CALIFORNIA FOREST PEST COUNCIL

70 Years of Connecting Science and Management for Healthy Forests

November 17 & 18, 2021


VIRTUAL POSTER SESSION
www.caforestpestcouncil.org

Forest Health Conditions in California 2021

CONDUCTED BY REGION 5 STATE AND PRIVATE FORESTRY AERIAL SURVEY PROGRAM

PROGRAM MANAGER AND LEAD SURVEYOR JEFFREY MOORE

U.S. FOREST SERVICE

Caring for the land and Serving the people

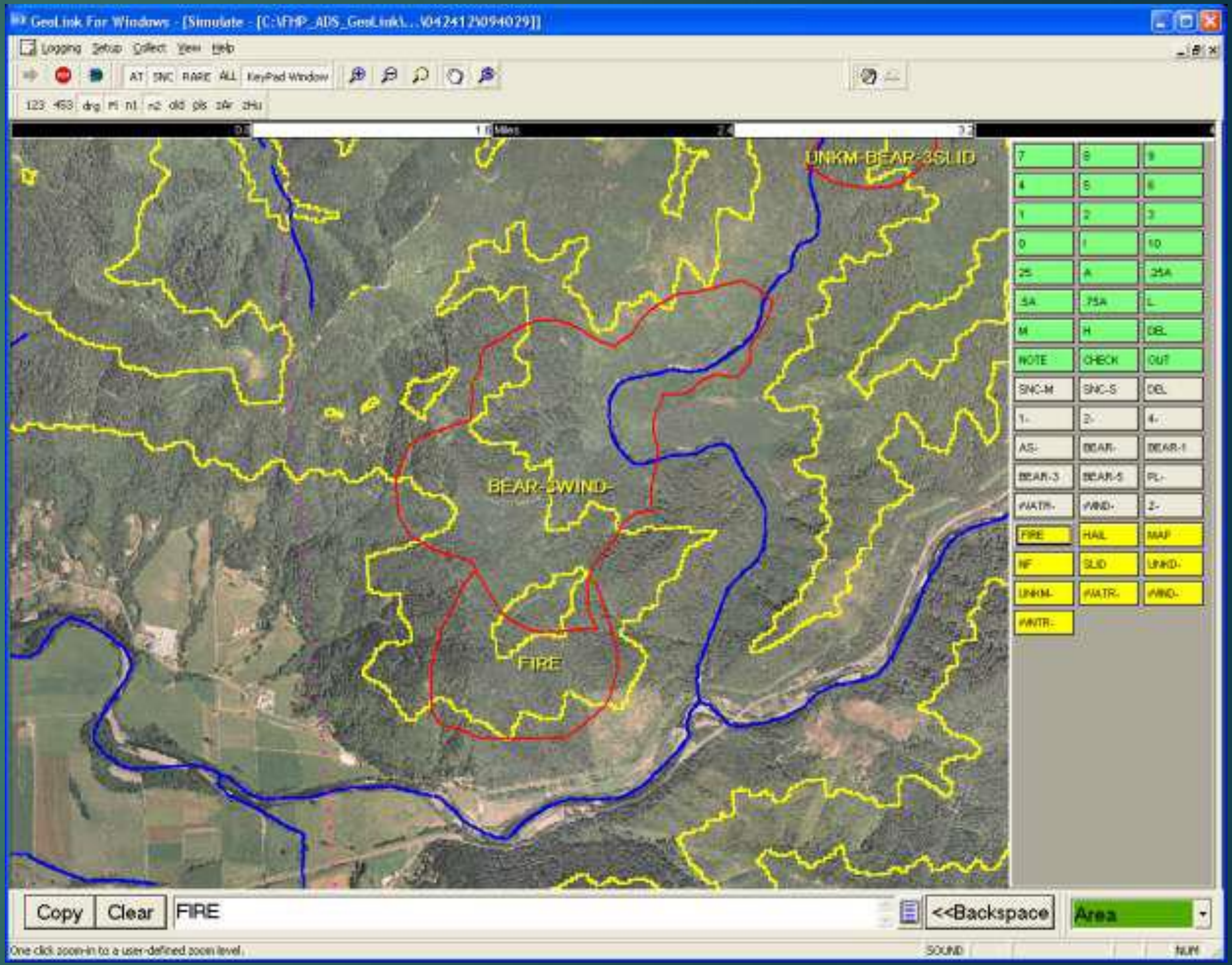
United States Department of Agriculture

Who We Are

- Small Program
  - One fulltime aerial detection survey specialist
  - Utilize a summer contract surveyor
- Plane and Pilot
  - Contracted Cessna 205
  - Operating budget around $90,000 annually for aircraft services
- Three part time GIS, RS and Reporting Support Staff

How we Operate

- Typical configuration
  - Two surveyors looking out opposite sides of aircraft
  - Visual estimation of red dead trees
  - Swath width 2 miles
  - Flight altitude approximately ‘1000 AGL
- In 2021 flew approximately 22,000 air miles in 145 hours of flight time surveying approximately 50 million acres
- Survey is conducted in summer once dead trees dry out and turn color. Late start in 2021
- Survey is meant to be coarse overview and detailed precision at stand level is limited



What We Record/Capture

Location, extent and severity of recently killed or damaged trees to the species level* of host and damage causal agent

- Approximately 95% of this damage is mortality mostly attributable to bark beetle or wood borer insect activity. Examples include:
  - Mountain pine beetle
  - Fir engraver
  - Goldspotted oak borer GSOB
- Other mortality agents include:
  - Root diseases such Sudden Oak Death or Port Orford-Cedar root disease
  - Bear feeding damage to young plantation Douglas-fir and redwood
  - Abiotic factors such as drought, windthrow, water damage etc. and special surveys

*We do not typically record trees killed by fire

Photos

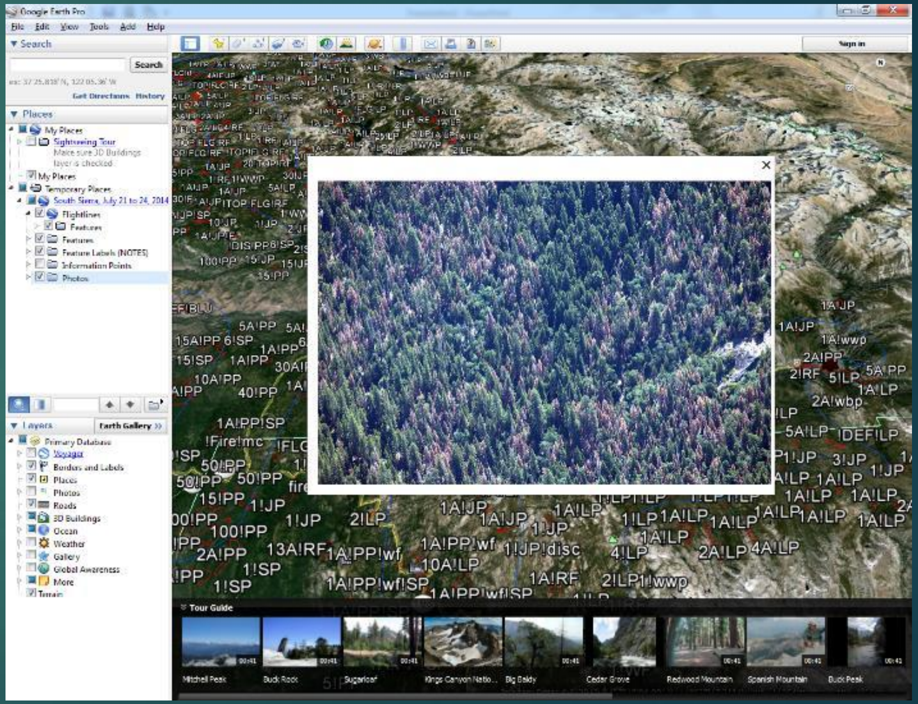
- Photos are taken and freely shared via our Flickr site at: https://www.flickr.com/photos/usfsr5/albums
- Photos are samples of events seen and are only occasionally taken for representation of larger scale events
- We do not take aerial imagery per se
- Photos as well as visual cues in general are on a unique top down, oblique angle that allows for enhanced views for better damage type and host tree species identification as well as a generous swath coverage
- Human eye is still superior to aerial or satellite imagery due to sentient oversight acuity, fine color/texture gradations, versatility during poor lighting conditions, etc. but is limited to visible spectrum, direct line of sight and general distance

Examples of Non-mortality tree Damage

- Defoliation
  - Defoliating insect activity such as tussock moth and oak leafroller
  - Foliar diseases such as *marssonina* and *anthracnose*
  - *Early leaf drop of deciduous oaks as a drought response was not recorded in 2021*
- *Flagging or Branch Dieback*
  - *Cytospora in true fir*
  - *Engraver beetles in conifers*
- *Dieback*
- *Topkill*
- *Discoloration*

