University of California
Agriculture and Natural Resources

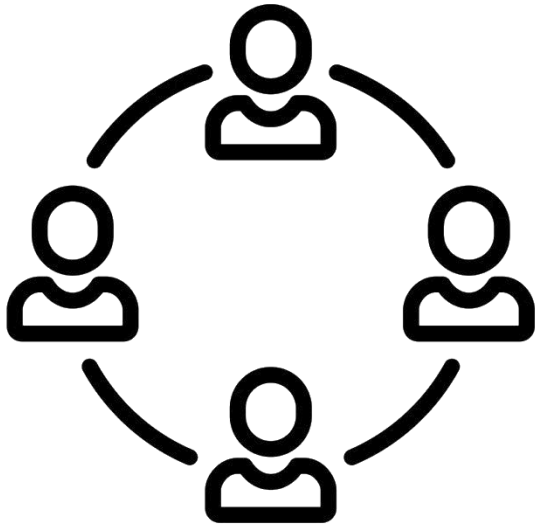
Berkeley
UNIVERSITY OF CALIFORNIA

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
CAL FIRE
SINCE 1885

Tree Mortality Data Collection Network

2021 Workshop

March 10-11th



Welcome!

Housekeeping Items (1/3)

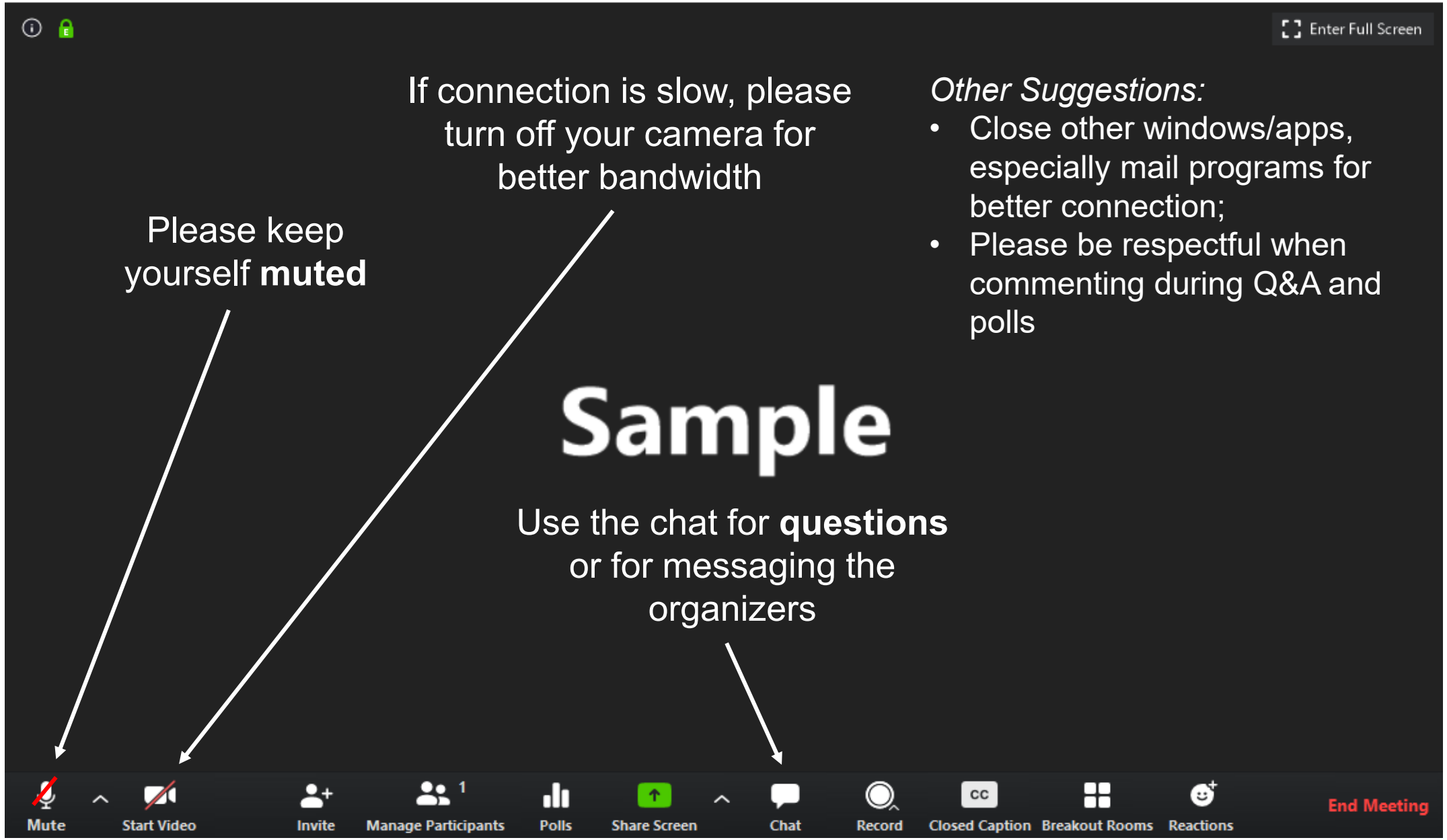
- The meeting is being recorded, and some individual presentations will be available shortly after the meeting in our project's website;

- UC ANR Program Support is assisting with many of the Zoom logistics for the meeting so if you have any issues, please send a direct message through the chat to Kellie McFarland (Support) or email ANRProgramSupport@ucanr.edu

- All participants are muted by default. We request that questions be added to the chat we can keep track of all questions and comments.

