Weather and Climate

Texas Master Naturalists
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This climate guide introduces elements of climate important to gardeners. An overview of natural climate patterns and differences are shown. Links to local climate information are provided.

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8. Climate Resources
9. Climate Change
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Section One: Introduction - Climate and Environment

CLIMATE

arid

Marine

tropical

"I like the climate . . . it suits my garden well"

What Controls our Climate?

There are four primary factors that control and define climate at any location:

1. Latitude
2. Elevation
3. Proximity to Oceans or Large Lakes
4. Topography

Latitude

The equator is 0º and the poles are 90ºN and 90ºS respectively. Most of the land surface of the earth is in the Northern Hemisphere while most of the Southern Hemisphere is covered by Oceans.

Elevation

Temperatures generally cool and precipitation often increases as you go up in elevation. Very large climate differences occur over very short distances thanks to changes in elevation.

Proximity to Oceans and Large Lakes

The Gulf of Mexico

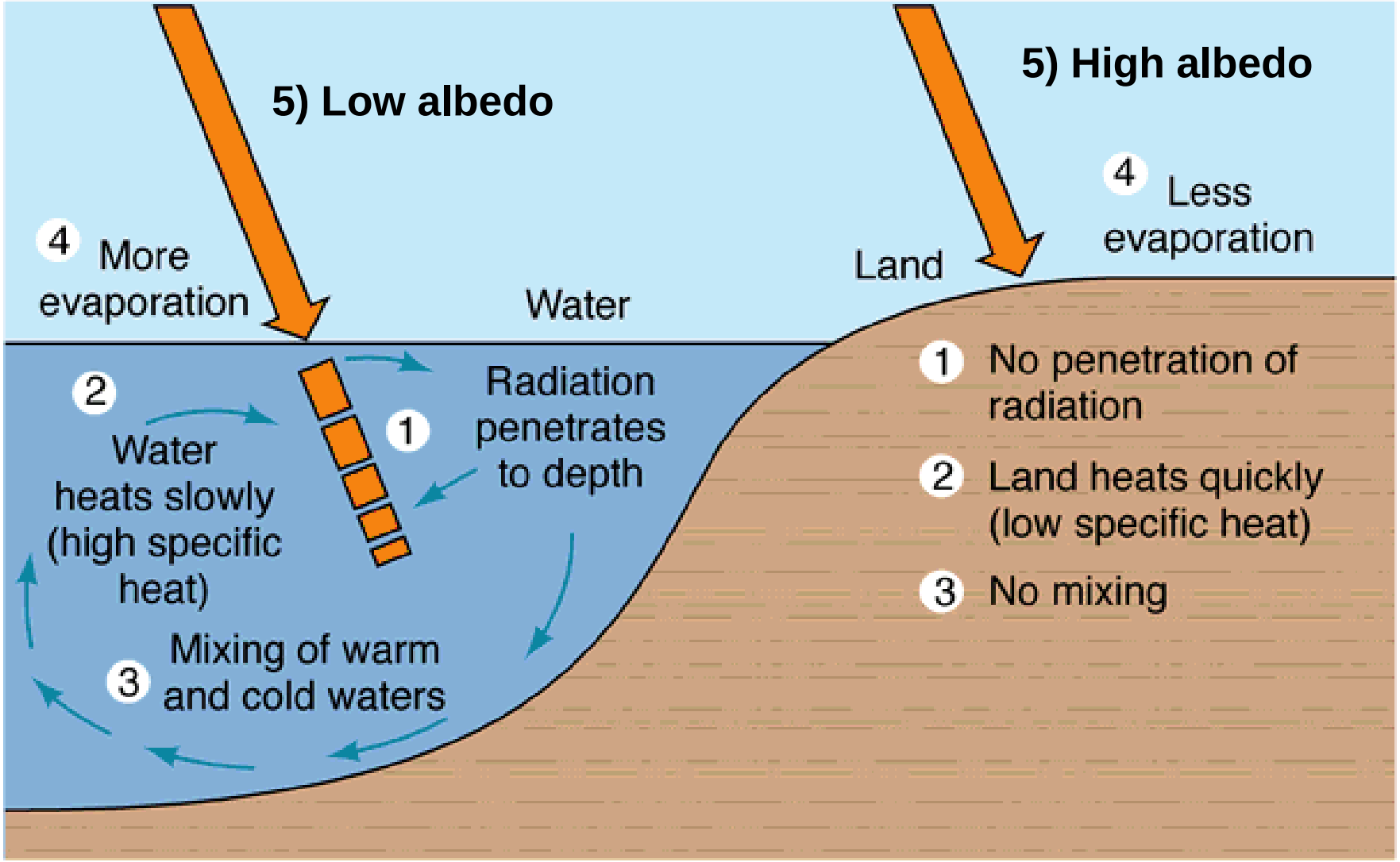
Lakes

Oceans

Puget Sound
Sebago Lake
Hilo Bay

Oceans and large lakes increase the humidity of the air and provide a moderating influence on temperature.

Land and Water Contrasts



Topography

Subtle features in the local landscape such as valleys, ridges, depressions, slopes and the distance and direction from mountain ranges all work together to help shape the climate. Valleys and depressions may be hot during the day, but there may be frost pockets at night. Nearby hillsides may be cooler in the day, but milder at night.

Micro-climates

Occurring naturally in many places

Nature provides remarkable local climate variations know as “Micro-Climates”

Example: Colorado’s orchards and vineyards can only grow well in a few specialized areas where wind and temperature are favorable.

Section Two: Sunshine

"Providing the power to grow our gardens"

Sunshine and Clouds

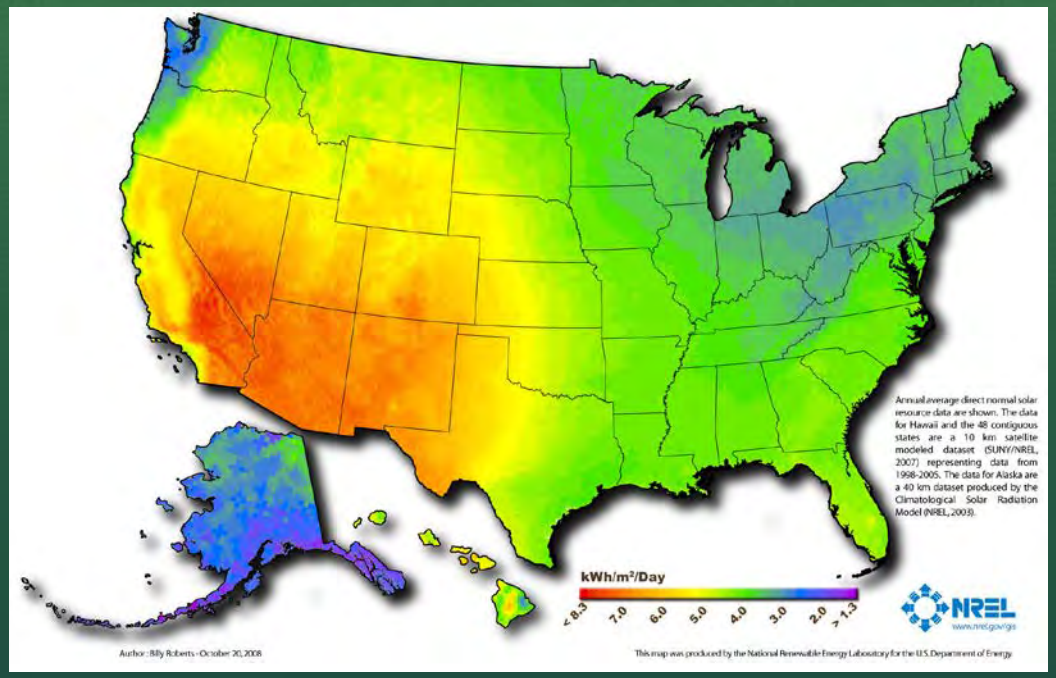
Sunshine provides the energy essential for photosynthesis and plant growth.

The more cloudy the days are and the shorter the day length, the less energy plants receive to grow!

Paying attention to the amount of sunshine also gives an idea of watering needs of plants. The more sun, the more water loss to evapotranspiration.

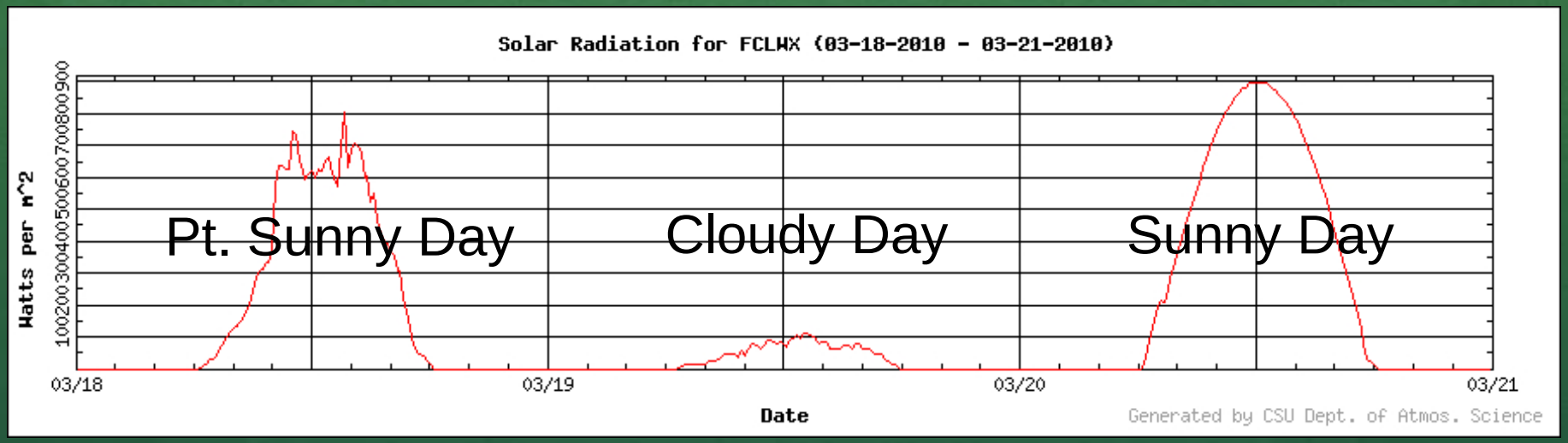
Annual Average Solar Radiation

Solar radiation is greatest in the Desert Southwest. It is least near the Great Lakes, over the Appalachian Mountains, as well as parts of New England and the Pacific Northwest



National Renewal Energy Laboratory: www.nrel.gov

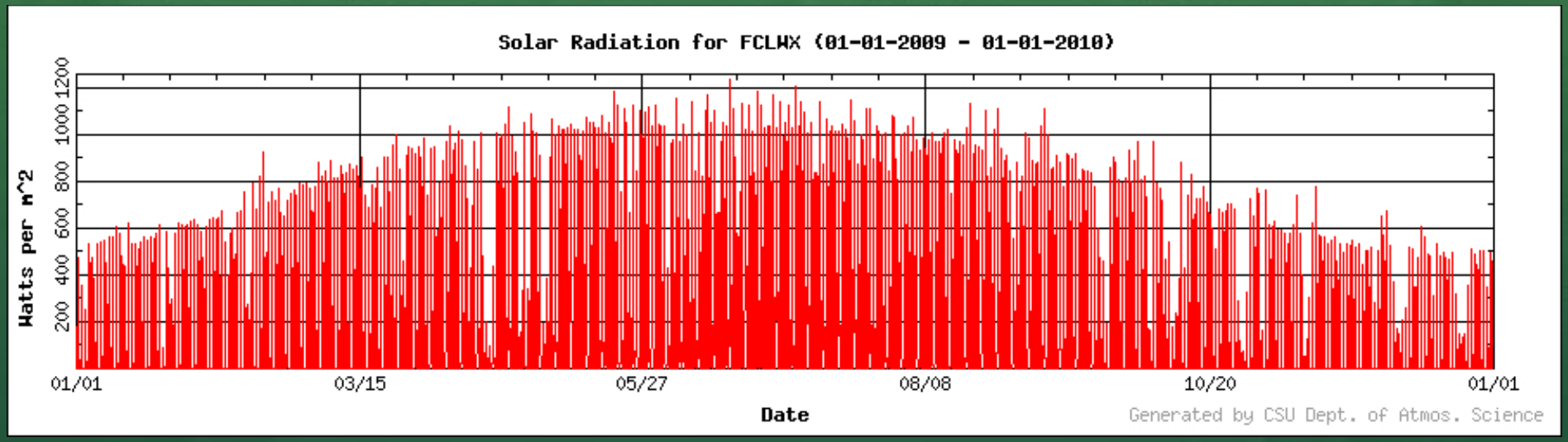
Daily Solar Radiation



The amount of daily solar radiation varies with the seasons and from day to day.

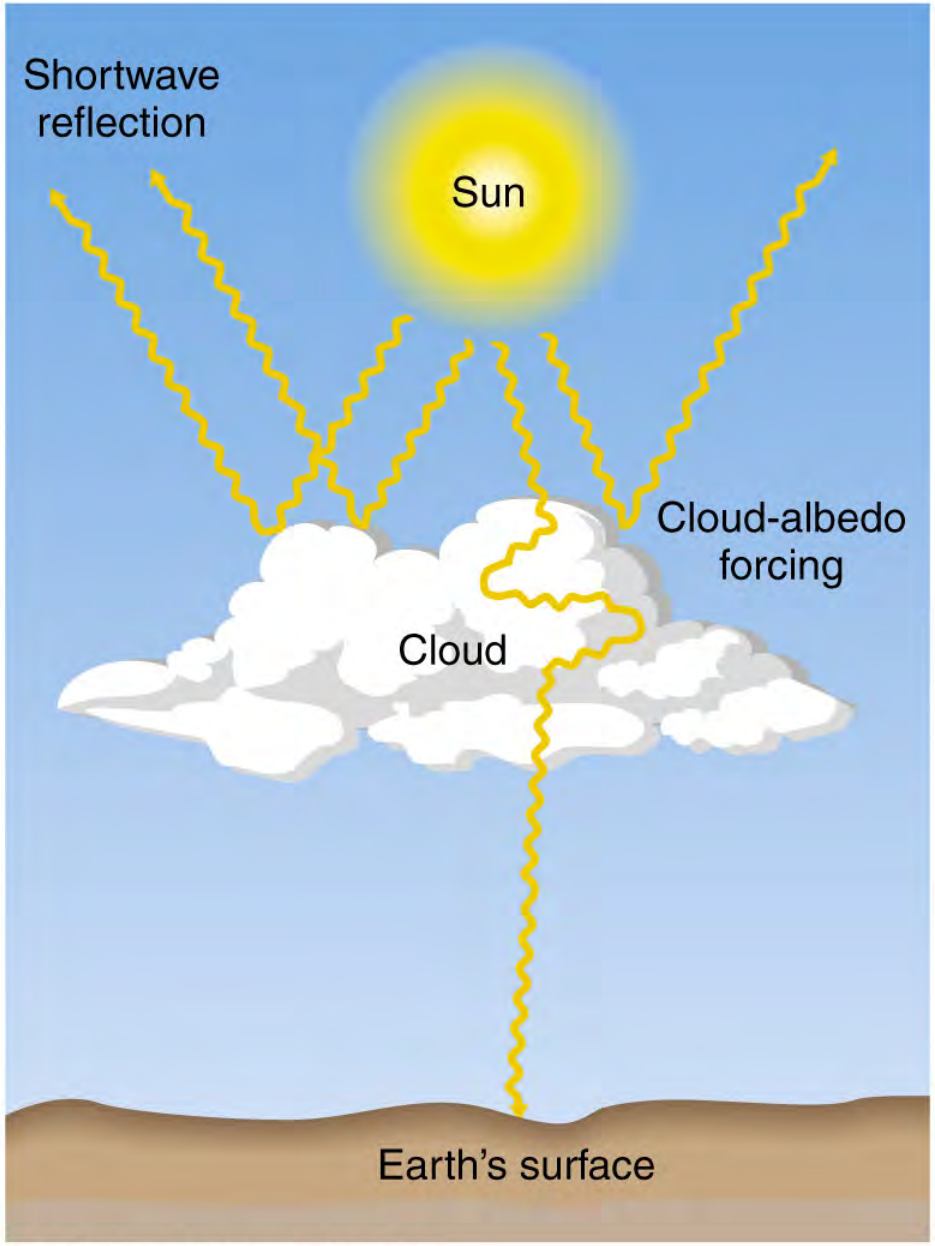
The above example shows a graph of three consecutive days with varying amounts of sunlight for Fort Collins, Colorado.

