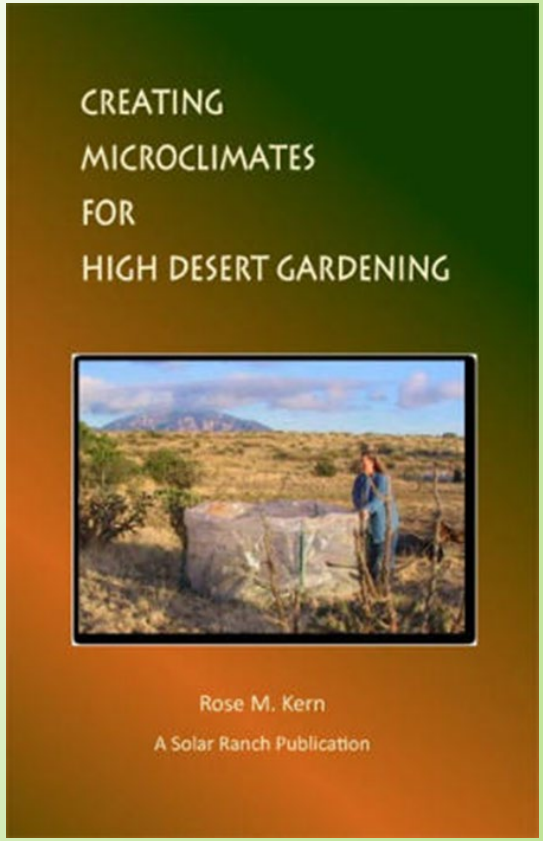
CONTINUING EDUCATION

Microclimates for High Desert Gardening

With Master Gardener Rose M. Kern

11/10/20

34 years as an Air Traffic Control Specialist and Pilot Weather Briefer



Over 60 years gardening

What is the difference between weather and climate?

Weather

Weather is the state of the atmosphere at the current time, describing for example the degree to which it is hot or cold, wet or dry, calm or stormy, clear or cloudy.

Climate

- The composite or generally prevailing weather conditions of a region measured over throughout the year and averaged over a series of years.
  - Temperature
  - Air Pressure
  - Humidity
  - Precipitation
  - Sunshine
  - Cloudiness
  - Winds

Southwestern High Desert

- Dry with more pronounced temperature variations than Standard.

- How does this affect daily weather?

Bernalillo County Vs Standards

Standard Sea Level Conditions

Surface Air Pressure – 29.92 inches of mercury

Water boils at 212° Fahrenheit/100° Celcius

High Desert Variations

Every 1,000 feet the Pressure decreases by 4%

At 5,000 fee, Water boils at about 203° F or 96° C

Sea Level vs High Desert

- Standard Temperature lapse rate
  - 2 degrees Centigrade per thousand feet.

Location/Altitude	Temperature C/F
Sea Level	34/93
Albuquerque International (5,101 feet)	24/75
Sandia Peak (10,678 feet)	13/55
Santa Fe (7,260 feet)	20/68
Albuquerque River Valley (4,850 feet)	25/77
Foothills (6,000)	22/72
West Mesa (5,550 feet)	24/76

East Mountains – varies according to elevation

Standard versus Us

Standard Equitorial Sea Level Conditions

Average Annual Daily Temperatures
Low 23°C/73°F High 31°C/88° F
(15 degrees F)

Bernco Variation

Average Annual Daily Temperature
Low 7.2°C/45° F **High** 20.5° C/69° F
(24 degrees F)

Standard versus Us

Standard World Wide Sea Level Conditions

Average Diurnal Temperature Differences
(Day/Night)
13 to 15°F Daily

Bernco Variation

Average Diurnal Temperature Differences
(Day/Night) 22 to 37° F **Daily**

Seasons in NM

- Spring – March, April, May
  - Primarily a westerly windflow 30-40 kts afternoons strongest in west mesa, valley
  - Strongest winds from the east (65-70Kts) affect east mountain, canyon, SE ABQ, Airport.

- Summer heat – Record High 107° F
- Summer/Fall Monsoons
- Winter dry and cold – Record Low -17° F

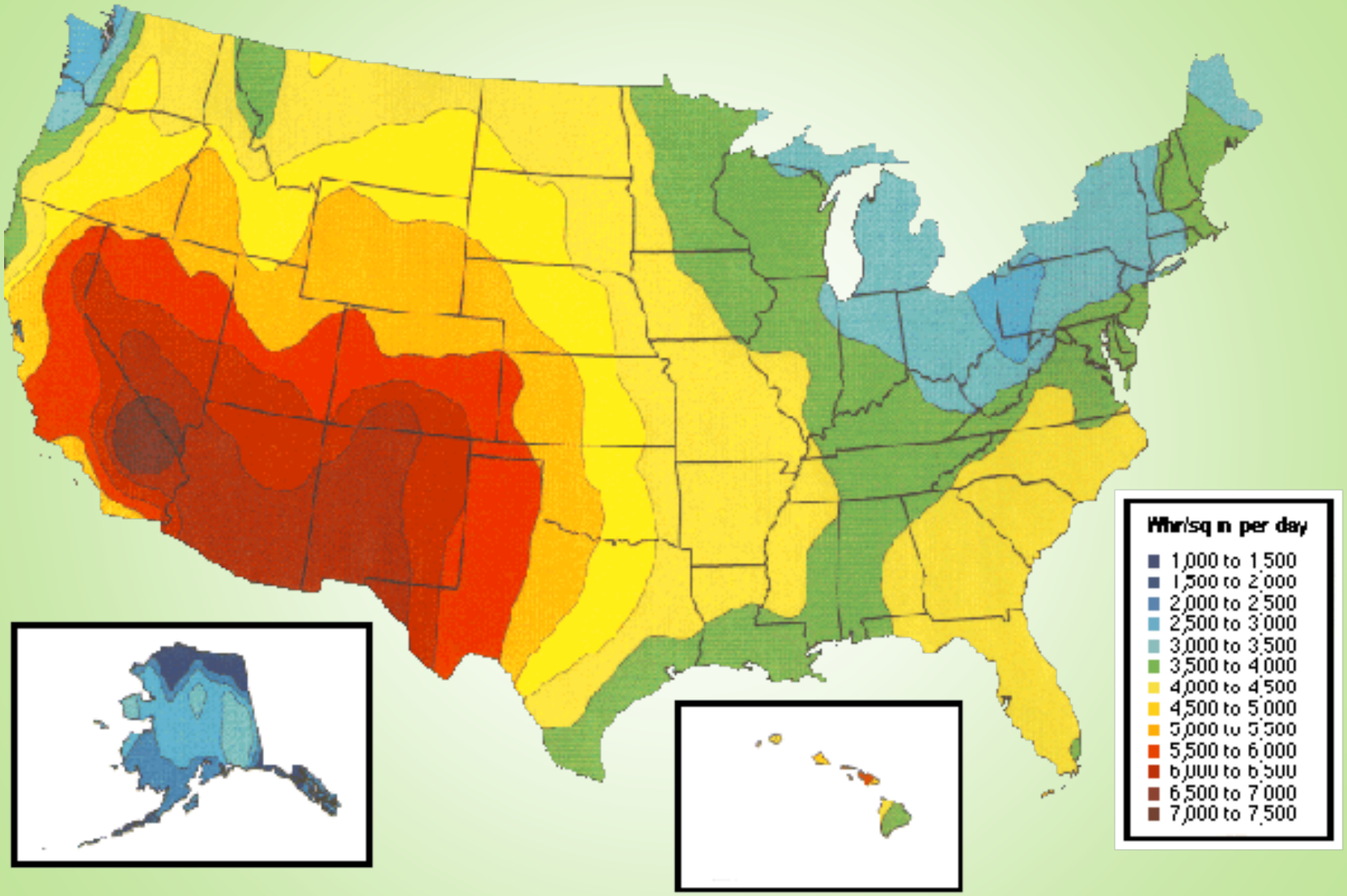
High Desert

- Below Average Rainfall (Average 9.4 in./year)
- Below Average Snowfall (10 inches/year
- Higher than average Diurnal temperature changes
- Lower Atmospheric Pressure due to elevation
- Less atmosphere protection
- More stars seen with naked eye
- Less Oxygen/Nitrogen
- More Solar Radiation strikes earth's surface

ABQ Weather Average Data

Month	Average High/Low °F (°C)	Average Humidity	Possibility of Sunshine
January	47/23 (8/-5)	55%	88%
February	53/27 (12/-3)	49%	77%
March	61/33 (16/1)	39%	73%
April	70/41 (21/5)	33%	79%
May	79/50 (26/10)	32%	76%
June	89/59 (32/15)	28%	85%
July	92/64 (33/18)	42%	75%
August	89/63 (32/17)	45%	67%
September	82/56 (28/13)	49%	71%
October	71/44 (22/7)	43%	69%
November	57/31 (14/-1)	48%	87%
December	48/24 (9/-4)	56%	86%

Solar Radiation



Daytime Questions

On an average **day**, with no major weather systems blowing in, what parts of the Greater Albuquerque Area are the:

