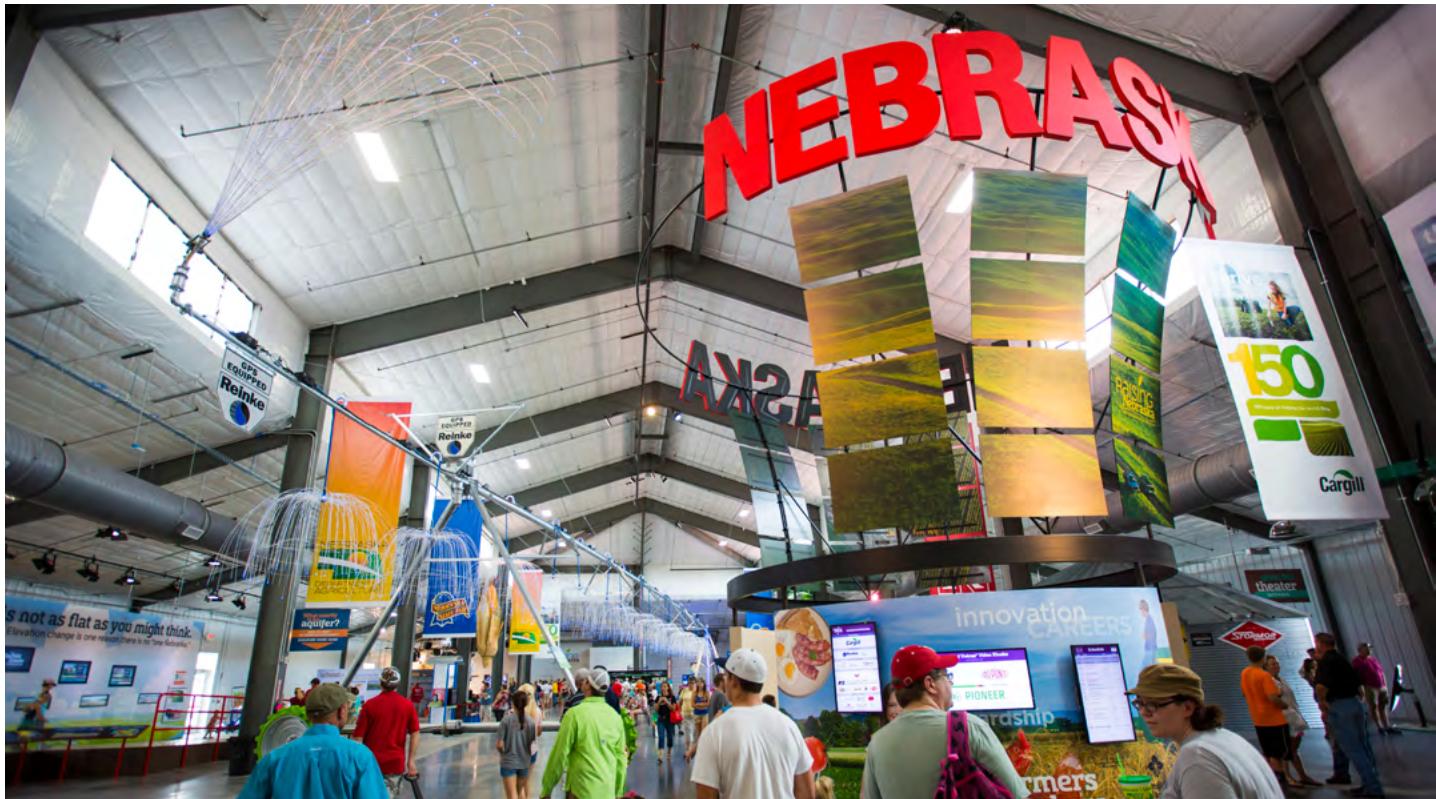


# Climate Crossroads



## RAISING NEBRASKA

# FLOOD, CLIMATE ADDED TO EXHIBIT

### NEBRASKA STATE CLIMATE OFFICE

With the Nebraska State Fair just around the corner, top country music acts, carnival rides and cotton candy may be on your mind. But add to the list one more state fair MUST DO this year: Visit Raising Nebraska on the fairgrounds. Because they'll be featuring the

