Plants Running Cold, Hot & Dry

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Grow Green Landscape Professional Training

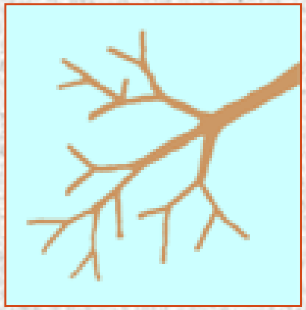
March 24, 2015

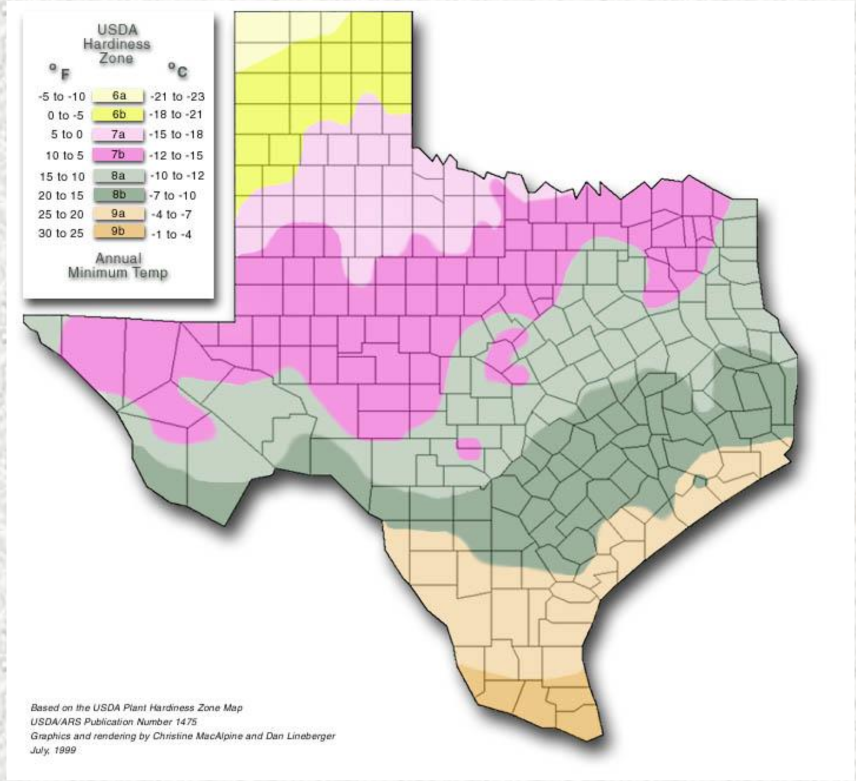
Hardiness

- Hardiness is genetic
- Each plant has an optimal temperature (and range) needed for growth
- Most plants max out at 86 ° F.
- Hardiness can be a function of location

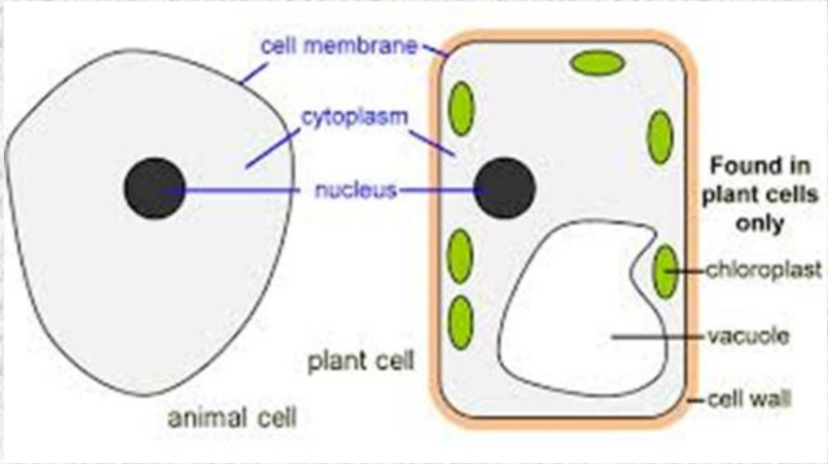
Cold Hardiness

- Ability of a plant to survive winters in a particular area
- Based on *the average* annual extreme minimum temperature during a 30-year period
- Austin = Hardiness Zone 8
- Average annual minimum temperature 10-20 ° F





