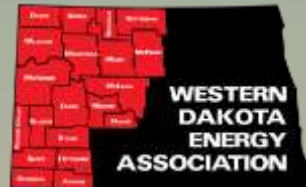

Wise Roads

Weather Information System to Effectively Reduce Oilfield Delays and Disruptions

Jonathan Rosencrans
WDEA Annual Meeting
October 9th, 2020



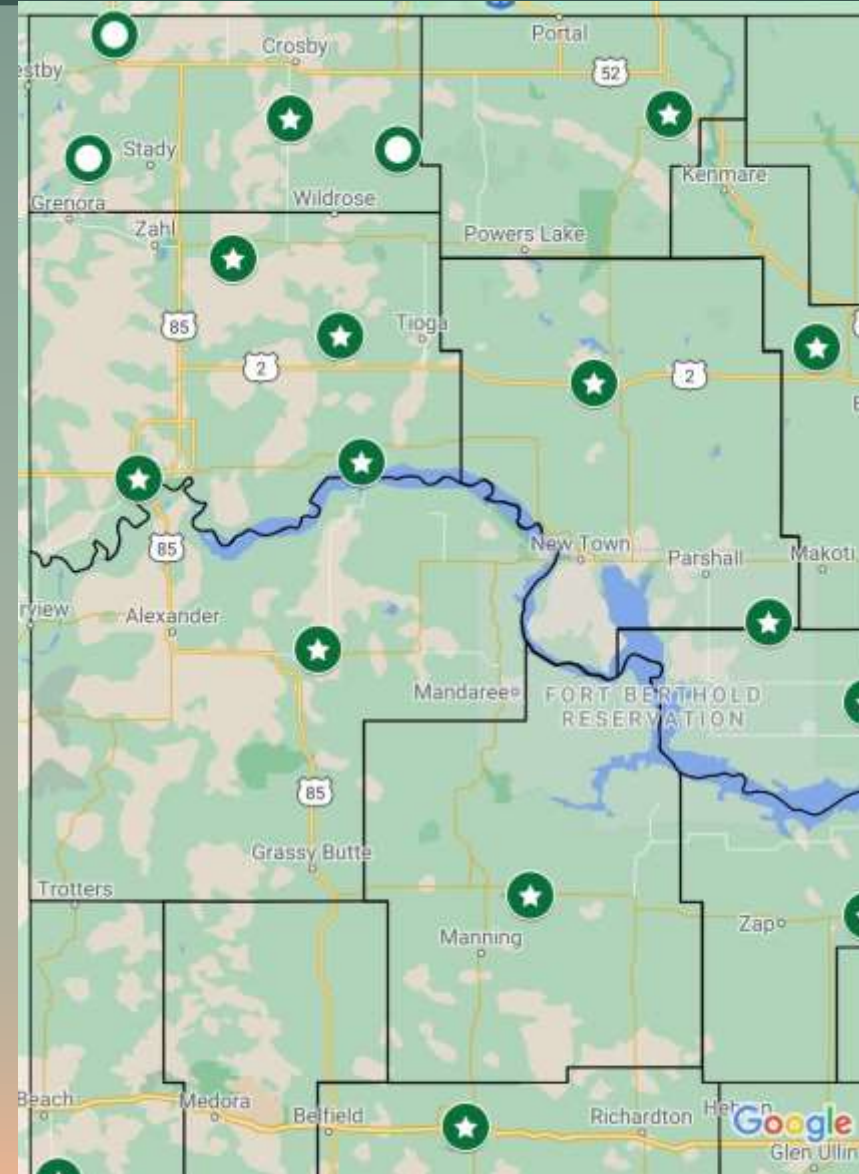
Wise Roads Project

- Expand the existing NDAWN network in oil producing counties
- Use high-density weather data, particularly rainfall, to precisely place weight restrictions
- Maximize benefit by working with research partners, agriculture and industry



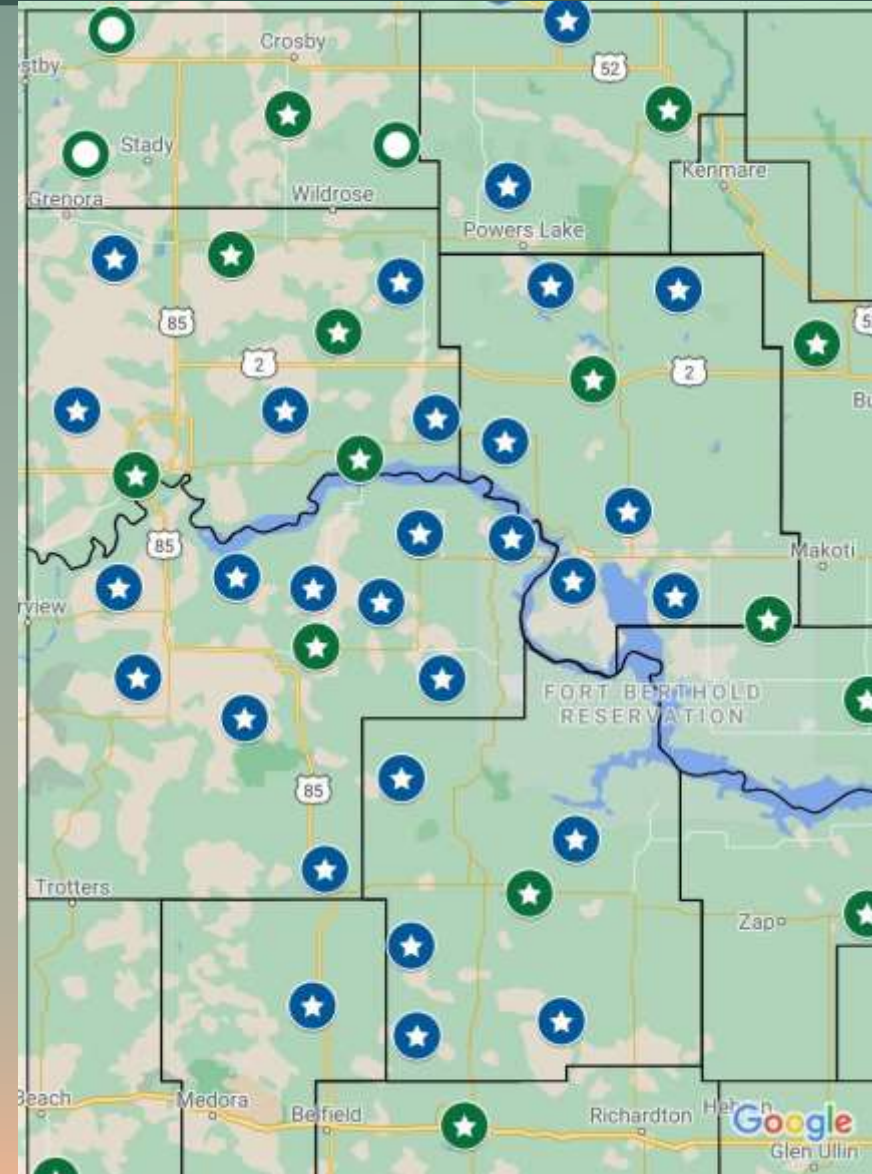
Spring 2019 NDAWN Stations

- 8 total weather stations in “Big Four” counties
- McKenzie and Dunn County each only had 1 station
- >40 miles between some stations



