

Sierra Foothills Oaks: Drought, Mistletoe, and Other Concerns



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Native Oak biology

- Long lived generalists as a group
 - Changes occur over years
- Promiscuous specialists as species
 - Hybrids within sections
 - White oak section
 - Red oak section (new world only)
 - Golden oak section
 - *Quercus chrysolepis*, canyon live oak

White oaks

(section *Quercus*)

- *Quercus lobata*
 - valley oak
 - white oak
- *Quercus douglasii*
 - blue oak
- *Quercus garryana*
 - Oregon white oak
 - Garry oak
- All native trees are oval or lobe leafed and deciduous
- Evergreen scrub oaks
- All immune to SOD





Red (black) oaks

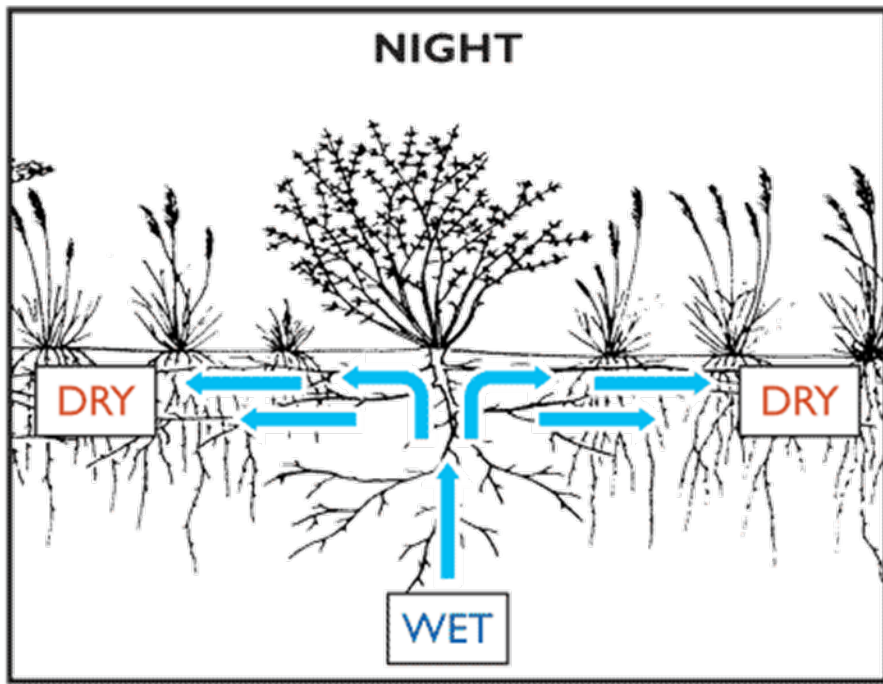
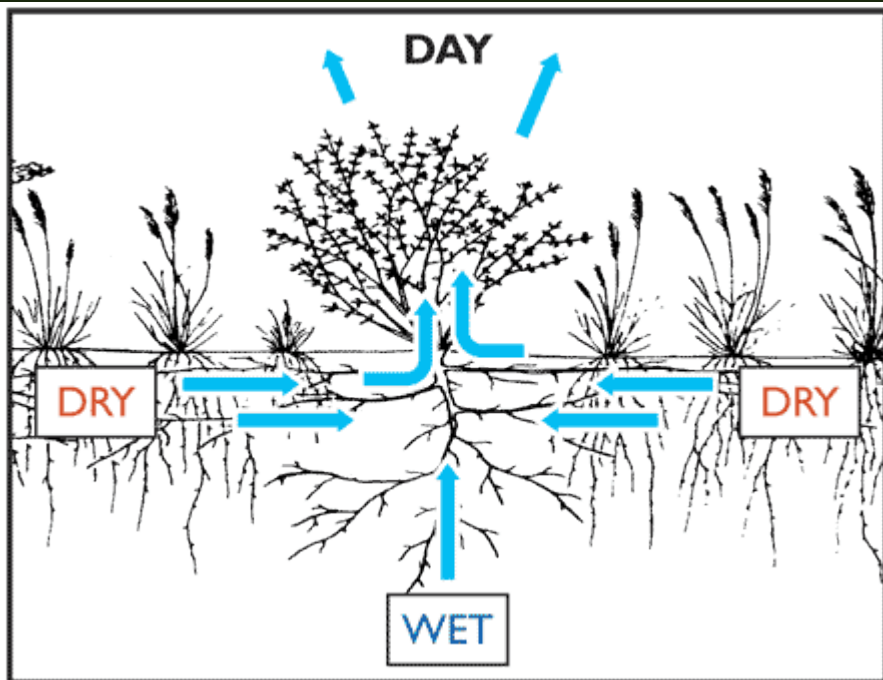
(Section Lobatae)