Percentage of Water in Plants



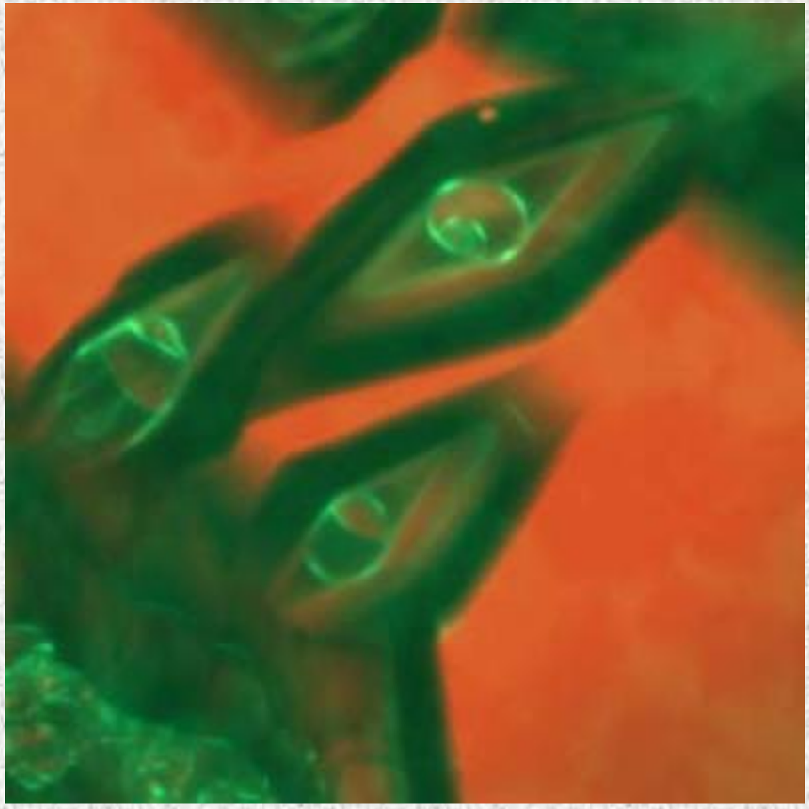
Bbc.co.uk

- Herbaceous plants = 80%
- Woody plants = 60%
- Lettuce = 95%
- Seeds = as low as 2%
- Cactus = 90-94% when hydrated
- Aquatic plants = 95%

How Cold Temperatures Injure a Plant

- Ice crystals form inside cells
- Water freezes <u>outside</u> the cells, in the intercellular spaces, this may lead to the extreme desiccation of the plant

Dealing with Cold: Antifreeze



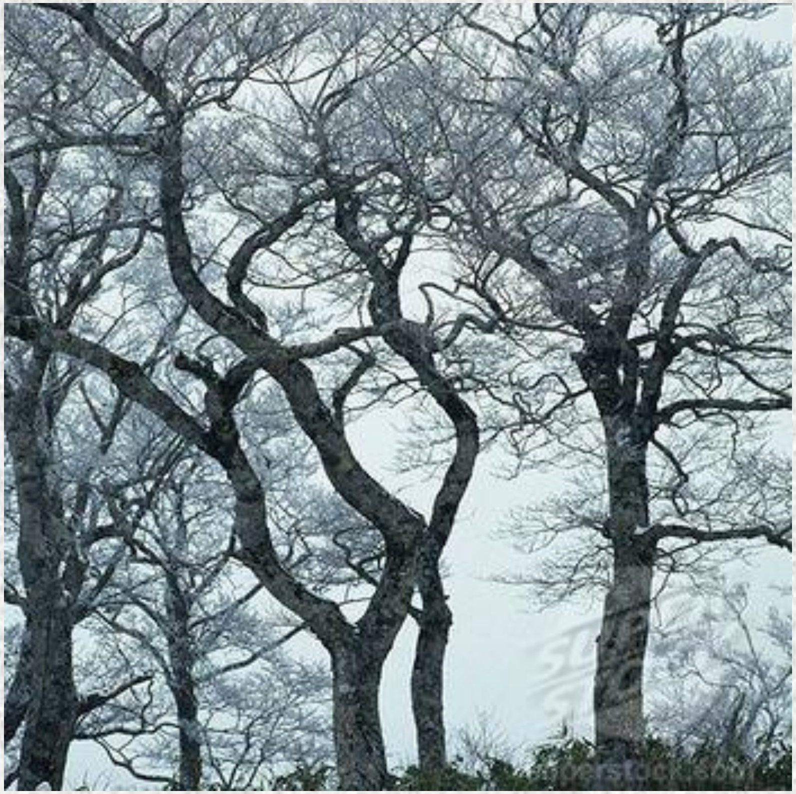
Ice crystals decorated by fluorescent antifreeze proteins.