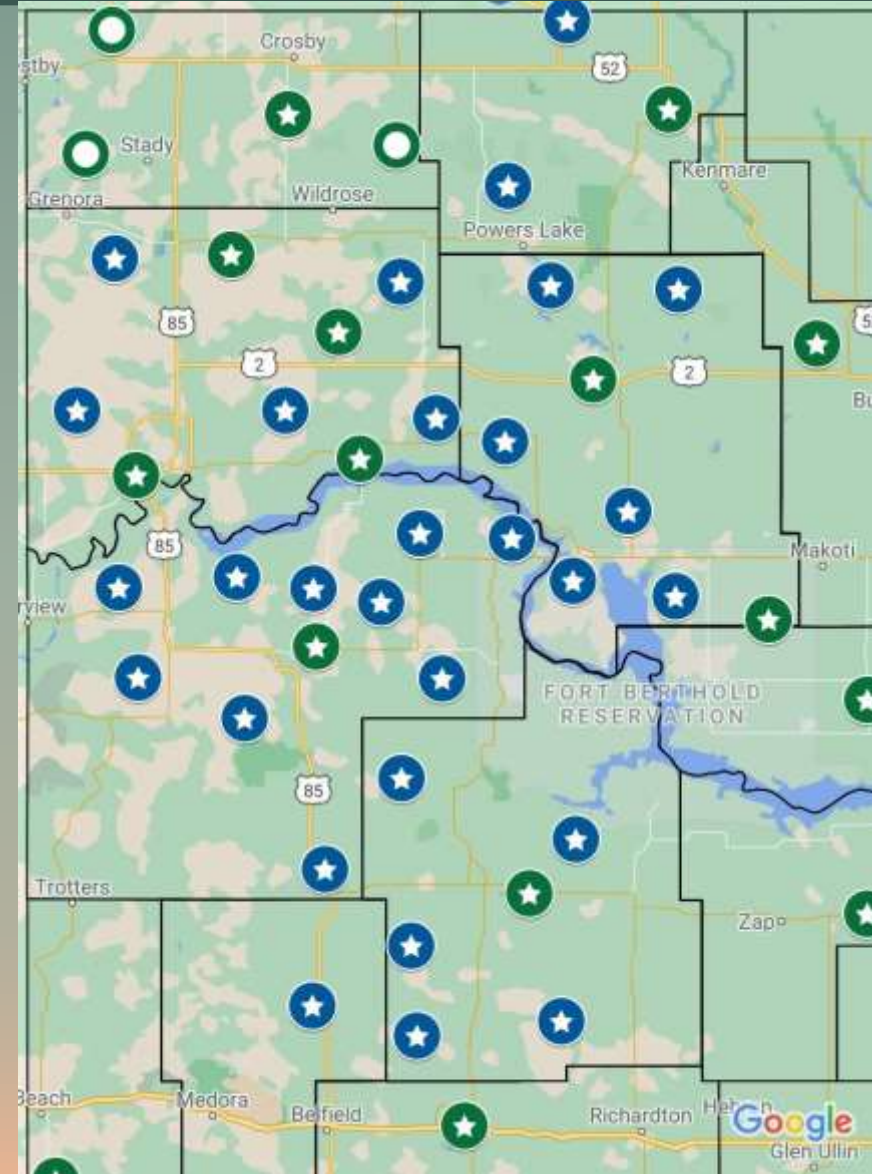
Current NDAWN Stations

- 30 additional weather stations installed since June 2019
- “Big Four” counties have a total of 34 stations
- ~12 mile spacing



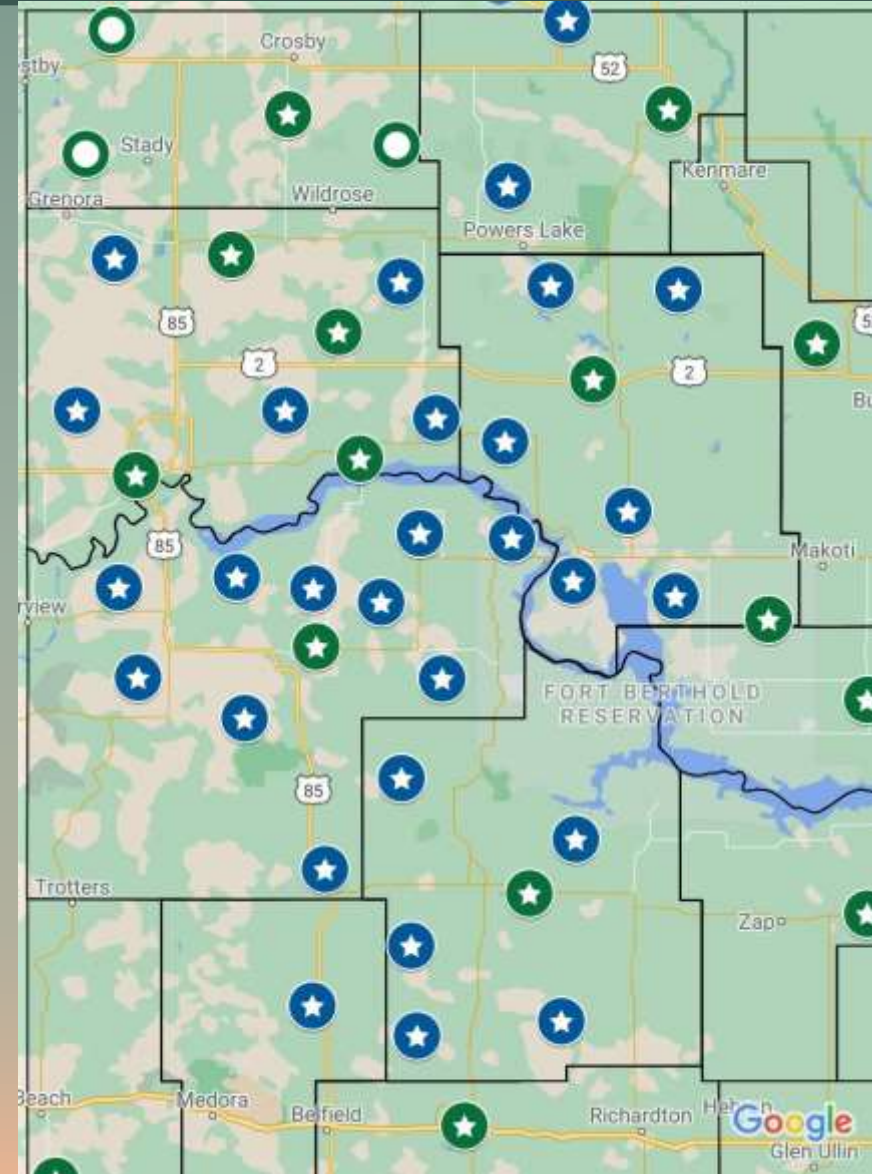
Current NDAWN Stations

- Dunn: 6 (+5)
- McKenzie: 11 (+10)
- Mountrail: 8 (+6)
- Williams: 9 (+5)



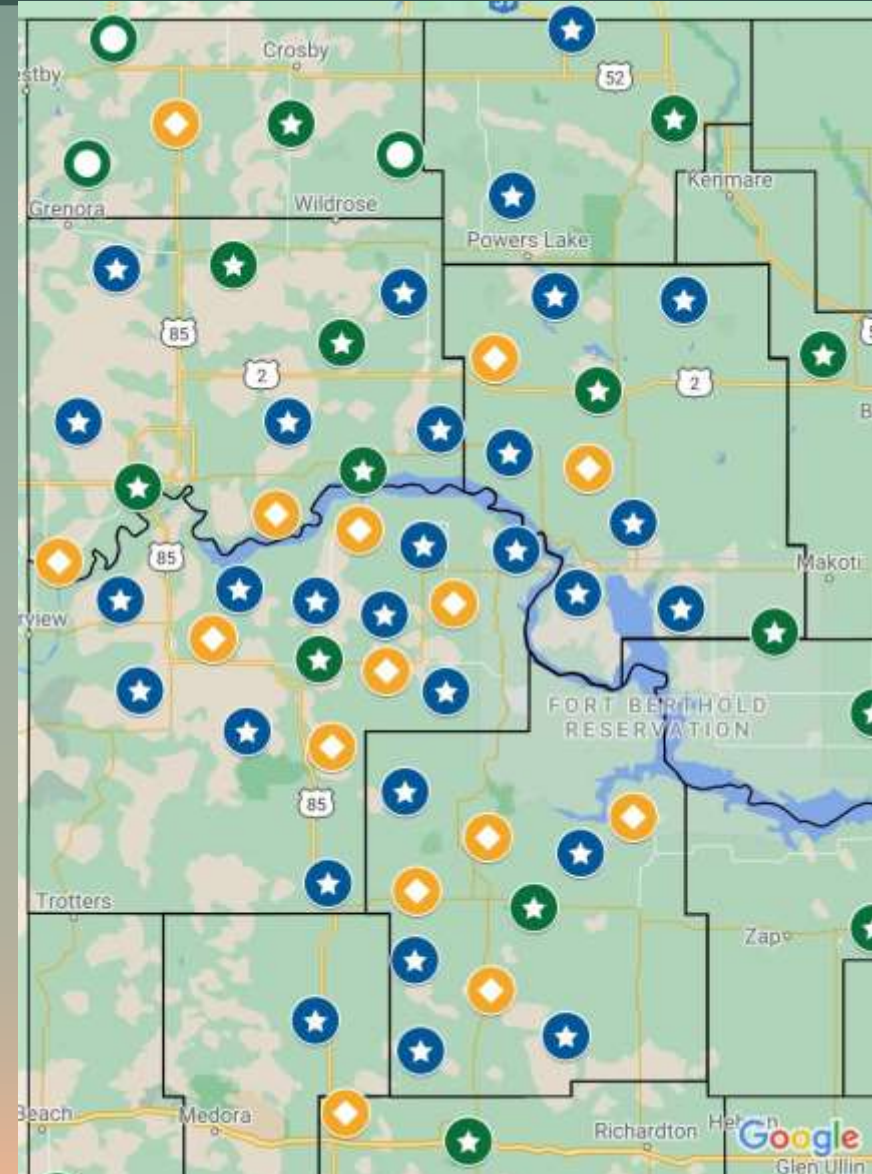
Current NDAWN Stations

- Billings: 1 (+1)
- Bowman: 2 (+1)
- Burke: 3 (+2)
- Divide: 4 (+0)
- Stark: 1 (+0)