Annual Solar Radiation

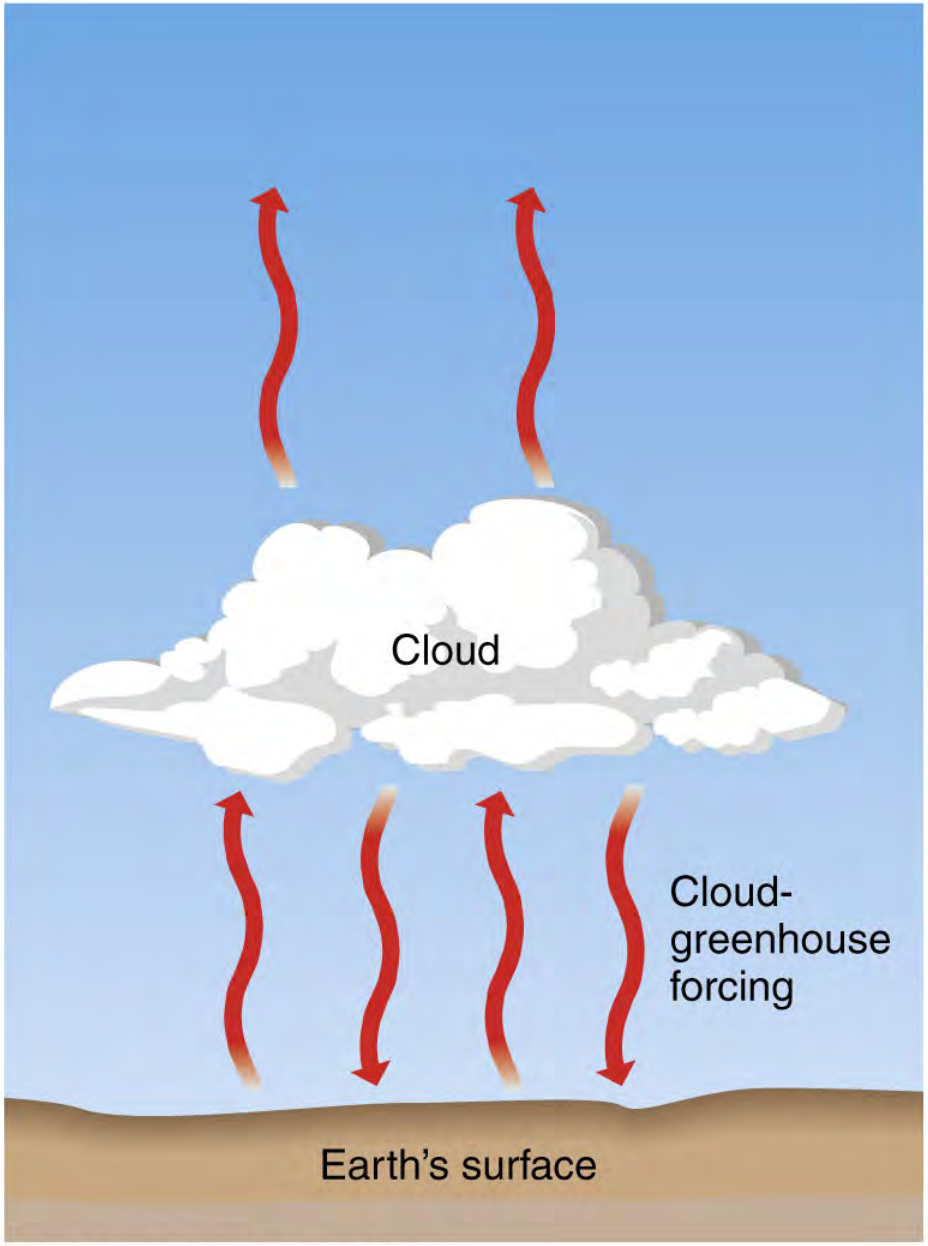


Above is a look at the amount of solar radiation received at one particular location over a year (http://ccc.atmos.colostate.edu/). Solar energy is highest in June when day length is longest and the midday sun is nearly overhead.

Clouds and Temperature



(a) Shortwave radiation



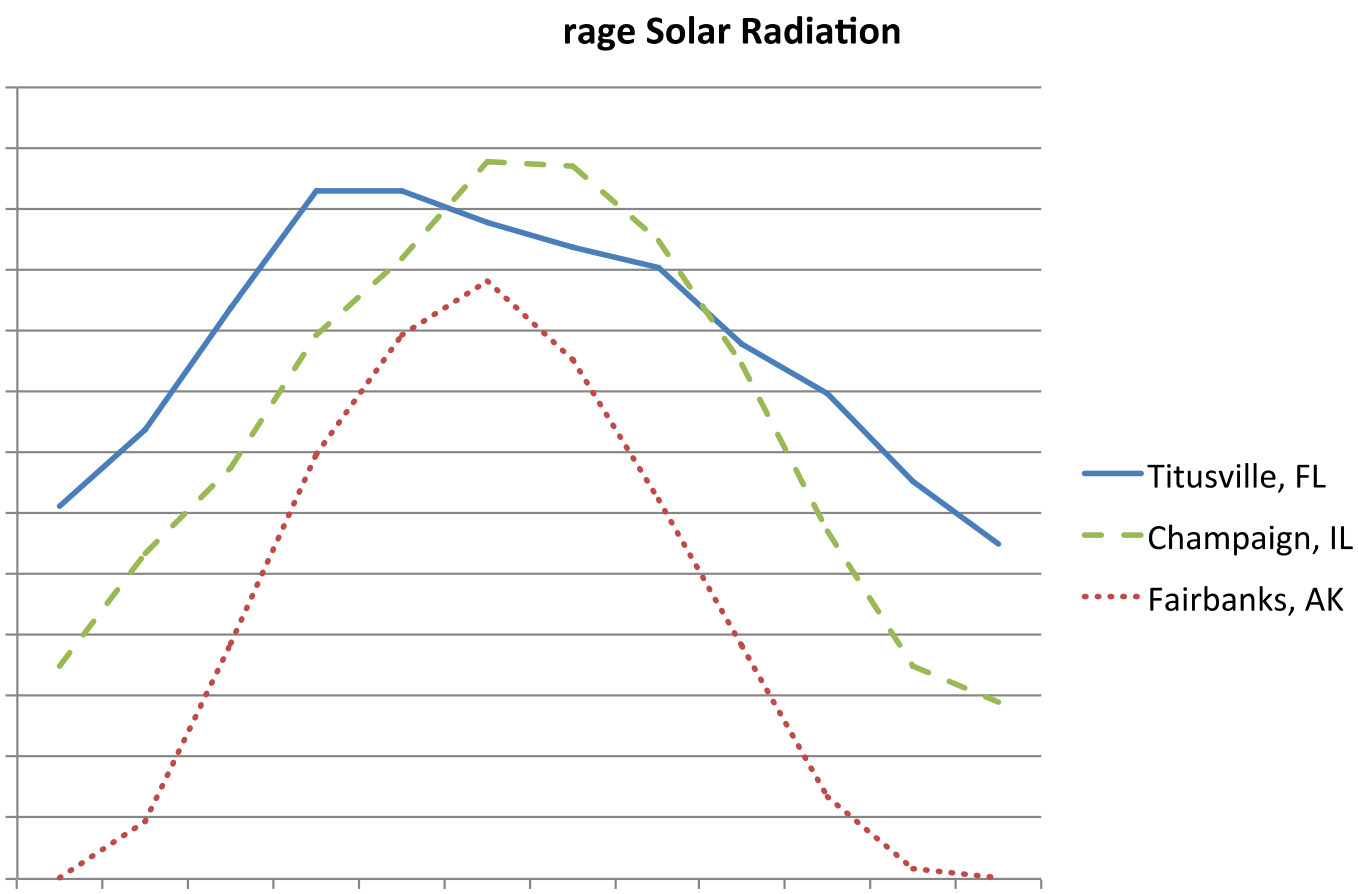
(b) Longwave radiation

Figure 4.7

Stratus
(90% albedo)

Cirrus
(50% albedo)

Solar Radiation varies across the nation



Section Three: Temperature

Temperature

below zero

Freezing

100°F

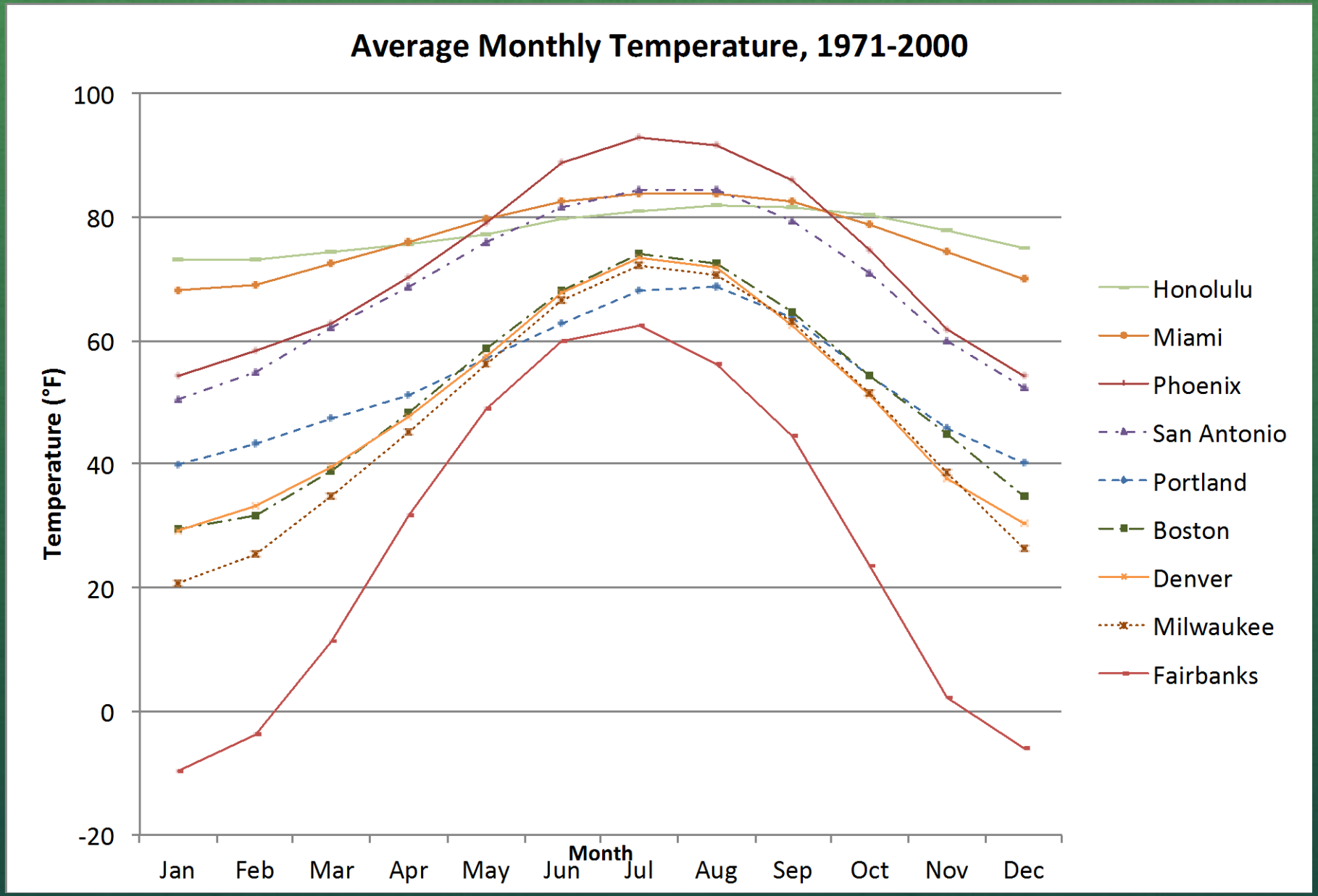
"Highs, lows and a lot of in-between"

