KANSAS STATE UNIVERSITY | Kansas Mesonet

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Written Testimony

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On behalf of the

Current Drought Assessment and the Kansas Mesonet

Submitted to the

United States Senate Committee
Agriculture, Nutrition, and Forestry; Subcommittee on Conservation, Climate, Forestry, and Natural Resources

For the Burlington, Colorado June 26, 2024 Field Event Titled: "Hearing on the High Plains: Combating Drought with Innovation."

Thank you for this opportunity to share an overview of the Kansas Mesonet and status of drought conditions across the High Plains. Through history, there have been trying times for agriculture in Kansas and this period is no different. We work to provide state producers, agencies and federal partners improved decision support datasets and optimize limited natural resources.

My name is Christopher "Chip" Redmond and I am a Meteorologist in the Department of Agronomy and the Kansas Mesonet manager at Kansas State University. Over the last 11 years in this position, I have helped expand the Mesonet, a network of agricultural and emergency management supporting weather stations (Figure 1), by over 50 additional stations through enhanced collaborations and partnerships. During this time, we have supported the direct return of millions of dollars back to Kansans through high quality and representative weather/climate data. For example, in 2019 alone, we provided supporting weather data to over 1,600 livestock loss claims through the United States Department of Agriculture Farm Service Agency Livestock Indemnity Program (LIP) claims resulting in the payouts of over $7.6 million dollars back to producers (LIP, 2020). This is only a small impact of the broader support the Mesonet provides to our users including producers, private enterprise and governmental agencies.