Nebraska State Climate Office in their newest exhibit addition focused on the flooding that struck the state in March 2019. Sprinkled among Raising Nebraska's 25,000 square feet of exhibition space, which includes video, touch screen technology and hands-on activities, will be

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*Photo of Raising Nebraska courtesy University of Nebraska-Lincoln*



IMAGES COURTESY RAISING NEBRASKA

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climatologists Martha Shulski, Tyler Williams and Al Dutcher sharing their knowledge in the Trusted Voices feature.

"One of the things that makes Raising Nebraska a unique place for learning is that we connect the public to the experts," said Sarah Polak, experience coordinator at Raising Nebraska. "There is much misinformation on the internet and in the public about agriculture, food, and weather. When our visitors have questions, we want them to have the best and most current information on a topic."

"Asking the NSCO climatologists to partner with us has allowed us to not only provide the best information, but it allows the public to hear directly from the experts on a topic."

In six short video clips, the NSCO climatologists provide the answers to commonly asked climate questions, including how climate is different than weather; how climate change and agriculture are related; and if global warming is real. But they'll also provide the answer to, "What caused the flood of 2019?" and "Are we really seeing greater weather extremes?"

Included in the exhibit will be footage from the [Platte River Timelapse project](#), showing the Platte River before, during and after the flood, and a mixed-reality experience that allows visitors to experience the height or depth of the flooding in a digital world. Polak also said new pieces will be added to the

exhibit as the impacts of the weather are revealed in the long term.

The spring flood was far-reaching, stretching along swollen river veins in southern and eastern Nebraska. Farms were destroyed, livestock lost, and communities severely damaged. Some areas remain under water, some areas are experiencing new flooding, and transportation and commerce are still being affected.

"To capture the impact (of the extensive flooding) in a short amount of time in a way that is meaningful is very difficult," Polak said. But they hope all visitors, Nebraskans and non-Nebraskans, learn from the exhibit the scope of the spring's weather events and their impact on the state.

"This past spring, and now summer, the public saw examples on TV and online of these farm and ranch families struggling due to weather. They also saw the impacts of weather on urban areas as well," she said. "We knew we could create an opportunity for people to talk about the what happened, how it happened, and why it happened from a fact-based place that can help people understand the events."

Polak said they also hope to increase the understanding about climate; and to better illustrate the connections between weather, climate and agriculture.

Raising Nebraska is an award-winning agricultural literacy experience on food and the families who grow it. It's also a collaborative effort among the [University of Nebraska-Lincoln's 4-H](#) and [Extension](#) programs.

"There is probably no more trusted source in the state of Nebraska than Extension," Shulski said. "Educators live and work in the communities they serve, know their stakeholders well, and most importantly will be a familiar face to talk about these topics. Trust leads to greater engagement, which hopefully will lead to better outcomes."

To be among the voices trusted by Nebraskans is an honor, and a position the state climate office doesn't take lightly. The mission, after all, is to arm stakeholders with the information they need to make decisions important to their lives.

Their excitement and passion for working on the project was evident to Polak from the first meeting.

"The spirit of collaboration and creative energy in working on this project has been wonderful," she said. "We are thankful to the NSCO and the climatologists for their support of this project and we look forward to continuing this partnership into the future."

## Find Raising Nebraska

Raising Nebraska is located in the Nebraska Building, near the [Nebraska State Fairgrounds](#) main gate at the intersection of State Fair Boulevard and South Locust Street, Grand Island, Nebraska. The educational experience is open year round and is free to the public.

[Learn more about Raising Nebraska.](#)



SHEALAH CRAIGHEAD/WHITE HOUSE VIA FLICKR

Floodwaters from the Missouri River cover farms, roadways, commercial property, and neighborhoods Tuesday, June 11, 2019, in Iowa and Nebraska.

