought frequency and severity for more than 3,000 locations across the country.

"The Drought Risk Atlas contains more than 3,000 of the best climate record stations in the U.S. and houses more than 1 billion records of index calculations alone," said Mark Svoboda, climatologist and leader of the NDMC's Monitoring program area. The stations chosen for the atlas go back at least 40 years with nearly continuous data, and some go back more than 100 years.

Users can find the closest climate station and see how often drought has affected an area, how bad it has been and how long it lasted, Svoboda said. They can look at drought through the lens of several different indices, including the U.S. Drought Monitor, the Standardized Precipitation Index (with and without potential evapotranspiration), the Palmer Drought Index, deciles, and more. They can also choose to look at records for a cluster of stations that are near each other that exhibit similar historic patterns of drought.



The Drought Risk Atlas includes data from 3,059 stations, which can be grouped into 139 unique climate regimes.



This heatmap shows a decile-based comparison of drought from 1937 to 1959 for a climate station in Grand Island, Nebraska.

Svoboda said that the data go through 2012 and contain both raw and serially complete datasets for the user to choose from. Users can download the data. The NDMC worked with the High Plains Regional Climate Center, which is also based at the University of Nebraska-Lincoln's School of Natural Resources, to incorporate data from the Applied Climate Information System.

"It's a giant set of quality-controlled data with a large time spread and a bunch of different indices to compare," said Chris Poulsen, the drought center geospatial analyst involved in crunching the numbers. "I don't know that there's another accessible dataset out there for drought. This is a set of data that's complete and QC'd back to 1900 and further."

Why have a drought risk atlas? "Whenever there is a drought, people want to know how it compares with past droughts," Svoboda said. "Until now, that information hasn't been readily available for a given climate station. We heard from stakeholders about the

for your local climate station

questions they needed answered." Stakeholders include agricultural producers, agency personnel, and planners.

"We hope it will lead to a more informed, better decision-making process, bringing it down to a producer-level scale," said Brian Fuchs, the NDMC climatologist who worked extensively on the atlas. "Users of various levels of expertise and needs can go in and quickly find information about drought history and frequency for any part of the country. It also gives users the ability to compare various drought indices quickly and see which ones work better in their area."

"It's a giant set of quality-controlled data with a large time spread and a bunch of different indices to compare."
– Chris Poulsen, NDMC geospatial analyst

The drought atlas may at first seem complex. Jeff Nothwehr, the NDMC GIS and web specialist who developed the website for the atlas, advised users visiting the site for the first time to have a goal in mind, such as learning record high and low temperatures for a given location, and to start with the help page if they feel overwhelmed.

Svoboda credited the U.S. Department of Agriculture's Risk Management Agency, the National Integrated Drought Information System and the National Oceanic and Atmospheric Administration's Sectoral Applications Research Program with supporting development of the Atlas.

Even though, where climate is concerned, the past is considered a less reliable guide to the future than it used to be, the Drought Risk Atlas can help researchers better anticipate future climate impacts, Svoboda said. "We're not done just because we launched the Drought Atlas," he said. "This is a tool to help researchers, decision makers and the public better understand droughts and their behavior. We can also use it to identify changes in drought behavior patterns."

What's in the Drought Risk Atlas?

- 3,059 stations with 40+ years of data
- 349 stations with 100+ years of data (11.50%)
- 537 stations with 90+ years of data (17.68%)
- 827 stations with 80+ years of data (27.22%)
- 1,170 stations with 70+ years of data (38.51%)
- 1,733 stations with 60+ years of data (57.04%)
- 2,462 stations with 50+ years of data (81.04%)

By state:

AL: 37	GA: 66	MA: 27	NC: 88	OH: 84	TX: 226
AR: 64	IA: 84	MD: 16	ND: 57	OK: 60	UT: 70
AZ: 79	ID: 53	ME: 23	NE: 106	OR: 94	VA: 56
CA: 187	IL: 75	MI: 66	NH: 15	PA: 70	VT: 11
CO: 67	IN: 47	MN: 74	NJ: 15	RI: 3	WA: 84
CT: 9	KS: 142	MO: 66	NM: 80	SC: 55	WI: 92
DE: 3	KY: 41	MS: 59	NV: 22	SD: 70	WV: 41
FL: 47	LA: 45	MT: 116	NY: 75	TN: 46	WY: 46

