Seasons, Climate, Weather & Abiotics

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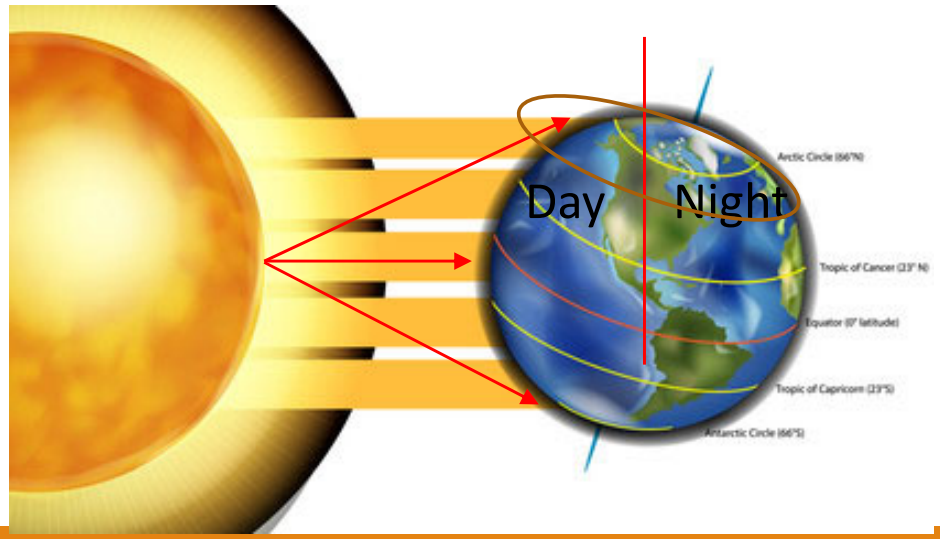
Some Basic Concepts

- Latitude: distance north or south of the earth's equator
  - Low latitudes near equator receive more direct sunlight (hot!)
  - High latitudes near the poles receive very little direct sunlight (cold!)
  - Mid latitudes are less extreme temperature-wise

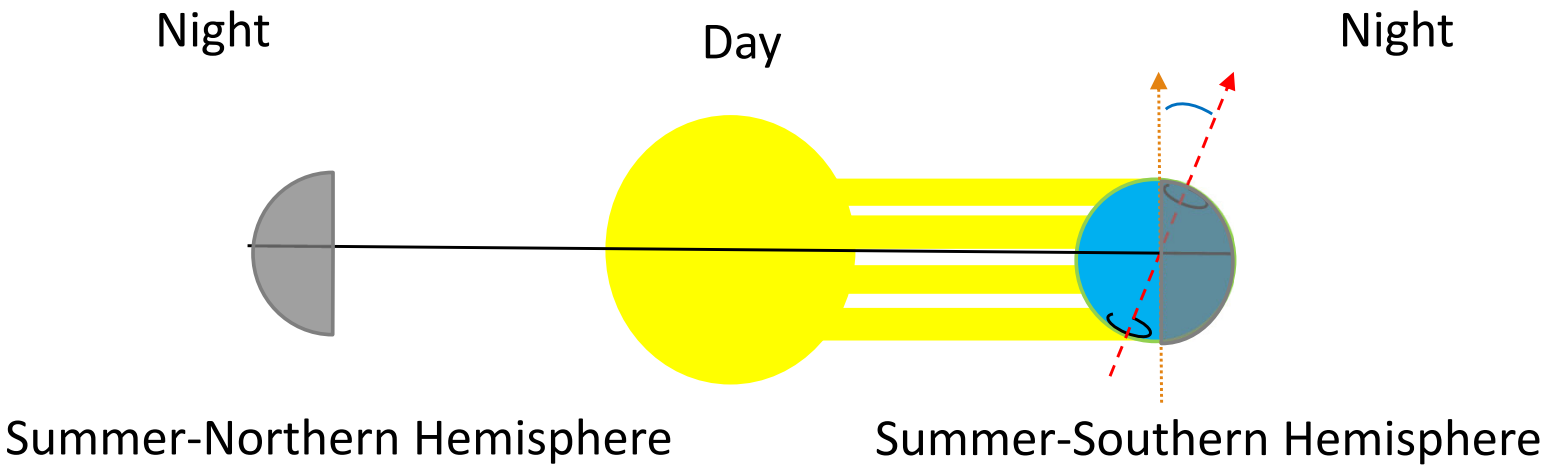


Seasons

Earth orbits the sun completely in one year

The earth spins on an axis that is tilted 23.4 degrees relative to the plane of its orbit to the sun

Seasons are caused by the tilt of the earth and its position relative to the sun due to orbital rotation



Growing Degree Days/ Heat Units

- Used to describe/compare growing seasons and regions
- Helps predict plant and insect growth and development
- The standard method uses the average of the max and min temp for day, minus a base of 50

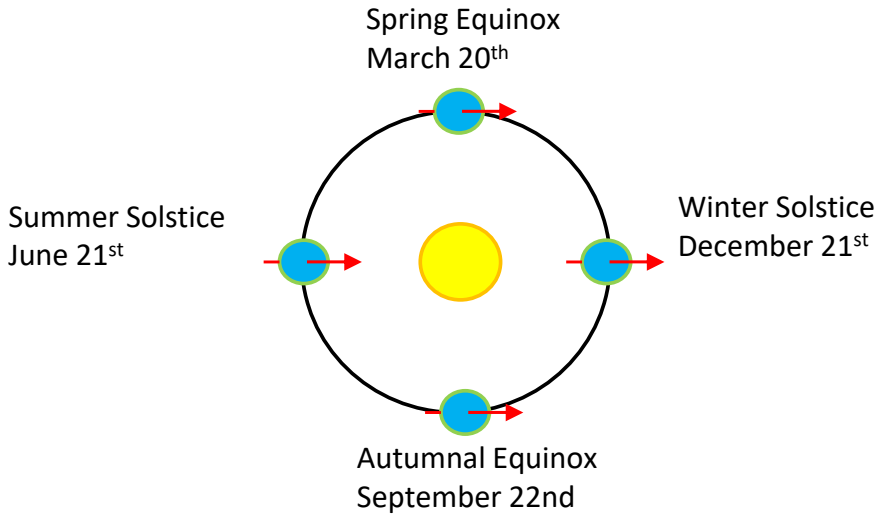
$$GDD = ((\max temp + \min temp)/2) - 50$$

Example: (85°F + 49°F)/2) – 50 = 17

Sum GDD between April 1st to October 31st

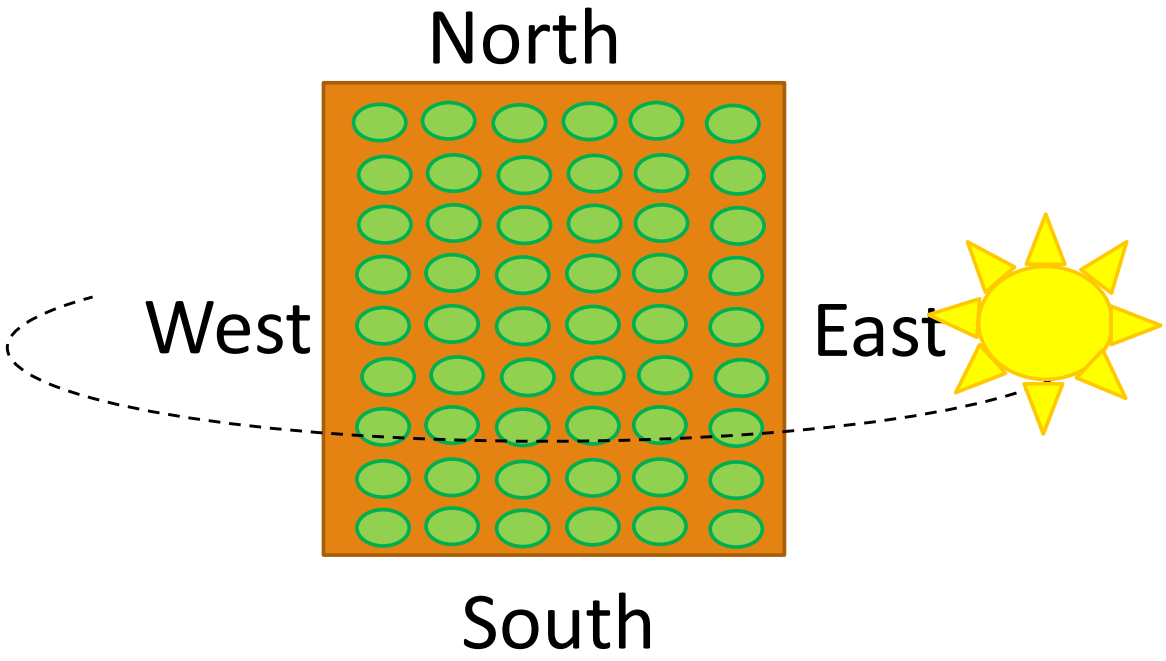
- There are several models

Solstice and Equinox (Northern Hemisphere)



