



Virtual workshop series: Water Resource Management and Irrigation in Kansas

Natural Resources PFT

Kansas Center for Agricultural Resources and the
Environment (KCARE)

Theme 3: Water Resource Management and Irrigation in Kansas

- Offered as a Professional Development Event in PEARS for county extension agents
- 5 sessions in March and April, 8:30 am to 9:30 am
 - The next session is *March 31, 2021*
- **Zoom Meeting ID: 952 6066 1935, passcode: water**

Today's format

- **Please mute** your microphones and sign in using the chat.
- Speakers will present for 30-40 minutes
- Panelists will join the discussion at the end
- Please ask questions through the **chat** function.
- Although our “end time” is posted for 9:30 a.m., participants are welcome to remain longer if they want to discuss the topic further.



Water Resource Management and Irrigation in Kansas

**Climate and weather resources to
support water decisions**

Tuesday, March 30, 2021



KCARE
Kansas Center for Agricultural
Resources and the Environment

K·STATE
Research and Extension

Speakers



Mary Knapp
Climatologist, Kansas State
University



Chip Redmond
Assistant Meteorologist,
Kansas State University

Panelists

David Hallauer, Meadowlark Extension District
Cody Miller, Phillips Rooks Extension District



Kansas Weather & Climate

Water Resources Training

March 30, 2021

Mary Knapp, Assistant State Climatologist

Chip Redmond, Assistant Meteorologist



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Research and Extension

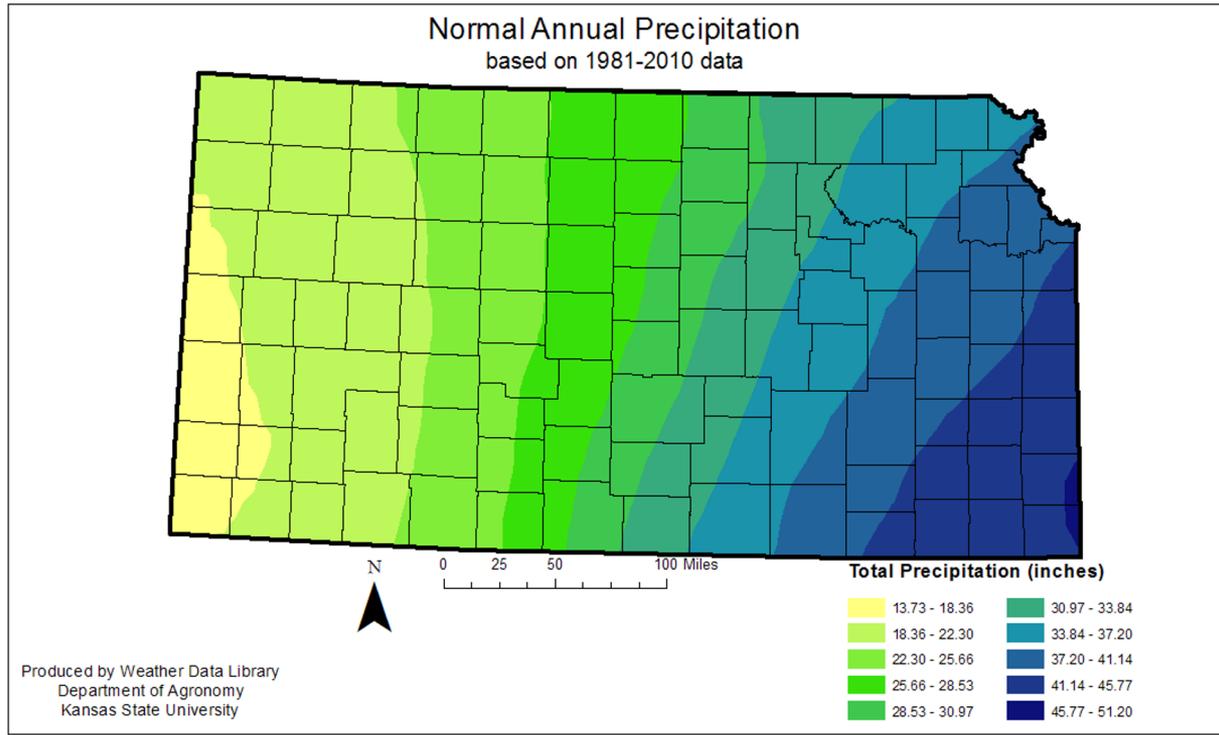
Weather vs. Climate

- Climate is the weather trend over long periods of time
 - Decades
 - Centuries
- Weather is the day to day state of the atmosphere
 - Short term
 - Immediate impact

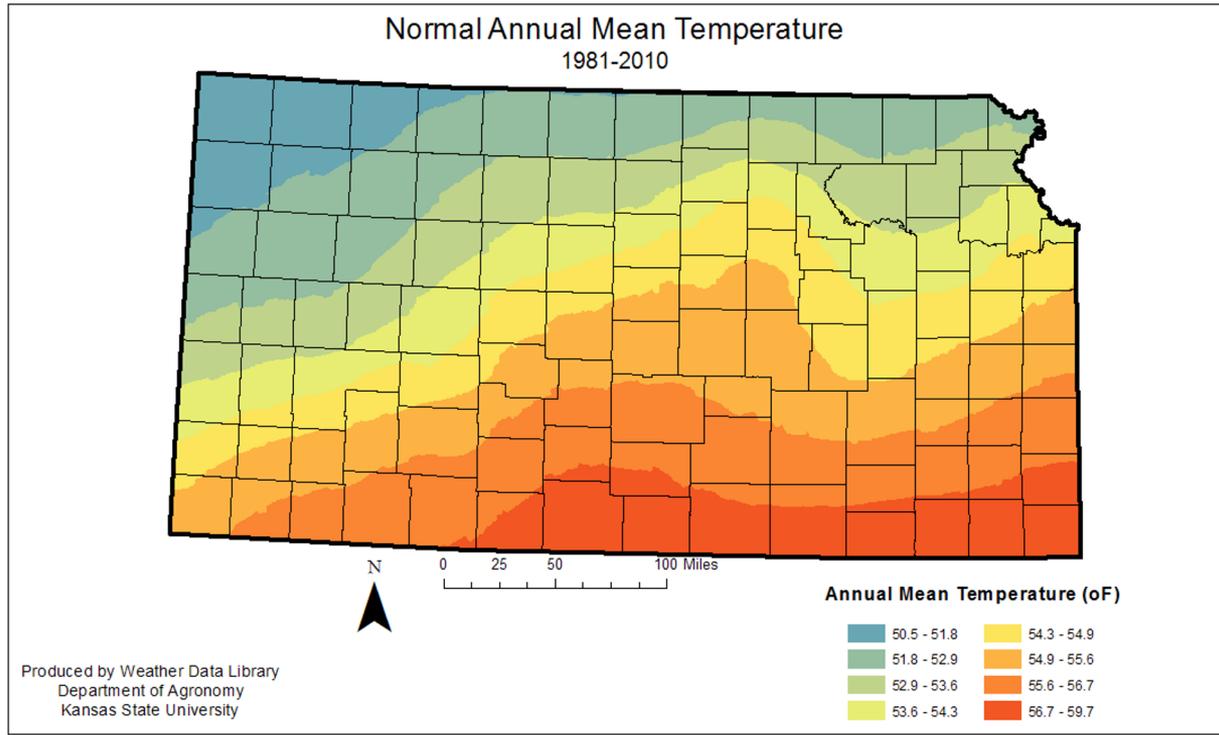
Terminology

- “Normals”
 - 30 year averages updated every 10 years
- Serves as baseline to measure change
- Current US “Normals” use 1981-2010
- Updated normal 1991-2020 to be released in May

