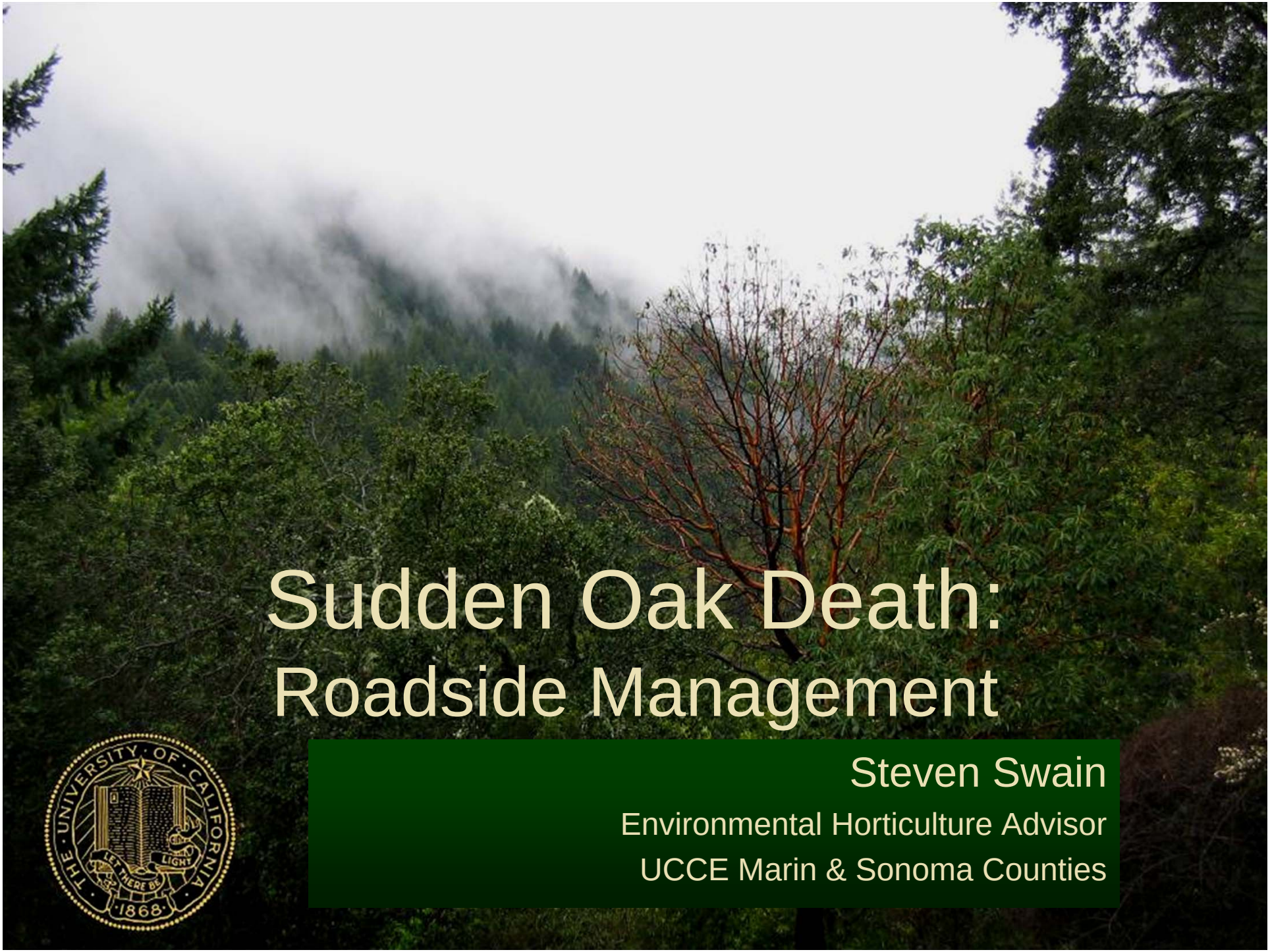


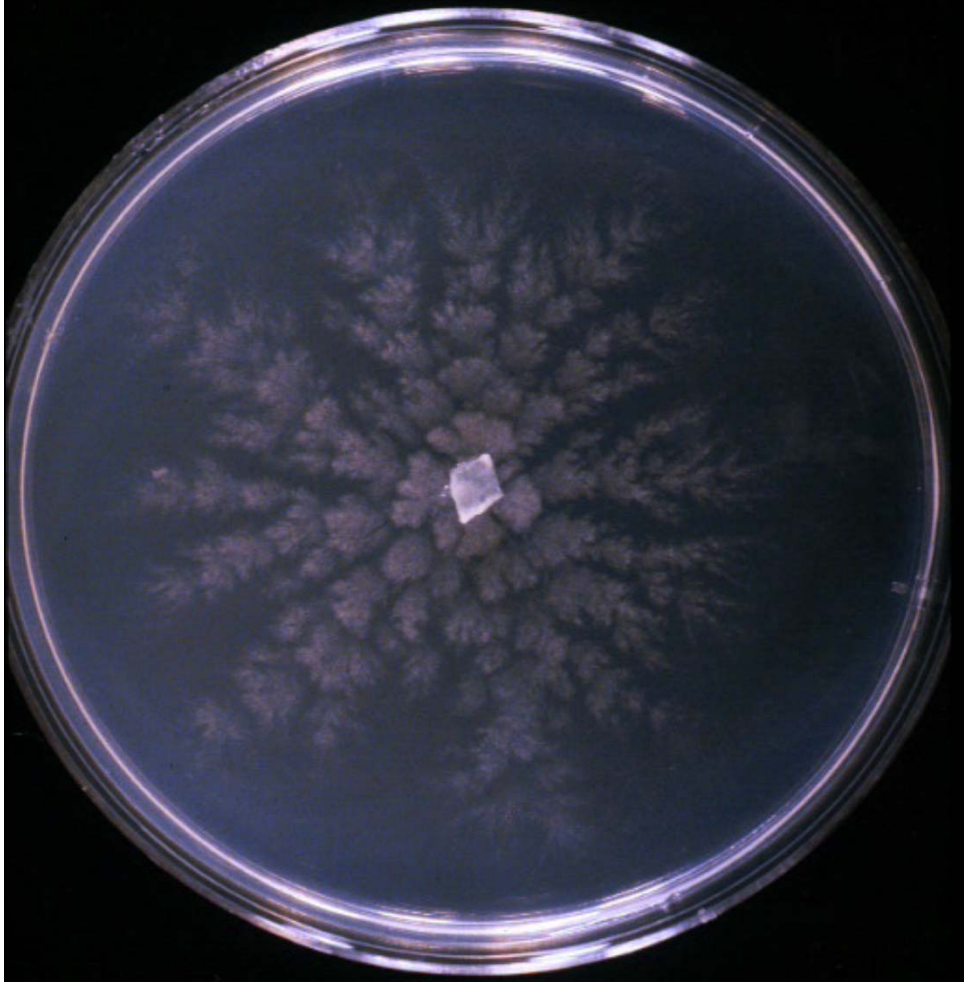
Sudden Oak Death: Roadside Management

Steven Swain
Environmental Horticulture Advisor
UCCE Marin & Sonoma Counties

Sudden Oak Death

- Caused by *Phytophthora ramorum*
  - Fungus-like organism
- 2 Diseases
  - Foliar blight (huge host list)
    - Nursery issue
  - SOD (kills oaks, tanoak)
    - Wildland issue
- Spread
  - Local: wind driven rain
  - Distance: people
    - Infected plants
    - Shoes & tires
