



Inside this issue:

Message from the director..... 1

Staff spotlight 1

Spirit Lake workshop..... 2

Product highlight 3

Outreach events..... 3

Research highlight 4

Update on regional climate conditions 4

Northern Plains drought assessment 5

Recent and upcoming travel and activities 6

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Unplanted fields near Falls City, NE (photo courtesy Crystal Stiles)

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Message from the Director

By Dr. Rezaul Mahmood

Hello from Lincoln where summer is finally here! This issue of *The Prairie Post* highlights workshop activities for tribal communities, a webinar for the Climate4Cities tools, and an assessment of pluvial years by our own Dr. Paul Flanagan.

We have traveled to a number of conferences and workshops and contributed meaningfully so that participants are better informed and prepared to effectively address various climate related issues. You can read more about these activities on page 6.

Several members of our team had noteworthy accomplishments this quarter. Natalie, our regional climatologist, successfully defended her dissertation and is expected to be awarded a Ph.D. degree in December. Warren, our applications programmer, received the prestigious School of Natural Resources (SNR) Staff Recognition Award for his outstanding service and contribution toward the missions of SNR and HPRCC. Finally, Crystal, our applied climatologist, will be receiving a five-year service award from UNL. Congratulations to Natalie, Warren, and Crystal! We are very proud of you.

In the meantime, I hope that you will be able to carve out some time to enjoy a much needed break during this summer. Thank you for reading this edition of *The Prairie Post*!



HPRCC Faculty and Staff Receive Awards



The HPRCC is pleased to announce that Warren Pettee received the School of Natural Resources (SNR) Spring 2019 Staff Recognition Award (pictured at left with SNR Director Dr. John Carroll, photo courtesy Shawna Richter-Ryerson). Since coming to the HPRCC in 2017, Warren has taken an active role in revising old, and developing new, products and services for the Center, and he was the driving force behind the HPRCC's new THREDDS Data Server.

Warren was presented with a plaque and a \$350 stipend at the SNR Spring Potluck in April. Fellow SNR faculty and staff nominated him for the award, based on the following criteria: 1) exceptional service and dedication to SNR, 2) creativity and innovation on the job, 3) ability to interact with faculty, staff, students and clientele, and 4) demonstrates initiative within the functions of their position. We all look forward to seeing what new and innovative things Warren has in store for the Center in the coming years!

Big congratulations also go to Dr. Crystal Stiles, who earned her 5-year University of Nebraska-Lincoln service award! HPRCC faculty and staff thank her for her dedicated service to the Center.



From Data to Decisions: Utilizing Data to Increase Resiliency on Tribal Lands

“What a beautiful day!”, “Wow, it was windy this week.”, “I hope we get some rain today.”, “When will this winter ever end!” In North Dakota, most small talk conversations involve some groaning or reflecting on the weather. But what exactly is weather? How is it different from climate? And how do we access reliable climate data? The Intertribal Research and Resource Center sponsored a workshop



May 14-15th, 2019 on the Cankdeska Cikana Community College (CCCC) (<http://www.littlehoop.edu/>) campus to help Spirit Lake community members, CCCC students and faculty, and tribal agency personnel answer these questions. Climatologists Natalie Umphlett and Crystal Stiles from the High Plains Regional Climate Center at the University of Nebraska in Lincoln, along with James Rattling Leaf from Rattling Leaf Consulting, LLC in Rapid City, SD facilitated the hands-on workshop.

Speaking to over 30 participants, CCCC President Dr. Lindquist opened the workshop by challenging participants to utilize education and data to better their community. Building off the President’s words, James Rattling Leaf emphasized how education and data take many forms which include language and cultural knowledge. Further, he asked, “How do we use scientific data and cultural data to make decisions?” Answering this question first requires a basic understanding of weather and climate as well as knowledge of what type of data are out there. Stiles describes weather as the here and now conditions in a place while climate is the average weather conditions over time. Or put more simply, “weather is the clothes you have on today and climate is the clothes you have in your closet.” Basic weather elements include solar radiation, air pressure, wind, air temperature, moisture, and precipitation measurements.

North Dakota is generally characterized by warm summers and cold winters but differences exist locally throughout the state. Umphlett helped participants access local climate data from the High Plains Regional Climate Center, which is a NOAA Regional Climate Center (<https://hprcc.unl.edu/>; <http://scacis.rcc-acis.org/>).

