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The Black Hills at sunset  
(photo courtesy Crystal Stiles)

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## Message from the Director

*By Dr. Rezaul Mahmood*

Hello from the HPRCC! It has been a busy summer for me, personally and professionally. I learned (again!) that settling down at a new place takes a lot of work and patience. However, my family and I are thankful for the assistance I have received from everyone here at the HPRCC and UNL. I would especially like to thank Natalie Umphlett for making my transition to this new position seamless.



Otherwise, it has been another busy summer for the HPRCC staff. Crystal Stiles has continued her work with the tribes and organized another workshop here in Lincoln in September for the Great Plains Tribal Water Alliance on climate data and tools. Bill Sorensen and Warren Pettee, our application programming team members, have been working on tool development and getting ready for the unveiling of much-anticipated ACIS GIS tools. Jamie Lahowitz, our AWDN manager, is busy upgrading the entire AWDN IT system. Shellie Hanneman, our data quality technician, has been assisting with the AWDN data and a variety of customer requests.

As for me, I attended a meeting on the Upper Missouri Basin soil moisture and snow monitoring network that was held in Sioux Falls, SD in August. I participated in a Regional Climate Services meeting here in Lincoln, attended by our partners from the National Centers for Environmental Information, National Weather Service, U.S. Department of Agriculture, the National Integrated Drought Information System, and the National Drought Mitigation Center. Both of these meetings were engaging and fruitful. Thanks for reading *The Prairie Post* and I am looking forward to communicating with you over the coming years.

## Meet Our Intern, Dalton Van Stratten



Dalton is a junior at UNL majoring in Meteorology-Climatology and minoring in Water Science. His passion for earth and atmospheric sciences developed at a young age when he would dig through landscaping and pick out cool rocks for his collection. Although he initially wanted to be a geologist, he became enthralled with storm clouds, and his fascination by their power turned his attention toward studying the earth's climate and atmosphere.

Soon after starting work with the HPRCC, Dalton learned ArcGIS on his own and began making a variety of climate maps to demonstrate what can be done with our new ACIS GIS Portal. Dalton said the best part of working with the HPRCC is working in an environment that aims to help people make smart decisions from a climate perspective that will positively impact society. We are very happy to have Dalton as a part of our team!



## HPRCC Datasets Offer More Flexibility for Users with the Addition of Shapefiles

The geographic data behind the High Plains Regional Climate Center's best known product, its rainbow-colored precipitation and temperature maps, is now available to users through a GIS portal on their website.

Since 2003, maps depicting precipitation and temperature — over a variety of time frames and in comparison to the previous 30 years of data — have been available for download, but shapefiles haven't.

That changed in late September, when the GIS portal went live (<https://hprcc.unl.edu/gis/>). Users can now download shapefiles as filled contours or as point data. “For years, people have asked us for shapefiles, but we weren't able to provide them,” said Natalie Umphlett, regional climatologist with the HPRCC. “Now, they can download the data for research applications, climate and drought monitoring, or simply for their own interest. The possibilities are truly endless.”

To make available the shapefiles, Warren Pettee, applications programmer with HPRCC, wrote new software capable of delivering the data. That data can be imported into QGIS and into ArcGIS, among other geographic information systems programs; saved; and refreshed daily with current data.

Interested users also can download individual files for over 500 map options that are available.

The maps themselves are produced daily using data from the Applied Climate Information System, which acts as a data portal for all climate observations gathered at thousands of stations throughout the country.

“ACIS maps request over 10 million pieces of data a day from ACIS web services,” said Bill Sorensen, software development specialist with the HPRCC. “Doing some spitball math, the number of accesses of a daily value for any variable per day for the ACIS maps is easily over 1 billion.” So when users go to download the shapefiles, computers on this end have churned through that data and turned it into an easily downloadable and usable format.

