NORTH DAKOTA AGRICULTURAL WEATHER NETWORK

MESONET MINUTE

AUTUMN 2025

The aurora dazzles at the Peace Garden during a particularly strong event mid-November.

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Updates From the Field

The autumn months at the North Dakota Agricultural Weather Network (NDAWN) continued with the same flurry of installation as the summer months with eight new stations. Six were installed in Minnesota, in cooperation with the Minnesota Department of Agriculture (MDA), and two in North Dakota:

- Elkton 5S, Mower County, MN
- Fosston 6SW, Polk County, MN
- Leota 2SW, Rock County, MN
- Luverne 6S, Rock County, MN
- Maxbass 6SW, Bottineau County, ND
- Rollag 3E, Clay County, MN
- Strasburg 15W, Emmons County, ND
- Viking 1SW, Marshall County, MN

Figure 1: A train passes by the Maxbass 6SW station during installation.

The stations feature all-season precipitation gauges; snow depth sensors; soil moisture and temperature probes at depths of 2”, 4”, 8”, 20”, and 40”; and deep soil temperatures with fourteen measurements at various depth increments to a depth of 7.5 feet to measure frost depth. These sensors are in addition to the standard weather instruments that every NDAWN station has to record rainfall, temperature, humidity, wind speed & direction, and barometric pressure. They also have high-resolution cameras that upload photos continuously during daytime hours, with some operational overnight as well. Additionally, Mohall 1W (Renville County, ND) and Perham 2NW (Otter Tail County, MN) were upgraded with additional sensors.

A highlight of the autumn was the electrification of the new Fargo research site near the NDSU Sheep Barn. The new site contains the Fargo NW NDAWN station, two research stations, and other contracted sensors. The two research stations were transferred to the new site from the old site, fully-assembled and undamaged, via a flatbed trailer across some rough train tracks and a half-mile down a muddy dirt road – these 15-minute, 5-mph drives were the real highlight for the field staff.

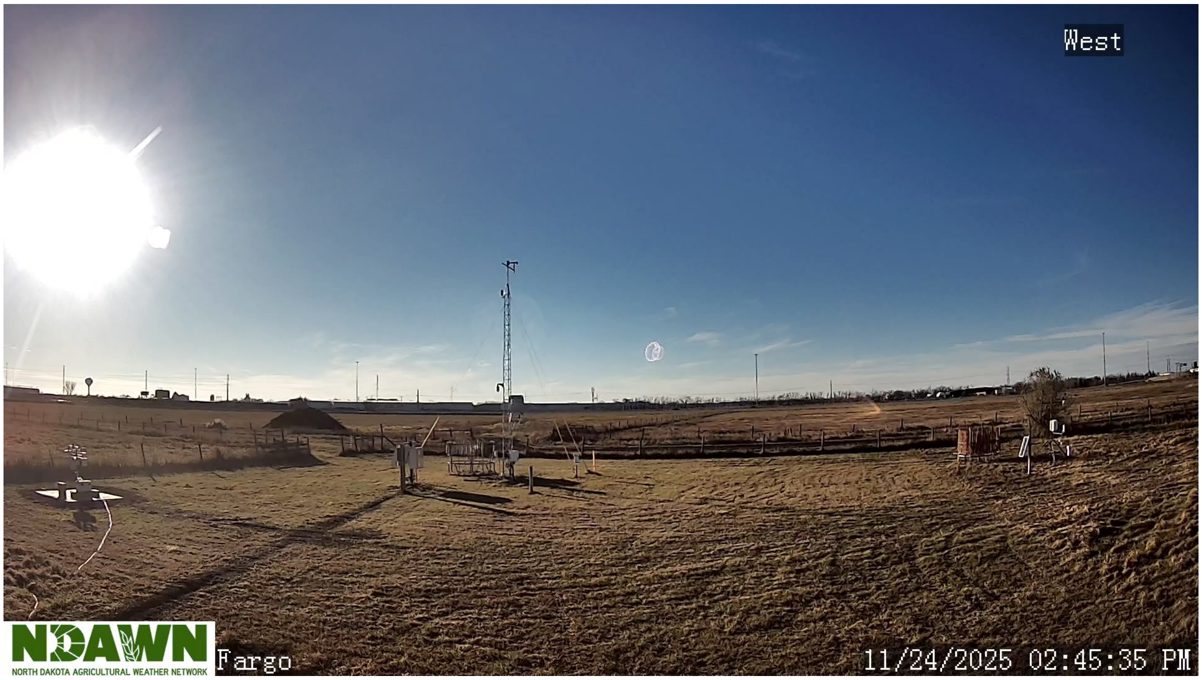


Figure 2: View of the Fargo Research Site

As the weather turns cooler, the final preventative maintenance and winterization of the all-season precipitation gauges are on the docket. This year was also time for the inaugural week-long road trip throughout the state with a towable boom lift to complete the preventative maintenance on the top wind monitor and temperature/RH sensor at 14 stations. The towable boom lift quickens the process of this top sensor maintenance immensely, as previously each tower would have to be tipped down to ground level and then back up, which can be a 2-hour process, dependent on how cooperative the bolts are. With the boom lift, it is possible to park, set up the lift, check the top sensors, pack up, and drive away within 30 minutes.

Figure 3: Preventative maintenance is performed at the top of the Carson 9ENE tower at sunrise

Growth of NDAWN

This year, the network grew by 35 stations – 18 in North Dakota and 17 in Minnesota. This brings the total number of stations to 264, which leads the nation in terms of mesonets.