Aspect

The compass direction that a slope or structure faces



Degree of Slope

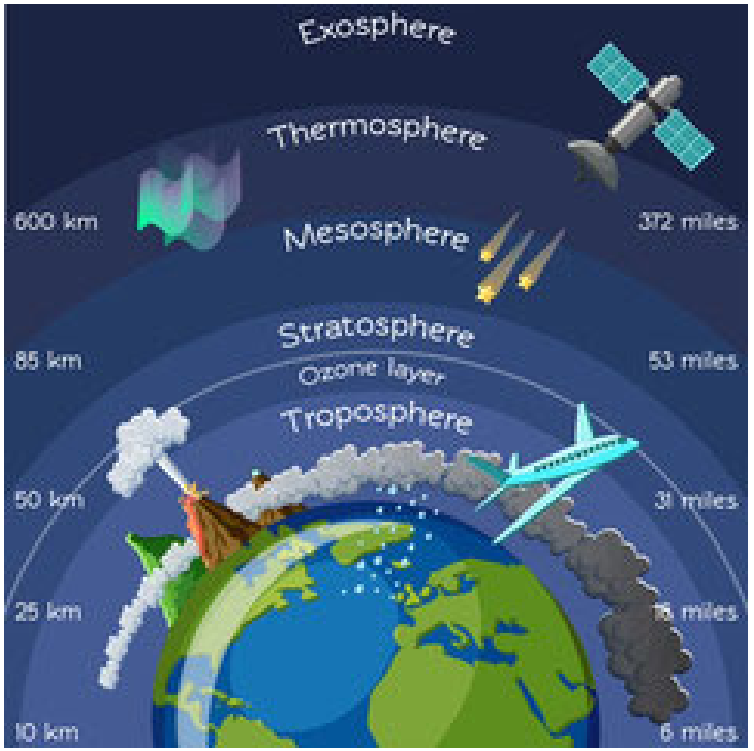
- Steepness of a grade
- As slope increases, more water runs off before it can percolate into soils
- Cold air drains from slopes, pools in low and flat areas
- Erosion is more severe
- Fire

The Earth's Atmosphere

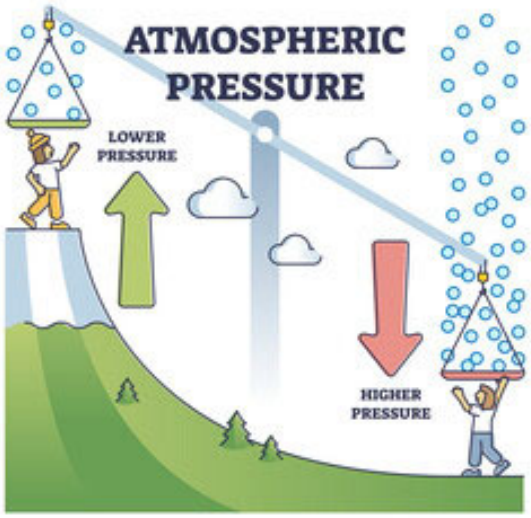
The thin, gaseous envelope comprised mostly of :

- N_2:78%(unavailable for plants)
- O_2: 21%
- Small amounts of H2O, CO2, and others

- Shields us from UV radiation (ozone layer)
- Keeps the earth at a survivable temperature
- Air is held near the earth by gravity, decreases as we get farther from surface