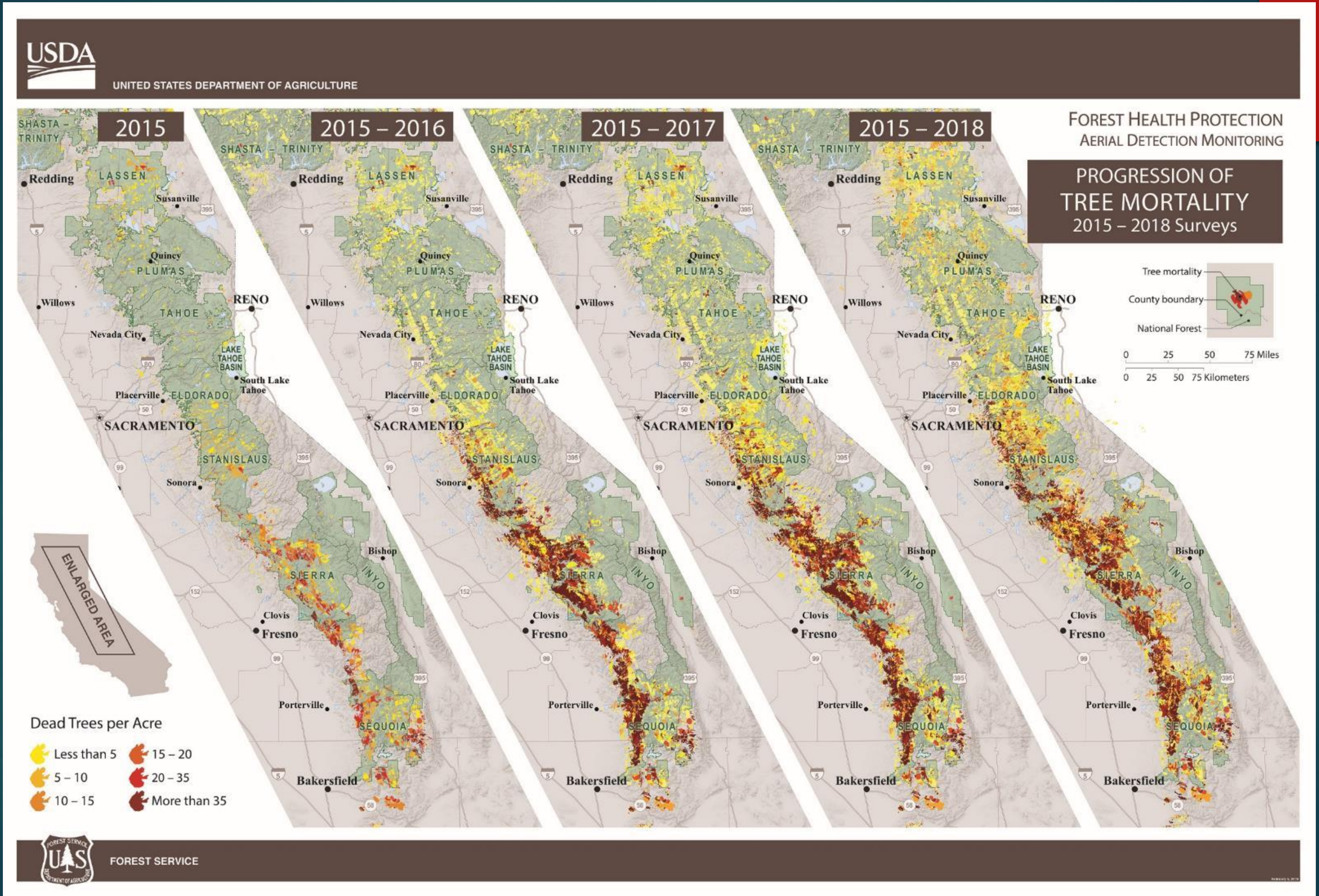
Deliverables

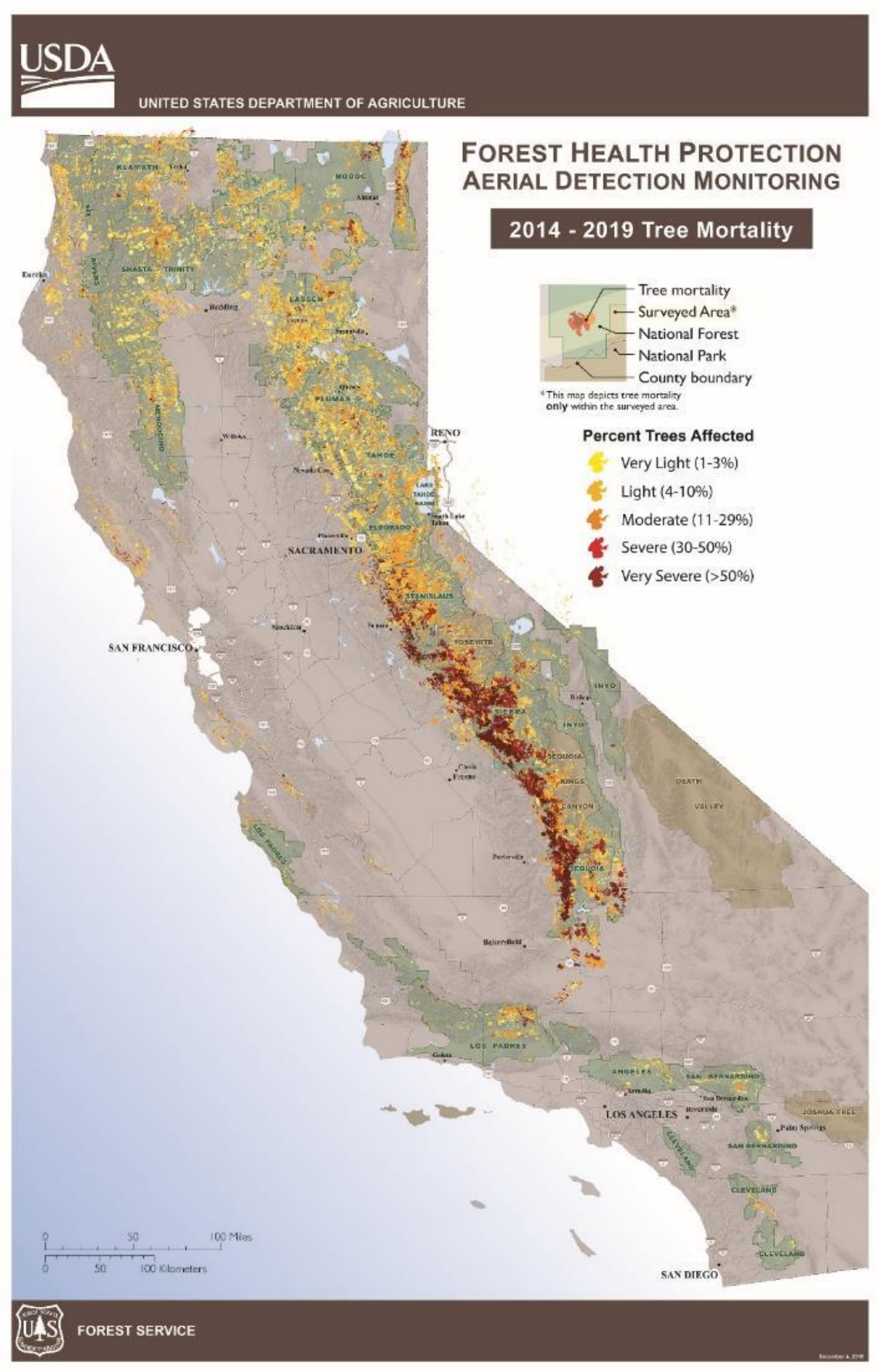
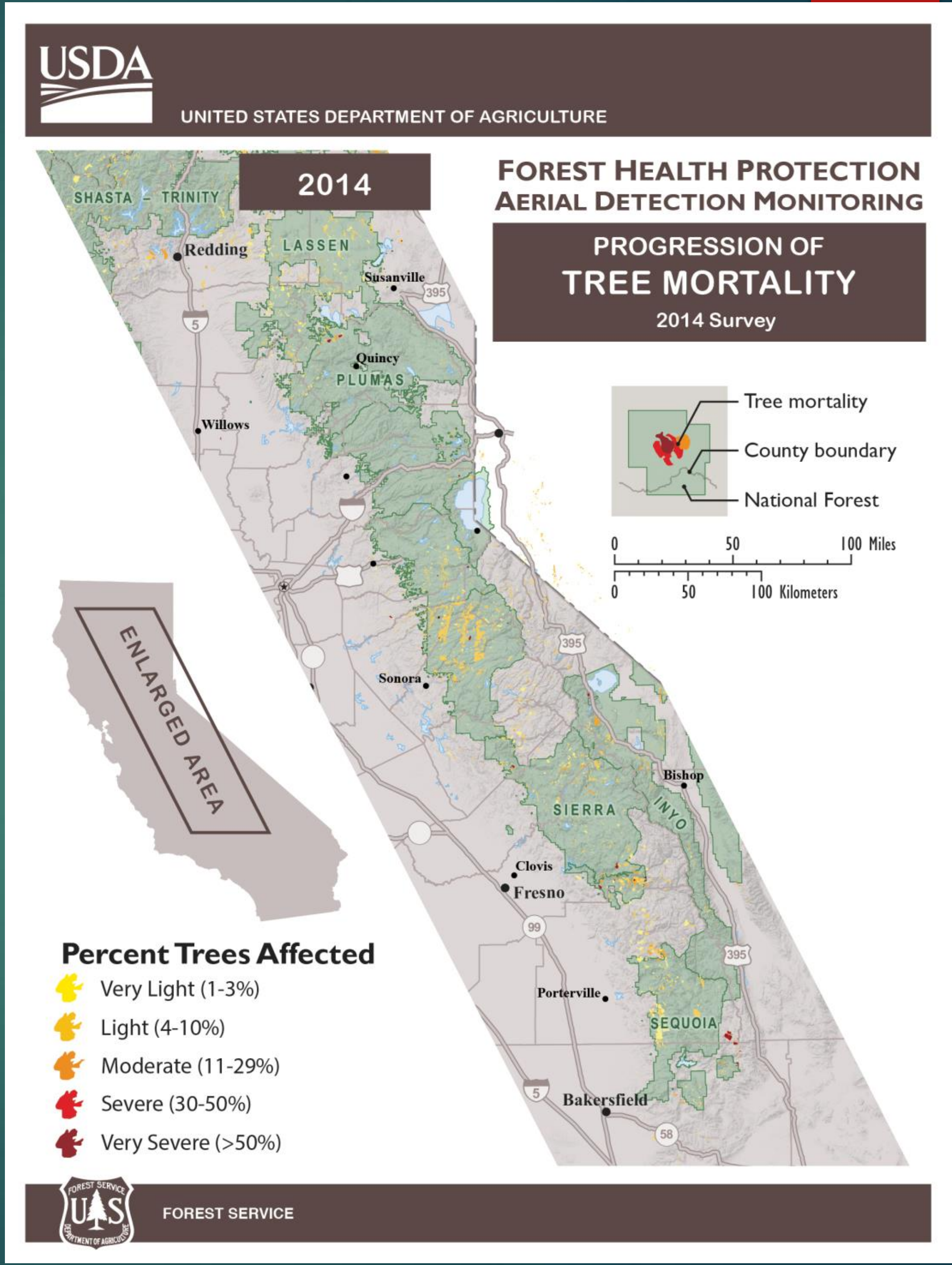
- Reports
  - Interim Reports are quick turnaround summaries of a particular location or flight iteration. They are preliminary and succinct and typically include a map of the reported survey area, major activity findings and a few select photos. They can be downloaded from here: http://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046696
  - KMZs for viewing data and collocated photos in Google Earth – not yet started for 2021
  - Storybook at: https://usfs.maps.arcgis.com/apps/Cascade/index.html?appid=d1316dc78e6c4f32931e1fae0a24ae4d
  - Short 2-page reports for each Forest in the Region
  - Final report summary – not yet started for 2021
  - National Aerial Survey Report
- GIS Data
  - Once finalized, a statewide Geodatabase is freely available for download and use in GIS applications
- Our Regional Data feeds into the National Database