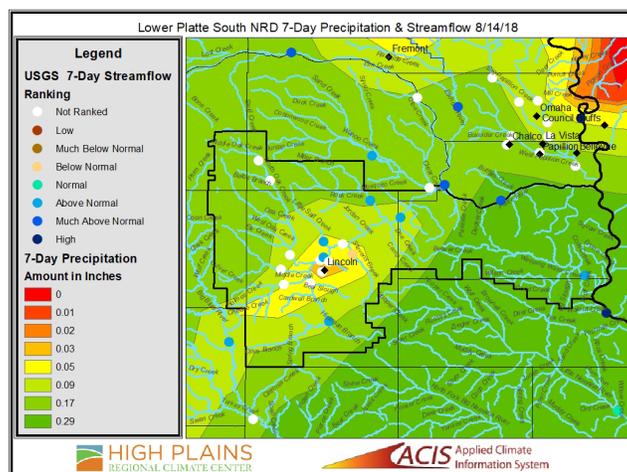
“The ability to download the data and create customized maps will allow our stakeholders to communicate the information within their sector in a more personal way,” said Crystal Stiles, applied climatologist with the Center. “They can also overlay the climate data with their own datasets to provide a deeper analysis of conditions that can help with monitoring, planning, and decision-making.”

Although the Regional Climate Center will create shapefiles for all ACIS Maps going forward, these will not replace the 250,000+ current and archived maps that are already available through the ACIS Maps page on the Center's website (<https://hprcc.unl.edu/maps.php?map=ACISClimateMaps>).

The project was funded by the National Integrated Drought Information System, a National Oceanic and Atmospheric Administration program authorized by Congress in 2006.

The High Plains Regional Climate Center is one of six Regional Climate Centers providing climate services to the nation. It covers Colorado, Kansas, Nebraska, North Dakota, South Dakota, and Wyoming, and operates as a part of the School of Natural Resources at the University of Nebraska-Lincoln.

-Shawna Richter-Ryerson, School of Natural Resources, University of Nebraska-Lincoln



Example of a map created in ArcMap from climate data shapefiles that are now publicly available on HPRCC's website. (Map produced by Dalton Van Stratten)