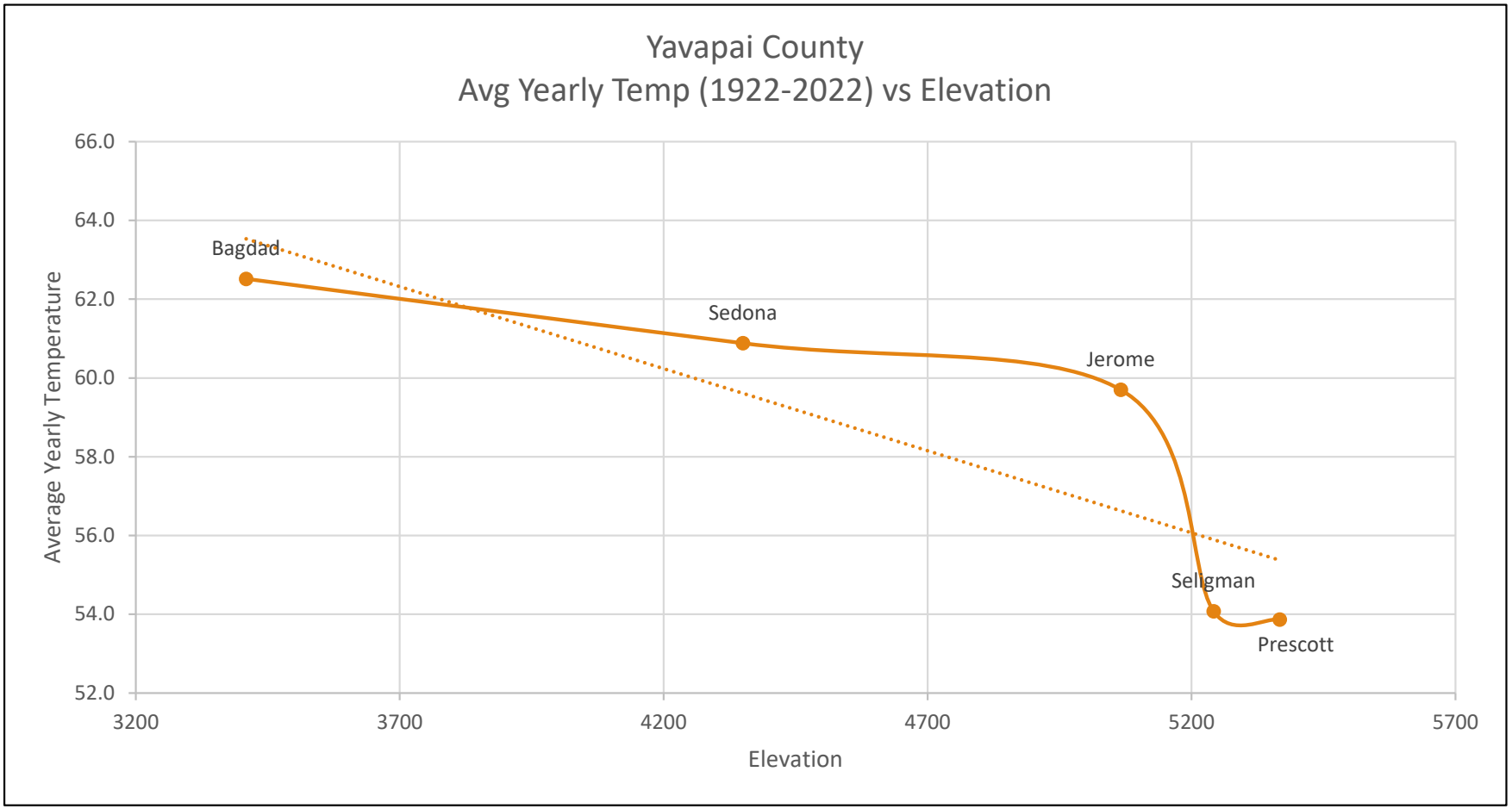


Elevation



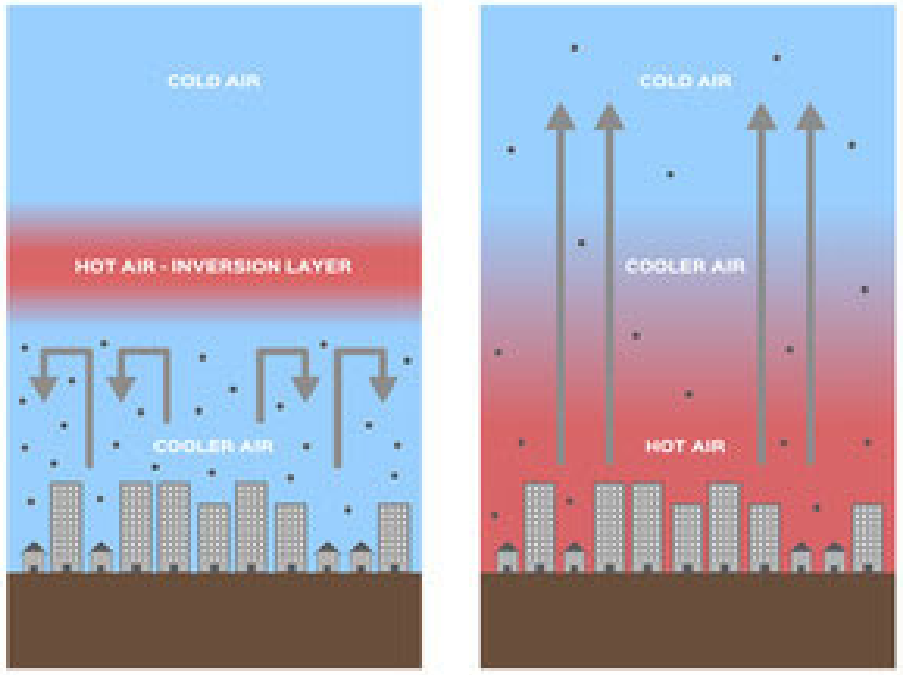
- Air molecules are being held near the earth by gravity, the closer to the earth, the stronger the pull
- As you move higher, air pressure falls because there is less atmosphere pressing down on the surface-air is thinner
- PV=T; as pressure goes down, so does temperature
- The effect of the sun warming the earth's surface and the surface radiating and warming the air dissipates as you get further away from the surface
- Lapse Rate: temperature falls 3.6 ^{o}F for every 1000ft rise in altitude
- Less atmosphere=less protection from the sun=more intense energy/heat

Yavapai County Temperature vs Elevation



Radiation temperature Inversion

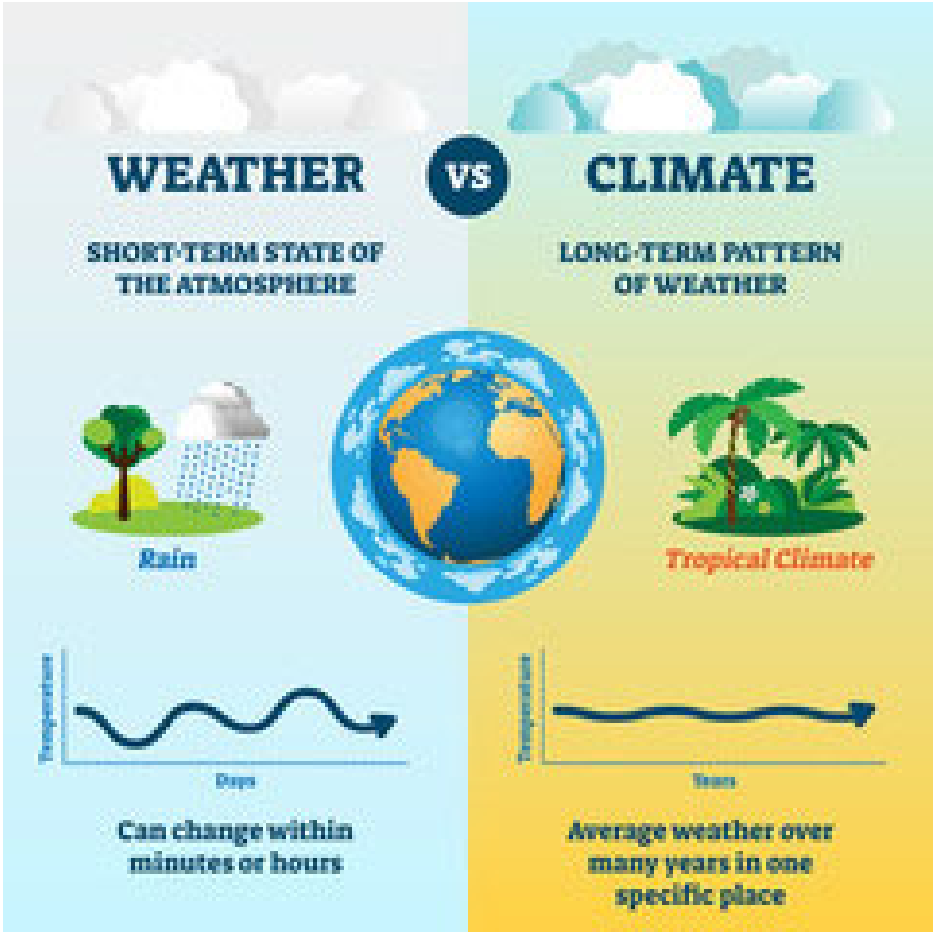
- Warm air between a sandwich of cold air
- Clear, calm skies allow heat to radiate away from the earth's surface quickly
- Warm air rises, cold air sinks



Weather Vs. Climate

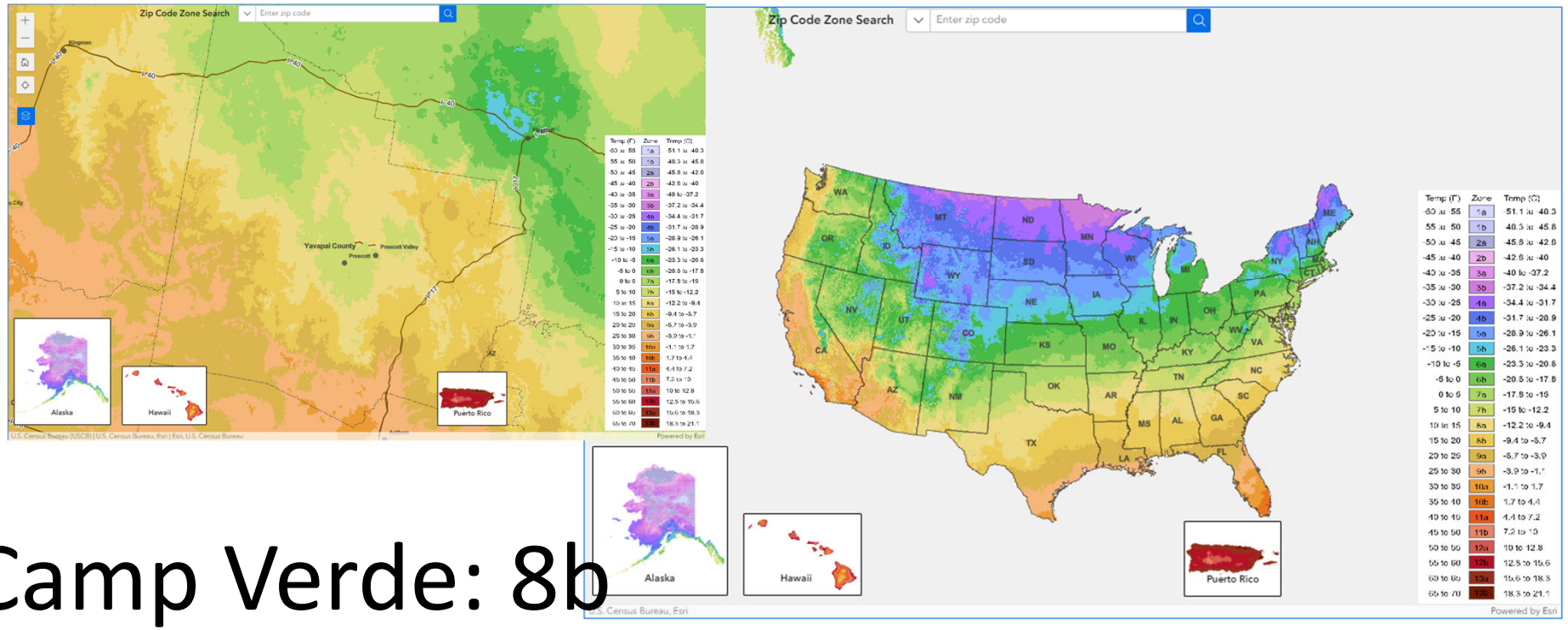
- Weather- the condition of the atmosphere at any given moment

