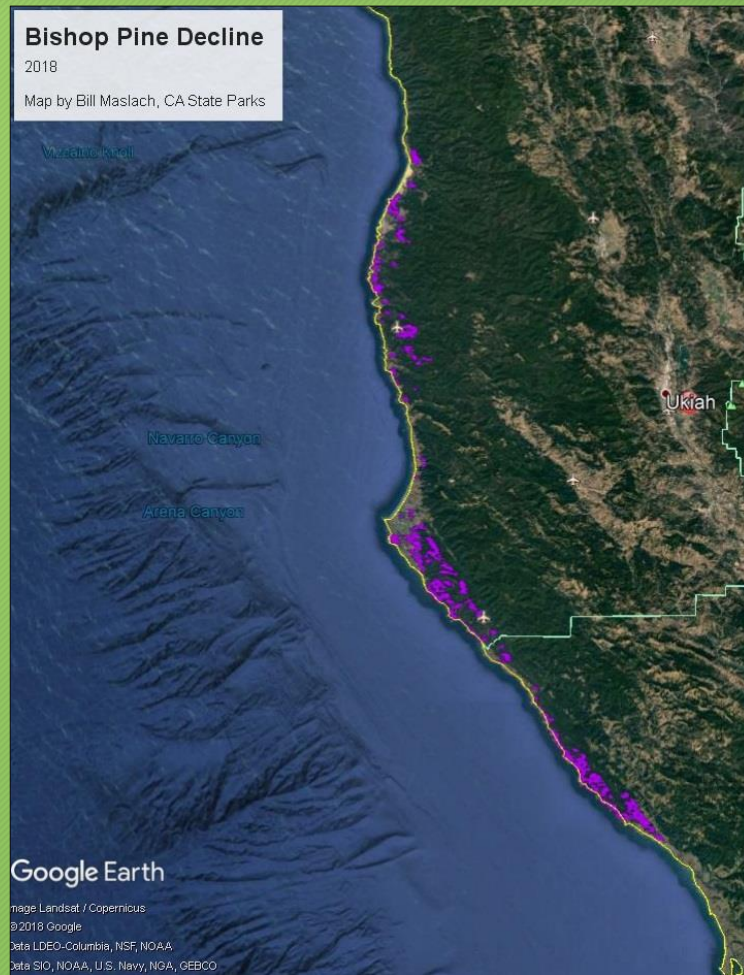


Ongoing Studies of North Coast Bishop Pine Decline

Chris Lee, Steve Voelker, Pete Angwin, Rose-Marie Muzika, Susan Marshall, Greg Giusti, Teresa Sholars, Lynn Webb, and Brendan O'Neil

Bishop pine die-off: ca. 2000-present



Map: Bill
Maslach, CA
State Parks



Plan for the Current Study

- Catalog pests found on bishop pine in the study area
- Core trees to understand establishment dates and growth patterns
- Look at soils for oomycete pests and to relate physical characteristics to tree decline
- Document the decline
- Continue the cycle into the future

Methods

- Establish sites from north to south, including:
 - Pure bishop pine stands
 - Bishop pine mixed with other tree species
 - Pygmy/oligotrophic-soils bishop pine stands
- 0.1-ha plots
- Each tree:
 - Diameter
 - Pest inventory
 - Gall rust and mistletoe ratings
 - Crown density
 - % branch dieback in crown