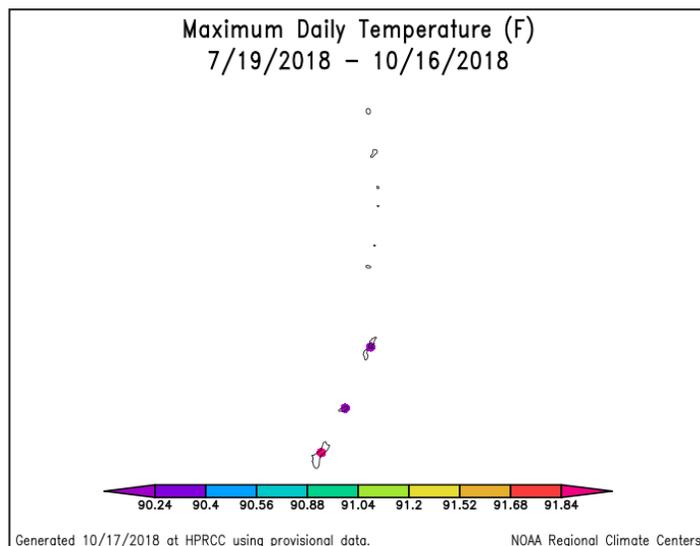
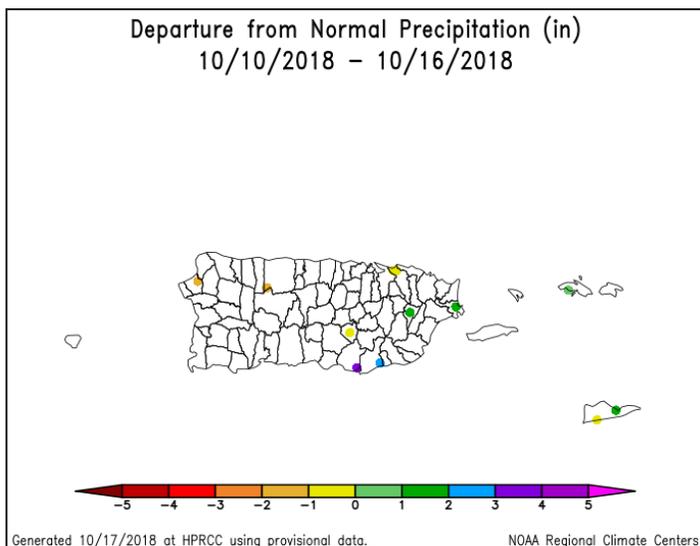
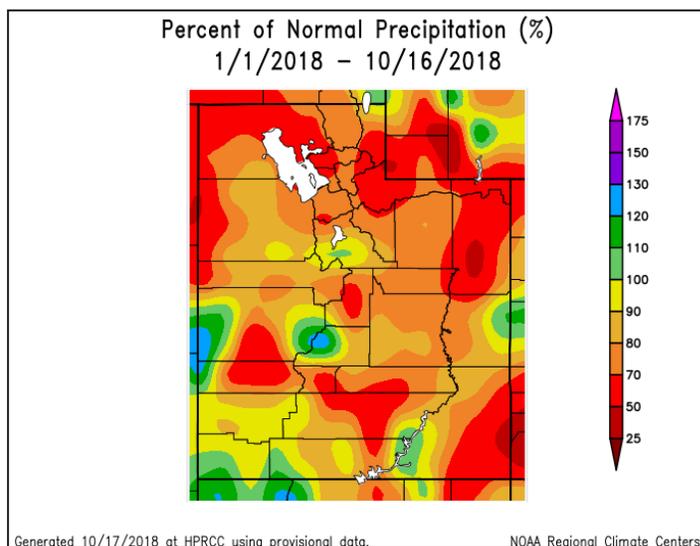
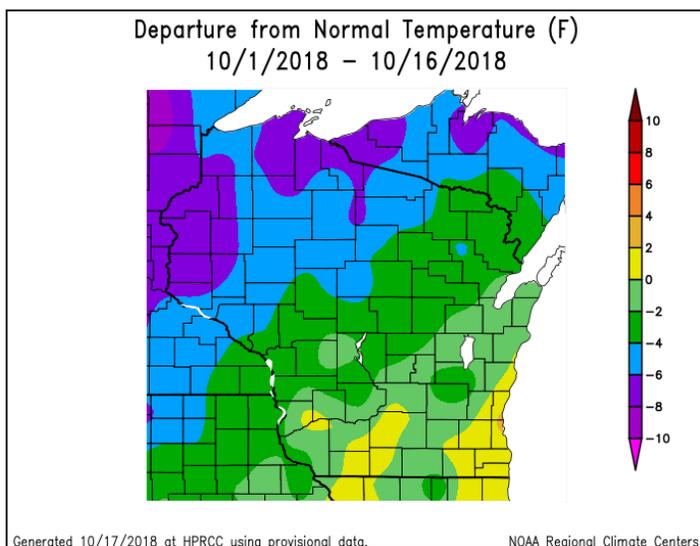
## ACIS Climate Maps Now Available for All 50 States and U.S. Territories

The High Plains Regional Climate Center has released ACIS climate maps for all 50 states, as well as the Caribbean and Pacific Islands. These maps are made in the same way as the original state maps, which were only produced for the Missouri River Basin region. With all states available, stakeholders across the country can use maps scaled for the data in their state.

The additions have been made possible through newer equipment, and all of the maps will be archived starting in November. This will likely be the final major update to the original map software. Thanks to the GIS project discussed on Page 2, more efficient software exists that will lead to the creation of clearer, more modern maps sometime in 2019.

Please keep in mind, small states with few stations will have less resolution in the contoured view, but dot maps are available, which offer a better picture at small scales. Pacific Islands may experience data outages depending on when or whether values are received from stations. In addition, due to the lack of data available for the U.S. Territories, only dot maps are available.

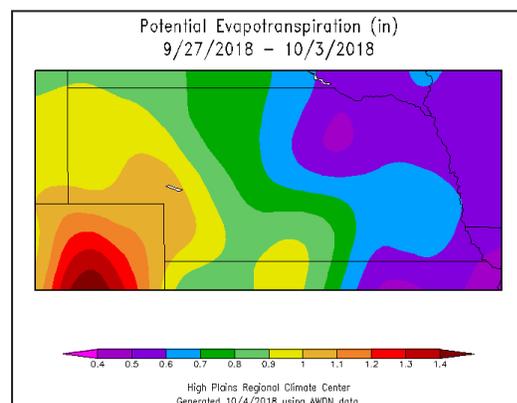
See below for several examples of ACIS maps for new regions (clockwise, from top left: Wisconsin, Utah, Guam/Mariana Islands, Puerto Rico/Virgin Islands). Check out all the ACIS climate maps available here: <https://hprcc.unl.edu/maps.php?map=ACISClimateMaps>.