    - Livestock

Phytophthora ramorum



Phytophthora ramorum in culture

Sporangia releasing zoospores

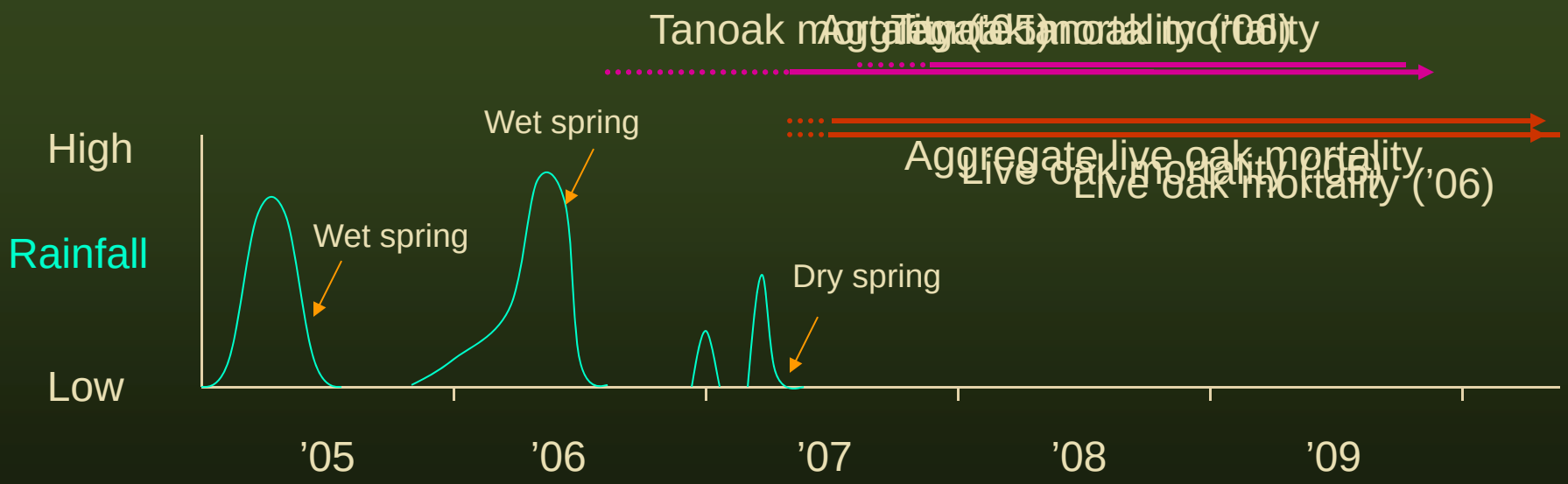
Chlamydospores

Impacts

- 1 million trees killed & 1 million currently infected
- 2,000,000+ acres affected
  - < 10% of high risk forest
- Ecology – forests look and act differently, wildlife impacts
- Safety – Hazard trees, fire dangers
- Economics – Costs of mitigation & quarantines, tree removals
- Emotional – individual property owners, recreational users