Seasonal Precipitation



Temperature



Impacts

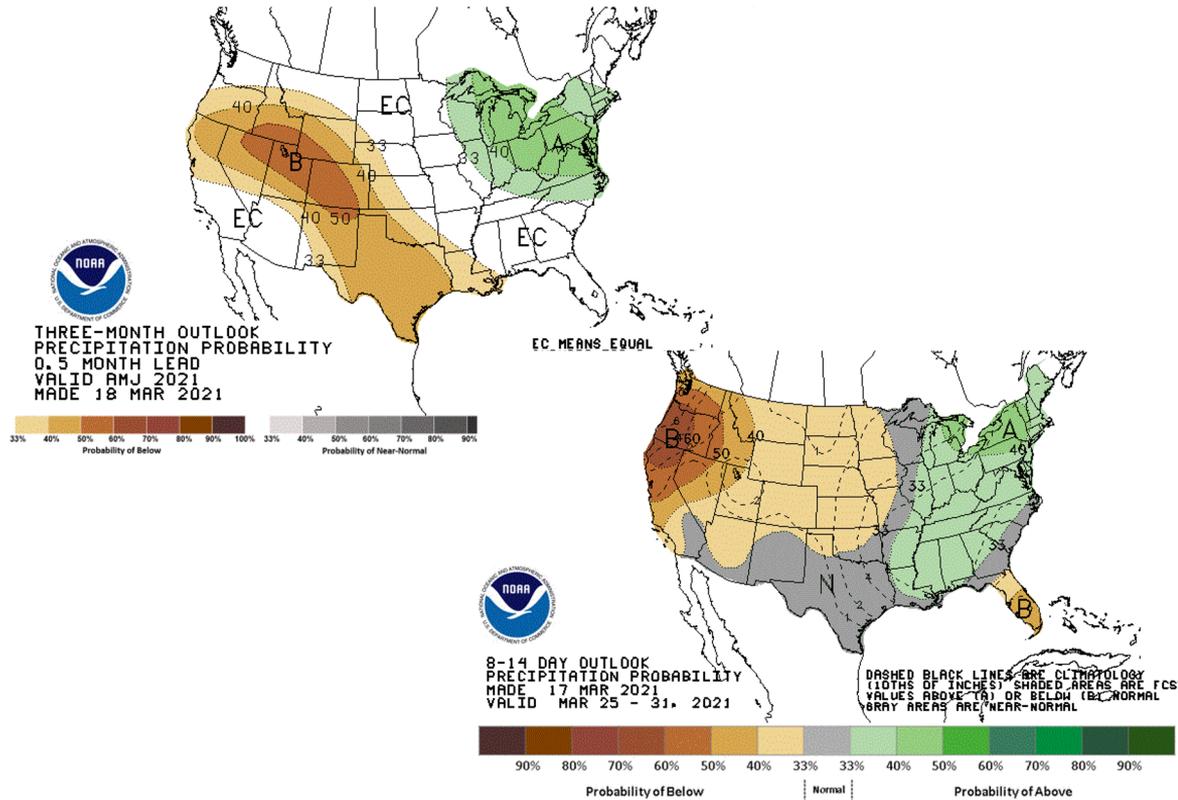
- Increased wind erosion potential
- Stress on Winter Wheat
- Falling surface water supplies – particularly stock ponds
- Increased fire danger



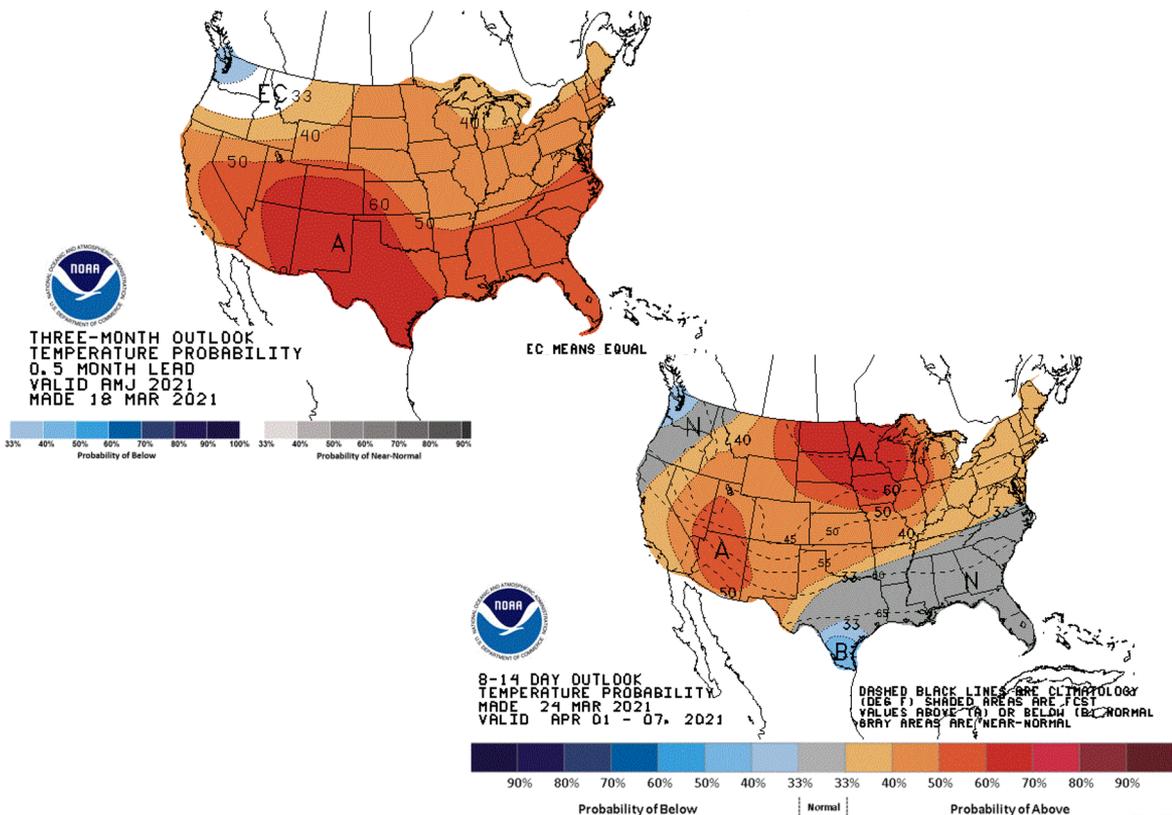
Finding Climate Data

- Kansas Climate website
 - <http://climate.k-state.edu/>
- National Climate website
 - <https://climate.gov/>
 - <https://www.ncdc.noaa.gov/climate-monitoring/>
- Climate Prediction Center
 - <https://www.cpc.ncep.noaa.gov/>

Understanding Climate Outlooks



Understanding Climate Outlooks



KCARE

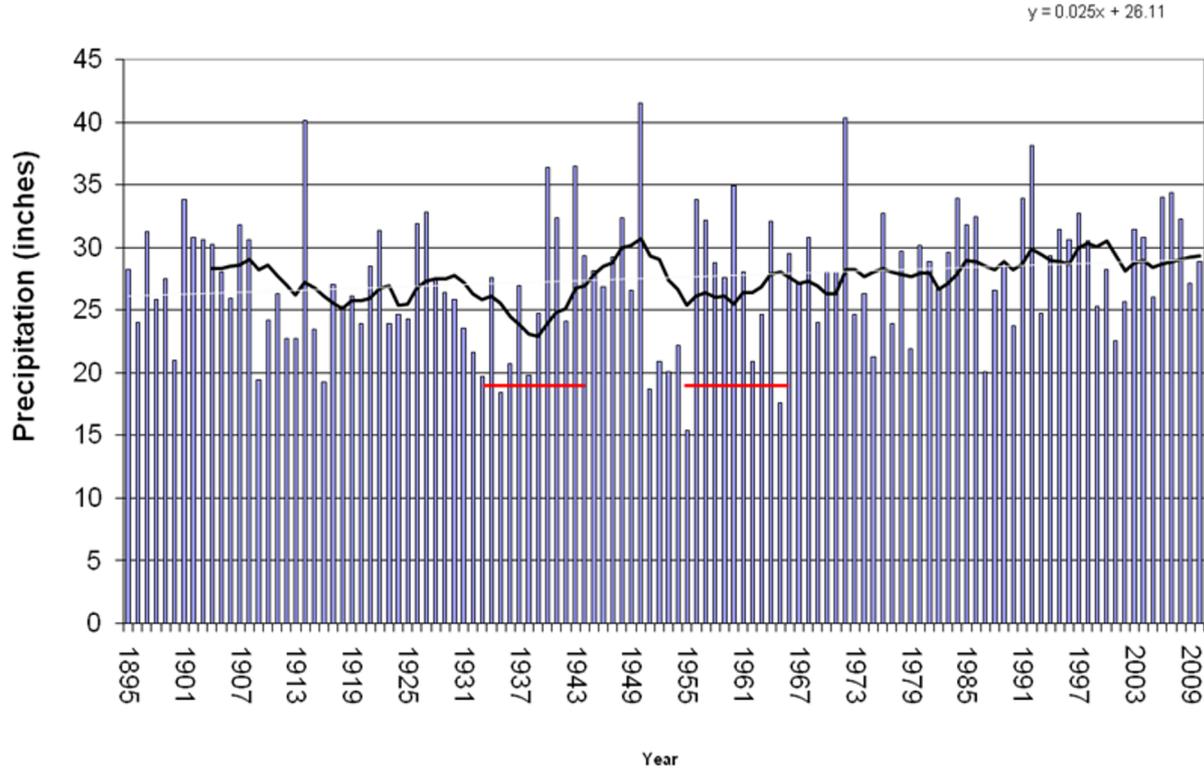
Kansas Center for Agricultural Resources and the Environment