- You will notice polls being launched at specific moments throughout each day of the meeting. We would appreciate if you all take a few seconds to answer these, and keep your "Menti" tab open on your browser.

Housekeeping Items (2/3)

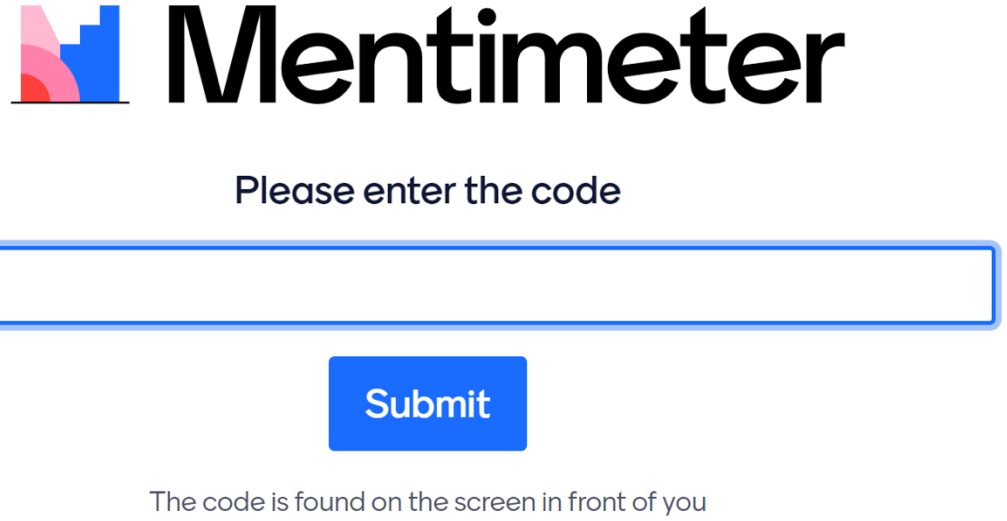


Other Suggestions:

- Close other windows/apps, especially mail programs for better connection;
- Please be respectful when commenting during Q&A and polls

Housekeeping Items (3/3)

Mentimeter polls during the workshop



- We will be putting poll question as link in the **chat** box of the zoom interface
- If the link doesn't work go to menti.com and use the meeting code (also provided in the chat)
- Keep menti tab **open** in your browser as we will ask multiple poll questions

