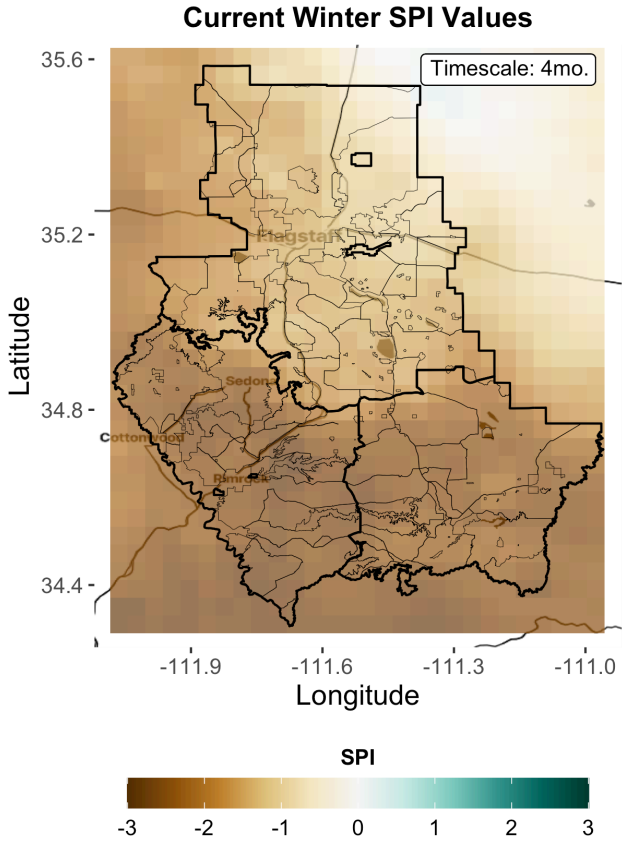
Coconino National Forest Climate Report: January 2025

Highlights

- The current average 4-month (October-January) Standardized Precipitation Index (SPI) for Coconino National Forest is **-1.96 (Very Dry)**.
- Average October-January precipitation was 2.13 inches, which was **-5.06 inches** different from the long-term average. This value ranks 126th out of 131 years in total precipitation (Rank 1 is the wettest year).
- Average October-January temperature was 42.8 degrees F, which was **+2.4 degrees F** different from the long-term average. This value ranks 16th out of 131 years in average temperature (Rank 1 is the warmest year).
- The 1-month outlook for March predicts a **33-40% chance of drier-than-average precipitation** and a **33-40% chance of warmer-than-average temperatures**. The 3-month seasonal outlook for March-May predicts a **50-60% chance of drier-than-average precipitation** and a **40-50% chance of warmer-than-average temperatures**. (More information at NOAA Climate Prediction Center, https://www.cpc.ncep.noaa.gov/)