- Climate: average (often long-term) condition of the atmosphere



USDA Hardiness Zones

planthardiness.ars.usda.gov/



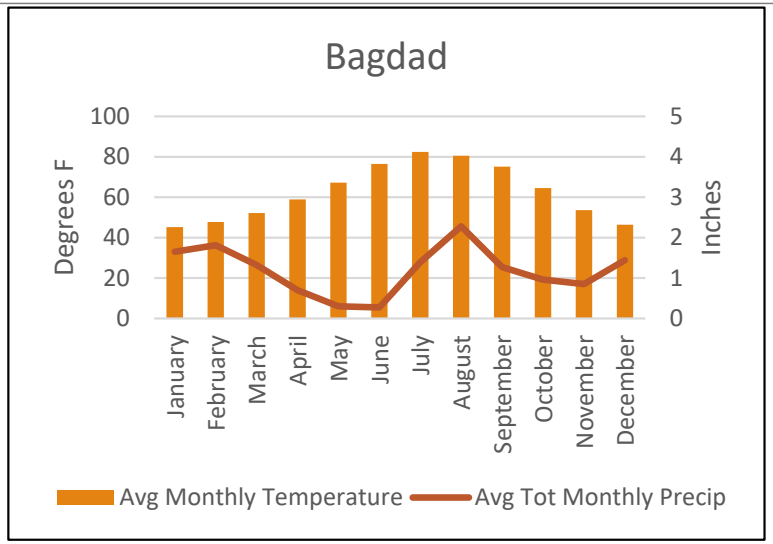
Camp Verde: 8b

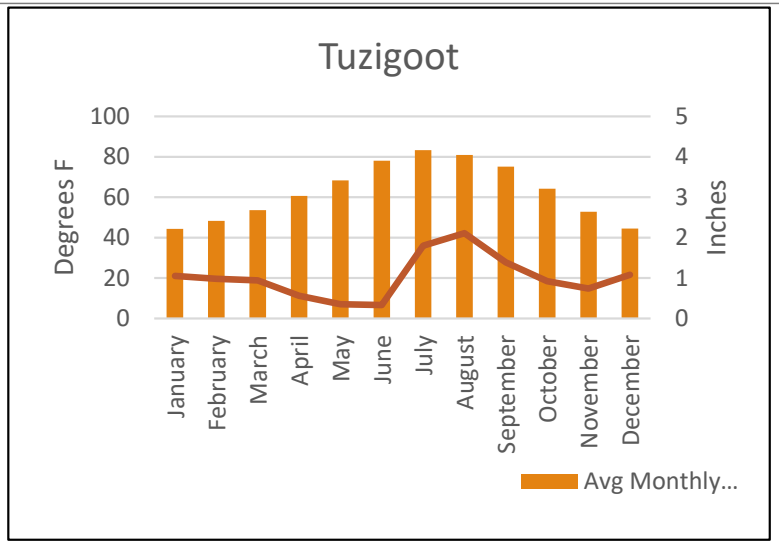
Prescott: 7b

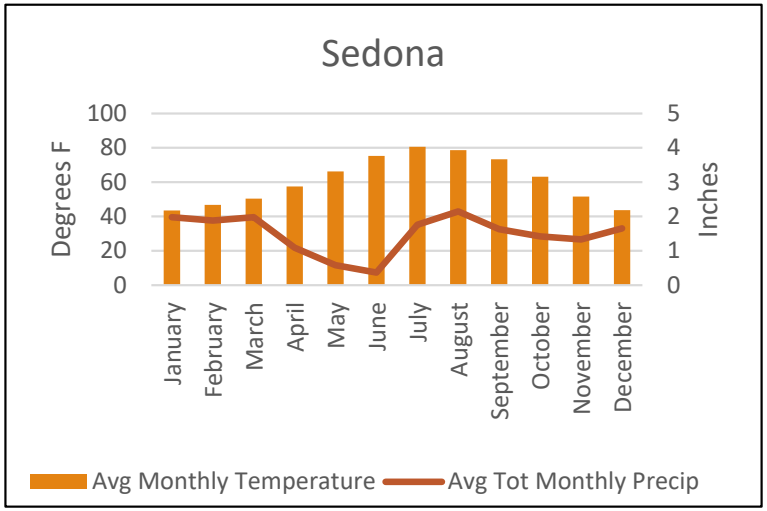
Arizona Climate

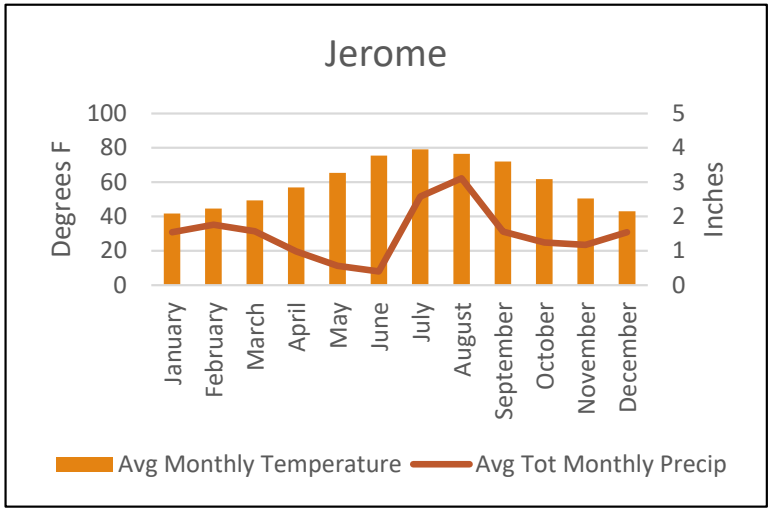
- Bimodal precipitation pattern
  - Uniform winter precipitation, ENSO-dependent
  - Variable summer precipitation; Monsoon originates in Sierra Madre in Mexico
- Diurnal temperature fluctuations
- Elevation drives temperature variability
- Periodic drought

Yavapai County Temperature and Precipitation (1922-2022)