The amount of precipitation is at the forefront of the minds of local farmers and ranchers. Specifically, times of drought can cause major financial and emotional stress. Stiles walked participants through how to utilize the United States Drought Monitor website to access current and past drought data (<https://droughtmonitor.unl.edu/>). Streamflow and snowpack are two factors that can indicate drought conditions but can also lead to flooding (<https://waterwatch.usgs.gov>, <https://www.nohrsc.noaa.gov>). May 15th, 2019 streamflow data show the majority of the state is currently experiencing near normal streamflow while the Red River Valley has above average streamflow.

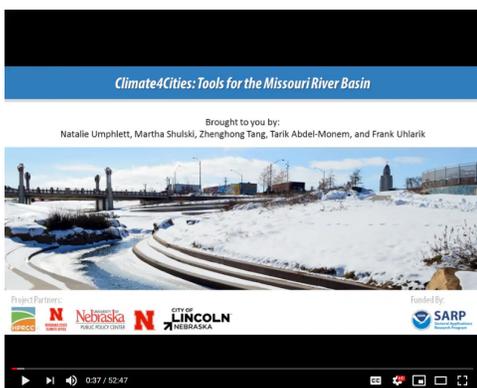
Accessing reliable climate data is only one part of the equation-making sense of and utilizing the data to make decisions is the harder part. Mark Junker of Sac and Fox Nation of Missouri in Kansas and Nebraska spoke to participants during a video conference about how his tribe utilizes the data. He produced four climate summaries to get a baseline understanding of his area. In June, he is forming tribal technical teams with eight other tribes to discuss combining traditional ecological knowledge and climate summaries to make tribal land decisions in the future.

When climate summaries are paired with outlooks (<https://www.cpc.ncep.noaa.gov>), communities are better able to make decisions. “If an area has been experiencing abnormally dry conditions and the outlooks predict below average precipitation, a water manager could use that to create guidelines for when community members can water their lawns or crops to better conserve water,” Junker explained.

James Rattling Leaf concluded the workshop with these parting words: “What can we do with this new knowledge? We can continue having conversations to better understand what is most important to our communities to increase our resiliency and survival. Let’s figure out how to inspire innovation by helping others think about how to creatively use and view data.”

-Used with permission from Anna Bahnson, United Tribes Technical College (link to newsletter (see June 2019 edition): <https://uttc.edu/irrc-newsletters/>)

Highlight on New Products



Screenshot of the first slide of the Climate4Cities tools webinar. Check out the Climate4Cities website here: <https://hprcc.unl.edu/climate4cities/index.php>.

Staff Give Webinar on Climate4Cities Tools

Earlier this year, the Climate4Cities team released a suite of tools to help cities access climate data and information that could help in municipal planning processes. There are four tools available on the Climate4Cities website:

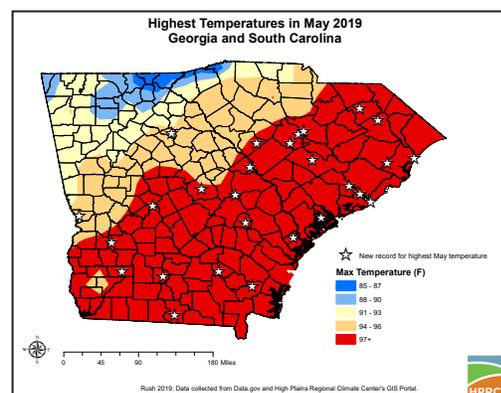
- *Historical Trends and Data Tool*: Explore historic climate trends for a city and compare to other locations. (<https://hprcc.unl.edu/climate4cities/historical.php>)
- *Future Projections Tool*: Compare current and future normals to see changing conditions. (<https://hprcc.unl.edu/climate4cities/projection.php>)
- *Sister City Tool*: Put projections into context by finding your sister city. (<https://hprcc.unl.edu/climate4cities/sister.php>)
- *Planning Documents Tool*: Discover new planning strategies by learning from other communities. (<https://hprcc.unl.edu/climate4cities/planning.php>)

If you have visited the tools and don't know where to start, there is a new webinar available that provides an overview of the website and a walk-through of each of the tools. The webinar has been posted to the Climate4Cities website and is available at the following link: <https://hprcc.unl.edu/climate4cities/webinar.php>.

Tutorial Developed for Creating Maps in ACIS GIS Portal

Last year, the HPRCC released a GIS Portal, which gives access to shapefiles of the entire suite of ACIS Climate Summary Maps (<https://hprcc.unl.edu/maps.php?map=ACISClimateMaps>). There are two ways to access the shapefiles: 1) by direct download and 2) by connecting to our GeoServer. Downloading files directly is easy - simply go to the site, find the file you are looking for, and click the links to start the download. Connecting to the GeoServer takes a few more steps, but if you are looking to use the data on a regular basis, this could be a way to save lots of time and energy in the long run.