Temperature's Impacts

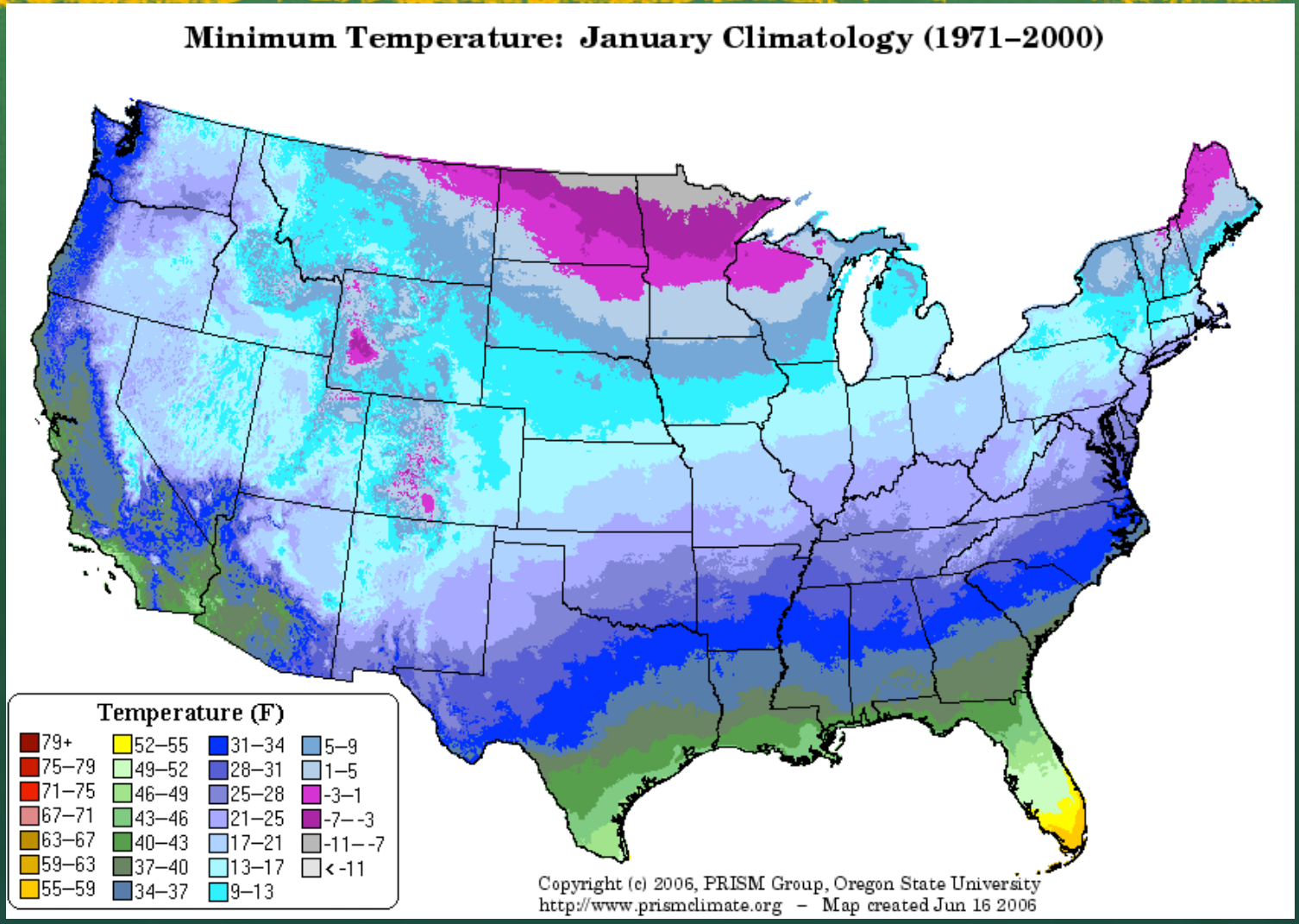
- Temperature has a variety of impacts on the environment. Some plants grow best in hot weather while other prefer it cool.

- Temperature also controls the development of certain diseases and insects.

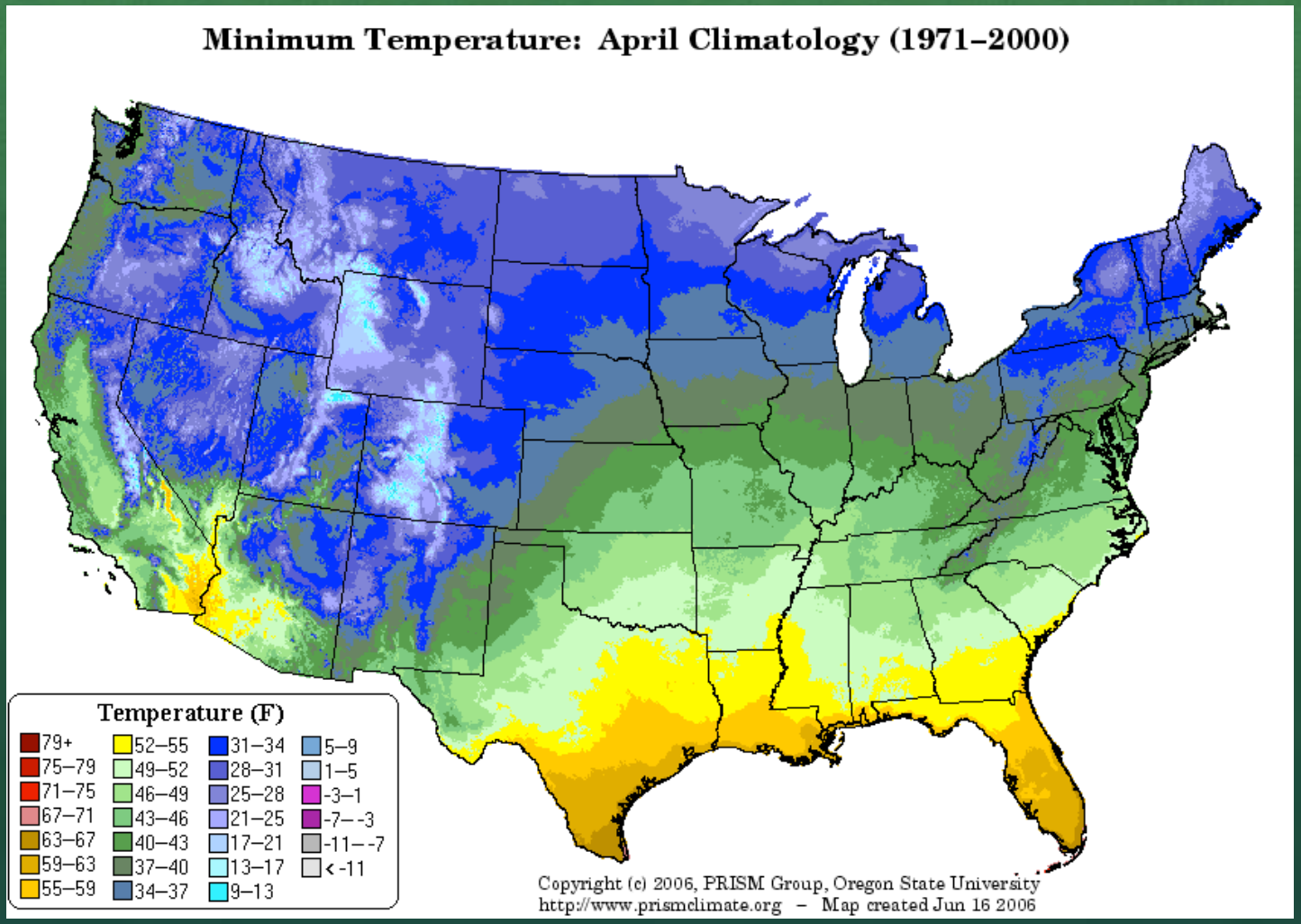
Average Monthly Temperature for selected cities, 1971-2000



