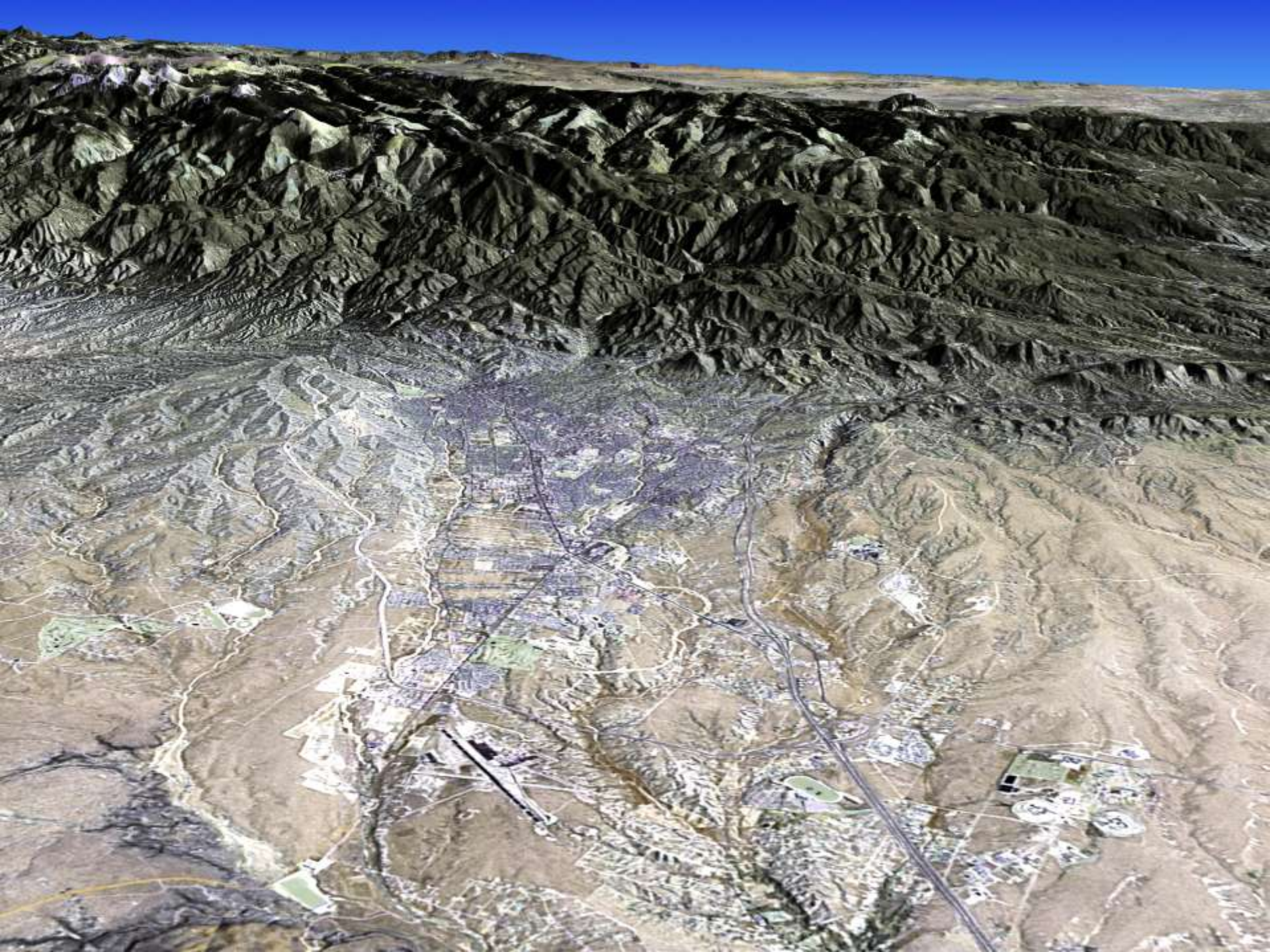
Santa Fe Ecosystems

Know where you live

Ecosystem information from: http://cpluhna.nau.edu/Biota/biotic_communities.htm

Santa Fe



Today we will learn…

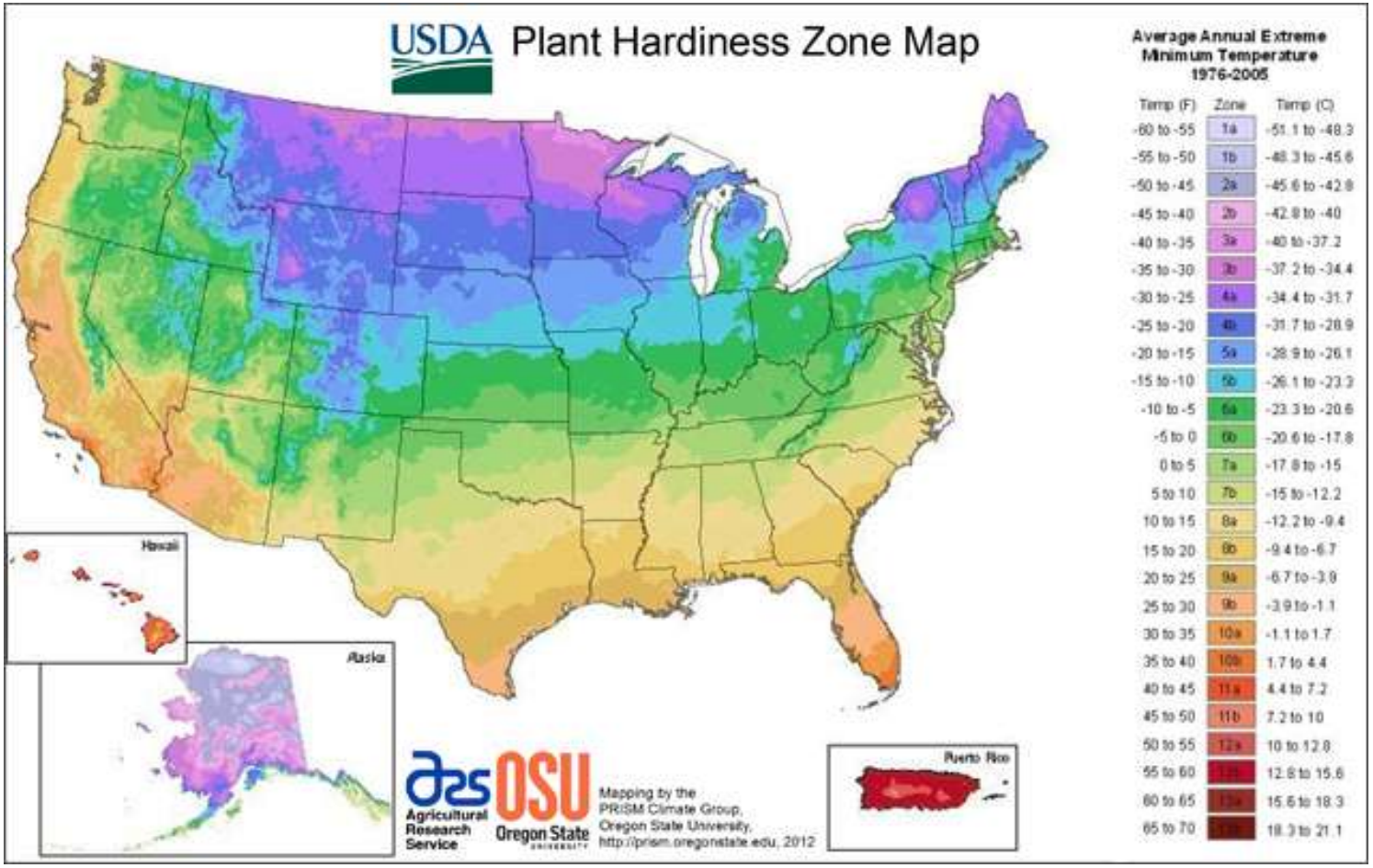
- What is our plant hardiness zone?
- What is climate? What is weather?
- What is Santa Fe's climate?
- What are the primary ecosystems in and around Santa Fe? How have these changed over the past 200 years?
  - Riparian Areas or Wetlands
  - Shrub and Semi-arid Grasslands
  - Pinon-Juniper
  - Ponderosa
  - Mixed Conifer