NDAWN hereby is present in 95 counties: all 53 counties of North Dakota, 39 in Minnesota, and 3 in Montana. Areal coverage for meteorological conditions by NDAWN stations in these counties lies at 96.3%. In fact, 99.7% of North Dakota is covered by NDAWN. When looking at Minnesota as a whole, coverage lies at 49.6% (*Figure 5*).

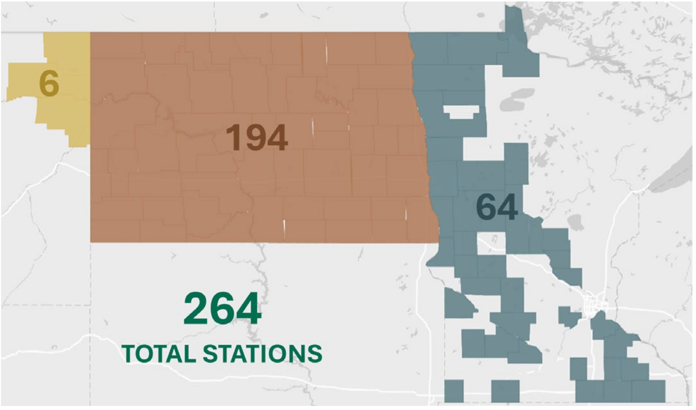


Figure 4: Map depicting all counties where NDAWN has a station with the number of stations per state.

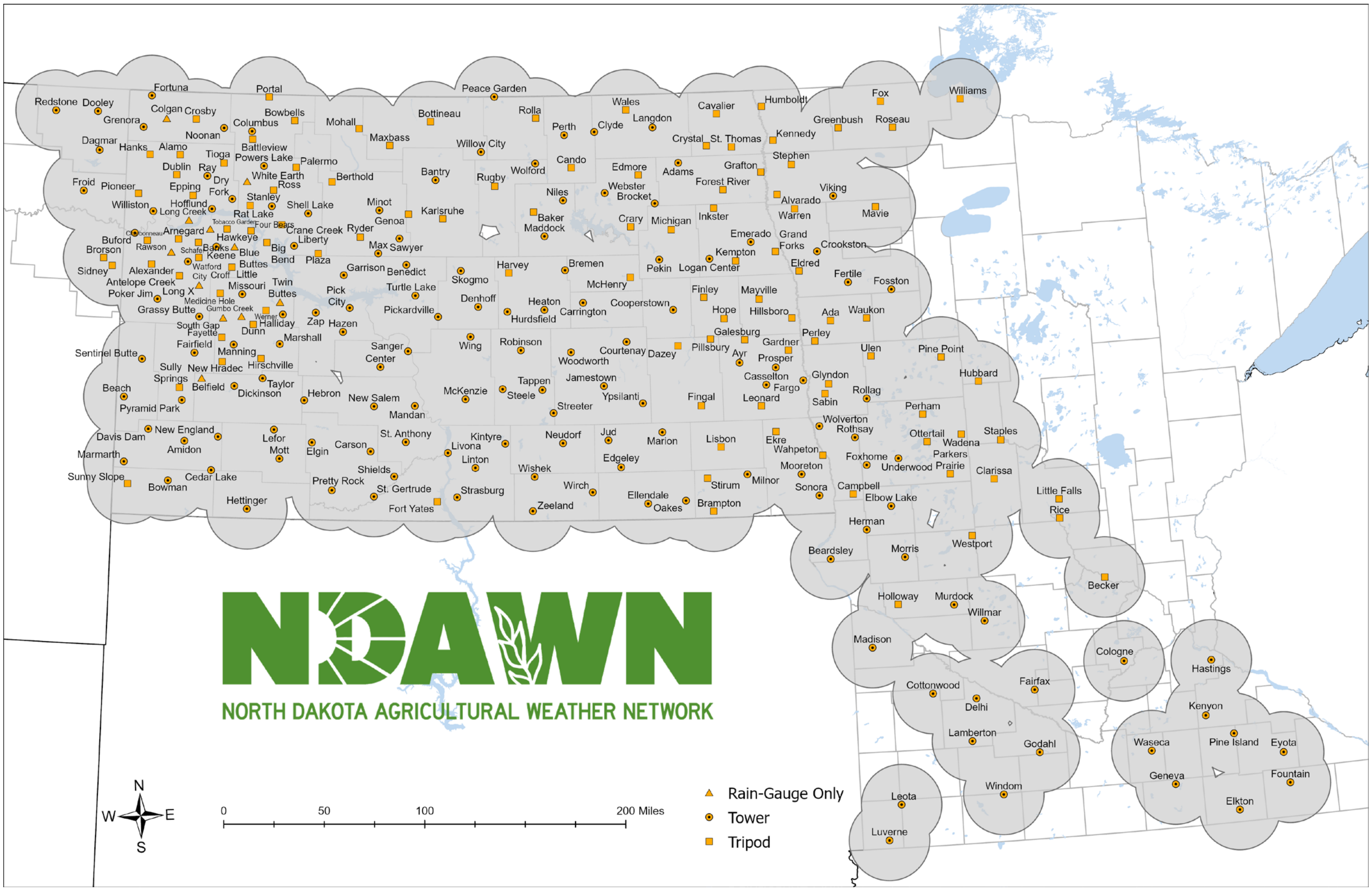


Figure 5: Using the standard 20-mile radius per station, areal coverage across the network can be portrayed

Of these 264 stations, 253 are fully-equipped and 11 are rain-gauge only. A fully equipped station can be either a tripod or a tower. Both types have the following standard equipment: 5ft temperature/RH sensor, 1.5ft & 10ft temperature sensors, 10ft wind speed & direction, 6.5ft solar radiation, 4” bare/turf temperature sensors, and two rain gauges. Tower stations have an additional 33ft wind speed & direction and 30ft temperature/RH. Stations can also have the following specialty sensors, based on need and funding: camera, all-season precipitation gauge, snow depth sensor, deep soil probe, and soil moisture and temperature probes.