Poll 1

Tree Mortality Data Collection Network

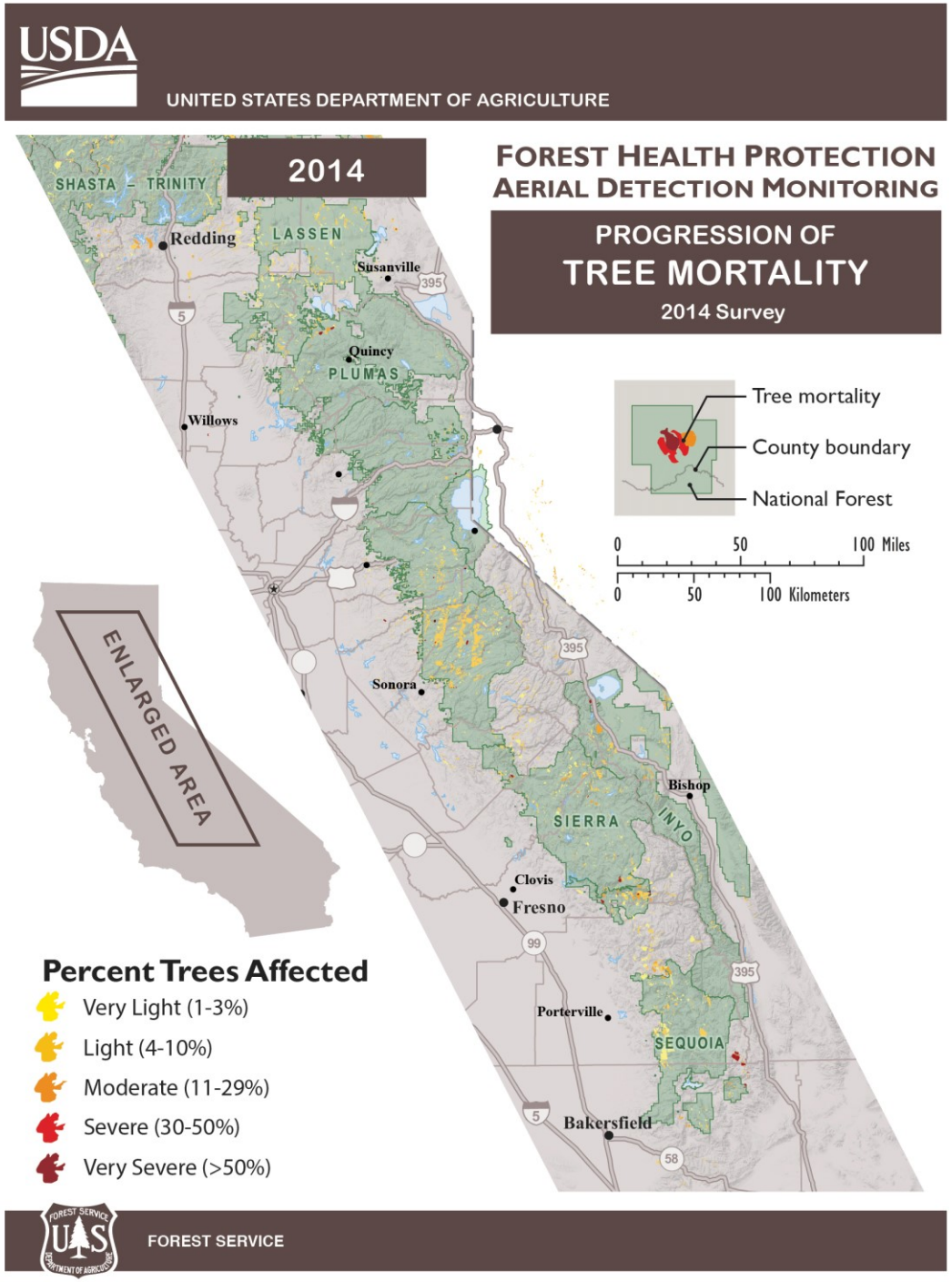
2021 Workshop

Meeting Goals and Structure

Dr. Jodi Axelson
Cooperative Extension Specialist – Forest Health
University of California, Berkeley

The California Tree Mortality Data Collection Network

- 2010-2019: ~ 163 million dead trees;
- 2017: **paradigm shift necessary**: translate our science into dialogue and action → *How?*
  - Annual workshops (2018, 2019, ~~2020~~, **2021**);
  - Put results quickly into the hands of forest decision makers and planners;
  - Continue sharing work with land managers and decision-makers to feed research findings into action for resilient future forests



The California Tree Mortality Data Collection Network

OUTLOOK

The California Tree Mortality Data Collection Network — Enhanced communication and collaboration among scientists and stakeholders

Critical research and dialogue are underway to understand the consequences of the massive wave of tree mortality in the Sierra Nevada.

Jodi Axelson, John Battles, Beverly Bulaon, Danny Cluck, Stella Cousins, Lauren Cox, Becky Estes, Chris Fettig, Andrea Hefty, Stacy Hishinuma, Sharon Hood, Susie Kocher, Devin McMahon, Leif Mortenson, Alexander Koltunov, Elliot Kuskulis, Adrian Poloni, Carlos Ramirez, Christina Restaino, Hugh Safford, Michèle Slaton, Sheri Smith, Carmen Tubbesing, Rebecca Wayman and Derek Young

Over 147 million dead trees were detected in California by the U.S. Forest Service Aerial Detection Survey (USFS ADS) from 2010 to 2018 (USDA 2019). The massive tree mortality, mostly in the Sierra Nevada and evident in swaths of conifers with red needles, resulted from the 2012–2016 drought and subsequent explosions in native bark beetle populations. While levels of mortality have declined in the last 2 years, the consequences will last for decades to come. Trees that died will fall over and surface fuel loads will increase — already the accumulation of millions of tons of dead material on forest floors is vastly outpacing the resources of local, state and federal jurisdictions to remove it. Urgent dialogue has started among UC scientists, forest managers, and public agencies to manage the consequences of the unprecedented tree die-off and increase the resiliency of forests to future droughts.

To accomplish these goals, we need data on the rates of ongoing tree mortality and dead tree fall, surface fuel build-up, wildfire hazard, forest renewal patterns, and the course of bark beetle outbreaks. Data are also needed to understand the long-term impacts of the wave of tree mortality on ecological services such as carbon storage and water quality.

In 2017, we set up the Tree Mortality Data Collection Network, led by academics at UC Berkeley and UC Agriculture and Natural Resources, to bring together scientists and agencies who are conducting field and remote-sensing studies across the Sierra Nevada. Then, rather than waiting for the results to be published in academic journals, we decided a paradigm shift was necessary — we would translate our science into dialogue by hosting in-person events and putting the results quickly into the hands of forest decision-makers and planners, and counties needing grants to remove accumulating surface fuels.