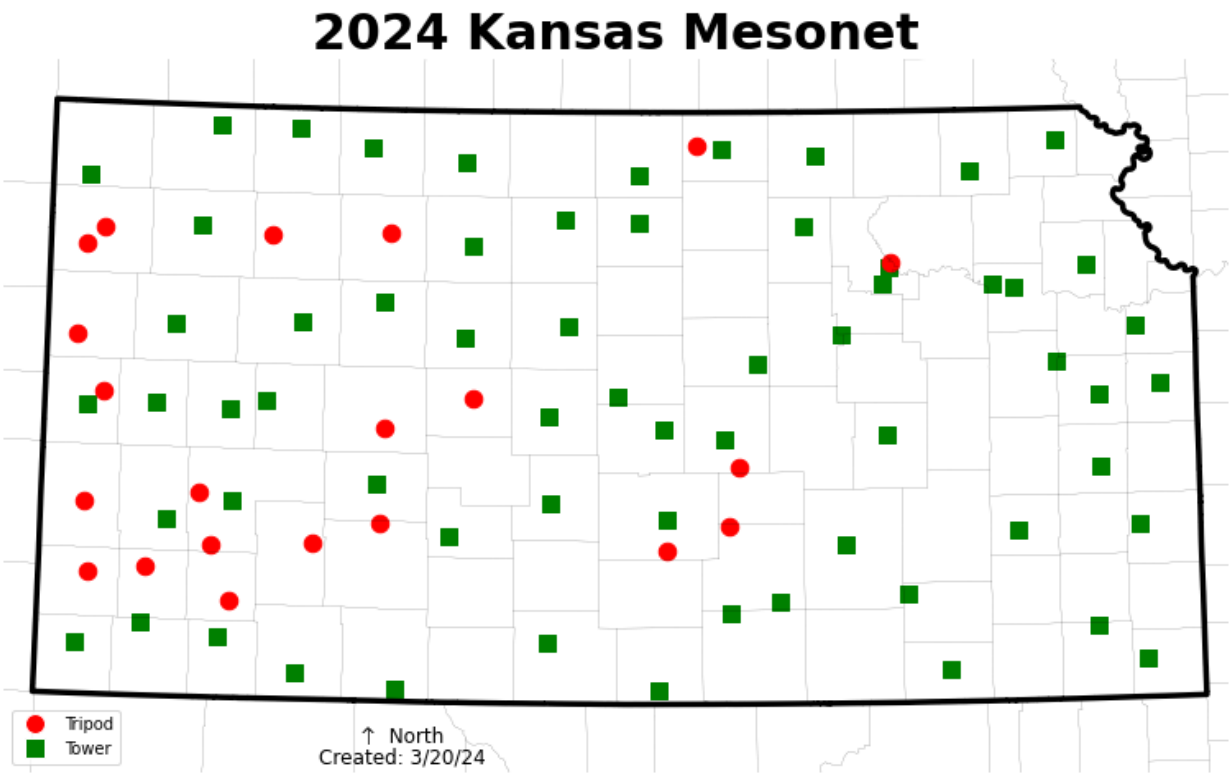

Figure 1. Current location of the Kansas Mesonet weather stations as of June 1, 2024. Source: mesonet.ksu.edu.

The climate of the High Plains can support excellent crops. Unfortunately, they can also bring devastation to agriculture; sometimes an event spanning several minutes can erase months of hard work. Drought and floods are typical for the region. These tend to offset one another over a span of several years with no one year typically reaching “normal.” Of these weather fluctuations that frequent the High Plains, drought is often the most impactful.

Drought has over 150 published definitions (Drought.gov, 2024) and can vary by who you talk to. For instance, the Merriam-Webster Dictionary defined drought as: "A period of dryness especially when prolonged (Merriam-Webster, 2024)." Meanwhile, the American Meteorological Society (AMS) considers drought as a “period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance (AMS, 2024).” The National Oceanic and Atmospheric Administration’s (NOAA) National Weather Service (NWS) further elaborates on potential impacts by defining it as “a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizable area (NWS, 2024).” Livelihoods and the sustainability of the High Plains heavily rely on the availability of water. Therefore, we must consider both agricultural and societal impacts the most. The resulting monitoring and tracking of long term precipitation and/or lack thereof, are critical in working to mitigate drought impacts and helping to prepare the next generation for the future changing climate.

Last year, 2023, brought a shift in the long term drought of the High Plains eastward into the Central Plains. This brought much needed moisture for western Kansas and the Colorado plains

and erased widespread United States Drought Monitor (US Drought Monitor, 2024) categories of extreme (D3) to exceptional (D4) drought initially at the start of 2023 (Figure 2, left). These wetter conditions resulted in good performing crops. The April-July 2023 period resulted in top ten wettest on record dating back to 1895 for most counties along and around the Kansas/Colorado state line (NCEI, 2024a). While there were still periods of stress in 2023, especially further east into central Kansas, the beneficial moisture helped sustain last year's growing season across the High Plains. Much of this moisture was the result of a weakening La Nina, colder than normal water in the eastern equatorial Pacific. This led to a transition to neutral (El Niño Southern Oscillation, ENSO) conditions and eventually an introduction of El Nino by the fall characterized by warmer than normal water over the same area of the Pacific (CPC, 2024). The High Plains region had struggled with moisture over the previous three years due to persistent La Nina. Historically, La Nina results in high pressure dominating the area with less precipitation and warmer than normal temperatures overall. The transition to El Nino brought this much needed increased precipitation for portions of the High Plains through December 2023.