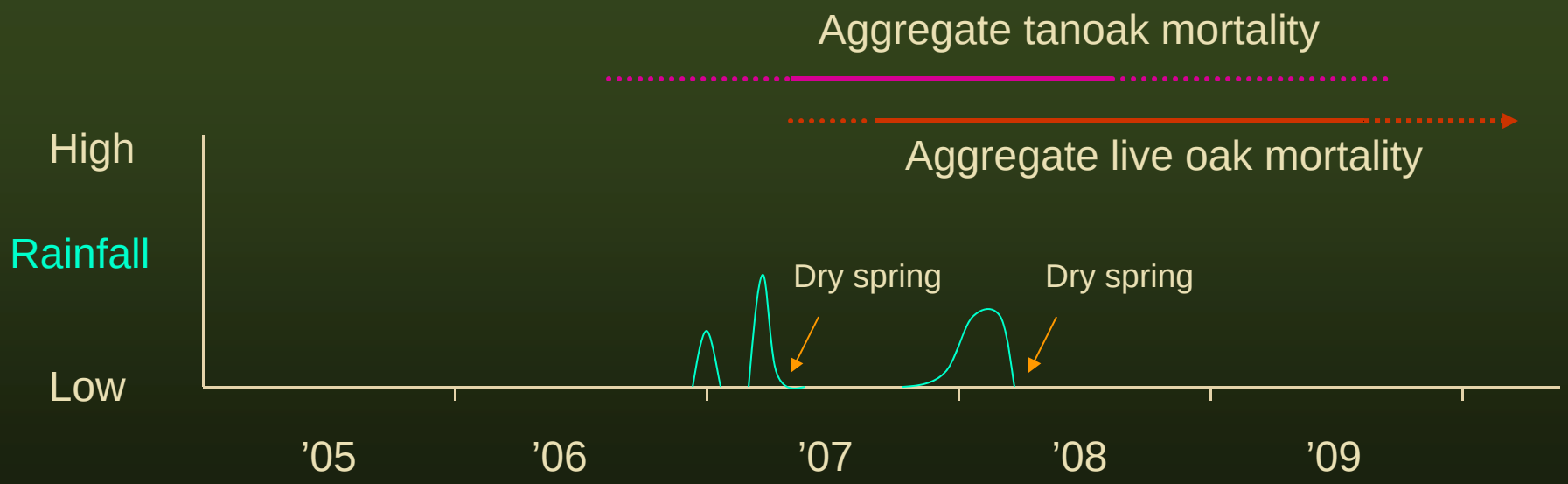
Oak Death Timeline

- Infection:
  - Wet springs
  - Tanoak mortality: 1-2 years
  - Coast live oak mortality: 2-3 years
  - Cryptic Infection



Oak Death Timeline

- Mortality rates will drop off with more dry springs
- Mortality rates increase following wet springs