To help get you connected to the GeoServer, we have created a new and improved tutorial, along with map examples, which is now ready for use on our GIS portal: <https://hprcc.unl.edu/gis/>. You can also check out this direct link to the tutorial: https://hprcc.unl.edu/pdf/ACIS_GIS/gisTutorial.pdf.



Example of a map created with data available from the HPRCC GIS portal. (Map created by Gannon Rush)

Outreach Events



Students use an IR thermometer to measure the temperature of various objects at the Nebraska Extension camp in Wilber. (Photo courtesy Emily Brown)

Nebraska Extension Camps

On May 30th and June 26th, Emily and Gannon helped with two camps through Nebraska 4-H and Extension in Wilber and Lincoln, NE. Camp attendees were able to test their weather and climate knowledge, measure the temperature of objects in the surrounding area with infrared (IR) thermometers, and practice writing and presenting forecasts on a green screen.

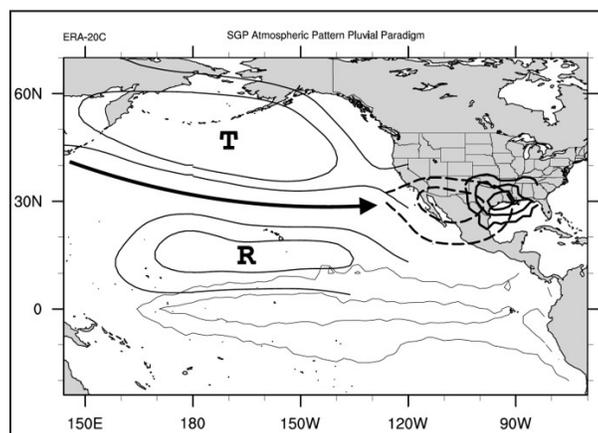
Weather Camp

On June 11th, Rezaul spoke with students participating in the National Weather Camp program. He demonstrated various tools that are provided by the HPRCC and discussed how they can be used for decision making. To learn more about Weather Camp at UNL, visit this link: <https://lincolnweather.unl.edu/weathercamp>.

Research Highlight: Wet Years in the United States Great Plains

Excessive precipitation, while not as directly impactful as precipitation deficits and drought, still causes its share of negative impacts. This year is a perfect example, as excessive precipitation over the Central U.S. has led to devastating floods, large-scale infrastructure damage, and a significant delay in the planting of crops across the region. Thus, it is important to know and understand these events, especially from an atmospheric driver standpoint.

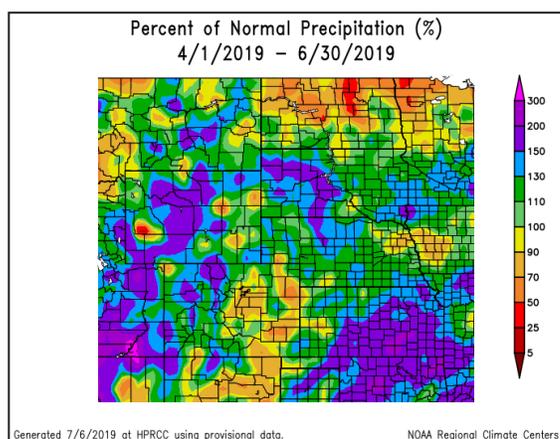
Work done by Dr. Paul Flanagan has shown distinct atmospheric anomalies that can be linked to the occurrence of precipitation excesses across the south central United States. These anomalies, identified by lower heights across the northern Pacific Ocean and southwestern United States, signal a movement of weather systems further to the south over the southern United States, causing an enhancement of precipitation across the south central United States. These atmospheric anomalies appear coincident with sea surface temperature warm anomalies across the tropical Pacific, with a peak anomaly in the central tropical Pacific. While a typical warm tropical Pacific (El Niño) event brings excessive precipitation to the southeastern United States, this research shows that this shifting of the main center of sea surface temperature anomalies towards the west appears to be causing the excessive precipitation to shift towards the south central United States (see figure above).