Santa Fe Averages,

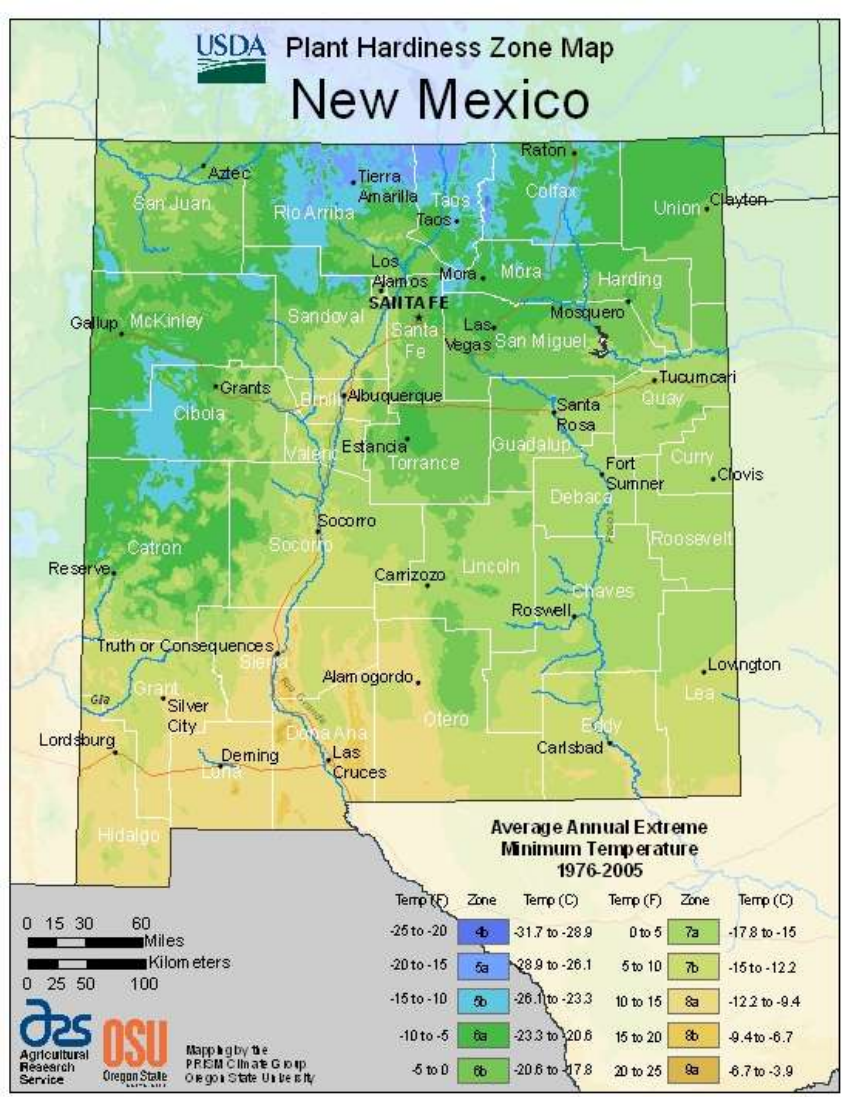
From NOAA and Weather.com

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °F (°C)	65 (18)	73 (23)	77 (25)	84 (29)	96 (36)	99 (37)	99 (37)	96 (36)	94 (34)	87 (31)	75 (24)	65 (18)	99 (37)
Average high °F (°C)	43.5 (6.4)	48.2 (9)	55.9 (13.3)	64.7 (18.2)	74.2 (23.4)	83.5 (28.6)	85.9 (29.9)	83.4 (28.6)	77.7 (25.4)	66.5 (19.2)	53.1 (11.7)	43.2 (6.2)	65.0 (18.3)
Average low °F (°C)	17.5 (−8.1)	21.5 (−5.8)	26.1 (−3.3)	32.3 (0.2)	41.0 (5)	49.4 (9.7)	54.4 (12.4)	53.3 (11.8)	46.5 (8.1)	35.5 (1.9)	24.6 (−4.1)	17.4 (−8.1)	35.0 (1.7)
Record low °F (°C)	−14 (−26)	−10 (−23)	−6 (−21)	10 (−12)	23 (−5)	31 (−1)	38 (3)	36 (2)	26 (−3)	5 (−15)	−12 (−24)	−17 (−27)	−17 (−27)
Precip. inches (mm)	.60 (15.2)	.53 (13.5)	.94 (23.9)	.77 (19.6)	.94 (23.9)	1.29 (32.8)	2.33 (59.2)	2.23 (56.6)	1.54 (39.1)	1.33 (33.8)	.85 (21.6)	.83 (21.1)	14.18 (360.3)
Snowfall inches (cm)	4.0 (10.2)	2.9 (7.4)	4.4 (11.2)	.4 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1.0 (2.5)	2.3 (5.8)	8.0 (20.3)	23 (58.4)
Avg. precip days (≥ 0.01 in)	3.4	3.7	4.7	4.0	4.7	5.6	9.6	10.3	6.3	5.2	4.0	4.2	65.7
Avg. snowy days (≥ 0.1 in)	1.9	1.5	1.3	.4	0	0	0	0	0	.3	.8	2.2	8.4