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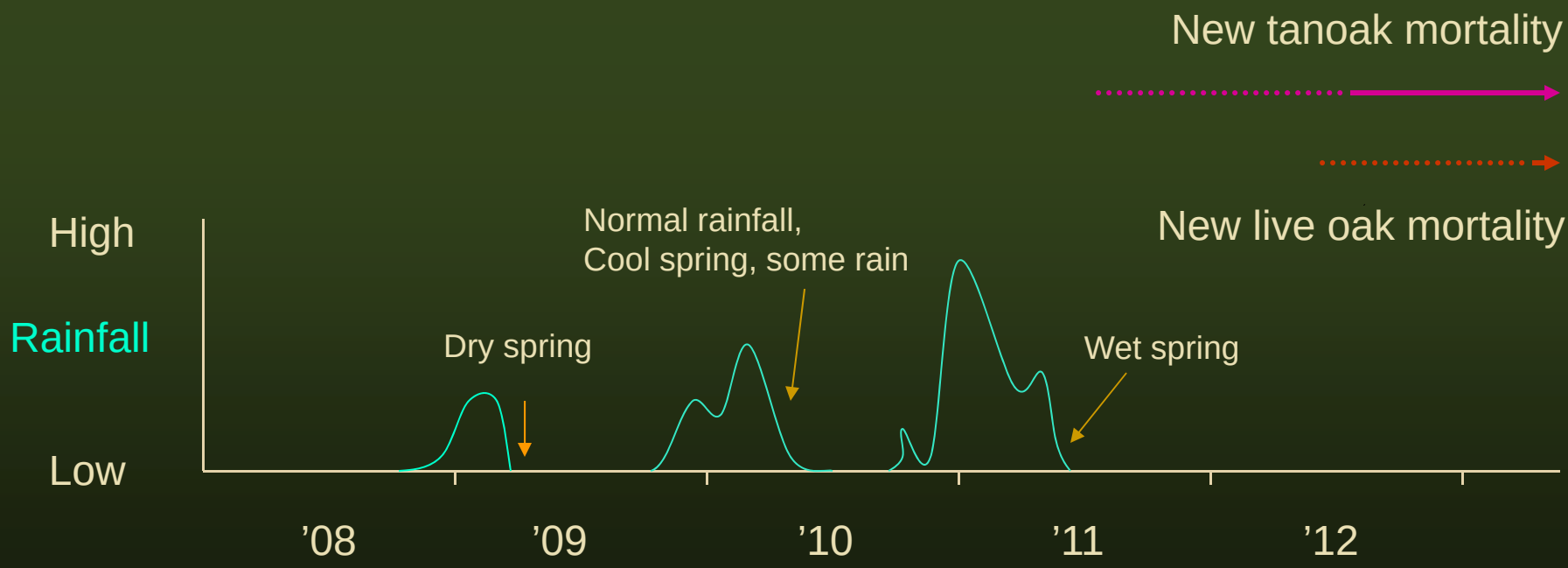
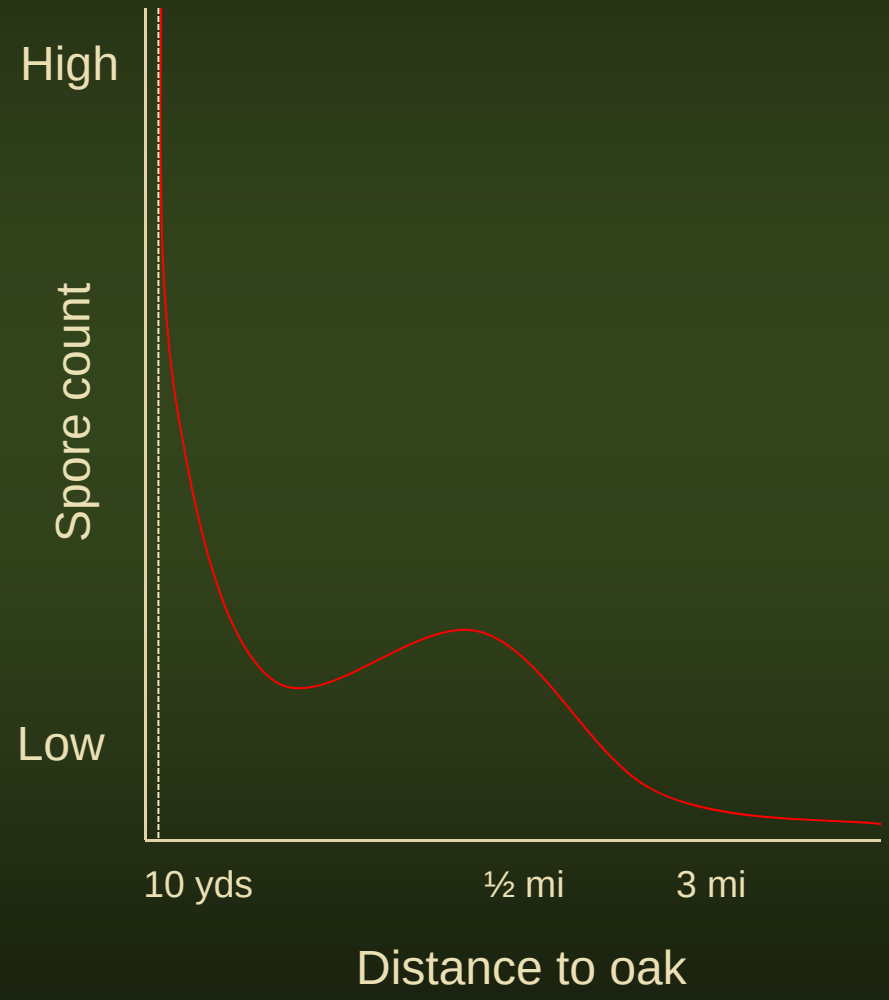


Distance to spore source

- Foliar hosts near true oaks high risk
  - Some risk even at larger distances
- Not as relevant for tanoaks
  - Foliar host itself
  - Self infection



Susceptible Species

Over 60 Genera; 115 Species/Varieties

Andrew's clintonia bead lily
Anise magnolia
Ardisia
Bay laurel
Bigleaf maple
Blueblossom

California bay laurel

California black oak
California buckeye
California coffeeberry
California hazelnut
California honeysuckle
California maidenhair fern
California nutmeg
California wood fern

Camellia

Camphor tree
Canyon live oak
Cascara
Castanopsis
Chinese gugar tree
Chinese witchhazel

Coast live oak

Coast redwood
Cornus Norman Haddon
Delavay Osmanthus
Douglas-fir
Drooping leucothoe
Eastern joy lotus tree
English laurel
European ash
European beech
European turkey oak
European yew
Evergreen huckleberry
Evergreen maple
False Solomon's seal
Fetterbush
Formosa firethorn
Goat willow
Grand fir
Griselinia
Holly olive
Holm oak
Horse chestnut
Hybrid roses
Hybrid witchhazel
Japanese evergreen oak

Kalmia

Kinnikinnick
Kobus magnolia
Laurustinus
Lilac
Loebner magnolia
Loropetalum
Madrone
Magnolia
Manzanita
Michelia
Mountain laurel
Myrtle-leafed Distylium
Ninebark
Northern red oak
Oleander
Oregon ash
Oregon grape
Oriental holly
Osmanthus
Pacific yew
Persian ironwood
Pieris
Planetree maple
Poison oak
Portuguese laurel cherry
Purple magnolia
Red fir
Red lotus tree
Red tip photinia
Redwood ivy