Wise Roads: Phase 4

- Rain gauge & camera
- Placed at existing oil locations
- Connected to AC power
- Moisture in snow & sleet can be measured with heated rain gauge



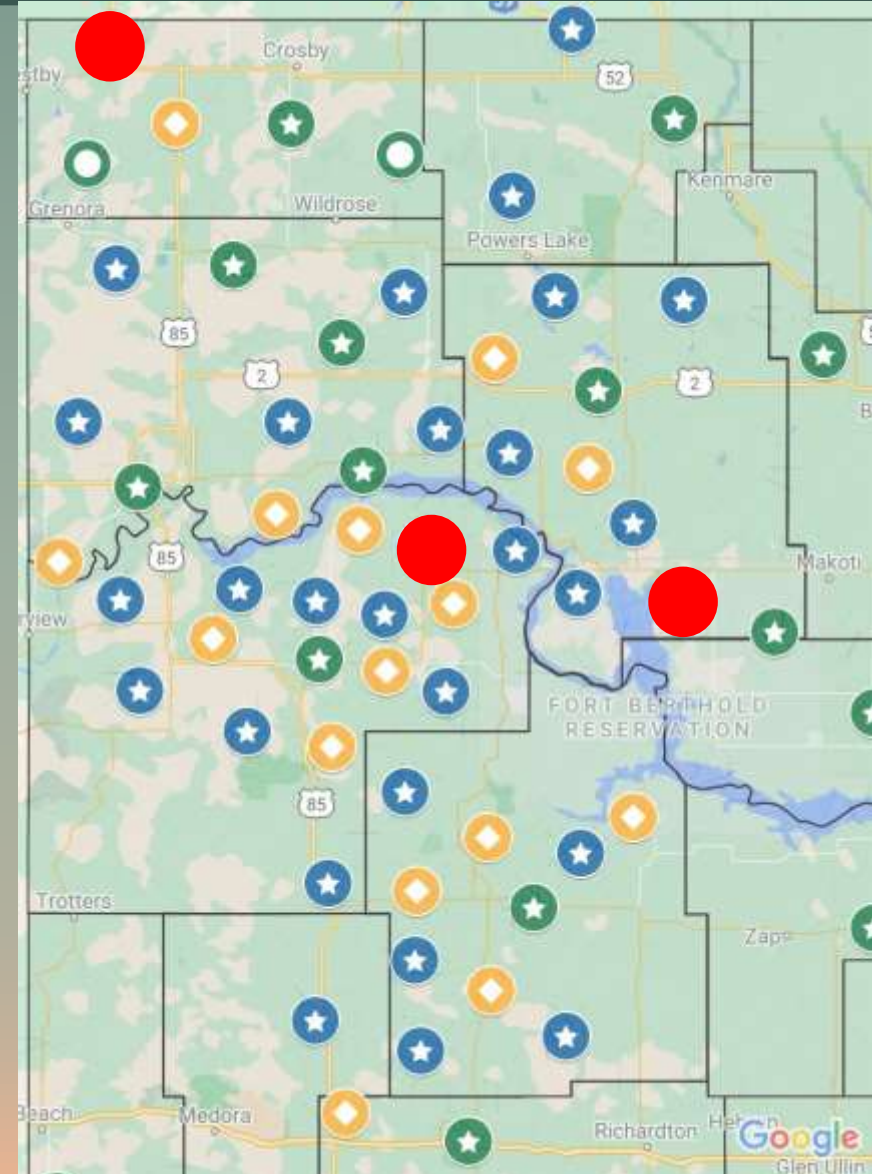
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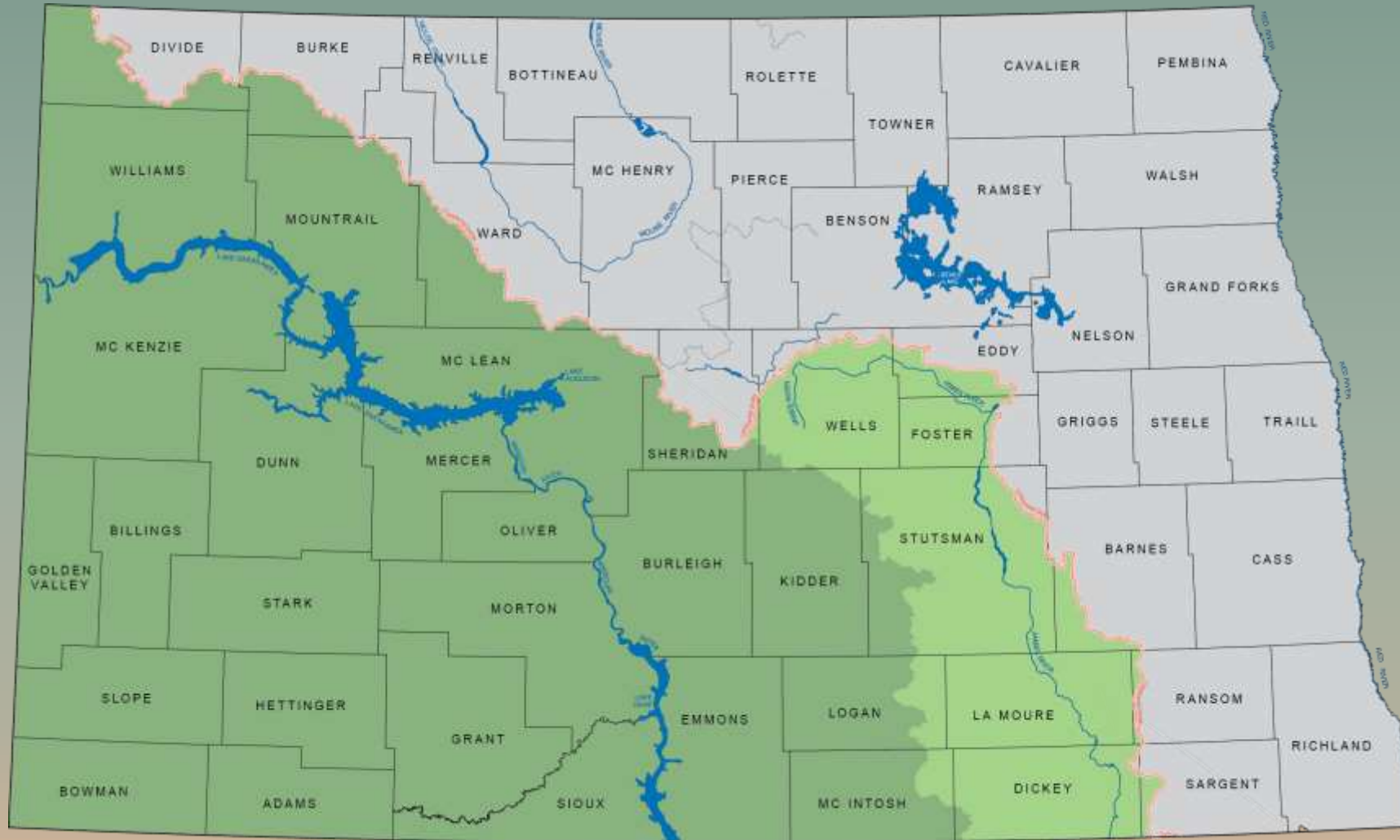


Wise Roads: Phase 4

- Only 3 weather stations currently measure moisture content of winter precipitation
 - Wet Snow
 - Early season rain