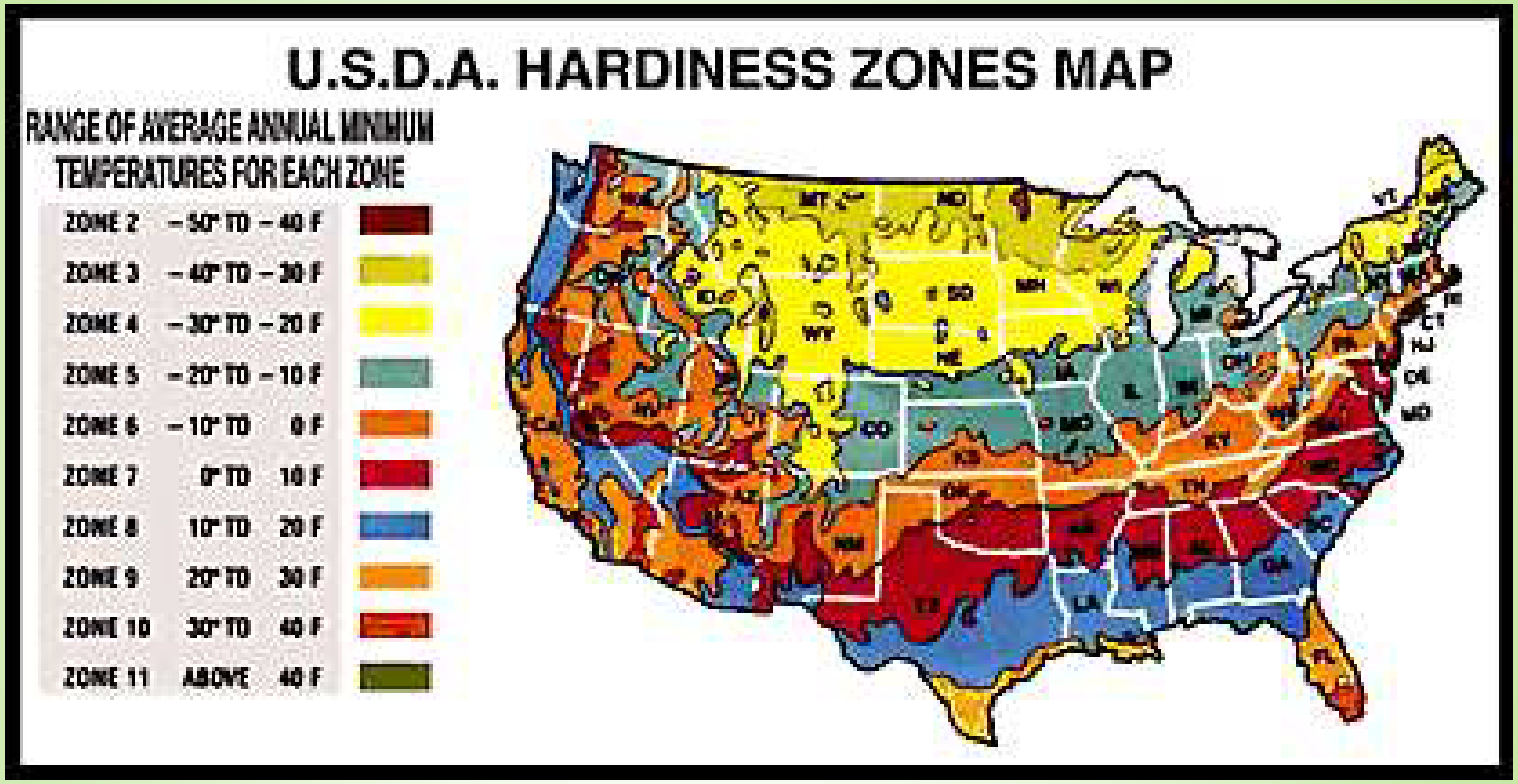
- Coldest/Coolest
  - East Mountains & NE/SE Mountain foothills
- Warmest
  - West Mesa
- Wettest
  - Heights - East Mountain -
- Dryest
  - Valley and West Mesa
- Strongest Winds
  - Canyon and I-40 corridor
- Stillest
  - North Valley

Nighttime Questions

- On an average **day**, with no major weather systems blowing in, what parts of the Greater Albuquerque Area are the:

- Coldest/Coolest
  - East Mountains & Rio Grande Valley
- Warmest
  - Heights, airport area
-

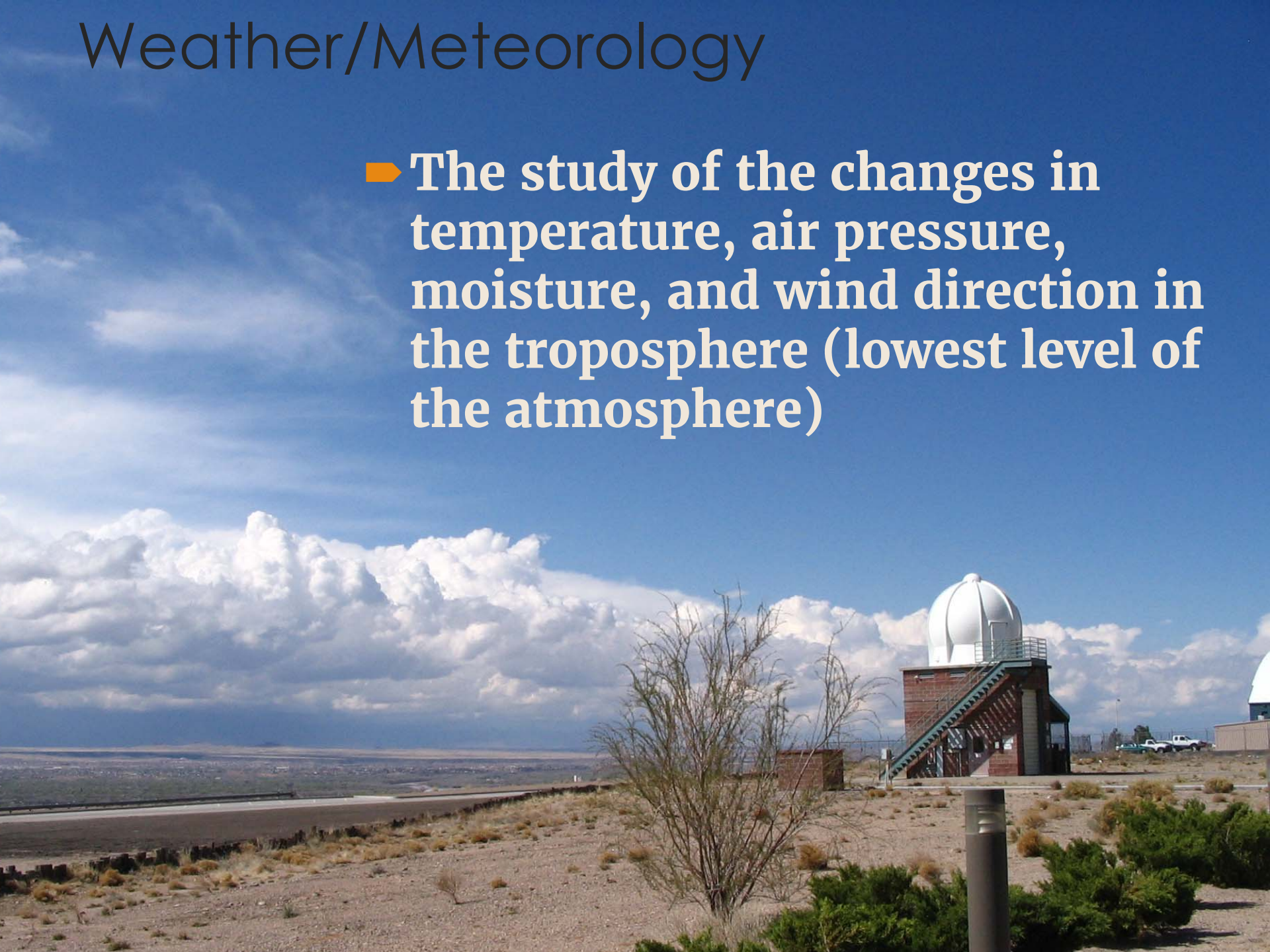
The Challenge!



The Bernalillo county Area consists of several temperate zones created by a combination of geography and meteorology.

Weather/Meteorology

- The study of the changes in temperature, air pressure, moisture, and wind direction in the troposphere (lowest level of the atmosphere)

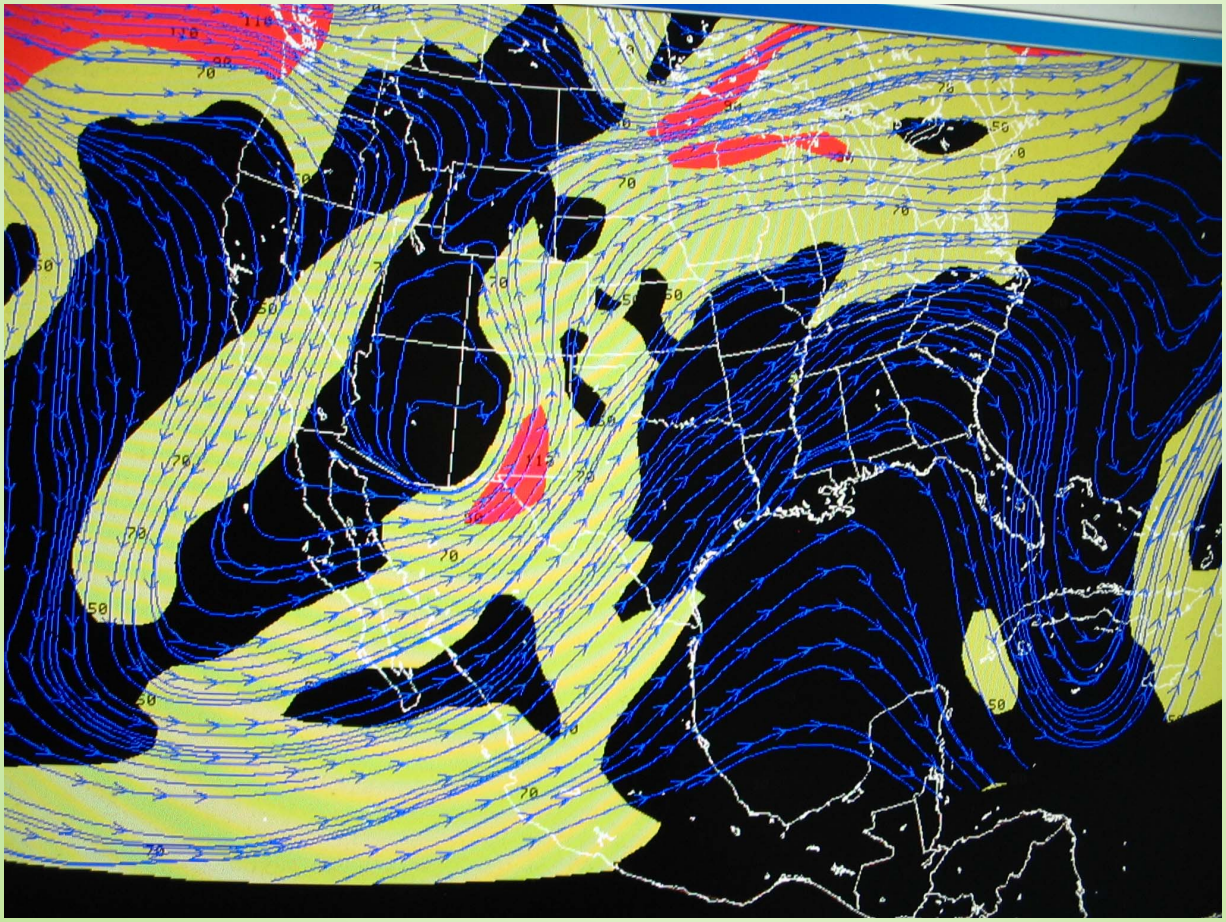


Where does our rain come from?