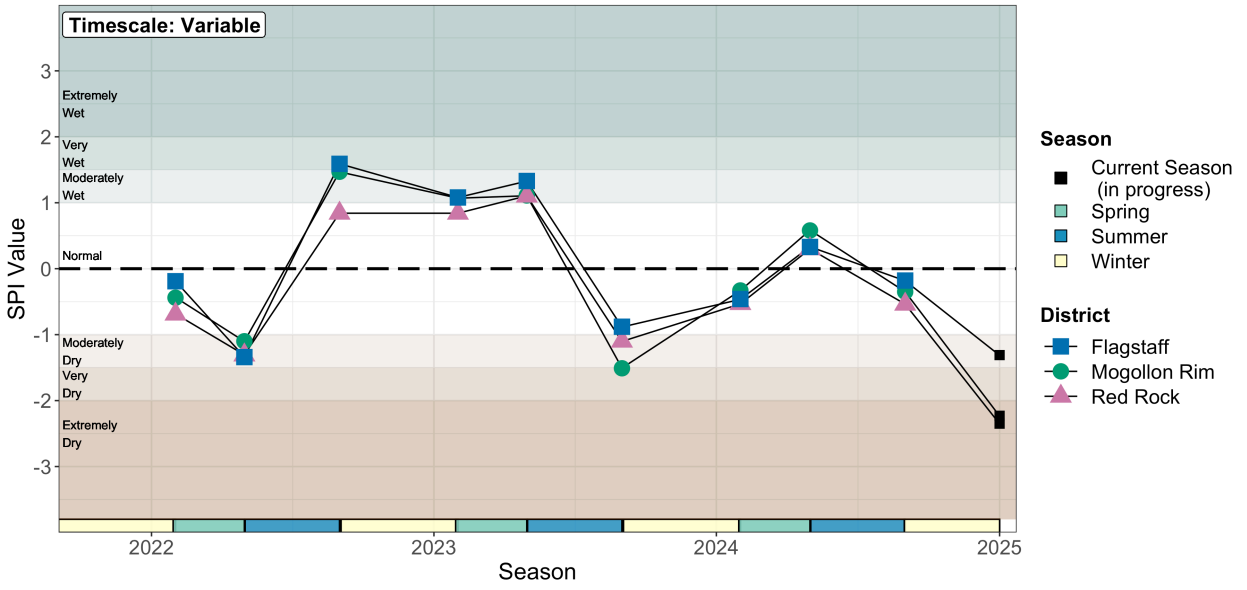


	Total Precip [in.]	Precip Anom [in.]	Temp Anom [F]	SPI	SPI Area < -1 [%]
Coconino National Forest	2.13	-5.06	2.41	-1.84	79.7
Mogollon Rim	1.66	-6.44	2.53	-2.23	100
Red Rock	1.17	-5.14	3.16	-2.35	100
Flagstaff	2.95	-4.22	1.9	-1.31	76.8

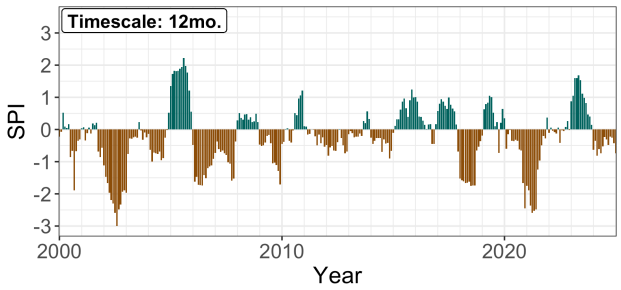
Figure 1: [Left] Coconino National Forest Standardized Precipitation Index (SPI) values for Winter 2025 (January 4mo. timescale). [Right] Table summarizing climate statistics for Winter 2025 (October - January). Note: Season in progress - partial statistics being reported.

Seasonal Progression Summary

This section contains seasonal drought information for the Coconino National Forest. Season lengths are based on historical climatology and typical land management schedules. Season lengths are as follows: Winter (Oct-Feb); Spring (Mar-May); Summer (Jun-Sep); Fall (-). Note: Current season statistics may be partial if season is in progress. Winter 2025 values are currently summarized from Oct-Jan.



	Total Precip [in.]	Precip Anom [in.]	SPI	SPI Area < -1 [%]	Mean Temp [F]	Temp Anom [F]	SPEI
Fall							
Winter*	2.13	-5.06	-1.84	90.9	42.8	2.4	-1.29
Spring	4.32	0.43	0.39	0	47.9	-0.2	0.72
Summer	6.63	-0.93	-0.32	2.2	70.6	4	-1.34
12mo	16.82	-3.89	-0.74	16	52.8	2.2	-0.88