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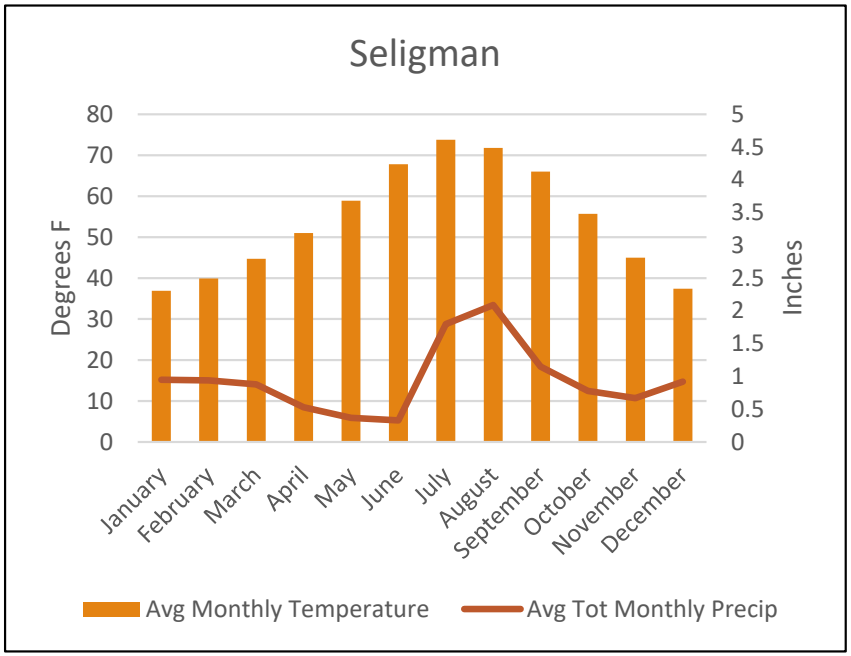
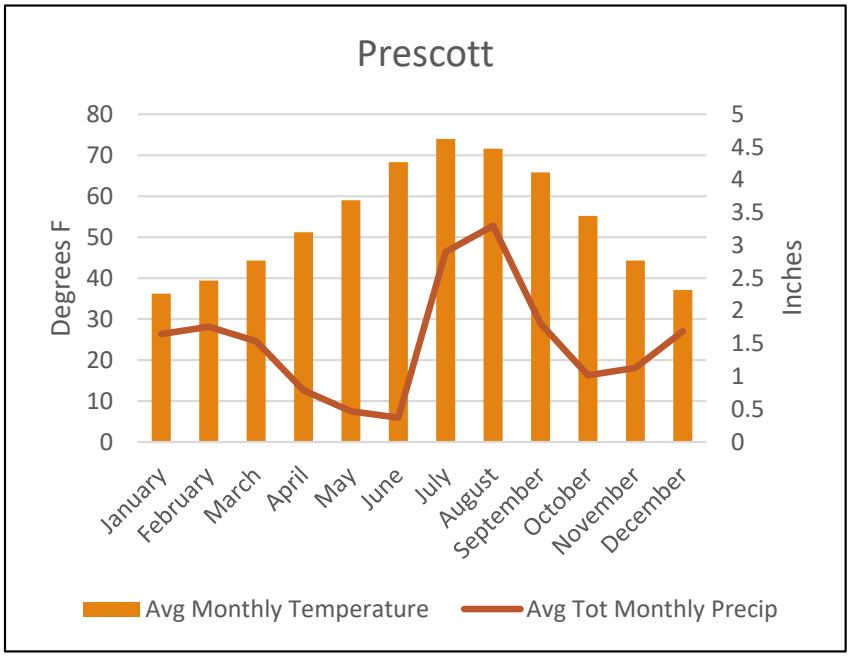
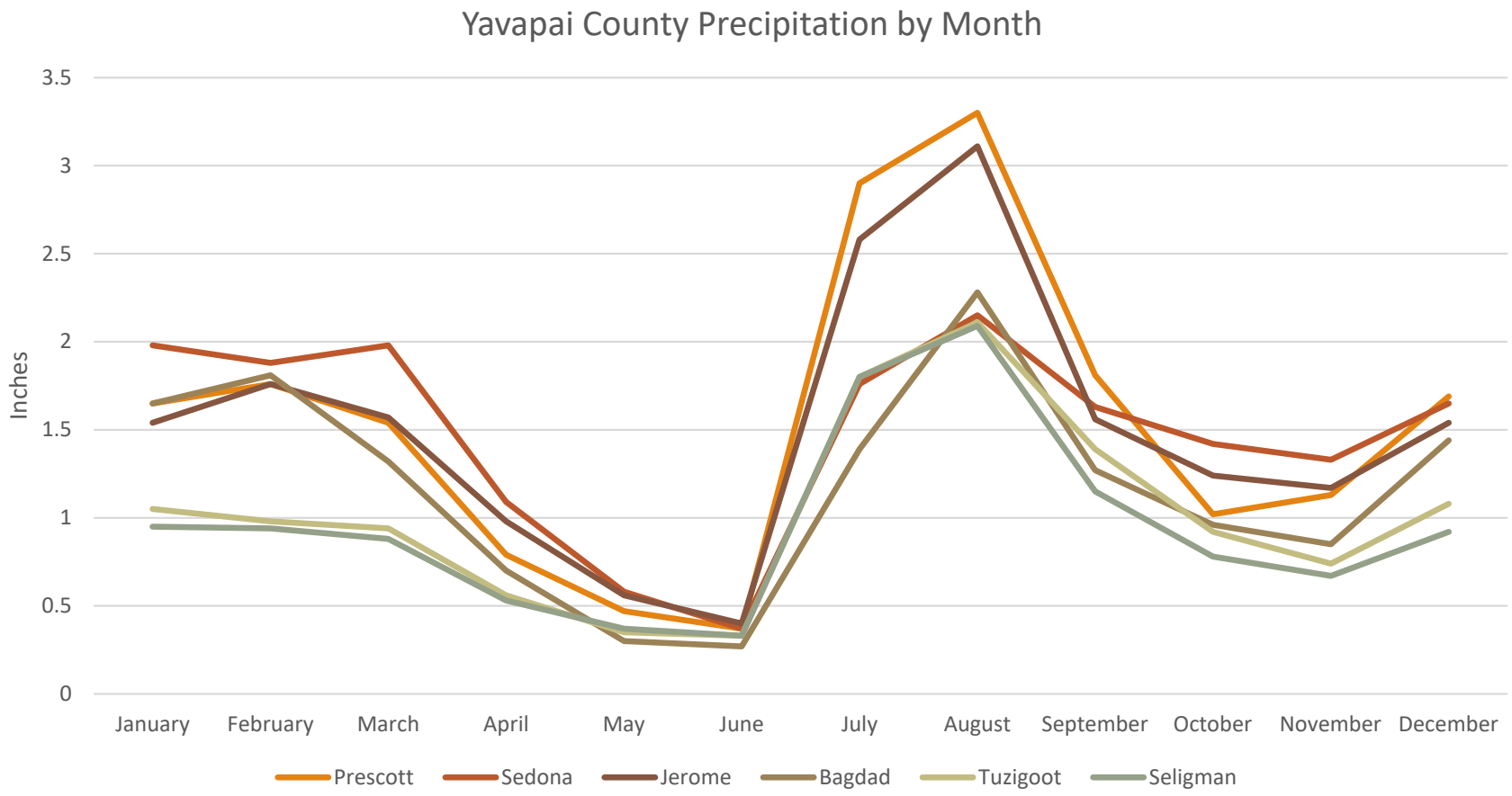




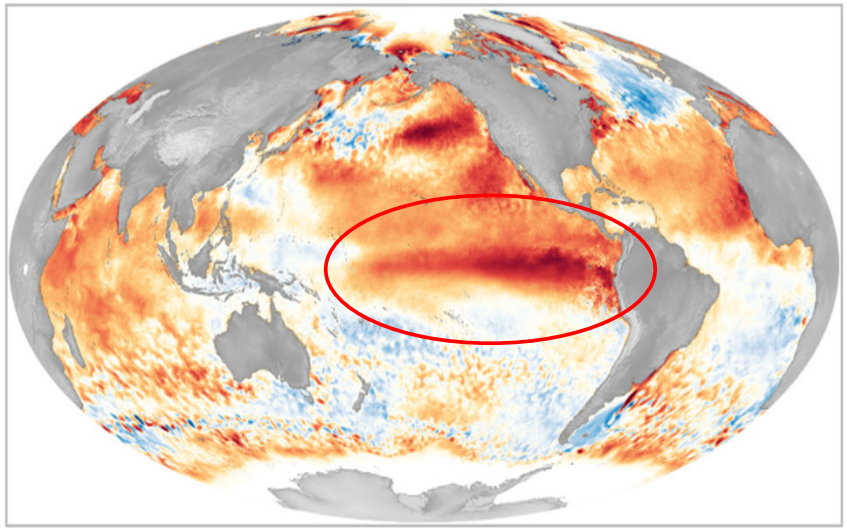
Yavapai County Precipitation



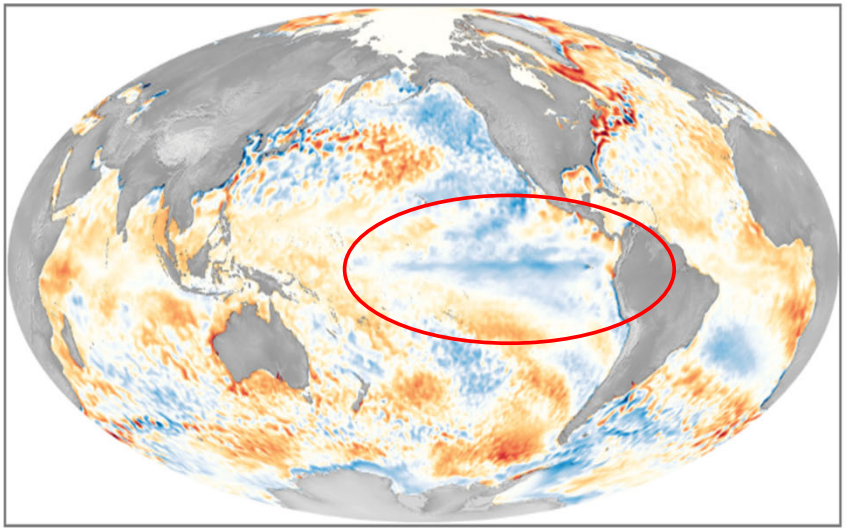
Winter Precipitation: El Niño and La Niña

Part of a larger phenomenon call the "El Niño Southern Oscillation"