Missouri River Basin pilot kicked off Feb. 26-27

Missouri River Basin stakeholders and researchers came together Feb. 26-27 in Nebraska City, Nebraska, for the kickoff of the National Integrated Drought Information System pilot project for the basin. Read more: http://go.unl.edu/5ckj

Tadesse leading $1.6 million NASA project to predict drought

Tsegaye Tadesse, climatologist and remote sensing expert at the National Drought Mitigation Center, is leading a three-year, $1.6 million, multi-institution NASA-funded project to help predict drought and flood in the Greater Horn of Africa.

Researchers will investigate which prediction methods work best for the Greater Horn, especially in light of an evolving climate, and will work with decision makers to produce seasonal forecasts that they can use, Tadesse said.

Droughts and floods can have devastating impacts in the region, even when early warning systems are in place, Tadesse said. In 2010, drought caused widespread famine that affected 11.5 million people, even though forecasters had predicted the drought well in advance.

The research team will work with local representatives of disaster relief and food security agencies, extension agents, the Famine Early Warning System and others to see what type of forecasts would be most useful, Tadesse said. Researchers will focus on developing forecasts at time and space scales that correspond to decision makers' needs. They will also see whether existing tools will allow them to go beyond predicting a wetter season than usual to anticipating an extreme event such as a flood using ground observation and remote sensing information.

Dr. Tsegaye Tadesse, left, NDMC climatologist, met with Dr. Girma Amente, right, president of Haramaya University in Ethiopia, during a trip in 2012. Dr. Girma, a collaborator on Ethioipan research, will visit the NDMC and others in Lincoln, Nebraska, May 4-6.

"Droughts and floods are mainly caused by large-scale ocean-atmosphere-land circulation patterns. If we understand how those interactions are working and their time lag, then we can improve predicting what's going to happen at local to regional scale."
– Tsegaye Tadesse, NDMC climatologist

Although they are looking for locally relevant patterns, the scope of the inquiry will include global weather patterns. "Droughts and floods are mainly caused by large-scale ocean-atmosphere-land circulation patterns," Tadesse said. "If we understand how those interactions are working and their time lag, then we can improve predicting what's going to happen at local to regional scale." The researchers will examine large-scale teleconnections for predictive power in the study region, including the El Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation, sea surface temperatures in the Indian Ocean, and predictors associated with the Indian monsoon.

The researchers will also examine state-of-the-art techniques based on climatology, remote sensing, environmental modelling and other forecast methods that can provide early warning of drought or flood conditions. They will evaluate how well state-of-the-art seasonal forecast methods for drought and flood are working in the study region, and how they can help anticipate impacts on crops, communities and other aspects of life. One of the forecast techniques the researchers will evaluate is the satellite and climate-based Vegetation Outlook, or VegOut, an effort led by Tadesse.

Tadesse, who also helped develop the drought center's Vegetation Drought Response

and flood in the Greater Horn of Africa

Index (VegDRI), is collaborating on this NASA project with researchers from Johns Hopkins University, NASA Goddard Space Flight Center, University of California-Santa Barbara's Climate Hazard Group, the U.S. Geological Survey's Earth Resources and Observation Science Center and Famine Early Warning Systems Network, the International