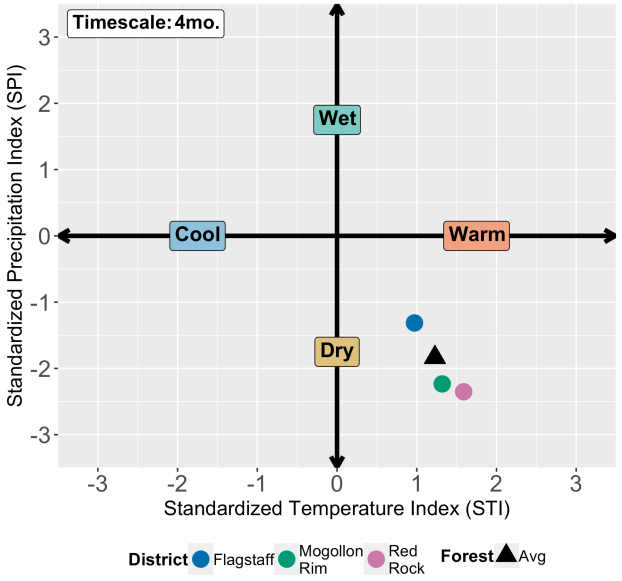
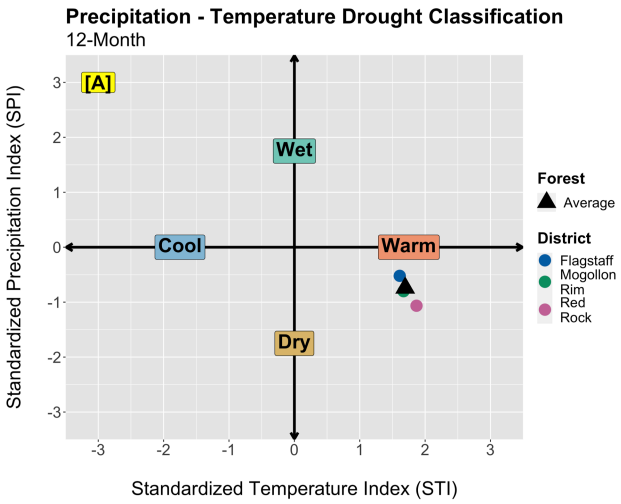


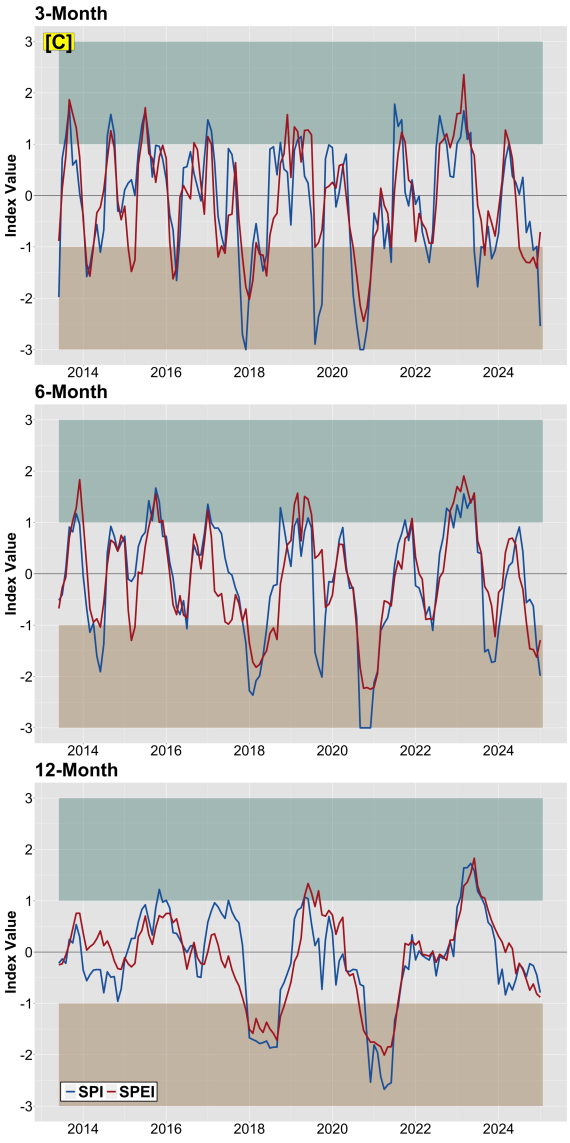
Figure 2: [Top] Variable-timescale seasonal SPI time series from 2022-2025. Displayed values represent the final SPI value for each season at a timescale equal to the defined season length. [Center-Left] Seasonal and 12-month climate statistics. Asterisk indicates current season. [Bottom-Left] 12mo. SPI time series from January 2000 - January 2025. [Bottom-Right] Drought classification quadrant showing standardized precipitation (SPI) vs standardized temperature (STI).