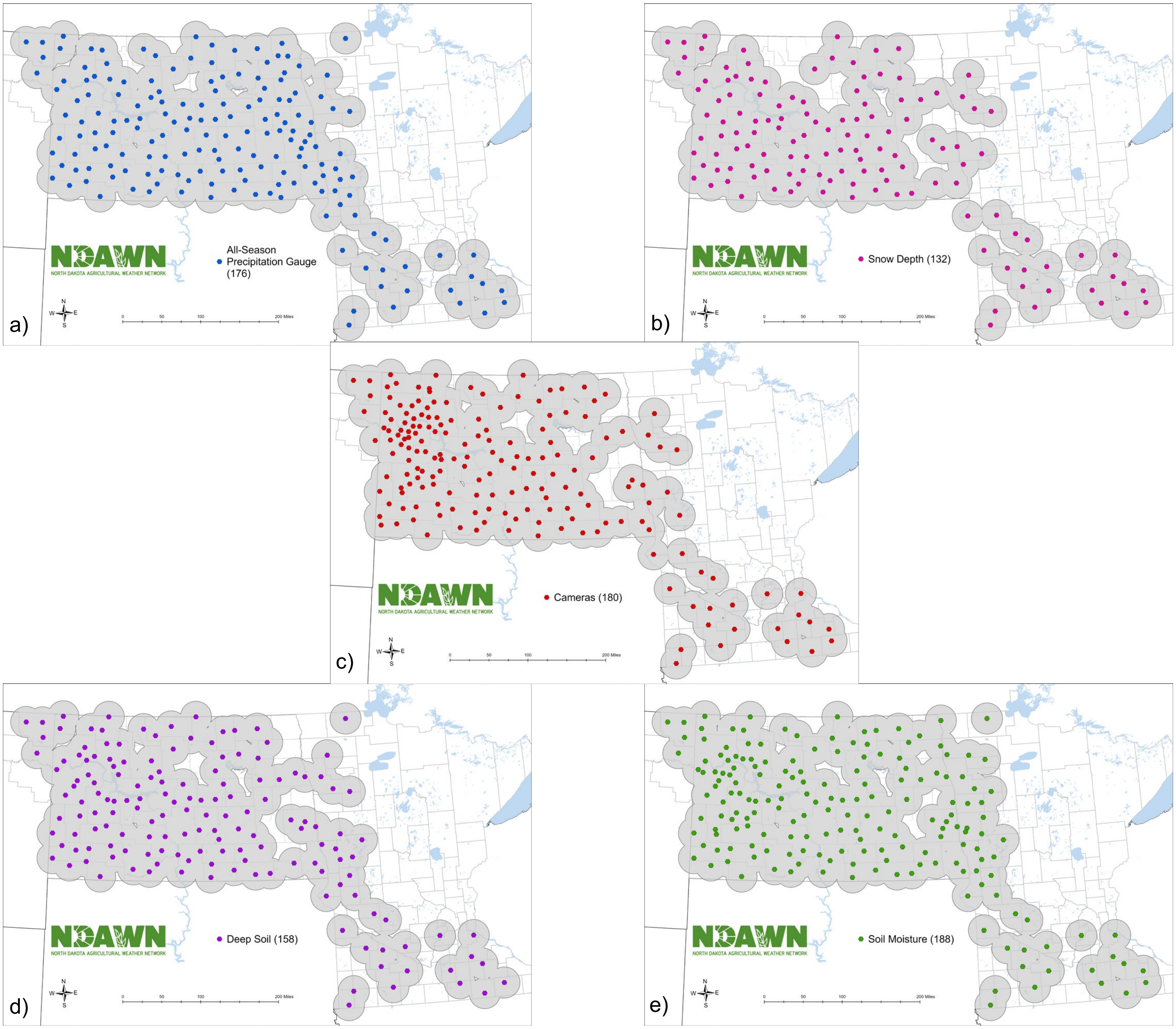


Figure 6: Current coverage maps, with a total count, for all-season precipitation gauge (a), snow depth (b), camera (c), deep soil (d), and soil moisture (e).

Although NDAWN was established over 35 years ago, over half the stations have been installed within the last 7 years. The first stations were installed in September 1988, with the 50th-station mark being reached about 10 years later. It took another 20 years for the next 50 stations to be installed, but since then progress has been rapid – 2 years, 3 years, and 2 years until the 250th mark was reached in August 2025.

The first 79 stations were all tripods as the first tower wasn't installed until September 2015, 27 years after the first station. But once again, progress has been rapid ever since with 50 towers installed by August 2022 and 100 by August 2024. The number of tripods peaked in June 2021 with 140, before beginning to decline as many were being converted to towers. Rain-gauge only stations were added between November 2020 and May 2023 for supplemental rainfall coverage as part of the WISEROADS project in conjunction with the Western Dakota Energy Association.