Gardening, Plant Hardiness Zones

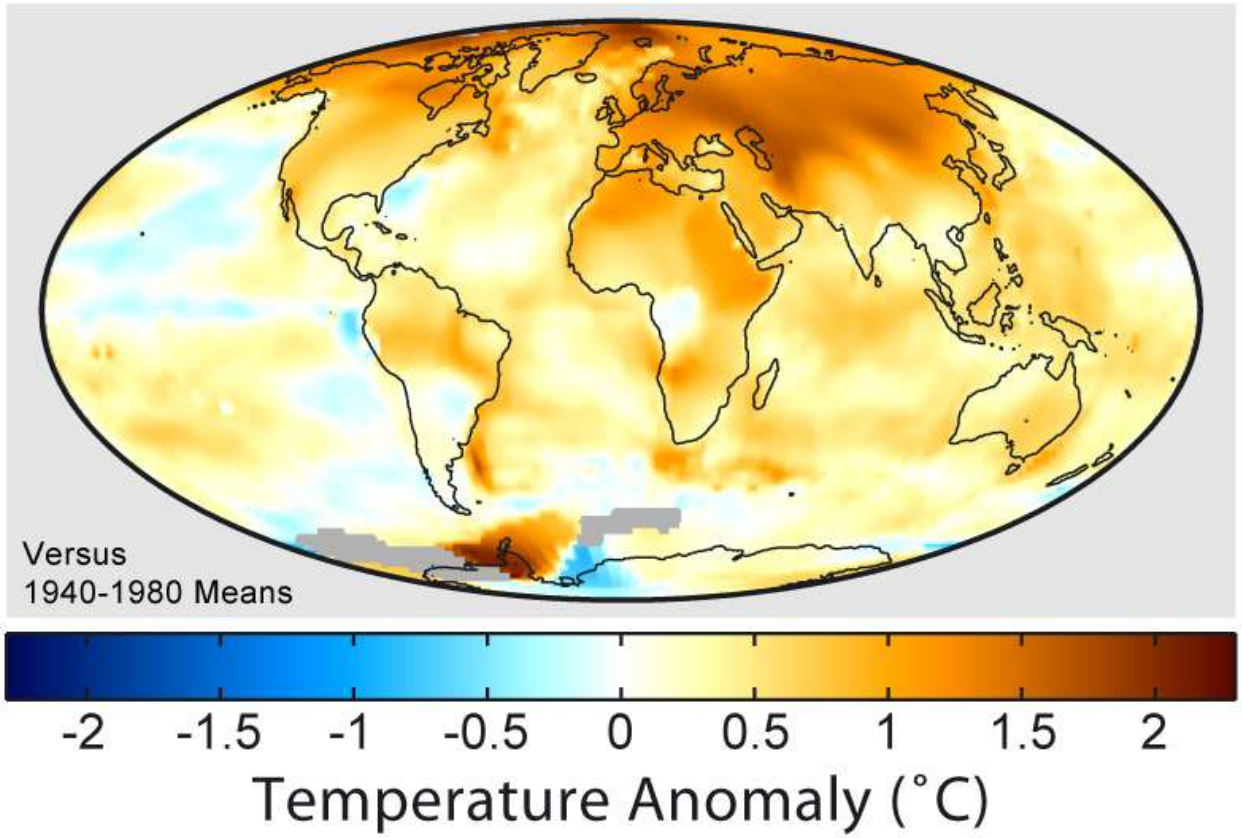


Changes… We are now 6a



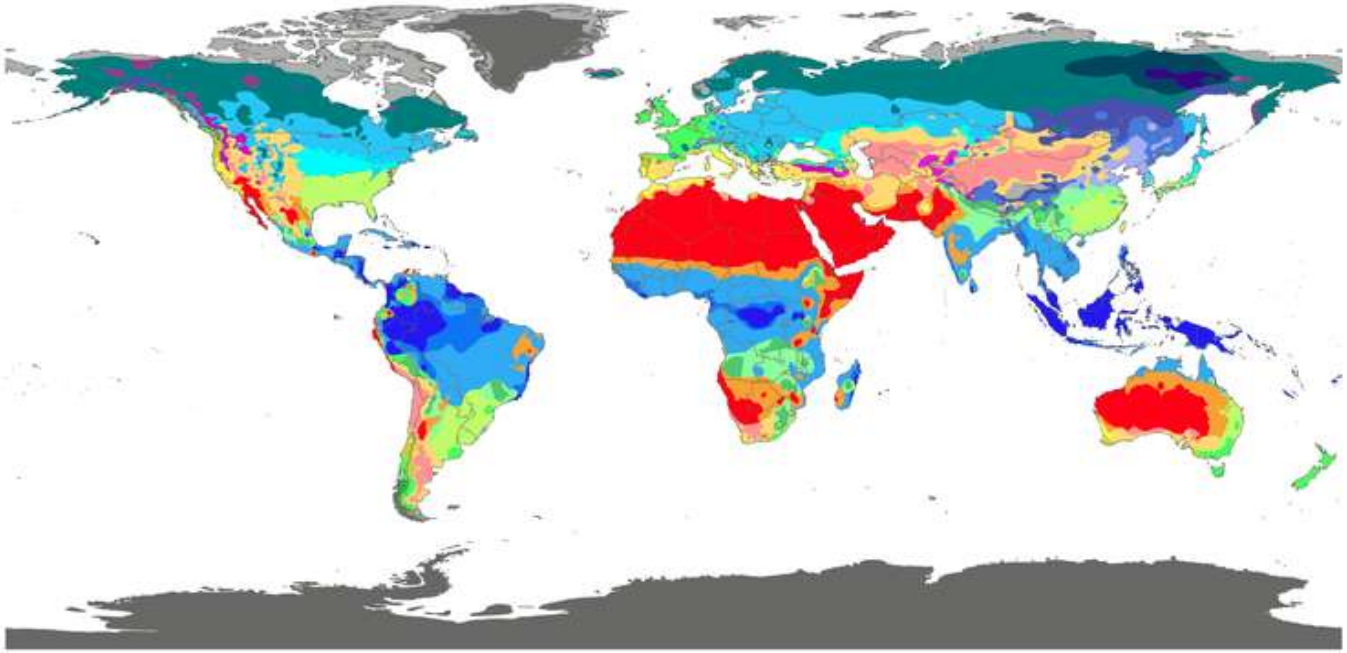
Our Changing Climate

1999-2008 Mean Temperatures



Koppen Classification

World map of Köppen-Geiger climate classification



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Af	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSh		Cwc	Cfc	Dsc	Dwc	Dfc	
	BSk				Dsd	Dwd	Dfd	

DATA SOURCE : GHCN v2.0 station data Temperature (N = 4,844) and Precipitation (N = 12,396)