Please direct any questions, comments, or suggestions to Mike Crimmins (crimmins@arizona.edu) or Trevor McKellar (tmckella@arizona.edu) at the University of Arizona. To view previous reports, please visit: https://cales.arizona.edu/climatereports/

Temperature Impacts on Drought

This section explores the impacts of temperature on drought development for different time length intervals. Figure [A] shows the relationship between the Standardized Precipitation Index (SPI) and Standardized Temperature Index (STI) at a 12-month timescale for the entire Forest and at each District . Table [B] shows precipitation and temperature-based climate statistics at 3-, 6-, and 12-month timescales. Figure [C] shows time series plots of the SPI and Standardized Precipitation-Evapotranspiration Index (SPEI) at 3-, 6-, and 12-month timescales. Note – the Hargreaves method is used to estimate potential evapotranspiration for the SPEI calculation.





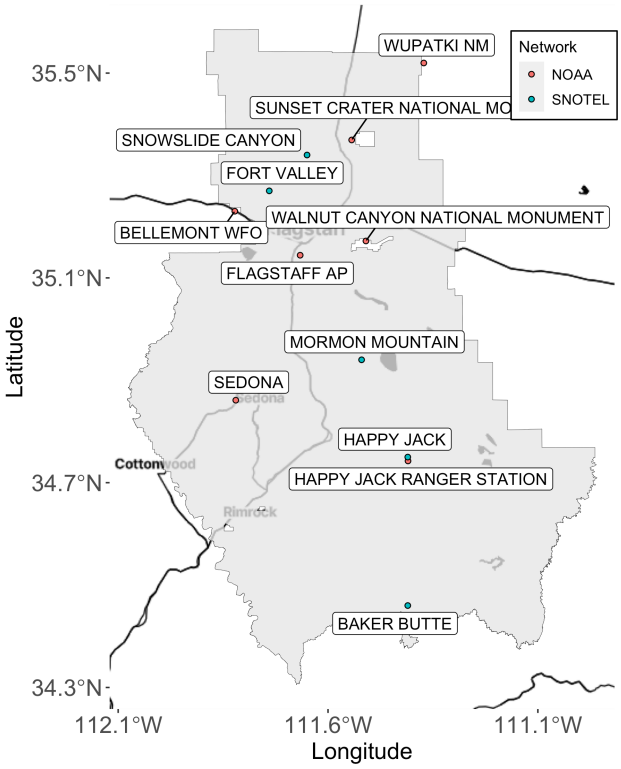
[B]

	3-Month	6-Month	12-Month
Total Precip [in.]	0.66	5.5	16.82
Precip Anom [in.]	-5.08	-6.4	-3.89
Mean Temp [F]	37.5	51.4	52.8
Temp Anom [F]	1.1	2.6	2.2
SPI	-2.54	-1.99	-0.79
STI	0.52	1.81	1.83
SPEI	-0.71	-1.29	-0.88

[A] Drought classification quadrant of the 12-month SPI and 12-month STI (Standardized Temperature Index). [B] Table showing 3-, 6-, and 12-month climate statistics for the Coconino National Forest. [C] Time series plots of the 3-, 6-, and 12-month SPI and SPEI.

Station Climate Summaries

Summaries from climate stations with relatively long periods of record, minimal missing data (<10% of days), and within the area boundary are presented in the following tables (5 and 6) as reference locations. These stations are a select subset of stations that contribute to the gridded climate maps. Red circles on map indicate locations of NOAA Global Historical Climate Network stations.