Currently, there are 146 towers, 107 tripods, and 11 rain-gauge only stations in the mesonet. Additional stations are planned for the coming years.

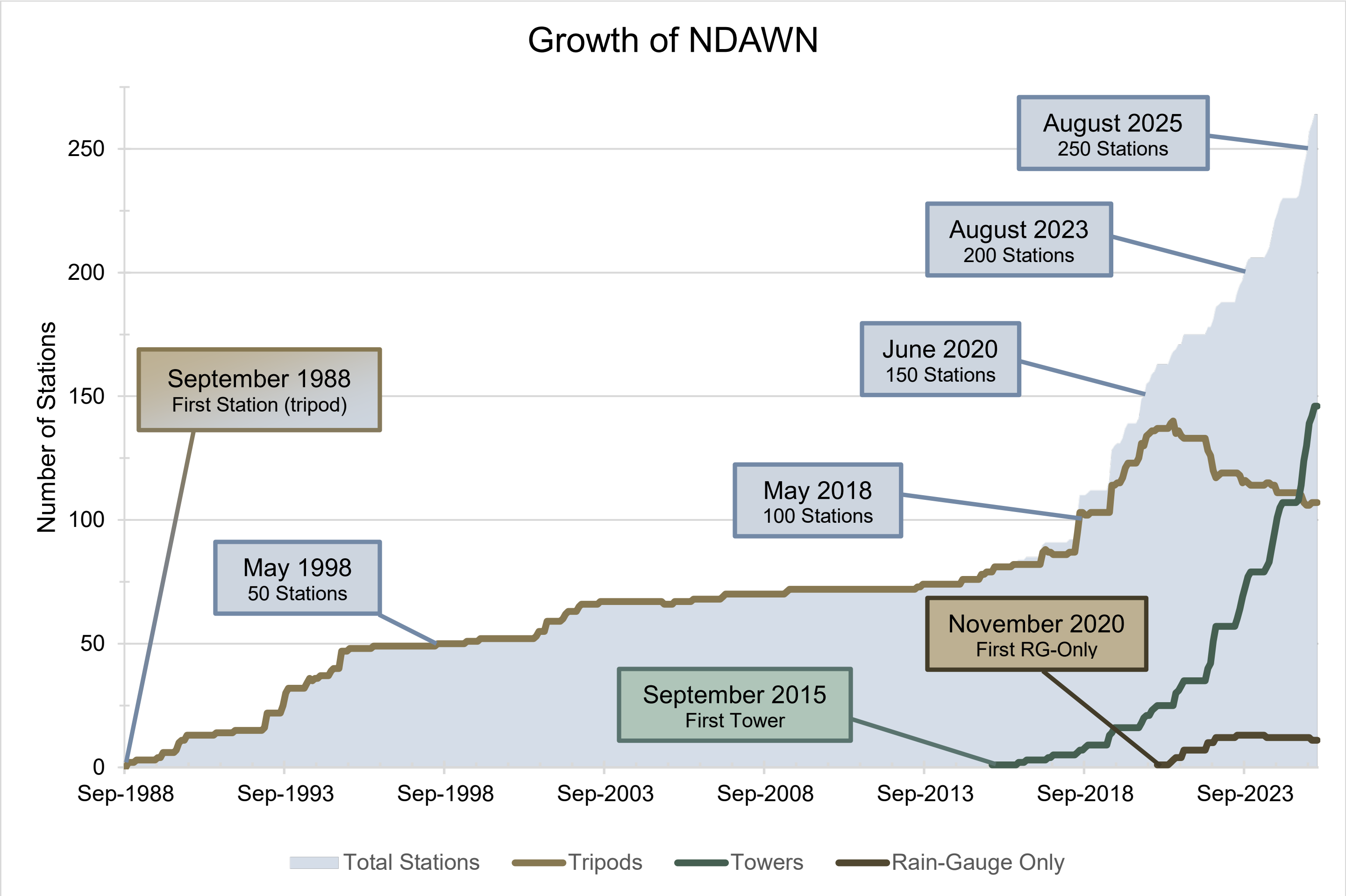
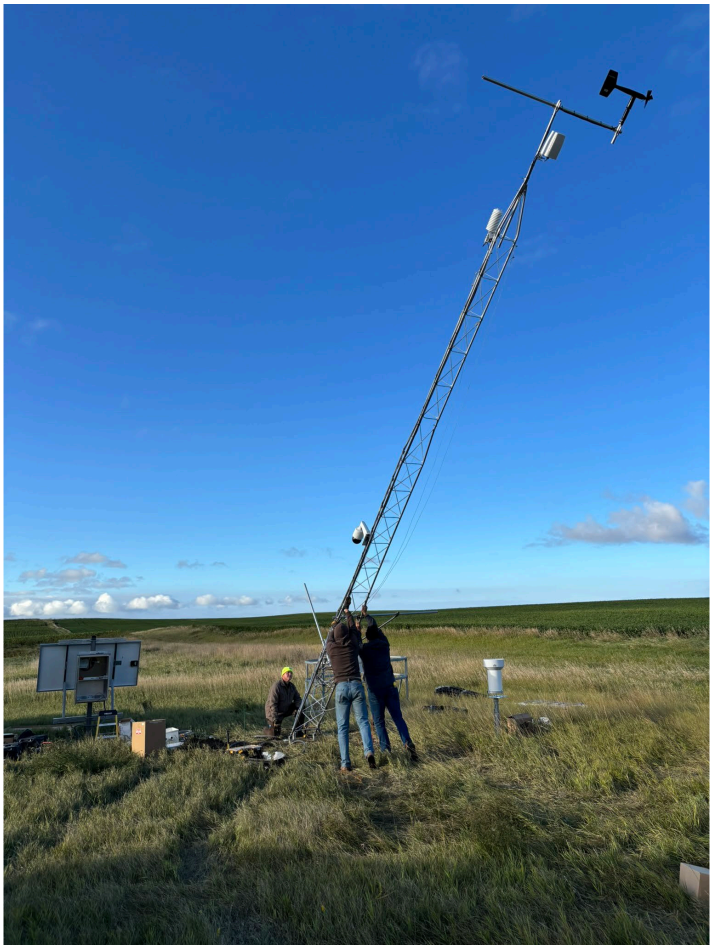