## Product Highlight: Potential Evapotranspiration Maps for Nebraska

Have you ever heard of the term evapotranspiration? We call evapotranspiration “ET” for short. ET is the combination of evaporation from the soil, plant surfaces, and water bodies (that’s the “E”) and transpiration from plants (that’s the “T”). Estimates of ET are useful, particularly for agriculture, because this can help producers estimate crop water use and, in turn, aid in the management of water resources for irrigation.

The Center has been offering maps of potential ET for most states in the region for years. But this summer, we began producing maps specifically for the state of Nebraska. Keep in mind that while the maps are offered year-round, they are most useful from about April through October, during the growing season. Both 1-day and 7-day maps can be accessed at Nebraska Extension’s CropWatch site: [https://cropwatch.unl.edu/et\\_resources](https://cropwatch.unl.edu/et_resources). This site also has other great resources, if you are interested in learning more!

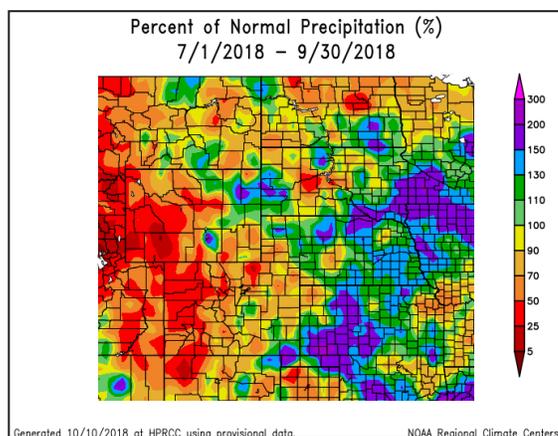


Please note: data used to calculate potential ET come from the Nebraska Mesonet, which is operated by the Nebraska State Climate Office. For more information, please see: <https://nsco.unl.edu/>.

### An Examination of Midwestern U.S. Cities’ Preparedness for Climate Change and Extreme Hazards

How well do local plans help communities prepare for climate change and extreme events? Are there differences in the ways that hazard mitigation plans, comprehensive plans, and emergency operations plans address climatic risk? In this new article published in *Natural Hazards*, you can learn about an assessment of over 150 local plans from cities in the states of Iowa, Kansas, Missouri, and Nebraska. Authors include Qiao Hu and Zhenghong Tang from UNL’s Community and Regional Planning Program, Martha Shulski from the Nebraska State Climate Office, HPRCC’s Natalie Umphlett, Tarik Abdel-Monem from the University of Nebraska’s Public Policy Center, and Frank Uharik from the City of Lincoln. Read more here: <https://doi.org/10.1007/s11069-018-3420-y>.

## Precipitation Extremes Prevail Across the High Plains



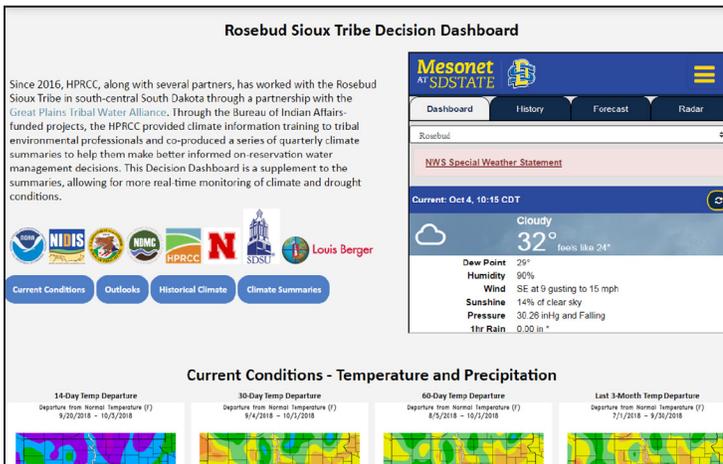
After a warm start to the summer, temperatures moderated in July and August, bringing cooler weather to much of the High Plains region. The exception was western Colorado, where summer temperatures remained above normal. Fall got off to a warm start for central and southern portions of the High Plains, as September temperatures ranged from 2-6°F above normal, while it was cooler than normal across North Dakota. Despite cooler temperatures later in the summer, the late-spring and early-summer heat caused crops to progress quickly, leading to early maturation. A positive of this outcome was it lowered the risk for a damaging freeze this year.