	Elev (ft)	POR	Max SWE (in)	Max SWE Anom (in)	Total Precip (in)	Precip Anom (in)
SNOWSLIDE CANYON	9721	1997-2025	5.7	-6.03	8.77	-4.49
FORT VALLEY	7359	2008-2025	0.4	-2.27	2.8	-3.73
MORMON MOUNTAIN	7490	1963-2025	0.5	-4.49	3.89	-6.75
HAPPY JACK	7520	1999-2025	0.5	-4.43	2.8	-7.05
BAKER BUTTE	7359	1965-2025	0.7	-3.66	2.49	-8.67

	Elev (ft)	POR	Total Precip (in)	Precip Anom (in)	Days with Precip	Total Snow (in)	Avg Temp (F)	Temp Anom (F)	Freeze Days
WUPATKI NM	4908	2000-2025	2.29	0.17	10	0	45.2	0.32	75
FLAGSTAFF AP	6999	1951-2025	3.62	-3.62	14	5.9	38.6	2.56	103
HAPPY JACK RNGR.STAT	7480	2019-2025	2.7	-0.43	10	5.3	37.6	0.8	94
SUNSET CRATER NAT.MON	6980	2002-2025	2.88	-1.71	6	12.8	36.8	1.78	95
BELLEMONT WFO	7152	2001-2025	2.23	-4.25	10	12.6	35.4	1.12	111
WALNUT CANYON NAT.MON	6695	1978-2025	2.74	-2.65	9	6.3	41.5	1.63	91
SEDONA	4430	1975-2025	0.91	-3.46	10	0	51.3	0.28	49

Figure 3: [Top-Left] Locations of NOAA and SNOTEL station(s) located within the report area boundary. [Top-Right] Table of SNOTEL station(s) statistics from 2024-10-01 to 2025-01-31. [Bottom] Table of NOAA station(s) statistics from 2024-10-01 to 2025-01-31.