The dialogue began in March 2018 at the first Tree Mortality Data Collection Network workshop held at the USFS Wildland Fire Training Center in McClellan Park, Sacramento, and continued at a second workshop there in March 2019. Along with other researchers, we presented newly collected data to state and federal agencies, local governments, nongovernmental organizations, landowners and community representatives (see next pages).

Online: https://doi.org/10.3733/ca.2019a0001
Published online March 11, 2019

Dead needles on tree in the Sierra National Forest.

U.S. Forest Service Region 5 thinning study

Becky Estes, Derek Young and Christina Restaino

Effects of thinning on tree mortality along a latitudinal gradient in forests on National Forest, National Park and Bureau of Land Management lands.

- Thinning effectiveness decreased along the latitudinal gradient to the southern Sierra, where water stress was so high that stand density was less important (fig. 2A).
- Thinning substantially reduced mortality in central Sierra.
- In 2017, even in thinned, high-mortality plots, the density of surviving canopy trees (> 3-inch diameter) was 18 per acre; regeneration (< 3-inch diameter) was 76 per acre, suggesting that most stands will recover reasonable densities naturally.
- Drought mortality (concentrated in pines) has led to species shift. Among surviving canopy trees and regeneration, there was an unnaturally high relative abundance of shade-tolerant conifer species; pre-drought thinning reduced this effect (fig. 2B).

Researchers will document changes in stand resilience by evaluating residual structure and composition.

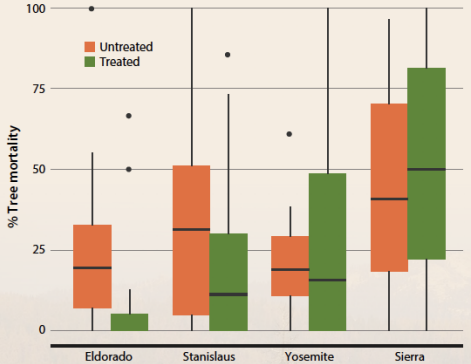


FIG. 2A. The effectiveness of thinning treatments decreased from the central to southern Sierra Nevada (Restaino et al., in press).

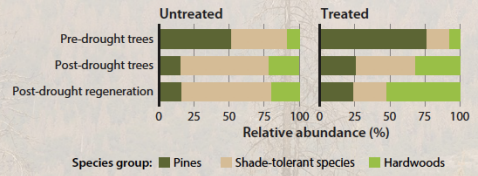


FIG. 2B. Drought has increased the dominance of shade-tolerant species, especially in unthinned stands. Thinned stands include more pines and hardwoods (Young et al., in review).

U.S. Forest Service Pacific Southwest Research Station mortality study

Chris Fettig, Leif Mortenson and Beverly Bulaon

Study in high-mortality areas, at three elevational bands, in the Eldorado, Stanislaus and Sequoia National Forests.

- Mortality most severe in 2016 (fig. 3) and concentrated in larger-diameter conifer trees — in 3 years only one oak (*Quercus*) died.
- Between 2014 and 2017, 48.9% of trees died (fig. 3), and there were higher levels of mortality at low elevations (60.4%) than at high elevations (46.1%).
- Mortality mostly attributed to western pine beetle (*Dendroctonus brevicomis*; WPB).
- Ponderosa pine (*Pinus ponderosa*), the only host of WPB in the area, suffered highest levels of tree mortality, from 18.2% to 100% per plot.
- 39% of plots lost all ponderosa pine.
- Sugar pine (*Pinus lambertiana*) experienced 48% mortality, concentrated in mid-diameter trees, most due to mountain pine beetle (*Dendroctonus ponderosae*).
- White fir mortality at 26%, most due to fir engraver.
- Mortality positively correlated with tree density (Fettig et al. 2019).

As funding allows, researchers will remeasure plots on a regular basis.

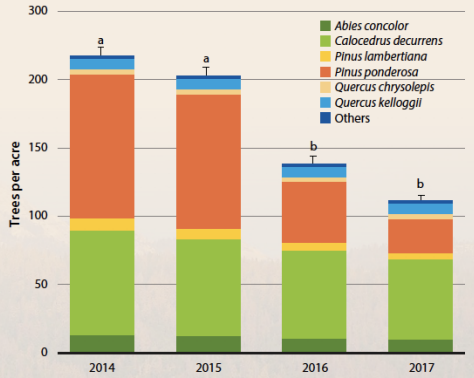


FIG. 3. Mean number of trees per acre by species (+ standard error of the mean, SEM), 2014–2017. Ponderosa pine (*Pinus ponderosa*) has suffered the highest levels of mortality. Means (+ SEM) followed by the same letter are not significantly different ($P > 0.05$). Adapted from Fettig et al. (2019).

What now?

