



CLIMATE IMPACTING ECOSYSTEMS

Climate offices, wildlife professionals take step toward creating climate change threat tools

In early February, Martha Shulski, director of the Nebraska State Climate Office, with partners from the High Plains Regional Climate Center, both at the School of Natural Resources at University of Nebraska-Lincoln, spearheaded a workshop intended to help fisheries and wildlife professionals examine how weather and climate information

could be integrated into their management decisions.

Participants at the 77th Midwest Fisheries and Wildlife Conference were challenged to come up with “triggers” climate offices can use to create a suite of tools useful to fish and wildlife professionals to indicate when action needs to occur.

WILDLIFE, 2

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Martha Shulski presents during the fish and wildlife climate workshop in February.

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An overarching theme from the event was that difficult decisions would need to be made by those professionals in the near future.

Disruptions in climate already are altering life cycles of species through shifts in watersheds, reduction in snowpack, more and longer droughts, and increasing air temperature. But at the same time, climate is only a part of the equation. State to state water use, altered landscapes and even migration shifts are part of it, too.

That’s why the state climate office and the regional climate center plan to continue pursuing partnerships with fish and wildlife professionals. And why that pursuit will be returned. The workshop was just the first in what both groups hope will be the start of partnerships that result in usable tools.

Clay Buchanan, assistant federal aid coordinator for the Michigan Department of Natural Resources who attended the session, sees value in learning more about climate data sources, tools and climate change impacts to be used in natural

resource management decisions and looks forward to training opportunities on scaling climate projections to specific needs of state biologists or research scientists.

“The climate workshop was beneficial,” he said. “I learned of the ways other state agencies and organizations were dealing with climate change and what questions they were asking relative to their natural resources and stakeholders.

“The organizers were exceptionally knowledgeable and interested in meeting the needs of climate data users, too.”

— SHAWNNA RICHTER-RYERSON

WINTER OUTREACH

NSCO IN SERVICE TO STAKEHOLDERS

The Nebraska State Climate Office has been busy this winter, meeting with people across the state who have a need for climate information.

Farmers, agriculture organizations, seed dealers, Nebraska Extension members, chambers of commerce and more put in requests for us to come talk — about climate tools, climate outlooks for 2017, historical climate trends and climate change.

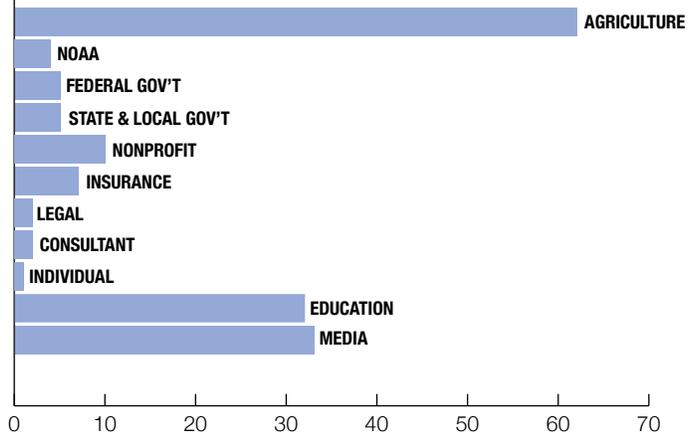
No crowd has been too small; we’ve talked to as few as five and as many as 300. Our two most requested talks are 2017 Ag Climate Outlook and the Climate Change and Historical Trends.

Al Dutcher, NSCO Extension agricultural climatologist, delivers the ag outlook, with a focus on the upcoming growing season and potential climate issues that could affect U.S. crop production. He looks at precipitation to date, including current soil moisture and snowpack levels. He also looks to the sea surface temperatures, both in the Atlantic and Pacific oceans, which have a large influence on climate and weather, especially in Nebraska where fronts tend to converge.

Through spring, Dutcher said, people should expect to see continued temperature extremes and increasingly wet conditions, which would could increase feedlot mud. Also expected: severe weather, including tornadic activity, in the central and northern High Plains region, and an



Data requests



increase in drought in the Southeast just prior to the planting season. For more weather outlook information, please read our spring outlook on page 3.