STATE
 Research and Extension

Climate Variability & Change

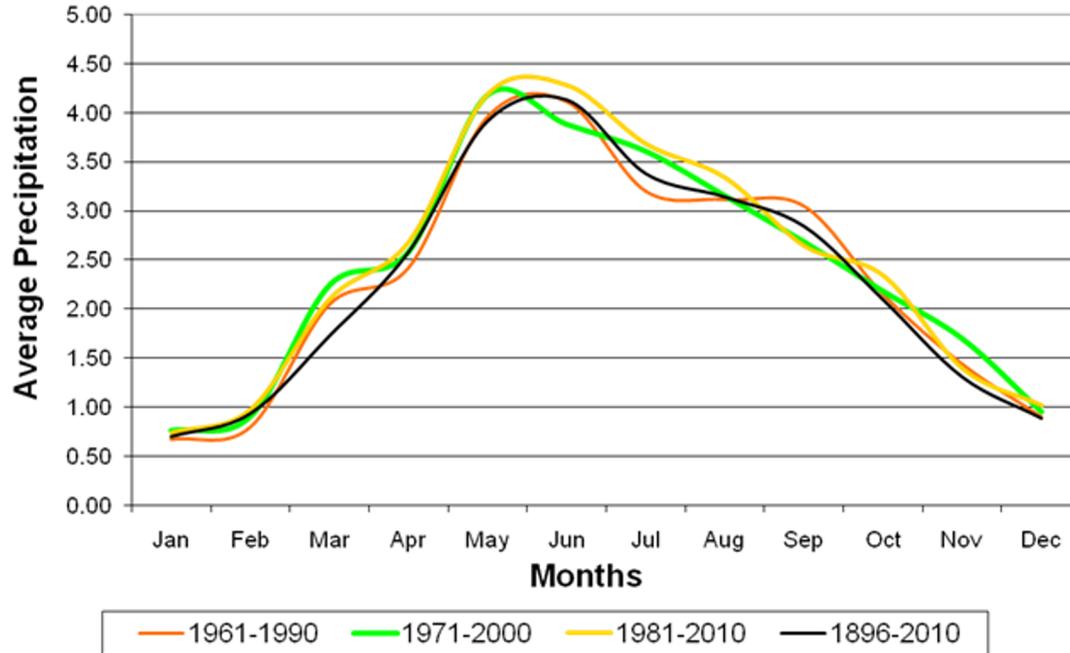
- What is changing and how it manifesting
 - Increase in average precipitation
 - Warming temperatures
 - Mostly winter time
 - Mostly increased low temperatures
 - Increased variability
 - Slight increase in average growing season length

Kansas Annual Rainfall

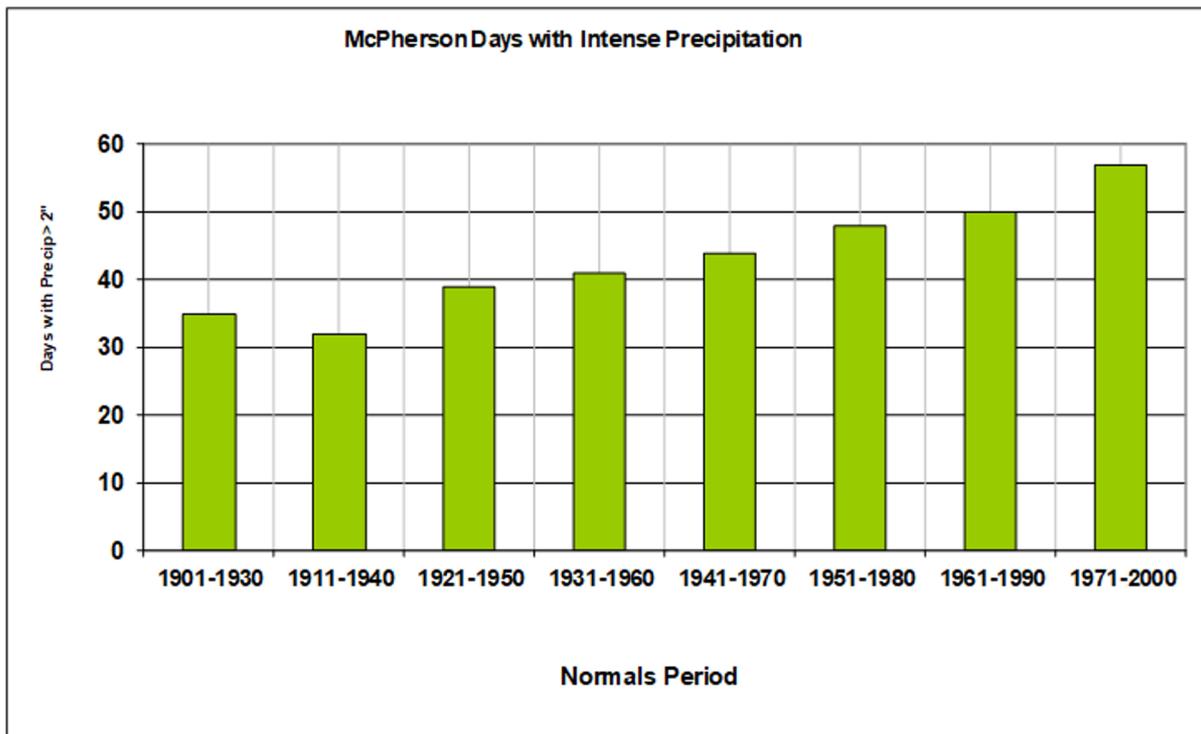


Seasonality

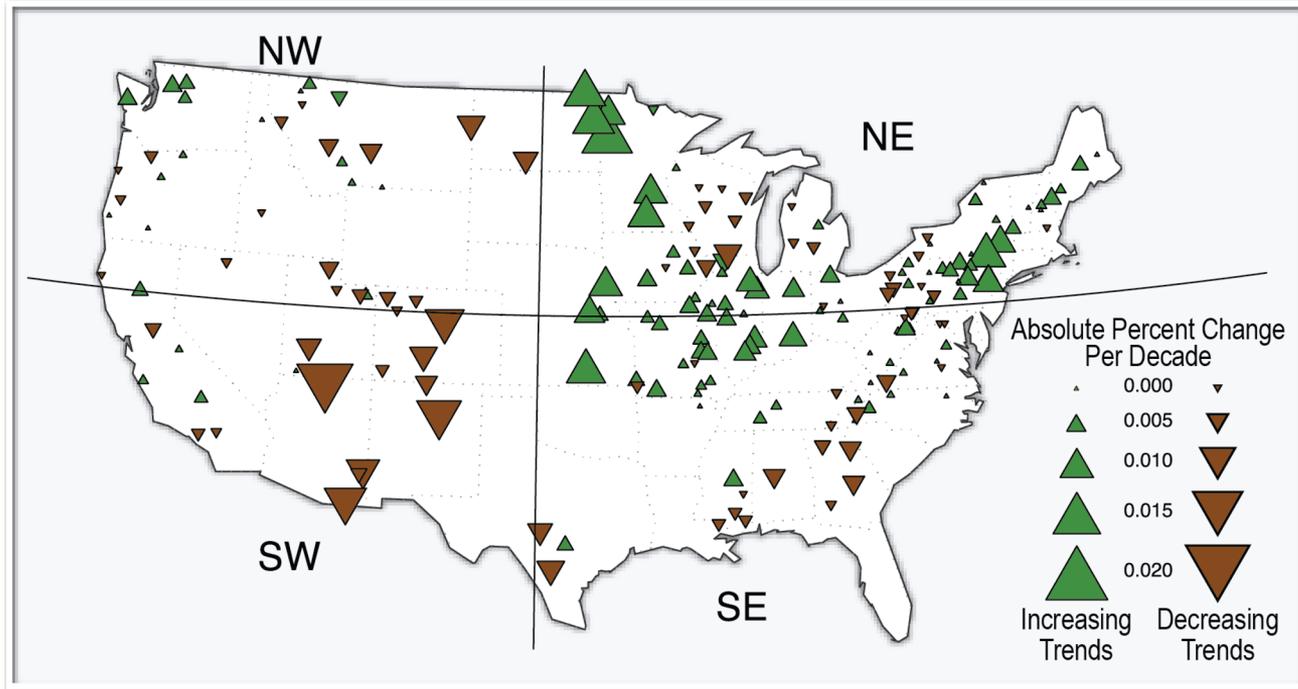
Kansas 30 Year Rainfall Pattern



McPherson, KS



Trends in Flood Magnitude



Third National Climate Assessment Report

3 September 2018 Manhattan, KS



Resources

- National Weather Service
 - <http://weather.gov>
- Climate
 - <http://climate.gov>
- Climate Predication Center
 - <http://www.cpc.ncep.noaa.gov/>
- Community Collaborative Rain Hail Snow (CoCoRaHS)
 - <http://cocorahs.org/>