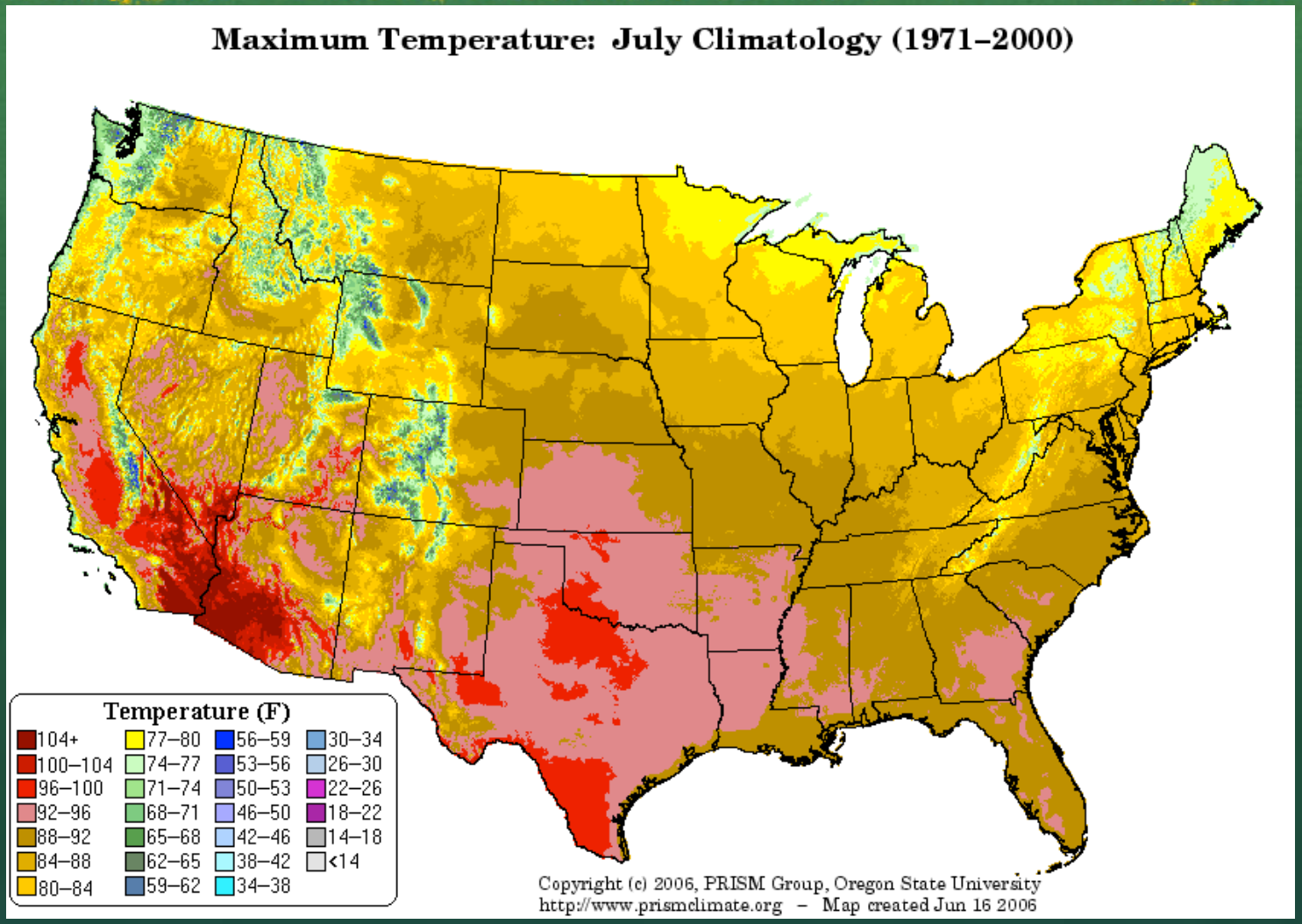
Winter Temperatures



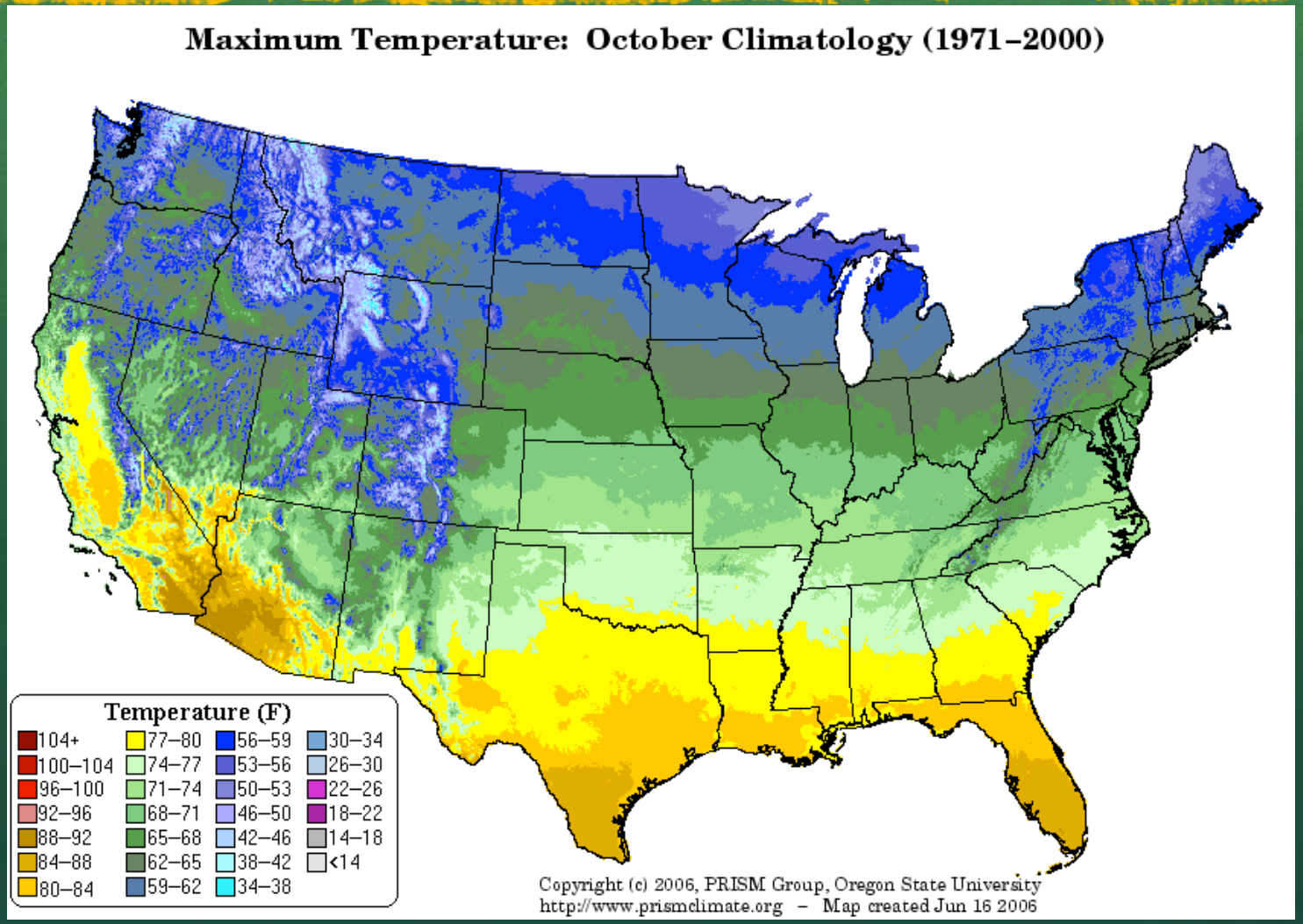
Spring Temperatures



Summer Temperatures



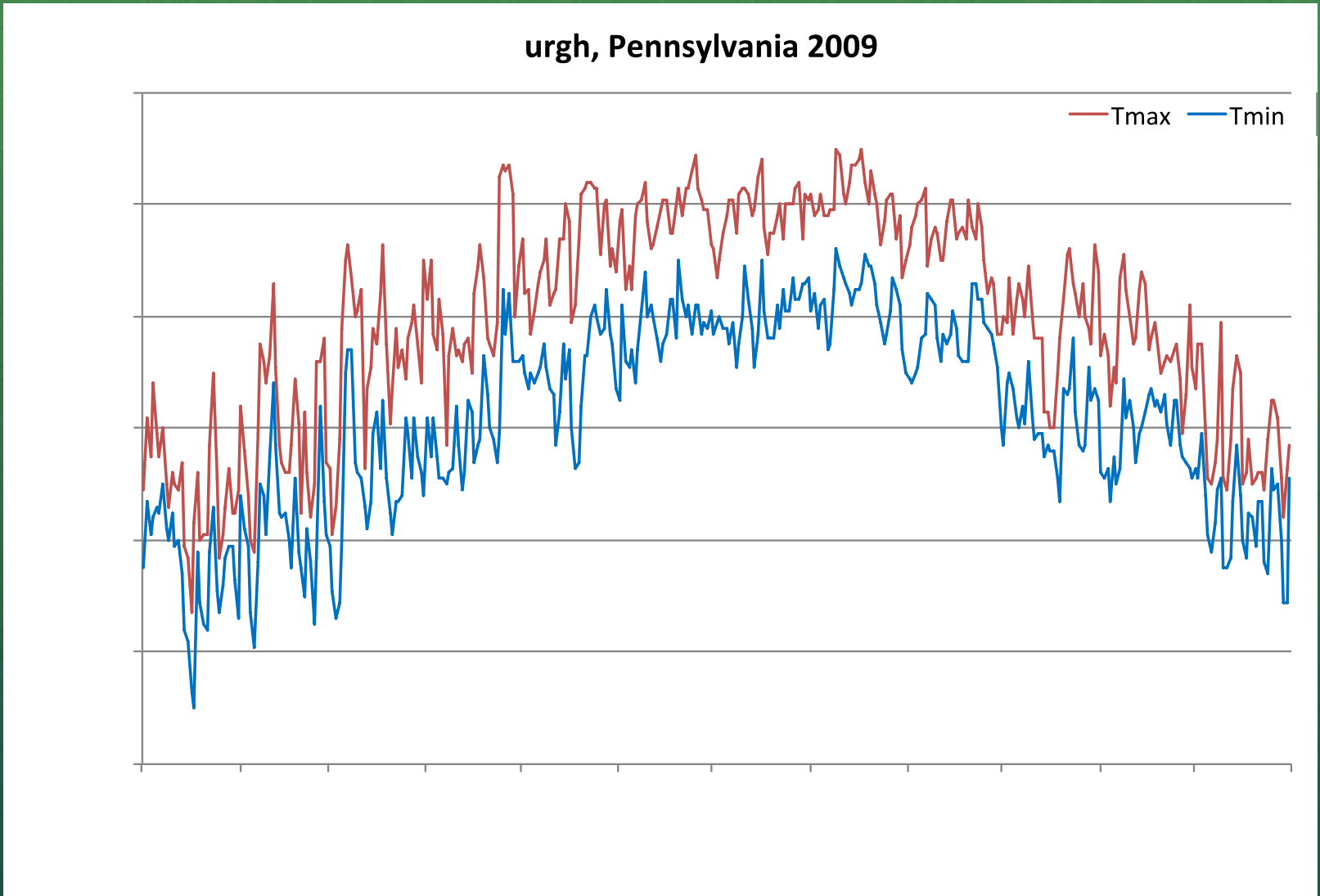
Autumn Temperatures



Actual Temperatures

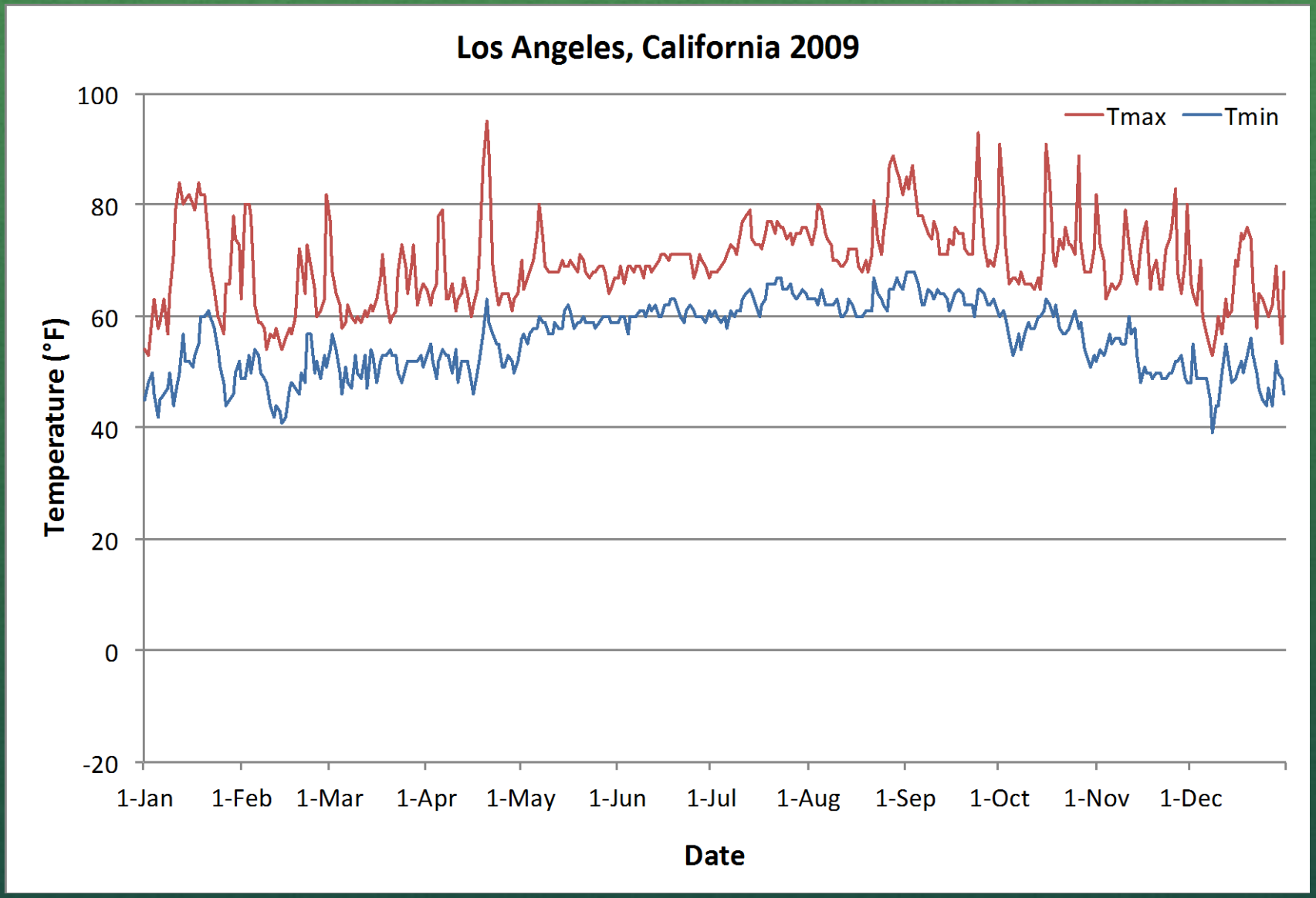
- Average temperatures (based on historical data) tell you what you can probably grow. Actual temperatures show the variation in your climate due to changeable daily weather and will effect how well your plants actually grow in a given year.

A year's worth of temperature for Pittsburgh, PA



In most parts of the country, day to day changes in temperature are common year round as air masses move and fronts pass by.

A year's worth of temperature for Los Angeles, CA



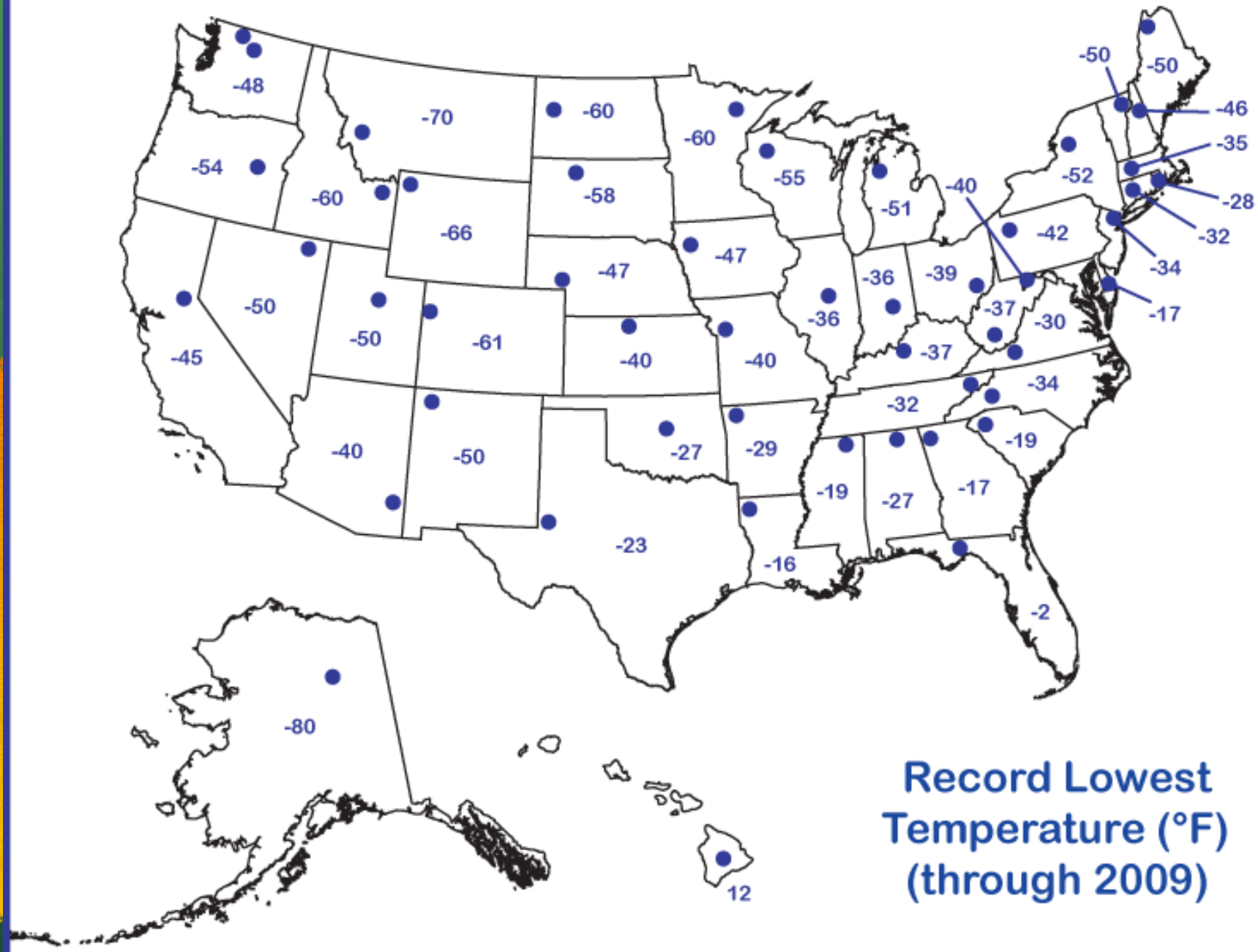
Notice that there is little variation in daily temperature swings during the summer.

Temperature Records

What is the coldest or warmest temperature ever recorded in your state?
Our next slides show the records for each state.

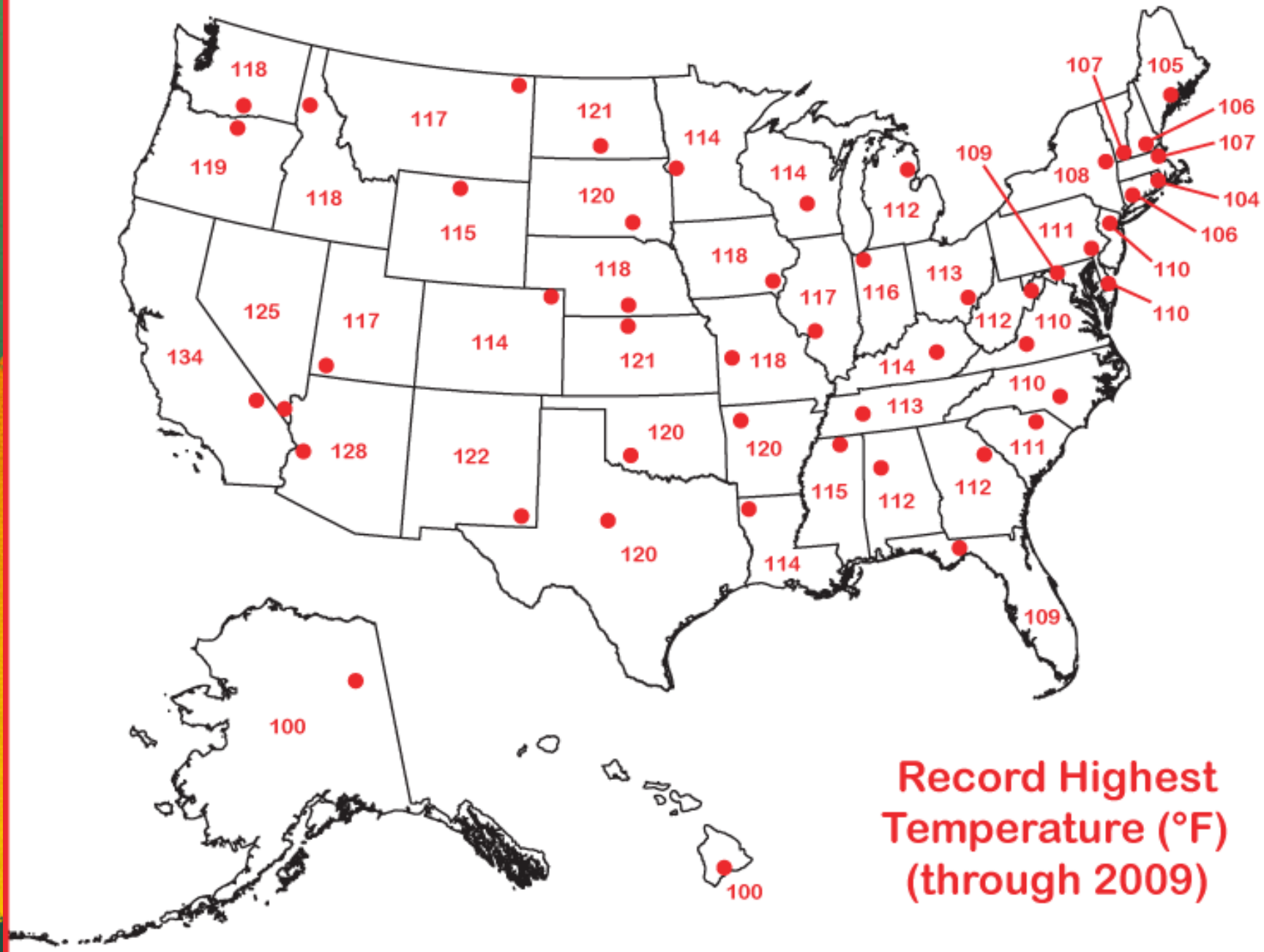
Photo: turnto10.com

Photo: lakevermillionrealestate.com



Record Lowest Temperature (°F) (through 2009)