How does it get here?

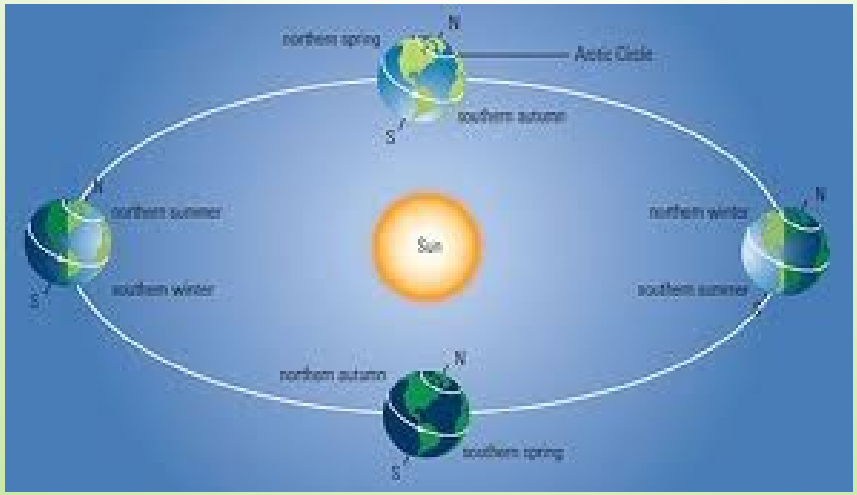
It blows in the wind.

Mid level winds carry moisture from the oceans to the land.



Why does wind blow?

- Planetary Revolution around the sun
- Planetary Rotation
- Tilt of Axis (seasons)
- Temperature variations
- Un-eveness of the earth's surface (mountains)



Most of our Wind is from what direction?

WEST

- Prevailing Westerlies are the winds in the middle latitudes between 35 and 65 degrees latitude.
- These prevailing winds blow from the west to the east pulling moisture from the oceans inland.

What direction does ABQ's STRONGEST winds come from?

The EAST

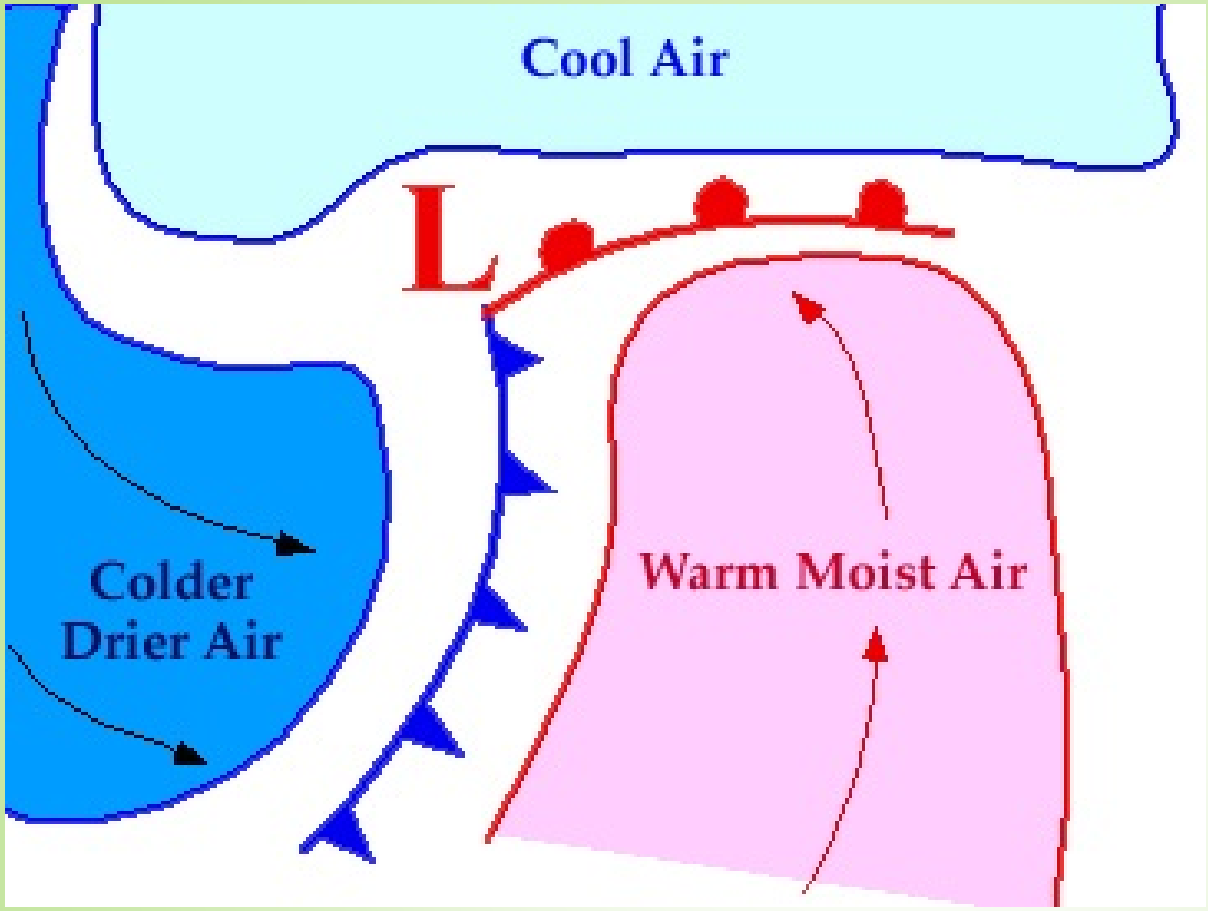
Why?

Bernoulli's Principle

Tijeras Canyon, I-40, Airport

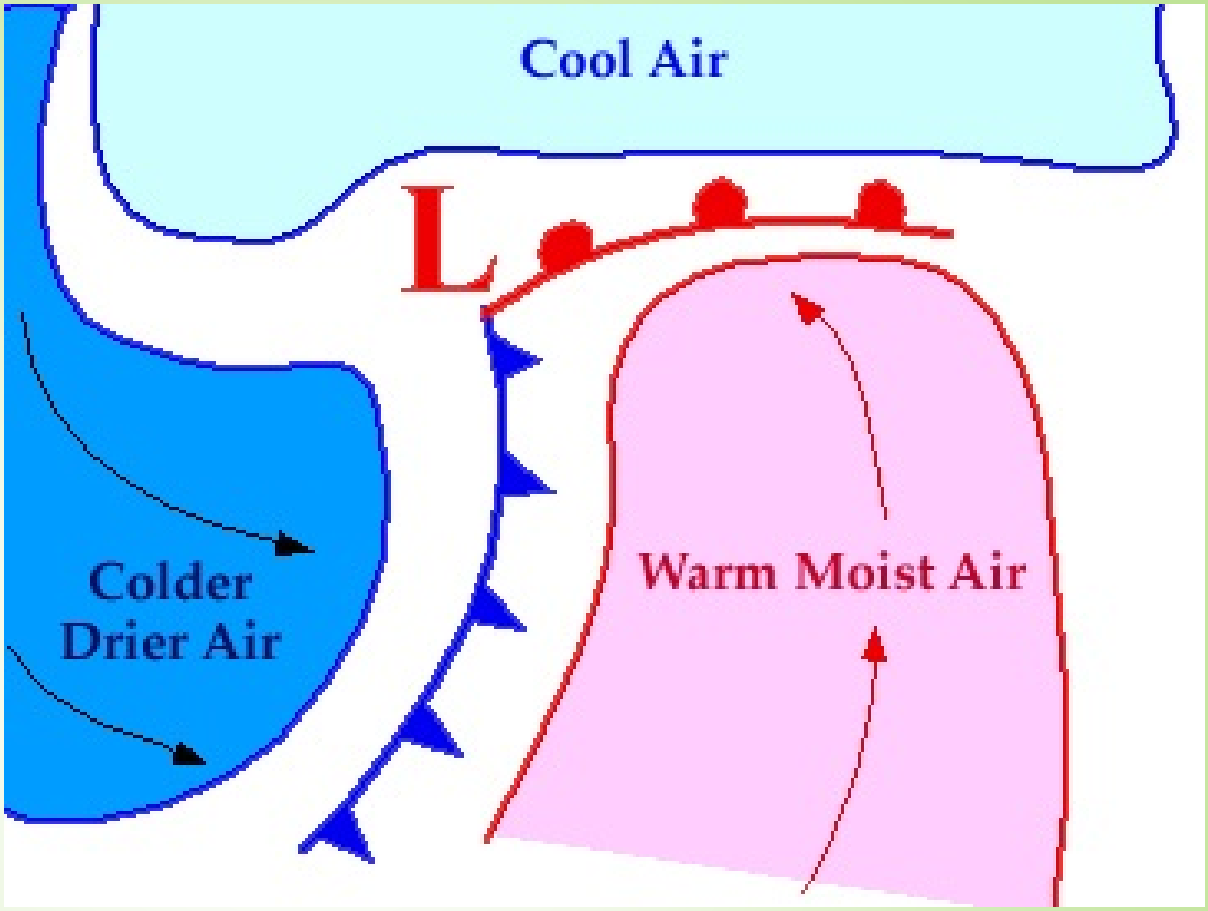
- Strongest winds pour through canyon when fronts slide down east side of state.