Rhododendron

Roble beech
Rugosa rose
Salal
Salmonberry
Saucer magnolia
Scotch heather
Scribbly gum
Sessile oak
Sheep laurel
Shreve's oak
Silk tassel tree
Southern magnolia
Southern red oak
Spicebush
Spike winter hazel
Spreading euonymus
Star magnolia
Strawberry tree
Striped bark maple
Sweet bay laurel
Sweet chestnut
Sweet Cicely
Sweet olive

Tanoak

Toyon
Viburnum
Victorian box
Vine maple
Western maidenhair fern
Western starflower
White fir
Winter's bark
Witch hazel
Wood rose
Yew

as of April 17, 2008

The big effects

- Tanoak
  - Redwood forest acorns
- True oaks
  - Slower to show symptoms
  - Slower to die
- Resistance
  - Not much in tanoak
  - Some in true oaks

Native Oak biology

- Lynchpin species for our forests
  - Lots of potential pests & pathogens means …
  - Lots of predators or control agents
  - Oaks actively manage pest populations
  - A few pests have the potential to go out of control

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
  - white oak
- All native trees are oval or lobe leafed and deciduous
- Evergreen scrub oaks
- All acorn cups knobbed
- All immune to SOD

Red (black) oaks

(Section Lobatae)

- *Quercus agrifolia*
  - Coast live oak
- *Quercus kelloggii*
  - Black oak
- *Quercus wislizeni*
  - Interior live oak
- *Quercus parvula*
  - Shreve oak
- Hybrids
- All native trees are either evergreen or have pointed lobes
- All acorn cups scaled
- All may get SOD
  - Some resistant

Preventative treatment

- Phosphonate (AgriFos)
  - Injectible
    - Higher dosage
    - Wounds tree
    - Slow application
  - Surface application
    - Lower dosage
    - Simple application
    - Moss burn
      - Understory leaf burn
  - Specimen trees
  - Absorbed by the tree, taken up into the leaves, and returned to entire plant
  - Inhibits fungal growth and activates the plant's own natural defensive response

Application timing

- Changes over time as we learn more
- Currently:
  - Spring and fall
  - First two
    - 6 months apart
  - All subsequent
    - 12 months apart

Application timing

- Flexibility
- Variables:
  - Application technique
  - Tree size (age)
  - Inherent resistance