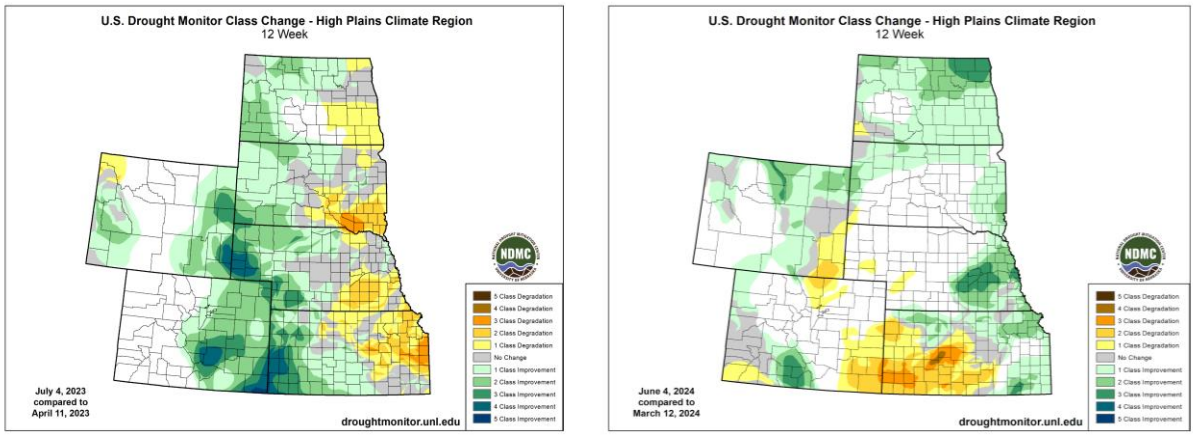

Figure 2. Drought change over the High Plains between April to July 2023 (left) and between March 2024 to June 2024. Drought improvements are in the green/blue whereas degradation is in yellow/orange. Maps as of June 13, 2024 from the US Drought Monitor (2024).

Unfortunately, this surplus of moisture was short lived. As of early June 2024, drought had once again prevailed and the reintroduction of D3 drought (US Drought Monitor 2024) had returned to Kansas with widespread drier conditions (Figure 2, right). While a weakening El Nino is likely a contributor, another factor is likely the waters of the North Pacific. Cool water along the North American/Canadian coast in the East Pacific combined with warmer waters in the middle of the North Pacific resulted in a negative Pacific Decadal Oscillation (-PDO). This -PDO typically persists in ten year segments and is usually very slow to change. The last time it was inverted, or positive (+PDO), was 2019 (NCEI, 2024b) when the majority of the High Plains region had drought free conditions on the Drought Monitor (Figure 3). In the last ten years, the other +PDO

time period was 2015, when a similar minimal drought period existed across the High Plains. Lastly, it is important to note that there are other oscillations and global patterns that impact the weather/climate in this region. However, ENSO and PDO have been the most prevailing influencers in High Plains drought persistence and development.

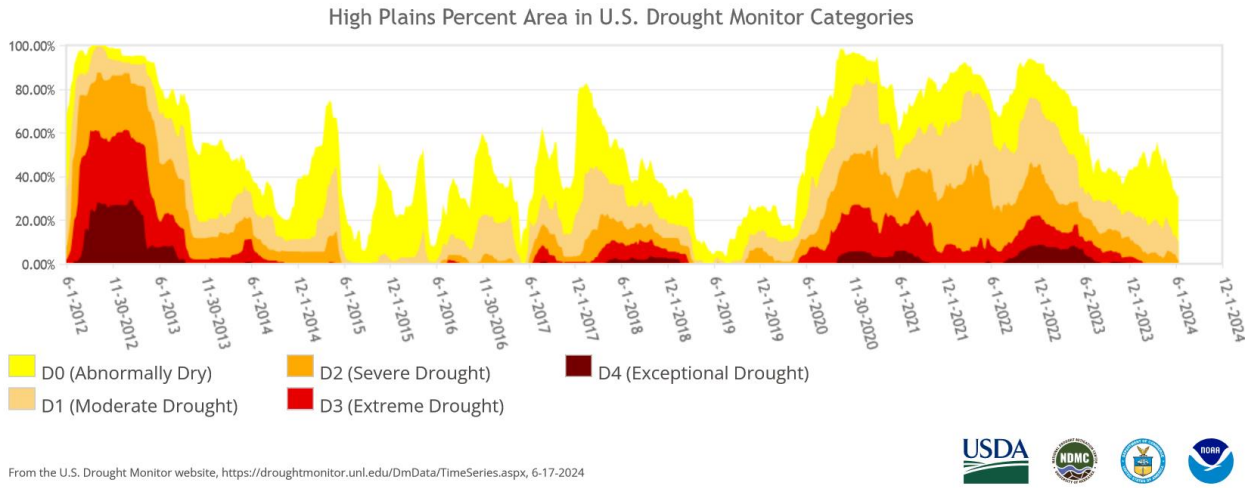

Figure 3. Drought Monitor categories over time (since 2012) for the High Plains region. Source, US Drought Monitor.