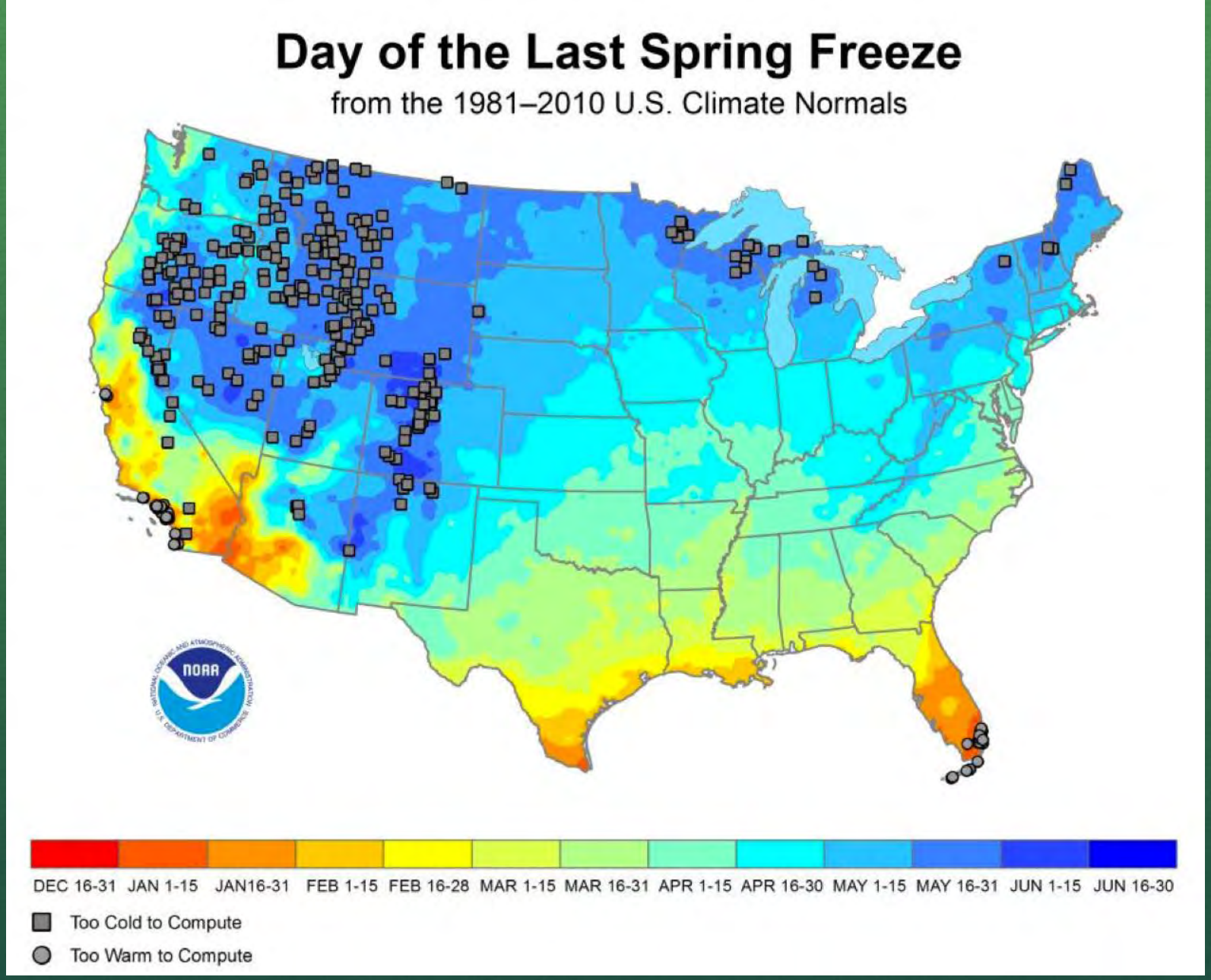
Courtesy of NCDC & NJ State Climate Office



Courtesy of NCDC & NJ State Climate Office

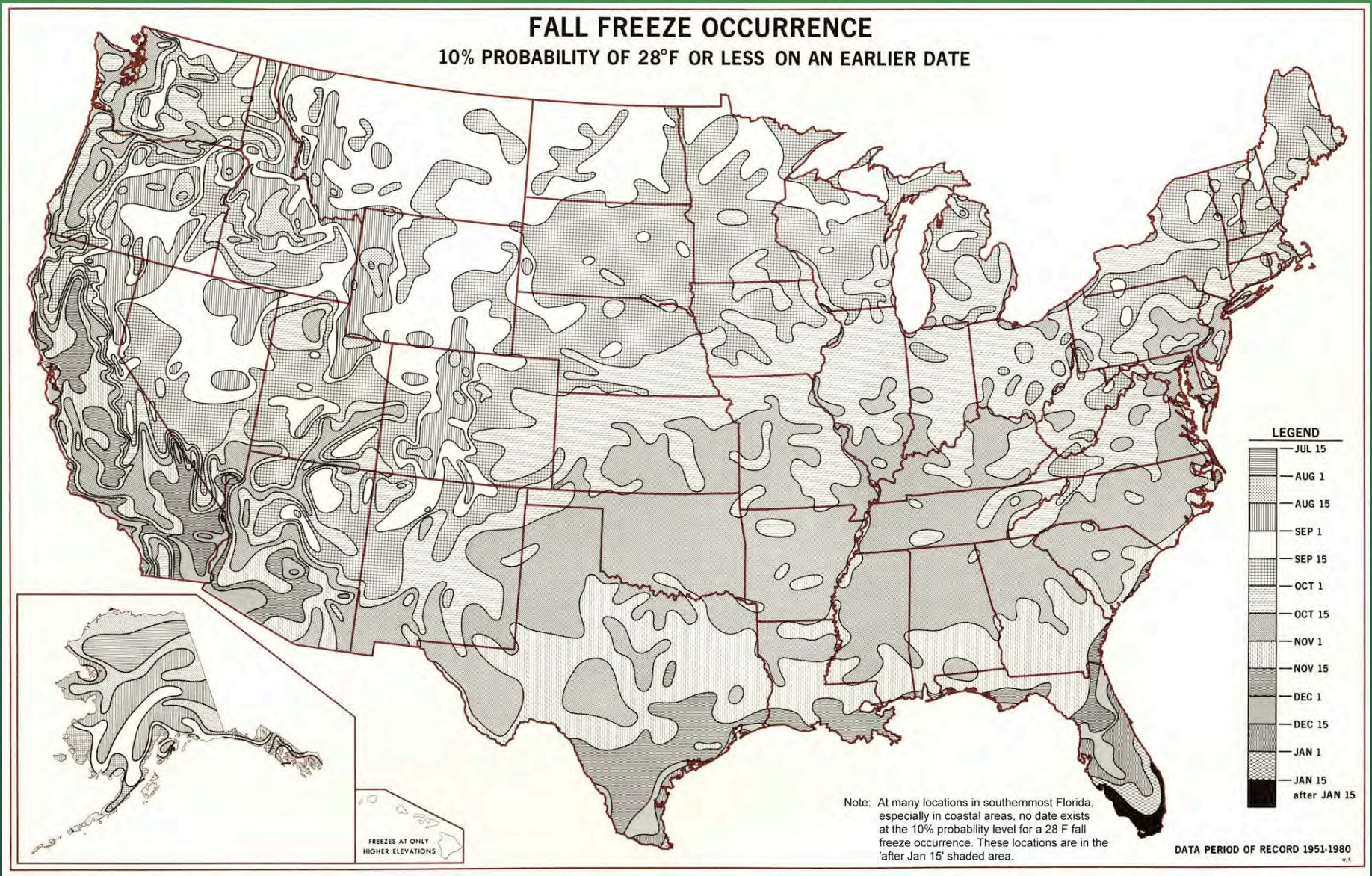
Frost/Freeze

Frosts and Freezes occur at different times in different areas of the country. Here are the average dates.



Courtesy of NCDC

Spring Freeze Occurrence



Courtesy of NCDC

Fall Freeze Occurrence

Section Four: Humidity and Dew Point

Humidity
Dew Point

RH
WET BULB

Psychrometer

"It's not the heat, it's the humidity"

Relative Humidity (RH)

"RH is a percentage of the amount of water vapor in the air compared to what it could potentially hold at a certain temperature."

- At higher temperatures the atmosphere is capable of holding much more water vapor than at colder temperatures.
- Normally the highest relative humidity occurs in the early morning, during the coolest part of the day. Plants transpire most during the warmest part of the day (usually afternoon) when the relative humidity is lowest.

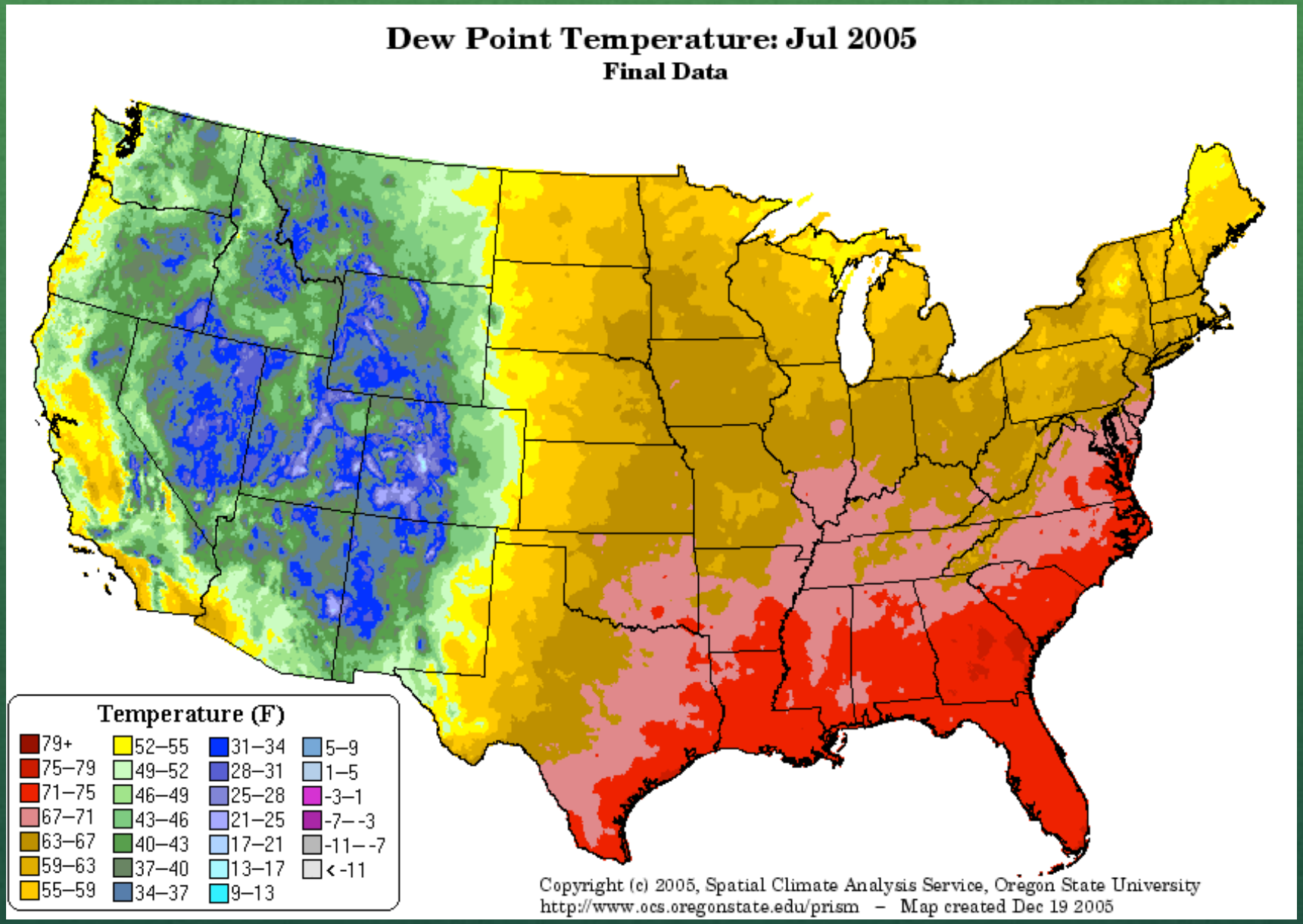
Relative Humidity (RH)

- RH has a direct effect on a plant's ability to transpire which affects its growth.
- Most plants grow best with higher RH. At persisting low RH many plants struggle to grow without irrigation.