NASA SPoRT Soil Moisture Estimates

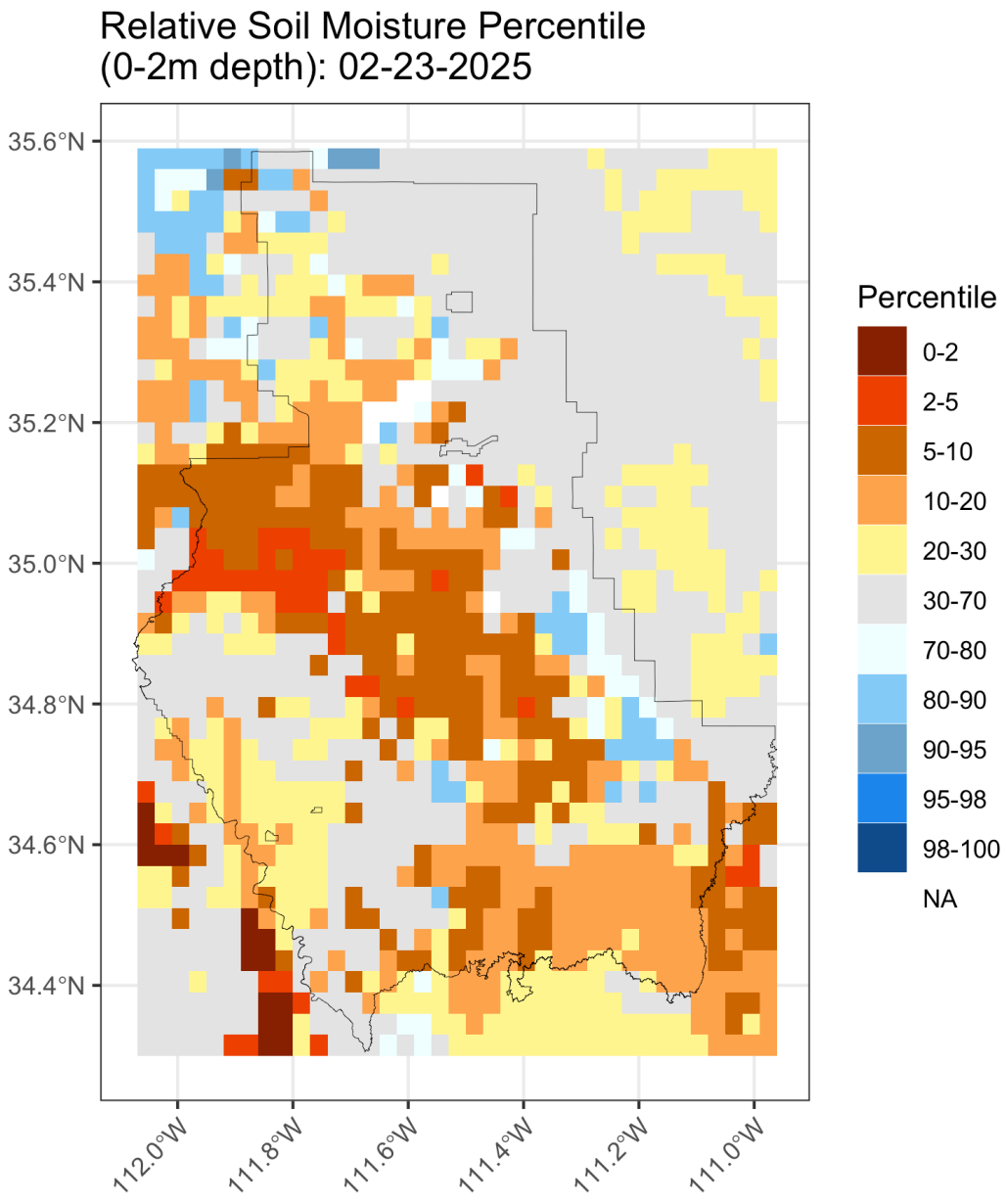


Figure 4: Integrated surface to 2 meter deep relative soil moisture estimate

Modeled soil moisture estimates are provided by the NASA Short-term Prediction Research and Transition Center. This program uses a land surface model to integrate surface weather conditions (e.g. precipitation, temperature, wind…) with surface and soil properties like vegetation cover, soil depth and type to track and make near real-time estimates of soil moisture on a 3km by 3km grid. This map displays how unusually wet or dry the relative soil moisture (based on local soil properties) is for the integrated amount from the surface to 2 meters deep. (more information at https://weather.ndc.nasa.gov/sport/modeling/lis.html)

Climatology and Trends

This section shows local climatology and trends for the Coconino National Forest. Evaluating local climatology is important for accurately defining an area's season lengths and understanding how local climate has changed over time. By observing historical monthly average precipitation and temperature, along with long-term trend analysis, an area's season lengths can be more accurately determined outside of traditional definitions. These more climatologically-aligned seasons can be used to better summarize climate statistics and portray season-to-season changes. Using this methodology can help land managers more effectively manage resources, aid decision making, and be better prepared for extreme weather events.