Martha Shulski, NSCO director and state climatologist, delivers the climate trends discussion, an educational talk focusing on the history of climate as well as projection tools and resources. Shulski describes the different between weather and climate (weather is your at-bat; climate is your batting average), but also covers climate variability and trends.

Shulski shares data sets and maps from well-respected sources, such as from the National Climate Assessment, that show nighttime low temperatures are increasing,

winter and spring seasons are warming faster than historical records show, frost-free seasons have lengthened and the Midwest is wetter overall than the normal set over a 30-year period.

Since Dec. 1, the two have given 45 of these talks to more than 2,600 people combined.

In addition, the office has fulfilled more than 163 data requests to stakeholders from a broad range of industries across the state.

This spring, the talks will taper off as the office and stakeholders turn their attention to the upcoming growing and severe weather season.

— SHAWNNA RICHTER-RYERSON

SPRING OUTLOOK

STORMY SPRING EXPECTED

We've officially entered our meteorological spring, which means it is time to look at what type of conditions might be expected through May across the United States. Precipitation and temperature trends were interesting this winter, and we have now entered a period generally regarded as the most volatile of our calendar year.

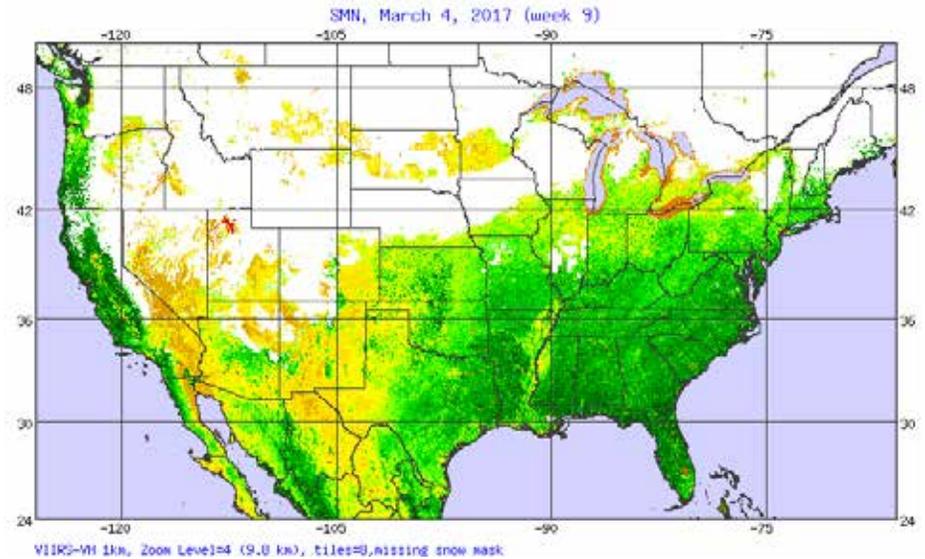
There have been losers and winners in the precipitation arena during the past eight months as heavy snowfall has blanketed most of the major mountain ranges across the western U.S. We also have been monitoring extreme wetness across the northern Plains and north-central Corn Belt. At the same time, dryness issues have expanded across the central and southern U.S., strengthening concerns about drought expansion into the central and eastern Corn Belt over the next few months.

Although it is not uncommon to experience dryness issues during the winter period, the unusual warmth experienced east and south of Nebraska has reinforced dryness concerns. Particularly concerning is persistent warmth during February that promoted earlier-than-normal dormancy break across the southeastern U.S.

The NOAA Center for Satellite Applications and Research Greenness index is signaling that dormancy break has now approached the southern border of Nebraska. Further to the southeast, most areas south of Tennessee are showing moderate greening, which indicates vegetation such as trees and grasses are actively growing and water use will begin to rapidly increase as temperatures proceed to the summer maximum.

We have been spared from complete dormancy break due to low temperatures consistently dropping into the mid 30's or lower. It is true that maximum temperatures set a series of daily high temperature records during February, but the low relative humidity air masses controlling our weather have allowed low temperatures fall off quickly once the sun sets on the western horizon.