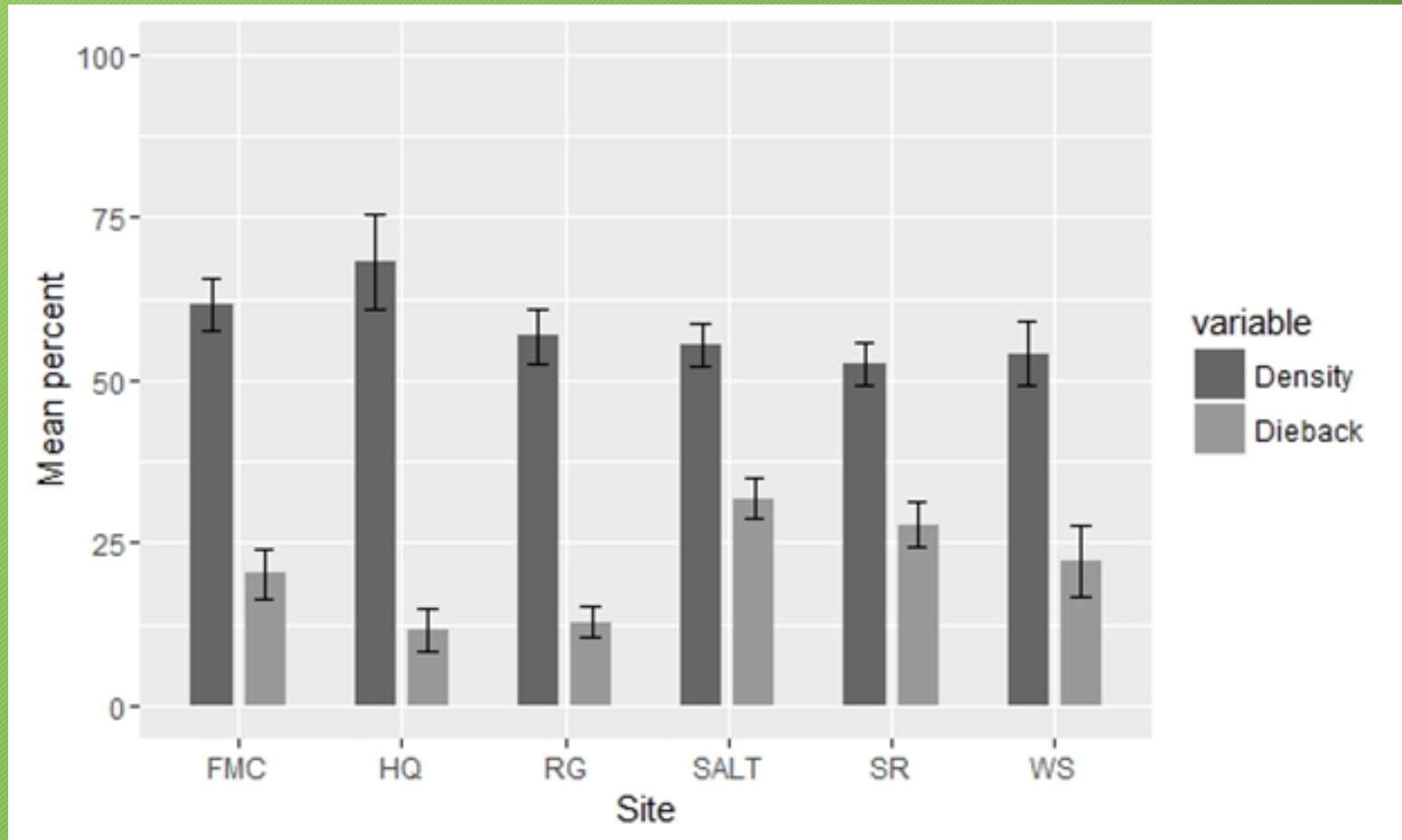
Methods

- Selected trees:
 - Tree height
 - Core
- Each plot:
 - Soil sampling in fall/winter and spring/summer, followed by baiting for *Phytophthora* spp.
- Each site:
 - 100-cm soil pits to record selected soil physical characteristics (e.g., color of horizons, texture, fine root presence, structure, etc.) and chemical characteristics (e.g., pH)