Figure 7: Graph depicting the total number of stations (towers + tripods + rain-gauge only) and each type at NDAWN over time, with significant milestones labeled

Upper Missouri River Basin Project

This September, NDAWN completed the Upper Missouri River Basin Project (UMRBP), a $6.4 million, five-year grant project funded by the U.S. Army Corps of Engineers that was awarded in 2020. This was part of a larger five-state (Montana, Nebraska, North Dakota, South Dakota, and Wyoming) effort to provide precise data, especially snow moisture content and soil moisture data, to improve hydrologic forecasting and managing water resources across the Upper Missouri River Basin. Filling these critical gaps of understanding in water inputs is vital for spring flood forecasts, flood preparedness, and drought resilience. North Dakota is the first state to finish their portion of the project.



Figures 8 & 9: The NDAWN field crew raises the tower at Strasburg 15W, the final station to be installed for North Dakota/NDAWN for the UMRBP, after affixing the top sensors (left). The field crew, from left to right, Julia Poblotzki, Jonathan Rosencrans, Nick Antonoplos, and Reece Wagner mark the completion of the project with a photo (right).

The 270,000 mi^2 basin was divided into 540 grids to better spatially distribute stations, with aims of one station centrally located per grid. For NDAWN this meant a total of 85 stations were needed. Within North Dakota, 40 existing stations were retrofit to UMRBP specifications and 41 new stations were built. The last 4 stations were retrofits in northeastern Montana. (*Figure 10*)

All stations within this project have a high-resolution camera; all-season precipitation gauge; snow depth sensor; soil moisture and temperature probes; deep soil temperatures; wind speed and direction at 10 and 33ft; and temperature and humidity at 1.5 and 30ft. These sensors are in addition to the standard weather instruments that every NDAWN station has.