Upper Missouri River Basin Project



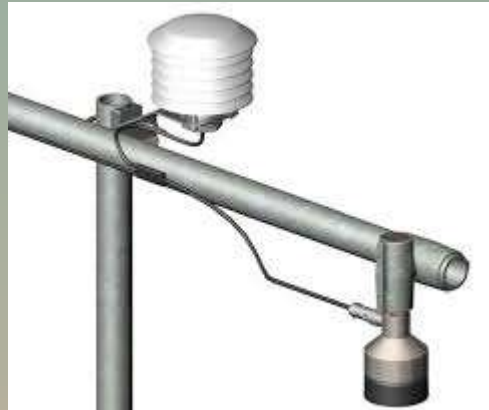
Upper Missouri River Basin Project

- NDAWN awarded \$6.4 million, 5-year contract
- Part of a larger 5-state project
- ~20 new stations will be installed in ND
- Many others will be upgraded
 - 20-25 mile spacing
 - Likely some Wise Roads stations



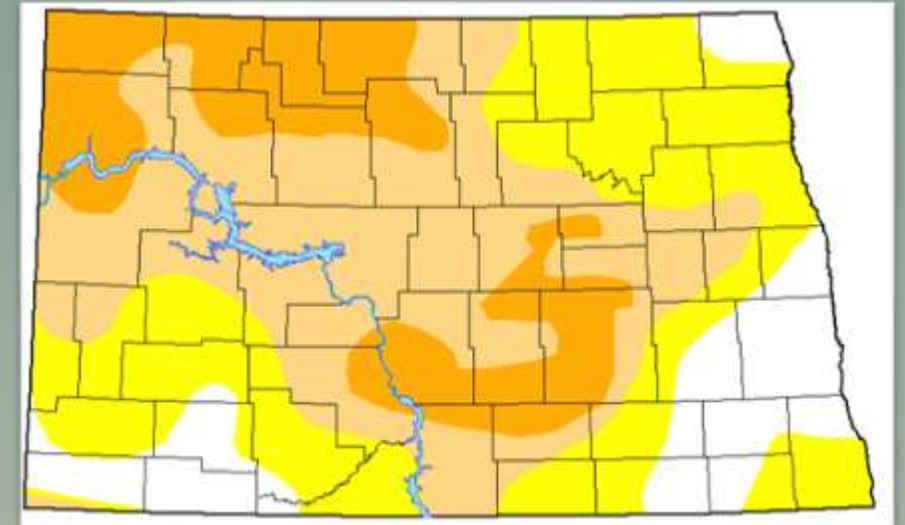
Upper Missouri River Basin Project

- Equipment upgrades include:
 - All-season rain gauge
 - Soil moisture/temperature sensors
 - Snow depth sensors



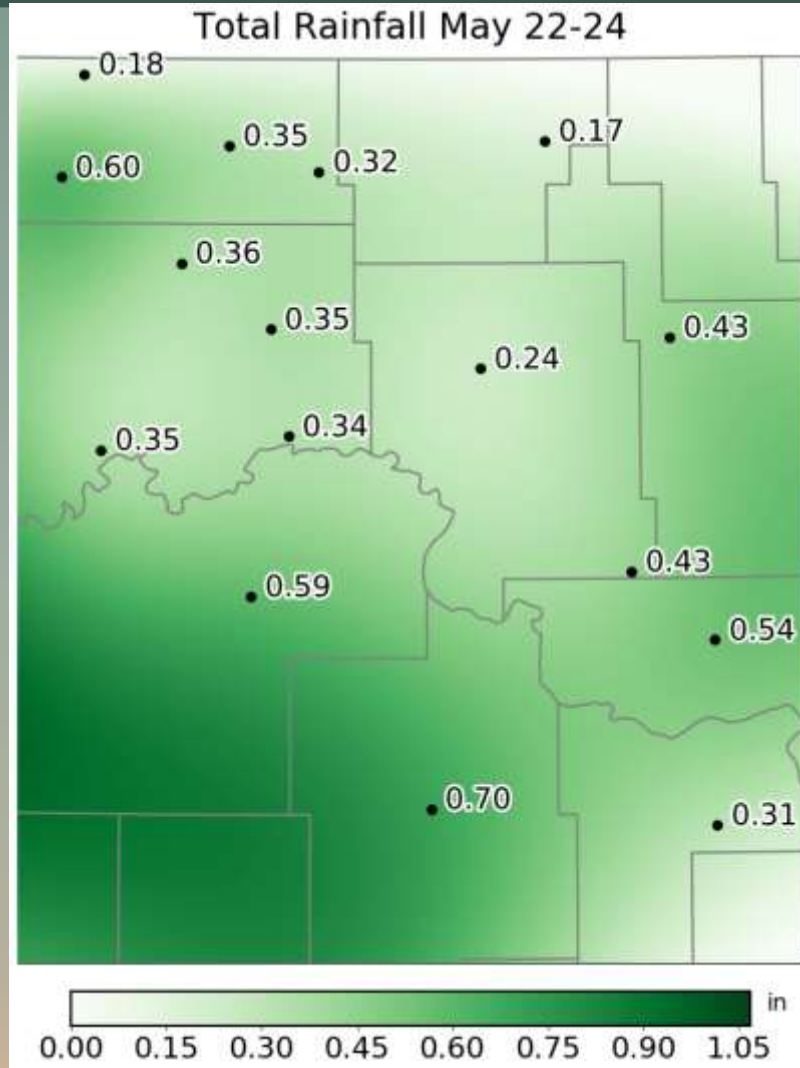
Upper Missouri River Basin Project

- Benefits to Wise Roads:
 - Additional winter precipitation data
 - Additional frost depth data
 - Additional stations on the periphery of the Wise Roads micronet
- Other Benefits
 - Drought Monitor
 - PRF (Rainfall Insurance)



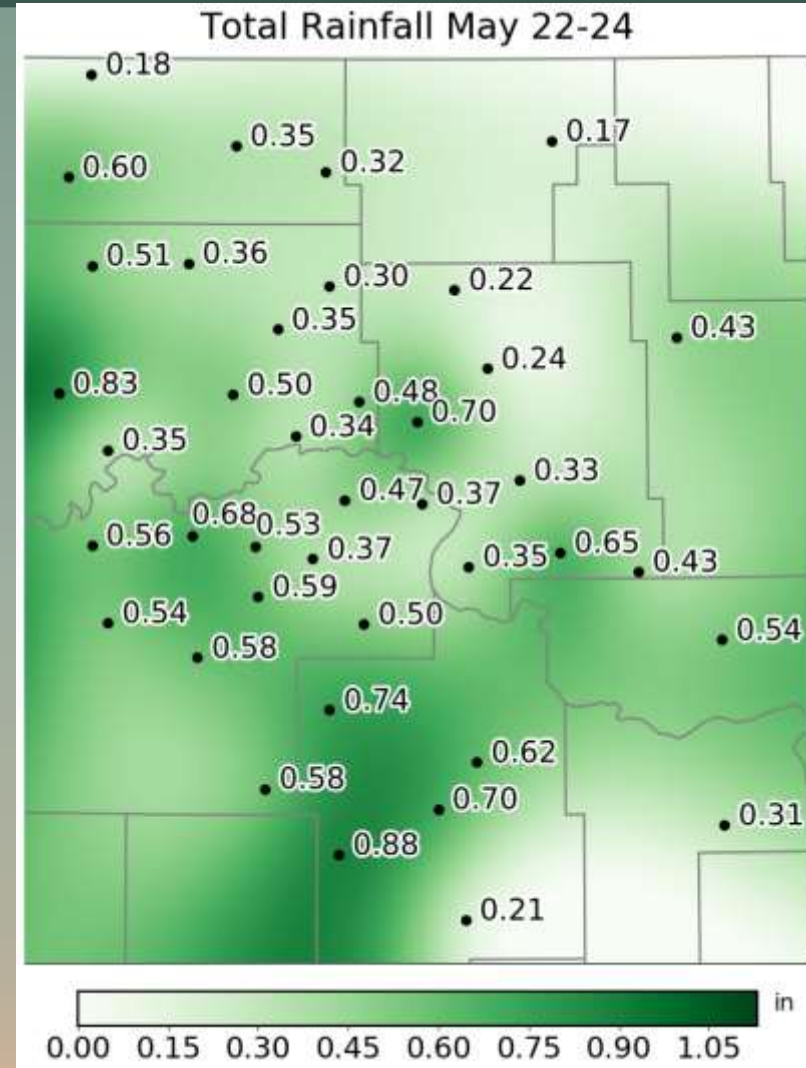
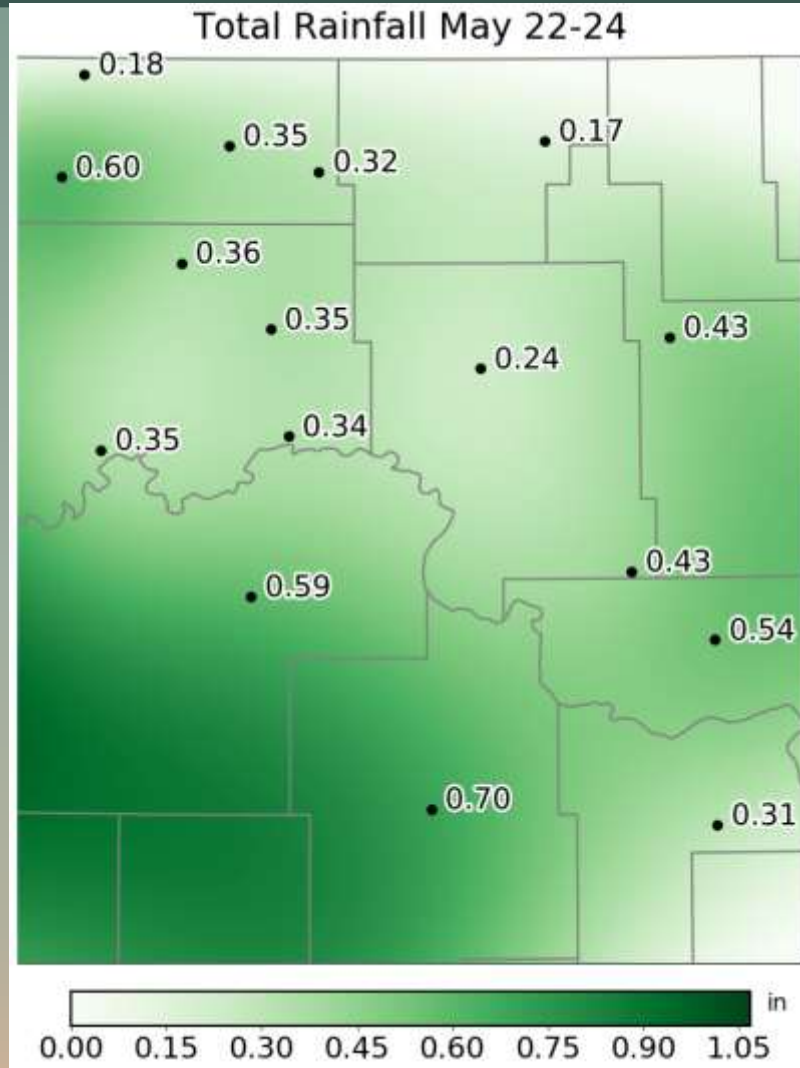
October 6, 2020 Drought Monitor