## FLOOD STANDS OUT IN HISTORY

It was about the timing, and though the first round of flooding occurred in March, the affects from it and the Nebraska State Climate Office's role in providing context for it persisted through the second quarter of the year.

The office received dozens of calls from media, hoping to shed light on what happened and why. Martha Shulski, NSCO director, talked with [CBSNews](#), and FujiTV, and the Omaha World Herald, and Al Dutcher spoke with local media outlets and the ag community. They gave presentations, joined in NOAA-led webinars, and met with hazard mitigation planners.

"I receive two primary questions about the flood," Shulski said. "What were the factors that caused it, and did climate change play a role?"

Simple questions, that don't have simple, one-word answers.

### What caused it?

The period of time leading up to the flood was wet. Soils were at or near saturation around much of the state. The previous

year, March 2018 to February 2019, was the sixth wettest on record in 124 years of record-keeping. February 2019 was the seventh coldest on record, allowing the soil to freeze deep. And then the snow fell. Snow sat atop the frozen and saturated landscape, the amount of water in that snow equivalent to a few inches of rain.

"The flood outlook going into spring was at much-above-normal risk, with an increased risk for major flooding," Shulski said.

Then a rapidly intensifying cyclone moved across the state on March 13 to 14, producing blizzard conditions in the west and several inches of pure rain in the east. Temperatures in the east were above freezing, and those mild conditions plus the rain caused the snow to melt rapidly.

"River ice was thick and ice jams occurred," she said. "The hydrologic system was full, and there was nowhere for the water to go but rise."

Rise it did, rushing into an already bloated river system where it topped levees before the Spencer Dam failed. And then the water was everywhere.

"In river gauge history, we have never seen levels this high before," Shulski said. "Eighteen locations reached new record crests in eastern Nebraska, and a number of locations along the Missouri river did, too."

Conditions were ripe for severe flooding, she said, before the storm came along.

"The timing of the series of events is what caused the large-scale impacts. ... Had the storm come along later in spring or summer, the impact would not have been near what it was."

Among the state's climate history, March 2019's flooding will stand out as a rarity.

### Did climate change play a role?

The flood was the result of a number of factors: wet, cold and storms. The wet conditions that set the stage in winter are a part of a historic trend in Nebraska, and the state can expect wetter winter and

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spring seasons and more heavy precipitation events due to climate change.

"The late winter storm, while difficult to pinpoint climate change as the direct cause, does fit in with what we expect to see more of due to climate change," Shulski said. "More heavy rain events are an implication of climate change."

#### Why?

As the atmosphere warms, more evaporation occurs, which leads to higher levels of water vapor in the air, that translate to more frequent and intense precipitation events. And as winter and spring get wetter, the chances

become greater of having a repeat of conditions like those in spring 2019.

#### Lessons learned

People play a role in spring's flooding conditions, too. What we choose to do with the landscape — where we build, where we farm, how we maintain our levees — can increase or decrease our risk to future flood, or even drought, risks.

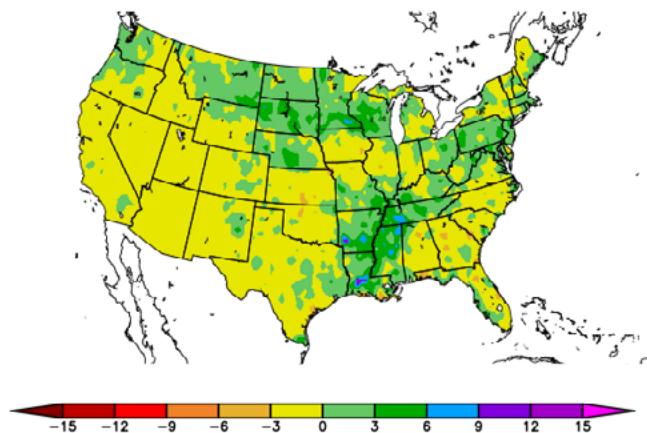
"An event of this scale allows us to see where our infrastructure weaknesses are and to enhance our preparedness for events of this scale in the future," Shulski said.