- *Quercus kelloggii*
 - Black oak
- *Quercus wislizeni*
 - Interior live oak
- Hybrids (oracle oak)
- All native trees are either evergreen or have pointed lobes
- May get SOD
 - Some resistant

A Few Words About Drought

- Plants make their food (sugars) from sunlight
 - $6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{sunlight \& chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
 - Red and blue light drive two different photosystems
 - Green light reflected
- Plants metabolize these same sugars to live, grow, and reproduce
 - Must live within an energy budget
- All of this requires water
 - A lack of water requires tradeoffs
 - Storage vs. defensive chemistry
 - Leaves vs. roots

Trees as water managers



- Hydraulic lift
- Uptake from sinker roots during day
- Redistribution via mycorrhizae at night
 - Communities of organisms that work together
- Soils 12" down stay moist
- Trees are usually the most valuable plants you have



People as Water Managers

- Usually pretty good
 - ... but not always
- All equipment fails
 - Underground
 - Works in the early morning
- Watering problems
 - Most common landscape maladies



Photo courtesy Igor Lacan, UCCE Advisor



Drought Response

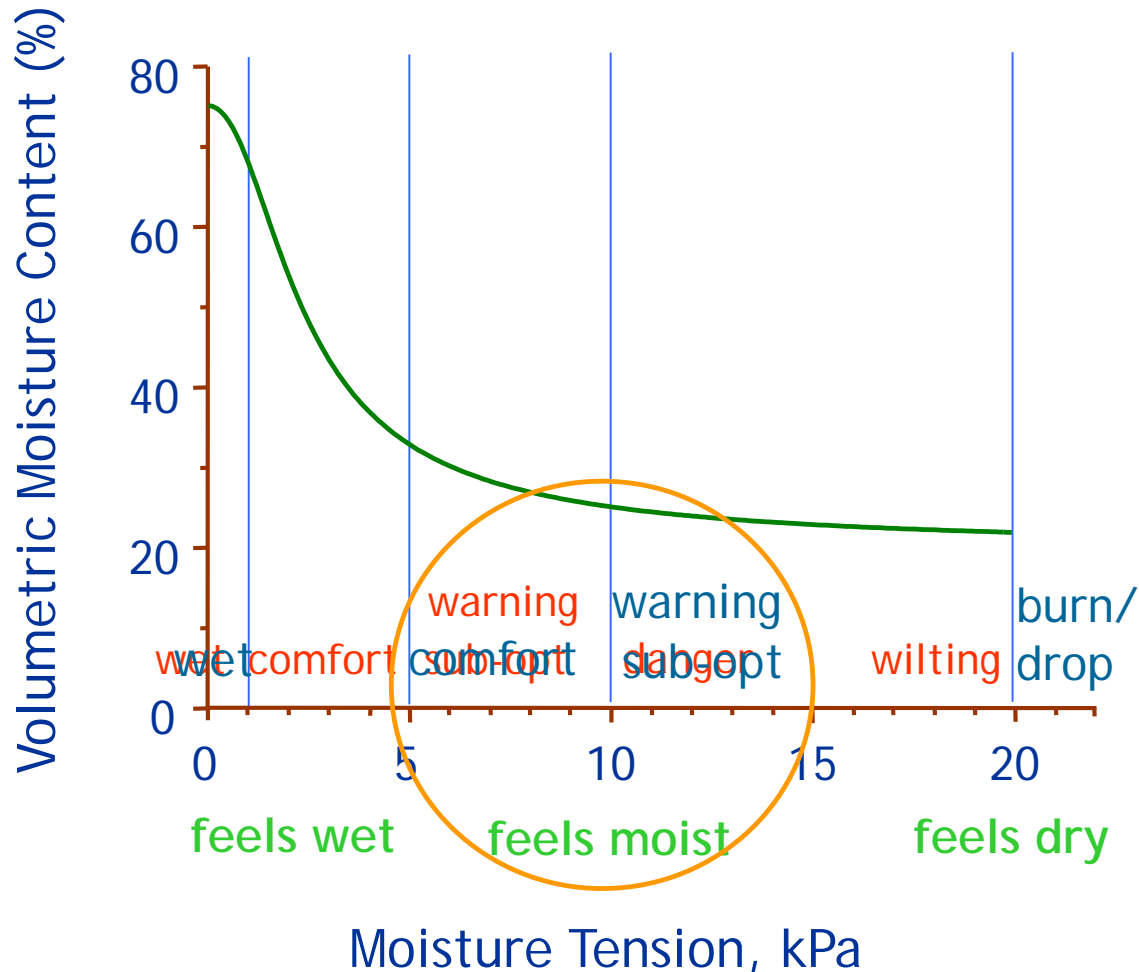
- Smaller leaves
- Abbreviated growth
- Trees “remember”
- Next years:
 - Fewer leaves
 - Budget (sugar) reallocation to roots
- “Stunted” above ground
 - Maybe bigger below ground!