Airmass



- A blob of air that has consistent properties throughout its structure– such as moisture and temperature.

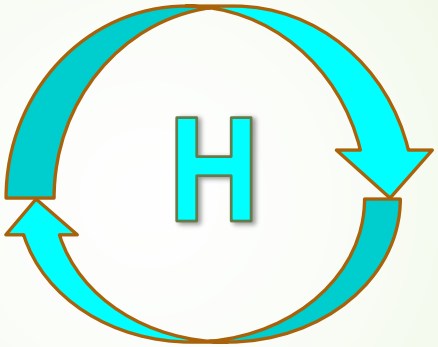
Airmass



- An airmass that is moving has a “frontal edge” that is pushing against another airmass.

High Pressure

- A heavy blob of air that looks like an upside down bowl – winds flow clockwise around the surface edge. Very Stable.



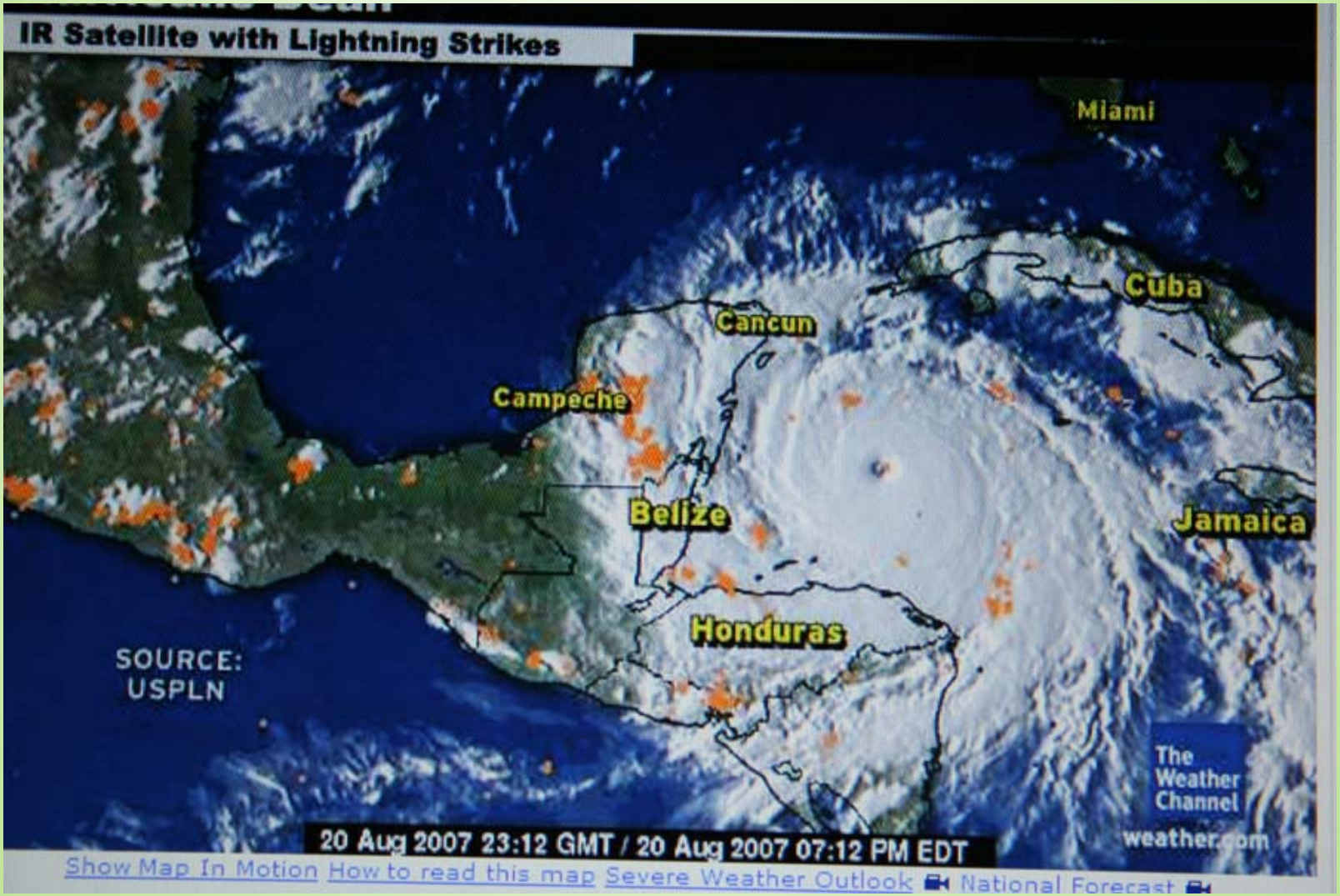
- Large Dry High Pressure Systems
- Equal Sunny Days!
- .

Low Pressure

- A lighter blob of air – bowl is upright and narrower more like a vase – winds flow counterclockwise around the surface edge.

The tighter the lines of pressure – the stronger the winds

Largest Low Pressure Systems



Low Pressure

- Strongest Low Pressure Systems?

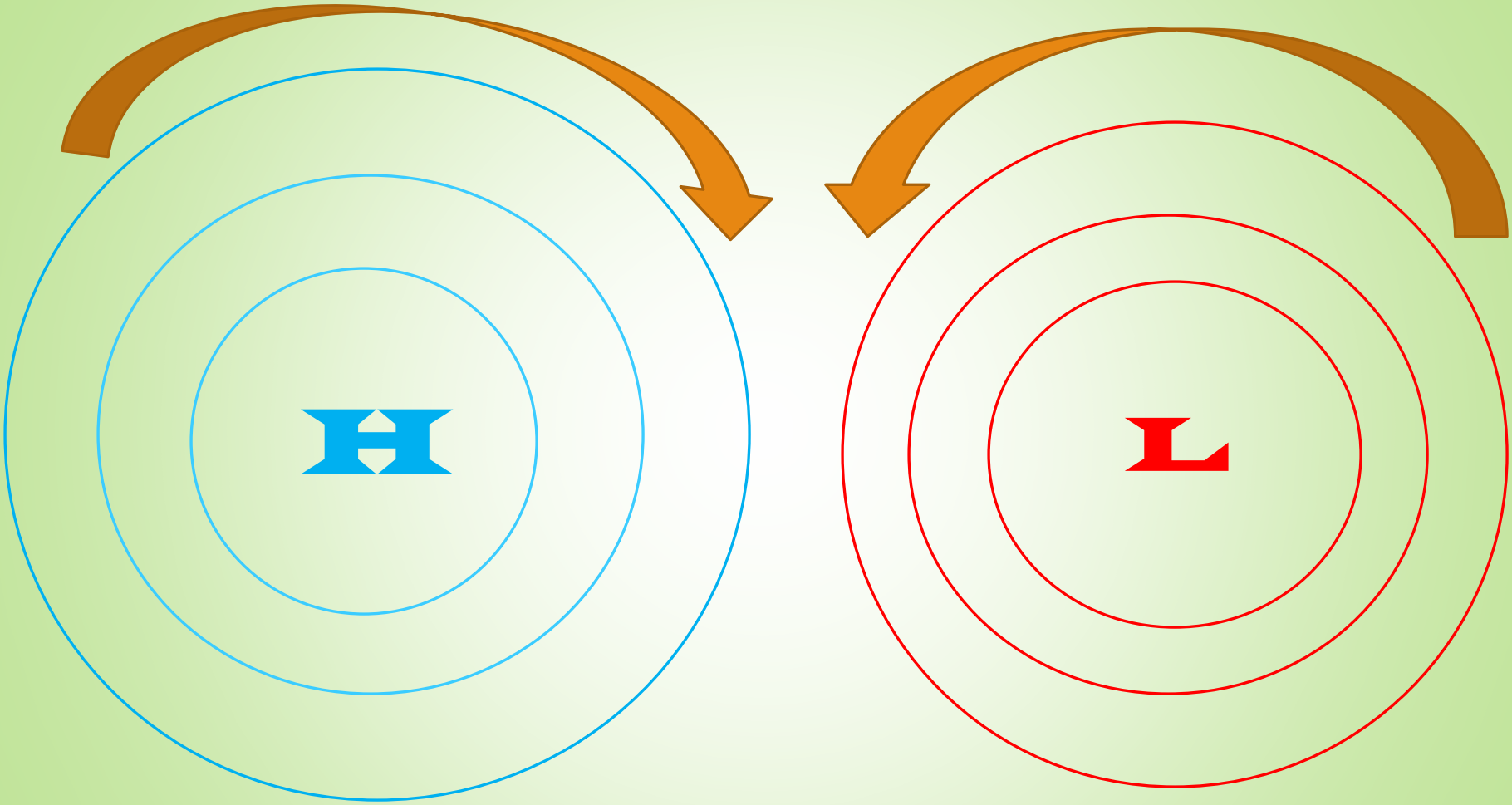
TORNADOS!

How often do we have tornadoes ABQ? Why?
If we do get them…where do they come from?

Why do Low Pressure systems make your joints ache?

Do Pressure differences affect plants?