Dew Point

"The temperature to which a given air parcel must be cooled at constant pressure and constant water vapor content in order for saturation to occur." - AMS Glossary of Meteorology

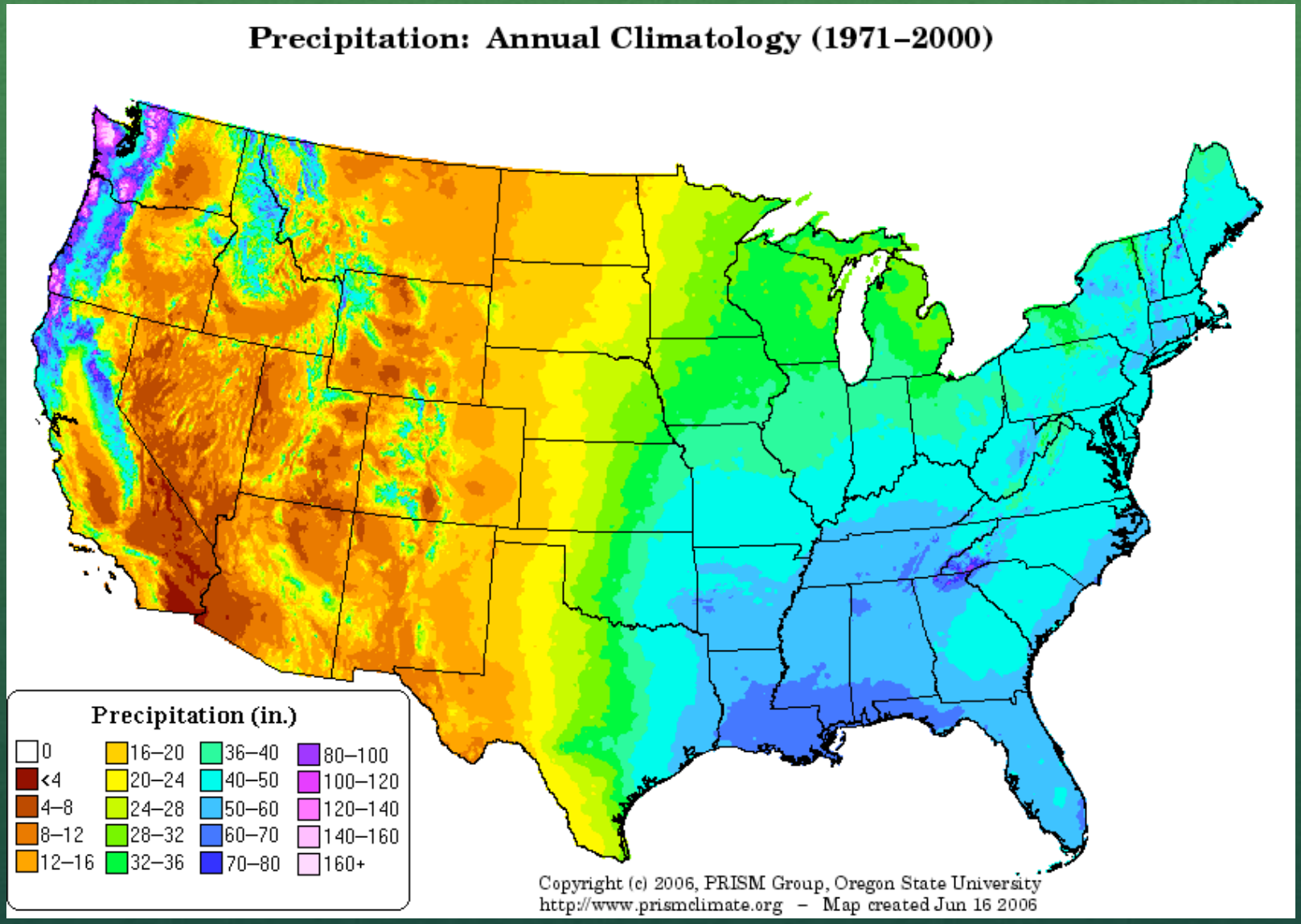
- High dew points may affect plant growth and may favor certain pests and diseases.



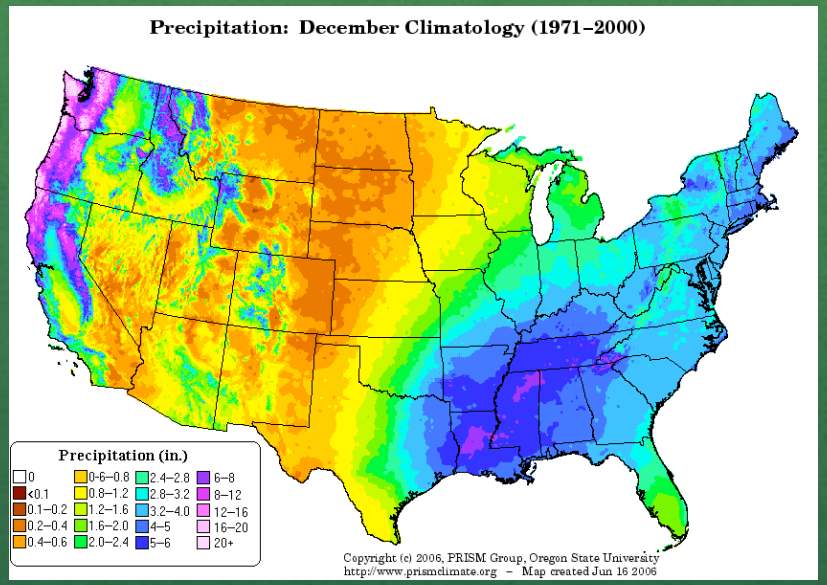
Here is a sample of typical summer dew point temperatures