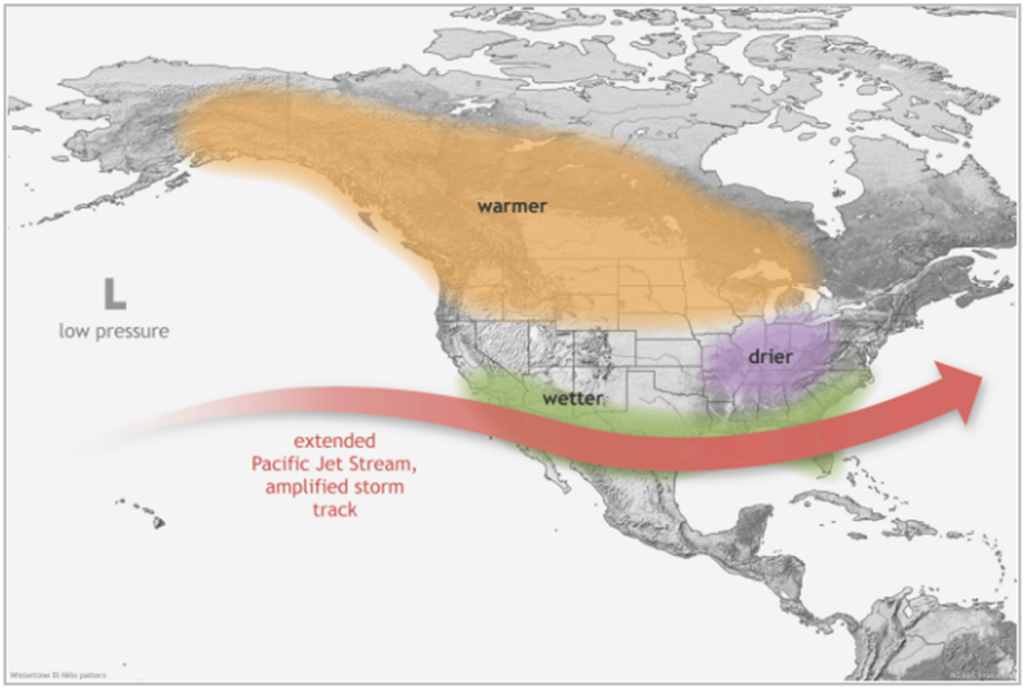
- Normally, trade winds blow from E→W across equatorial Pacific Ocean
  - Pushes warm water west, replaced with cold from deep
  - Warm water in west creates clouds, storms, and general instability in the region
- El Niño is caused by weaker trade winds, and therefore a warming of Eastern Pacific waters, causing more rainfall around the world
  - Droughts in Indonesia, floods in Peru
  - Peaks around Xmas time
- La Niña is a strengthening of the trade winds and greater than normal warming of the Western Pacific



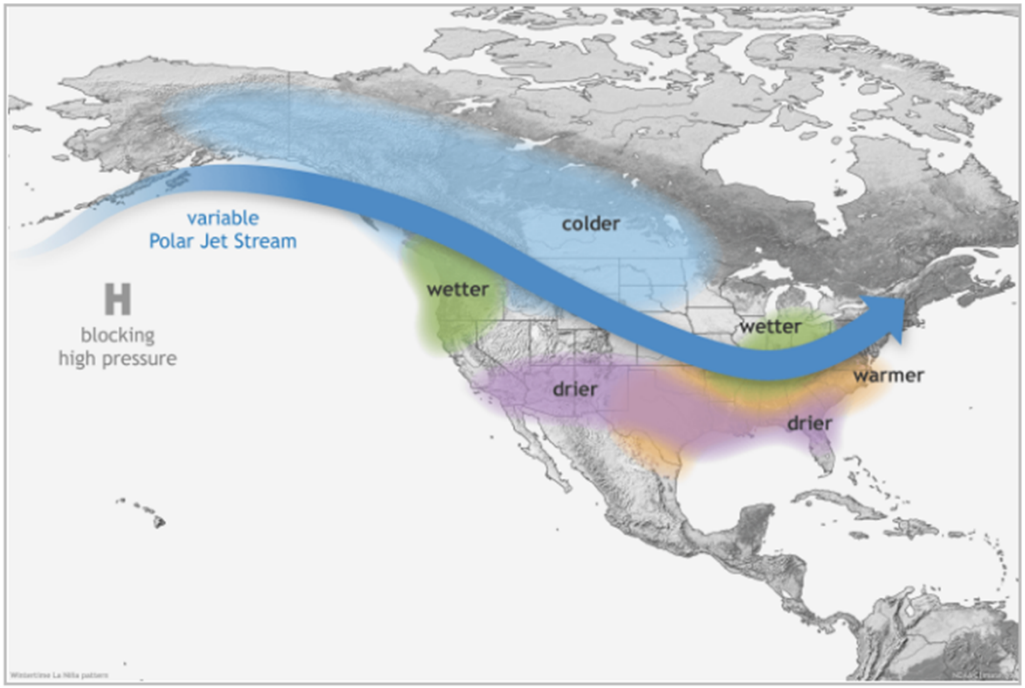
A very strong **El Niño** in 2016 – large 'red tongue' in equatorial Pacific. (Credit: NOAA/NESDIS)



La Niña event – large blue area in equatorial Pacific. (Credit: NOAA/NESDIS)



Typical wintertime **El Niño** pattern. (Credit: climate.gov)



Typical wintertime **La Niña** pattern. (Credit: climate.gov)

Summer Precipitation: North American Monsoon

As spring and summer heat build over North America, air rises sucking moisture in from Sea of Cortez and Gulf of Mexico

Seasonal shift in winds-normally from the west, switch S/SE

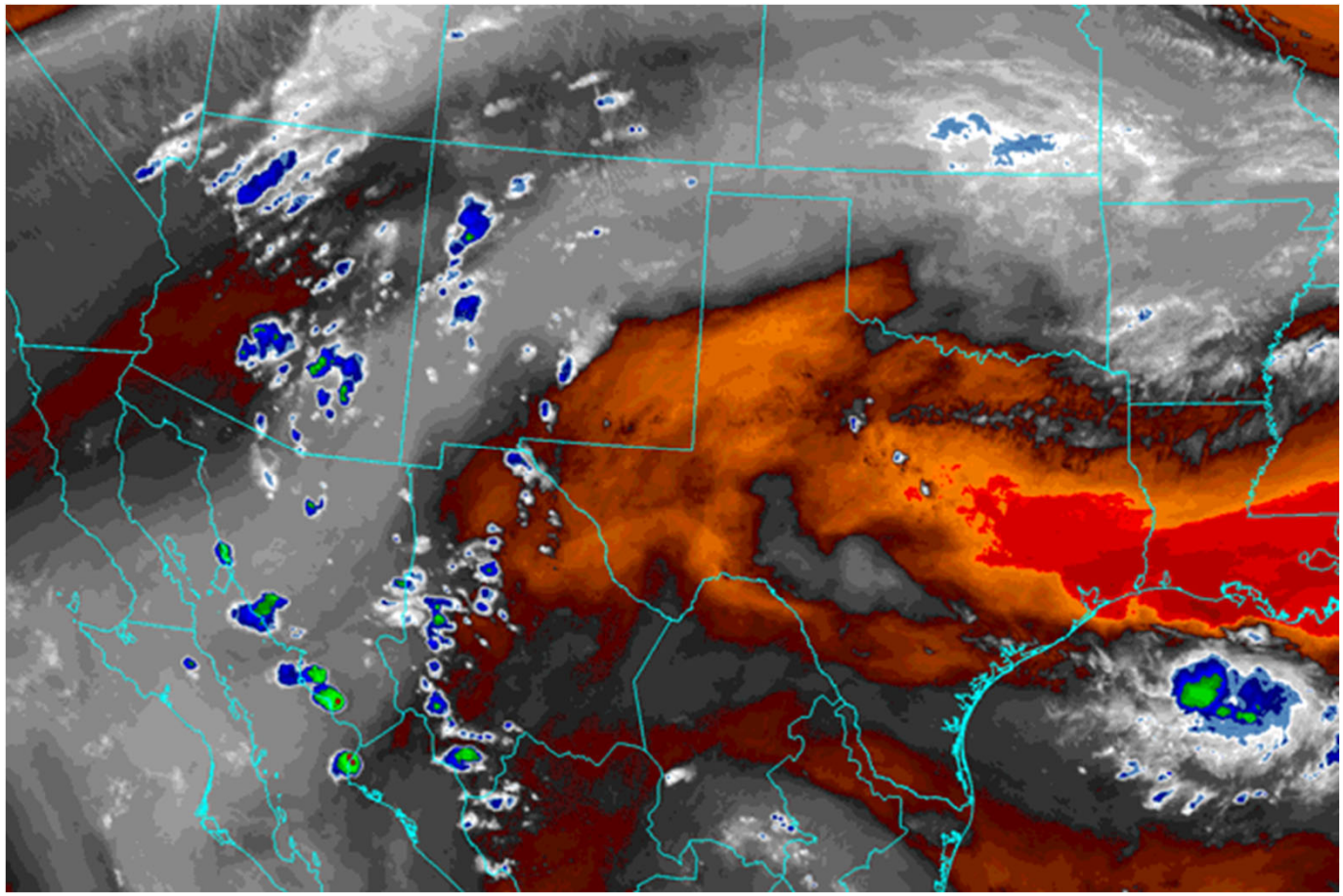
- Bring precipitation from the Sea of Cortez and Gulf of Mexico