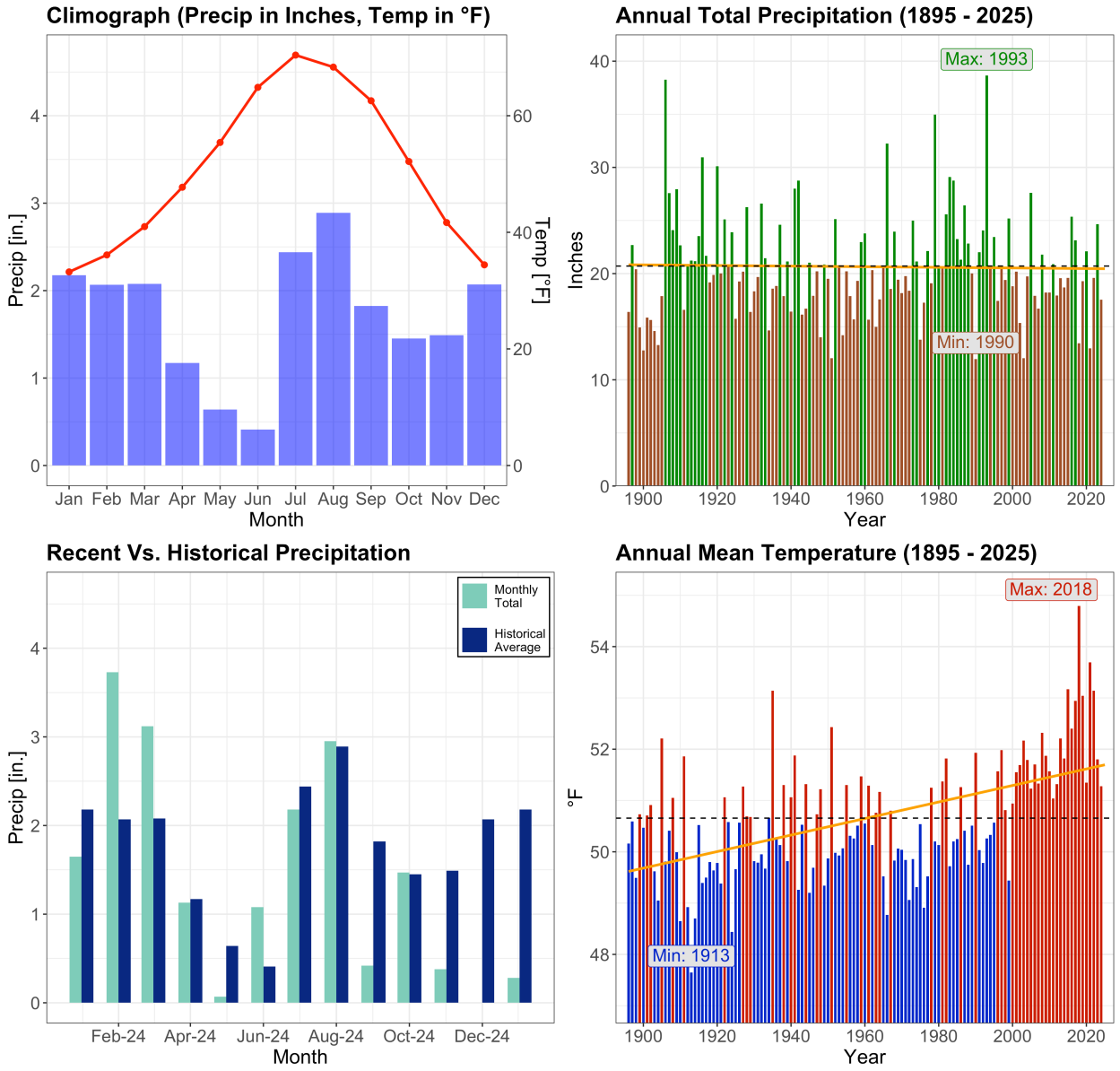


Figure 5: Local climograph showing monthly average precipitation and temperature (1895 – 2025) [Top-Left]. Previous 12-month precipitation totals compared to the monthly average [Bottom-Left]. Annual total precipitation [Top-Right] and mean temperature [Bottom-Right] from the previous 12-months (February - January) from 1895 - 2025. The long-term trend line (yellow), and minimum and maximum years are highlighted.

Mechanics Behind the Standardized Precipitation Index (SPI)

The SPI is a meteorological drought index which use monthly precipitation sums to calculate a time series of z-score values. The SPI uses z-score values to represent the number of standard deviations a monthly precipitation total is from the long-term mean. The sign (positive or negative) of a z-score value represents if the monthly total precipitation is above (+, water surplus) or below (-, water deficit) the long-term mean for *all other instances of that month on record*. Furthermore, the size of the z-score value represents the frequency of drought conditions (Table . Smaller SPI values (i.e. falling near zero) represent more frequent drought events while larger SPI values (positive or negative) are less frequent drought events.