Credit: Ido Braslavsky/Ohio University

Antifreeze or "ice structuring" proteins – found in some fish, insects, plants, fungi and bacteria – attach to the surface of ice crystals to inhibit their growth and keep the host organism from freezing to death

Dealing with Cold: Drop Leaves

- Deciduous plants drop their leaves before the winter chill sets in effectively shutting off the flow of water between roots and leaves then growing new leaves and water transport cells when warmer weather returns

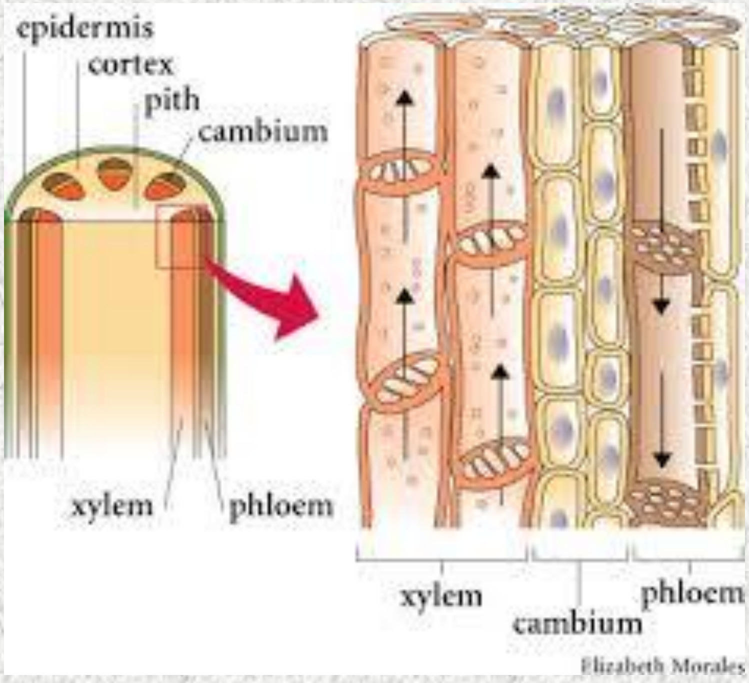


Dealing with Cold: Dieback

- Some plants dieback to the ground in winter and re-sprout from their roots

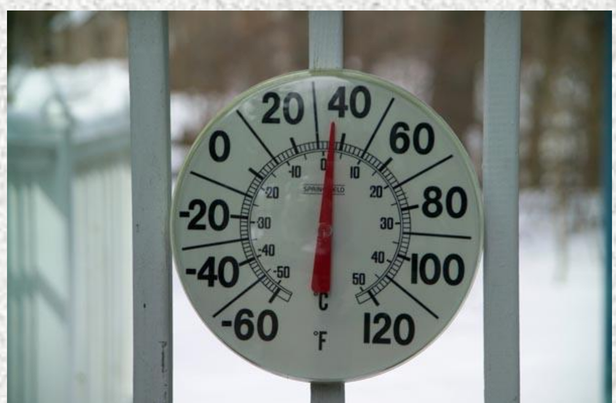
Dealing with Cold: Develop Narrow Transport Cells

Narrower water transport cells, makes the parts of the plant that deliver water less susceptible to blockage during freezing and thawing



Dealing with Cold: Acclimation (Hardening) & Duration

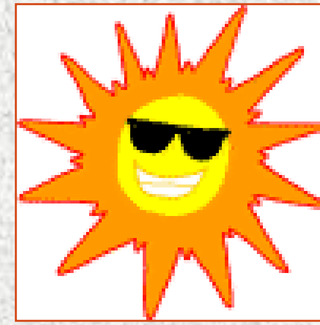
- Some plants, can become more cold tolerant or cold hardy simply by being exposed to near freezing temperatures.
- Some need gradually decreasing temperatures
- Duration of exposure to cold: Many plants that can survive a short period of exposure to cold may not tolerate longer periods of cold weather