Extremes in precipitation were experienced across the region during the past few months. For instance, eastern South Dakota, central and eastern Nebraska, and central Kansas were extremely wet, while much of North Dakota, Wyoming, and Colorado were dry (see map at left). Flooding occurred in several locations such as

Brookings, SD and Manhattan, KS. In wet areas, harvest slowed and an increase in mosquitoes and West Nile Virus cases were evident. Meanwhile, drought persisted and intensified in western Colorado where many locations experienced one of their driest water years (October 1 – September 30) on record. Impacts were felt across many sectors, including agriculture, municipal water resources, and recreation and tourism.

Want to know more about climate conditions in the High Plains? Check out our monthly and quarterly climate summaries here: <https://hprcc.unl.edu/climatesummaries.php>.

## Great Plains Tribal Water Alliance Returns to Lincoln for Climate Workshop



The HPRCC has been working with the Great Plains Tribal Water Alliance for the past two years to help build capacity to use climate information for decision making. Thanks to two Bureau of Indian Affairs-funded grants, HPRCC staff provided two workshops for tribal environmental professionals from the Flandreau Santee Sioux Tribe, Oglala Sioux Tribe, Rosebud Sioux Tribe, and Standing Rock Sioux Tribe on climate data tools and climate summaries. While participants learned a great deal from these workshops, new staff members expressed interest in learning the materials, and previous participants felt they could use a refresher. Therefore, the HPRCC held a workshop for previous and new project participants that was focused on using tools to help produce climate summaries.

The workshop was very hands on, as participants spent the majority of the time reviewing and using the tools in a computer lab. Participants also took the opportunity to begin putting together climate summaries for their reservations that discussed summer events and the fall outlook. On the afternoon of the last day of the workshop, attendees participated in a focus group discussion intended to assess the climate-related needs of the tribal communities. Participants talked about their greatest concerns regarding a changing climate, how they use climate information, datasets they prefer and need, and how they prefer to get them.

One of the outcomes of the workshop was interest by the tribes in developing climate dashboards for each reservation in order to more easily access climate data and tools needed for monitoring and climate summary development. At the request of the Rosebud Sioux Tribe, the HPRCC developed a dashboard for the Rosebud Reservation (see screen shot above). It includes data from the Rosebud mesonet station, ACIS climate summary maps of various time scales for South Dakota, drought tools such as the U.S. Drought Monitor and the Evaporative Demand Drought Index (EDDI), streamflow maps, historical climate information, outlooks, and much more. Check out the dashboard here: <https://hprcc.unl.edu/rosebud.php>.

## HPRCC to Work with Several Tribes on New Climate Resilience Projects

Thanks to FY2017 climate resilience funding from the Bureau of Indian Affairs and our continued collaborations with tribal communities, the HPRCC will be partnering on three new projects with tribes across the region. Below is a description of each of these projects:

**Kansas, Nebraska and Iowa Tribes Adaptation Planning:** Submitted by the Sac and Fox Nation of Missouri in Kansas and Nebraska, this project will entail a series of workshops being conducted across several reservations in Kansas, Nebraska, and Iowa on various topics such as climate summaries, hazard vulnerability, drought early warning systems, and adaptation planning. The HPRCC has subcontracted with the Tribe to design and deliver a training workshop on how to develop reservation-specific climate summaries, as well as develop a web page to house all project materials and add web content.