A More Complete Picture



- What the map would have looked like without Wise Roads

A More Complete Picture

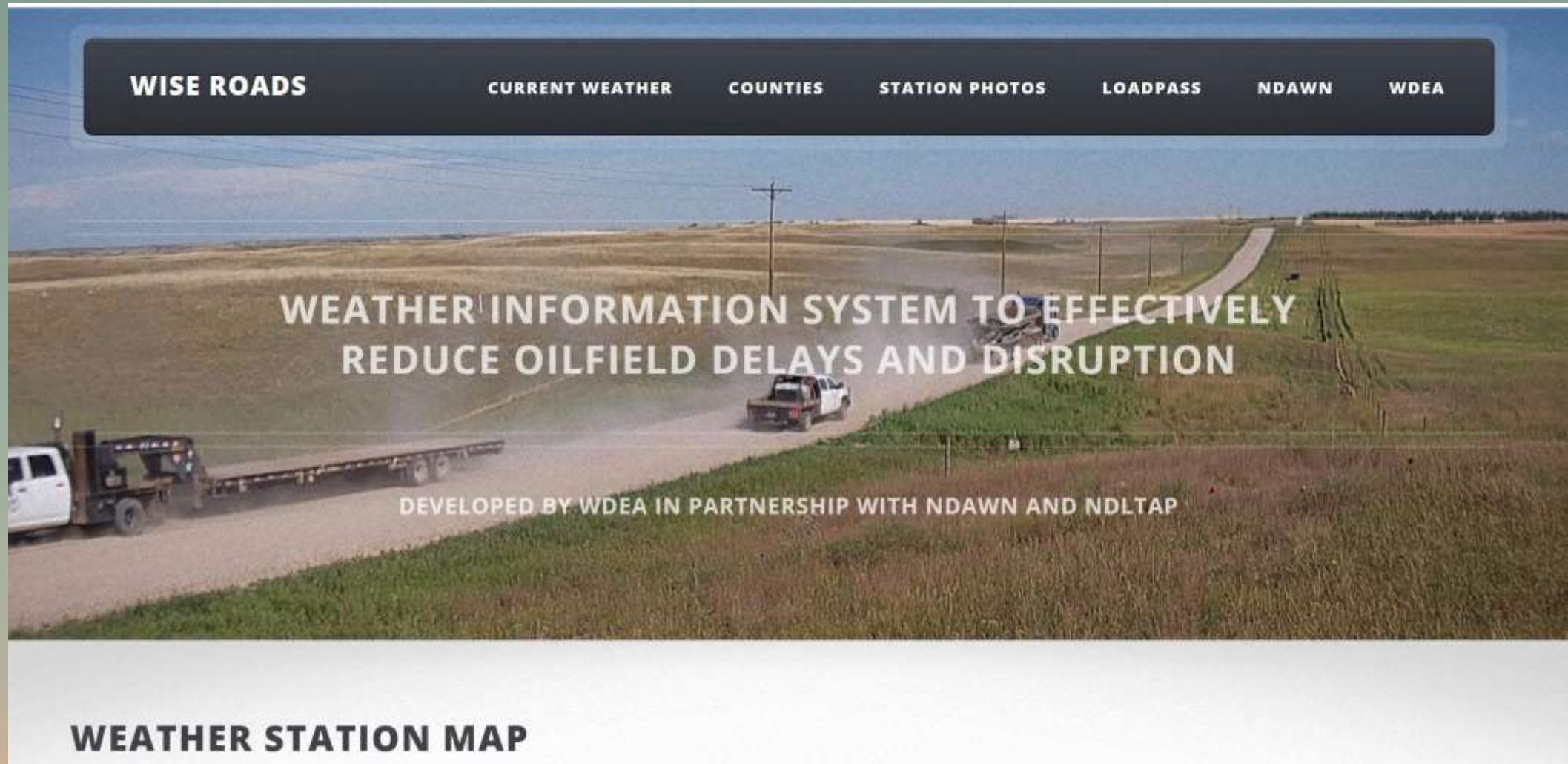


Weather Data Resources

- WiseRoadsND.com
 - Current weather maps of western ND
 - Most recent camera images
 - Links to each station's individual data
- NDAWN Website (NDAWN.org)
 - 10 original Wise Roads weather stations available
- Stationname.ndawn.org (ex. Hawkeye.ndawn.org)
 - Current & historical data for an individual station