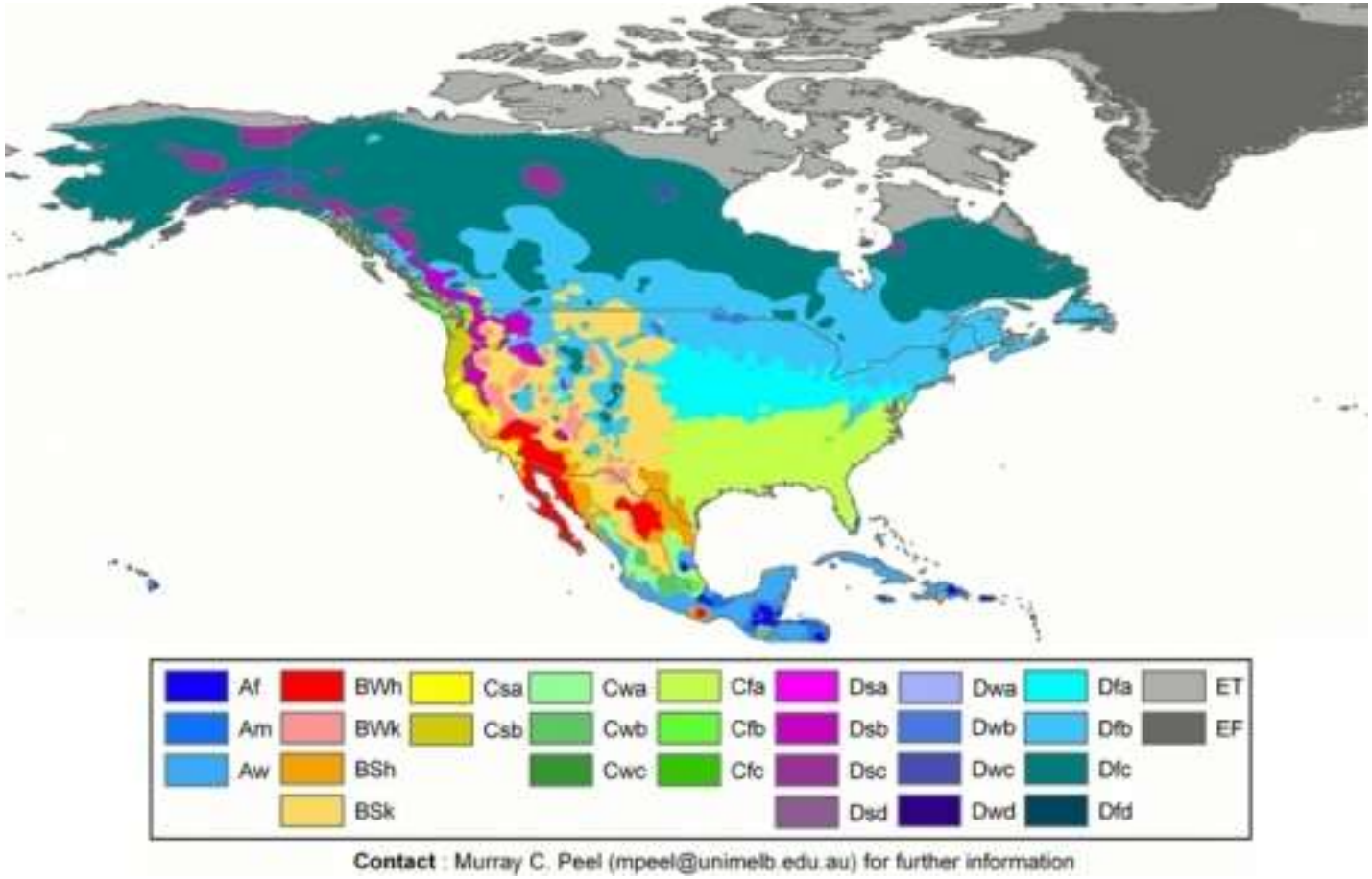
PERIOD OF RECORD : All available

MIN LENGTH : ≥30 for each month.