Forest Health Conditions Prior to 2021

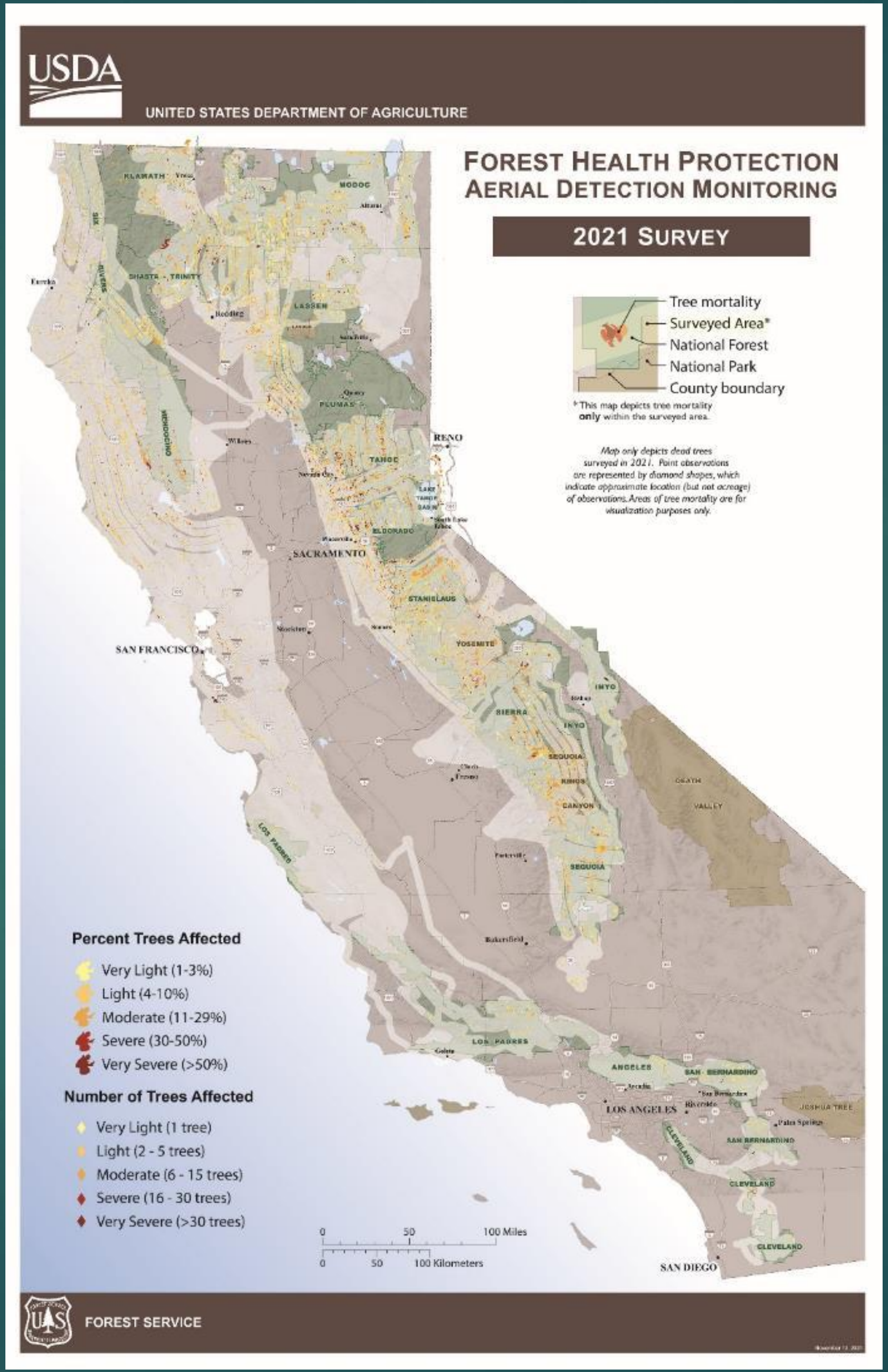
- Statewide six year drought from 2010 to 2016 resulted in an estimated129 million dead trees.
- Each successive year mortality was greatly expanded both in area affected and overall intensity until 2017 a year after the end of the drought.
- In 2017 to 2019 an estimated additional 60 million trees died.
- No survey was flown in 2020 due to Covid 19 concerns. Remote sensing of key areas showed continued elevated mortality but appeared significantly reduced from 2019.
- In all years since 2016, mortality has been primarily concentrated in fir and mortality has generally expanded at higher elevations.
- Mortality has been concentrated primarily in both white and California red fir and most intense in the southern Sierra Nevada Range at mid to high elevations.


USDA
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
PROGRESSION OF
TREE MORTALITY
2015 – 2018 Surveys
2015
2015 – 2016
2015 – 2017
2015 – 2018
Tree mortality
County boundary
National Forest
0 25 50 75 Miles
0 25 50 75 Kilometers
SHASTA - TRINITY
Redding
LASSEN
Susanville
Quincy
PLUMAS
Willows
RENO
TAHOE
Nevada City
LAKE TAHOE BASIN
South Lake Tahoe
Placerville
ELDORADO
SACRAMENTO
STANISLAUS
Sonora
Bishop
INYO
SIERRA
Clovis
Fresno
Porterville
SEQUOIA
Bakersfield
ENLARGED AREA
Dead Trees per Acre
Less than 5
5 – 10
10 – 15
15 – 20
20 – 35
More than 35
FOREST SERVICE


USDA
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
2014 - 2019 Tree Mortality
Tree mortality
Surveyed Area*
National Forest
National Park
County boundary
*This map depicts tree mortality only within the surveyed area.
Percent Trees Affected
Very Light (1-3%)
Light (4-10%)
Moderate (11-29%)
Severe (30-50%)
Very Severe (>50%)
RENO
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
0 50 100 Miles
0 50 100 Kilometers
FOREST SERVICE

USDA
UNITED STATES DEPARTMENT OF AGRICULTURE
2014
FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
PROGRESSION OF
TREE MORTALITY
2014 Survey
SHASTA - TRINITY
Redding
LASSEN
Susanville
Quincy
PLUMAS
Willows
Sonora
Bishop
SIERRA
INYO
Clovis
Fresno
Porterville
SEQUOIA
Bakersfield
Tree mortality
County boundary
National Forest
0 50 100 Miles
0 50 100 Kilometers
ENLARGED AREA
Percent Trees Affected
Very Light (1-3%)
Light (4-10%)
Moderate (11-29%)
Severe (30-50%)
Very Severe (>50%)
FOREST SERVICE

2021 Aerial Survey Draft Highlights

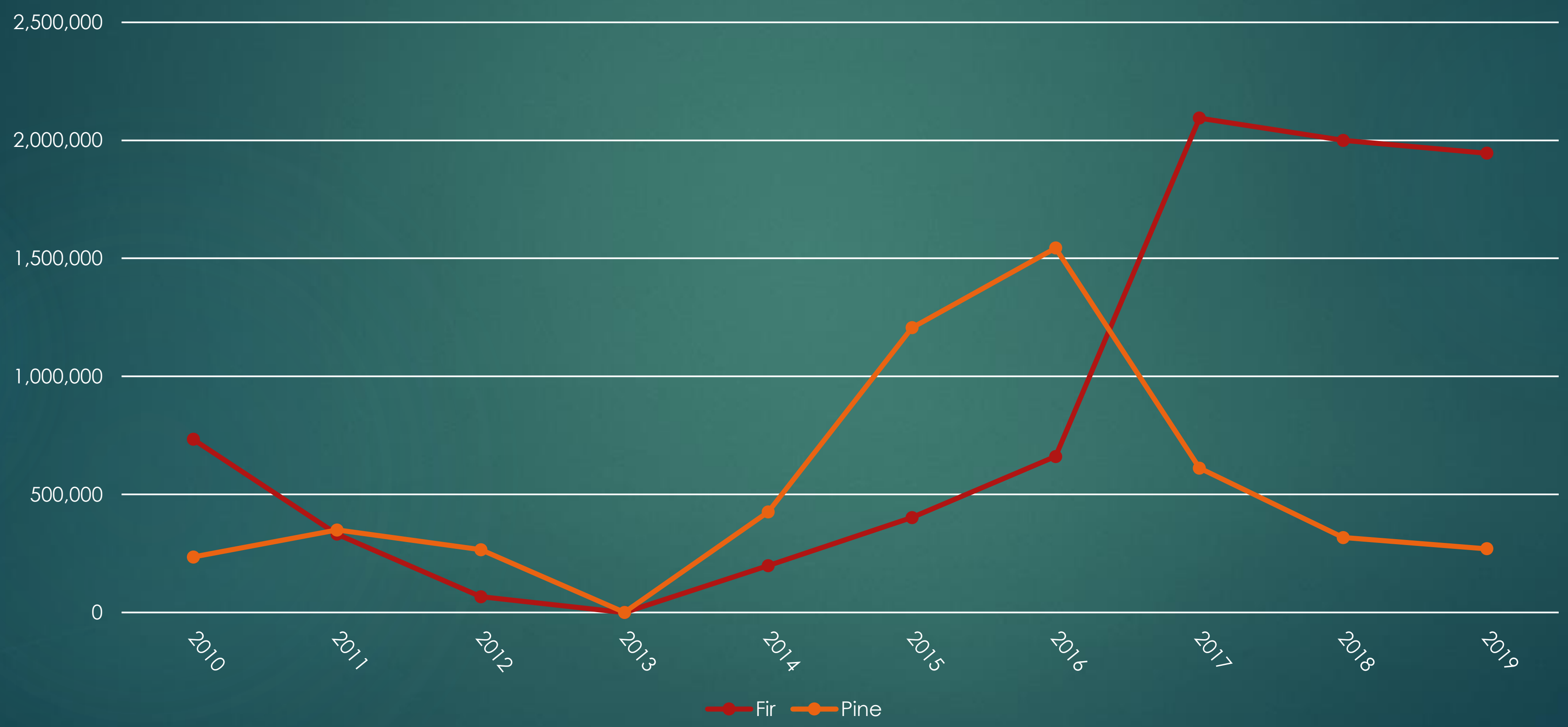
- Approximately 1.2 million acres with elevated levels of tree mortality were recorded in 2021 down from 2.4 million acres recorded in 2019, no comprehensive data for 2020
- Areas of pine most heavily impacted the 2010-2016 drought years are now bereft of viable host
- Fir was the most impacted and mortality was common throughout the Sierra Nevada Range closely correlated with heavy stocking
- New mortality was most concentrated in higher elevation fir within the central Sierras Nevada Range. Previous fir mortality was concentrated further south
- Farther north new fir mortality was most intense in heavily stocked mixed conifer stands and previous top kill was now dead
- Pine mortality was relatively minor overall and typically occurred in small clumps. However, areas in the central sierras and other localized areas were greatly elevated.
- Sudden oak death related mortality was elevated from previous years due to several years in a row of droughty spring conditions
- GSOB activity continues to spread