Conceptual diagram of the Southern Great Plains Pattern pluvial year paradigm. The light solid lines represent positive Sea Surface Temperature anomalies, the thick solid lines represent 250 mb streamfunction anomalies, the dashed bold lines represent 500 mb Eddy Geopotential Height anomalies and the solid bold lines represent the precipitation anomalies. The arrow represents the theorized jet stream resultant from the streamfunction anomalies, the “T” stands for trough (negative streamfunction anomalies) and the “R” stands for Ridge (positive streamfunction anomalies). All contours were created using ERA-20C anomaly fields.

While this analysis was completed using a dataset of atmospheric states from the past, it still has implications for current events. The excessive precipitation that is occurring this year over the south central United States appears to be driven by the same atmospheric anomaly pattern identified within our work on a subset of historical wet events in the south central United States. There is hope that the research being completed into these excessive precipitation events, leading from this work, will one day aid in forecasting such events and help local, regional, and federal resources be able to manage their impacts across the central United States. (This research has been published in the *Journal of Hydrometeorology* (<https://doi.org/10.1175/JHM-D-17-0148.1>) and is currently in review for acceptance into the *Journal of Climate*.)

Wet Conditions Create Issues for Agriculture



Winter stuck around for a while in the High Plains this year, with several areas receiving snow as late as May. Given the early start to winter last fall and heavy snows through the spring, some locations had their snowiest winter season (defined as July-June) on record, including Mobridge, SD, Sisseton, SD, and Lincoln, NE. While this was a welcomed event in Colorado, where drought during the previous year negatively impacted recreation/tourism and water supplies, in the eastern High Plains the snow contributed to flooding issues and caused the growing season to get off to a late start this spring. Below-normal temperatures during the spring did not help either, and as of the end of June, crop progress was well behind the five-year average for much of the region. In fact, corn and soybeans were still being planted throughout the region into late June. On the other hand, the ongoing wetness improved drought conditions across the region.

Only northern North Dakota was experiencing dryness by the end of June, as this region contended with dry soils that were causing agricultural issues. Otherwise, persistent heavy spring/early summer rains on top of saturated soils continued to cause both urban and rural flooding issues for the eastern High Plains. The high cost and long-term impacts from the flooding that began in March have become more evident as well. To learn more about climate conditions in the High Plains, check out our monthly, quarterly, and annual climate summaries here: <https://hprcc.unl.edu/climatesummaries.php>.

Flash Drought: New Reports Examine the 2017 Northern Plains Drought



The 2017 Northern Plains drought sparked wildfires, destroyed livestock, and reduced agricultural production. Neither the drought's onset nor its severity were forecasted. In May 2017, the region was mostly drought-free, and at least average summer precipitation was forecasted. By July 2017, North Dakota, South Dakota, eastern Montana, and the Canadian prairies were experiencing severe to extreme drought, resulting in fires that burned 4.8 million acres across both countries and U.S. agricultural losses in excess of \$2.6 billion dollars. NIDIS and partners have published two reports to examine the evolution and impacts of the drought, as well as lessons learned, needs, and gaps.

The report, *Flash Drought: Lessons Learned From the 2017 Drought Across the U.S. Northern Plains and Canadian Prairies*, examines the historic 2017 drought event and its impacts, identifies opportunities to improve timeliness of and accessibility to early warning information, and identifies applied research questions and opportunities to improve drought-related coordination and management within the Missouri River Basin Drought Early Warning System. The needs that were repeatedly voiced during this study provide stepping-stones to improve outcomes in future droughts for this and other regions, including:

- Invest in new and existing monitoring and observation networks, which would support the development of better indicators to provide early warning and allow decision-makers to better assess their drought risk and determine what actions to implement.
- Improve the understanding of the relevant processes that inform forecast models in the region, which could improve seasonal forecasts to enhance drought preparedness.
- Improve drought mitigation and response plans to consider trade-offs and actions that benefit both the human and ecosystem health and services, and put plans in place before a drought hits.
- Maintain strong relationships and networks to share information between federal, state/provincial, tribal, and local stakeholders before, during, and after drought, thereby improving the process of drought preparedness and response.

The report, *The Causes, Predictability, and Historical Context of the 2017 U.S. Northern Great Plains Drought*, evaluates the causes, predictability, and historical context of the 2017 Northern Plains drought. The study was led by a team of weather and climate experts from NOAA's Earth System Research Laboratory's Physical Sciences Division and the Cooperative Institute for Research in Environmental Sciences located at the University of Colorado Boulder.