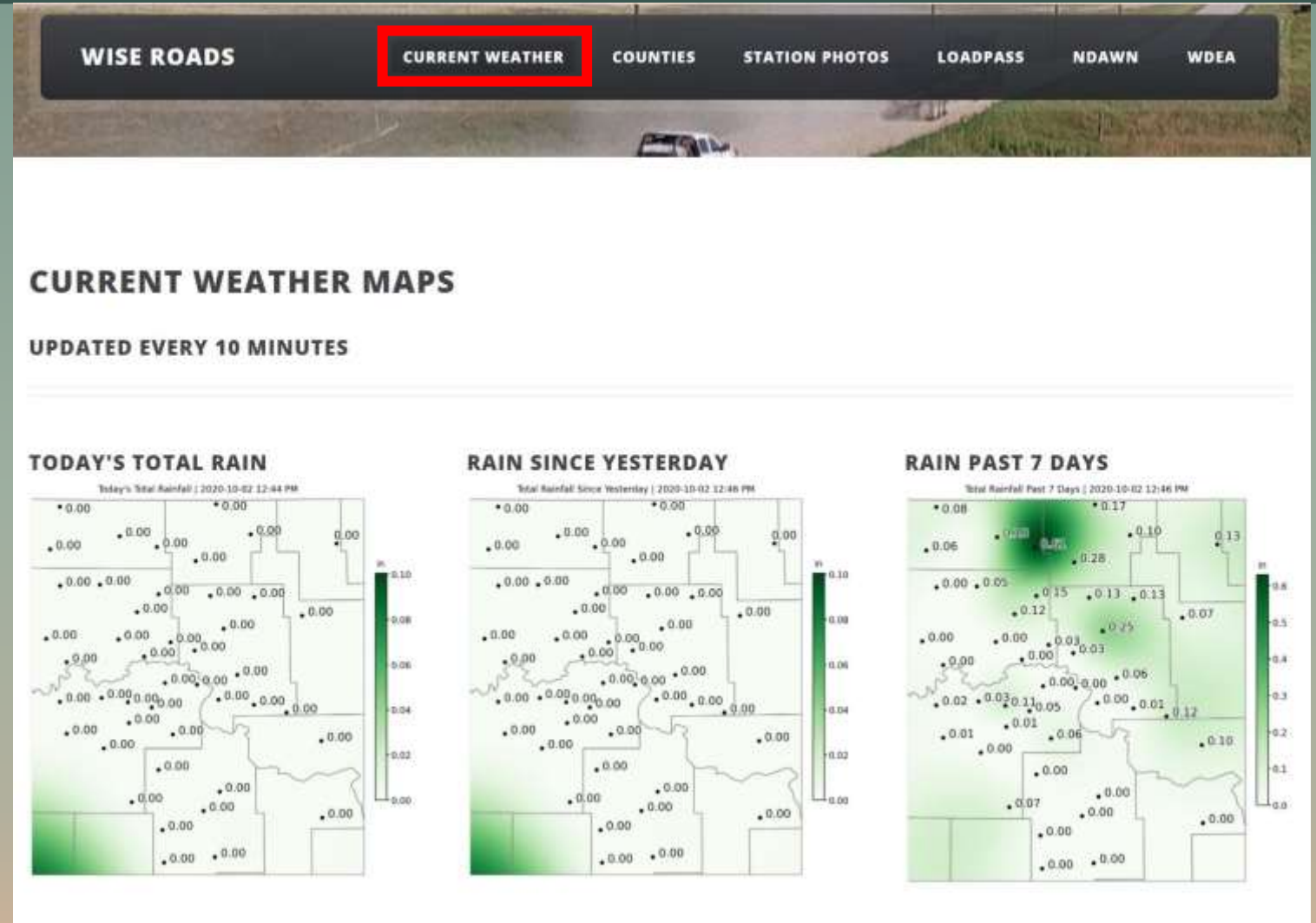


WiseRoadsND.com



WiseRoadsND.com – Current Weather

- 1-, 2- & 7-Day rain totals
- Current temp & wind
- Today's max & min temp
- Today's peak wind gust



WiseRoadsND.com – Counties

- Maps showing all stations in the county
- Links to weather and soil data

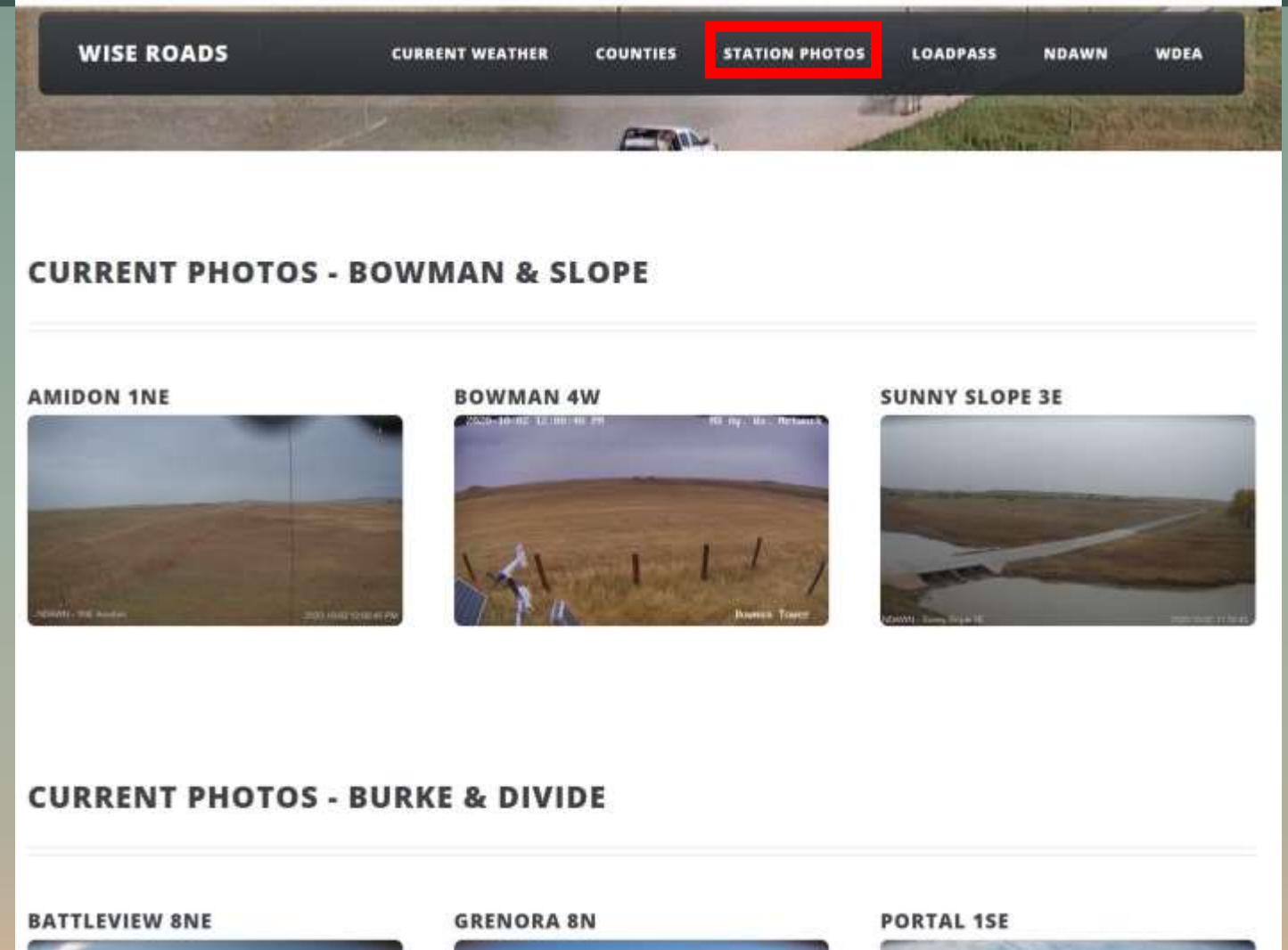
The screenshot shows the WiseRoadsND.com website. The top navigation bar includes links for WISE ROADS, CURRENT WEATHER, COUNTIES (highlighted with a red box), STATION PHOTOS, LOADPASS, NDAWN, and WDEA. Below the navigation bar is a banner image of a truck on a road. The main content area is titled 'MCKENZIE COUNTY' and includes a link to 'MCKENZIE COUNTY RAIN DASHBOARD'. The page is divided into two columns: 'WEATHER DATA' and 'SOIL DATA'. Each column contains a list of links to specific locations. To the right of the main content is a map of McKenzie County showing the locations of the weather and soil data stations.

WEATHER DATA	SOIL DATA
Alexander	Antelope Creek
Antelope Creek	Arnegard
Arnegard	Charbonneau
Banks	Croff
Charbonneau	
Croff	


Map locations: Hawkeye, Charbonneau, Arnegard, Banks, Keene, Watford City, Alexander, Croff, Antelope Creek, Grassy Butte.