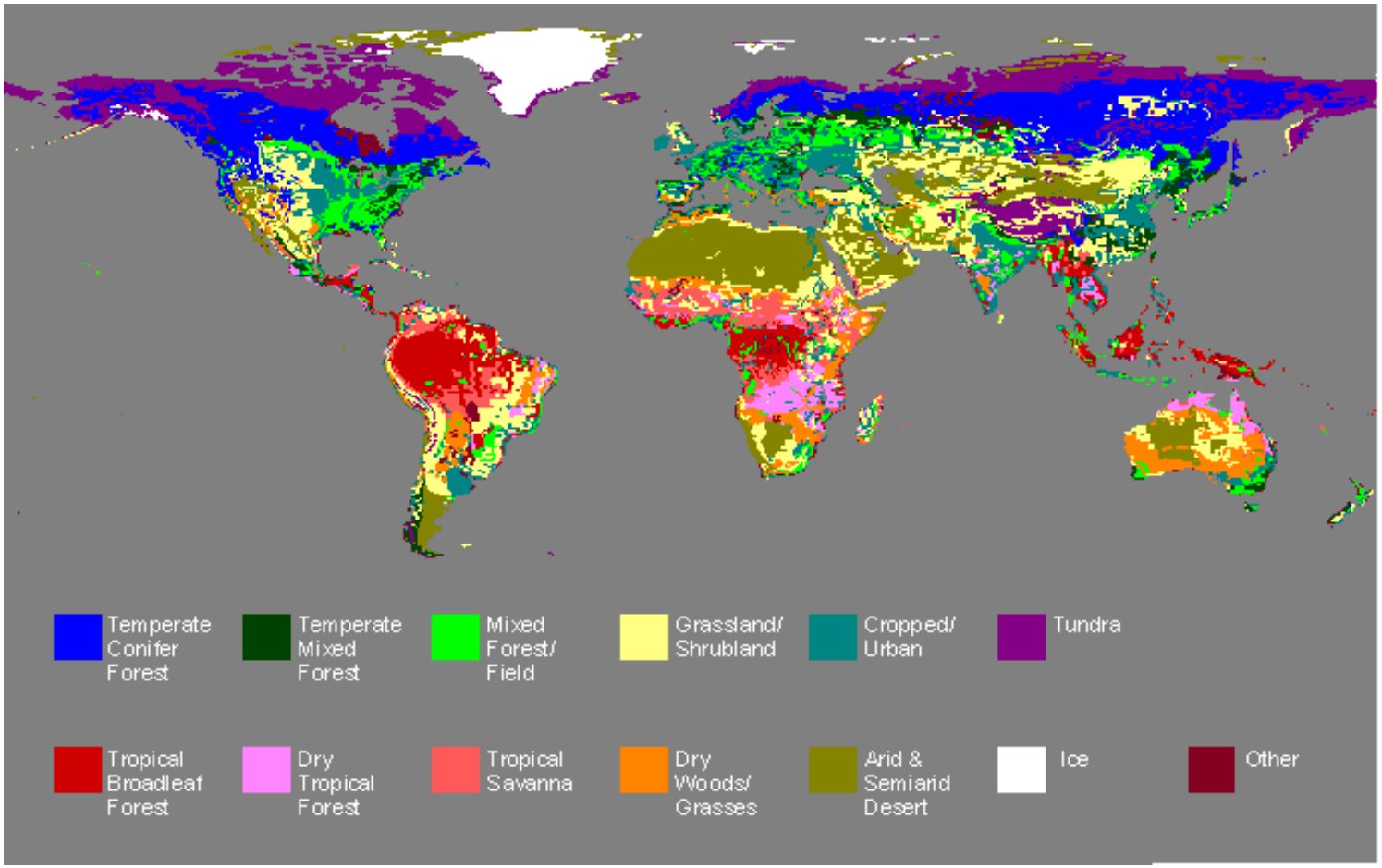
RESOLUTION : 0.1 degree lat/long

Contact : Murray C. Peel (mpeel@unimelb.edu.au) for further information

Santa Fe: BSk
Semi-arid, Steppe, Cold Winters

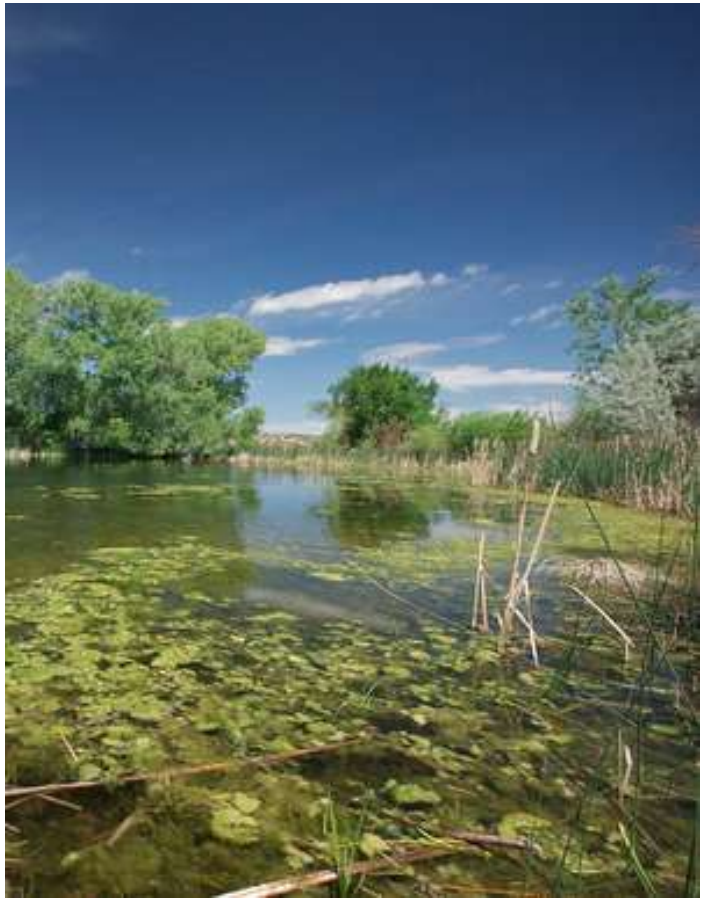


Ecosystems


Temperate Conifer Forest
Temperate Mixed Forest
Mixed Forest/ Field
Grassland/ Shrubland
Cropped/ Urban
Tundra
Tropical Broadleaf Forest
Dry Tropical Forest
Tropical Savanna
Dry Woods/ Grasses
Arid & Semiarid Desert
Ice
Other

Wetlands and Riparian Areas

- Interface between wet and dry systems, defined by plant populations
- Depend on an intact groundwater and often some surface water, with seasonal variability
- Common native trees and shrubs, depending on location and elevation, include:
  - Narrowleaf cottonwood *Populus angustifolia*) and other varieties of cottonwood (
  - Box-elder (*Acer negundo*)
  - Bigtooth maple (*Acer grandidentatum*)
  - Rocky Mountain maple (*Acer glabrum*)
  - Water birch (*Betula occidentalis*)
  - Aspen (*Populus tremuloides*)
  - Thin-leaf alder (*Alnus tenuifolia*)
  - New Mexico locust (*Robinia neomexicana)*
  - Scouler willow (*Salix scouleriana*)
  - Arroyo willows (*Salix lasiolepis*)



Wetlands and Riparian Areas, cont.