Unfortunately, the slower pace of



NOAA CENTER FOR SATELLITE APPLICATIONS AND RESEARCH GREENNESS INDEX

dormancy break across Nebraska has contributed to periods of high fire danger since the middle of February. Until grasses are actively growing, we should expect that periods of high fire danger are likely. Further south of Nebraska, rainfall is needed to promote rapid grass growth. Temperatures are certainly warm enough to promote grass growth, but moisture has been difficult to come by.

Heavy snow activity the entire winter across the western U.S. has brought snowpack levels in many basins to the point where current estimates exceed the April 1 statistical peak of an average snow year. Storm activity has shown little signs of abating for systems entering the western U.S., although the mean storm pack appears to be lifting toward the northern half of California and the Pacific Northwest. If this trend continues, snowpack levels in the central and northern Rockies should continue to build through the end of March.

Official Outlook

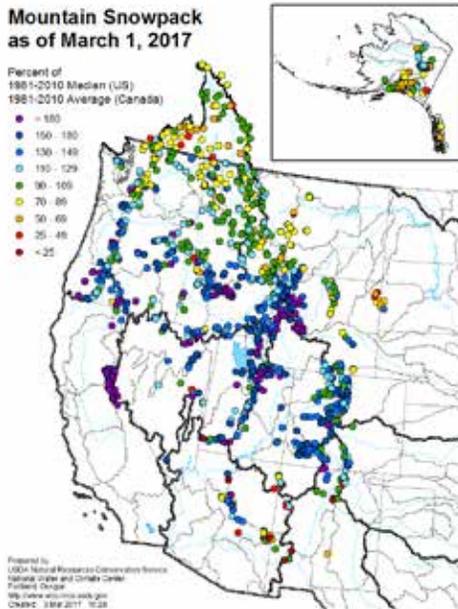
Short-term models (less than 30 days) continue to point toward very active weather returning to the northern and central United States through early April. Western U.S. storm activity has been slowly shifting

northward over the past month and will continue this trend through the end of spring. If past history is any indication of future storm activity, a highly variable temperature pattern should continue through much of our spring season.

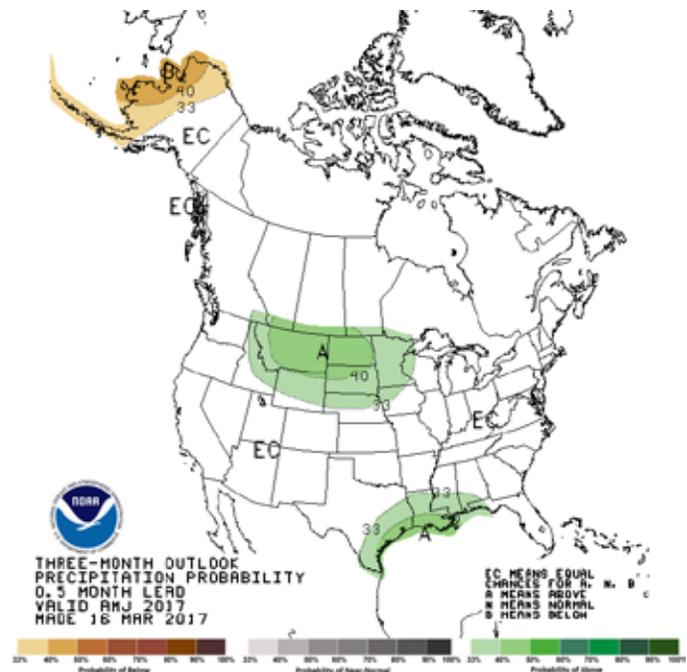
Each time a series of storms entered the western U.S., a downstream ridge enveloped areas east of the Rockies resulting in above-normal temperatures. Once the final storm moved into central U.S., cold air from Canada was able to slide southward on the backside of the surface low and introduce below normal temperatures to our region of the country. The length of these past cold air outbreaks were determined by the amount of time that the western U.S. stayed precipitation free.

A recent stretch of cold air intrusions (Feb. 25 to March 5) resulted in several severe weather events from Iowa eastward through Ohio. During my talks across the state this past winter, I mentioned that the atmospheric pattern would lead to widespread severe weather outbreaks this spring if there was no relaxation in the present storm tracks that dominated our winter season.