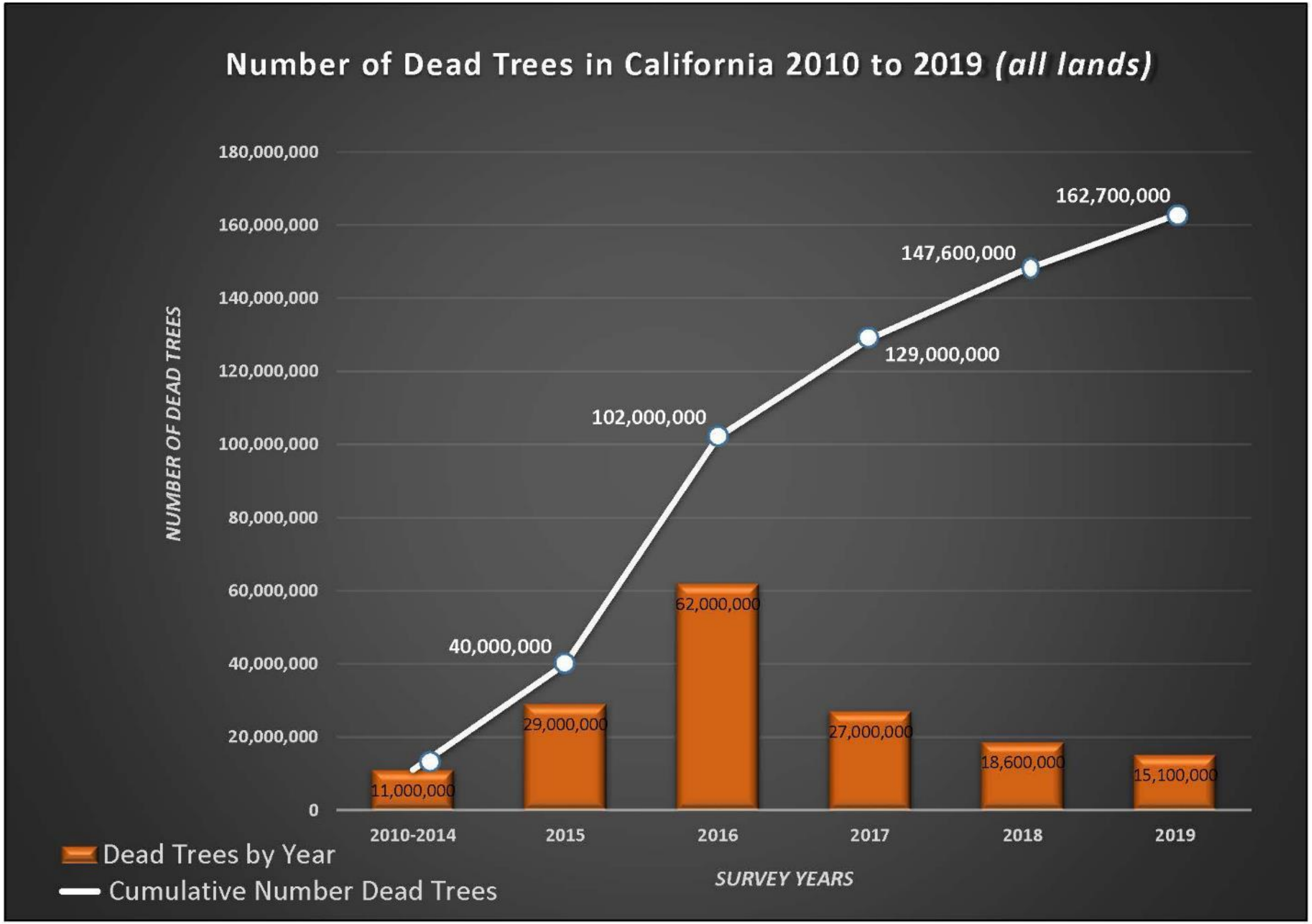


USDA
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
2021 SURVEY
Tree mortality
Surveyed Area*
National Forest
National Park
County boundary
*This map depicts tree mortality only within the surveyed area.
Map only depicts dead trees surveyed in 2021. Point observations are represented by diamond shapes, which indicate approximate location (but not acreage) of observations. Areas of tree mortality are for visualization purposes only.
RENO
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
Percent Trees Affected
Very Light (1-3%)
Light (4-10%)
Moderate (11-29%)
Severe (30-50%)
Very Severe (>50%)
Number of Trees Affected
Very Light (1 tree)
Light (2 - 5 trees)
Moderate (6 - 15 trees)
Severe (16 - 30 trees)
Very Severe (>30 trees)
0 50 100 Miles
0 50 100 Kilometers
FOREST SERVICE

Pine and Fir Mortality Trend Line

Acres With Mortality





Number of Dead Trees in California 2010 to 2019 *(all lands)*
NUMBER OF DEAD TREES
180,000,000
160,000,000
140,000,000
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
0
162,700,000
147,600,000
129,000,000
102,000,000
40,000,000
11,000,000
29,000,000
62,000,000
27,000,000
18,600,000
15,100,000
2010-2014
2015
2016
2017
2018
2019
SURVEY YEARS
Dead Trees by Year
Cumulative Number Dead Trees

Was 2021 a "Typical" Year for Forest Health in CA?

- Typically, red dead are apparent the year following actual mortality and this is known as a lag
- A more typical year in CA will see 0.5 - 1.5 million trees die across half a million acres and 2021 was at the high end of normal
- Fir trees that were greatly compromised by other agents such as fir engraver, cytospora, mistletoe and/or heterobasidian were most heavily affected. Typical stand conditions are typically still over mature and over stocked
- Why did the drought effects take longer to affect high elevation ecotypes? Water table? Climate? Engraver Beetles*

Expectations for 2022

- Pine bark beetle populations are likely expanding
- Overall health of surviving pine trees in the southern Sierra Nevada Range are now much improved, however areas further north are now vulnerable
- Fir engraver beetle populations are still greatly elevated
- Root disease and other damage causal agents, overstocking and overmature conditions in fir are abundant
- SOD infection rates have likely been declining for several years
- GSOB expansion will likely continue
- Invasive shothole borers are also expanding, but ADS has had little success in detecting this type of mortality
- A new exceptional drought throughout most of CA in 2021 and ongoing drought for three years likely enables successful bark beetle reproduction and promotes other damage agent activity
- Unlike the great drought of 2012-2016, only one year of above normal precipitation occurred in 2017

Fir and whitebark pine mortality in the Mammoth area Inyo National Forest

Thank You

USDA Forest Service R5 Aerial survey Program
jeffrey.moore@usda.gov

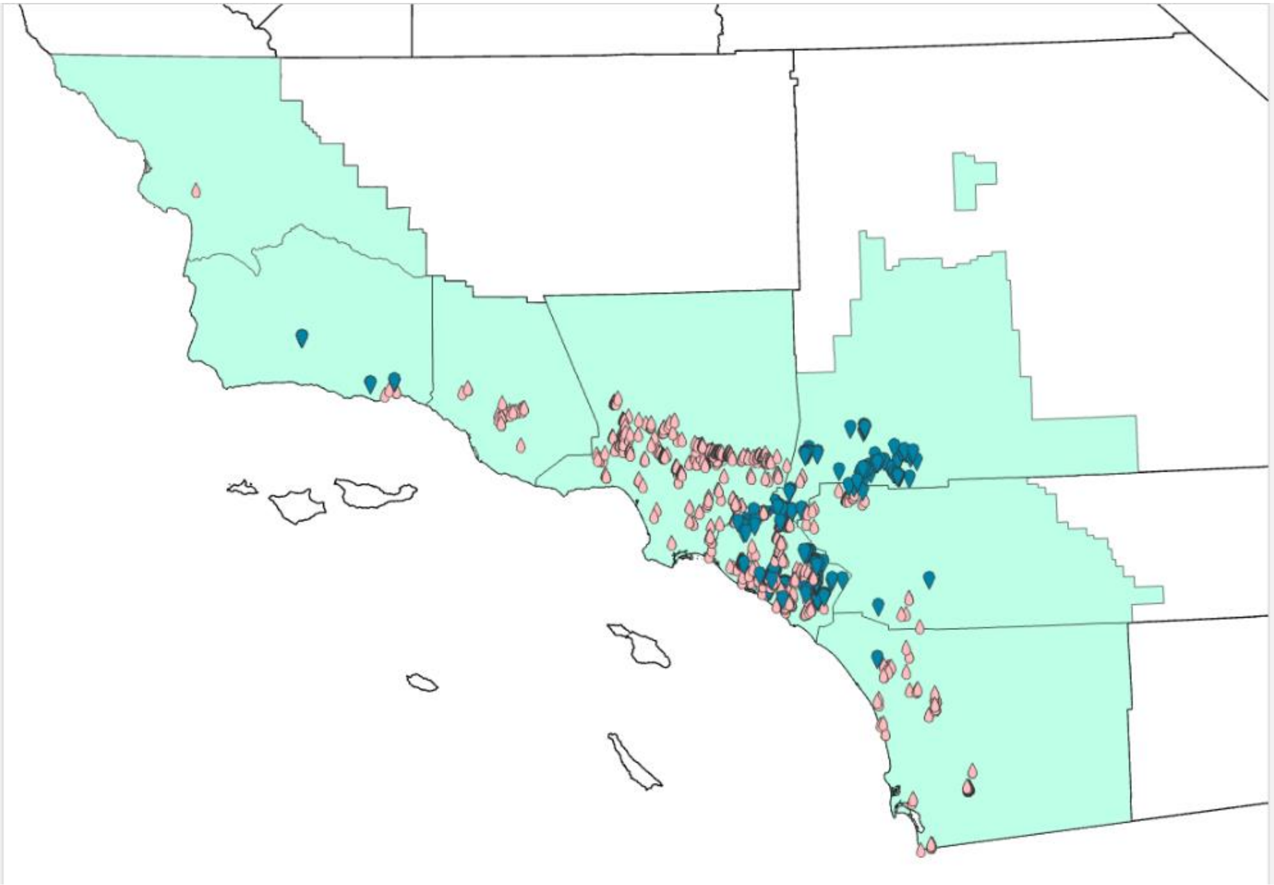
Laricifomes officinalis (Quinine conk)

Updates: ISHB, GSOB, MOB, SOD and Pitch Canker

Kim Corella, Forest pathology and entomology program, CAL FIRE

2021 ISHB Updates

- ISHB continues to spread:
  - Santa Barbara County – north to Santa Ynez
    - Host found on: Box Elder and Sycamore
  - San Bernardino County – in the foothills of the national forest.
    - Trap catches
  - Riverside County – east of Temecula
    - Host found on: Sycamore
  - Orange County - north of Yorba Linda, Garden Grove area,
    - Hosts found on : Sycamore, and trap catches