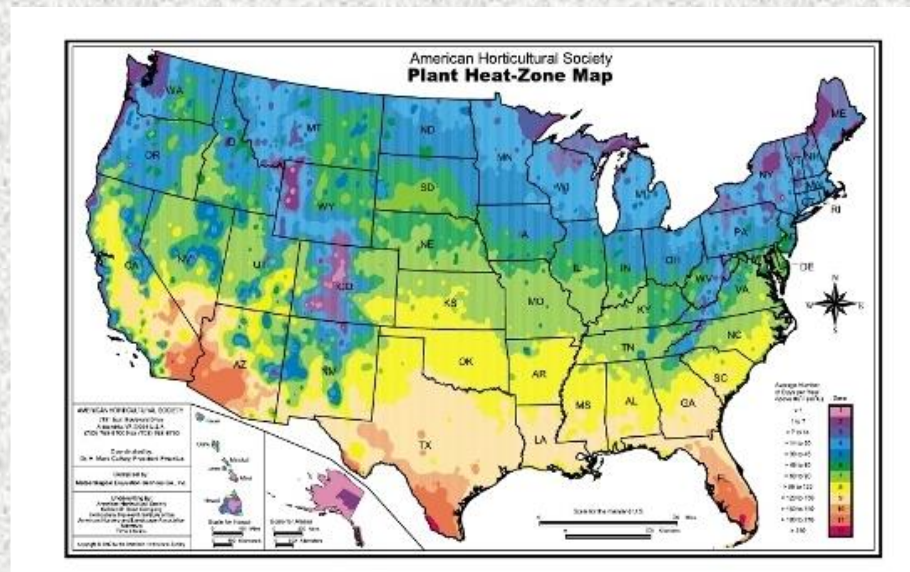
Dealing with Cold: Annuals

Start growing from seeds when conditions are right

Heat Hardiness Maps



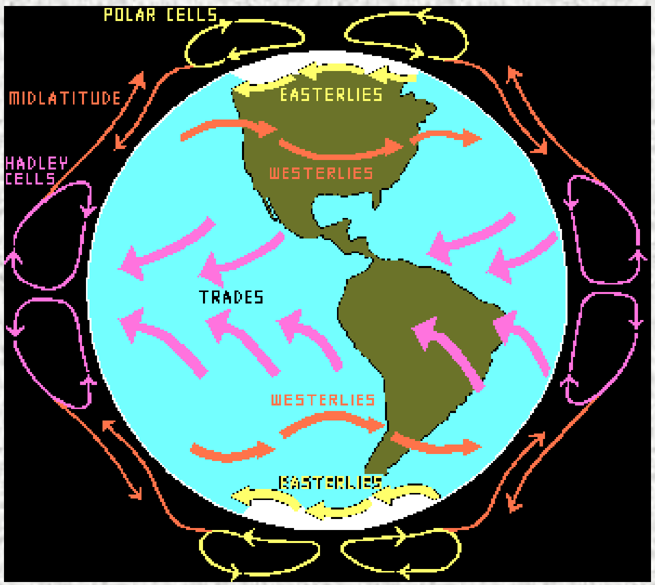
- Based on average number of days each year that a region experiences "heat days"- or temperatures over 86 °F. when plants begin suffering physiological damage from heat.



Zone 1 = less than 1
Zone 12 = 210 or more heat days

Macroclimate
(or just Climate)