We have had very limited severe weather here in Nebraska, but we have been



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NOAA

FROM PAGE 3

dealing with a very dry atmosphere that lacks the necessary moisture in the lower layers of the atmosphere to support rapid intensification when storms begin to develop. Most of these systems have developed over western Iowa and strengthened as they progressed eastward.

Once dormancy of native vegetation occurs, there will be more atmospheric water vapor available to interact with cold fronts and our severe weather risk will begin to increase. This should occur during the second half of the month according to recent weather model output. At the same time, severe weather outbreaks across eastern Nebraska typically coincide with early spring snow storm activity over western Nebraska and models are hinting at one of these events developing during the third week of March.

With a bountiful snowpack in place across the central Rockies and a storm pattern favoring the central and northern Rockies through early April, additional gains to the snowpack should continue and statistical odds favor an above-normal snowpack and above-normal streamflow projections as we enter the beginning of our snow melt period by mid-April. This is also likely after reports from the Colorado State Climate Office indicating that the recent warmth felt east of the Rockies resulted in no melt loss at the snow monitor-

ing locations in upper elevations scattered throughout the headwater region of the Platte watershed.

The Climate Prediction Centers 90-day outlook for the March to May period indicates a broad area of above-normal moisture from the Pacific Northwest eastward through the western Great Lakes region. The southern extent of this forecasted area reaches as far south as the northern Nebraska border. If this materializes, the risk of spring flooding will remain elevated for the eastern Dakota's, southern Minnesota, southern Wisconsin, northern Iowa and northeast Nebraska.

Temperature forecasts for the spring period by the CPC increases the odds for above-normal temperatures across the central Plains when compared to previous model runs for the same comparable period. If this forecast comes to fruition, below-normal moisture likely would result in a rapid expansion of the abnormal dry and moderate drought conditions currently indicated for south central and southwest Nebraska.

We saw some expansion of drought conditions across southern Nebraska during the first half of March, and expect precipitation patterns to become more favorable in late March and early April. We are going to need to see eastern Colorado also become significantly wetter than what they have experienced since late last summer in order to keep drought expansion at bay. A failure for this region to receive at least

normal precipitation would support an intensifying drought signal, with southwest Nebraska on the northern periphery of drought region.