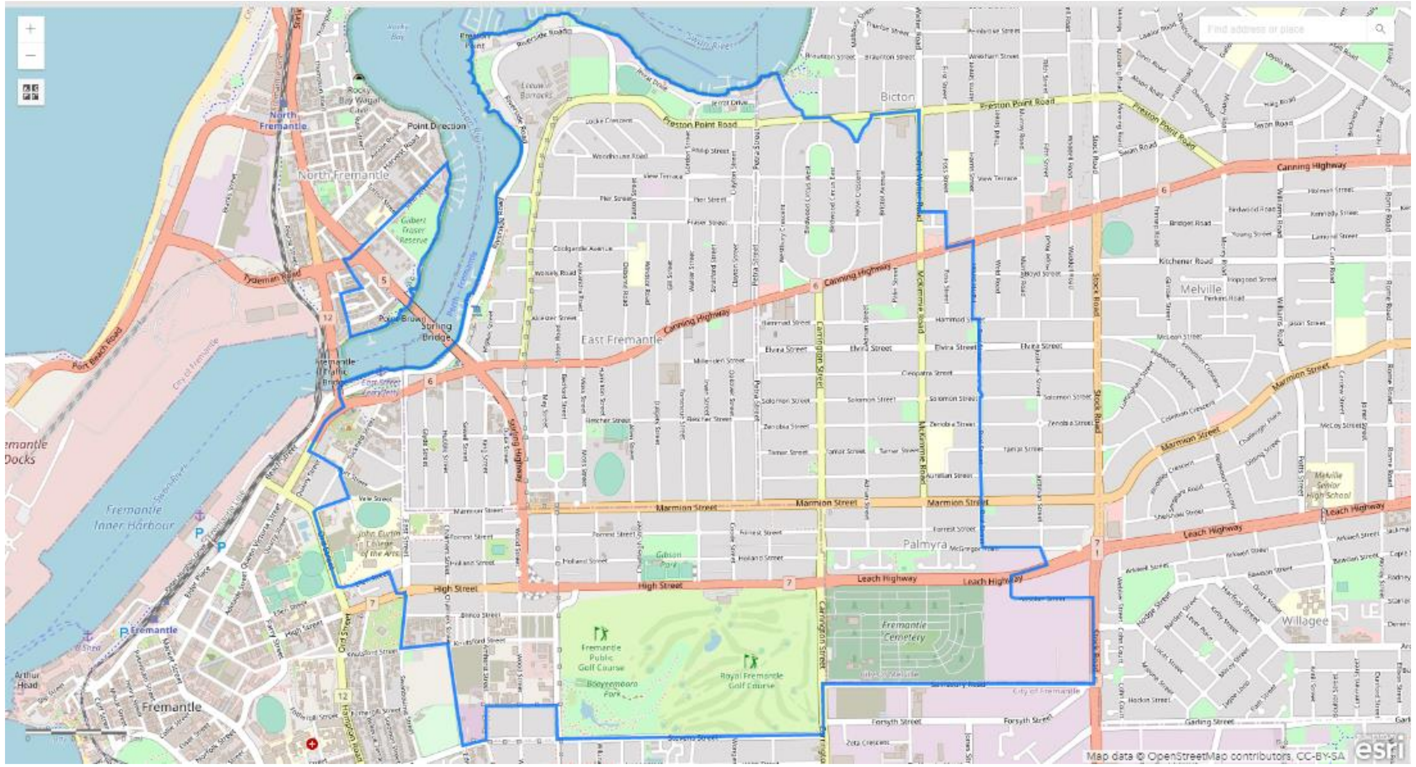
2021 ISHB Updates

Online Communication 10/20 – 9/21

- @ISHB_SoCal – Twitter launched in Jan. 2021. Through Sept. 30, posted 61 tweets and achieved 14,221 impressions and 723 profile visits. Currently have 63 followers.
- ISHB.Update – Facebook page currently has 84 followers. Over 12 months: 63 posts; 1,022 reach; 47 likes/reactions
- Website had 7.5K users and 10K sessions over 12 months
- Online course issued 528 certificates of completion over 12 months

2021 ISHB Updates

- ISHB has been found in East Fremantle, Australia



BIOSECURITY AND AGRICULTURE MANAGEMENT REGULATIONS 2013

QUARANTINE AREA NOTICE

EAST FREMANTLE AND FREMANTLE

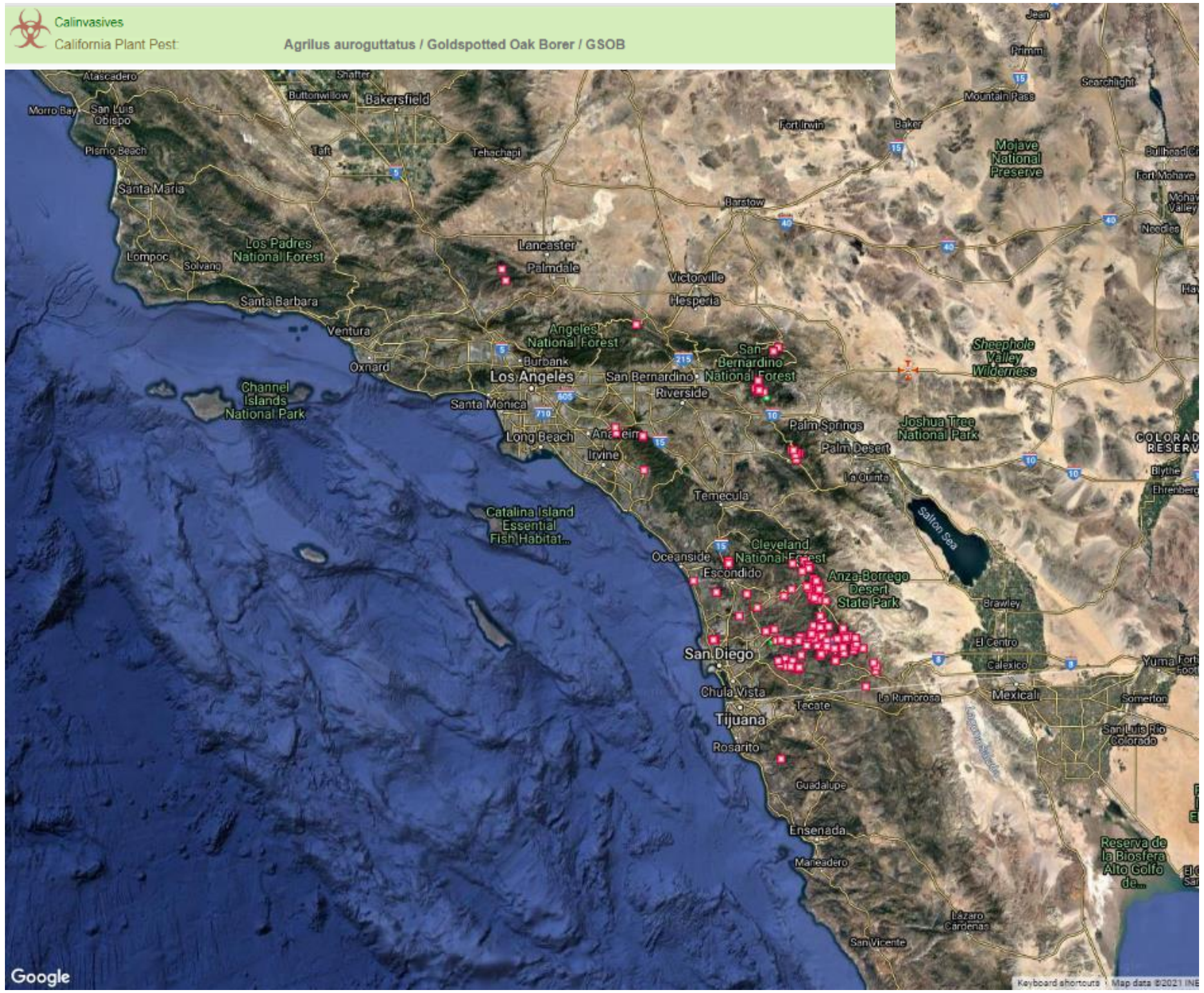
Polyphagous Shot-Hole Borer (*Euwallacea fornicatus*)

1. Under regulation 60 of the Biosecurity and Agriculture Management Regulations 2013 (**Regulations**) the area within the boundaries described below is declared to constitute a quarantine area for a period of 6 months following the date of publication.

2021 ISHB Updates

- Found in Backyard maple tree, August 6-16, 2021
- Response activities include:
  - Quarantining the area for 6 months starting Sept 21, 2021
  - Restricting the movement of plant host material from Genus of 244 plants (PSHB hosts plants).
  - Machinery must be disinfected before moving offsite
  - Surveying to determine the distribution of PSHB - trapping
  - Containing the pest to prevent further spread
  - Providing advice and information to residents, industry and other stakeholders
  - Working with partners here in CA for treatment and management information.