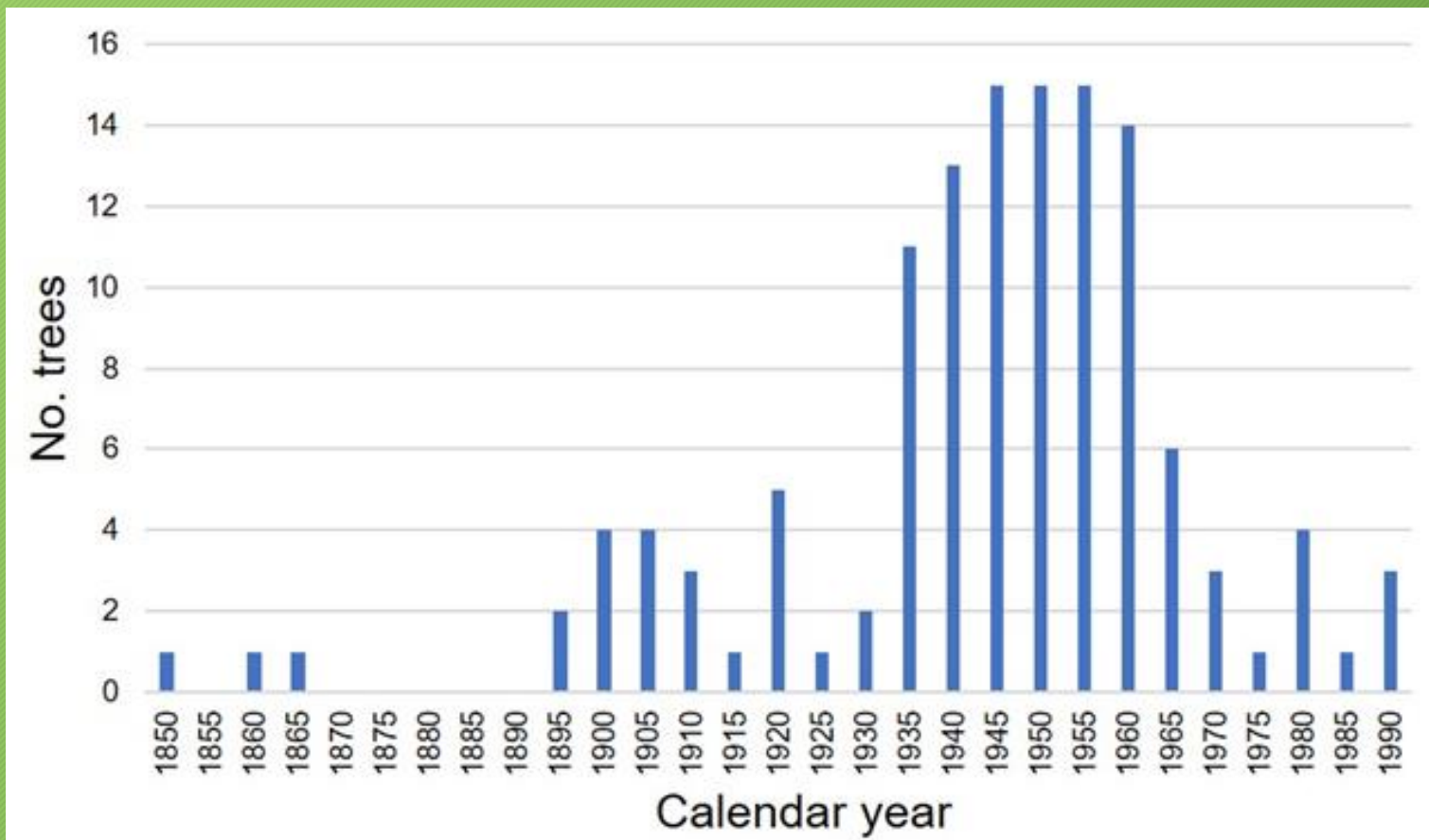
Results: Tree statistics

- Mean diameter per plot
 - All trees: 19.7-56.7 cm (7.8-22.3 in)
 - Pines: 21.8-76.6 cm (8.6-30.2 in)
- Mean density per plot
 - All trees: 210-890 stems/ha (85-360 stems/ac)
 - Pines: 120-510 stems/ha (49-207 stems/ac)
- Basal area per plot
 - All trees: 8-113 m²/ha (35-492 ft²/ac)
 - Pines: 5-90 m²/ha (22-392 ft²/ac)