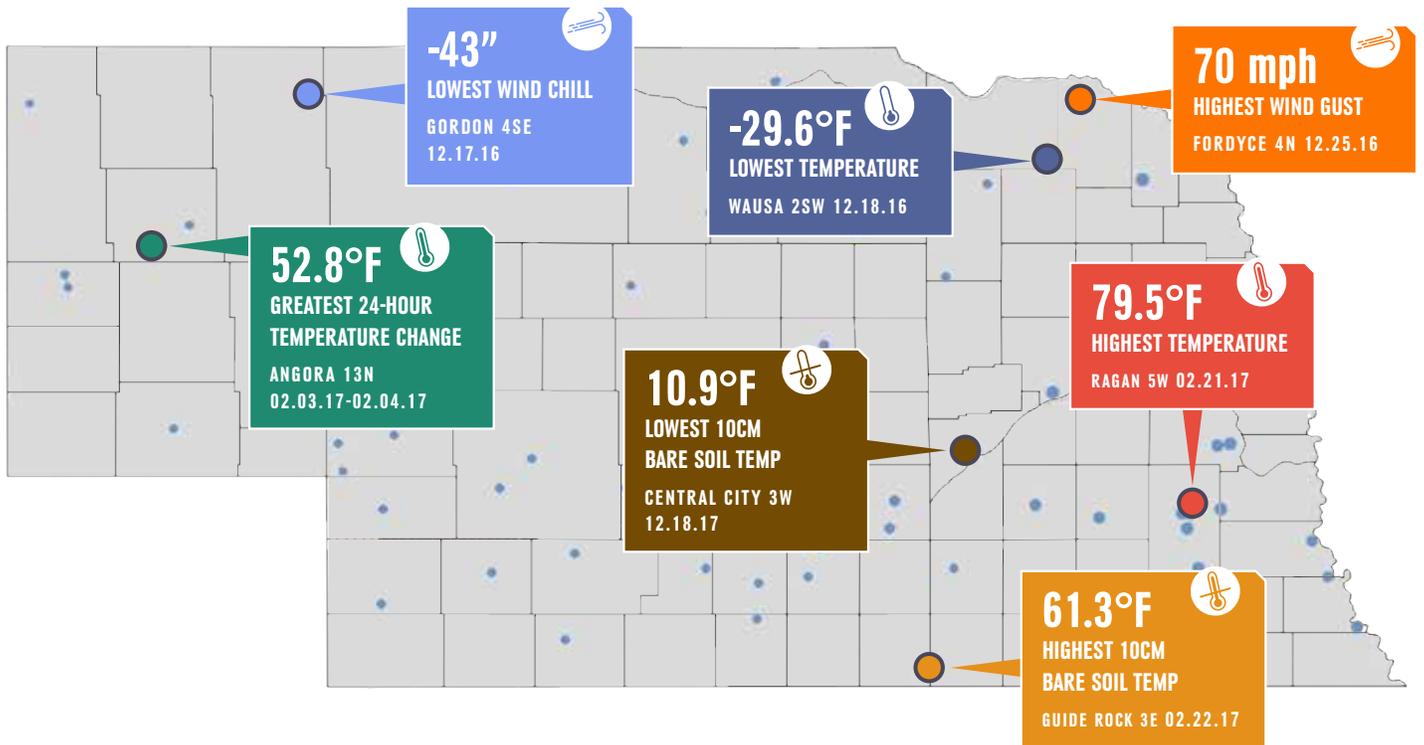
Bottom line is that atmospheric weather patterns continue to point toward an active spring weather pattern that is expected to result in above-normal moisture immediately to the north and east of Nebraska. With soil profiles essentially full, there is little available space for additional precipitation events. This should lead to periodic flooding and the potential for planting delays if storm activity remains active from mid-April through May.

At the same time, the expansive drought area from eastern Oklahoma through the western Carolinas is not projected to receive above-normal spring moisture. If temperatures remain above normal this spring (highly likely), drought expansion likely will occur as we move through the month of May.

Whether the southern Plains dryness builds north into Nebraska during our spring season will depend on whether the low pressure systems continue to move through the central and northern Rockies. As long as the pattern remains active, dryness expansion will be subdued. If storm activity slows significantly from mid-April on, the southern third of Nebraska will likely be engulfed by northward building dry pocket currently located across Oklahoma.

— AL DUTCHER

CLIMATE EXTREMES WINTER 2016-'17



» **GET REAL-TIME DATA**

View real-time data collected by the Nebraska Mesonet on its website: mesonet.unl.edu

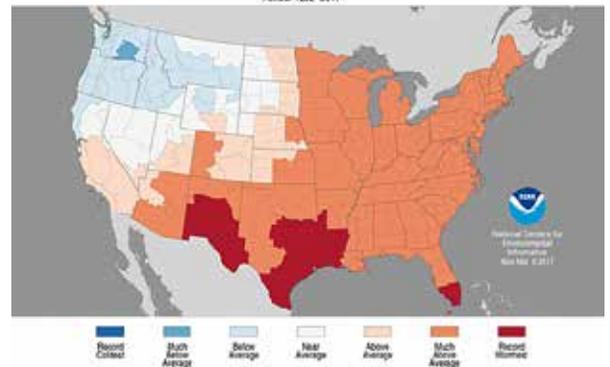
STATE WINTER CLIMATE SUMMARY

Warmth and overall wetness was the story this winter in Nebraska. Temperatures averaged out at 27.9°F, which is 3.1 degrees above the long-term average. This average lies in the warmest third out of all Nebraska winters. High temperatures averaged three degrees warmer than average at 39.9°F and the average low was 16.6°F, 3.4°F above average. There was quite a bit of temperature variability within the winter – this is Nebraska after all. December even brought a taste of severe weather season on Christmas Day in central and eastern Nebraska with a rare bout of heavy rainfall (yes, rain, not snow) and tornadic activity. February saw more than its fair share of records broken with several hundred new daily highest daytime highs and highest nighttime lows reported during the third week of the month.