Contact Information

Weather Data Library

- E-mail: kansas-wdl@k-state.edu
- URL: mesonet.k-state.edu
- URL: climate.k-state.edu

Weather, Related Datasets to Water Resources

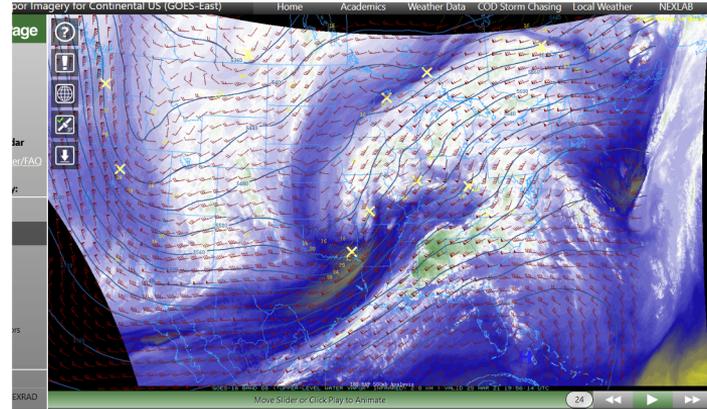
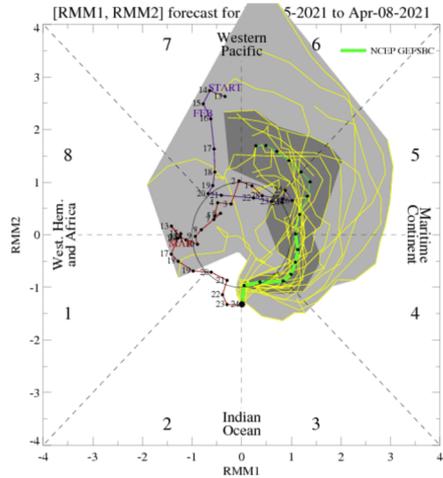


3/30/21

Chip Redmond - Assistant Meteorologist, Mesonet Manager

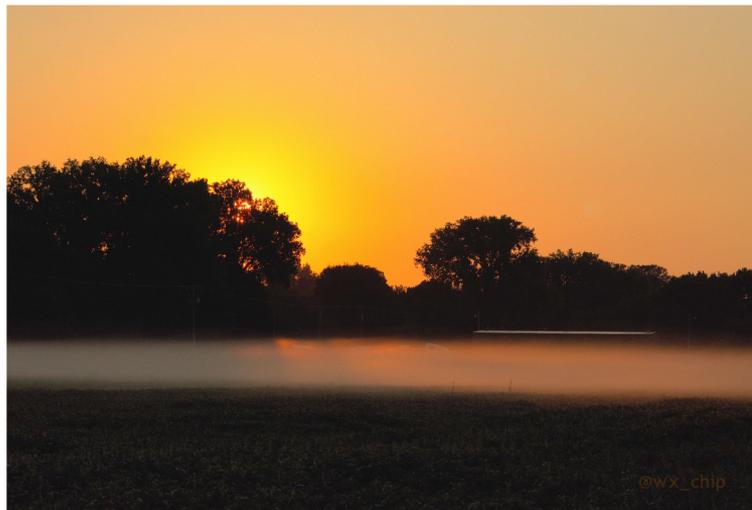


Weather data comes in many forms



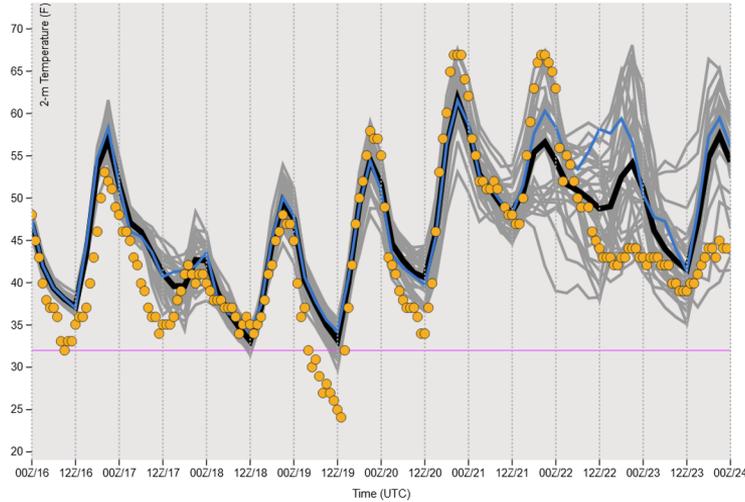
Some data isn't forecastable

- Evapotranspiration
- Inversions
- Irrigation needs



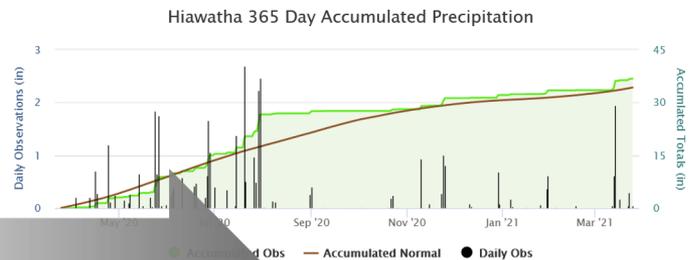
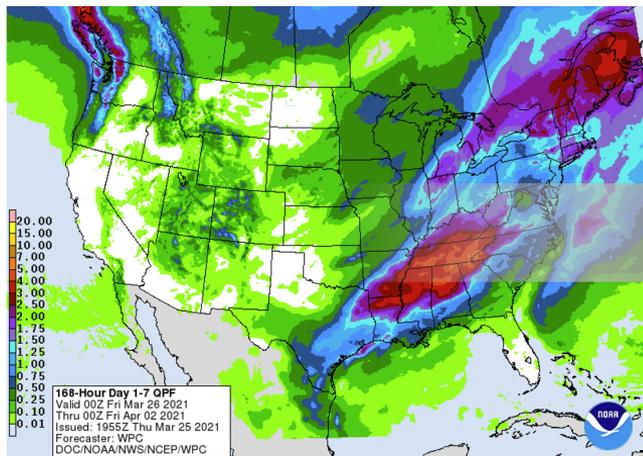
Observations play a critical role in forecast accuracy

EMC's GEFS plumes for KHYS
00 UTC 16 March 2021 cycle





Data user must bridge between forecast & observations



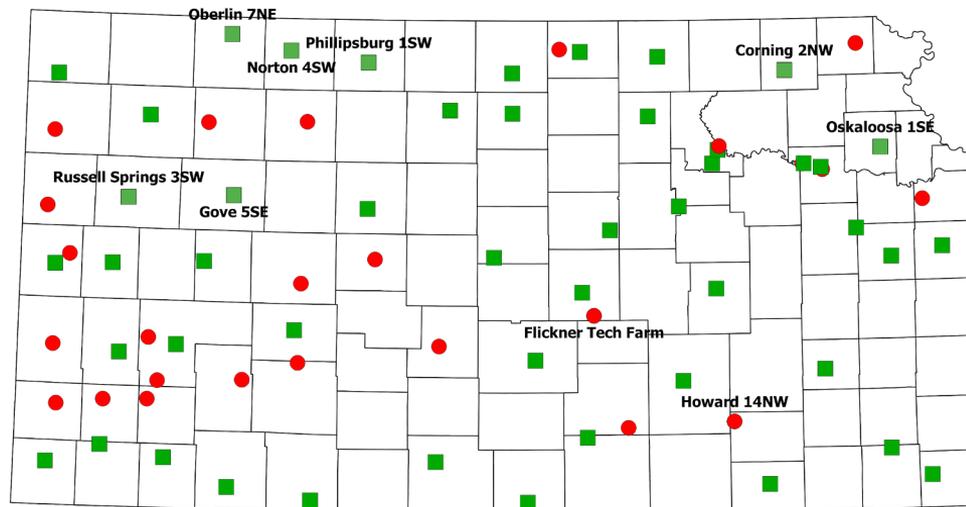
<https://www.bestinhorticulture.co.uk/media/c/pg/2551/1598804650/rc/1000/562/75/an-impromptu-rain-gauge.jpg>