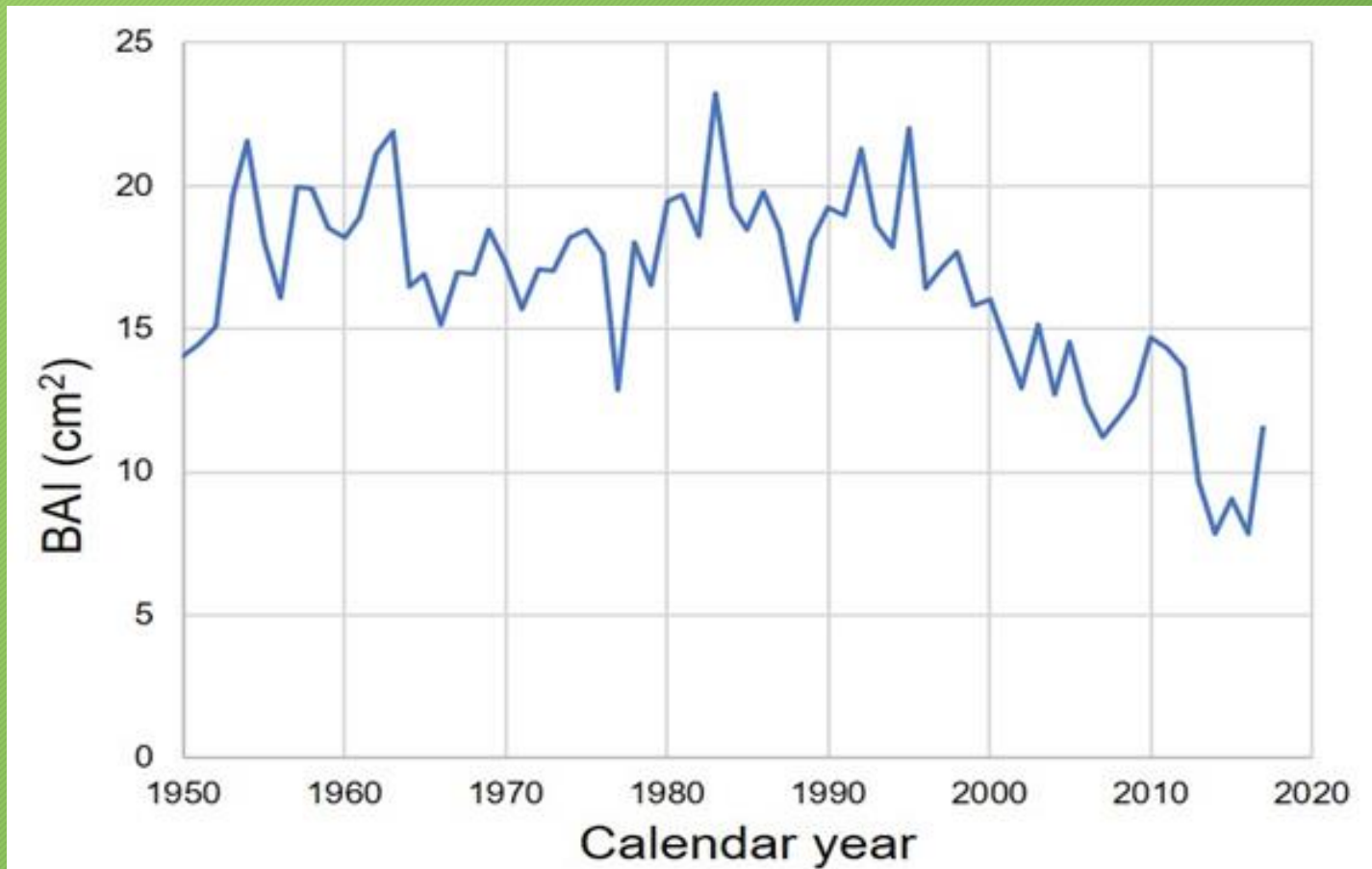
Results: Crown condition



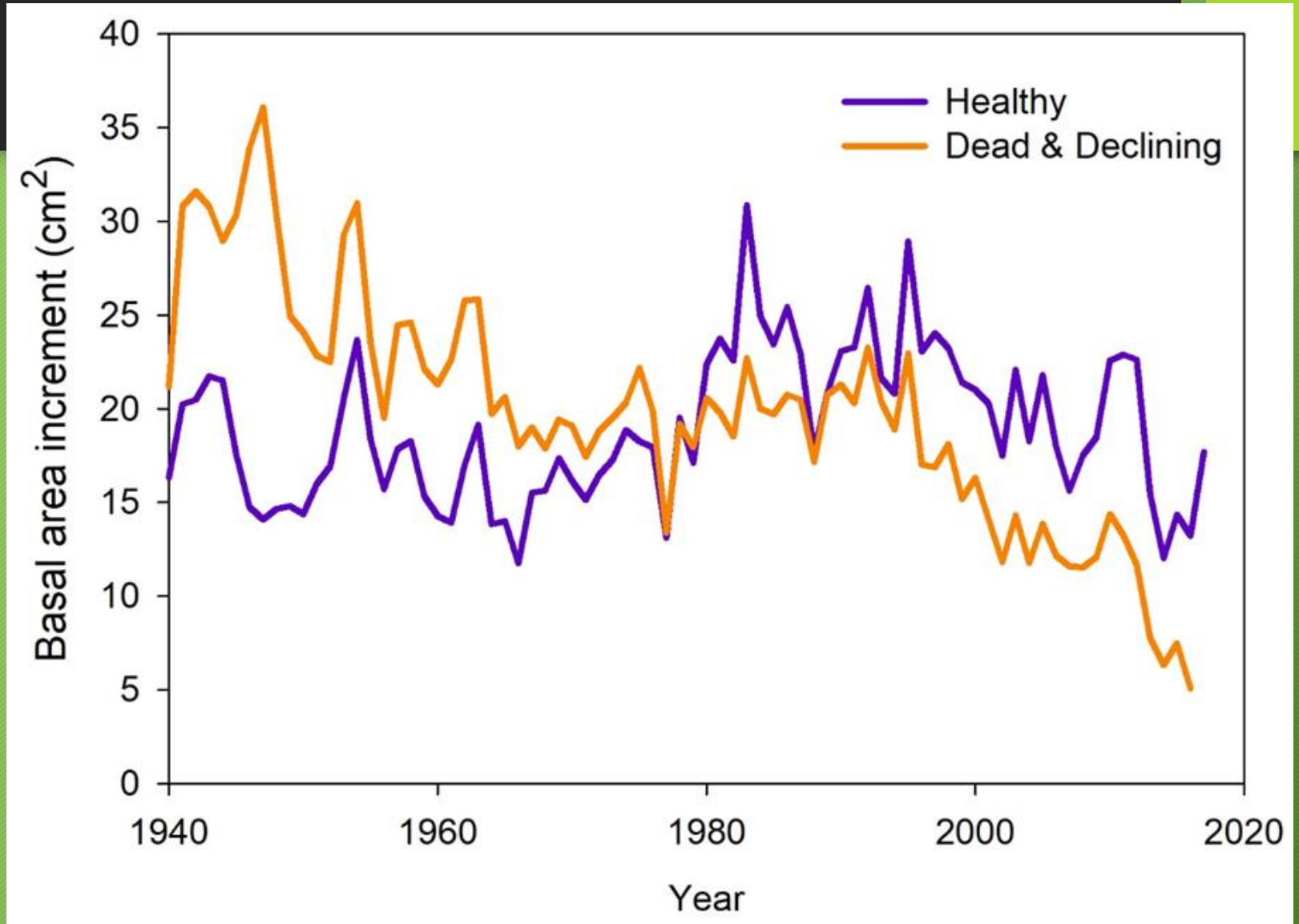
Results: Tree establishment



Results: Tree growth



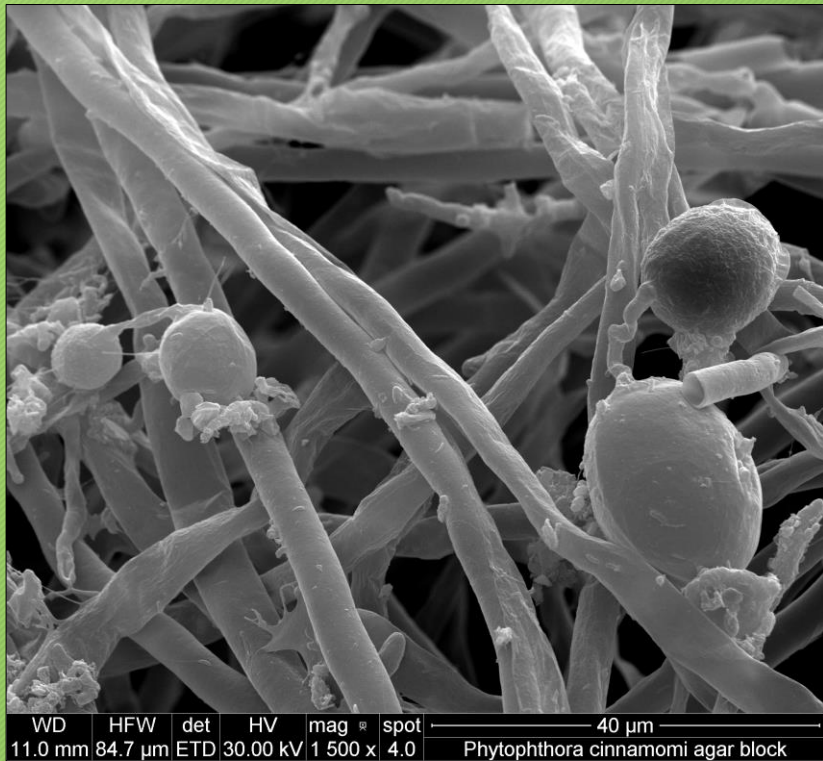
Tree growth



Results: Pests

Pest scientific name	Common name / disease caused	Plant part affected
<i>Armillaria</i> sp.	Armillaria root disease	Large (structural) roots
<i>Phaeolus schweinitzii</i>	Schweinitzii root disease	Large (structural) roots
<i>Onnia</i> sp.	Tomentosus root disease	Large (structural) roots
<i>Phytophthora cinnamomi</i>	Phytophthora dieback	Fine roots