- The long term weather patterns of a large geographical area

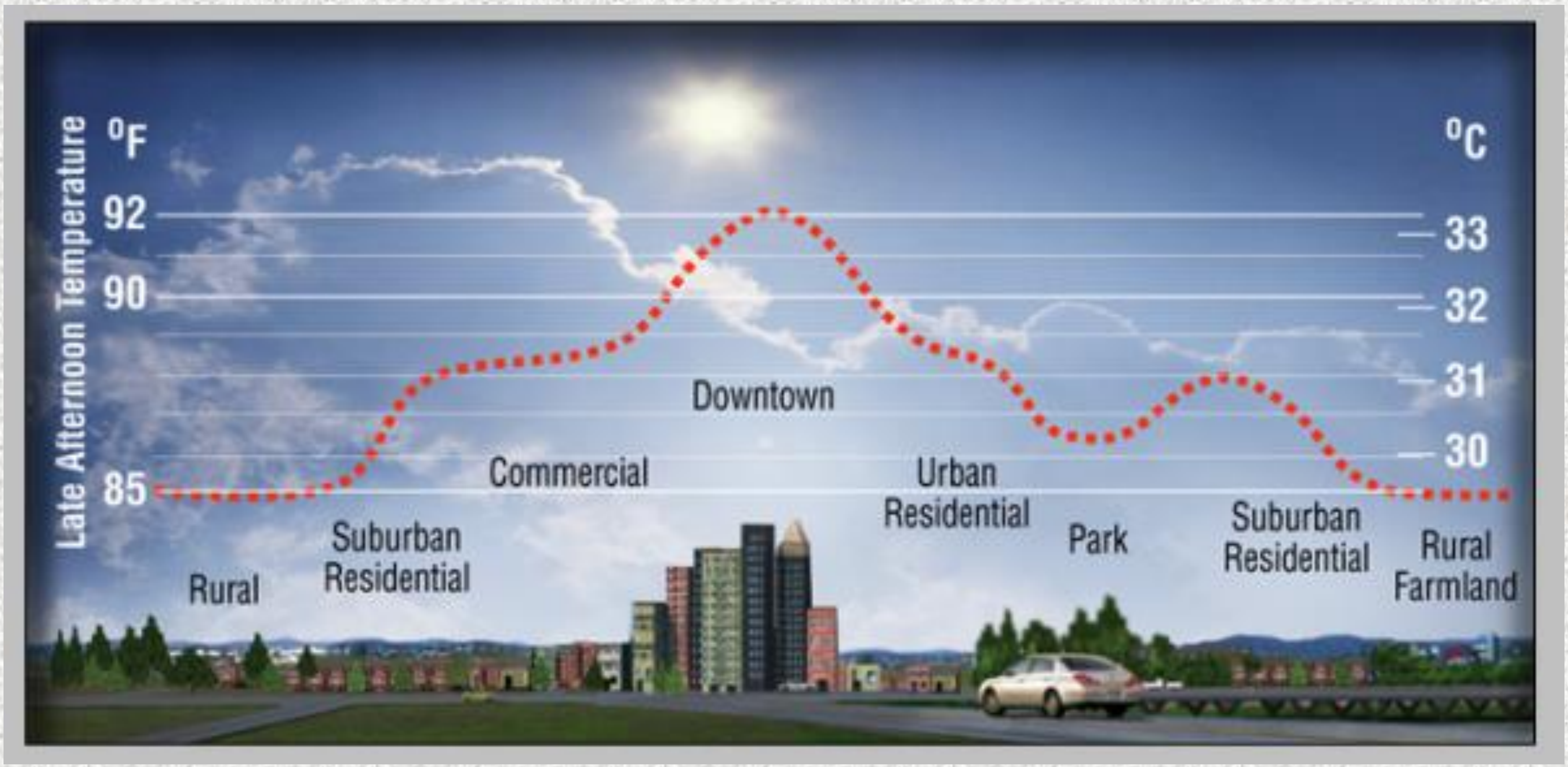


Microclimate

- Condition in a relatively small area, within a few feet above and below the Earth's surface

Microclimate Factor:
Aspect: Hills, slopes and low areas

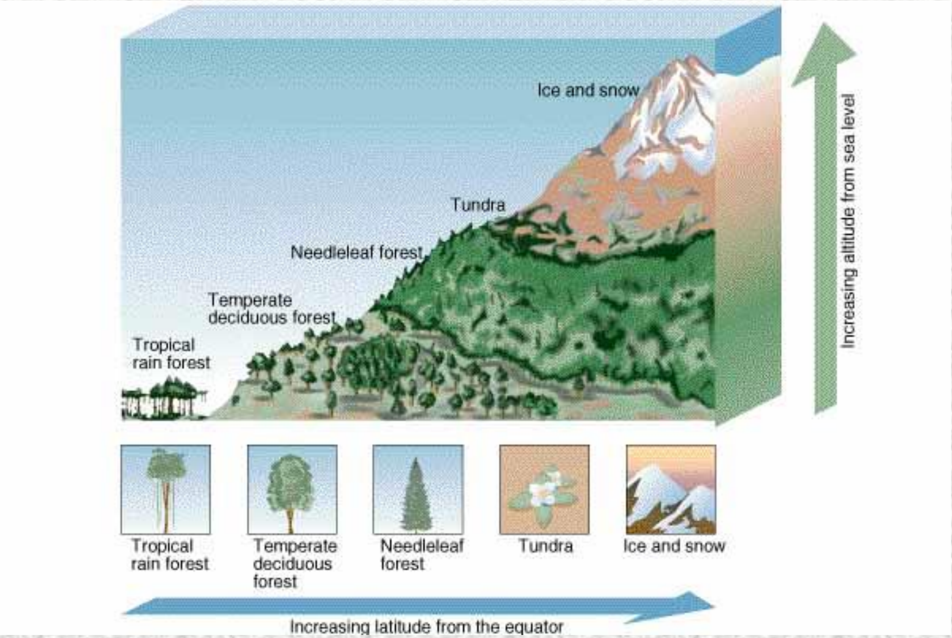
Microclimate Factor: Structures
Proximity to buildings & heat island effect