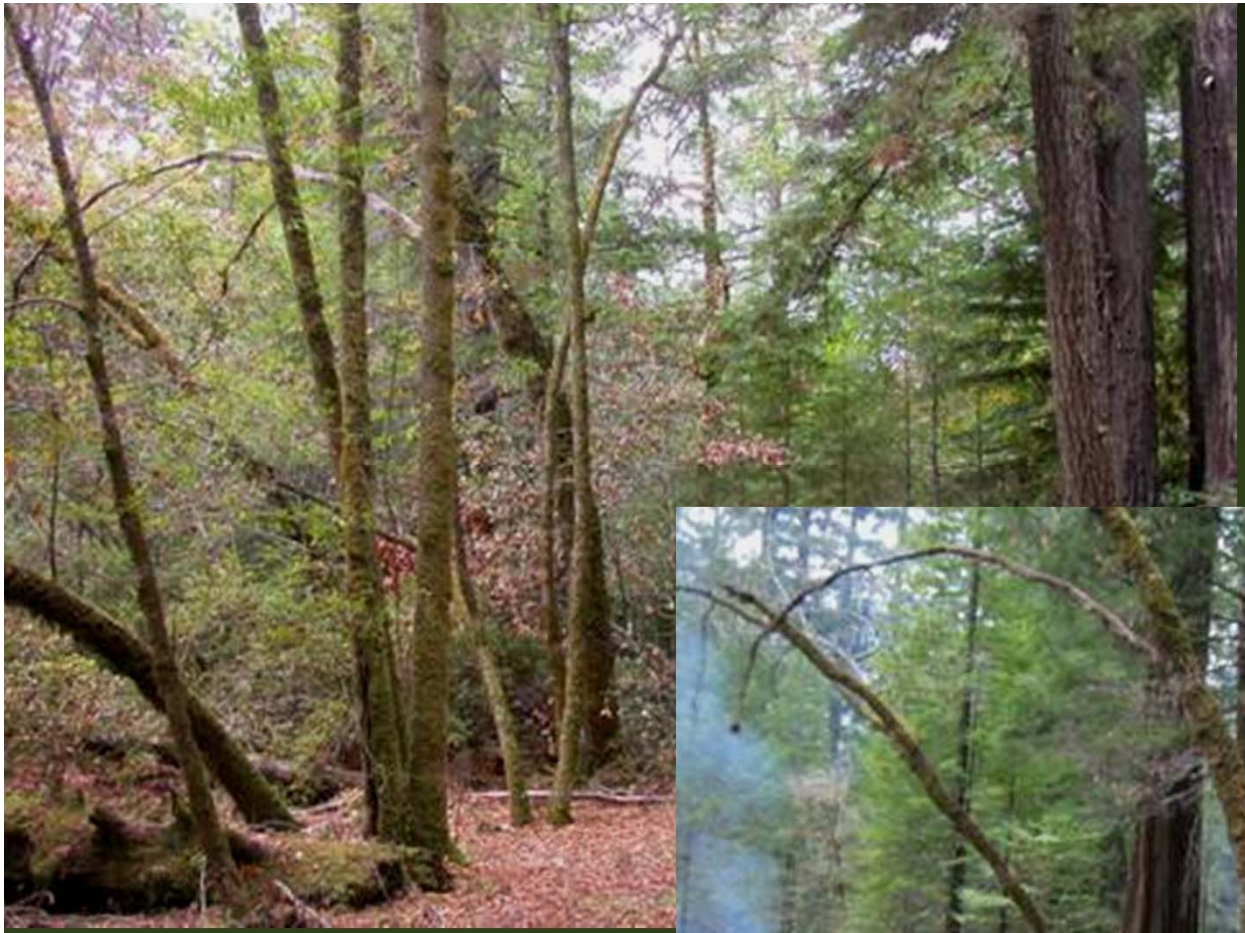
Phosphonate limits

- Helps bolster tree's natural defenses
  - Weak tree = weak effect
- Better as prophylactic
  - Not great curative
  - Treat ahead of time
- Useless on infected tanoaks
  - Cryptic infection

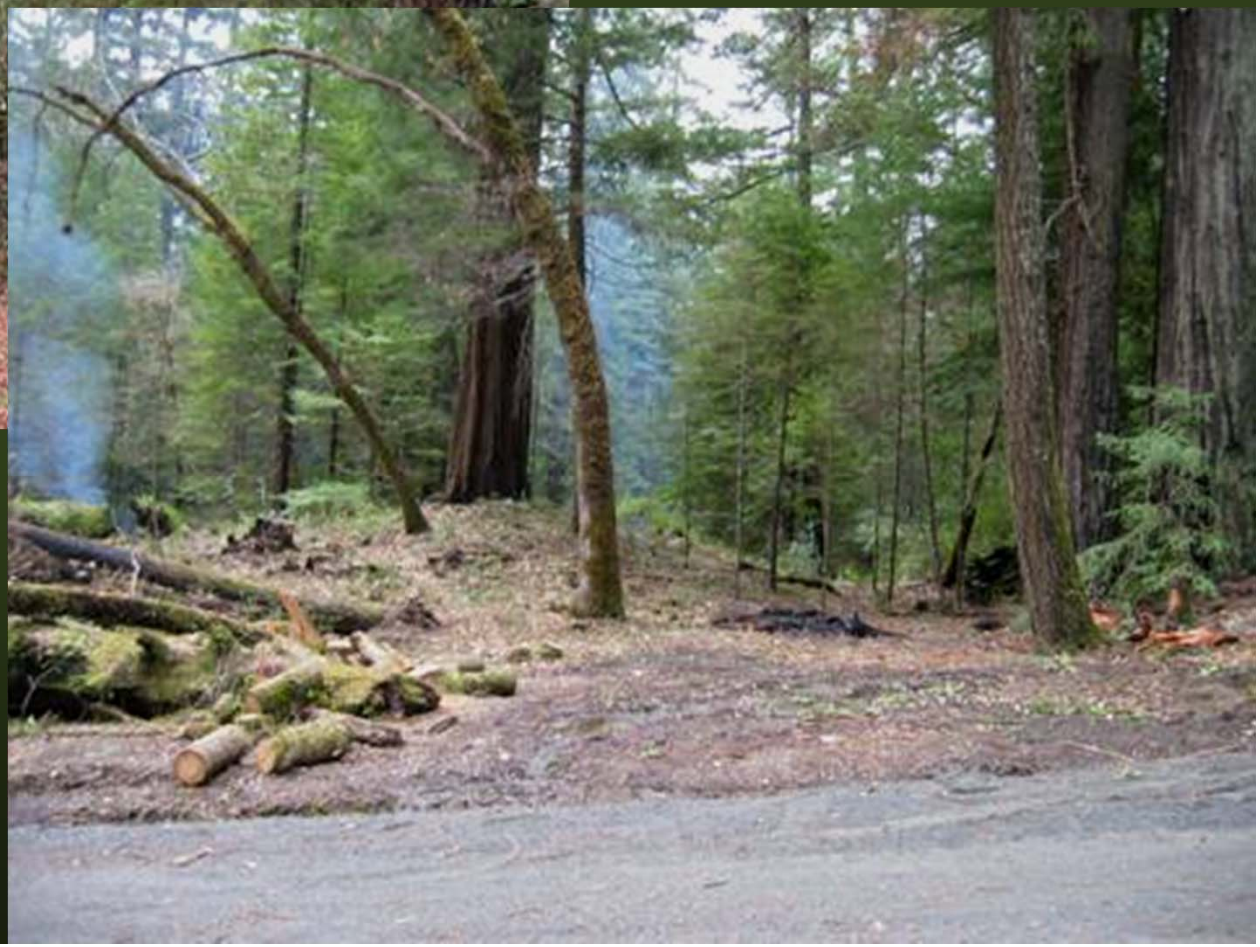
Some oaks already resistant

- Continual re-infection from nearby bay laurels means they eventually succumb
- Removal of bays may help these oaks survive