Communities already are doing so. The Nebraska Emergency Management Agency and several Native tribes across the state have hosted meetings, inviting the state climate office to contribute to discussions. The NSCO provides historical climate trends and distills climate projections into usable assessment information.

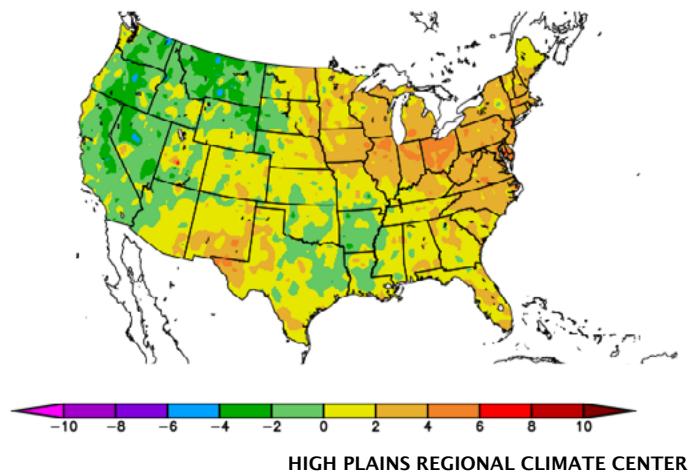
"Essentially to answer the questions: How have things changed in the past, and how will things change in the future?" Shulski said. "We can help Nebraskan's assess their risk of weather hazards."

Right now feels like the right time to do so, because timing is everything.

Departure from Normal Precipitation (in)  
6/24/2019 – 7/23/2019



Departure from Normal Temperature (F)  
6/24/2019 – 7/23/2019



Figures 1 & 2. Maps generated at HPRCC using provisional data.

HIGH PLAINS REGIONAL CLIMATE CENTER

# FREEZE RISK ON HORIZON

Spring was challenging across a substantial portion of the U.S. due to persistent rainfall and below-normal temperatures that delayed corn planting frequently. These type of conditions are challenging enough, let alone following an exceptionally wet fall that led to significant planting delays and high soil moisture values.

Although Nebraska wasn't immune to these conditions, our crops are much further along than the eastern Corn Belt, which bore the brunt of the continuous



**AL DUTCHER**  
Extension  
Climatologist

rainfall events in April and May. Our saving grace was that we were able to get a small window of dry weather in early May that allowed producers to get into their fields to plant.

Even with the tiny planting window in May, there was a wide spread in regards to planting: Over 75% of our corn crop emerged during a three-week window,

compared to a normal year when most of our crop emerges in a 10-day window. Corn that emerged during the late-May to mid-June period has consistently been reporting the most significant stress.

Figure 1 and 2 show the departures from normal for precipitation and temperature for the 30 days prior to the completion of this forecast. You will notice that temperatures have been above normal from the front range of the

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Rockies through the eastern Corn Belt, with below-normal temperatures across the northern Rockies and the West Coast states.

Precipitation surpluses across the U.S. Corn Belt the past 30 days were confined to the western two-thirds of Nebraska, as well as the northern Plains states eastward through Wisconsin. Drier-than-normal conditions these past 30 days allowed for fields to dry enough that producers were finally able to get some of their spraying and fertilizer chores completed.

Unfortunately, late-planted crops have exhibited stress conditions, especially corn, where root development was unable to keep up with plant demands, especially during periods when temperatures moved into the 90's to low-100's. Additionally, early planted corn was beginning to pollinate during our most recent stretch of mid-90's to low-100's. Hopefully the high dew point temperatures minimized pollination issues.

Even with the warm temperatures these past 30 days, there remains considerable angst in regards to the elevated freeze risk to late planted corn that will need above-normal temperatures during September to reach maturity without freeze damage. In addition, soybeans will need good moisture during August to promote good pod fill.