2021 GSOB Updates



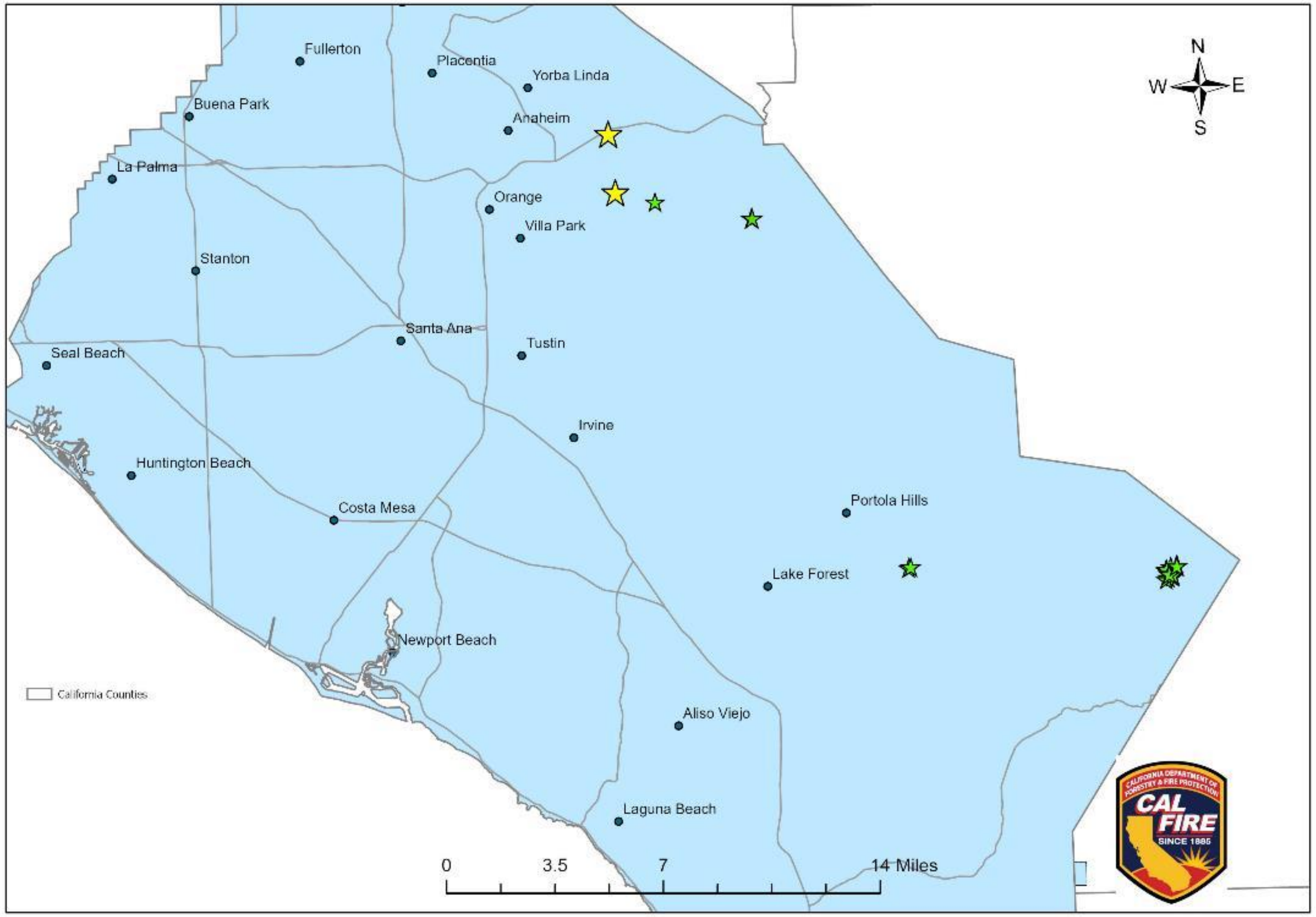
Goldspotted Oak Borer Zone of Infestation
California

2021 GSOB Updates

Two new infestations – Orange County

- Oak Canyon Nature Preserve – July 2021
  - Large infestation – 5-7 years old
- Deer Canyon Park – Sept 2021
  - Surveys are planned

New Goldspotted Oak Borer Locations for Orange County



2021 GSOB Updates – Oak Canyon Nature Preserve

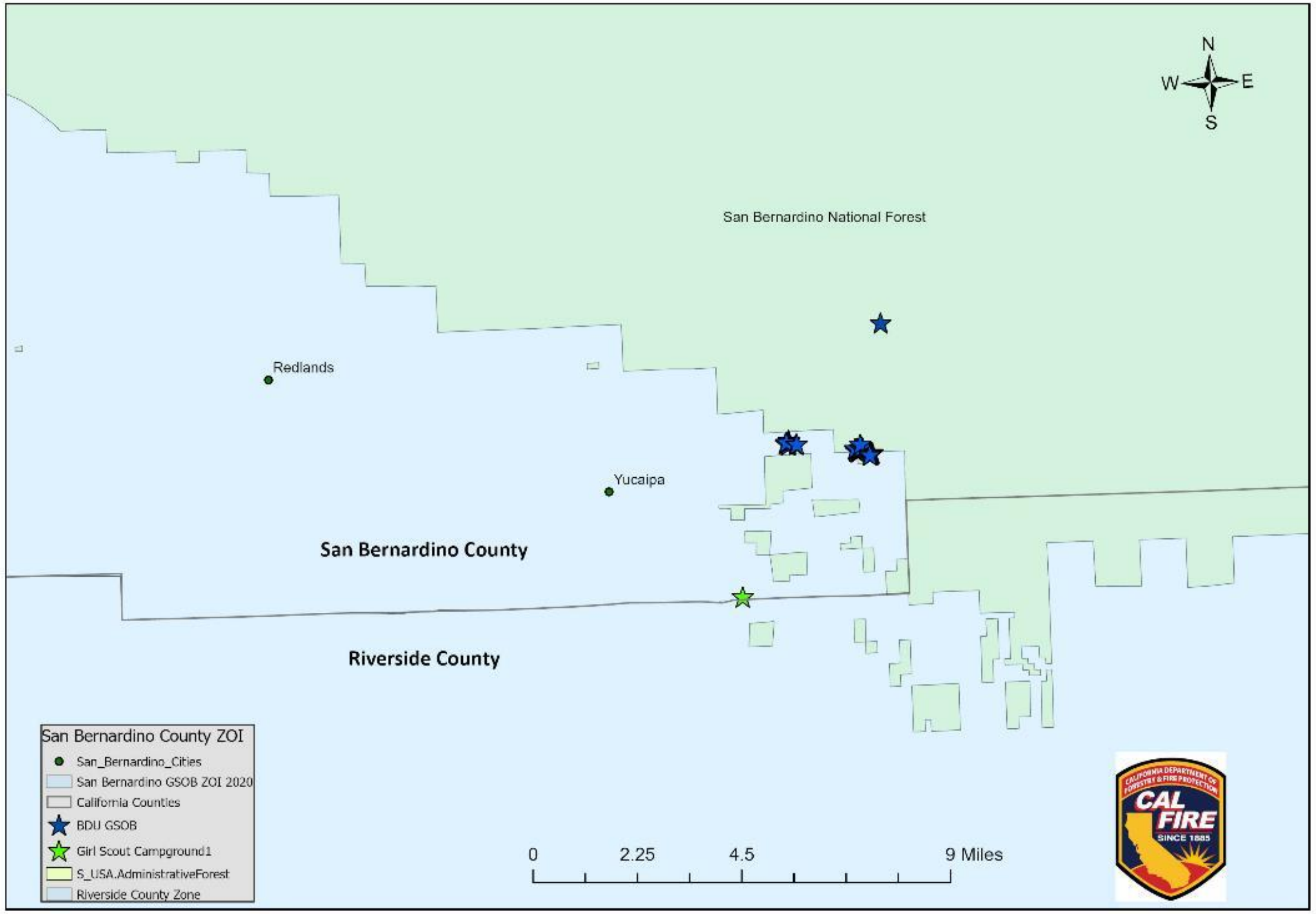
- 10-12 Amplifier trees
- Infestation has been in the area for approximately 5-7 years
- 1 ¼ miles from Weir Canyon infestation
- Treatments will be applied in March and testing a new chemical Azadirachtin
  - Secondary metabolite from Neem seed
  - Disrupts normal insect growth/molting, sterilizes adults and deters egg laying
  - Used successfully in for control in Emerald Ash Borer

2021 GSOB Updates

One new infestations

- San Bernardino County
  - Girl Scouts Campground - October 2021
- 4 miles from the Oak Glen Infestation

New Goldspotted Oak Borer Location for San Bernardino County



2021 GSOB Updates

- IERCD - surveys are were completed last week
  - Along the campsites and road
  - Surveys will continue throughout the campground and into homeowner sites

- Only a couple of highly infested trees

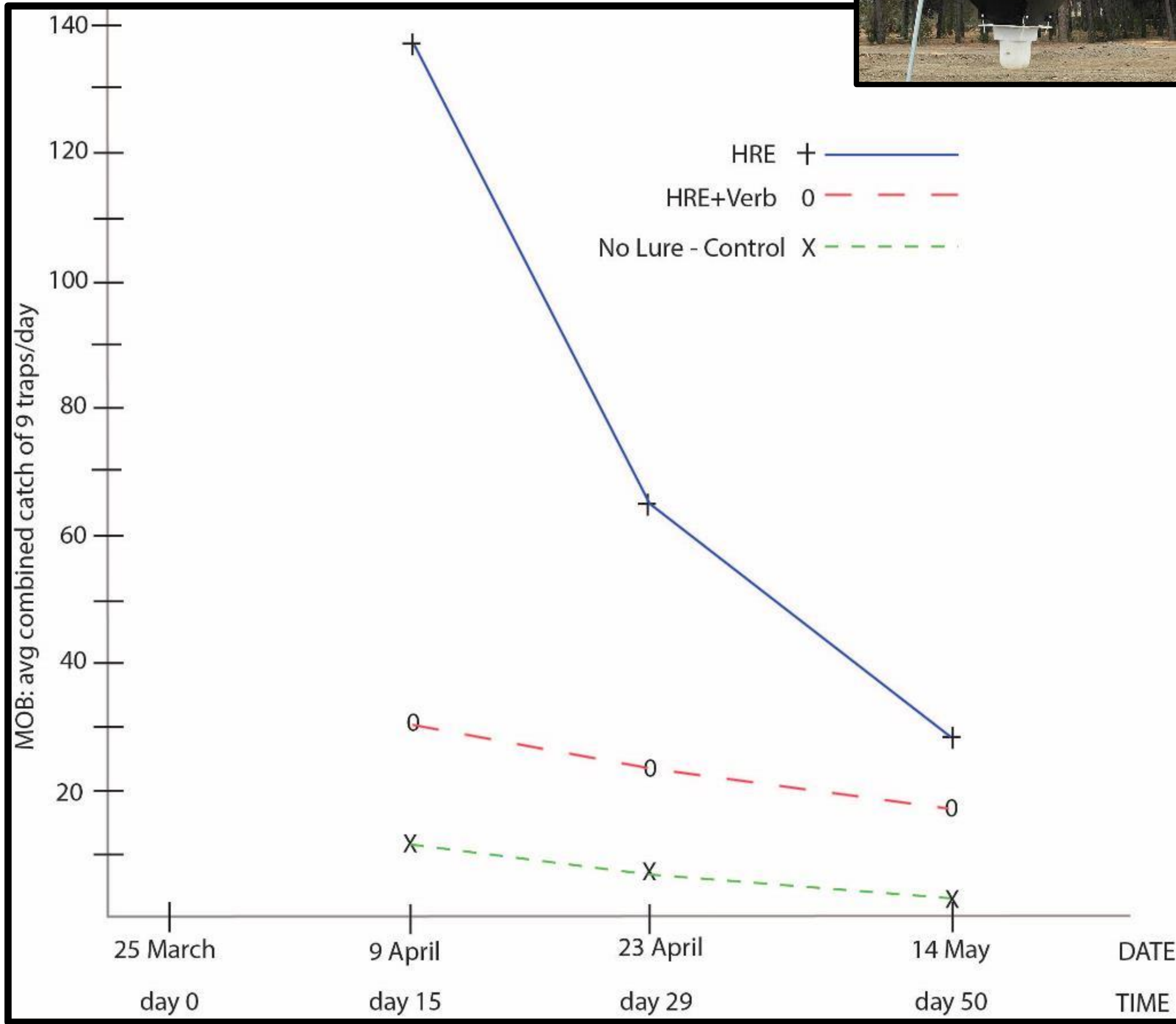
- Management strategies are being considered

2021 GSOB Updates

- Long-Term Monitoring Plots
- 28 Monitoring plots set up in San Diego and San Bernardino Counties
  - California black oak and Coast live oaks
  - 19 -Burned
  - 9 -Unburned
  - Track – forest stand conditions, tree mortality, degree of tree injury associated with wildfire severity and severity of GSOB-infestation.