Observations critical - automated or manual

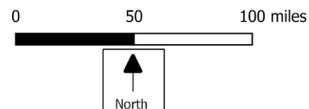




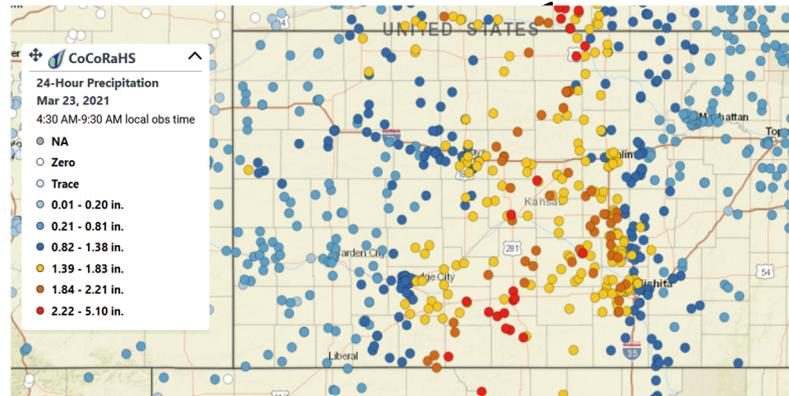
2020 K-State Kansas Mesonet Additions (10/15/20)



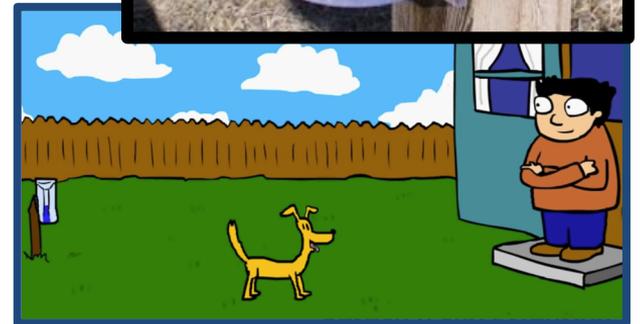
Station Type
● 10 ft. Tripod
■ 30 ft. Tower



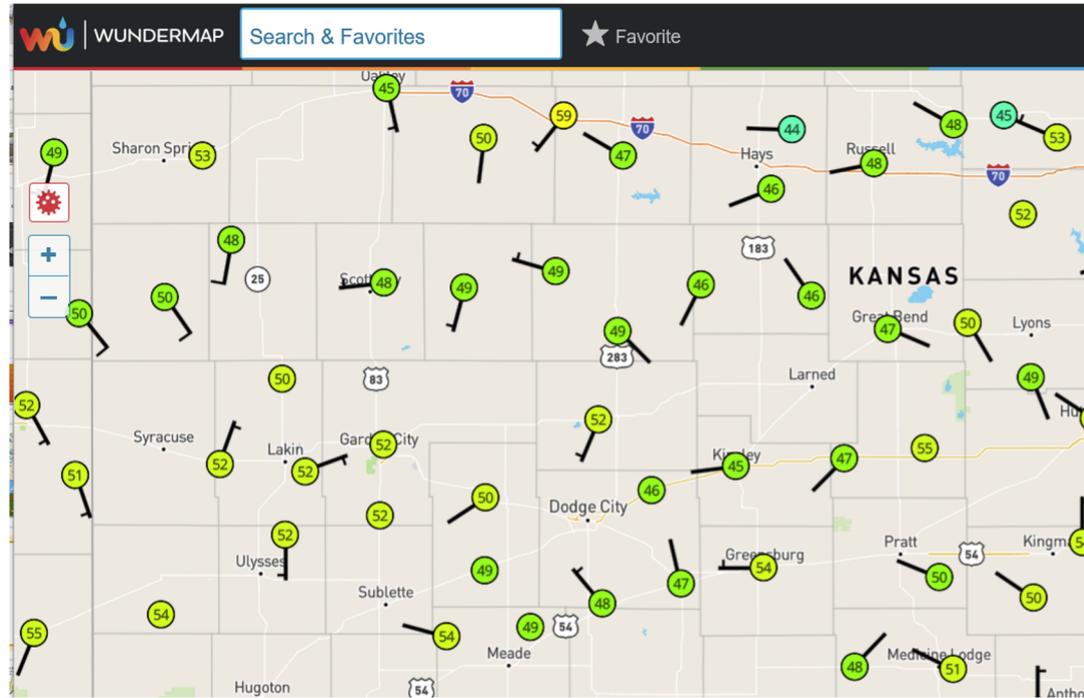
Kansas State University Weather Data Library (WDL) Weather Station Mesonet
As of: 10/15/2020
Created by: Christopher Redmond - WDL Manager
christopherredmond@k-state.edu
785-477-6204
mesonet.k-state.edu



<https://www.cocorahs.org/>



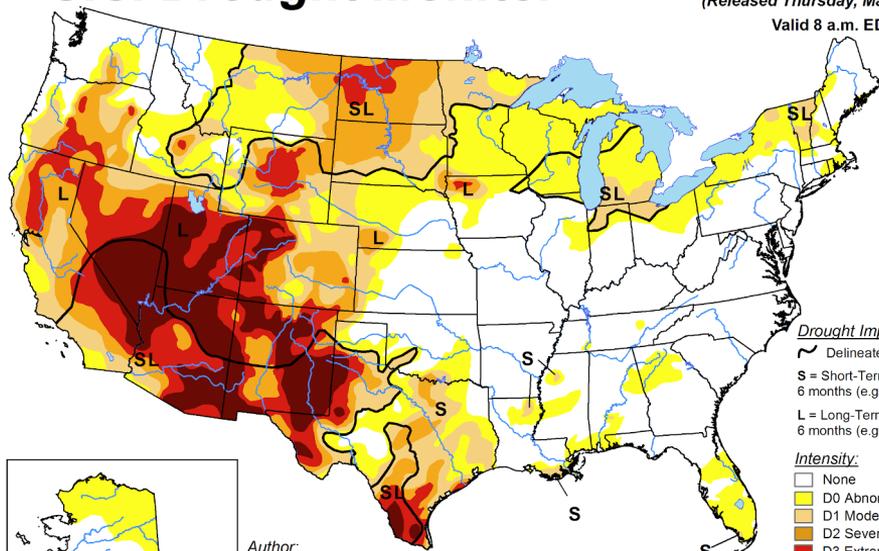
Weather apps





U.S. Drought Monitor

March 23, 2021
(Released Thursday, Mar. 25, 2021)
Valid 8 a.m. EDT

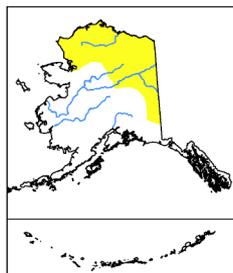


Drought Impact Types:

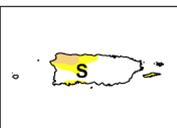
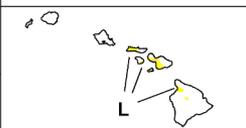
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



Author:
Brad Pugh
CPC/NOAA



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



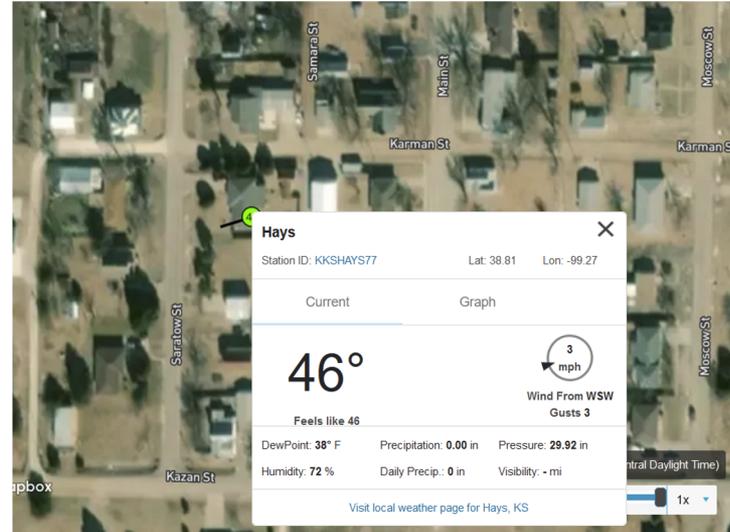
droughtmonitor.unl.edu



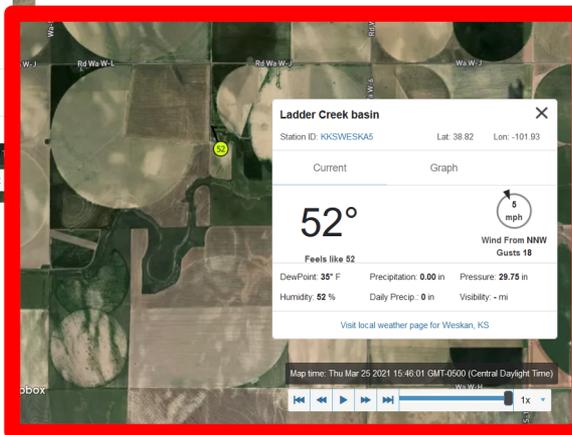
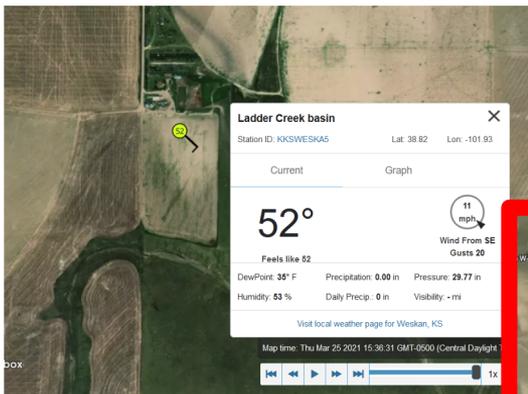
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Local “micro-nets” best for small scale management