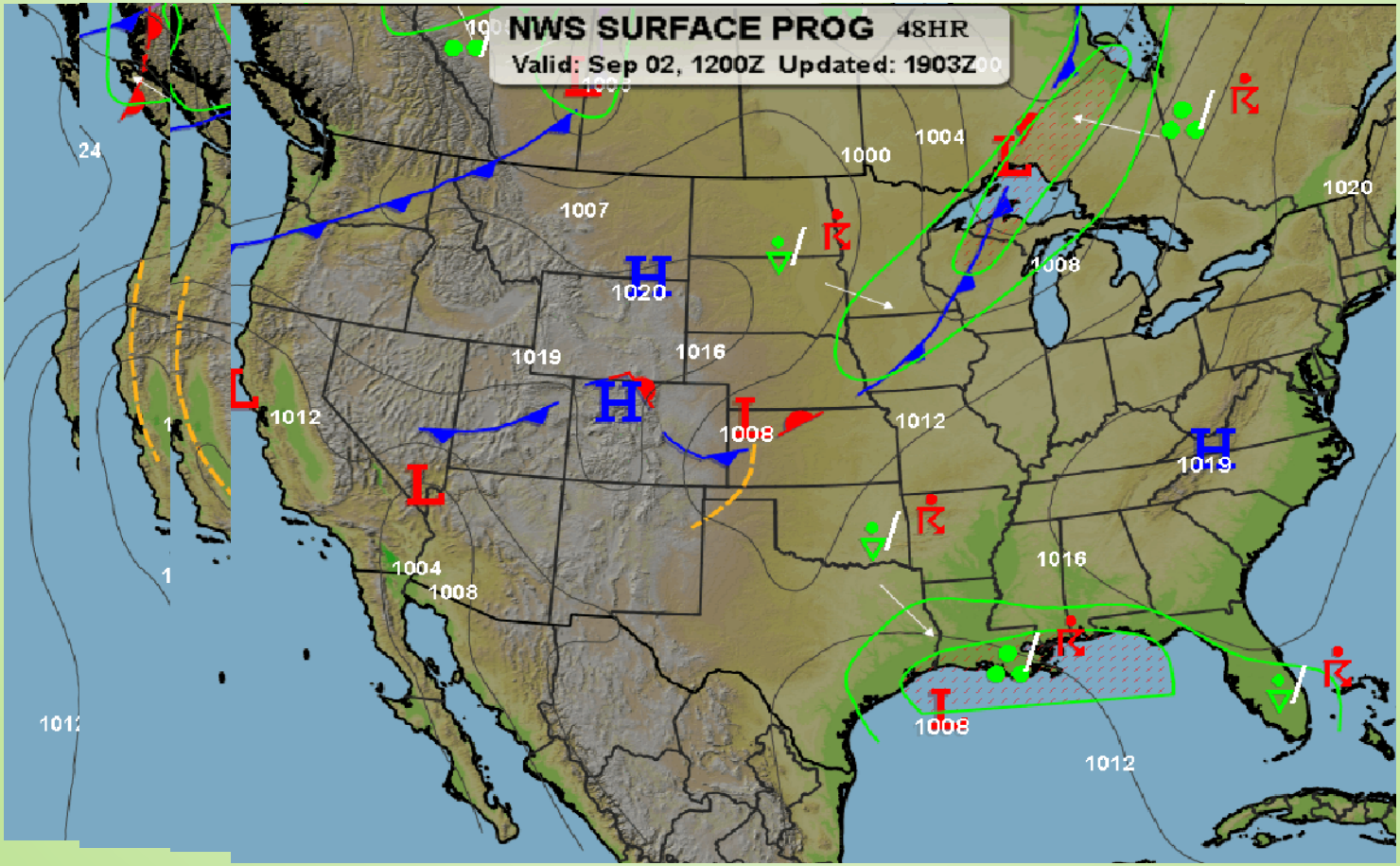
Surface Winds



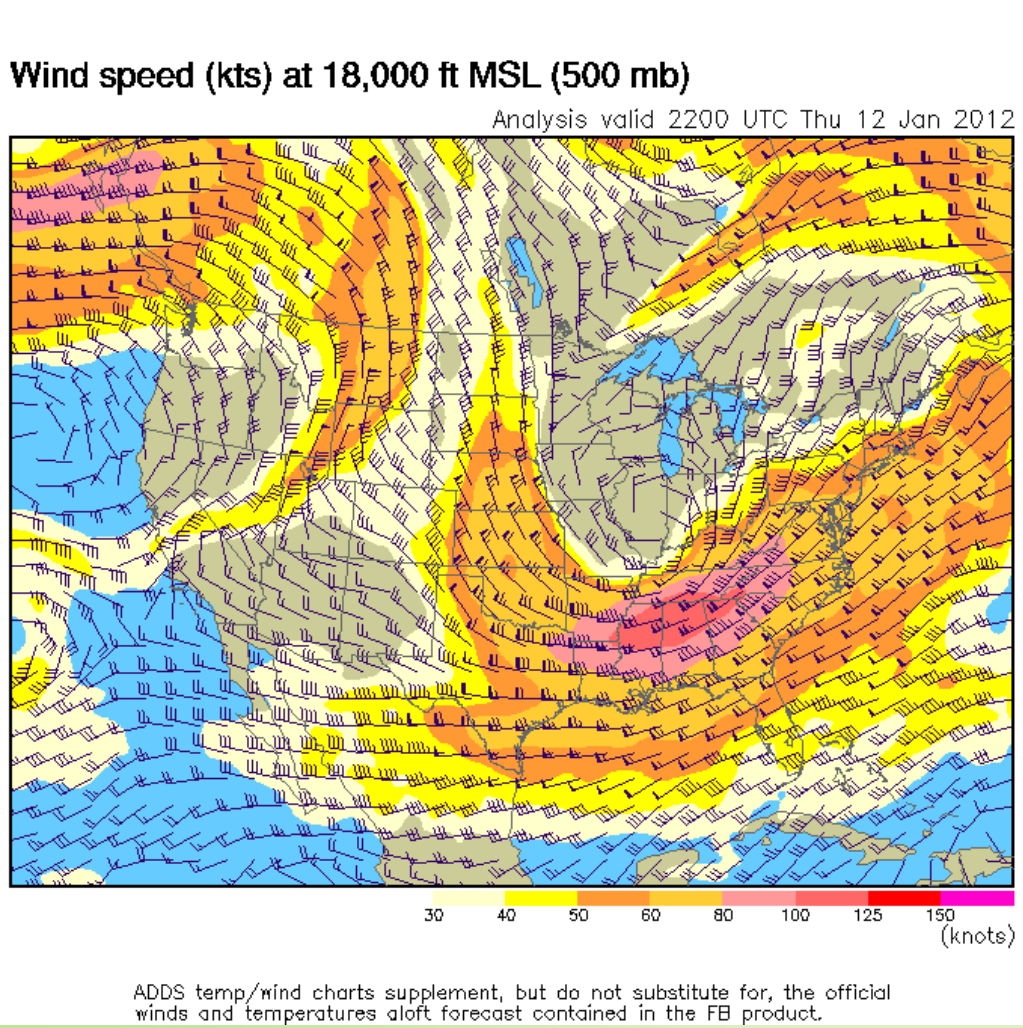
Very Strong Systems of High and Low Pressure are depicted with multiple closely spaced rings

What is a Front?

- The leading edge of an airmass as it moves across the ground.

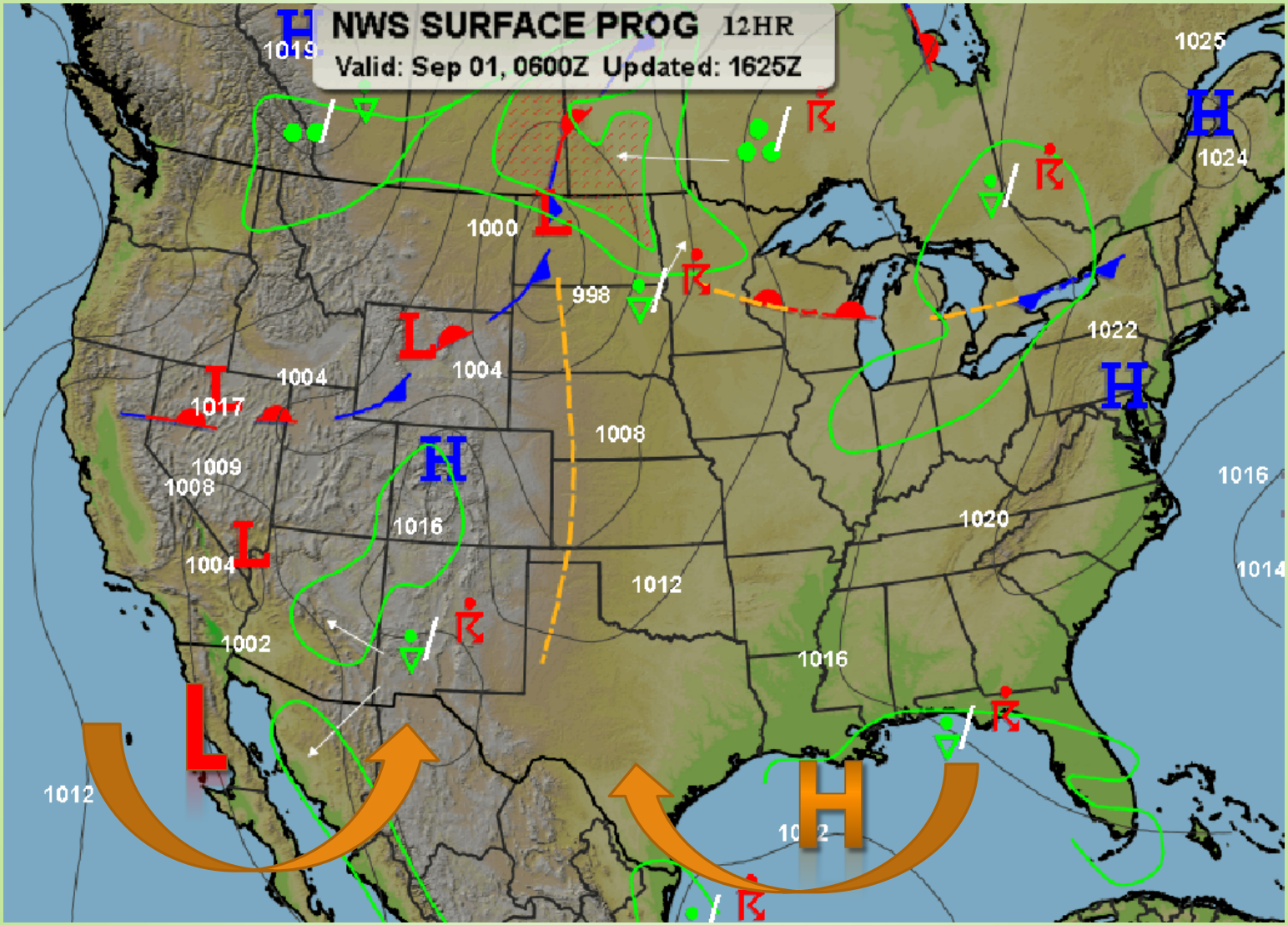


How do you tell when seasons are about to change?