USDA United States Department of Agriculture

2019 HIGHLIGHTS OF TREE MORTALITY FROM INSECTS AND DISEASES AS SEEN BY AERIAL SURVEY

Approximately 41 million acres surveyed

PACIFIC SOUTHWEST REGION

15.1 MILLION DEAD TREES

2.2 MILLION ACRES WITH MORTALITY

PINE
WESTERN, MOUNTAIN, and JEFFREY PINE BEETLES

- Native insects which attack several pine species
- During the protracted drought of 2012-2016, these beetles **reached outbreak levels**, killing millions of trees in the Southern Sierra Nevada range; pine mortality has decreased but remains greatly elevated (~2x background levels)
- ★ Partnering with CALFIRE in state task forces to address forest health and resilience and to remove biomass from affected areas
- ★ R5 developing strategy for whitebark pine

CALIFORNIA OAKS
GOLDSPOTTED OAK BORER

- Invasive insect which attacks several western oak species
- First identified in San Diego County in 2008; **now present in 4 additional counties**
- 2019 mortality from aerial survey fairly consistent over last 4 years
- ★ Monitoring and treating high value individual trees

'ŌHI'A
RAPID 'ŌHI'A DEATH

- A **devastating tree killer** caused by a vascular wilt fungus
- Spread throughout the Big Island of Hawaii and now found to a much lesser extent on Kauai, Oahu, and Maui
- ★ Utilizing a new survey technology to map the extent of rapid 'ohi'a death

CALIFORNIA FIRS
FIR ENGRAVER

- Significantly impacting California red fir and white fir
- Fir engraver-caused mortality **made up 82%** of detected mortality in California in 2019
- ★ Providing support for pest suppression, hazard tree removal, and surveying

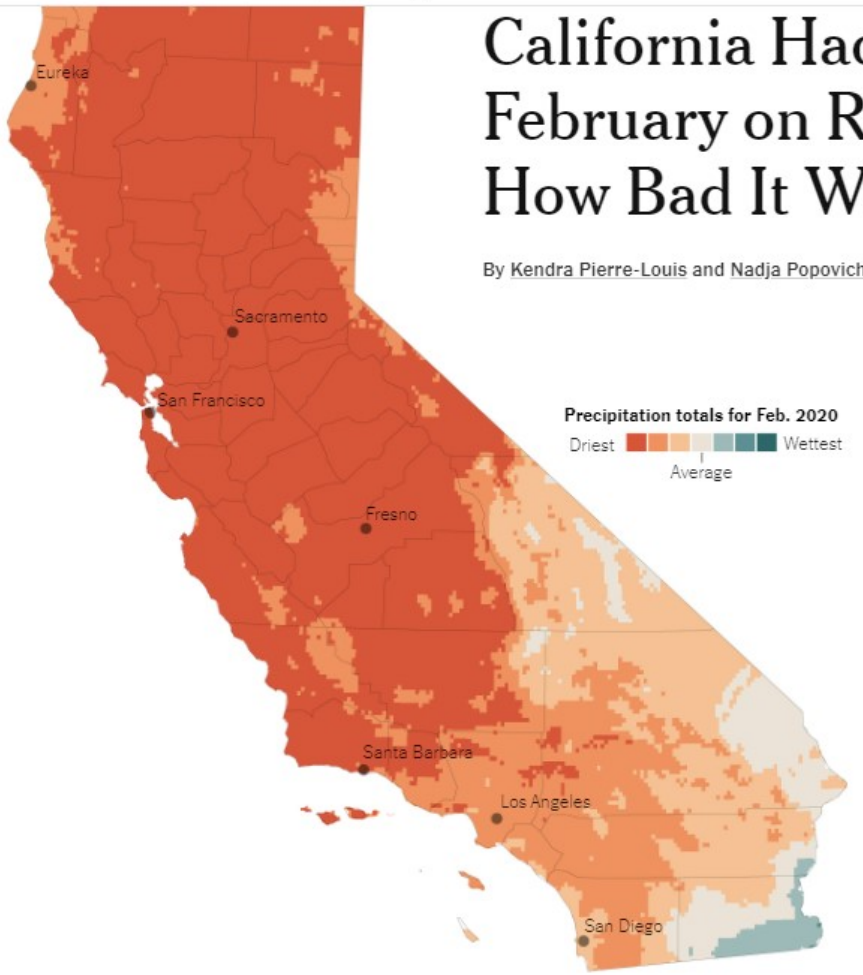
CALIFORNIA OAKS
SUDDEN OAK DEATH

- Tree disease which kills several oak species and tanoak
- **Significant effects** in coastal forests in California and Oregon
- SOD mortality in 2018 and 2019 have been 3-6x higher than between 2012-2017
- ★ Supporting partner efforts for survey and management

The New York Times

California Had Its Driest February on Record. Here's How Bad It Was.