WiseRoadsND.com – Station Photos

- Latest camera images sorted by county
- All images are in HD and downloadable



NDAWN.org – Current Weather



North Dakota Agricultural Weather Network

NDSU

NDSU Agriculture

NDSU School of Natural Resource Sciences

NDAWN » Current weather

NDAWN

HELP

WEATHER DATA

Current

Hourly

Daily

Weekly

Monthly

Yearly

NWS Daily Normals

NWS Monthly Normals

Monthly Report

Deep Soil Temperatures

Soil Moisture

APPLICATIONS

ACCOUNT

Current Weather

Show information

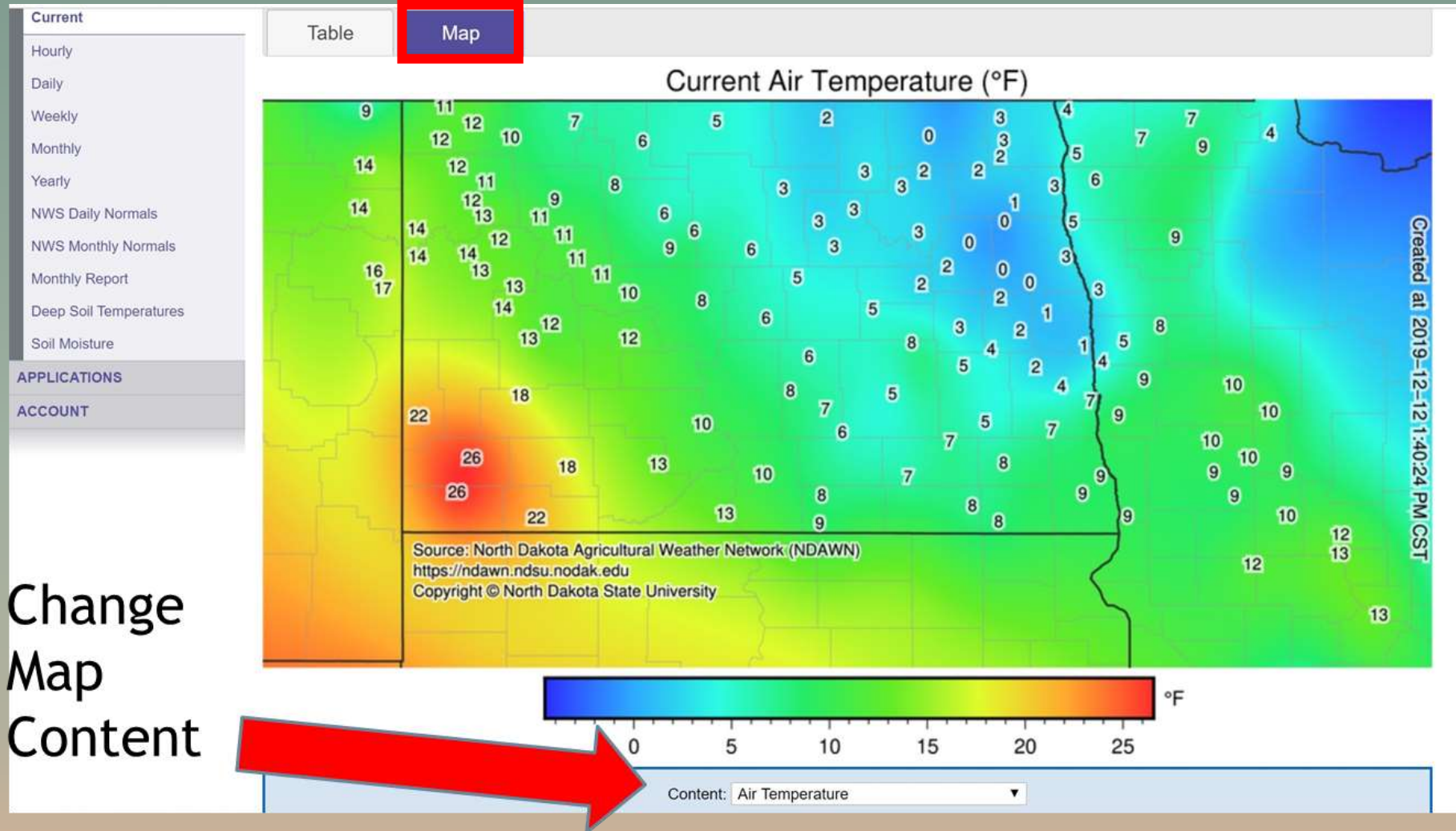
Table

Map

☒ Show data from additional heights

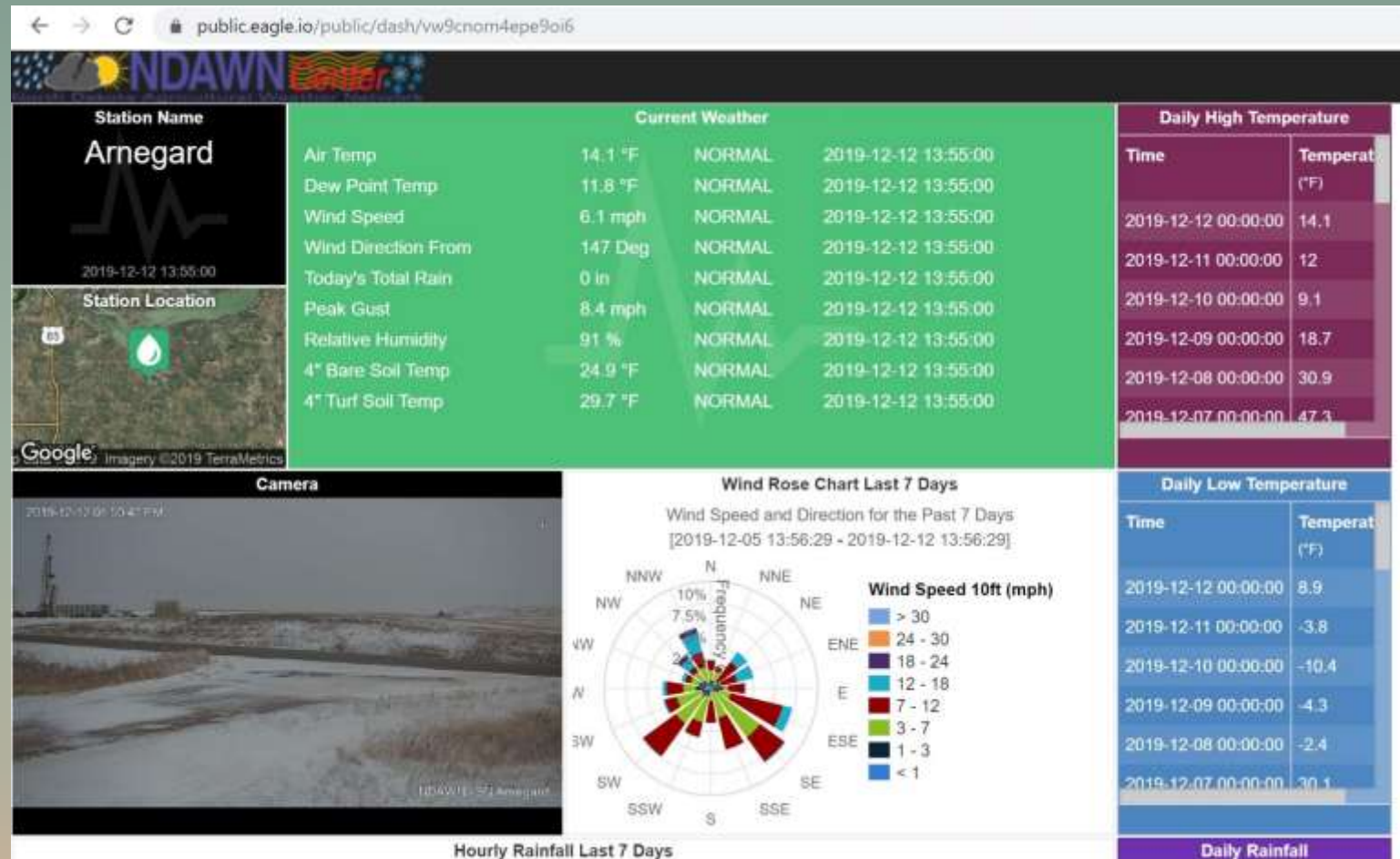
Current																	
Station	Ag District	Last Updated	Air Temp	Wind Chill	Wind Dir	Wind Speed	Peak Gust	Rel Hum	Dew Point Temp	Est. Wet-bulb Temp	Est. ΔT	Inversion 9/1.5 m	Inversion 3/1 m	Bare Soil Temp	Turf Soil Temp	Solar Rad	Sea-level Baro Press
Ada 1N	MN-NW	<div><div></div><div>12 Dec 13:35 CST</div></div>	5°	-3°	NW	3 mph	4 mph	82 %	1°	4°	1°	---	-1.9°	33°	33°	253 W/m²	---
Adams 5N	ND-NE	<div><div></div><div>12 Dec 13:35 CST</div></div>	2°	-8°	ENE	4 mph	5 mph	85 %	-2°	1°	1°	0.1°	-0.3°	25°	30°	288 W/m²	1029.1 mb
Alamo 2S	ND-NW	<div><div></div><div>12 Dec 13:35 CST</div></div>	12°	-1°	SSE	9 mph	12 mph	85 %	9°	11°	1°	---	-0.2°	28°	28°	235 W/m²	---
Amidon 1NE	ND-SW	<div><div></div><div>12 Dec 13:35 CST</div></div>	26°	16°	SSE	9 mph	11 mph	86 %	22°	25°	1°	-1.7°	-0.9°	32°	33°	189 W/m²	1016.6 mb
Aremgard 9N	ND-WC	<div><div></div><div>12 Dec 13:30 CST</div></div>	14°	4°	SE	6 mph	8 mph	90 %	11°	13°	1°	---	-0.3°	25°	30°	118 W/m²	---
Baker 1N	ND-NC	<div><div></div><div>12 Dec 13:35 CST</div></div>	-3°	-17°	ESE	14 mph	17 mph	83 %	-2°	2°	1°	---	-0.4°	32°	33°	180 W/m²	1019.7 mb
Beach 9S	ND-SW	<div><div></div><div>12 Dec 13:35 CST</div></div>	22°	11°	SE	8 mph	12 mph	94 %	20°	21°	1°	---	-0.2°	32°	32°	288 W/m²	1019.5 mb
Becker 1W	MN-C	<div><div></div><div>12 Dec 13:35 CST</div></div>	13°	3°	N	5 mph	7 mph	79 %	8°	12°	1°	---	-0.6°	33°	33°	147 W/m²	---
Berthold 5NW	ND-NW	<div><div></div><div>12 Dec 13:35 CST</div></div>	8°	-5°	SE	7 mph	10 mph	85 %	4°	7°	1°	---	-0.2°	27°	28°	246 W/m²	---
Bottineau 14W	ND-NC	<div><div></div><div>12 Dec 13:35 CST</div></div>	5°	-13°	SE	13 mph	16 mph	80 %	0°	4°	1°	---	-0.3°	29°	29°	163 W/m²	1020.7 mb
Boulevard 1N	ND-NW	<div><div></div><div>12 Dec 13:35 CST</div></div>	7°	0°	SE	11 mph	14 mph	82 %	2°	5°	1°	---	-0.4°	28°	28°	150 W/m²	1019.3 mb