Starts when dewpoints over 55 degrees for three straight days

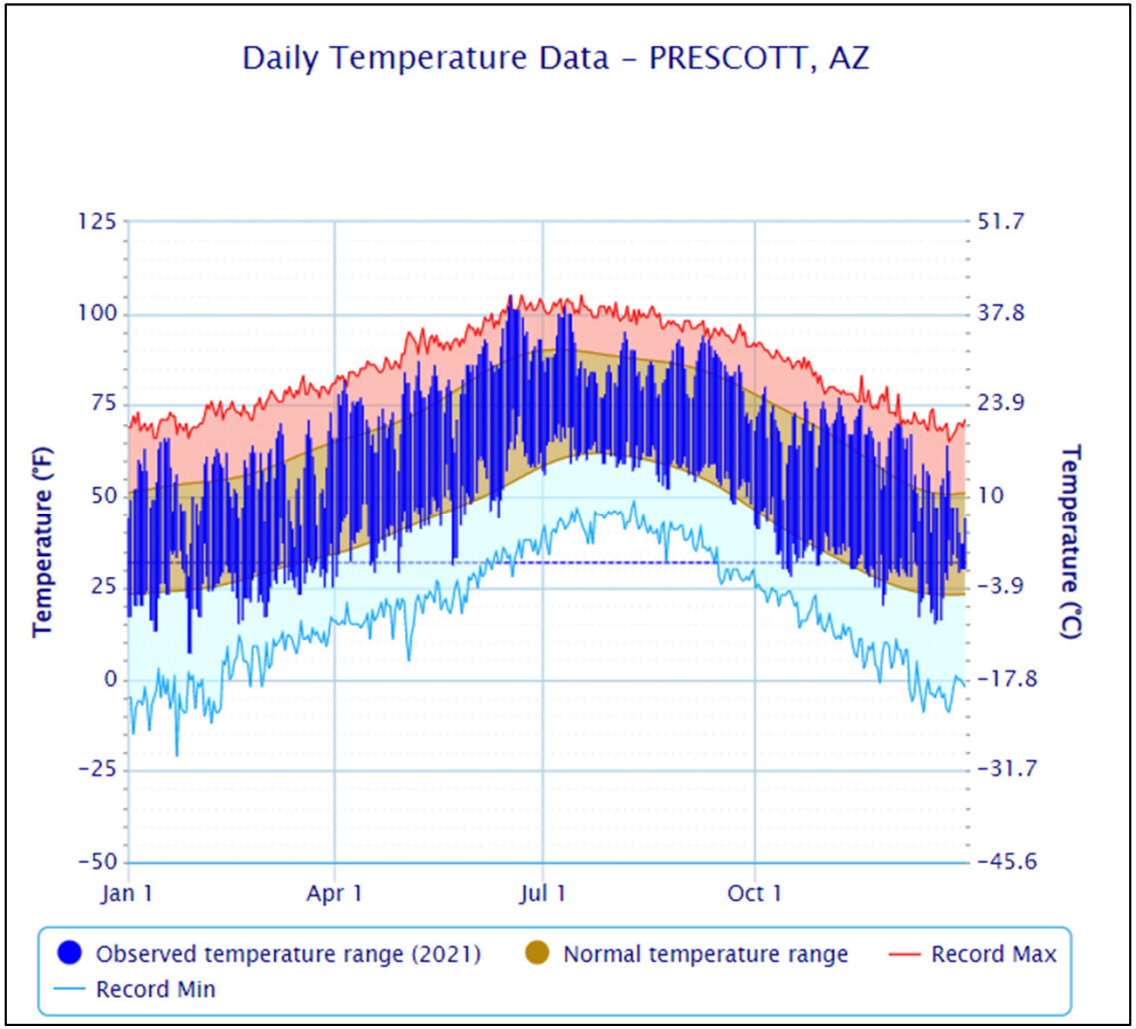
Official season: June 15 to September 30th

Very difficult to forecast

Summer Precipitation: The North American Monsoon Season



Yavapai County Diurnals: Daily temperature cycles



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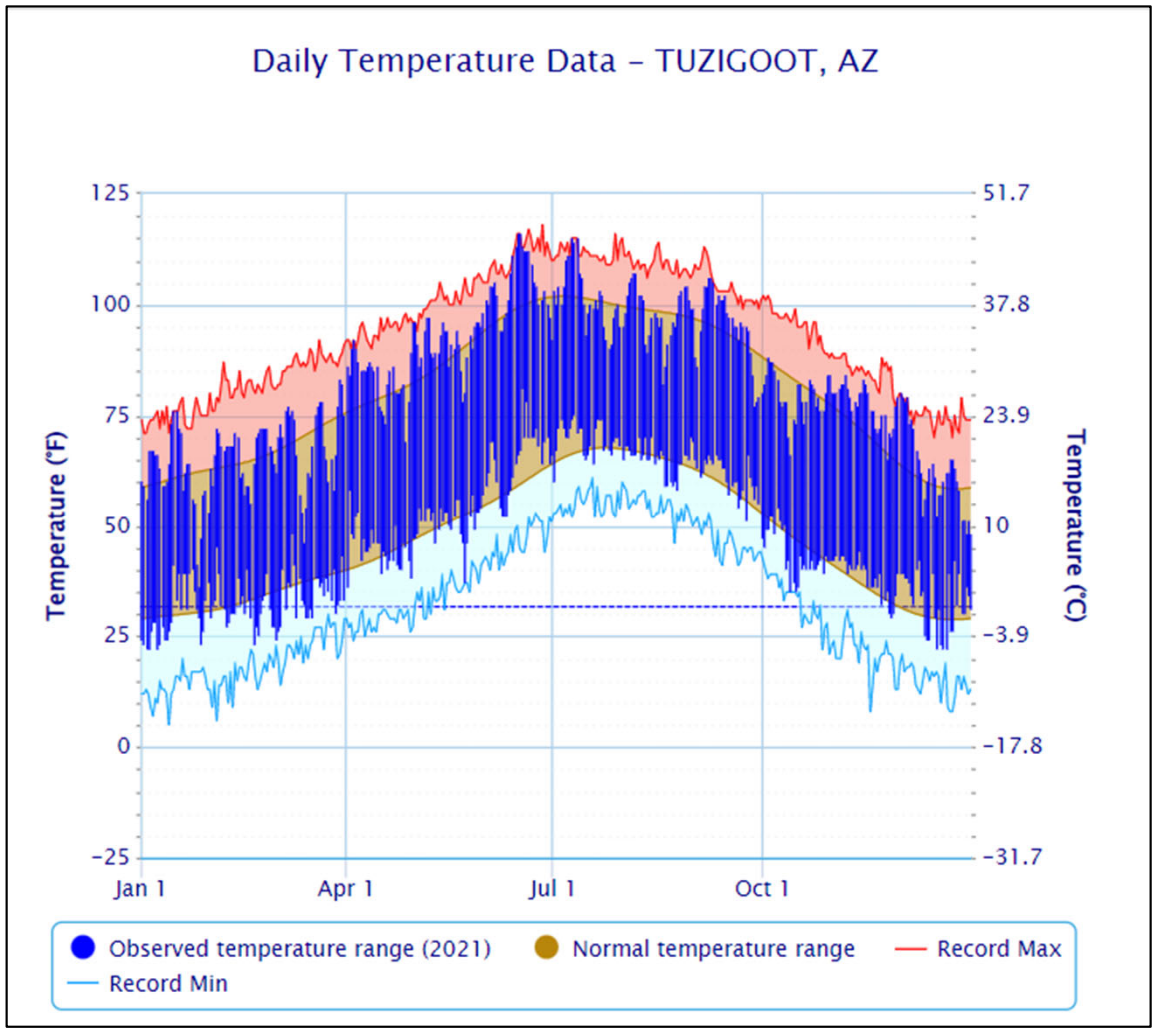


Spring/Fall Frosts in Prescott

Spring Freeze Probabilities Prescott 1922-2022

Earliest	90%	80%	70%	60%	50%	40%	30%	20%	10%	Latest
11-Apr	24-Apr	30-Apr	05-May	09-May	12-May	18-May	21-May	26-May	01-Jun	17-Jun

Fall Freeze Probabilities Prescott 1922-2022

Earliest	10%	20%	30%	40%	50%	60%	70%	80%	90%	Latest
23-Aug	23-Sep	01-Oct	06-Oct	09-Oct	13-Oct	16-Oct	20-Oct	25-Oct	01-Nov	15-Nov