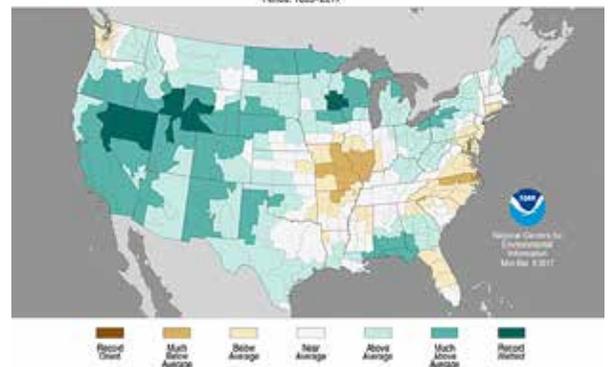
Precipitation statewide for winter (Nebraska’s driest season on average) was 2.51 inches, about three quarters of an inch above the long-term average. Snowfall was plentiful in the north, but fell short of normal in the south.

– MARTHA SHULSKI

Divisional Average Temperature Ranks
December 2016-February 2017
Period: 1895-2017



Divisional Precipitation Ranks
December 2016-February 2017
Period: 1895-2017



MESONET

MAINTENANCE SEASON IS HERE

Spring has arrived, and with it, comes the Nebraska Mesonet weather station maintenance season.

Over the next six months, our senior mesonet technician Glen Roebke will be visiting each of our 67 weather station sites to perform a checkup and calibrate or replace weather measurement instruments. Instruments he ensures are working in property order include those that measure air temperature, humidity, liquid precipitation, wind speed and direction, solar radiation, barometric pressure, soil temperature and soil moisture. Each of those research-grade pieces of equipment gather data that feeds into our real-time maps available at mesonet.unl.edu.

During this year's run, Roebke also will replace the current wind sensors with an updated model, the RM Young anemometer, which is more robust and has better performance under potential icing conditions that can occur during extreme weather events. Many storms, for example, are accompanied by record-breaking wind speeds and dramatic direction changes. The current anemometers can ice over, literally freezing in their tracks and eliminating the possibility of data collection until the ice melts.

Many neighboring states already have made this change, and installing a similar or identical anemometer in Nebraska will make data normalization easier when comparing



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each state's data streams.

Also this quarter, we intend to upgrade the weather station at Long Pine 20S, also known as Barta, to a 10-meter tall configuration. The majority of our weather stations are tripod configurations that gather data at both 6 feet and 9 feet. The 10-meter configuration has sensors at 6 feet, 9 feet and 30 feet. This added level will allow us to:

- Match an international height standard compared to other networks and observation systems already using 10-meter

towers;

- Calculate flux throughout an atmospheric column that aids in modeling and research; and
- Give us low order redundancy to measure at that station point to cover for instrument failure.

We're hoping to have the station installed by the end of June.

— SHAWNA RICHTER-RYERSON

EYE ON ENERGY

The Nebraska State Climate Office just began a new one-year research project to improve short-term wind forecasting across the state with the intended outcome of helping wind energy operations maximize efficiency and accurately determine wind generation output.

The project will use Nebraska Mesonet wind observations from its 67 weather stations to verify output of the Weather Research and Forecasting model currently being used at the University of Nebraska-Lincoln. The hope is to create a special-

ized WRF real-time simulation package specific to the wind energy production needs in the Nebraska.

Nebraska currently is ranked fourth in the nation for wind energy resources, according to the state of Nebraska website, but only 2.77 percent of its energy consumption and 6.94 percent of its electricity was generated from wind power in 2014, the most recent year data was available.

The wind forecasting project will combine the expertise of the state climate office and the Holland Computing Center,

a high-performance computing resource for the University of Nebraska system. Martha Shulski, NSCO director, and David Swanson, HCC director, are co-lead scientists on the project.

The project is funded through the Nebraska Center for Energy Sciences Research, a collaboration between the Nebraska Public Power District and the University of Nebraska-Lincoln. It was established in 2006 with the intent of supporting innovative research in energy sciences.

— SHAWNA RICHTER-RYERSON