By Kendra Pierre-Louis and Nadja Popovich March 3, 2020

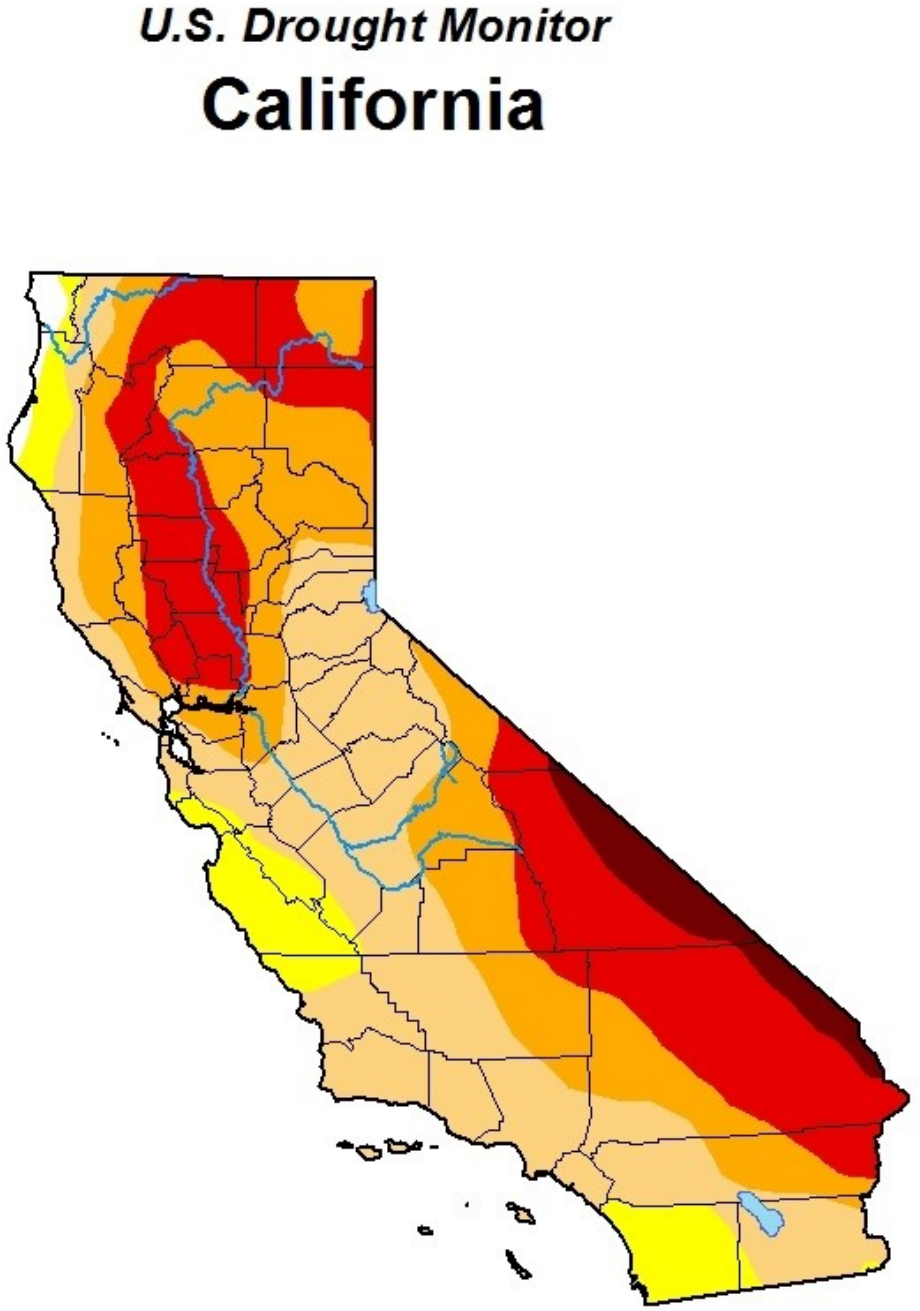


https://www.nytimes.com/interactive/2020/03/03/climate/dry-california.html?smid=nytcore-ios-share

March 4th, 2020

What now?

Berkeley Forests - Blodgett Research Forest
© Emilio Vilanova



HOW?