**Wind River Drought Adaptation Planning:** The HPRCC is pleased to have another opportunity to work with the Eastern Shoshone and Northern Arapaho Tribes of the Wind River Indian Reservation. A drought adaptation plan will be developed for the Tribes as part of this project. The HPRCC is partnering on this project to help facilitate drought planning workshops on the reservation, as well as provide expertise as the drought plan is developed.

**Drought Adaptation Plans to Build Tribal Resilience:** Similar to the Wind River project, this project will involve the development of drought adaptation plans for the Flandreau Santee Sioux Tribe and the Standing Rock Sioux Tribe. The HPRCC will attend a project kick-off meeting in which staff will provide an overview of how climate information and summaries can be incorporated into drought planning.

## Recent and Upcoming Travel and Activities



A member of the Menominee Nation talks to water summit participants about burial grounds on the reservation. (Photo courtesy Crystal Stiles)

### High Plains AMS/NWA Conference, Hastings, NE (August 7-9)

The American Meteorological Society and National Weather Association held a joint conference for the High Plains region that Warren attended. He presented on HPRCC's new GIS products, web portal, and GeoServer and discussed how to access and use them. This conference was a great way to engage with our region's stakeholders!

### North Central Extension Water Summit, Keshena, WI (August 15-17)

Crystal attended this meeting between state land-grant universities and tribal colleges and universities at the College of Menominee Nation to discuss collaboration on projects regarding water resources. Crystal presented on trainings that HPRCC has conducted for tribal environmental professionals on obtaining climate information and producing climate summaries.

### Kentucky Drought Early Warning System Kickoff Meeting, Frankfort, KY (September 6)

As part of her National Drought Mitigation Center duties, Crystal is assisting with the new Kentucky Drought Early Warning System project, which was funded by the National Integrated Drought Information System (NIDIS). She helped organize the kickoff meeting held in early September. For more information on this project, see this press release: <https://www.wku.edu/news/articles/?view=article&articleid=6766>.

### Regional Climate Services Meeting, Lincoln, NE (September 26-27)

Rezaul attended the 1st Annual Great Plains Climate Services Planning Meeting in Lincoln. The purpose of the meeting was to provide program updates amongst the partners in attendance, discuss current climate services initiatives, and strategically plan for region-wide activities. Partners in attendance included the HPRCC, National Centers for Environmental Information, National Integrated Drought Information System, National Drought Mitigation Center, National Weather Service, and the USDA Northern Plains Climate Hub.

### Great Plains Tribal Water Alliance Fall Conference, Rapid City, SD (October 2-4)

Crystal attended the GPTWA water conference, which is typically held twice a year, to discuss the wrap-up of two BIA-funded projects and future opportunities for collaboration. Jonathan Schrader of the Flandreau Santee Sioux Tribe and Shelby Ross of the Oglala Sioux Tribe shared their experiences learning about how to write climate summaries for their lands.

### Northern Plains Climate Workshop, Sioux Falls, SD (October 9-11)

Natalie attended and presented at the Northern Great Plains Climate Workshop, which was hosted by the North Central Climate Collaborative. The purpose of the workshop was to bring together those interested in learning how to incorporate weather and climate information into their programs. In addition to presentations and panel discussions, attendees worked in small groups to discuss challenges, opportunities, and ways to move forward on climate-related issues in the Great Plains.

### Upcoming: Nebraska Climate Partners Meeting, Lincoln, NE (October)

Natalie and Rezaul will be attending the Nebraska Climate Partners Meeting in Lincoln later this month. This meeting will bring partners together who are interested in advancing climate-related topics for the state of Nebraska. Others in attendance will include representatives from the National Centers for Environmental Information, the National Weather Service, the National Drought Mitigation Center, and the Nebraska State Climate Office.

### Upcoming: American Meteorological Society Annual Meeting, Phoenix, AZ (January)

Crystal, Natalie, and Warren are attending the AMS Annual Meeting this year. Crystal and Natalie will be participating in a tools café session where they will be demonstrating a drought planning tool and the ACIS GIS Portal. Warren will be presenting on the HPRCC's Python-based product generation framework. They are also looking forward to Phoenix in January!



Panel members discuss how drought impacts their sectors at the Kentucky Drought Early Warning System kickoff meeting. (Photo courtesy Crystal Stiles)