<i>Phytophthora cambivora</i>	Phytophthora dieback	Fine roots and root crown
<i>Elongisporangium</i> (= <i>Pythium</i>) <i>undulatum</i>	Pythium root rot	Fine roots
<i>Pythium dissotocum</i>	Pythium root rot	Fine roots
<i>Rhizoctonia</i> sp.	Rhizoctonia root rot	Fine roots
<i>Fusarium circinatum</i>	Pine pitch canker	Branches and stem
<i>Phomopsis/Diaporthe</i> sp.	Phomopsis canker	Branches and stem
<i>Diplodia scrobiculata</i>	Diplodia blight	Branches and stem
<i>Arceuthobium littorum</i>	Coastal dwarf mistletoe	Branches and stem
<i>Porodaedalia</i> (= <i>Phellinus</i>) <i>pini</i>	White pocket/heart rot	Stem
<i>Endocronartium harknessii</i>	Western gall rust	Branches and stem
<i>Dendroctonus valens</i>	Red turpentine beetle	Lower stem
<i>Ips plastographus</i>	Coastal pine engraver	Stem
<i>Pseudips mexicanus</i>	Monterey pine Ips	Stem
<i>Hylastes</i> sp.	bark beetle	Stem
<i>Hylurgops porosus</i>	bark beetle	Stem

Rogues' gallery



Phytophthora cinnamomi (photo:
Chris Tominello-Ramirez)



Porodaedalia
(=*Phellinus*) *pini*



Western gall rust

More rogues

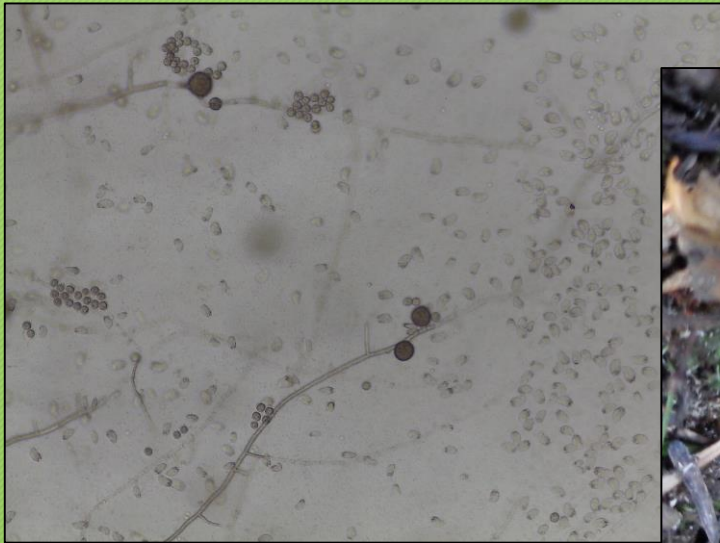


Dwarf mistletoe



Bark beetles

. . . And more



Elongisporangium
(=Pythium) *undulatum*



Armillaria sp.