As we enter a period of potential summer 2024 drought, we must consider the current trends in climatology of the High Plains. Building off Peter Goble's testimony, the data in Kansas points to similar climate trends. While we continue observing both wet and dry years as expected with regional climatology, another disturbing long term pattern has emerged. Heavy rains have been increasing, however, periods between such rains are longer in duration. For example, ten days or longer streaks between wetting rains (0.1" or more) have increased 25% at the Tribune, Kansas NWS Cooperative Observer (COOP) site. That means not only are there more dry spells but also additional opportunity to miss critically timed moisture during crop growth in the warm season.

When precipitation does fall, there has been a roughly 20% increase in 1" rain events since 1897. Therefore, this heavier rainfall has less opportunity to be absorbed by the surface and is more likely to run off. The region needs lighter rain events to capture the moisture in the ground and store it for crop utilization. When we lose heavy rainfall to runoff, we require more timely rain events to keep up with crop growth during the summer months. This end result is more limited surface moisture and higher demands from natural resources like the Ogallala Aquifer.

Additionally, these heavy rains place stress on flood storage, infrastructure and downstream entities to handle increasing runoff events of which they previously weren't built to support.

Understanding climate and the limited High Plains resources has led to water use reduction efforts across the region (KDA, 2024). While this has resulted in improved water use, data to make these decisions is dependent upon new (in relative terms to climate) data observations that help producers make decisions. This is especially a concern because locations like Tribune's NWS COOP, that has accurately reported since 1897, are becoming more limited. In research done by the Kansas Climate Office, the state has lost 36% of its long term COOP observers since 2000. Therefore, quality climate data has become increasingly sparse. This is where state networks like the Kansas Mesonet (Mesonet, 2024) or Colorado's COlorado AGricultural Meteorological nETwork (CoAgMET, 2024) are increasingly important to long term support of regional agriculture and sustainment of local natural resources. These weather and environmental networks not only sustain historical standardized data collection but also build an enhanced spatial and temporal database. These provide significant additional meteorological and climatological phenomena beyond historical temperature and precipitation data. Therefore, the applicability and usability of both raw data and derived products (such as National Fire Danger Rating System, crop herbicide/pesticide spray guidance, soil temperature and moisture products) are more supportive of producer decisions beyond the original NWS COOP data.

Both the Kansas Mesonet and the CoAgMET networks are part of the National Mesonet Program (NMP). The NMP consists of automated weather station networks located in areas most susceptible to severe weather and data sparse regions and installed closely together to gather "mesoscale meteorological" observations such as temperature, humidity, and atmospheric pressure (NOAA, 2024). Due to their proximity to each other, Mesonet data can identify small-scale features at the surface that can indicate rapidly deteriorating weather conditions not shown by other observations. These are critical to providing data in areas that are underrepresented and increasingly scarce in the absence of NWS COOP data. Additionally, to better monitor and understand drought and the resulting impacts, supporting such networks as the Mesonet, whether through the NWS Weather Reauthorization Act (HR-6093, 2024) or the National Mesonet Authorization Act (HR-2995, 2024) are essential in helping the producers and other entities in the High Plains region.

With the changing landscape of weather observations and building drought concerns amidst a dynamic climate, evaluating drought conditions is critical to producer success in the High Plains. While some improvements have occurred over the last year, drought will continue to challenge producers in 2024 and beyond. Therefore, decision makers will rely heavily on data provided from these Mesonets to assist with irrigation planning, understanding crop stress, soil moisture availability, fire weather risk and ground truthing for resulting loss insurance payouts of both crops and livestock.

On behalf of the Kansas Mesonet and the Kansas State Climate Office, thank you very much for the opportunity to present this information. Many utilize the weather data in the region with over one million Kansas Mesonet website interactions in 2023. As a result, we hope to not only

support the efforts of the High Plains producers but also provide a vital resource for those that need this data on an operational or research basis. Lastly, I'd like to acknowledge Matthew Sittel (Assistant Kansas State Climatologist) for his help in building this report.

Sincerely,

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Meteorologist at Kansas State University and Kansas Mesonet Manager

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