- Less than 1 percent of the total acreage of public lands in the 11 western states are home to:
  - 72% of all reptiles
  - 77% of all amphibian species
  - 80% of all mammals
  - 90% of all bird species routinely use riparian areas for food, water, cover or migration routes
- Human Impact
  - Decline due to destruction
  - Conversion to other uses
  - Significant degradation in structure, function, or composition
  - Introduction of non-native species, such as saltcedar or tamarisk (*Tamarix ramosissima*)
  - 90% loss of presettlement riparian ecosystems has occurred in Arizona and New Mexico

Semi-arid Grasslands and Shrub-Steppe

- Native grasslands were once common below the pinon-juniper communities and above the semi-arid scrub
- Commonly dominated by Blue Grama, the New Mexico state grass, or other gramas
- Historically:
  - Cold-tolerant, cool-season bunch grasses that are native to these grasslands
  - Productive during spring and early summer
  - Existed in a mosaic with deep-rooted shrubs
  - Late1800s and the coming of the railroad and the cattle industry extensively altered these ecosystems.
- Wildfire suppression and cattle favored shrub species and invasive species over native grasses
  - Sagebrush
  - Chamisa
  - Cheatgrass
- Grasslands are endangered by continued grazing and spread of cheatgrass

Cheatgrass

Blue Grama

Piñon and Juniper

- Widespread on the Colorado Plateau between about 5000 feet to 7000 feet
- 11.4% of New Mexico,
- Most common plants:
  - Colorado pinyon pine (*Pinus edulis*)
  - Utah juniper (*Juniperus osteosperma*)
  - One-seed (*J. monosperma*)
  - Rocky Mountain (*J. scopulorum*)
- Annual precipitation is typically from 10 to about 15 inches
- Evolved both drought and cold resistance

Piñon and Juniper, cont.

- Piñons dominate at higher elevations, more forested
- Juniper tends to grow at lower elevations and in more arid areas
  - Scaled foliage allows it to conserve water more effectively than piñons
- Long history of livestock lead to widespread desertification of understory conditions
- Changes include:
  - decreases in cool-season grasses
  - increases in grazing-resistant plants such as snakeweed and big sagebrush
  - Piñon die off, due to drought and heat

Ponderosa Pine Forests

- Forests on higher mesas and mountains of the Colorado Plateau from 6000 feet to about 8000 feet
- The predominant form of the pine throughout the Colorado Plateau is the three-needled, Rocky Mountain ponderosa pine (*Pinus ponderosa var. scopulorum*)
- Other associated trees:
  - Gambel oak (*Quercus gambelii*) at lower elevations
  - New Mexico locust (*Robina neomexicana*) at lower elevations
  - Southwestern white pine (*Pinus strobiformis*),
  - Rocky Mountain Douglas-fir, (*Pseudotsuga menziesii var. glauca*)
  - Rocky Mountain white fir (*Abies concolor var. concolor*)
  - Quaking aspen (*Populus tremuloides*).

- Common understory plants include
  - Arizona fescue
  - Mountain muhly
  - Lupine
  - Buckbrush
  - Cliffrose
  - Currant
  - Apache plume
- Animal populations include:
  - Abert's squirrels
  - Mule deer
  - Rocky Mountain elk
  - Chipmunks
  - Voles
  - Steller's jay
  - Brown creeper
  - White and red-breasted nuthat
  - Juncos
  - Red-shafted flicker
  - Western tanager

Ponderosa Pine Forest, cont.

- Ideal Ponderosa Climate
  - Relatively mild winters (average slightly above 30° F)
  - Precipitation as snow saturates the soil.
  - Dry spring and fall with lightning caused forest fires
  - Wet summers
- Ponderosa pine forests increased after the last glacial period
- Small changes in climate may have a larger impact on ponderosa pine than on some other western conifers
- Naturally, widespread surface fires that occurred 2-15 years favored grasses and limited pine densities
- The effects of grazing and fire suppression since the late 1880s have increased tree density and in turn destructive forest fires

Mixed-Conifer Forest

- Elevations from about 8000 feet to 10,000 feet

- Depending on location
  - Douglas-fir
  - white fir
  - blue spruce
  - southwestern white pine
  - ponderosa pine on warmer slopes.
  - Quaking aspen, following disturbances
  - Gambel oak, following disturbances
- Populated by diverse wildlife
  - black bears
  - mule deer
  - elk
- Rich, moist soil found at these elevations
- Diverse understory of forbs, grasses, and shrubs
- Human Impact
  - Fire suppression, causing severe crown fires instead of frequent shrub fires
  - Ponderosa pine was once codominant until fire suppression allowed the development of dense sapling understories
  - Now dominated by the more fire-sensitive Douglas-fir and white fir
  - Local plants may become threatened or endangered

Big ideas

- Santa Fe is getting warmer
- A warming climate will change the local ecosystem
- We are in a semi-arid, cold, steppe climate, NOT a high desert
- Water = Life
- We are living in a transition zone, between semi-arid grasslands, piñon-juniper, and ponderosa/coniferous forests
- The Leonora Curtin Wetland is a riparian zone
- The Botanical Garden at Museum Hill is in a piñon-juniper zone