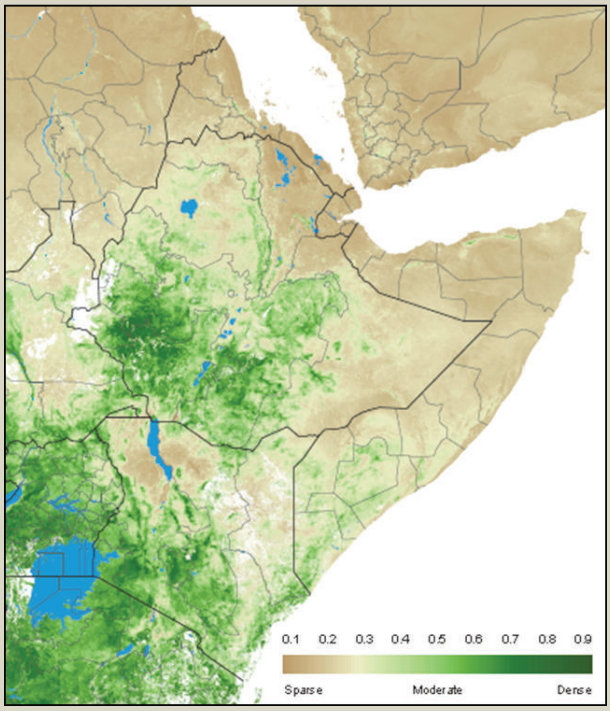
Tadesse experimented with a pedal-powered well during a 2012 visit to a farm in Dessie zuria, Wollo, Ethiopia.

Research Institute for Climate and Society at Columbia University, the University of Wisconsin-Madison, and the University of Nebraska-Lincoln, which is where the drought center is based.

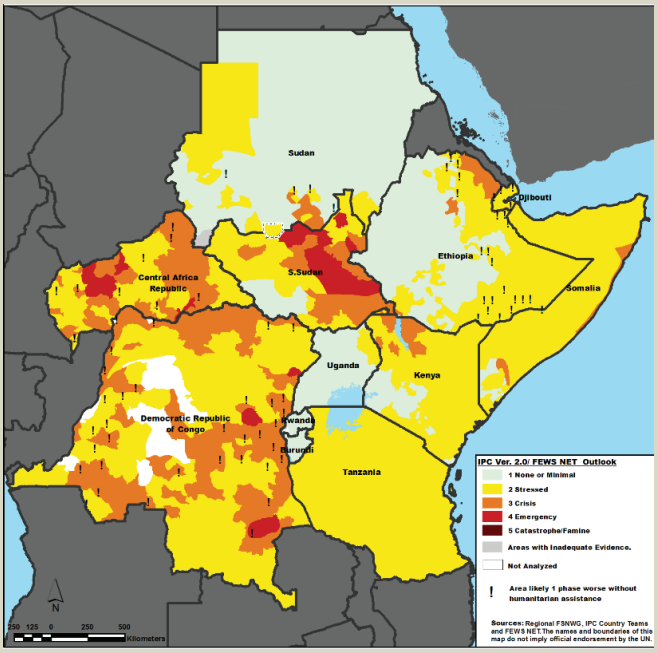
Other researchers from the University of Nebraska-Lincoln are Guillermo Baigorria, School of Natural Resources and Department of Agronomy and Horticulture, Shimelis Beyene, Institute for Ethnic Studies and Department of Anthropology, Brian Wardlow, Center for Advanced Lance Management Information Technologies and School of Natural Resources, and Michael Hayes, drought center and School of Natural Resources.

Tadesse is also involved in related efforts at the Drought Center that include developing the Quick Drought Response Index (QuickDRI), an integrated approach for rapid response agricultural drought monitoring in the United States funded by NASA, and developing the Vegetation Drought Response Index (VegDRI) model for Canada, funded by Agriculture and Agri-Food Canada.

NDVI Map of Greater Horn of Africa for the period 6 – 15 April, 2014



These two maps are examples of drought-related decision-making tools for eastern Africa. At left, the Normalized Differentiated Vegetation Index is computed from satellite data and displays health of vegetation. This map is available via the U.S. Geological Survey and the USAID Famine Early Warning System Network. Below, the Food Security Conditions map from FEWSNet reflects, in part, the effects of drought on rainfed agriculture in the region. Social and economic systems also play a big role in food security.