Microclimate factor: Bodies of water

- Water has a moderating effect on air temperatures
- High specific heat of water gives it large thermal capabilities
- Plants are somewhat insulated from temperature extremes

Microclimate Factor: Altitude

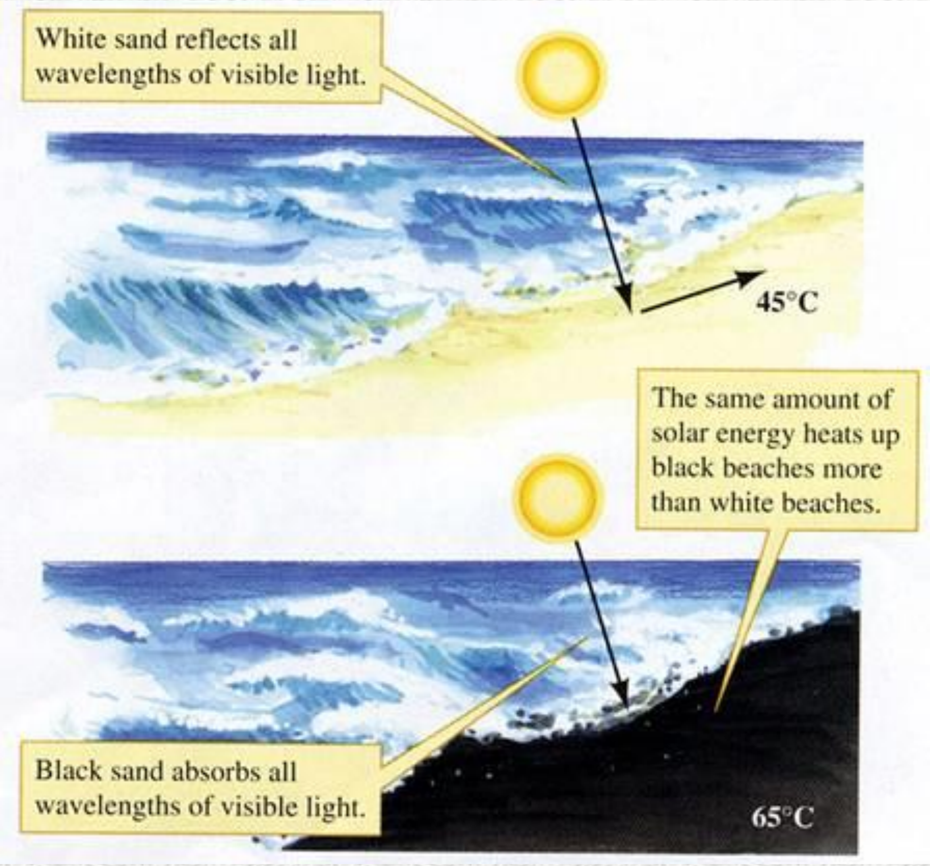


- The higher the elevation, the cooler the temperature Each 300 foot gain in elevation results in an average 1 °F drop in temperature