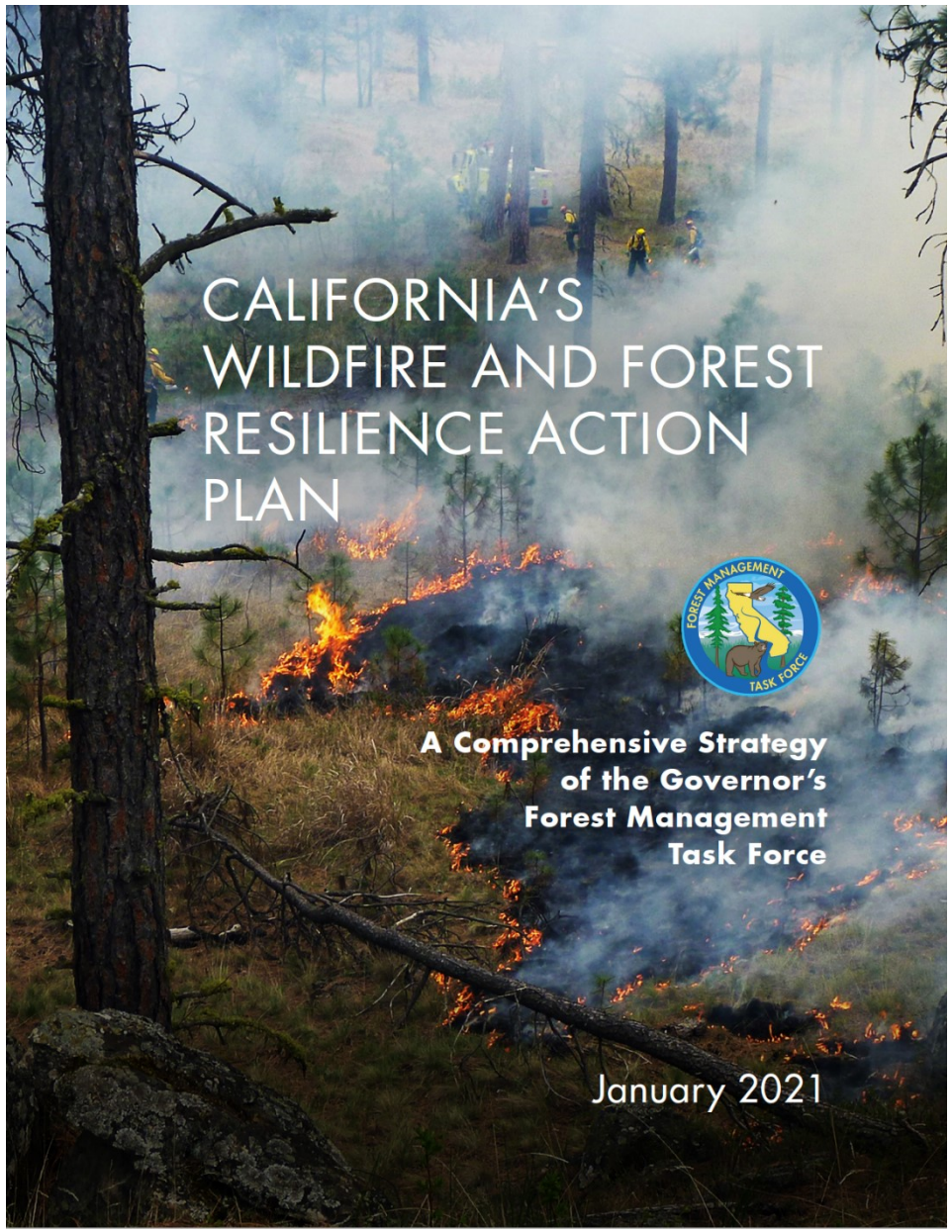
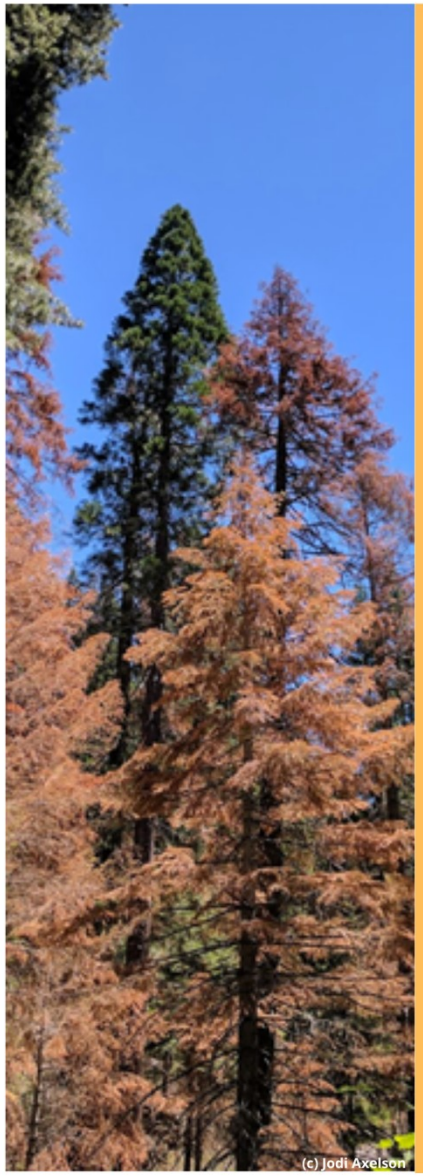