NDMC and UNL climate and social scientists help refine tools

Climate and social science researchers at the National Drought Mitigation Center and others from the University of Nebraska Lincoln helped develop AgClimate View$_{DST}$ and Corn Growing Degree Day$_{DST}$, the first two of a suite of products from the Useful to Usable project (U2U) to help farmers manage increasingly variable weather and climate conditions.

"We are excited to announce the launch of our first of several decision support tools. Our social science research on the front end helped our team of climate experts, economists and agronomists create easy to use tools that make climate data accessible and useful to the agricultural community. We'd like to think we are demystifying climate data one user at a time and hope producers will use the information to make better decisions and ultimately increase yields with minimal environmental impact," said Linda Stalker Prokopy,

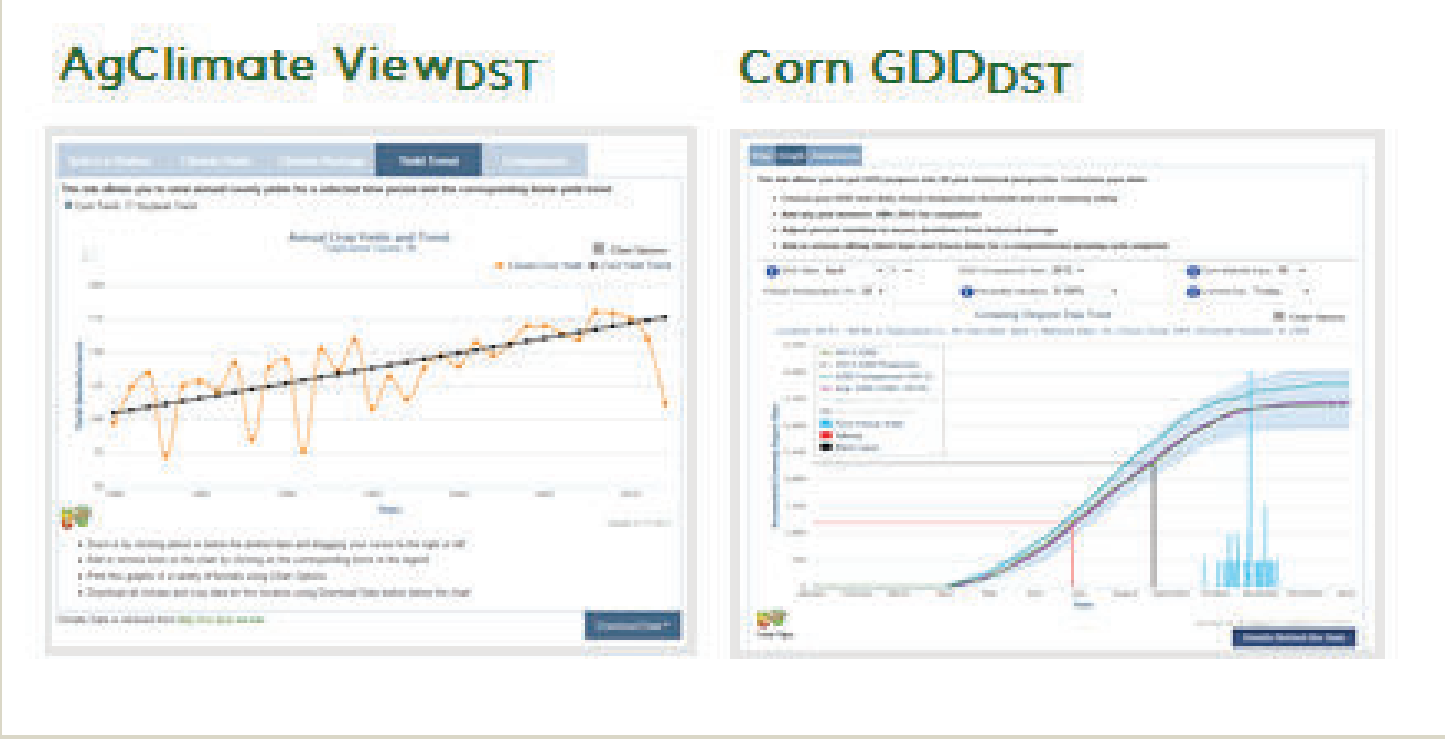
Tonya Haigh

Associate Professor of Natural Resource Social Science at Purdue and U2U project director.