Bay laurel thinning / removal



Before



After

“Alternative” treatments

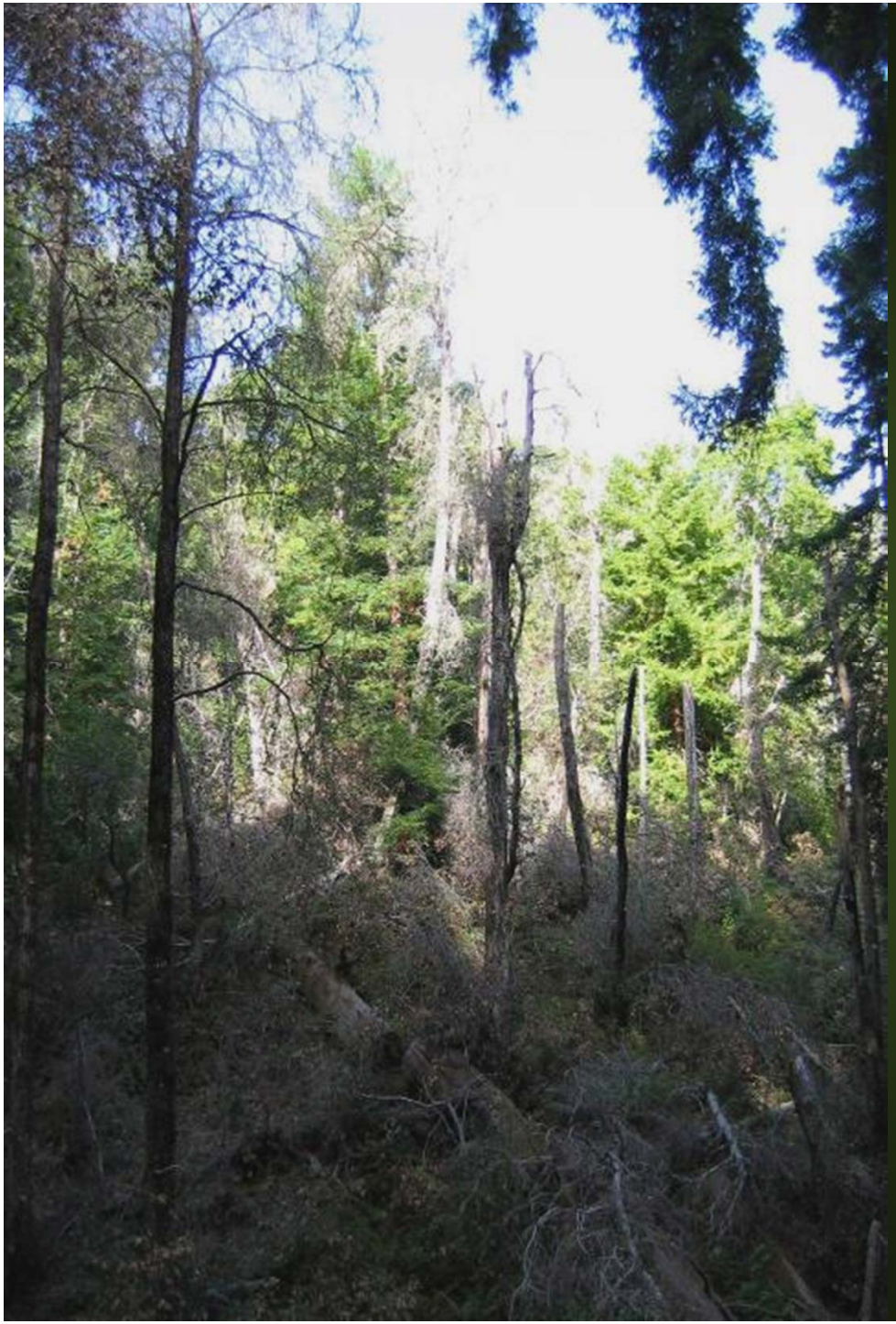
- Forest decline claim
- Soil acidification claim
  - Acid rain
  - Mosses and lichens
- No scientific data
- Probably won’t hurt anything
  - Soil test?

Bark scribing

- Potential “new” technique being evaluated
- Early trials show some promise
- Cankers may need to be small

Presidio find

- No bays anywhere close
- Toyons quite close
- Genetic fingerprint matches nursery type, not wild type
  - Neighbor across street had infected landscape plants in 05 & 06
  - Rain years!
- Suggests “bay” focus might be a little myopic



What if they're already dying?