We are now approaching the home stretch of our agricultural season as crops pollinate and move toward maturity. As of late July, the jet stream pattern over the U.S. featured an expansive upper air ridge extending from the southwestern U.S. through the central and southern Plains. As weather systems have been entering the Pacific Northwest, they have been able to push the top of the ridge southward resulting in a storm track that has favored much of the upper Midwest.

As we slide into the month of August, I expect that the pattern during July will continue through much of the month. We will likely move between hot-and-humid conditions to cool-and-moist conditions similar to July, with each episode lasting three to seven days in length. For Nebraska specific, it appears that our precipitation opportunities will be tied to the amount of monsoon moisture that can work its way around the periphery of the



## WE'RE ON YOUTUBE

Catch Al's weekly climate forecast, filmed by Market Journal at the University of Nebraska-Lincoln, our [YouTube channel](#).

upper air ridge.

When the upper air ridge is pressed southward by upper air troughs moving across the northern Plains, monsoon moisture should be pulled northeastward toward Nebraska, increasing our chances for precipitation. When the ridge builds back northward in response to these low pressure systems moving into the eastern U.S., the monsoon moisture feed will likely be directed toward the Dakota's and Minnesota.

As we move toward the end of August, statistically we should begin to see the influence of the southern U.S upper air ridge begin to weaken. This would allow upper air troughs coming into the western U.S. to dig further south and drive the primary storm track toward the central Plains. If the monsoon remains active, then our moisture events should be on the stronger side. I would not be surprised to see renewed concerns of a repeat of last fall when much of the Corn Belt dealt with significant harvest delays.

Since El Niño conditions continue, but in a weaker state than last fall, odds favor that some of the evaporated moisture in the central Equatorial Pacific will be drawn northeastward into troughs moving into the western U.S. If this occurs, the southern Plains (Kansas, Oklahoma, Texas), will experience typical El Niño conditions with above-normal moisture.

Ultimately the hardest part of this fore-

cast is during the late September through the end of October forecast. With late planted crops needing a warm September and at least no freeze before mean hard freeze dates, any trough riding over the top of the southern Plains ridge has the potential to deepen and pull Canadian air southward.

Based upon current atmospheric patterns, the most likely region for an early freeze would be the central and eastern Corn Belt, with northeast and east-central Nebraska lying on the western periphery of this area. Of course, this area is further behind in regards to crop maturity than Nebraska, so it naturally has a higher risk of freeze damage under normal temperatures through the remainder of the cropping season. Add to this that upper air troughs has shown the greatest strengthening over the eastern U.S. and you have the perfect scenario for early freeze conditions.

I would like to state that this three-month forecast is highly uncertain and tries to take into consideration the current atmospheric setup and how things might progress as we move through the late summer through mid-fall period. If monsoon moisture under-performs during August and September, then drier conditions across the southern Plains would lead to a stronger upper air ridging pattern, which would lead to warmer September conditions for much of the western Corn Belt.

# Weather stations to get solar upgrade

The Nebraska Mesonet crew is in the thick of their summer maintenance and station upgrade schedule, with nearly all our weather stations completed.

In addition to ramping up site visits to four per year instead of two, Glen Roebke, Regan Kerkman and Stonie Cooper also are installing larger solar panels on half of the stations, with the other half to get the upgrades next year.

"Nebraska Mesonet stakeholders have indicated a desire for more immediate access to near real-time data across the state," said Cooper, Nebraska Mesonet manager. "From emergency managers, water managers, to agricultural operators, there is a trend towards needing to know in the immediate."

All stations will get large solar panels for larger energy capture, as well as larger battery packs, which will allow every-minute updates at [mesonet.unl.edu](http://mesonet.unl.edu).

"This upgrade puts the Nebraska Mesonet in a position to provide reactive information to those that need it, when they need it," he said.