Average Growing Season: 153 days

Spring/Fall Frosts in Verde Valley

Spring Freeze Probabilities Tuzigoot 1922-2022

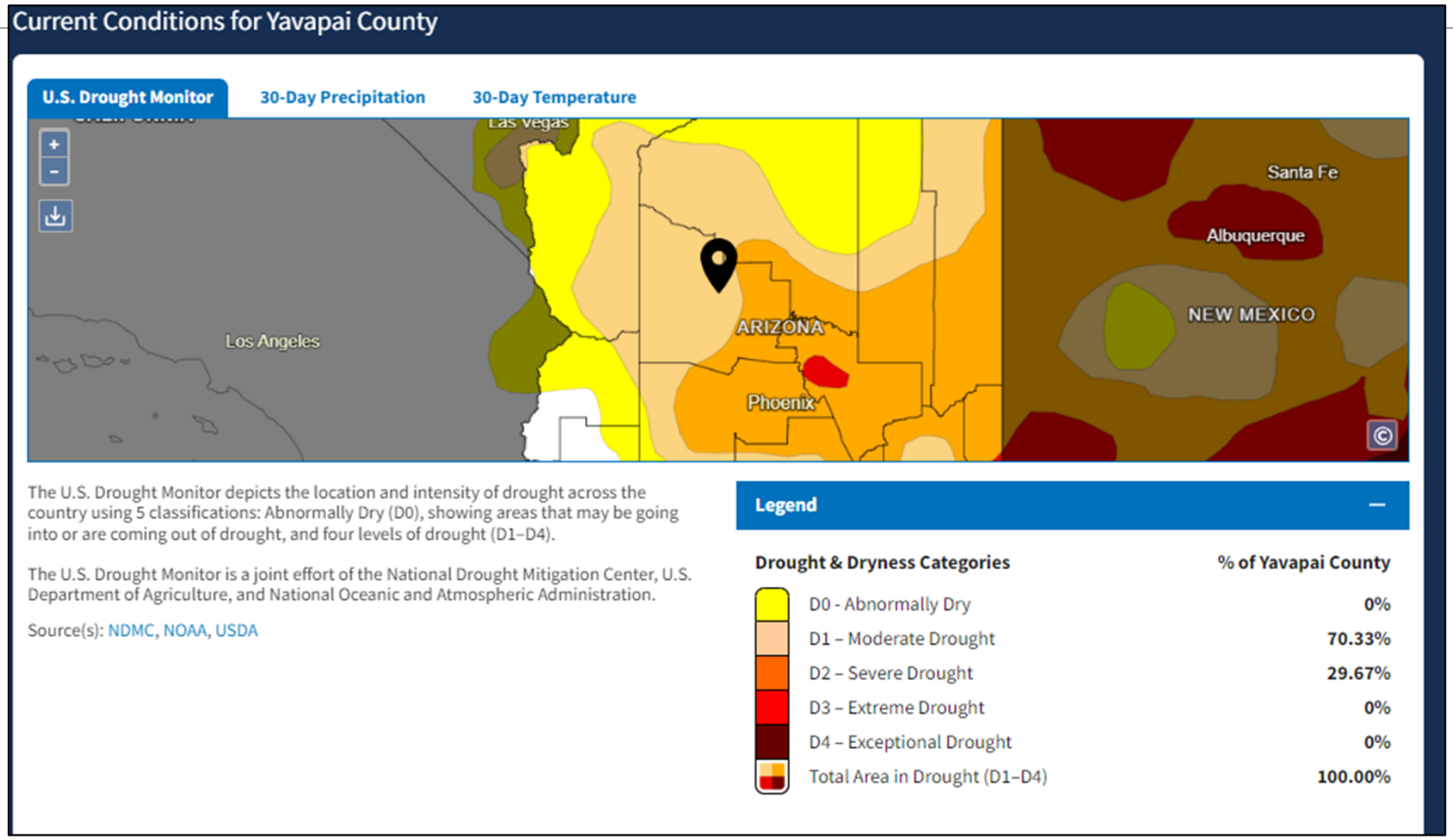
Earliest	90%	80%	70%	60%	50%	40%	30%	20%	10%	Latest
10-Feb	11-Mar	16-Mar	22-Mar	27-Mar	01-Apr	07-Apr	13-Apr	21-Apr	27-Apr	14-May

Fall Freeze Probabilities Tuzigoot 1922-2022

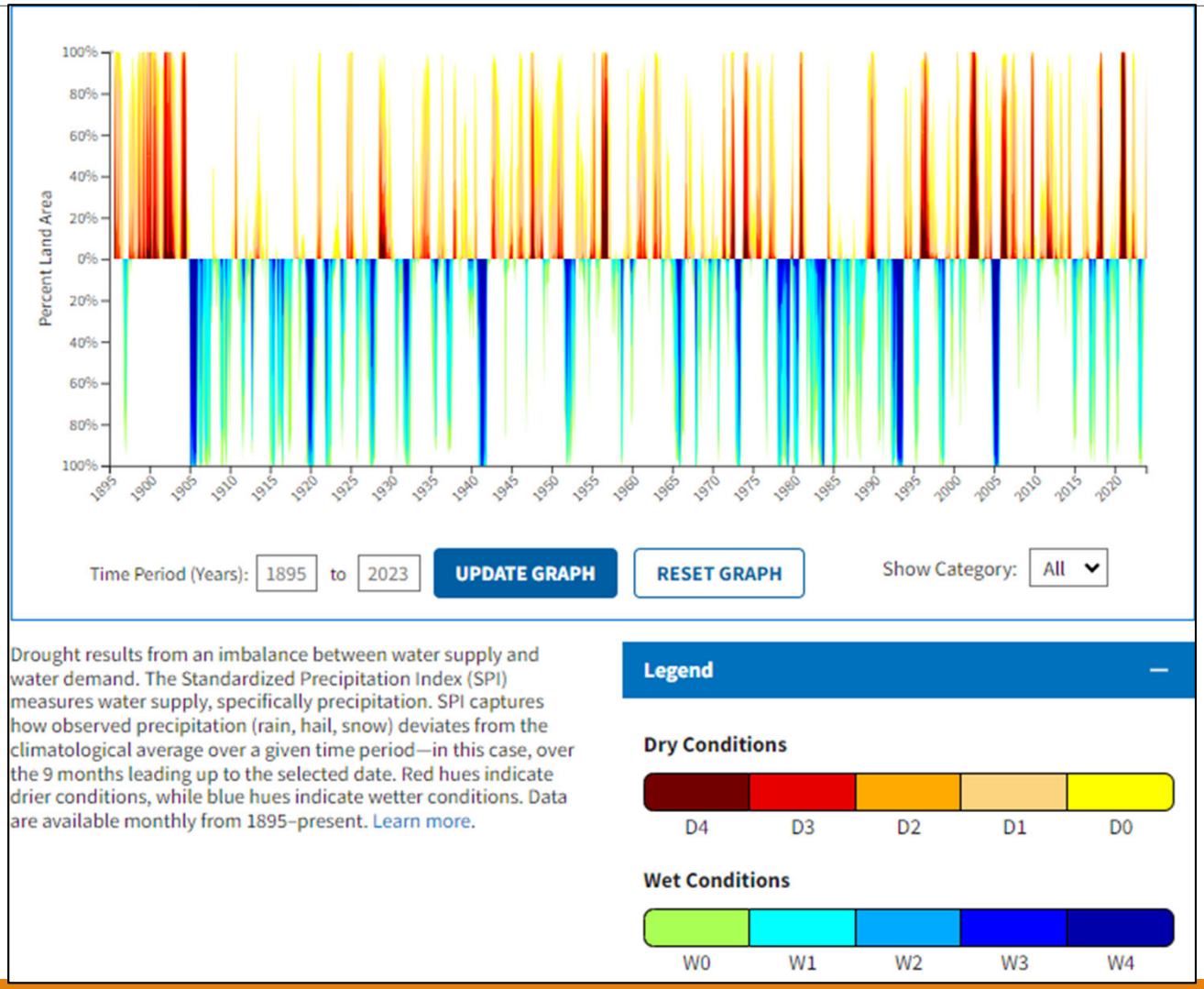
Earliest	10%	20%	30%	40%	50%	60%	70%	80%	90%	Latest
	26-Oct	18-Oct	04-Nov	06-Nov	09-Nov	13-Nov	15-Nov	18-Nov	23-Nov	07-Dec

Average Growing Season: 221 days

Drought in Yavapai County- Current



YC Drought Conditions 1895 to Present



Drought Conditions 2000-2024