Drought Response

- Feedback loops between
 - genes & environment
 - metabolism
 - production of:
 - drought specific metabolites
 - chemical defenses
 - may affect tree for life
- Water is key for sugar production
- No water, no defense
 - Sunburn
 - Pests & pathogens
 - Fire

Moisture Retention Curve



- How water tensions feel to a rose.
 - Note that although the soil feels moist to us, it may be dangerously low in water!
- How water tensions feel to a blue oak
 - Better adapted to dry conditions
- How these moisture levels feel to us
 - NOTE: clay soils can feel soft at 15 or higher



Management Recommendations

- Understand your plant's relationship to water
 - A community approach
- Assess water status 12" below grade
 - Hydraulic lift
- Let the tree tell you how it's doing
 - Look at current growth
 - Effects occur over years

Stress & Diseases

- Primary pathogens
 - Attack regardless of the state of the tree's health
 - Tend to be exotics
 - Prefer healthy trees
 - Treatment difficult
- Opportunistic pathogens
 - Attack weakened trees
 - Tend to be natives
 - Improve conditions



Beetles that attack oaks

- Bark & ambrosia beetles
 - Pin-sized boring holes
 - Talcum-fine boring dust
 - Wood colored
 - (ambrosia beetle)
 - Rust colored
 - (oak bark borer)



Ambrosia beetle

- California native
- Farms the *Ambrosiella* fungus
- They kill drought stressed oaks
- No curative treatment





Ambrosia beetle

- The last part of SOD
- Don't need *Phytophthora* to kill trees
 - See and smell drought stress
 - Outbreaks in low rainfall years
 - Deep, infrequent summer water
 - Preventative pyrethroid insecticides



Oak bark beetle

- Similar lifecycle to ambrosia beetles
 - See and smell drought stress
 - Outbreaks in low rainfall years
 - Deep, infrequent summer water
 - Preventative pyrethroid insecticides
- Feed on living cambium



Oak bark beetle

- Tunnels may flux
 - New fungal associate
Geosmithia pallida
 - Similar to alcohol flux
 - May be deadlier
 - Check origin of foam
 - Tunnel: Oak bark beetle