## Looking back

In late July, ranchers and cattle producers across the state battled above-average heat, which triggered heat-stress emergencies for their livestock. Among the tools they looked to for information was the Cattle Comfort Index, a heat index designed for cattle.

The index, available as a real-time map on the Mesonet website, is a formula combining temperature, wind, sunshine and relative humidity to determine the



## MEET THE MESONET

**Station:** ALLIANCE 6NW

**Birth date:** MAY 29, 1988

**Location:** BOX BUTTE COUNTY

**Elevation:** 1,241 METERS

**Sponsor:** UPPER NIOBRARA WHITE NATURAL RESOURCES DISTRICT

**Quote:** **"**The Alliance station would have had to be pulled (without a new sponsor recently) and would have created a very large data hole in the Panhandle. Special thanks to Patrick O'Brien, manager of that NRD."

— Stonie Cooper, Nebraska State Climate Office

"felt" temperature by the cattle. It was originally designed by a team of researchers from the University of Nebraska-Lincoln and the University of Queensland, Australia.

Between July 17 to 20, Cooper said

the index would reach close to 120 for many parts of the state, which helped cement actions by farmers — providing extra water, limiting food intake, and wetting down feedlots — to help cool cattle and limit deaths.

# Regan Kerkman joins state climate office

If you live near a Nebraska Mesonet station, you may just see our newest employee servicing the equipment, installing upgraded units or maintaining the sites.

Regan Kerkman, a Nebraska native and University of Nebraska-Lincoln graduate, will mostly serve the western part of the state, serving as our second Mesonet technician. He joins Glen Roebke, who

has serviced our stations for more than 20 years, and Stonie Cooper, the Mesonet manager.

Now a couple of months into his new job, Kerkman said his favorite part so far has been the ability to work outside.

"Coming from a farm, I've always enjoyed working outside and with my hands, so I like being able to tap into that side of

me," he said. The farm is also where he first developed a love of weather.

"I always watched the weather growing up," he said. "As a farmer you want to know when the next rain will happen. That mixed with the fascination of watching storms form over the crops piqued my interest in weather."

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SHAWNA RICHTER-RYERSON, NSCO

Glen Roebke teaches Regan Kerkman how to install a weather station at St. Michael's grounds in south Lincoln.

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Those interests propelled him to pursue a degree in meteorology with a minor in agronomy, two subjects he combines daily now in his role with the state climate office.

"The weather affects soil management and crop production so it is beneficial to have an understanding of how they affect each other," he said. "Growing up on the farm, I understood the importance of how weather affected agriculture, but now I want to help provide accurate weather data set for others."

Kerkman sees the quality and accurate data as the most valuable thing the Nebraska Mesonet provides. All stations are top-of-the-line and equipped to record continuous observations of myriad climate conditions. And as a National Mesonet Program partner, we now visit each station four times yearly to make sure observations are as accurate as

## WEATHER JUNKIES

We can't introduce our newest employees without also highlighting a couple of their faves. Here, learn a little more about Regan Kerkman, a Nebraska native, University of Nebraska-Lincoln graduate, and our newest weather station technician.

**Favorite weather event:** Severe weather involving a super-cell

**Most interesting thing about climate:** How it's changing and how it will affect the future

possible. This data is then used by decision-makers across the state.

In addition to maintaining stations and equipment, Kerkman also will help calibrate the weather-observation instruments during winter months. Currently, Nebraska is the only climate office capable of calibrating its own equipment.

To give him a leg up on that process, Kerkman recently was sent to Logan, Utah, for a Campbell Scientific training

course about data loggers — the device that transports every observation back to our live feed at [mesonet.unl.edu](http://mesonet.unl.edu). And this month, Kerkman will visit Oklahoma Mesonet technicians to learn how other state operates its network.

Until then, he'll be in the field: mowing station sites; checking rain gauges; installing new solar panels; and otherwise helping keep our network in tip-top shape.

# Climate change, flood analysis lead requests

So far in 2019, we've met with more than 2,900 people and fulfilled nearly 90 data orders. We've provided talks on climate and climate change; given forecasts; supplied numbers; and deciphered complicated climate model projections for our users.