- Evaluation
  - Hazard
  - Fire
- Removal plan
  - Not always necessary
- Reforestation
  - Right tree, right place

Hazard trees

- No target? No hazard
- Hazard warnings:
  - *Annulohypoxylon*
    - Sapwood decay
  - Ambrosia beetle
    - Gallery builder
      - Tan frass in cracks
    - *Ambrosiella* fungus
  - Native organisms
    - Failure when still green

Disposal

- Quarantine
  - Don’t move infected material out of county
- Best left on site
  - Wrap cut wood in clear plastic?
  - Lop brush to ground
- Composting at commercial facilities
- County landfill

Contagion

- Chippers
  - Cannot be effectively cleaned
  - Not much need
  - Run “clean wood” through before leaving site
- Chippers & Trucks
  - Clean tires of mud
    - Before going to un-infested areas

Photo: TreeCrews, Atlanta GA

Contagion

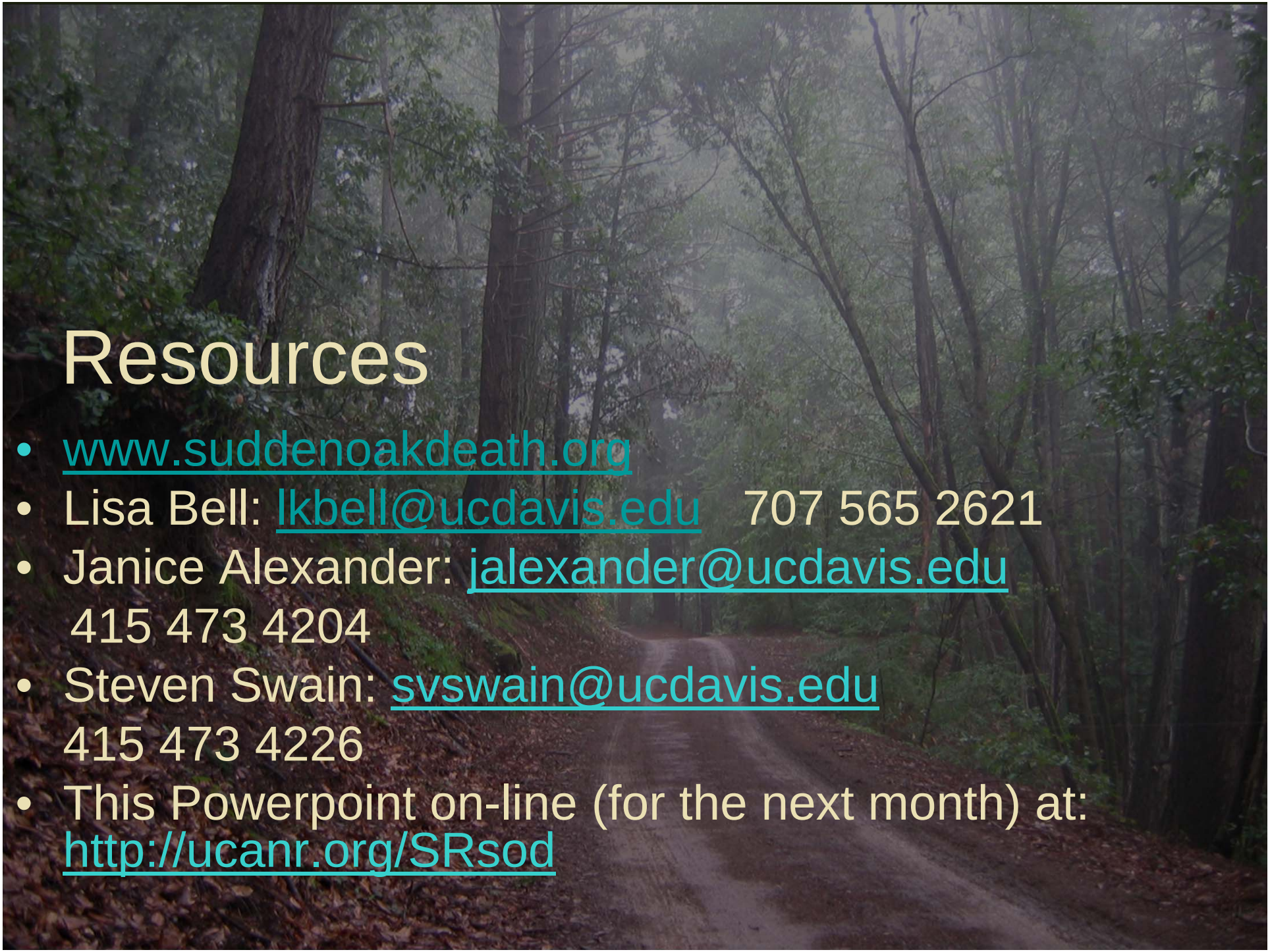
- Chips
  - Low contagion risk
  - Composting kills
  - Quarantine
  - Best not by road
- Wood
  - Low contagion risk
  - Local firewood
    - Keep dry
    - Quarantine
  - Best not by road

Contagion

- Leaves and brush
  - High contagion risk
    - Foliar pathogen
    - Quarantine
  - Lop on site or
  - Chip and compost
- Chain saws & hand tools
  - Disinfect?

Oak Mortality

- Follows wet springs
  - 1 to 3 year symptom lag
  - Spotty distribution
- Spread of SOD
  - Associated with foliar hosts
  - Oaks don’t spread disease
- Oaks
  - Red oaks susceptible
  - White oaks immune
- Hazard trees
  - Beetles or Annulohypoxylon
- Contagion
  - Chip and leave on site
  - Local firewood
  - Clean tires



Resources

- www.suddenoakdeath.org
- Lisa Bell: lkbell@ucdavis.edu 707 565 2621
- Janice Alexander: jalexander@ucdavis.edu 415 473 4204
- Steven Swain: svswain@ucdavis.edu 415 473 4226
- This Powerpoint on-line (for the next month) at: http://ucanr.org/SRsod