- As the planet's axis revolves around the sun the jet stream stabilizes in a smooth west to east flow during winter and summer, but waves wildly north to south during the spring and fall transition times.

Onset of Monsoon Pattern



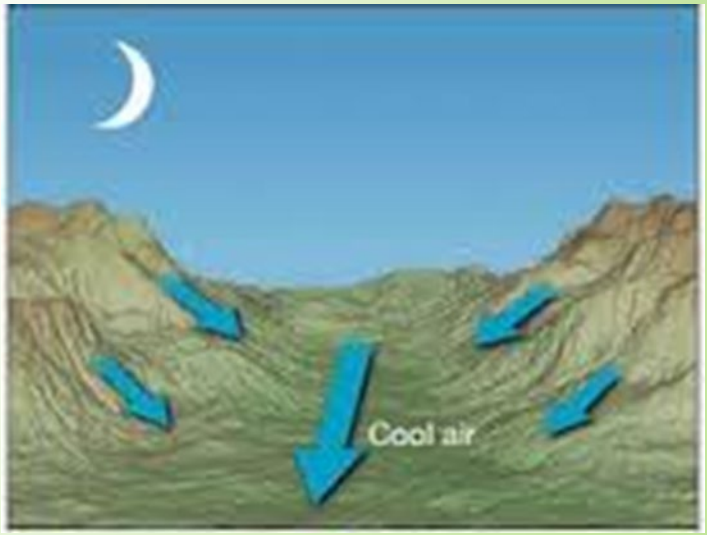
Microclimate

- The climate of a small area, as of confined spaces such as caves or houses, of plant communities, wooded areas, mountain valleys or of urban communities, which may be different from that in the general region.

ABQ Climates - Generalizations

- **Valley Areas** – Cooler temperatures at night when cold air flows down from Heights. Higher incidents of smoke in winter as it is trapped in an inversion

- **Heights** – more rains during the monsoons closer to mountains, morning winds calms, afternoon winds westerly, evening winds easterly.



ABQ Heights and Tijeras

- More rains during the monsoons because they are closer to mountains,
- Morning winds normally calm, afternoon winds upslope, evening winds downslope.

More Generalizations

- **East Mountains**

- More moisture due to fronts dropping down from north and monsoonal wind flows aloft. (Storms develop over Mountains and drift east)

- Summer windflow easterly as air warms, calms in cool of the evening, westerly in late evening, calm at night

More Generalizations

- **West of Mountains**
- Summer windflow westerly as air warms and pushes up the mountain, westerly in late afternoon as cool air flows down the mountain and calm at night

- **Northwestern flats and West Mesa**

Stronger/Drier winds from the west.

More Generalizations

- Monsoonal flow patterns. (July through September). Clear and calm in the morning. (Moisture is ambient at mid-altitudes) Scattered cumulus by noon growing upwards into storms by 2pm.
- Summer storms are **not organized**…they drift with the prevailing winds, peaking by about 7pm.
- After sunset cooler temperatures dissipate the storms, clear skies by midnight in most places.

Creating Beneficial Microclimates at Home

- Microclimates are created to protect plants from damaging winds, solar radiation, hail and extreme temperatures, and to offer them the best growing conditions possible.

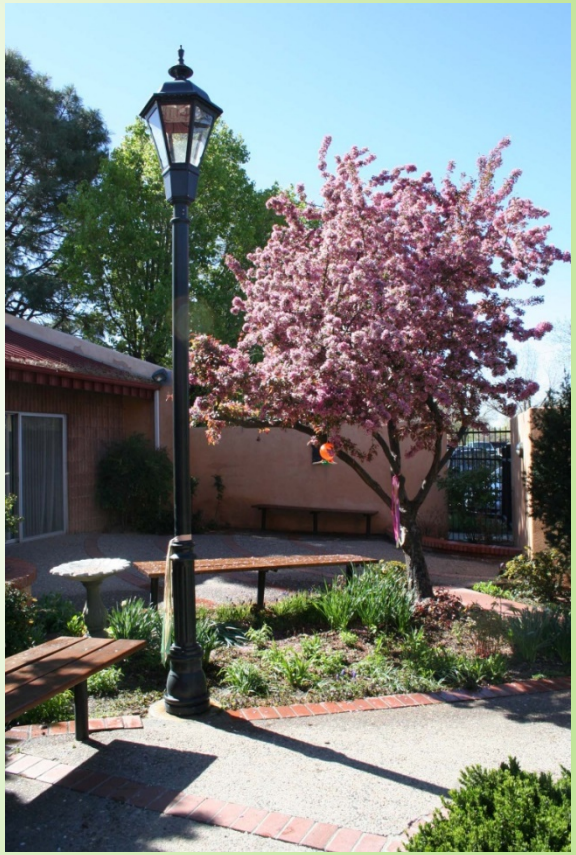
- The first step in creating a beneficial microclimate is knowing the needs of the plant, the location of the sun and the general climate of your property.

Wind Flow modifiers

- Trees and bushes slow it down
- Buildings and walls deflect it
- Lakes and Rivers load it with water
- Mountains re-route wind
- Valleys protect from it

Microclimate Designs

Albuquerque Garden Center



Coldest Micro Areas

North side of House.
Shaded areas
North side of Hills

- Cold Air flows downhill. Walls and fences can capture pockets of cold air.

Think about this

- Cold air will pool in lower parts of the yard – or on the downhill side of a property against a wall.
- Black plastic or dark colored mulch will heat the earth earlier in the year
- Lighter mulch (rocks) will reflect heat away from the plant's roots.

Frost Dates: First and last frost dates for Albuquerque, New Mexico

In the Spring									
Temperature	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Last 16°	Mar 8	Feb 25	Feb 18	Feb 11	Feb 5	Jan 30	Jan 24	Jan 15	Jan 3
Last 20°	Mar 30	Mar 18	Mar 10	Mar 2	Feb 24	Feb 17	Feb 10	Feb 1	Jan 21
Last 24°	Apr 9	Mar 31	Mar 25	Mar 20	Mar 15	Mar 10	Mar 5	Feb 26	Feb 18
Last 28°	Apr 23	Apr 17	Apr 12	Apr 8	Apr 5	Apr 1	Mar 29	Mar 24	Mar 18
Last 32°	May 3	Apr 27	Apr 23	Apr 19	Apr 16	Apr 13	Apr 9	Apr 5	Mar 30
Last 36°	May 16	May 10	May 6	May 2	Apr 28	Apr 25	Apr 21	Apr 17	Apr 11

In the Fall									
Temperature	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
First 16°	Nov 25	Dec 1	Dec 5	Dec 9	Dec 12	Dec 16	Dec 20	Dec 25	Jan 3
First 20°	Nov 14	Nov 19	Nov 22	Nov 25	Nov 28	Dec 1	Dec 4	Dec 7	Dec 12
First 24°	Nov 7	Nov 11	Nov 14	Nov 16	Nov 18	Nov 20	Nov 23	Nov 26	Nov 30
First 28°	Oct 22	Oct 27	Oct 31	Nov 3	Nov 6	Nov 9	Nov 12	Nov 16	Nov 21
First 32°	Oct 13	Oct 18	Oct 22	Oct 25	Oct 28	Oct 31	Nov 3	Nov 6	Nov 11
First 36°	Oct 8	Oct 12	Oct 16	Oct 18	Oct 21	Oct 23	Oct 26	Oct 29	Nov 2

On average, your frost free growing season starts Apr 16 and ends Oct 28, totaling 195 days.

Spring Planting Strategy

- Cole crops like **broccoli, cauliflower, and cabbage plus lettuce and spinach** can be direct seeded into your garden **around March 5**, but it's better to start them indoors around February 6 and then transplant them into the garden around March 27.

- Direct plant **onion starts and potatoes** around **February 16.** Sow the seeds of **peas** (sugar snap and english) at the same time. If the ground is still frozen, then plant these as soon as the ground thaws.

- **Tomatoes, peppers, and eggplants** - Start these indoors around February 6. Then, around April 12 you should start watching the weather forecast and, as soon as no frost is forecast, go ahead and transplant those into the ground.

- Summer vegetables like **beans, cowpeas, corn, squashes, pumpkins, cucumbers, watermelons, gourds and sunflowers**, plant those seeds directly into the ground at or after April 16, or when the soil is near 60° F in temperature.

Fall Planting Strategy

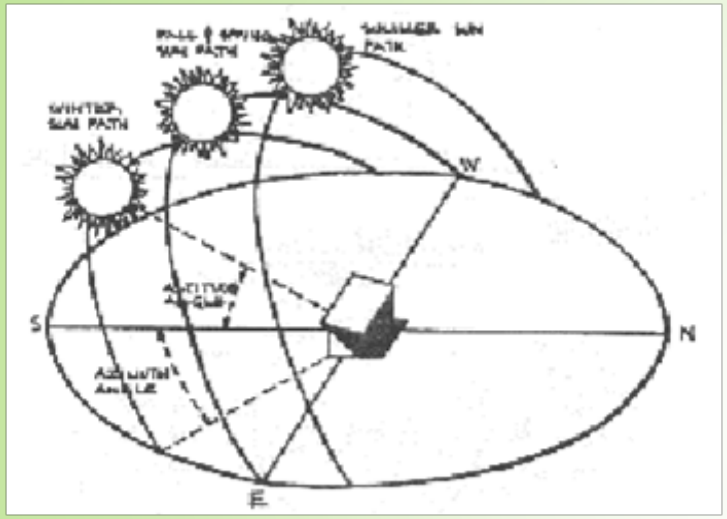
- Crops must mature and harvest *before* the winter frosts begin, around October 28. Calculate how much time each variety needs between planting and picking using "Days to Harvest" on the seed packet.

- Most **tomatoes, peppers and eggplants**, for example, require around 100 days to harvest, transplant seedlings around July 20.

- Fall is the time to plant **garlic and onions** – mid September

- B**roccoli, cauliflower, cabbage and spinach** direct seed into your garden around August 19, or because of the heat during that time of year, you can plant inside June 30 and then transplant them into the garden around August 9.

Know where the sun is!



The Sun is lower in the sky during the winter – and almost overhead during the summer.