Understanding of local factors important



Wallace	
Station Metadata	
Temperature	49 °F
Dewpoint	33 °F
Humidity	55%
24-hr Precip	0 inches
Wind	SSW at 14 mph
SLP	1010.4 mb
Last Observed	3:30 PM CDT

Wallace	
Station Metadata	
Temperature	50 °F
Dewpoint	34 °F
Humidity	54%
24-hr Precip	0 inches
Wind	SSW at 13 mph
SLP	1010.0 mb
Last Observed	3:45 PM CDT



Know where you get your data and its quality!



Ralphs Weather OBS @WeatherNut27 · Mar 24

My Backyard Data for this month so far:

Coldest Day was the 2nd with a max of 30.9° and a low of 17.1°.
Warmest day was yesterday max of 67.5°
Windiest day was the 14th

Name: City: West Norwalk State: Connecticut
Elevation: 260 ft Lat: N 41° 15' 00" Lon: W 073° 50' 00"

Temperature (°F), Rain (in), Wind Speed (mph)

Day	Mean Temp	High	Time	Low	Time	Heat Deg Days	Cool Deg Days	Rain	Avg Wind Speed	Wind High	Time	Dom Dir
1	38.9	44.6	15:48	26.8	23:57	25.6	0.0	0.00	9.9	47.9	23:56	NWN
2	24.1	30.9	16:05	17.1	06:28	45.7	0.0	0.00	10.0	42.6	10:44	NW
3	39.5	47.9	15:49	26.4	00:19	35.4	0.0	0.00	2.7	22.2	14:49	NWN
4	33.7	42.1	11:47	24.1	23:48	30.6	0.0	0.00	6.0	34.1	16:47	NW
5	27.2	34.0	15:49	20.9	06:49	35.1	0.0	0.00	6.5	37.3	16:27	NW
6	27.7	30.8	13:49	23.7	23:19	37.3	0.0	0.00	4.6	25.7	10:19	NW
7	29.1	38.5	15:49	23.6	03:19	36.0	0.0	0.00	2.6	23.5	12:19	NWN
8	28.9	39.9	15:50	19.2	06:20	36.1	0.0	0.00	2.3	20.4	13:50	NWN
9	42.6	59.7	15:50	29.1	00:20	20.6	0.0	0.00	2.9	18.2	15:20	NW
10	40.6	53.6	15:50	28.2	06:20	24.2	0.0	0.00	1.1	8.5	00:20	S
11	53.3	65.0	15:20	37.4	00:20	15.9	0.0	0.00	0.5	12.8	14:20	NWN
12	56.6	65.0	15:50	47.7	23:50	8.4	0.0	0.00	5.3	25.7	23:50	N
13	38.3	47.7	00:20	30.2	06:16	26.3	0.0	0.00	5.2	34.1	04:20	NWN
14	37.8	48.2	14:48	27.7	23:51	27.0	0.0	0.00	10.4	58.6	14:48	NW

1 3 1



Ralphs Weather OBS @WeatherNut27 · Mar 24

I don't use the stations rain gauge in case your wondering why no precip. Not accurate especially with heavy rains so I disconnected it.

1 1 1

Determine decision points and how data may inform them



Irrigation Resources

- Build a mental model with ET, precipitation
 - ET = potential evapotranspiration (calculated, not measured)
 - Mesonet Menu > Weather > Historical Weather > Daily
- Precipitation (graphically)
 - Mesonet Menu > Precipitation > Daily Totals



Historical Weather

- Mesonet
- Weather
- Agriculture
- Precipitation
- Fire
- About
- Kansas Climate Office

- Historical Weather
- Weekly Summary
- Soil Temperature
- Yesterday's Weather
- Degree Days
- Wind Gusts
- Freeze Months
- Heat Index
- Wind Chill
- 2017 Eclipses

Weather Data Library
Kansas Mesonet
Kansas State University
1004 Throckmorton
Manhattan, KS 66506
785-532-7019 or 785-532-3029

Historical Weather

Mesonet Data Policy

English Metric Table Graph CSV SHEF Weather Parameters

Leoti

2020-07-01 — 2020-07-10

	Air Temperature		Relative Humidity	Precip	Wind Speed		2" Soil Temperature		4" Soil Temperature		Solar Radiation	ETo	
	Max °F	Min °F	Avg %	Total inches	Avg mph	Max mph	Max °F	Min °F	Max °F	Min °F	Total ly	Grass inches	Alfalfa inches
07-01	90.6	59.1	56.4	0.26	8.9	26.9	89.1	74.3	85.8	76.5	668.3	0.32	0.44
07-02	98.1	63.8	69.0	0	9.4	34.2	89.7	75.5	85.6	76.9	557.8	0.34	0.48
07-03	91.5	58.2	70.1	1.08	7.9	25.1	81.5	70.2	80.4	73.0	562.5	0.26	0.35
07-04	90.4	58.3	61.8	0	5.9	21.0	88.6	69.7	84.8	72.3	688.5	0.28	0.36
07-05	88.0	64.3	66.7	0	4.8	16.4	87.4	73.8	84.0	75.7	511.5	0.22	0.27
07-06	91.2	62.1	58.0	0	4.5	14.6	92.7	72.6	88.3	74.9	695.0	0.27	0.34
07-07	93.0	64.6	56.5	0	11.3	31.9	91.1	75.7	87.7	77.6	682.8	0.34	0.48
07-08	101.3	64.0	47.4	0	10.1	27.0	92.7	76.0	89.1	78.0	697.9	0.43	0.62
07-09	90.1	64.5	65.3	0	8.2	20.5	91.0	78.0	88.0	79.6	551.1	0.25	0.34
07-10	88.8	69.0	72.5	0	8.0	20.2	87.9	78.6	85.8	79.8	391.9	0.21	0.28
summary	92.3	62.8	62.4	1.34	7.9	34.2	89.2	74.4	86.0	76.4	600.7	2.91	3.97





Historical Weather

- Mesonet
- Weather
- Agriculture
- Precipitation
- Fire
- About

Kansas Climate Office

Daily Totals

Weather Data Library
Kansas Mesonet

Precip Daily Totals

Notice: Recent freezing temperatures may affect precip observations. [Learn more here](#)

Leoti

Station Metadata

Since Midnight 0"

Yesterday 0.03" (-0.03)

2 days 0.03" (-0.09)

7 days 0.49" (0.11)

14 days 2.38" (1.7)

30 days 2.38" (1.26)

120 days 2.77" (0.16)

180 days 2.8" (-2.03)

365 days 13.21" (-6.16)

Change Station

Departure

30 Days

Page Tour

With Funding From
KANSAS CORN

Table

Chart

Departure - 30 Days Through Yesterday

Mesonet Data - Precip at Mar 25 2021 09:40 (CDT)

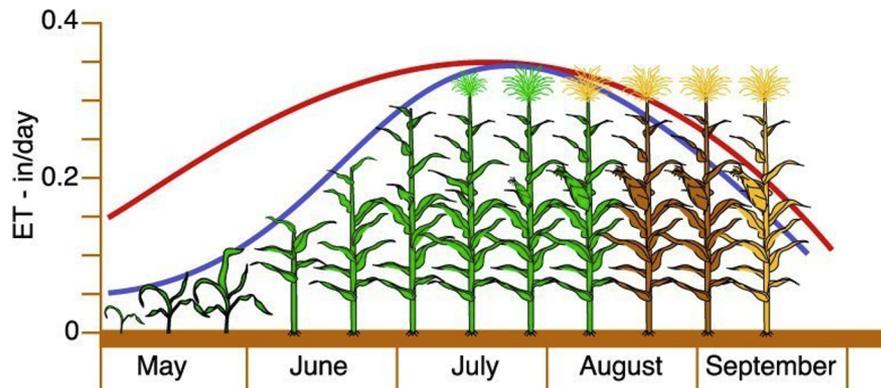
Legend: -12 -10 -8 -5 -4 -3 -2 -1 -0.5 0 0.5 1 2 3 4 5 8 10 12