The U2U research team includes climatologists, social scientists and other researchers from institutions across the Corn Belt.

AgClimate View$_{DST}$ provides convenient access to customized historical climate and crop yield data for the U.S. Corn Belt. Users can view graphs of monthly temperature and precipitation, plot corn and soybean yield trends, and compare climate and yields over the past 30 years.

Martha Shulski



AgClimate ViewDST and Corn GDDDST provide detailed analysis of data for specific locations. Try them at AgClimate4u.org

for agriculture

Tapan Pathak

Corn Growing Degree Day$_{DST}$ allows users to track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection. This innovative tool integrates corn development stages with weather and climate data for location-specific decision support tailored specifically to agricultural production.

Both tools are designed for agricultural advisors and producers in the North Central region of the United States as well as Kentucky and Tennessee. The U2U$_{DST}$ Suite can be accessed via U2U's web portal.

"We engaged potential users throughout the process, and they really shaped what's in the tools," said Tonya Haigh, a rural sociologist at the NDMC who also helped conduct surveys of farmers and farm advisors. Preliminary focus groups in Nebraska in early 2013 helped determine which tools to make first, and later focus groups in the summer and fall helped refine prototypes. "Crop advisors, the NRCS (Natural Resources Conservation Service) and farmers were all able to give us feedback before the tools were released."

Martha Shulski, director of the High Plains Regional Climate Center, based at UNL in the School of Natural Resources, provided technical and scientific support in developing the tools. "The HPRCC is pleased to be a part of this multidisciplinary team and lend our expertise in climatological data support and services," Shulski said. "We also look forward to hosting these decision support tools at the conclusion of the U2U project so the products continue to aid producer decisions into the future."

Tapan Pathak, Extension educator in climate variability, also at SNR, has been working with farmers to increase awareness of the tools. He presented the two new U2U tools at eight crop production clinics across Nebraska in January, reaching about 1,700 people, including producers, crop consultants, and Extension faculty and staff, and observed steadily growing interest.

"We engaged potential users throughout the process, and they really shaped what's in the tools. Crop advisors, the NRCS (Natural Resources Conservation Service) and farmers were all able to give us feedback before the tools were released."

– Tonya Haigh, NDMC rural sociologist

Useful to Usable is a USDA-funded research and extension project designed to improve the resilience and profitability of U.S. farms in the Corn Belt amid a variable and changing climate. The project is comprised of a team of 50 faculty, staff, and students from nine North Central universities with expertise in applied climatology, crop modeling, agronomy, cyber-technology, agricultural economics, and other social sciences.

Others at UNL who are part of the U2U project are Cody Knutson, who heads the NDMC's Planning and Social Science program area, Juliana Dai, graduate student in the School of Natural Resources, and Roger Elmore, systems agronomist at the Robert B. Daugherty Water for Food Institute

See the tools: AgClimate4U.org

"We'd like to think we are demystifying climate data one user at a time."

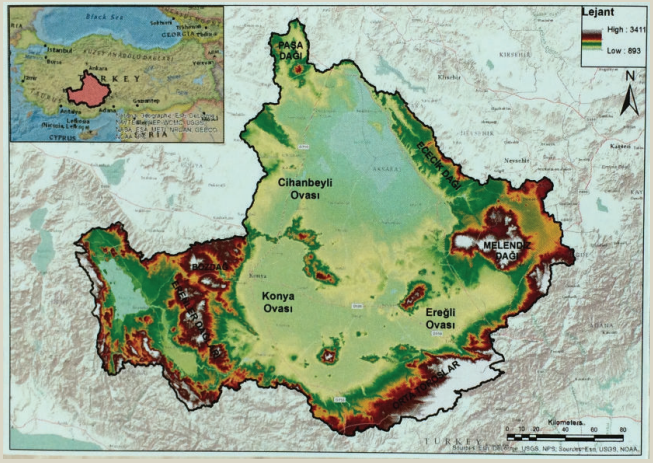
– Linda Stalker Prokopy, U2U project director

Svoboda helps Turkey with drought early warning and planning

Mark Svoboda, leader of the NDMC's Monitoring program area, traveled to Ankara, Turkey, in early March on behalf of USAID and other organizations to help that country begin planning for drought management at a river basin level. A two-day workshop focused on starting a drought management plan for the Konya Basin on the Central Anatolian Plateau. It is a semi-arid-to-arid basin at a high elevation that drains to lakes and wetlands rather than to an ocean.