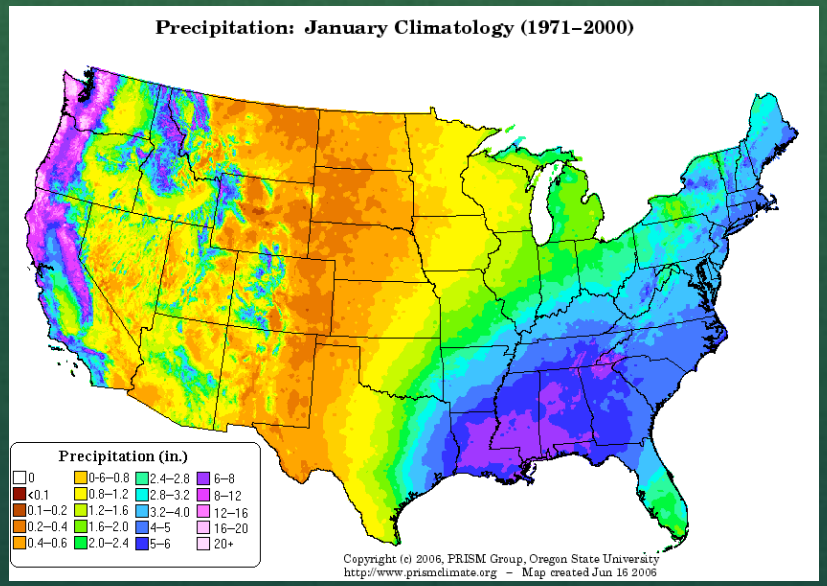
Section Five: Precipitation

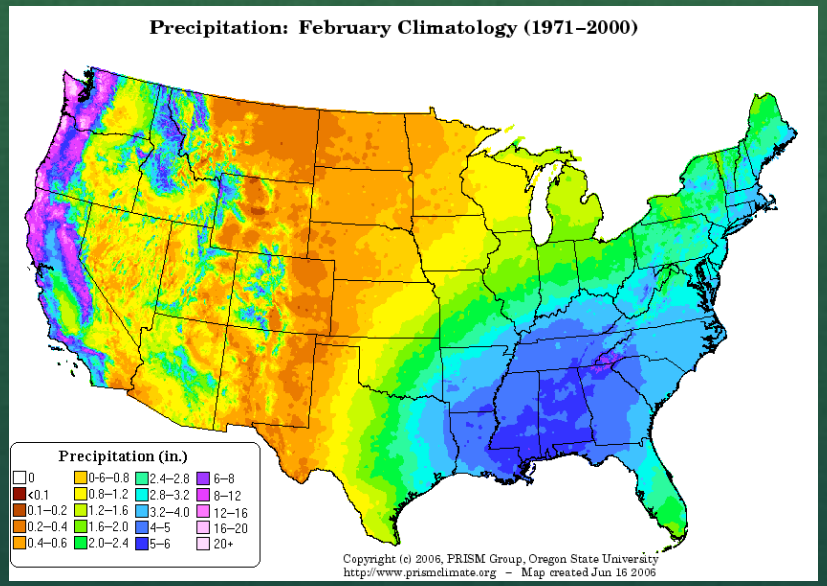
Average Precipitation



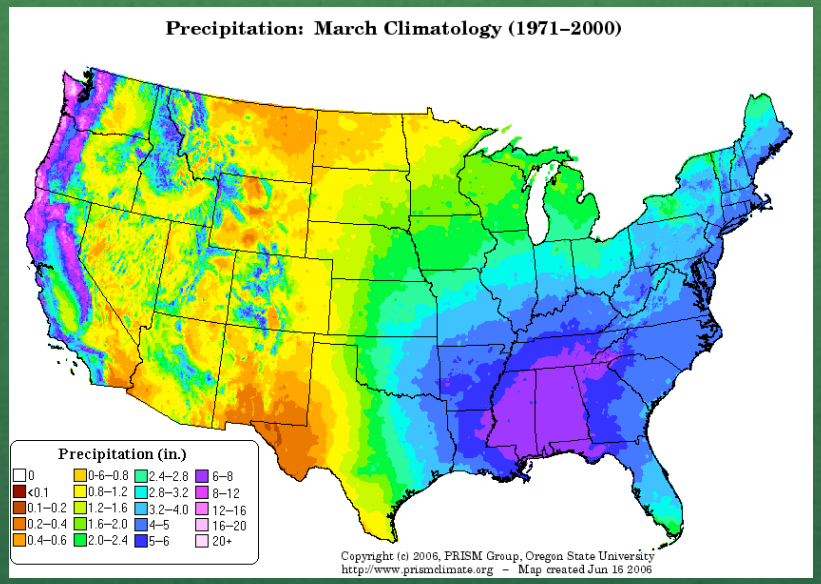
Average Winter Precipitation

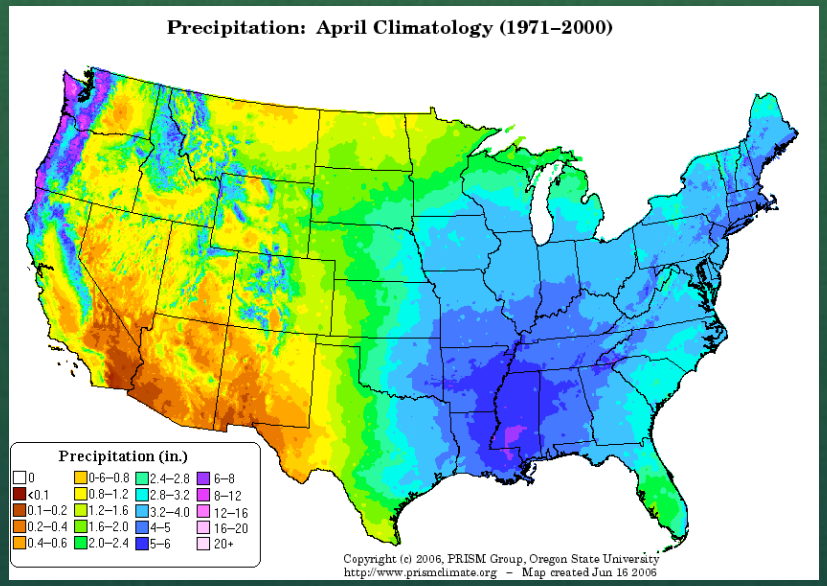


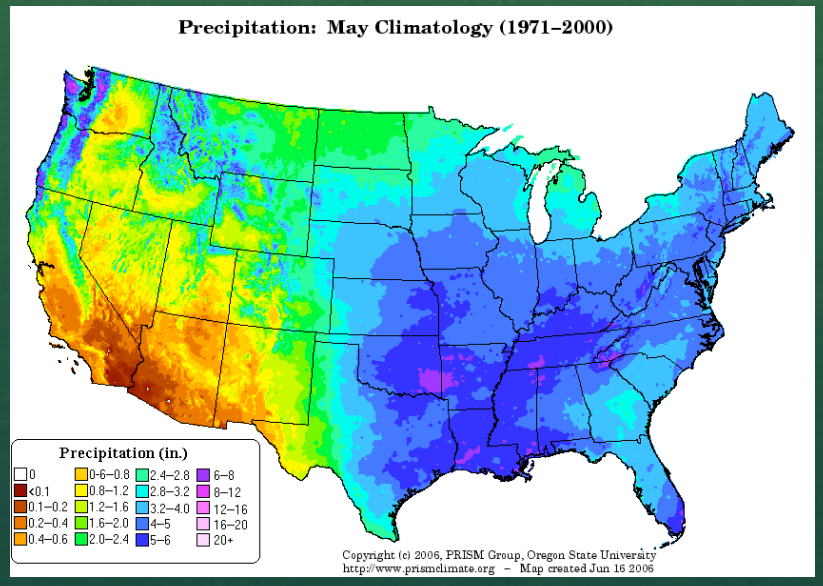




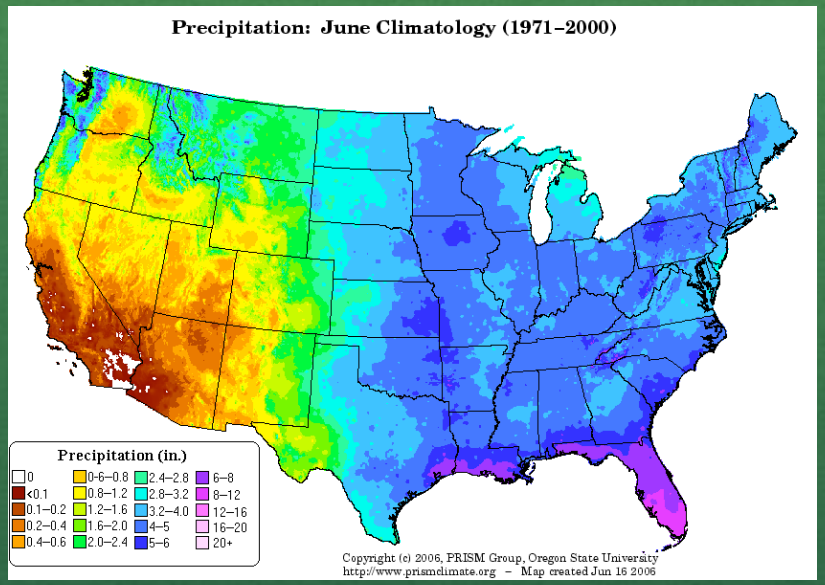
Average Spring Precipitation

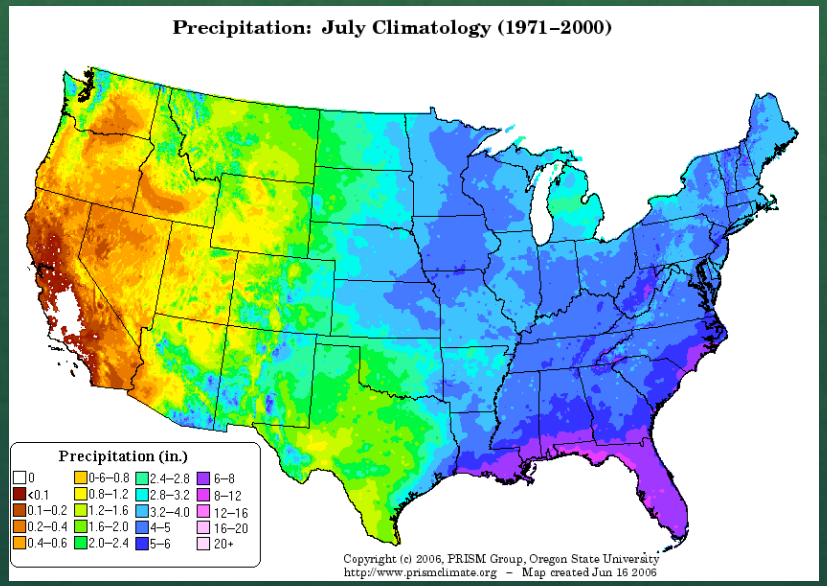


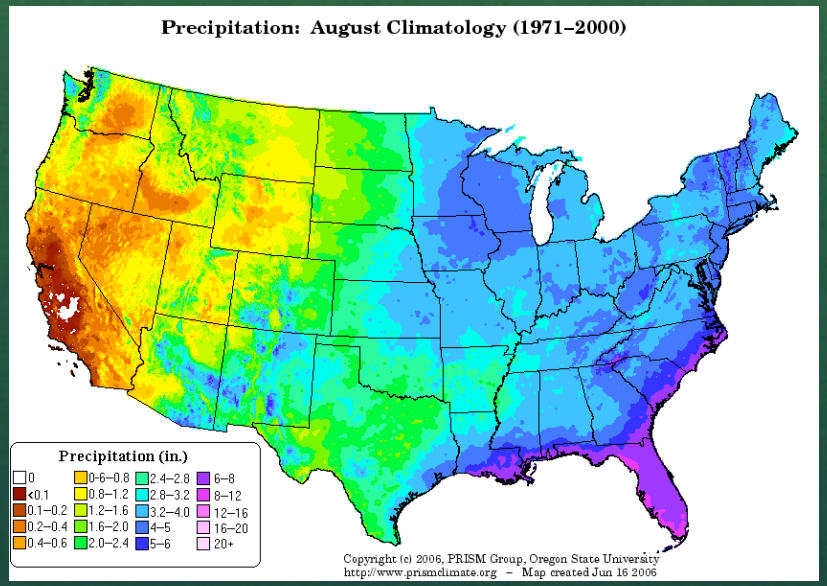




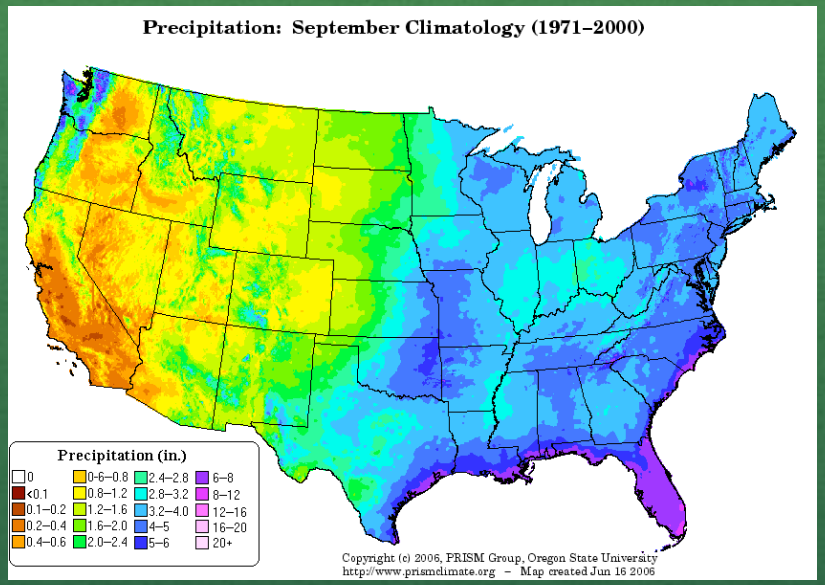
Average Summer Precipitation

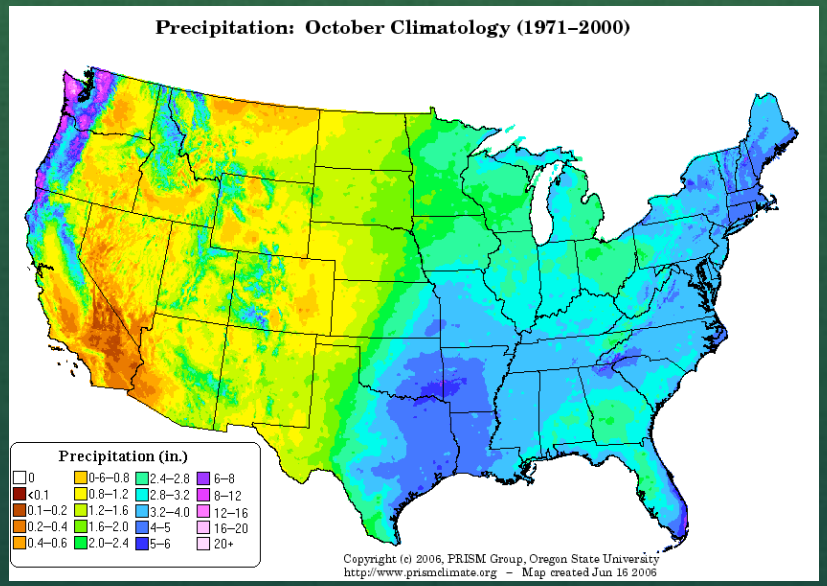


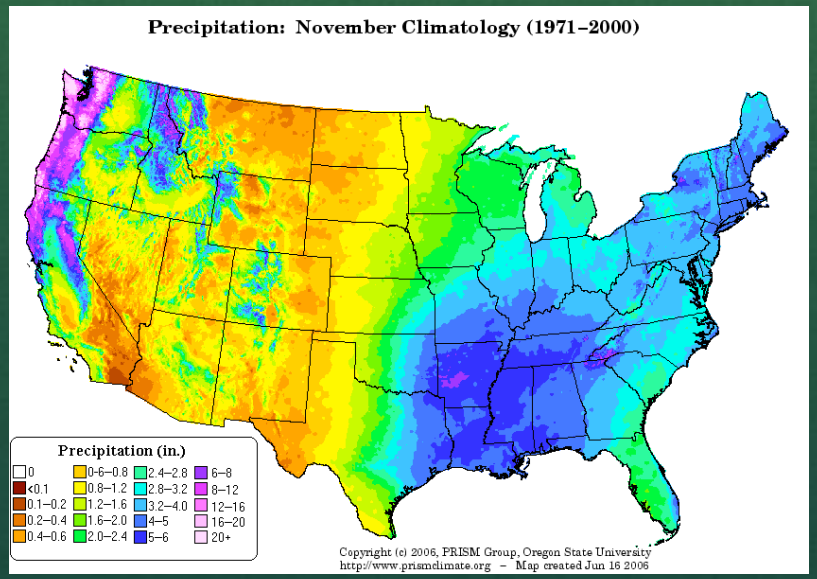




Average Autumn Precipitation





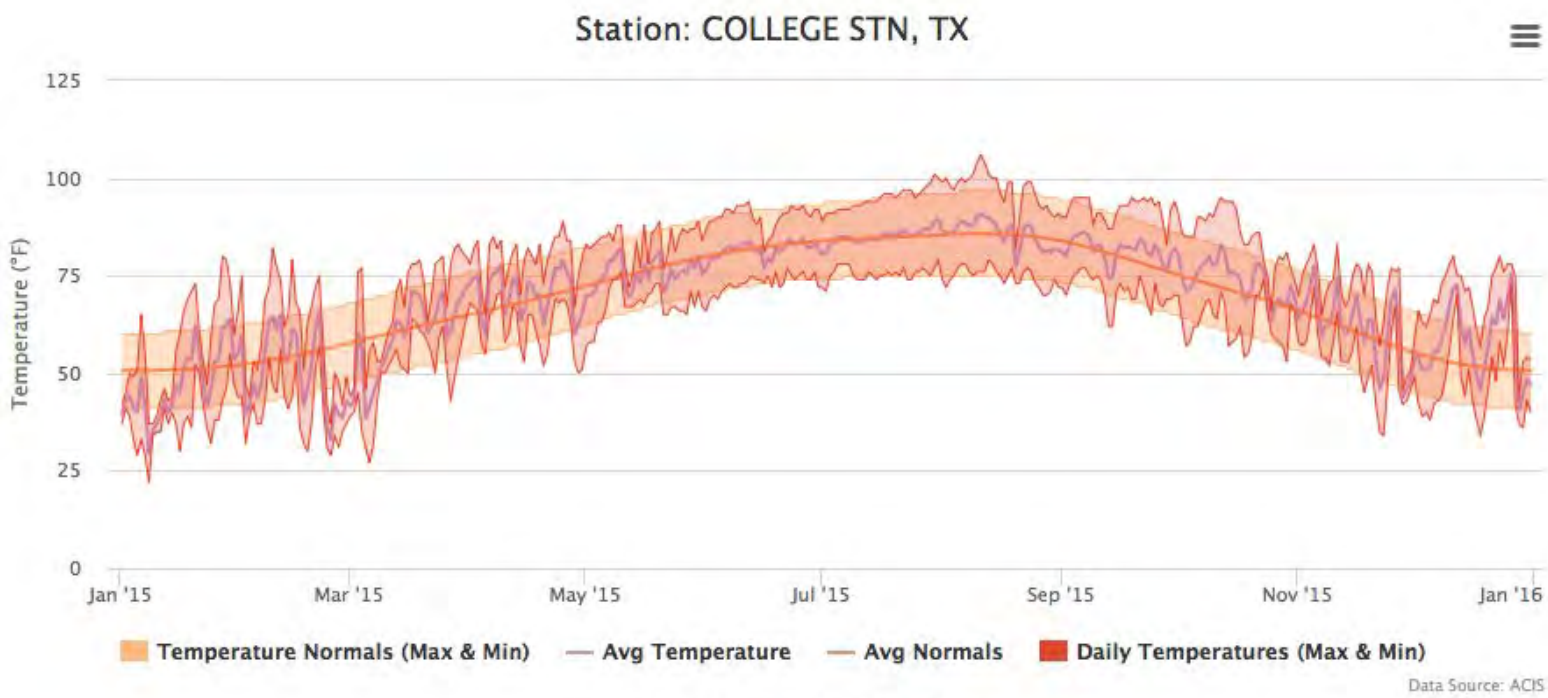


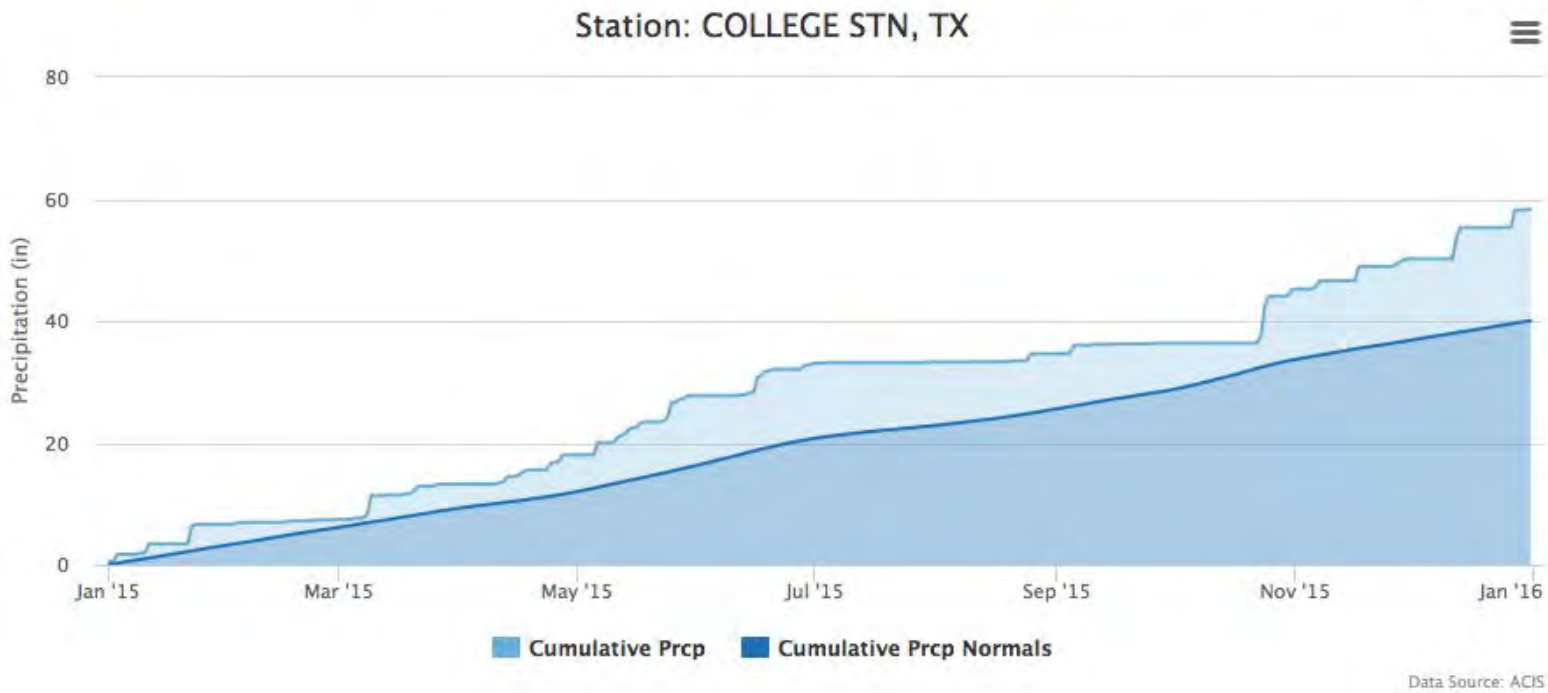
Local precipitation can vary significantly by year and location