They are farmers and ranchers; natural resource and municipality managers; public power utility companies and business leaders; students and adults; lawyers and insurance firms; churches and church communities. They are every Nebraskan, no matter their location, profession, income level or political affiliation, who is in need of the information to make a decision that depends on our state's historical climate record.

For some of our consumers, that's raw data. It's a scientist or federal agency hoping to use the data to discover something new or document more completely something we already know. But in most cases, it's someone in the media trying to gain context for current weather events or someone in agriculture hoping to make a decision that will affect his or her livelihood.

This quarter, floods in March and July drew a higher-than-normal number of media requests. Both local media outlets and international ones called asking about the cause or causes for the flood events and whether they were linked to climate change (Curious yourself? We've tackled that topic on page 3 of this edition).

Martha Shulski and Al Dutcher,

climatologists with the NSCO, also have fielded a growing number of requests for climate-change-related information, such as Nebraska trends and potential affects going forward.

"I think this is because of several factors: People want to know how it is linked to weather extremes and the National Climate Assessment report was released last fall and received a lot of press," Shulski said.

In other words, climate and climate change has been in the news a lot.

Ag producers, crop boards, natural hazard planning groups, and even the Catholic Climate Covenant, hosted by Creighton University, have all reached out, requesting information or presentations.

"People care very much about this issue and want solutions and want to know how to communicate about this topic," Shulski said. In many cases, those asking the questions are also looking at how they can mitigate future hazards. She and Dutcher are doing what they can to provide the facts based on more than a century's worth of climate data collected across the state.

The state climate office is in a unique position to offer that data.

"We have the specific expertise on local weather and climate, as well as agriculture," Shulski said. "We provide science-based data and information."

And they do it on a quick turnaround. Without a state climate office, data requests would have to go through either

federal-level or region-level climate organizations.

"The general thought is local offices (state climate offices) are more in tune with climate conditions in their respective service regions and are able to process requests in a much more timely fashion than at the national level," Dutcher said. "Turn around generally occurs within a 24-hour period compared to a minimum of a week at the national level, or longer if you are not paying expedited charges."

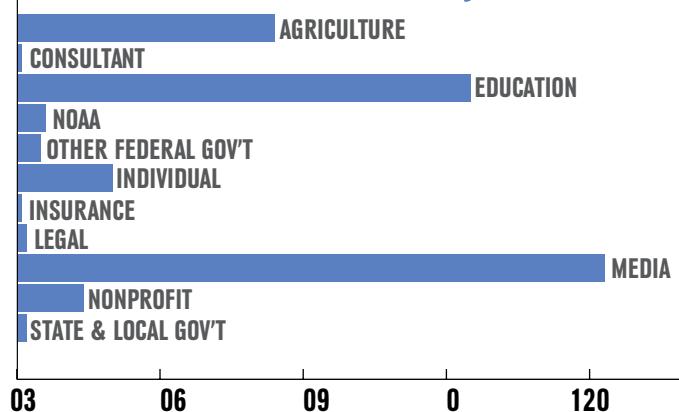
Part of their job, too, is to keep their ears to the ground and determining what will most help Nebraskans meet their information needs next.

Dutcher currently is working on creating tabular and graphical information presenting monthly, seasonal and annual normals for average, minimum and maximum temperature; liquid-equivalent precipitation; and snowfall variables for the state. Included in the work is a frequency-of-occurrence analysis. Stakeholders can expect that information to be available [on our site](#) in the near future.

"Additional products will include precipitation frequencies of specific thresholds, frost/freeze probabilities, precipitation probabilities, snowfall frequency above specified thresholds, and energy usage normal, such as heating-degree days and cooling-degree days," he said.

Dutcher and Shulski are methodical in their analyses and deliver only science-based facts. That's why NSCO is a trusted source of climate information.

## Climate service contacts by sector



**NSCO**