Deciduous trees planted south of your home or garden will allow the warmth of the winter sun to keep plants warm, but block the strong solar radiation in the summer.

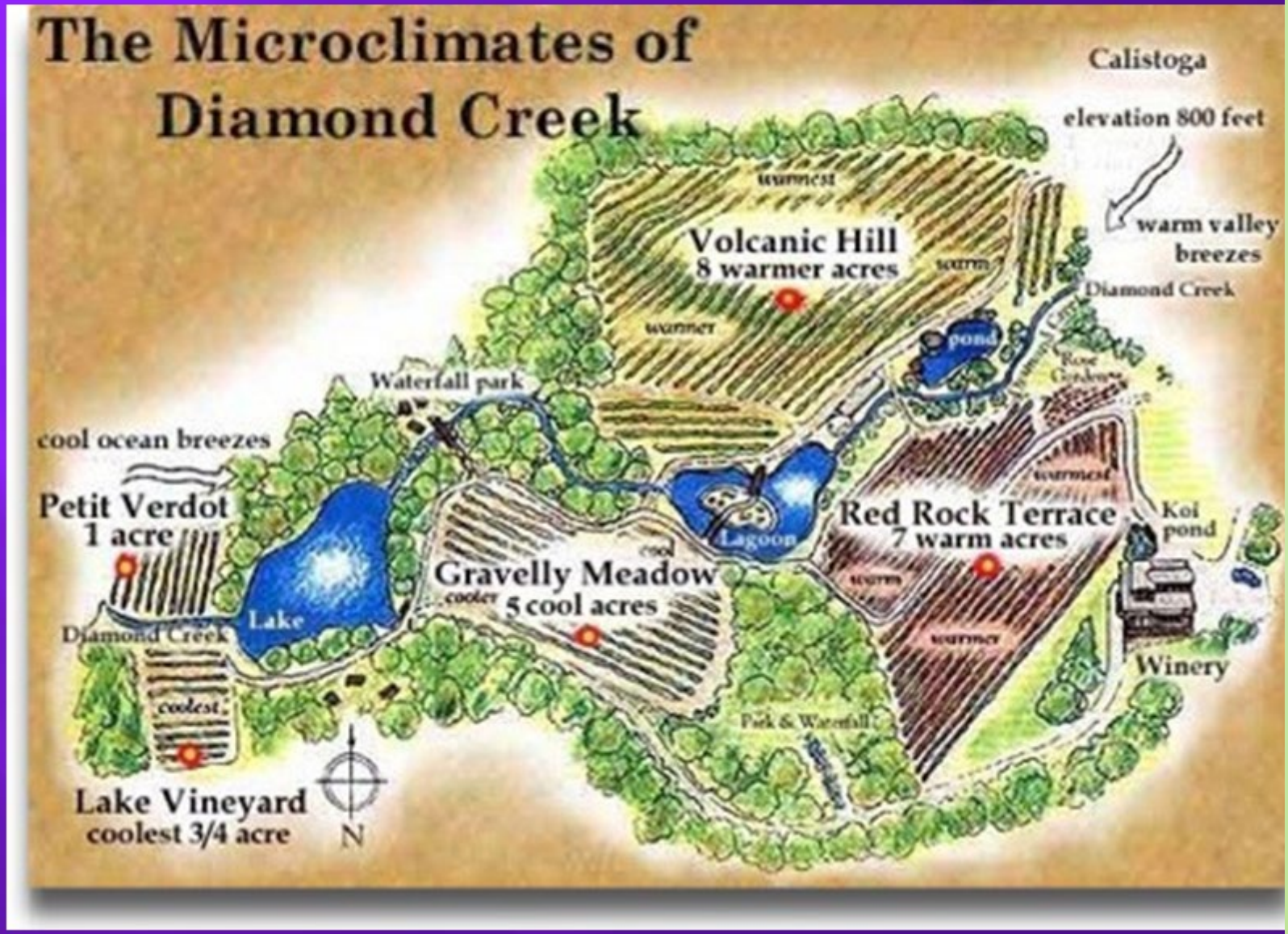
Microclimates can be many sizes

Orchard

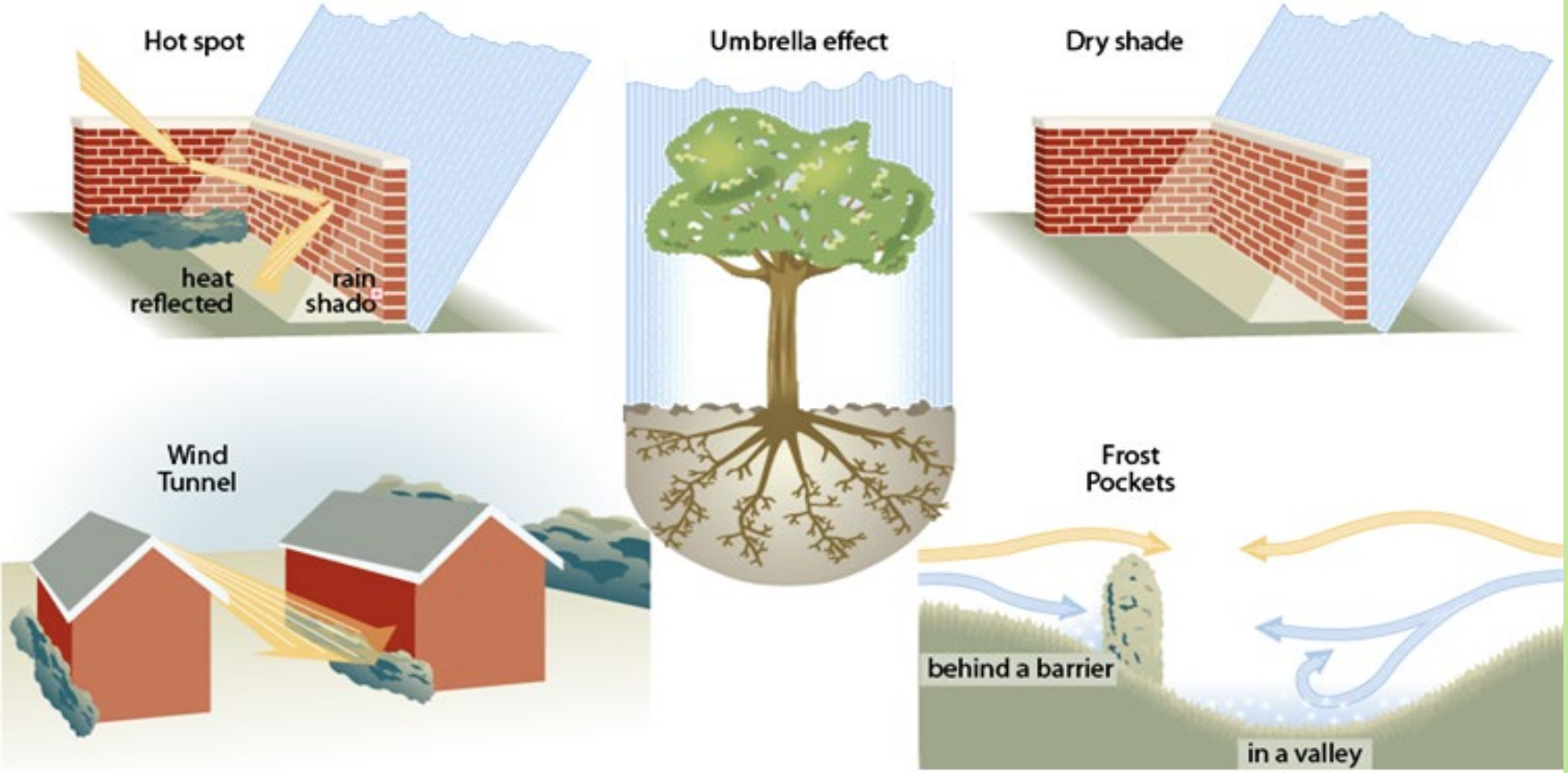
Terraces

Frog Garden

Microclimate Designs



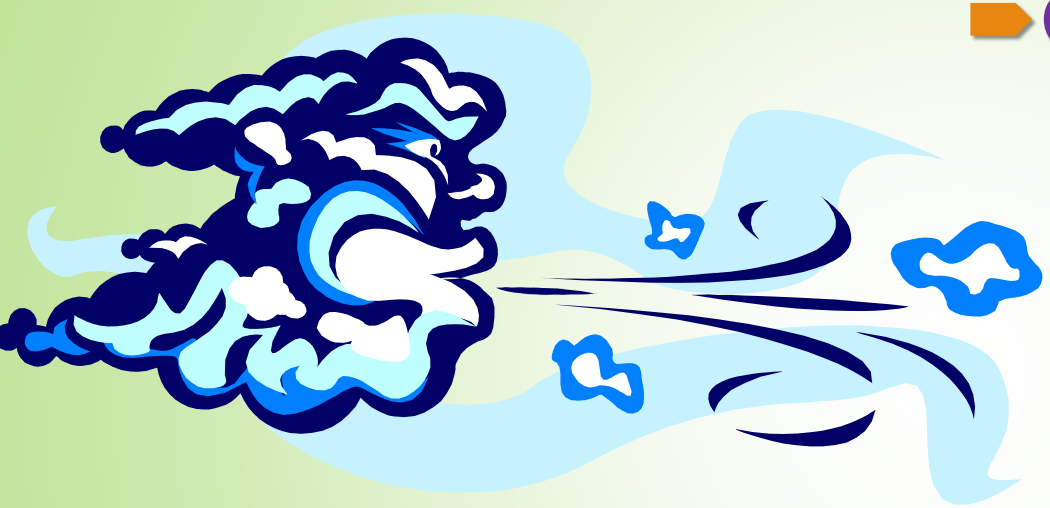
Microclimate Elements



Mass absorbs heat

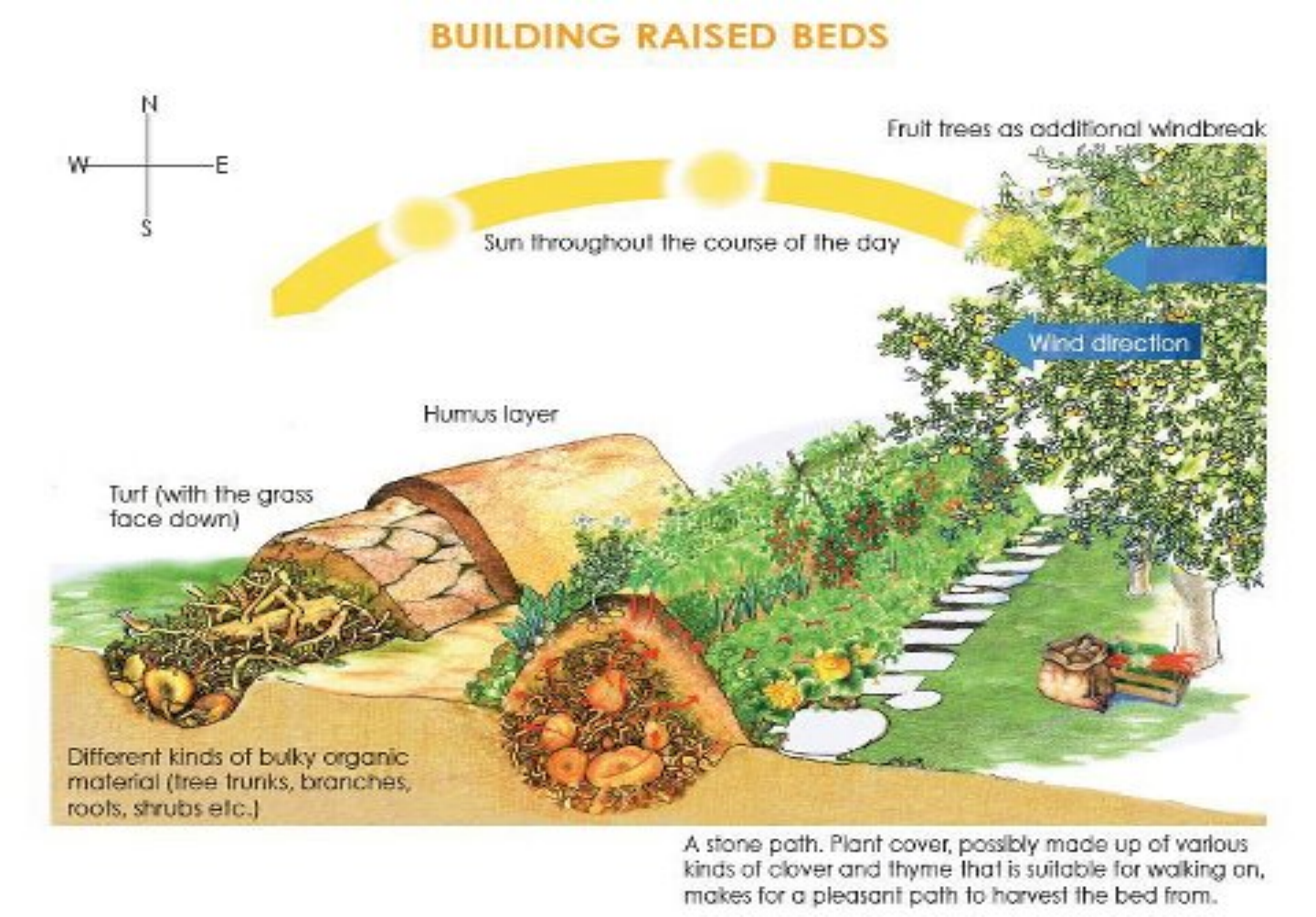
Place heat loving plants against south facing walls to keep them protected from the depredations of winter cold!

Protecting from Wind



- Create wind barriers
  - Walls/Fences
  - Bushes
  - Row Covers
  - Big Rocks
  - Houses/Sheds
  - Wall o'waters

Microclimates and raised beds



Options for providing shade

- Set the plants against the eastern side of a wall. The wall will shade them in the afternoon.
-

Walls and Fences also provide protection from strong winds

Shade with other plants

Groups of plants will also protect each other.
Plant rows of corn, or bushes to shade other plants.
Plant on the North or East side of a large tree or other plants.

More Shade/WX Options

Build a PVC pipe "box" and use glue guns or clips to attach shear curtains from Goodwill!

More shade options

- Erect a trellis or canopy above the garden that only shades it for part of the day.

Sunshade lets in the rain, but protects from sun scalding and gives partial protection from Hail.

Do Tomatoes need full sun?

- The packages of seeds, and the general wisdom imparted by many gardening books are written for places that are closer to sea level – they have 5,000 feet more atmosphere protecting from the sun!

- Tomatoes and many other plants that say “full sun” in the books, will benefit during the summer by having some shade, especially during the heat of the day.

Sun scalded tomatoes and peppers

Green Chiles and onions

Above: Planted in April
Right: June

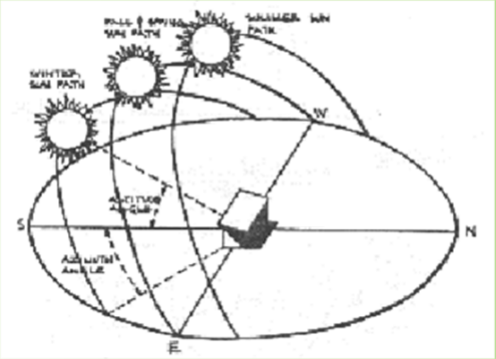
Early July

Wind Blocks


Ball
Quart Jars
Pint Jars

Winter Protections

Plants set against a dense south wall will have more protection from freezes due to radiant heat.



Sunroom on south side of house lets in lots of sun in winter but not much in summer.

Plants that create their own microclimates

Kale, Parsley, Mums, bushy plants

- Leaves brown and die in cold weather, but if you leave them on the plant they protect the stem and root areas – which come back quickly as they warm in the spring.
- Prune them back to new growth after last hard freeze.

The ultimate microclimate

Southwestern problems with greenhouses stem from too much heat during summer months.

Humidity levels must remain high and air circulation is required if plants are to be kept there year round.

Protects from

Cold
Hail
Wind
Snow
Critters

Tijeras, Elevation 7,321 Ft.

Less than $100

- 10x10 frame from an old shade structure
- 2 layers of thick plastic laid at 90 degrees over top
- Set against south wall of garage

- Strawbales hold down the edges inside the tent
- Jugs of water absorb sunlight during the day and give off heat at night

Greenhouse Heating Options

- Electric Space Heater or “Hot Rocks”
- Jar Candles or bunson burners
- Milk jugs painted black and filled with water
- Chemical hot packs
- Large Compost piles outside the North Wall

- Remember not to cook your plants!

Sunrooms and South Windows

Cold Frames

Place a wooden box over a planting area – or build a raised bed.

Put an old window over the top -Be Careful not to overheat!

Buy or build a cloth covering that opens easily.