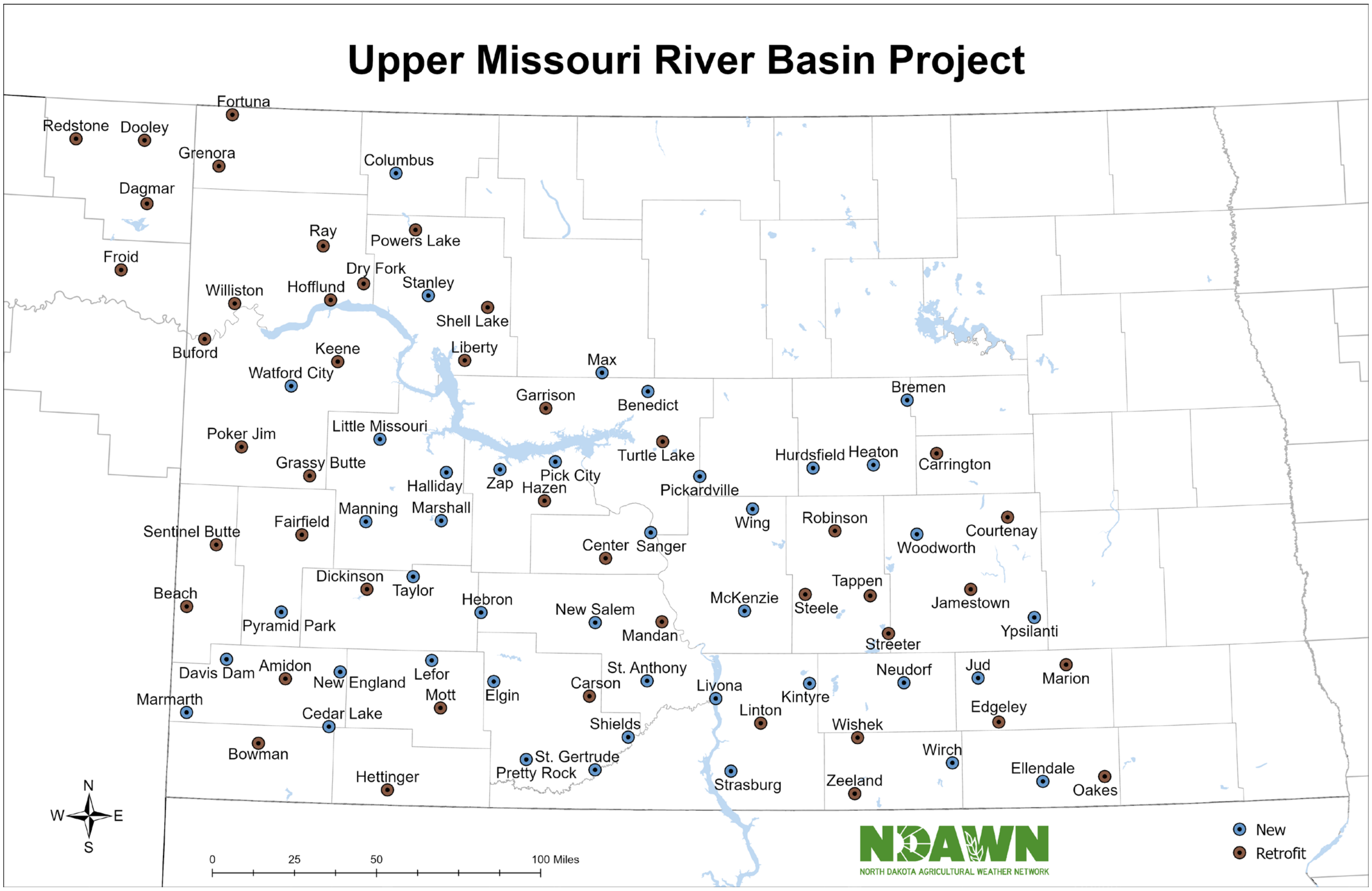


Figure 10: Map depicting the 85 NDAWN stations associated with the UMRBP

The UMRBP stations are fully integrated into the NDAWN network and thus all agriculture tools, weather data, and soil data that are standard for NDAWN stations are available. These ag tools and models can be found at ndawn.org, along with downloadable station data. Station photos and maps of current and cumulative conditions can be found at ndawn.info. Data for all UMRBP stations across the five states can be viewed at drought.gov.

Autumn Statistics

Table 1: Select statistics from NDAWN stations for the time period of September 1 – November 30, 2025

	Highest	Lowest
Maximum Temperature	94.7°F at Madison 5SW (9/29)	-1.2°F at New Hradec 6NW (11/30)
Minimum Temperature	71.4°F at Becker 3S (9/15)	-25.9°F at New Hradec 6NW (11/30)
Diurnal Temperature Range	53.9°F at Buford 3SE (9/28)	1.2°F at Medicine Hole 9NW (10/16)
Average Temperature	52.2°F at Godahl 1N, Lamberton 2W	44.3°F at Peace Garden, Rolla 2S
Departure from Average Temperature	+5.9°F at Fertile 4N, Livona 5S	+1.2°F at Sidney 1NW
Total Precipitation	10.31” at Webster 1N (243% | +6.07” of normal)	2.01” at Dagmar 7WSW, Dooley 3S (76% | -0.65”, 77% | -0.60” of normal)
Daily Precipitation	3.27” at Ross 4E (9/13)	0.41” at Dooley 3S (11/24)
Peak Wind Gust at 10ft	61.2 mph at Wales 1W (9/14)	29.8 mph at Little Falls 6SE (11/26)
Peak Wind Gust at 33ft	67.0 mph at Pickardville 6SW (9/4)	35.2 mph at Fountain 3W (10/20)

Maximum, minimum, and diurnal range temperatures are based on daily values. Peak wind gusts and daily precipitation are based on each station’s daily maximum for the season. Average temperature, departure from average temperature, total precipitation, and average wind speed are based on the combined seasonal values. Only stations with an all-season precipitation gauge are used for total precipitation statistics. Maps of monthly, seasonal, and annual statistics can be found at ndawn.info/climate_statistics.html

The average air temperature this autumn across all NDAWN stations was 47.9°F, which is 4.3°F above normal. The 12-month average temperature is 42.3°F, which is 1.1°F above normal (*Figure 11*).

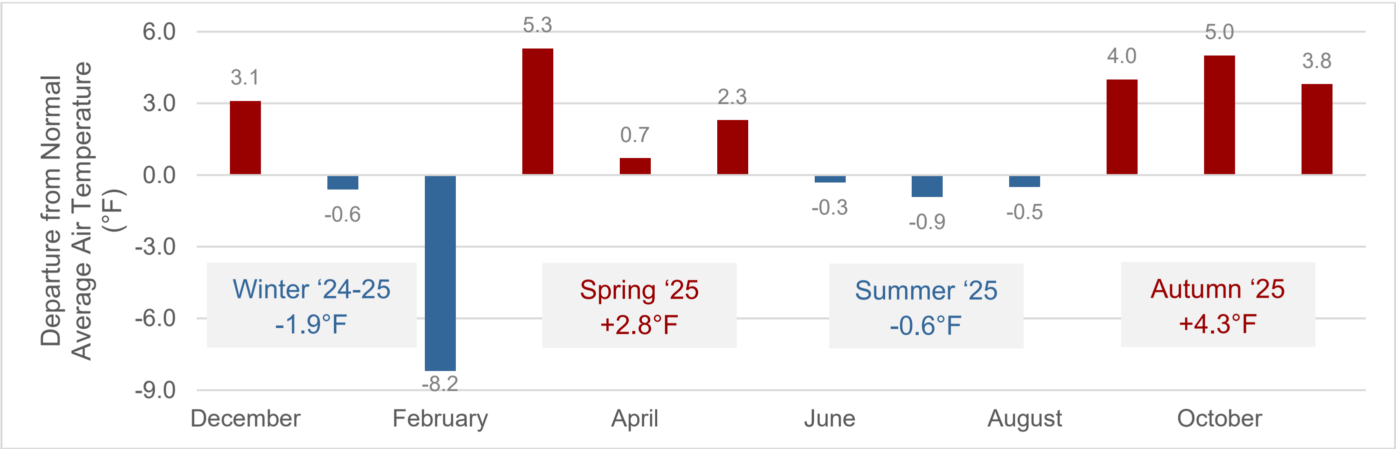


Figure 11: Graph depicting the departure from normal average air temperature across NDAWN for the last 12 months

Nearly every NDAWN station recorded a temperature below 0°F this autumn, with only far northern and southeastern Minnesota spared (*Figure 13*). Most of the network reached this benchmark between November 26 – 30, which is close to the historical average date of November 20 (*Figure 12*).