This study demonstrated that the rapid onset of the drought in the spring and summer of 2017 was mainly due to failed rains. Observed May-July precipitation over eastern Montana was the lowest on record and average precipitation over Montana, North Dakota, and South Dakota was the third lowest on record dating back to at least 1895. Failed rains led to the third largest soil moisture decline for any three-week period over eastern Montana since at least 1916.

Climate model simulations reveal that droughts with intensity similar to that of 2017 are 20% more likely due to anthropogenic influences. Anthropogenic influences increase the likelihood of droughts in July because of long-term reductions in soil moisture, also known as aridification. Aridification is forced by increases in evapotranspiration associated with rising temperatures.

Below average May-July 2017 precipitation was not predicted in advance of the season. Cumulative precipitation deficits were only predictable through sequences of up to three day forecasts. Sequences of longer than five day forecasts provided no indication that the seasonal evolution of precipitation would be different from average.

-Publication date: May 30, 2019 via the National Integrated Drought Information System (direct link to original article: <https://www.drought.gov/drought/news/flash-drought-new-reports-examine-2017-northern-plains-drought>)

Recent and Upcoming Travel and Activities



Natalie poses with partners from the regional climate collaboration panel discussion at the National Adaptation Forum in Madison, WI.

National Adaptation Forum, Madison, WI (April 23-25)

Crystal and Natalie attended their second National Adaptation Forum, this year held in beautiful downtown Madison, Wisconsin. They each participated in a panel discussion – Crystal talked about the Center’s work with tribes, while Natalie discussed the importance of regional climate collaboration. Natalie also demonstrated the Climate4Cities tools during a tools café session.

MOISST Soil Moisture Workshop, Manhattan, KS (May 22-24)

Rezaul participated in the 2019 National Soil Moisture Workshop. He also contributed to discussions as one of the authors for the ‘Implementation’ chapter of a document focusing on the development of the National Soil Moisture Network.

Meeting with UNK Students, Lincoln, NE (May 31)

In May, a group of University of Nebraska-Kearney students visited the HPRCC to learn about the Climate4Cities project. Natalie gave them an overview of the project and a tour of the website. The students had great questions! If you are interested in visiting the HPRCC, please let us know.

LTAR Meeting, Lincoln, NE (June 4-6)

Rezaul attended the Long-Term Agroecosystem Research (LTAR) Network Annual Meeting. A part of the USDA Agricultural Research Service, the mission of the network is understanding and enhancing the sustainability of agriculture. At the meeting, Rezaul contributed to the discussion as part of the weather and climate working group.

Tribal Technical Teams Workshop, Reserve, KS (June 18-19)

In June, Crystal and Natalie attended and presented at the “Building Resilience with Tribal Technical Teams – Lower Missouri River Tribes Adaptation Planning Workshop.” This was the first in a series of workshops that is part of a project funded by the Bureau of Indian Affairs that involves nine tribes in Kansas, Nebraska, and Iowa.

American Association of State Climatologists Annual Meeting, Santa Rosa, CA (June 24-27)

Rezaul and Paul attended this annual gathering of climatologists from state, regional, and national levels. Rezaul co-led a presentation of the “Recommendation and Best Practices for Mesonets” document to AASC attendees. The document was approved by a unanimous vote.

High Plains Technical Workshop on Drought Monitoring, El Reno, OK (July 9-10)

In early July, Rezaul and Natalie traveled to El Reno, OK, which is home of the USDA-ARS Grazinglands Research Laboratory and Southern Plains Climate Hub. This workshop brought together a number of partners from across the High Plains in order to discuss ways to improve drought monitoring in the region.

Upcoming: NIDIS Missouri River Basin Drought Early Warning System Annual Meeting, Billings, MT (August)

In late August, Rezaul and Natalie will be attending the NIDIS Missouri River Basin Drought Early Warning System Annual Meeting. The meeting will bring together partners and stakeholders from across the Basin to prioritize drought-related activities for the coming months.

Upcoming: Kansas Climate Summit and Regional Climate Services Workshop, Manhattan, KS (September)

HPRCC faculty and staff will be attending this summit to help identify Kansas-focused needs, as well as build awareness and a shared understanding of climate tools and services. The Summit is a collaboration between NOAA, the State Climate Office of Kansas, and the HPRCC.

Upcoming: Climate Prediction Center (CPC) Stakeholders Meeting, College Park, MD (September)

Rezaul will participate in this meeting, which will focus on discussing existing, new, and future CPC products, as well as soliciting feedback from stakeholders on product performance and future needs.



Drought monitoring workshop attendees participate in a World Café session. (Photo courtesy Tonya Bernadt)