Cold Frame Option

Window pane over a raised bed holds in heat well – but be sure to have some airflow when daily temps are higher!

Short freeze Protective Covers

- Milk jugs
- Plastic Pretzel Containers
- Blankets or sheets
- Piles of Leaves or mulch
- Trash Bags with clothespins

Wall o' Water

Protects plants from cold, wind, and sun!

Covered raised beds

Ways to Protect Flowering Fruit Trees from late spring Freezes

- Turn on the sprinkler!
- Smudge Pots
- Tree covers

Plant Fruit Trees Where?

On the NORTH side of the wall or house!

Keeping the roots where the soil stays cold the longest delays flowering.

Strategies for Warming the Ground

Black 55 Gallon plastic barrels cut in half

Black Plastic over soaker hose.

Black or Dark Gravel

Cooling with Ground covers

Purslane

Pine Needles

Straw

Light Colored Gravel

Clover

Match the Plant to the Need

Can take lots of heat, doesn't like to be really cold.

Planted in a raised bed against a south facing adobe wall.

Strategy

Make a diagram of your house and yard noting where there is natural shade and what parts are hotter or colder.

Plants below are on the north side of a fence – they get plenty of light through reflection at this latitude!

East side of wall and tree provide natural shade in the heat of a summer afternoon.

Cabbages set in a bed 10 inches below the sides and covered at night in early March are a lot happier than the ones at the right with no added protection.

Trellis provides climbing support for beans and casts shadows on them and some of the plants just to the north.

Butternut squash vines growing up the south side of a raised bed give these green chile's shade from the heat on 105 degree days.

Know Your Yard

- Think about your property – what microclimates exist naturally?
- Where are the high points in the landscape around you?
- Where are the low points where cool air will pool naturally?
- Where does sunlight strike at different times of the day and/or year?

Albuquerque Master Gardeners

www.abqmastergardeners.org

Who are Master Gardeners? We are community volunteers trained in horticulture by the New Mexico State University Cooperative Extension Service. We can answer both general and specific questions about all aspects of growing things.

The Master Gardener Program

- A three month class program as well as participate in 40 hours of volunteer work during the year.
- Classes begin in January continue once a week on Tuesdays through the middle of April.
- Two required classes each Tuesday: 8:30 – 10:00 AM and 10:30 AM – 12:00 noon.
- Extra optional classes from 1:00 – 2:30 PM.
- The Master Gardener classes are university-level and are taught by NMSU professors, veteran Master Gardeners, and other highly educated members of the local horticulture community.
- To apply: www.abqmastergardeners.org

For More Information

Climate and Weather websites

https://garden.org/apps/calendar/?q=Albuquerque%2C+New+Mexico

www. Weatherunderground .com

www.aviationweather.gov

http://www.weather.com/outlook/homeandgarden/garden/weather/tenday/USNC0121

Microclimate Websites

http://gardening.cornell.edu/weather/microcli.html

http://ucanr.org/sites/ucmgnapa/files/65702.pdf

Questions? - Contact
solarranch@swcp.com

References

- U.S. Weather Service Historical data

  www.weather.gov

- US Climactic Data
  - https://www.usclimatedata.com

  - Albuquerque City data
  - www.visitalbuquerque.org/about-abq/weather/

Rose's Blog and information on Gardening, Solar Cooking and Sustainable Living Practices

www.solarranch.com