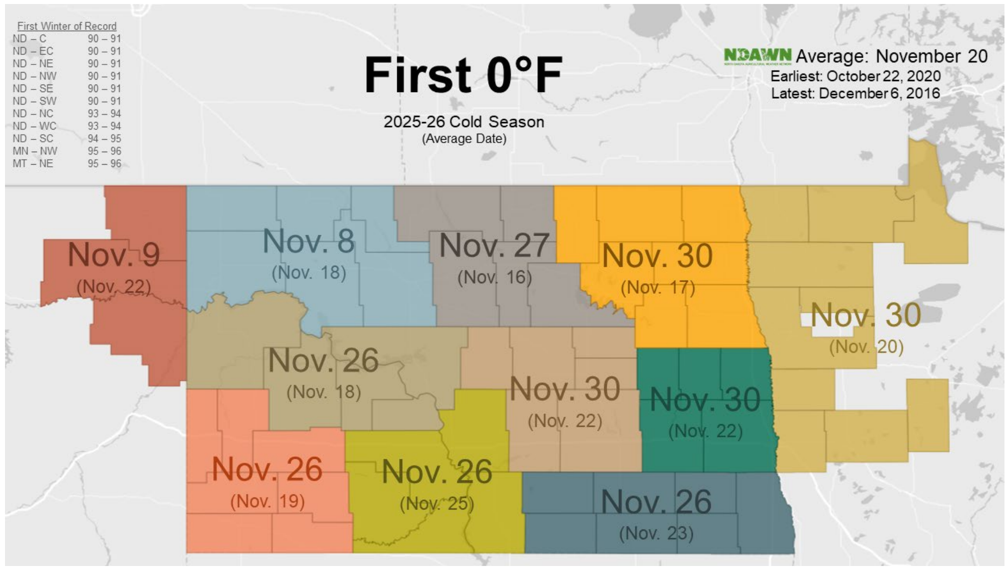


Figure 12: Graphic depicting the first date of the 2025-26 cold season that an NDAWN station in a given agricultural statistic district recorded a temperature of 0°F or lower and the average first date (30+ year average).

New Hradec 6NW recorded the lowest temperature of the autumn on November 30 with -25.9°F. While quite cold, this was not the earliest observation of a temperature of -25°F or colder at an NDAWN station – Bottineau holds that record with a measurement of -25.4°F on November 23, 2013.