Table 1: SPI Drought Categories

SPI Value	SPI Category
≥ 2	Extremely Wet
1.5 to 1.99	Very Wet
1 to 1.49	Moderately Wet
-0.99 to 0.99	Near Average
-1 to -1.49	Moderately Dry
-1.5 to -1.99	Very Dry
$\leq$ -2	Extremely Dry

Note:

Table adapted from https://drought.unl.edu/Monitoring/SPI/MapInterpretation.aspx

An important feature of the SPI is the ability to be calculated at a variety of monthly timescales. This flexibility allows the SPI to evaluate drought conditions for different time periods. For example, a 3-month SPI calculation compares total precipitation from the 3 months with all other instances of those same 3 months on record. Land managers can assess SPI values of different timescales to interpret short and long-term drought conditions on their land.

About the data used in this report

- PRISM Climate: The gridded used in mapping and forest and district level climate summaries is provided by the PRISM (Parameter elevation Regression on Independent Slopes Model) statistical mapping system. This system uses a weighted regression scheme to interpolate station data while accounting complexities like topography and rain shadows. The PRISM mapping system relies on a high density of stations to account for small variations in temperature and precipitation. Use caution in interpreting fine-scale patterns (or lack thereof) in regions with low station density. More information on PRISM can be found at https://prism.oregonstate.edu/ and https://climatedataguide.ucar.edu/climate-data/prism-high-resolution-spatial-climate-data-united-states-maxmin-temp-dewpoint.
- Climate Stations: Station-level data used in this report consist of NOAA Global Historical Climatology Network(NOAA-GHCN) stations and USDA NRCS Snow Telemetry sites which include Cooperative Observer sites, Airports, and CoCoRAHS volunteer observations and also USDA NRCS Snow Telemetry(SNOTEL) sites. NOAA-GHCN stations consist of Cooperative Observer sites, Airports, and CoCoRAHS volunteer precipitation observations. SNOTEL sites are automated stations located in key snow monitoring locations, often in forested locations. NOAA-GHCN data were accessed through the Regional Climate Center-Applied Climate Information System(RCC-ACIS) and SNOTEL data were downloaded using the 'snotelr' package.

Report Information

- This report was generated on 2025-02-23 .
- Past reports can be found at: https://cales.arizona.edu/climatereports/

Contact information

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- Trevor McKellar, Research Scientist (tmckella@arizona.edu)

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Appendix A

This appendix contains additional climate statistics for District's within the Coconino National Forest.

Table 2: Current Drought Conditions

District	Minimum SPI	Mean SPI	Maximum SPI	Total Precip [in.]	Anomaly [in.]
Mogollon Rim	-2.63	-2.23	-1.43	1.66	-6.44
Red Rock	-2.8	-2.35	-1.48	1.17	-5.14
Flagstaff	-1.92	-1.31	0.1	2.95	-4.22

Note:

Coconino National ForestSPI and climate statistics for Winter 2025 (October-January). Statistics are calculated based on the average of all PRISM grid cells lying within a District boundary.

Table 3: District-level Seasonal SPI and Climate Statistics

District	2025 Winter SPI*	2024 Summer SPI	2024 Spring SPI	12mo. SPI	2025 Winter Precip [in.]*	2024 Summer Precip [in.]	2024 Spring Precip [in.]	12mo. Precip [in.]	12mo. Precip Anom [in.]
Mogollon Rim	-2.23	-0.35	0.58	-0.80	1.66	7.45	5.04	18.36	-4.59
Red Rock	-2.35	-0.54	0.30	-1.07	1.17	5.24	3.72	13.47	-4.75
Flagstaff	-1.31	-0.18	0.33	-0.52	2.95	6.96	4.26	17.84	-3.02

Note:

Coconino National Forest seasonal SPI and climate statistics by District. Asterisk (*) signifies season in progress - currently partial Winter (Oct-Jan). Values are calculated based on the average of all PRISM grid cells lying within a District boundary.