Lake Austin Altitude

Microclimate Factor: Raised Beds

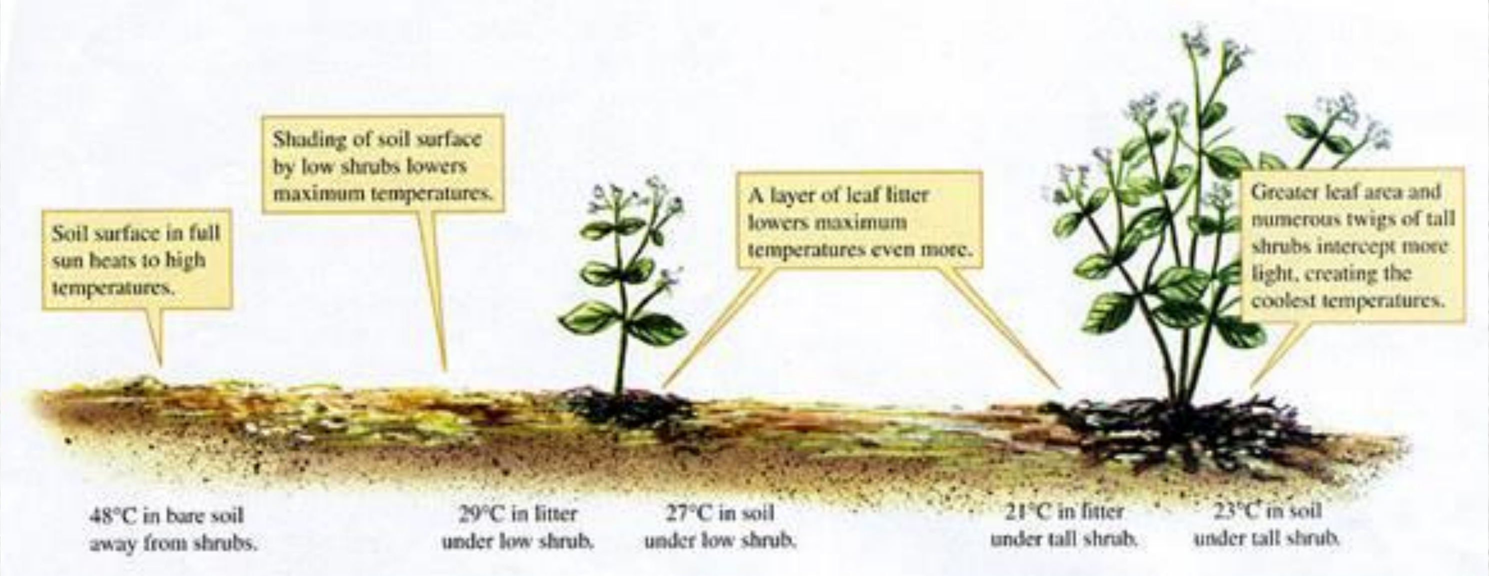
Microclimate Factor: Color of the ground



Microclimate Factor: Soil type & moisture

- Sandy soil will heat up quicker than clay soil
- Plants that might otherwise be hardy in your zone might be injured if soil moisture is too low in late autumn and they enter dormancy while suffering moisture stress.

Microclimate Factor: Vegetation



Humidity

- High relative humidity limits cold damage by reducing moisture loss from leaves, branches, and buds. Cold injury can be more severe if the humidity is low, especially for evergreens

Ways Plants Deal with Drought

- By avoiding it (annuals)
- Storing and saving water
- Reducing water lost through transpiration
- Adaptations

AVOID DROUGHT CONDITIONS: SHORT LIFECYCLE

Horsemint

Indian Blanket

Seeds have almost no metabolism, are resistant to environmental extremes; “smart” to wait until specific environmental conditions exist