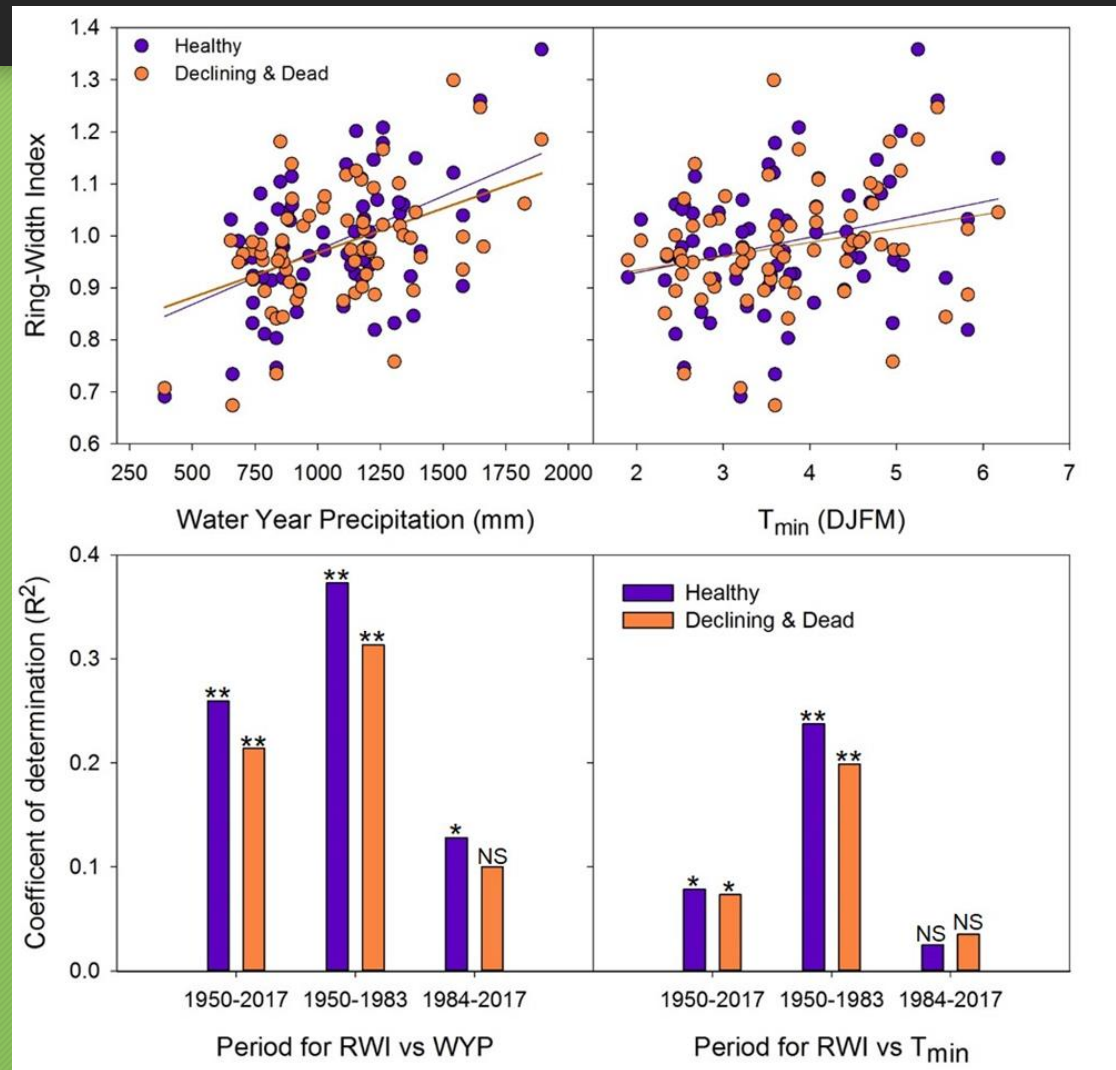


Phaeolus schweinitzii

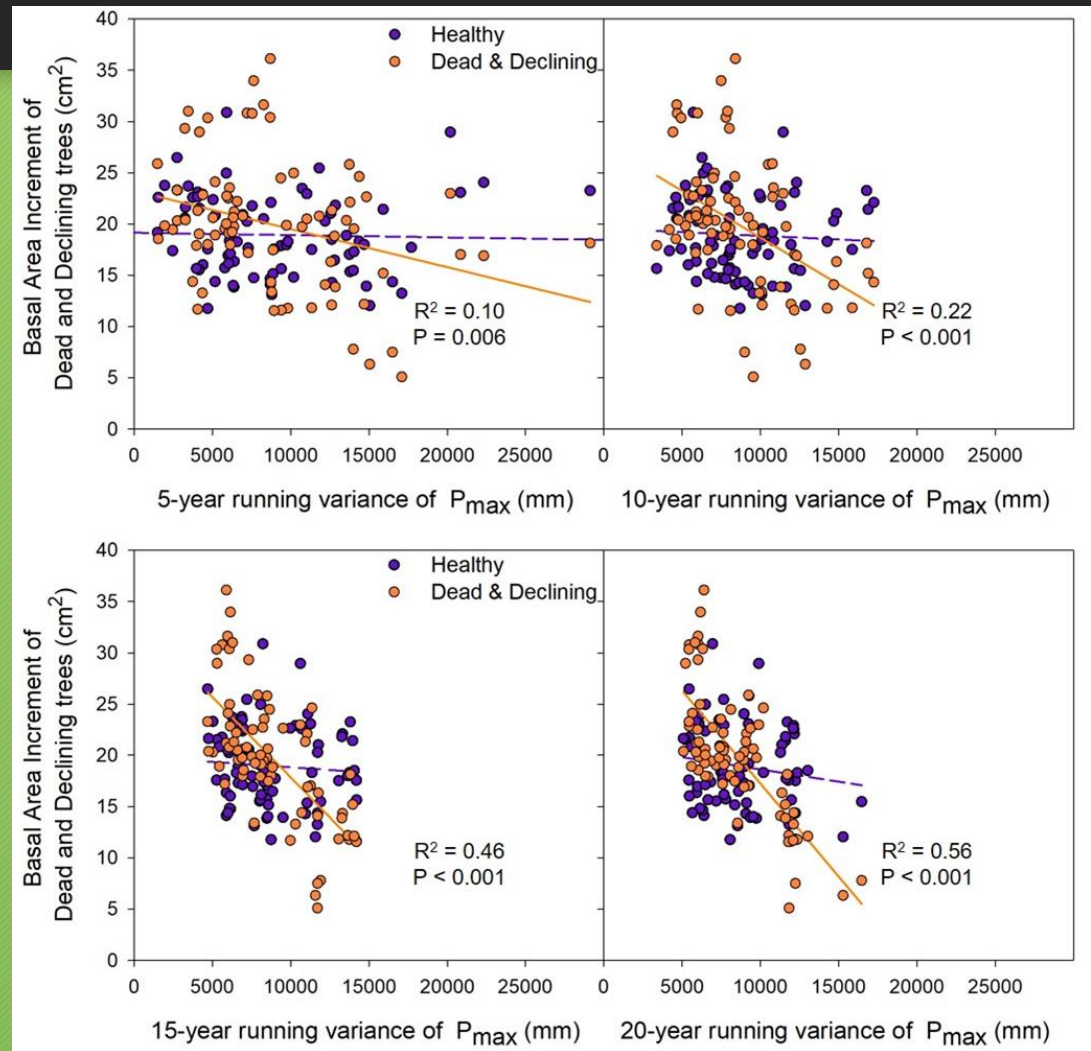
Soils

Site	Sand%	Silt%	Clay%	pH	Classification
McKerricher	74-88%	6-17%	6-9%	5.6-5.8	Inceptisol
Virgin Creek	88-89%	6-7%	4-6%	5.6-5.8	Entisol
State Parks HQ	48-61%	29-36%	10-15%	5.4-5.6	Entisol
Russian Gulch	45-49%	33-36%	18-19%	5.2-5.8	Alfisol
Woodlands	35-55%	14-24%	21-47%	4.2-5.0	Ultisol
Sea Ranch	40-72%	20-33%	8-28%	5.4-5.8	Ultisol
Fisk Mill Cove	40-56%	19-24%	20-41%	5.6	Ultisol
Salt Pt Pygmy	61-71%	10-30%	1-19%	4.4-4.8	Ultisol

Sensitivity to Temperature and Precipitation



Variance in Monthly Precipitation



Thank you

- USDA Forest Service, Forest Health Monitoring, Evaluation Monitoring
- Suzanne Rooney Latham and California Department of Food & Agriculture
- USDA Forest Service, Forest Health Protection
- California Department of Forestry & Fire Protection and Jackson Demonstration State Forest
- California State Parks (Renee Pasquinelli, Bill Maslach, Terra Fuller)
- The Sea Ranch Association