Branch Dieback

- Fungal diseases with fancy names
- Endophytes
 - Most plants already infected
 - Like chicken pox
 - Opportunistic
- Huge host range
 - Oaks (Diplodia)
 - Redwoods, Sequoias, other conifers (Botryosphaeria)
 - Madrone, Manzanitas
 - ... and on ...
- Improve growing conditions
- Consult UC IPM

Photo: Larry Costello

Phytophthora

- Many species thrive in warm, wet soil
 - e.g., *P. cinnamomi*
 - Many of these will attack almost any tree under the right conditions
- All require water to infect
- Thrive in “Drench and Drought” irrigation
 - Know your plants
 - Monitor your soil
 - Let things dry without stressing the plant





Photo: Beryt Oliver

Armillaria (oak root rot)

- Starts on stressed trees
- Can move on to others
- Common in California soils
- Likes:
 - Summer irrigation
 - Consistently warm moist conditions
 - Droughts, hot summers
 - Vineyards
 - Lawns
 - Injured roots
 - Especially larger roots
- Fungicides ineffective

Armillaria

- “Oak Root Rot”
- White mycelia
- Usually bark is soft where disease is advanced
- Smells like fresh mushrooms
 - Often subtle
- Sometimes clumps of tan mushrooms
 - White spores







Armillaria Management

- Water
 - Timing, amount, and location
 - Let things dry
- Chemical Tx not shown effective
 - Despite labels
- Removal
- Air spade
 - If caught early enough



Photo: Bob Ray Co., Inc.

Oak Twig Blight

- *Cryptocline cinerescens*
- California native
- Likes warmth, high humidity
 - Nearby irrigated lawns



Oak Twig Blight

- Black pimple like growths on recently killed twigs
- Prune out in dry weather
- Reduce humidity if possible in summer



Mistletoes

- Two kinds:
 - Broadleaf
 - *Phoradendron spp.*
 - Classic leafy mistletoe
 - Dwarf
 - *Arceuthobium spp.*
 - Little outward sign of infection



Dwarf Mistletoes

- True parasites
 - Not green
 - Yellow, brown, black, red ...
- Shoot sticky seeds up to 40 feet
- Hard to treat
- Just infest conifers
 - Why do we care?
 - They kill trees
 - Cause branch failures
 - Increase fire hazard





Broadleaf mistletoes

- Hemiparasites
 - Do their own photosynthesis (Green)
 - Get water from host
 - Some sugars in some cases
- Important for birds
 - Eat the white berries
 - ... and spread the problem
- Mostly infest hardwoods
 - Branch damage in severe cases
 - Δ mortality not measurable
 - Exceptions for drought



Broadleaf mistletoes

- *Phoradendron macrophyllum* (*leucarpum*)
 - Western mistletoe, but many common names
 - Species status in dispute
 - Wide host range
- *Phoradendron villosum*
 - Also many common names, including hairy & pacific mistletoe
 - Mostly infects oaks

Mistletoe treatment

- Prune the branch
 - Cut at least a foot below the mistletoe stem
- Or
- Cut the mistletoe off
 - Wrap the branch in heavy plastic trash bags and duct tape the ends
- Growth regulators
 - Ethephon does work
 - But also affects trees
 - Not popular to spray



Trees & shrubs are not passive

- They actively manage water and pests
- Pathogens need an angle to survive
 - Opportunistic pathogens and pests attack stressed trees (we give 'em plenty)
 - Primary pathogens attack other trees in certain specific cases
 - Warm, moist soils; etc.
- Diagnosing the problem
 - The disease triangle
 - UC IPM for specific disease ID & treatment

References

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- Raviv M; Leith J.H; Burger D.W; Wallach R (2001) Optimization of Transpiration and Potential Growth Rates of 'Kardinal' Rose With Respect to Root Zone Properties. *Journal of the American Society of Horticultural Research*.
- UC IPM Mistletoe Webpage <http://ipm.ucanr.edu/PDF/PESTNOTES/pnmistletoe.pdf>

Thanks!

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