2021 MOB Updates

- Verbenone Trial
  - 27 Cross vane panel traps – Calistoga
  - Tested:
    - High Release Ethanol lure
    - High Release Ethanol lure + Verb
    - Control – no lure
  - Significant differences on April 9 & 22
    - High Release Ethanol lure most effective
  - Plan to evaluate new ambrosia beetle specific Splat in 2022



2021 MOB Updates

Management – Splat treatment of bole?

Problem: Does MOB climb or fly directly to top of tree?

In Europe NONE TRAPPED ≥50 ft. (Hardersen et al. (2014)

- All collected at ground level
- No traps between ground level and 50 ft.

30 ft towers with 5 double-sided sticky traps set up May 2021, Napa county, CA

- 2 Beetles collected at 25 ft. above ground so far

Seasonal flight ended just before towers set

- Will reset in Feb 2022

Spatio-temporal analysis of beetles from the canopy and ground layer in an Italian lowland forest. Hardersen et al. (2014) Bulletin of Insectology 67 (1): 87-97, 2014

2021 MOB Updates

- Long-Term Monitoring Plots
- Valley, blue and Oregon Oaks
- Burned
- Unburned
- Track
  - Crown & bole health
  - Insect damage

2021 MOB Updates

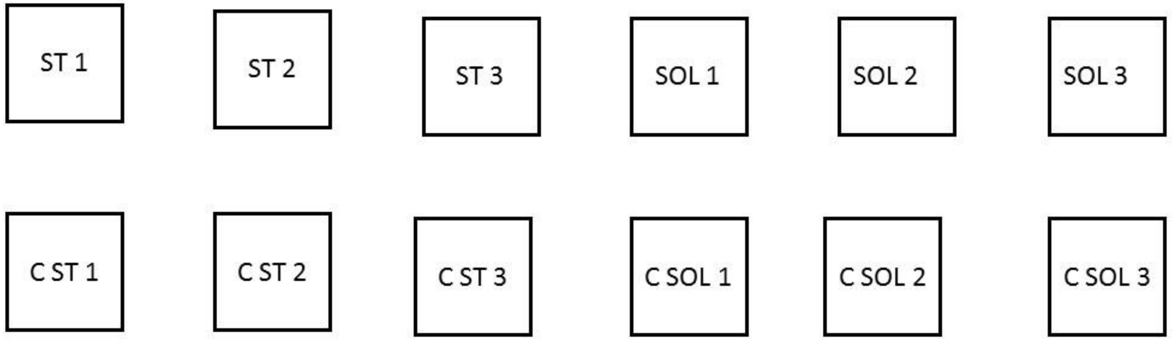
- Evaluation of Chipping, Solarization, and Steam Treatment
- Set up – Nov. 2, 2021
- Results late winter 2022

Steam Treatment: Partners

California Department of Food and Agriculture (CDFA)
David Pegos
Dominican University of California
Vernon Jordan
Wolfgang Schweigkofler
USGS-FS
Sheri Smith
University of California Cooperative Extension-Mendocino County (UCCE)
Michael Jones
California Department of Forestry and Fire Prevention
Curtis Ewing
Tom Smith
Chris Lee
Kim Corella

Calistoga Steaming

plot size : 10x10 ft; pile height: approx. 2 ft
4 temperature sensors/plot



ST 1: Steaming wood chips
ST 2: Steaming mid size branches
ST 3: Steaming trunk/fire wood

C ST 1: Control wood chips with tarp
C ST 2: Control mid size with tarp
C ST 3: Control trunk with tarp

SOL 1: Solarisation wood chips
SOL 2: Solarisation mid size branches
SOL 3: Solarisation trunk/fire wood

C SOL 1: wood chips no tarp
C SOL 2: mid size branches no tarp
C SOL 3: trunk no tarp

2021 MOB Updates

- Evaluation of Chipping, Solarization, and Steam Treatment
- Set up – Nov. 2, 2021   Results late winter 2022

2021 Sudden Oak Death Update: North Coast

- Slow-the-spread management undertaken in EU1 infestation in Del Norte County (November and December)
- Infected and roadside hazard trees cut, root systems treated with herbicide
- A wide buffer zone of tanoaks (negligible bay laurel) treated with herbicide
- Infected and roadside hazard woody material disposed of in air curtain burner or cogeneration plant
- *P. ramorum* recovered in June 2021 at two nearby locations by PCR; reconfirmation of these locations pending
- *P. ramorum* not reconfirmed at nearby NA1 site
- NA2 *P. ramorum* detected near Port Orford, OR

Post-management decontamination; photo Yana Valachovic, UC Cooperative Extension

2021 Sudden Oak Death Update: Bay Area

UC Berkeley SOD Blitz samples increasing numbers of trees each year

Overall, new infections were low around the coastal counties

Significant new outbreaks in 2021:

- Santa Lucia and Santa Cruz Mountains, Big Sur, Carmel Valley
- South and West Marin County
- Oakland Hills
- Sonoma County

SOD at Pt Reyes; photo Chris Lee, Cal Fire

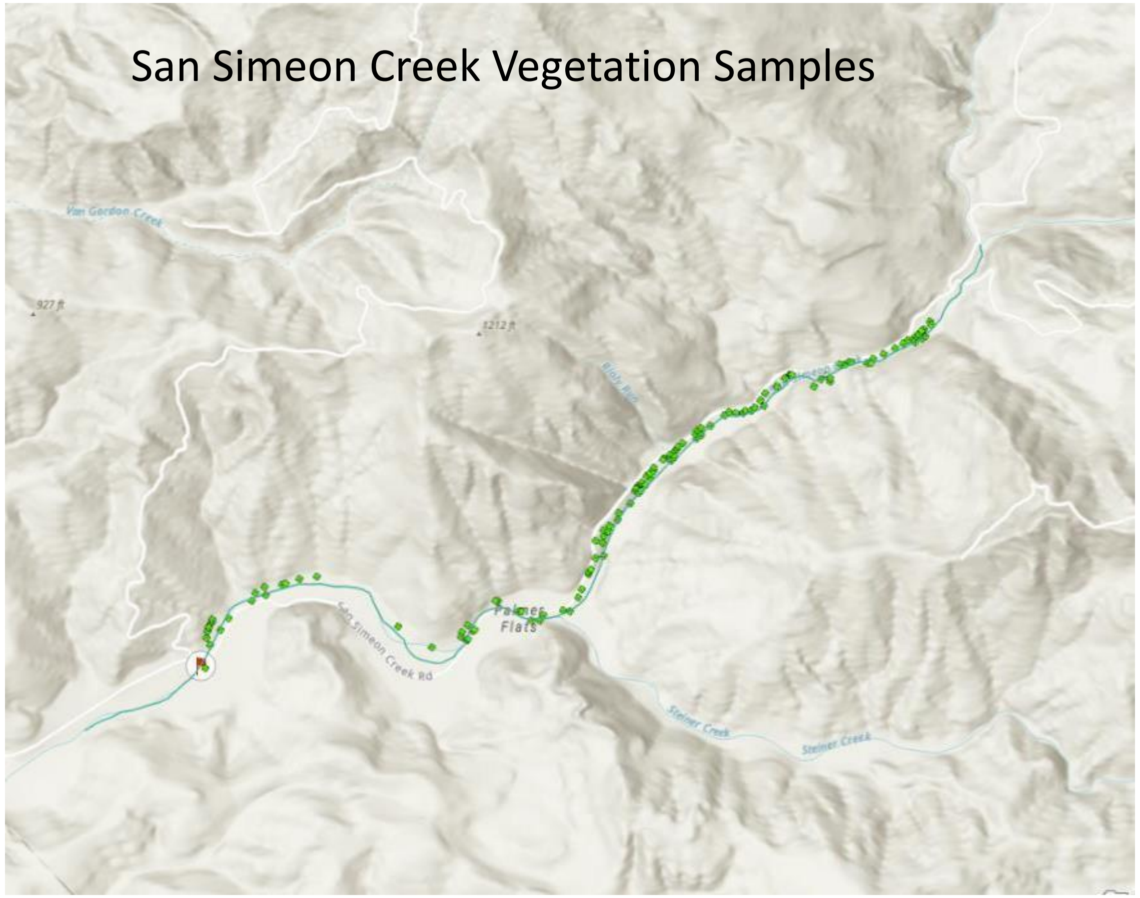
2021 Sudden Oak Death Update: Central Coast

2019 – new positives

- Santa Rita Creek
- San Simeon Creek

Santa Rita and San Simeon Creeks were intensively surveyed this year to find origin of positive stream baits.

- All 200 samples came back negative



2021 Sudden Oak Death Update

Request for Pre-Proposals for 2022-2023

From the Forest Health Protection Program of the State and Private Forestry Section of the Pacific Southwest Region of the USDA Forest Service

- Conducting Activities Related to Monitoring, Extension, Management and Mitigation of the Sudden Oak Death Disease caused by *Phytophthora ramorum*.
- Deadline for submission - January 11, 2022
- Contact Phil Cannon for more information, philip.cannon@usda.gov

2021 Pitch Canker Updates

- Seems to be increasing in areas along the north coast
  - Sonoma and Mendocino Counties
  - On shore pine, *Pinus contorta ssp. contorta*

Before

After

Questions??