Svoboda said he was encouraged by the breadth of institutional support for developing a plan. Participating agencies or ministries included the Turkish State Meteorological Service, the General Directorate of State Hydraulic Works, the Ministry of Food, Agriculture and Livestock, the Ministry of Energy and Natural Resources, and the Ministry of Science, Industry and Technology.

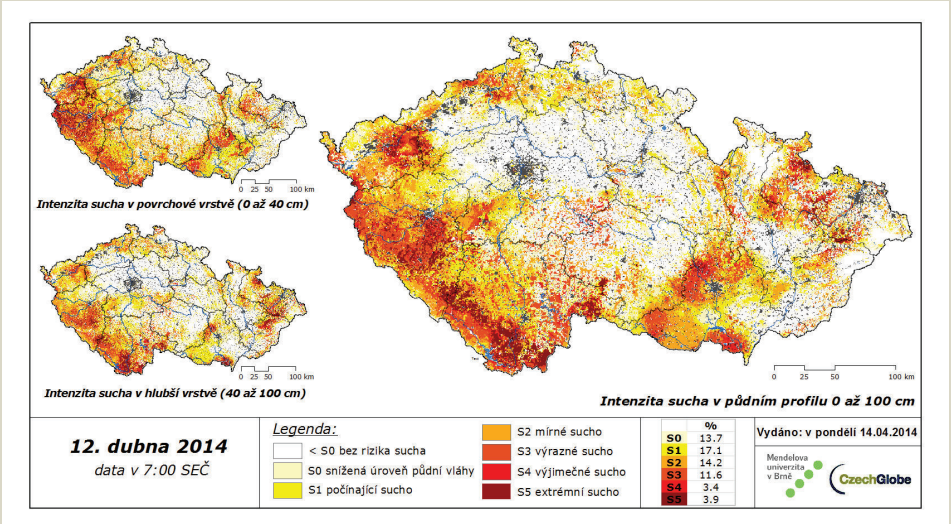
Svoboda gave a presentation on the drought monitoring and prediction component of a national drought policy. Turkey's steps toward drought planning are in accord with the recommendations adopted at last year's United Nations-sponsored High Level Meeting on National Drought Policy. Svoboda attended with Roger Pulwarty, director of the National Integrated Drought Information System Program Office.



Mark Svoboda, leader of the NDMC's Monitoring Program Area, helped the Konya Basin in Turkey get started on a drought management plan.

An Ankara-based consulting firm, Dolsar Engineering, is contracted to work with stakeholders to establish a drought management plan that: follows an integrated river basin management approach, that considers the water budget and vulnerability of the basin, that includes measures for drought mitigation, that will prevent impacts on resources and on socio-economic well-being, that includes measurements and thresholds to determine drought and water scarcity, and that includes measures to be taken before, during and after drought.

NDMC researchers and Czech scientists work on monitoring



Tsegaye Tadesse, NDMC climatologist, and collaborators Brian Wardlow and Jess Brown traveled to the Czech Republic in February to help researchers there produce a drought map similar to VegDRI, but with a unique emphasis on soil climatology and soil health. The map is part of the Czech Globe project. Wardlow, who led development of VegDRI, is now with the Center for Advanced Land Management Information Technologies, which, like the NDMC, is based at the University of Nebraska-Lincoln in the School of Natural Resources. Brown is with the U.S. Geological Services EROS Data Center in Sioux Falls, South Dakota. The map is online: intersucho.cz