Leoti 365 Day Accumulated Precipitation

1.8 24



Crop ET versus Reference ET



Mesonet Menu > Agriculture > Degree Days



Degree Days

Page Tour Page Help

Stations

- Ashland 8S
- Ashland Bottoms
- Belleville 2W
- Butler
- Cherokee
- Cheyenne
- Clay
- Colby
- Elmdale 1SE
- Garden City
- Great Bend

Calculation

- Corn GDU
- Long Season Sorghum
- Short Season Sorghum
- Cotton
- Alfalfa Weevil
- Heating Degrees
- Cooling Degrees
- Custom

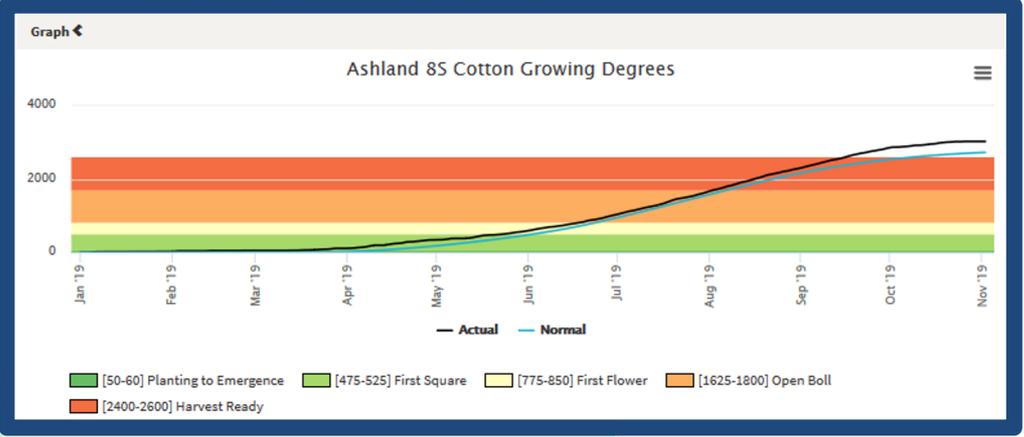
Cotton Equation

2019-01-01 — 2019-11-02

Station	Actual
Ashland 8S	3027
La Crosse	2402
Richfield	2855
Sherman*	2309

*Calculated with missing data. See CSV Data :: Full Data Set for details

[50-60] Planting to Emergence	[475-525] First Square
[775-850] First Flower	[1625-1800] Open Boll
[2400-2600] Harvest Ready	



Water Quality Resources

- Soil moisture and ground saturation
 - Mesonet Menu > Agriculture > Soil Moisture
- Spray tool provides inversion monitoring and wind data
 - Mesonet Menu > Agriculture > Inversion



Soil Moisture

Lane

Station Metadata

5 cm Dry
Percent of Saturation 24%
Vol. Water Content 0.1 m³/m³

10 cm Dry
Percent of Saturation 33%
Vol. Water Content 0.14 m³/m³

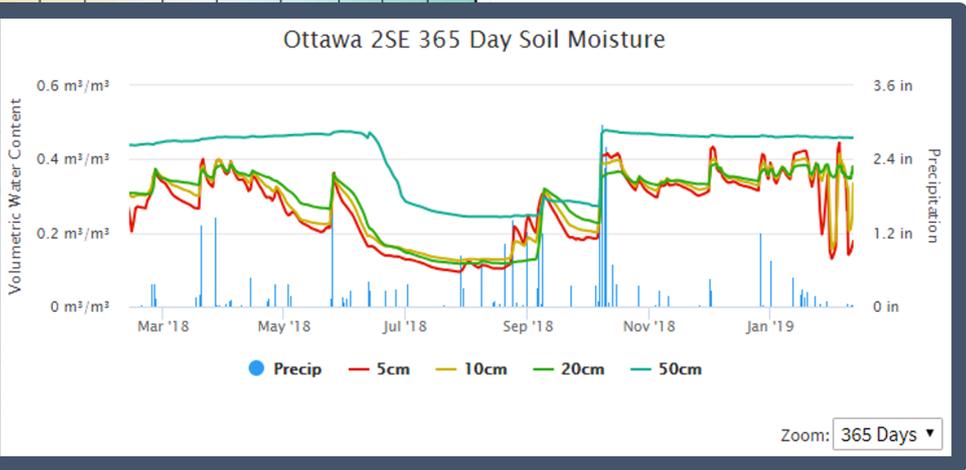
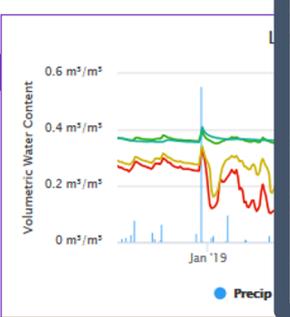
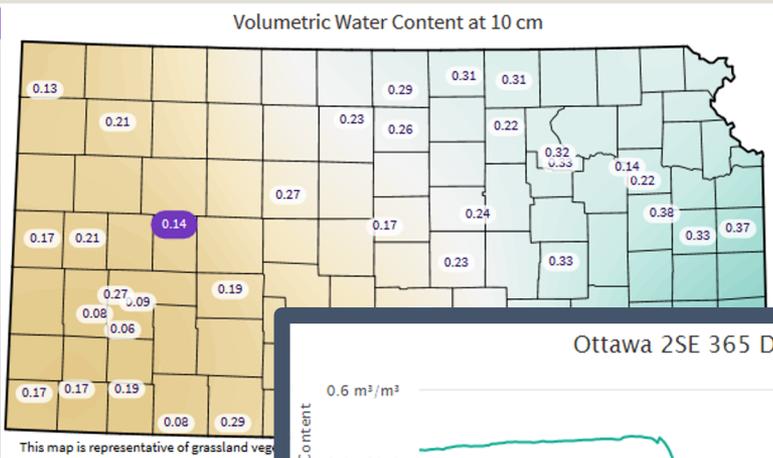
20 cm Wet
Percent of Saturation 56%
Vol. Water Content 0.23 m³/m³

50 cm Wet
Percent of Saturation 64%
Vol. Water Content 0.27 m³/m³

Change Station

10 cm WWC

Page Tour





Inversion

Garden City

Station Metadata

Current Observations

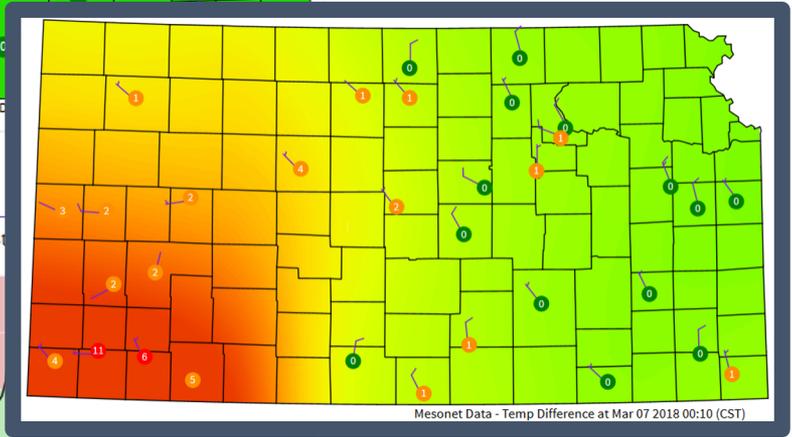
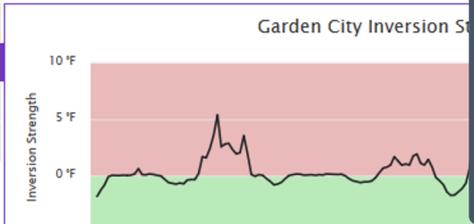
2m Temp 66 °F
10m Temp 64 °F
Difference -2 °F
Inversion **No**
Wind N at 3mph
Last Observed 03:30 PM CST

Change Station
Change Map
Page Tour

Temp Difference



- Table
- Chart**
- Download
- Resources





Livestock

- During periods of excessive heat, water availability
 - Mesonet Menu > Agriculture > Animal Comfort
- Saturated soils increase cattle health concerns
 - Mesonet Menu > Agriculture > Soil Moisture
- Water retention ponds and surface water resources
 - Pan evaporation



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Resources and the Environment

Animal Comfort

Use the "Page Tour" button or click here to get started.