NDAWN.org – Current Weather

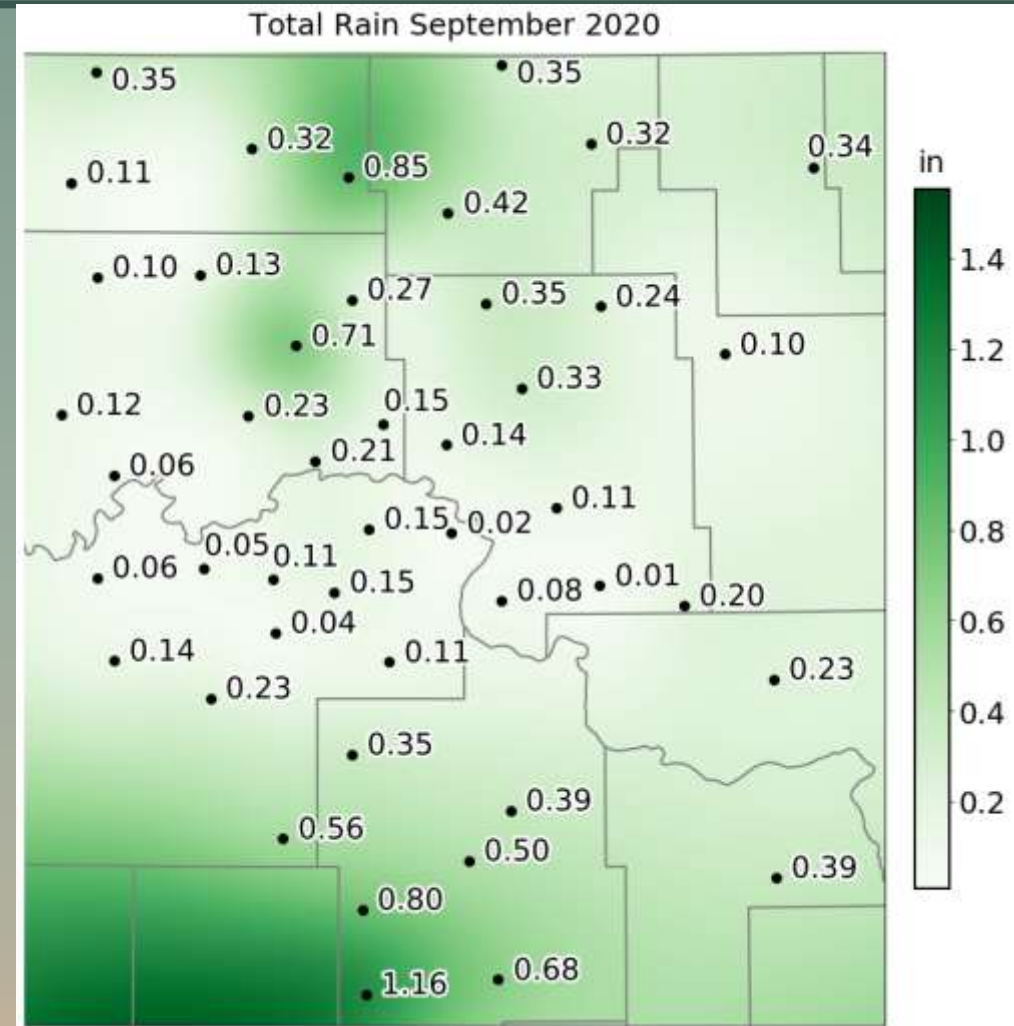
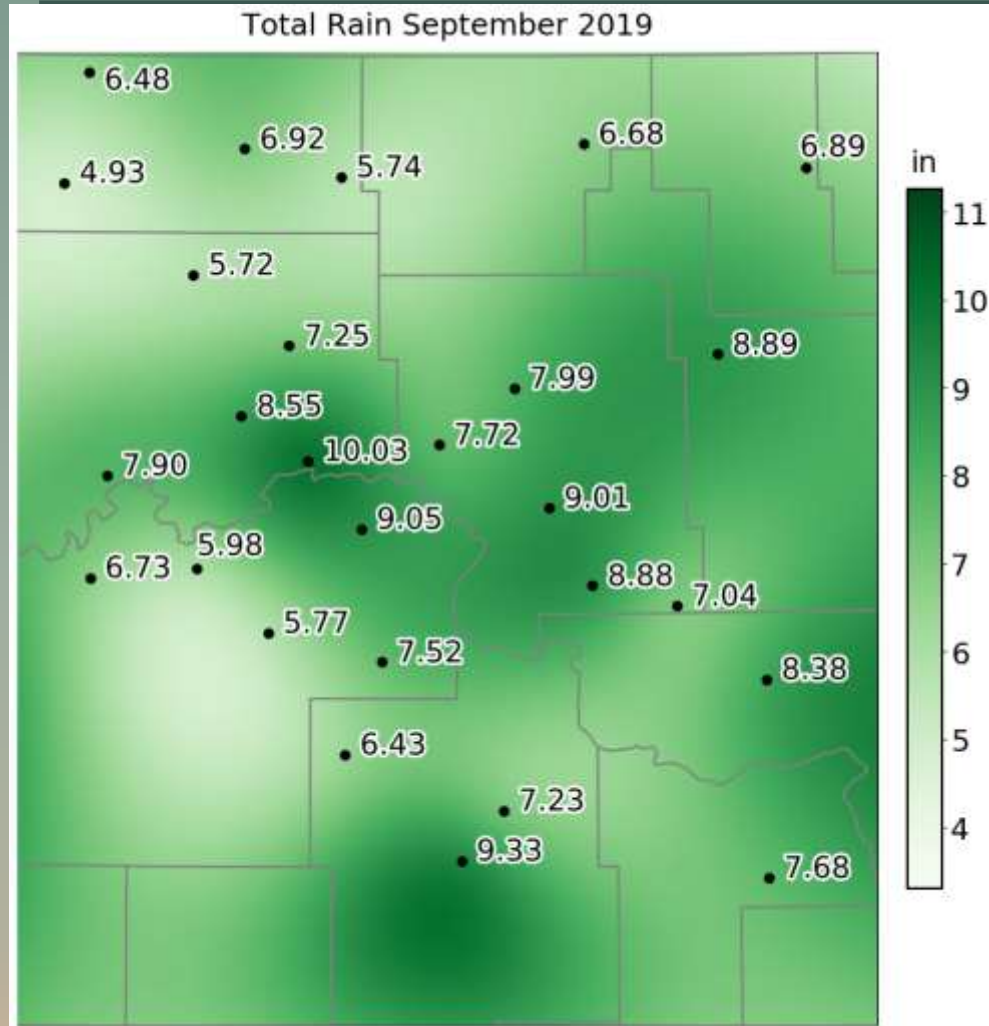


Weather Data Dashboards

- Stationname.ndawn.org
 - ex. Croff.ndawn.org
- Current weather
- Historical daily high/low/rainfall
- Camera image



2019 vs 2020 September Rainfall





North Dakota Oil & Gas Research Council