WATER SAVER: UNDERGROUND STORAGE

Spider Lily

WATER SAVER: STORAGE IN SUCCULENT LEAVES

Ghost Plant

Sedum

DROUGHT TOLERANCE – REDUCE WATER LOSS: GRAY, HAIRY LEAVES

Lamb's Ears

Wooly Stemodia

DROUGHT TOLERANCE - REDUCE LOSS: WAXY LEAVES

Cherry Laurel

DROUGHT TOLERANCE - REDUCE WATER LOSS: REDUCE LEAF AREA SMALL LEAVES, LONG LEAVES

Rosemary

Desert Willow

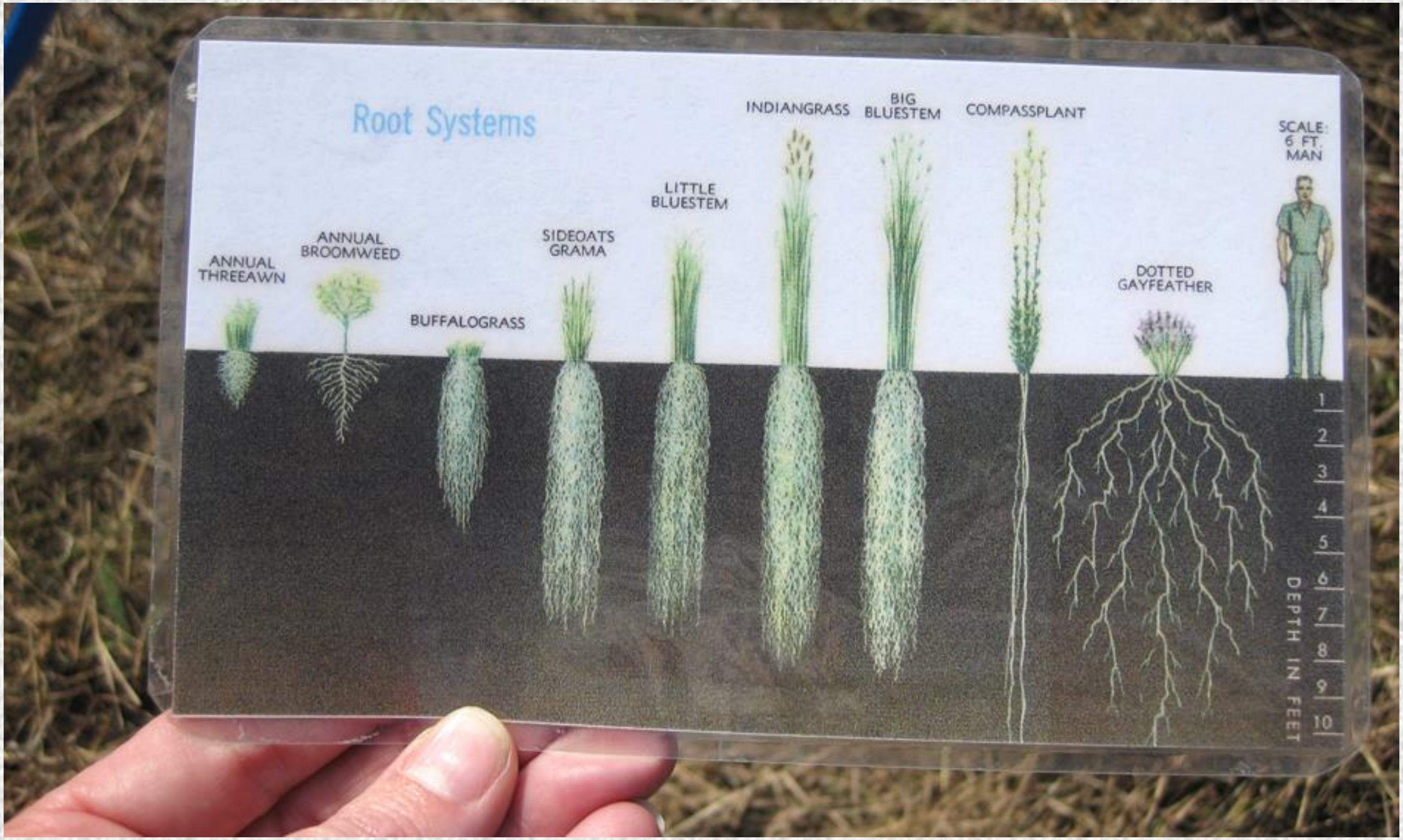
DROUGHT TOLERANCE REDUCE LOSS: SPINES, BITTERNESS, AND/OR TOXICITY
(LESS LIKELY TO GET EATEN)

Agave

DROUGHT TOLERANCE MINIMIZE NEED FOR WATER: SUMMER DORMANCY

Buffalograss

DROUGHT TOLERANCE: ADAPT EXTENSIVE ROOTS



DROUGHT TOLERANCE:
ADAPT WATER COLLECTION STRUCTURE

DROUGHT TOLERANCE – MINIMIZE NEED FOR WATER: SLOW GROWING

DROUGHT TOLERANCE
MINIMIZE NEED FOR WATER
INCREASED PHOTOSYNTHETIC EFFICIENCY

- Three types of photosynthesis
  - C3 about 85% of land plants
  - C4 about 8% of land plants
  - CAM about 3%

C3 PHOTOSYNTHESIS

- Most plants
- Stomata are open during the day
- Photosynthesis takes place throughout the leaf
- With normal light, under cool and moist conditions C3 plants are more efficient than C4 and CAM plants

C4 PHOTOSYNTHESIS

- Only about 3% of land plants including corn, summer annual plants
- **Grasses and sedges comprise about 79% of the 3%**
- Stomata are open during the day.
- Photosynthesizes faster than C3 plants
- They use water more efficiently so do not need to keep stomata open as much (less water lost by transpiration)

CAM PHOTOSYNTHESIS
(CRASSULACEAN ACID METABOLISM)

- 8% of land plants – many succulents such as cactus & agave
- **Only consume about 10% of the water other plants use**
- Under arid conditions use water more efficiently because stomata open at night when evaporation and transpiration rates are usually lower and (no sunlight, lower temperatures, lower wind speeds, etc.).
- CAM-idle can leave their stomata closed night and day. Allows the plant to survive dry spells, and it to recover very quickly when water is available again

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