Figure: the Pillars of Resilience

Source: Tahoe Conservancy

California's Wildfire and Forest Resilience Action Plan

University of California
Agriculture and Natural Resources



THE CALIFORNIA TREE MORTALITY DATA COLLECTION NETWORK

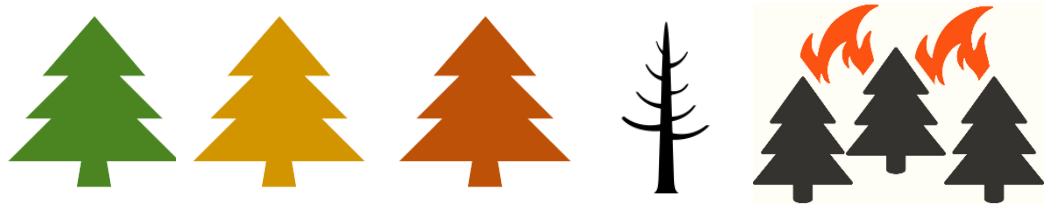
2021 WORKSHOP

MARCH 10-11, 2021
9 AM – 12:30 PM (BOTH DAYS)
ONLINE MEETING VIA ZOOM

More info in our website

Goals:

- Share latest results of field-based research programs (e.g., tree mortality, tree fall rates, regeneration patterns) and management efforts post-tree mortality
- Discuss frameworks for incorporating data into forest management planning and policy



Fuels and wildfires: fuel structure, dynamics, management

Reforestation: genetics, adaptation, challenges

DAY 1 - MARCH 10: FUELS AND WILDFIRES

8:30-9:00 EARLY ACCESS TO THE MEETING

9:00-9:15 WELCOME, MEETING GOALS AND GENERAL STRUCTURE — Poll 1

Emilio Vilanova / Jodi Axelson UC Berkeley

9:15-9:45 PLENARY TALK: *LISTENING TO THE TREES: WHAT GLOBAL TREE MORTALITY OBSERVATIONS TELL US ABOUT THE FATES OF EARTH'S HISTORICAL FORESTS UNDER FURTHER HOTTER-DROUGHT*

Craig Allen - USGS New Mexico / William Hammond - Oklahoma State University

9:45-10:00 Q & A

10:00-10:05 BREAK

10:05-10:20 CHARACTERIZING SURFACE FUELS ACROSS SIERRA NEVADA MIXED-CONIFER FORESTS

Emilio Vilanova - UC Berkeley

10:20-10:35 BARK BEETLE-KILLED PONDEROSA PINE SNAG DEMOGRAPHY: INITIAL CHANGES IN FUEL LOADS

Leif Mortenson - US Forest Service

10:35-10:40 Q & A — Poll 2

10:40-11:05 TRACKING TREE MORTALITY AND FIRE RISK TO GIANT SEQUOIAS AND THEIR ECOSYSTEMS: AN OVERVIEW OF ON-GOING EFFORTS AT SEQUOIA AND KINGS CANYON NATIONAL PARKS — Christy Brigham - National Parks Service

11:05:11:20 THE 2020 CALIFORNIA FIRE SEASON IN CONTEXT: WAS IT A DISASTER?

Crystal Kolden - UC Merced

11:20-11:25 Q & A

11:25-11:30 BREAK — Poll 3

11:30-12:30 INTERACTIVE PANEL DISCUSSION Moderator: John Battles - UC Berkeley

2021 Workshop

- Two half-day workshop
- 2 plenary talks (1 each day)
  8 short talks
- 2 Panel discussions (1 each day)
  Day 1: Fuels - Fires
  Day 2: Reforestation
- **187** participants registered
  (as of March 8th)

DAY 2- MARCH 11: POST-MORTALITY MANAGEMENT – REFORESTATION

8:30-9:00 EARLY ACCES TO THE MEETING

Poll 4

9:00-9:15 WELCOME TO NEW PARTICIPANTS, QUICK SUMMARY DAY 1
Emilio Vilanova / Jodi Axelson UC Berkeley

9:15-9:45 PLENARY TALK: THE COLLECTIVE PIPELINE TO CLIMATE-SMART REFORESTATION
Britta Dyer - American Forests

9:45-10:00 Q & A

10:00-10:05 BREAK

10:05-10:20 USING ASSISTED GENE FLOW DURING REFORESTATION TO ESTABLISH CLIMATE-ADAPTED FORESTS
Derek Young - UC Davis

10:20-10:35 THE CALIFORNIA SEED ZONE MAP AND POST-FIRE REFORESTATION IN A WARMING FUTURE
Jessica Wright - US Forest Service

10:35-10:45 Q & A

Poll 5

10:45-11:00 REFORESTATION FOR RESILIENCE: THE CLIMATE-WISE REFORESTATION TOOLKIT
Amarina Wuenschel - US Forest Service

11:00-11:15 REPLANTING STRATEGIES UNDER CHANGING WILDFIRE, CLIMATE, AND BUDGET CONDITIONS
Malcolm North - US Forest Service

11:15-11:25 Q & A

11:25-11:30 BREAK

Poll 6

11:30-12:30 INTERACTIVE PANEL DISCUSSION Moderator: John Battles - UC Berkeley

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California Tree Mortality Data Collection Network

2021 Workshop

Welcome!

Questions and/or Comments?

jodi.axelson@berkeley.edu