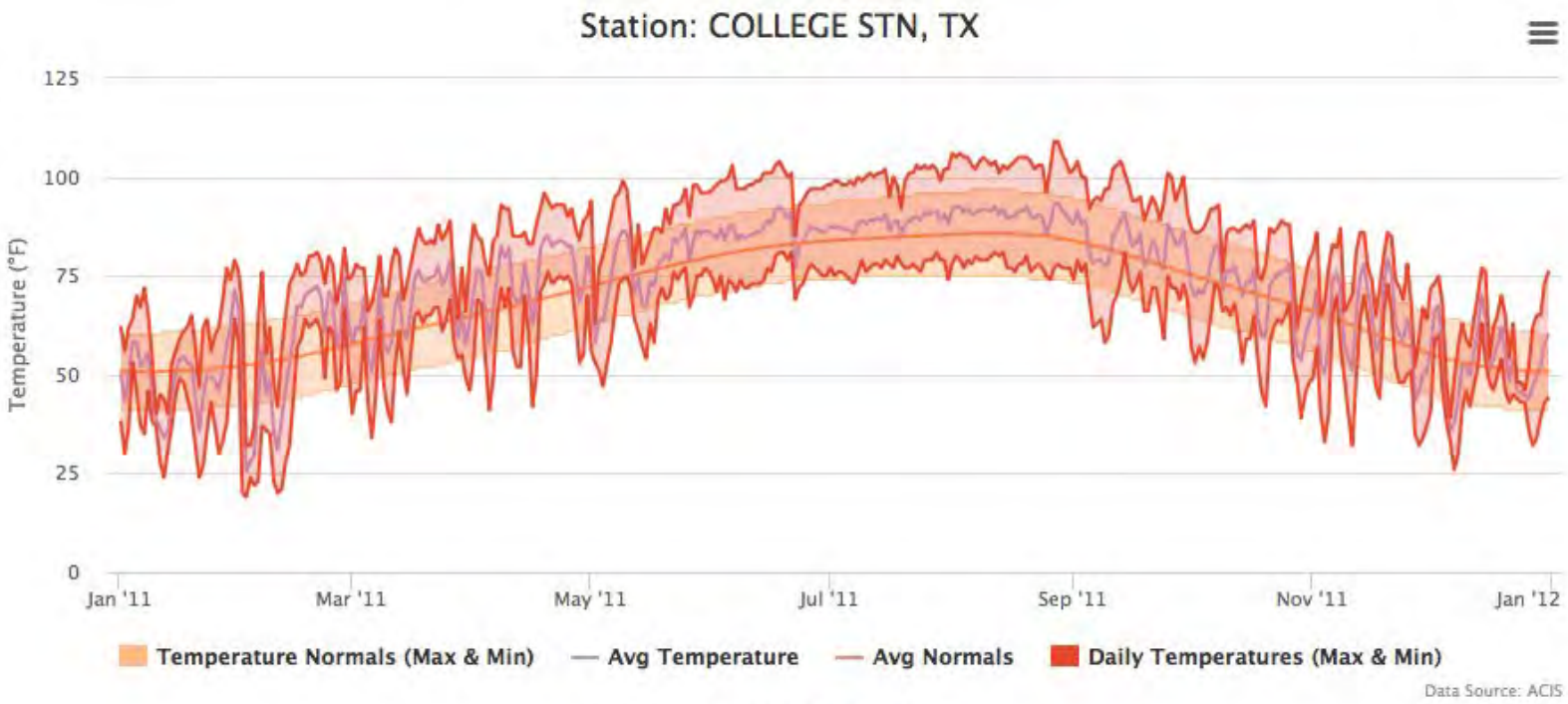
What about in your community ?

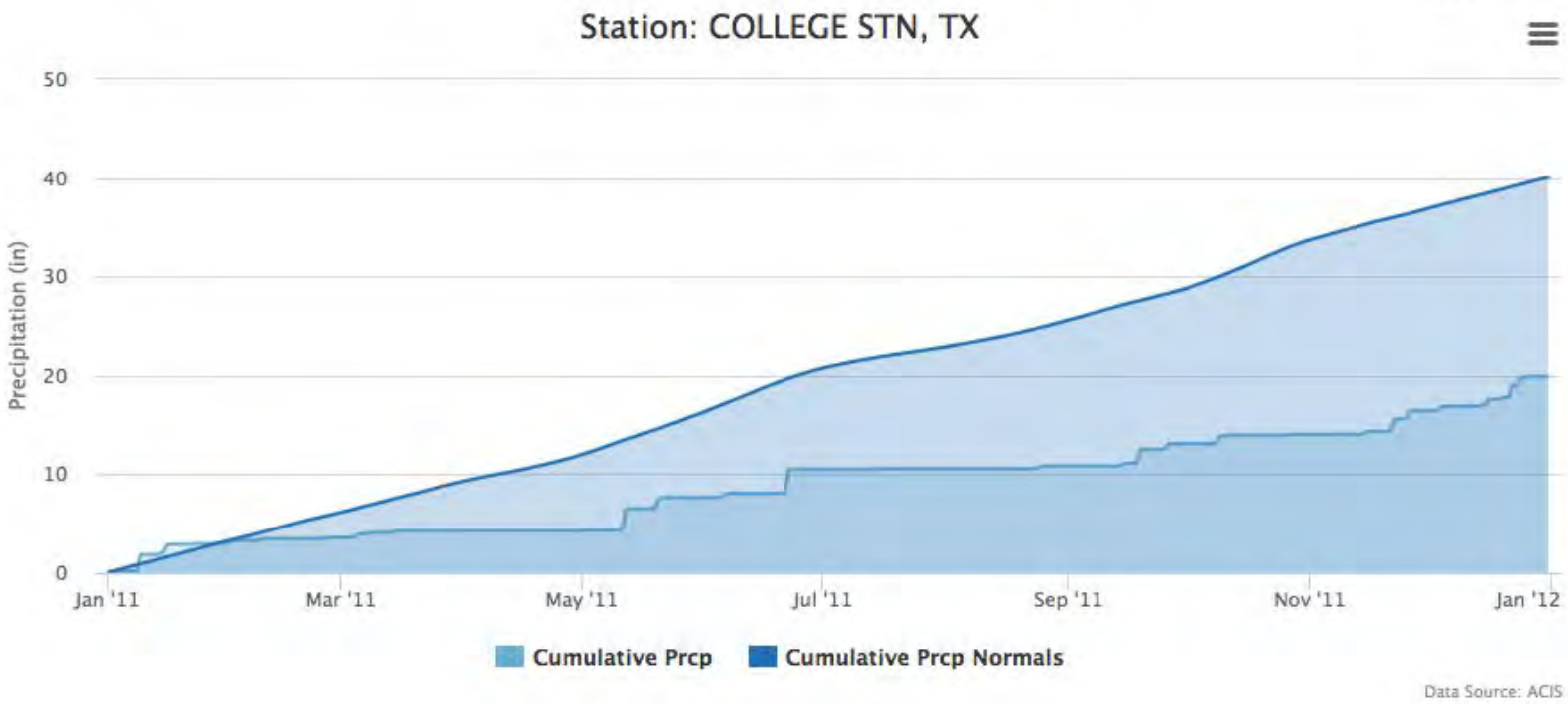
Yearly Variability: Each year is different

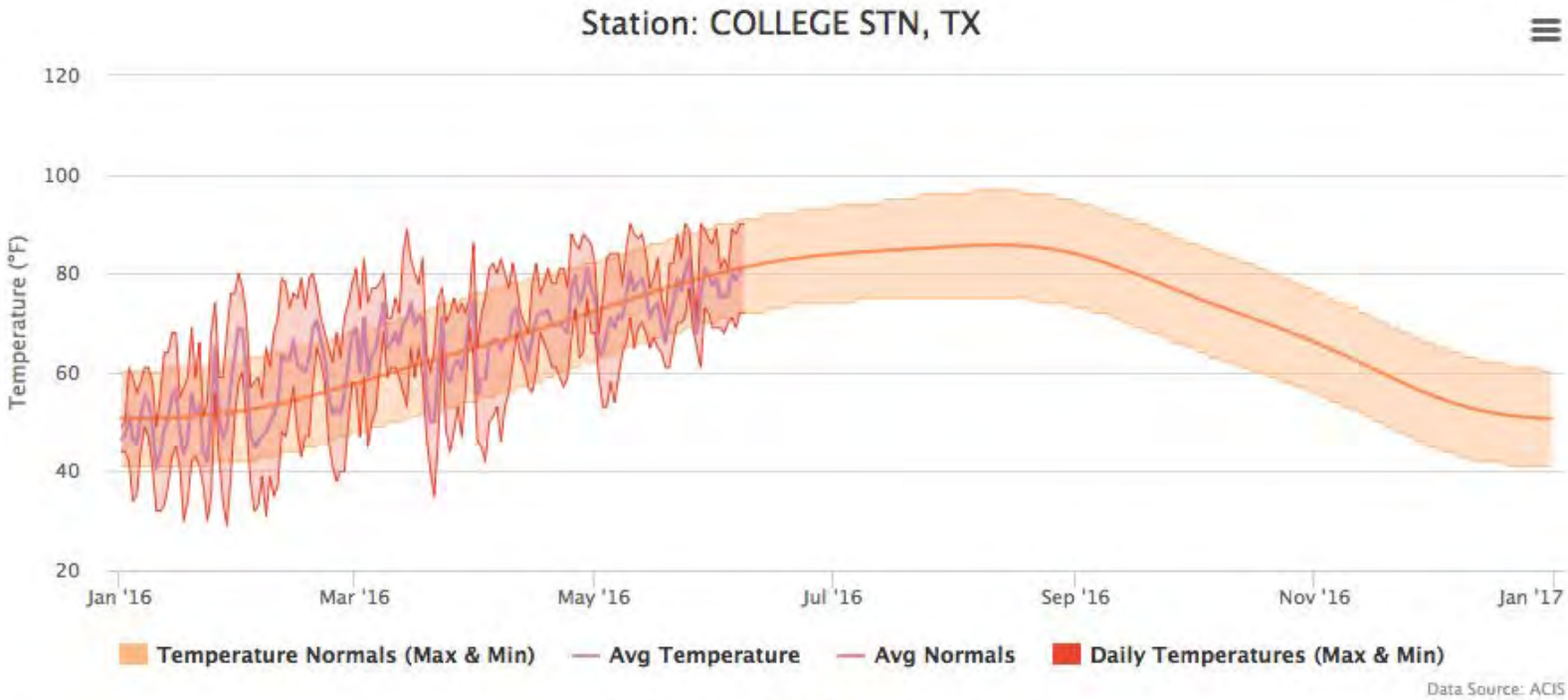
- When it comes to precipitation every year is different and those differences may greatly affect your garden. What grows successfully one year may struggle the next.

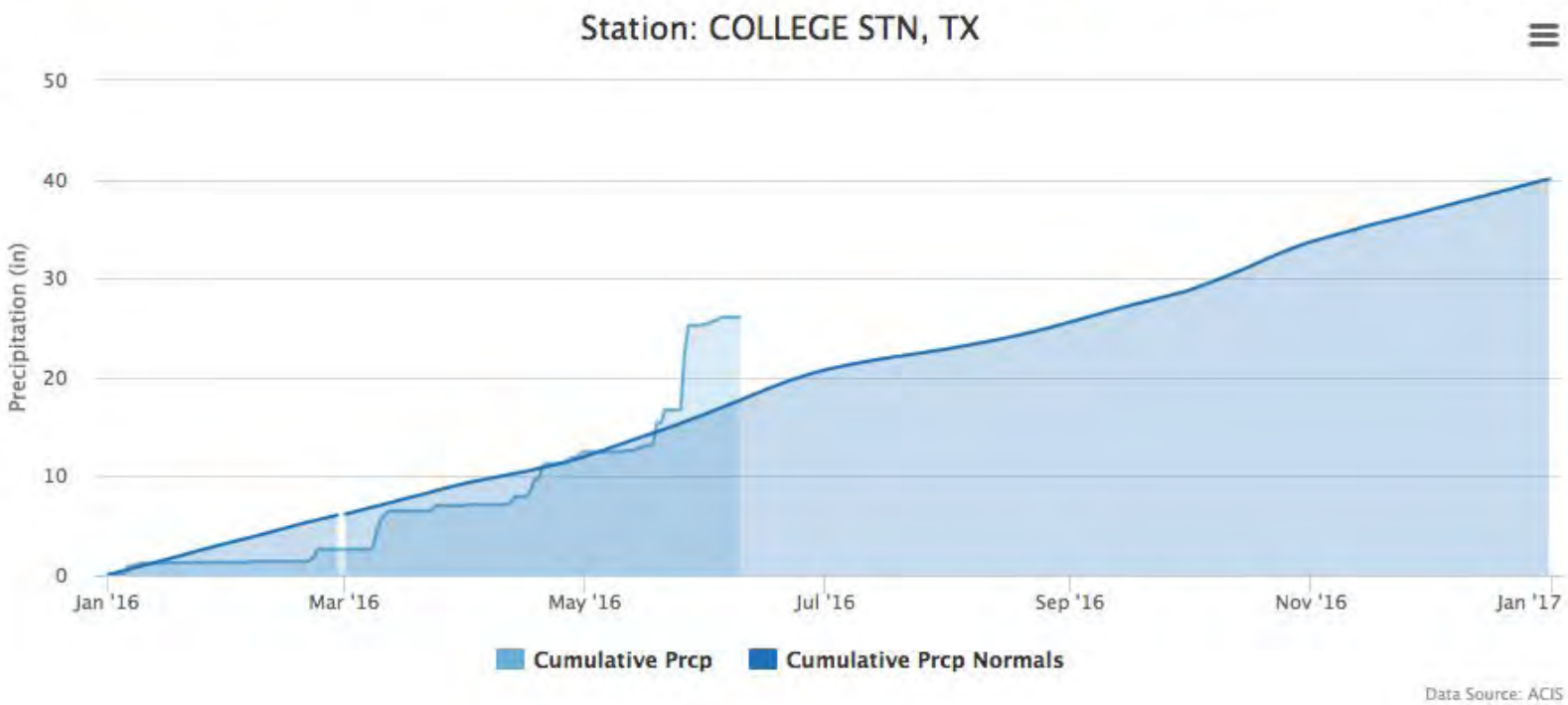

Station: COLLEGE STN, TX
125
100
75
50
25
0
Temperature (°F)
Jan '15
Mar '15
May '15
Jul '15
Sep '15
Nov '15
Jan '16
Temperature Normals (Max & Min)
Avg Temperature
Avg Normals
Daily Temperatures (Max & Min)
Data Source: ACIS


Station: COLLEGE STN, TX
80
60
40
20
0
Precipitation (in)
Jan '15
Mar '15
May '15
Jul '15
Sep '15
Nov '15
Jan '16
Cumulative Prcp
Cumulative Prcp Normals
Data Source: ACIS


Station: COLLEGE STN, TX
125
100
75
50
25
0
Temperature (°F)
Jan '11
Mar '11
May '11
Jul '11
Sep '11
Nov '11
Jan '12
Temperature Normals (Max & Min)
Avg Temperature
Avg Normals
Daily Temperatures (Max & Min)
Data Source: ACIS


Station: COLLEGE STN, TX
50
40
30
20
10
0
Precipitation (in)
Jan '11
Mar '11
May '11
Jul '11
Sep '11
Nov '11
Jan '12
Cumulative Prcp
Cumulative Prcp Normals
Data Source: ACIS


Station: COLLEGE STN, TX
Temperature (°F)
120
100
80
60
40
20
Jan '16
Mar '16
May '16
Jul '16
Sep '16
Nov '16
Jan '17
Temperature Normals (Max & Min)
Avg Temperature
Avg Normals
Daily Temperatures (Max & Min)
Data Source: ACIS


Station: COLLEGE STN, TX
Precipitation (in)
50
40
30
20
10
0
Jan '16
Mar '16
May '16
Jul '16
Sep '16
Nov '16
Jan '17
Cumulative Prcp
Cumulative Prcp Normals
Data Source: ACIS