Hodgeman

Station Metadata

Current Observations

Stress Level: **Moderate**

Comfort Index: 87°F

Temperature: 81°F

Windspeed: 7 mph

Rel. Humidity: 55%

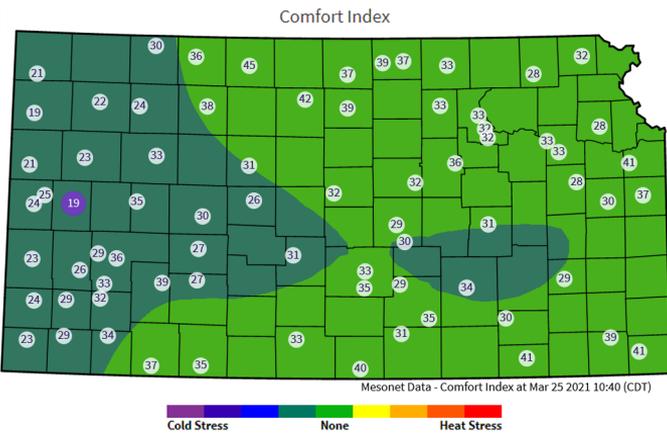
Solar Radiation: 626 W/m²

Last Observed: 10:20 AM CDT

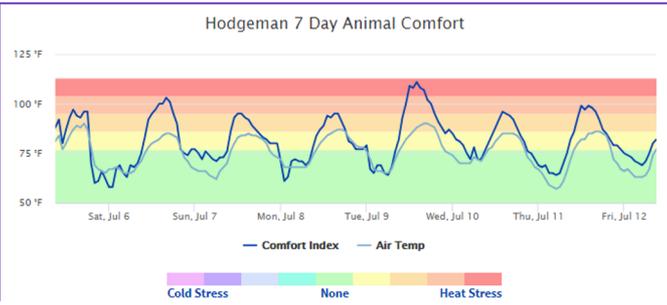
Change Station

Change Map

Page Tour



- Table
- Chart**
- Download
- Resources



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Research and Extension



Utilizing Forecast Data

- Weather FRET (forecast reference ET) data
 - <https://digital.weather.gov/mobile/index.php>
 - <https://digital.weather.gov/?zoom=4&lat=37&lon=-96.5&layers=F00BTTTFTT®ion=0&element=42&mxmz=false&barbs=false&subl=TFFFF&units=english&wunits=nautical&coords=latlon&tunits=localt>
- National Weather Service (weather.gov)
- Phone apps 🗓️

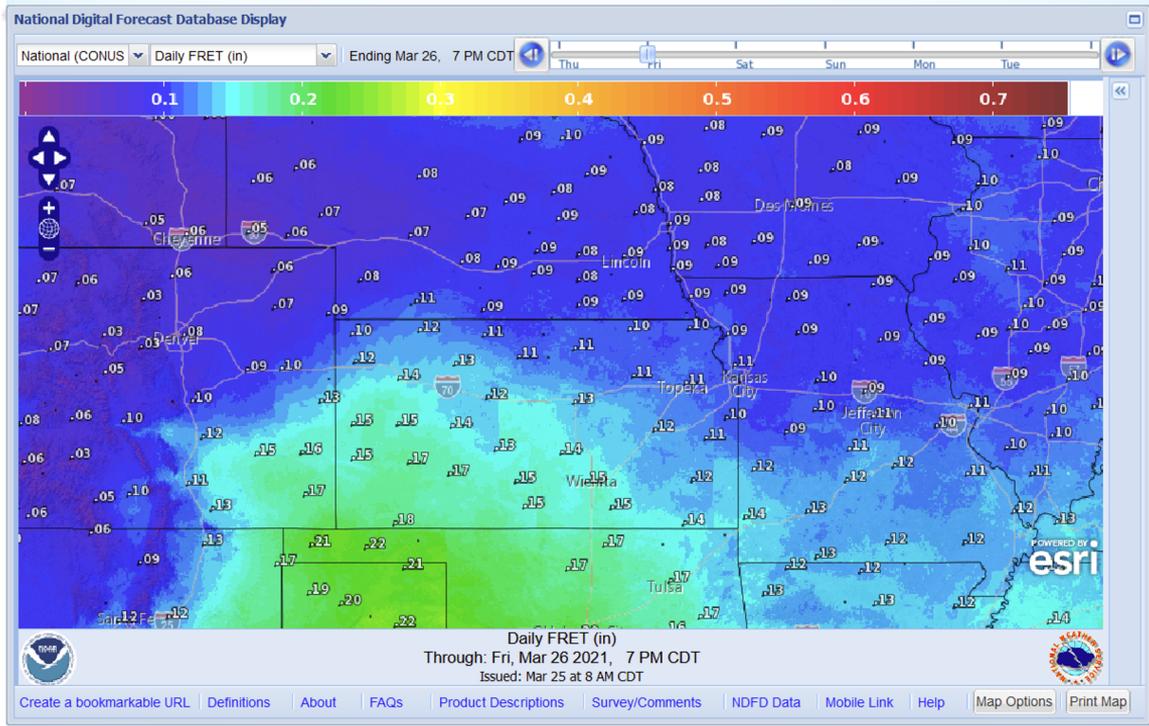


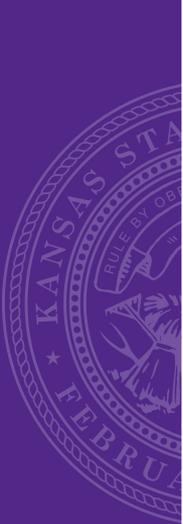
Graphical Forecasts

Weather.gov - National Digital Forecast Database Graphical Forecasts

National Weather Service

National Headquarters





NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Local forecast by 7:16 5C or 32P code
[Enter location] [GO]
Location Help

Major Severe Weather Outbreak Today for the Mid South and Tennessee Valley
A major severe weather outbreak is likely today in the Mid South and Tennessee Valley, especially in central and northern Mississippi, northern Alabama and western and middle Tennessee. Numerous tornadoes (several intense and long track), widespread damaging winds (some hurricane force), and scattered large hail (some baseball size) are expected with these intense thunderstorms. Be Weather Ready! [Read More >](#)

#Safe Place Selfie

ACTIVE ALERTS FORECAST MAPS RADAR RIVERS, LAKES, RAINFALL AIR QUALITY SATELLITES

Customize Your Weather.gov

City ST
Enter Your City, ST or ZIP Code
Remember Me
Get Weather
History Map

NWS Forecast Office Wichita, KS
[Weather.gov](#) > Wichita, Kansas

Current Hazards Current Conditions Radar Forecasts Rivers and Lakes Climate

Click a location below for detailed forecast.

[Matches, Warnings & Advisories](#)

[Hazardous Weather Outlook](#)

Last Map Update: Thu, Mar. 25, 2021 at 5:23:18 pm CDT

weather.gov

Current conditions at
Lt. William M. Milliken Airport (K13K)
Lat: 37.85°N Lon: 96.29°W Elev: 1208ft

Overcast
49°F
9°C

Humidity 78%
Wind Speed NE 6 mph
Barometer 29.77 in
Dewpoint 42°F (6°C)
Visibility 10.00 mi
Wind Chill 46°F (8°C)
Last update 25 Mar 5:15 pm CDT

More information:
[Local Forecast Office](#)
[More Local Wx](#)
[3 Day History](#)
[Mobile Weather](#)
[Hourly Weather Forecast](#)

Extended Forecast for
8 Miles SW Piedmont KS

Tonight	Friday	Friday Night	Saturday	Saturday Night	Sunday	Sunday Night	Monday	Monday Night
Low: 38 °F	High: 68 °F	Low: 48 °F	High: 66 °F	Low: 40 °F	High: 65 °F	Low: 43 °F	High: 70 °F	Low: 50 °F

Detailed Forecast

Tonight Patchy fog after 1am. Otherwise, cloudy during the early evening, then gradual clearing, with a low around 38. Northwest wind around 6 mph becoming calm.

Friday Patchy fog before 10am. Otherwise, mostly sunny, with a high near 68. Breezy, with a southeast wind 6 to 11 mph increasing to 16 to 21 mph in the afternoon. Winds could gust as high as 29 mph.

Topographic
Click Map For Forecast



Weather Data Library

- E-mail: kansas-wdl@k-state.edu
- URL: mesonet.k-state.edu
- URL: climate.k-state.edu



Questions and Discussion



KCARE
Kansas Center for Agricultural
Resources and the Environment

K-STATE
Research and Extension

Water resource management and irrigation in Kansas

Upcoming session: Wednesday, March 31, 8:30am

Topic: Innovative water management technologies

Presenters: Andres Patrignani, K-State Department of Agronomy; Ray Flickner, Flickner Innovation Farm, Moundridge; Jeff Davidson, KCARE Watershed Specialist

Hosted by: Natural Resources PFT and KCARE