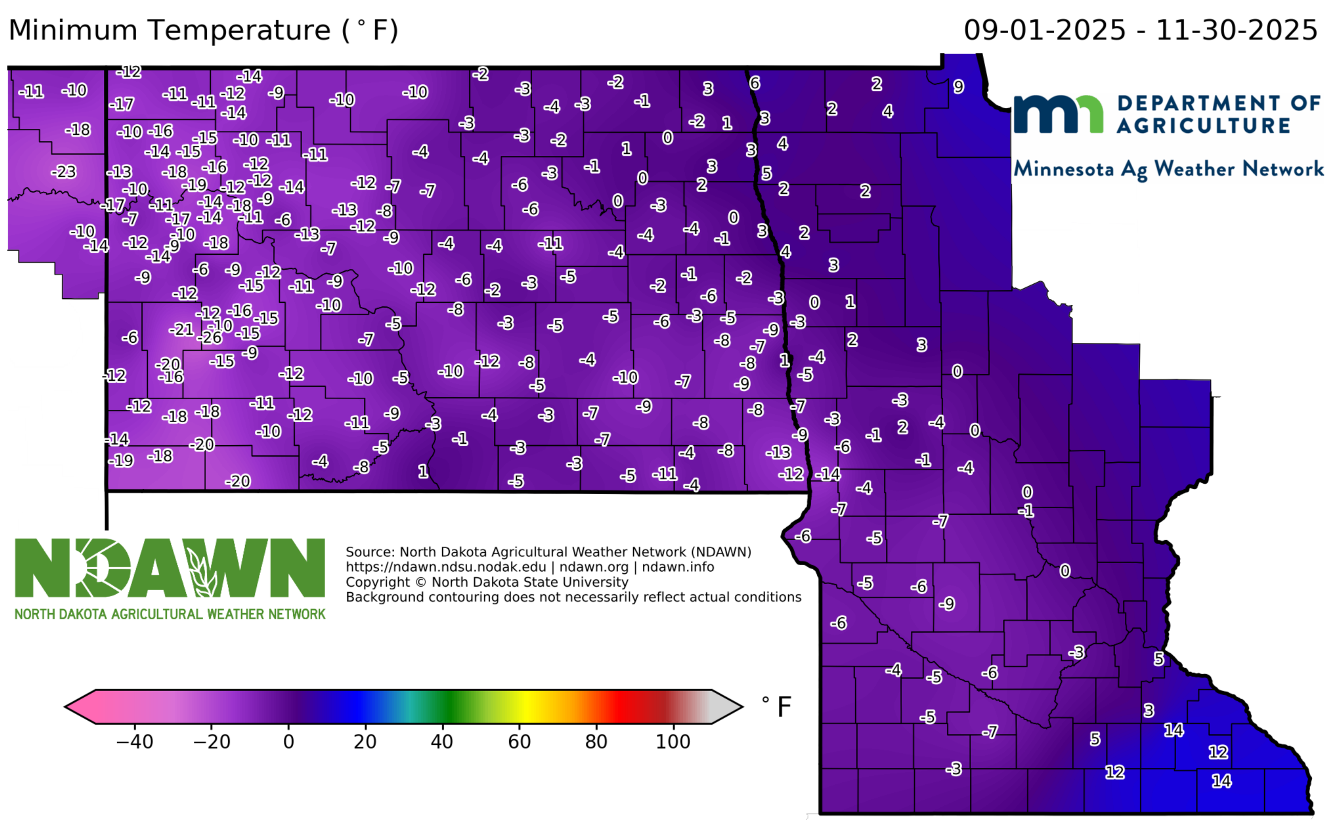


Figure 13: Map of the minimum temperature recorded at NDAWN stations during the 2025 Autumn

Around the State with Station Cameras


East
NDAWN Four Bears
09/13/2025 08:00:02 AM


South
NDAWN
Peace Garden
11/13/2025 05:12:15 PM


NorthEast
NDAWN
NORTH DAKOTA AGRICULTURAL WEATHER NETWORK
Maxbass 6SW
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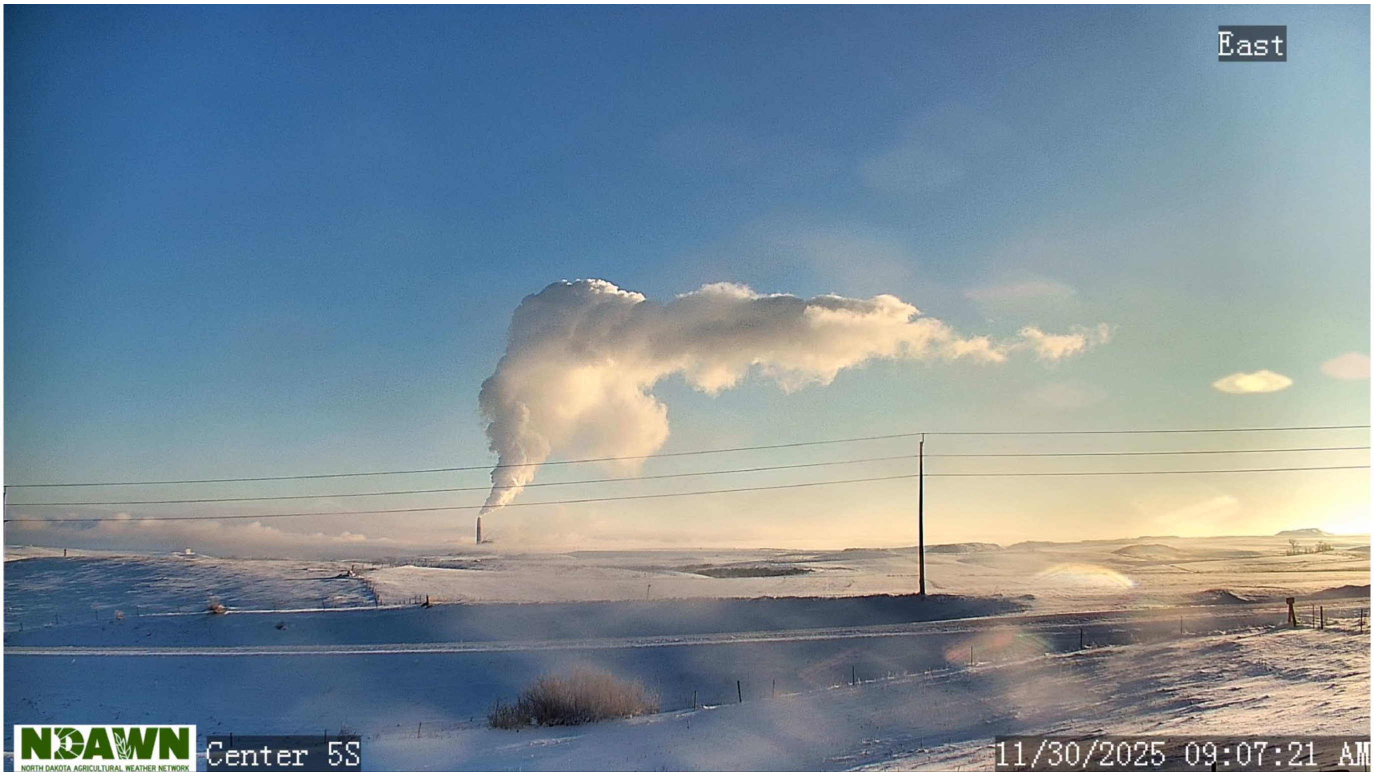
East
NDAWN
NORTH DAKOTA AGRICULTURAL WEATHER NETWORK
Center 5S
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