Mt. Shasta

Xylella fastidiosa subspecies in California

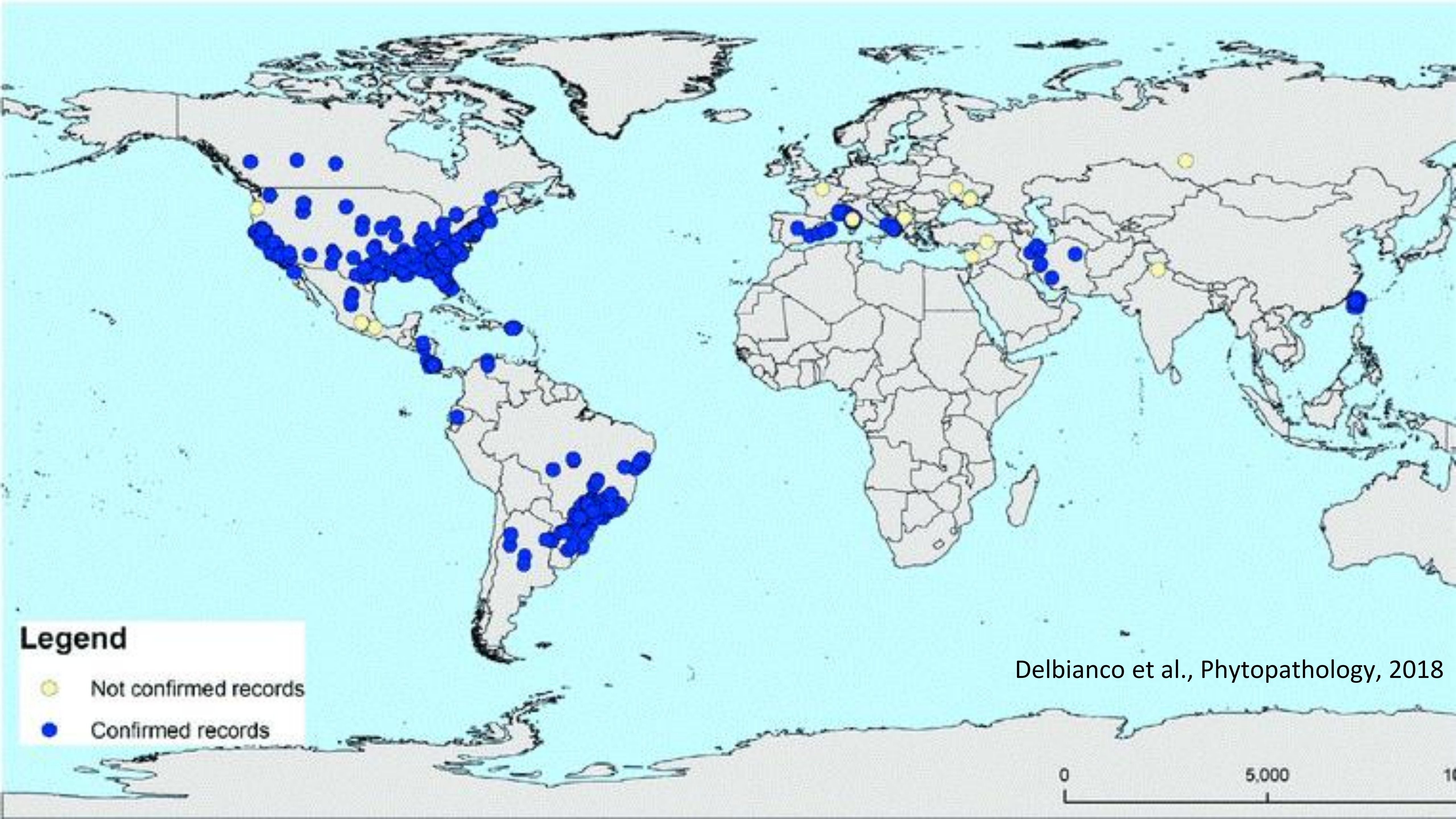
Sebastian Albu
California Department of Food and Agriculture
Plant Pest Diagnostics Lab

https://roperlaboratory.weebly.com

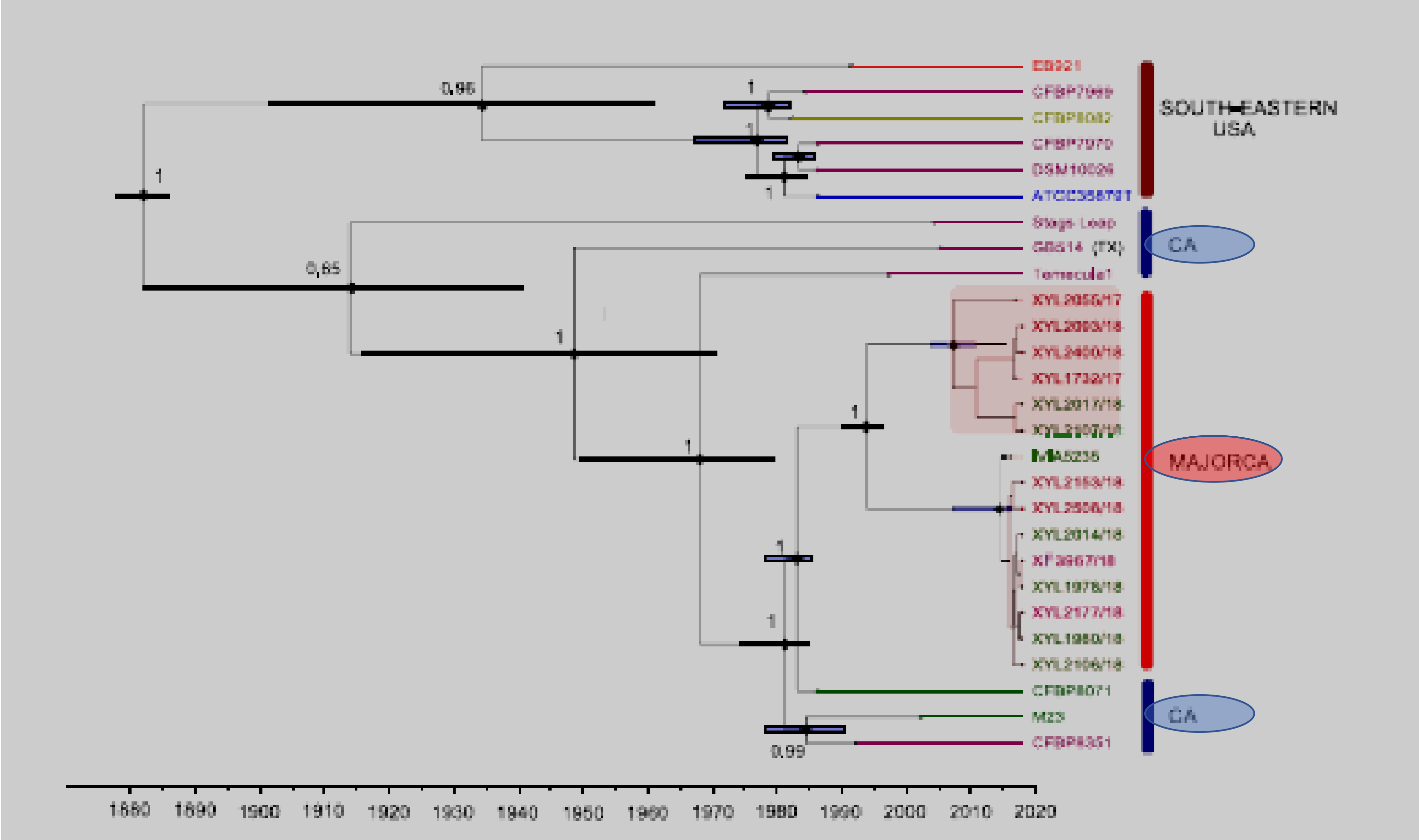
Xylella fastidiosa subspp. (major)

- *fastidiosa*
- *multiplex*
- *pauca*

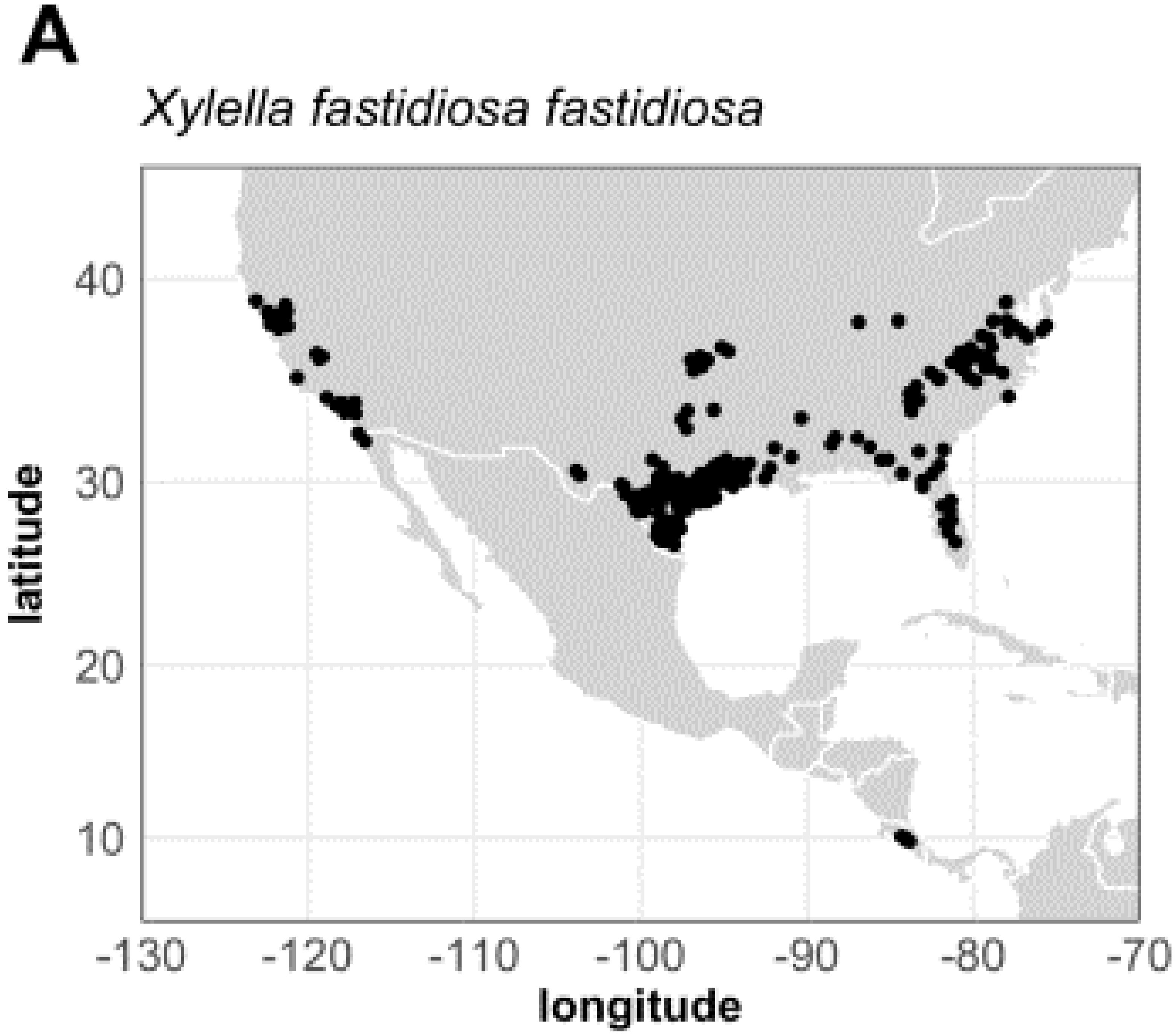
Randall et al., 2009, App. and Env. Microb.

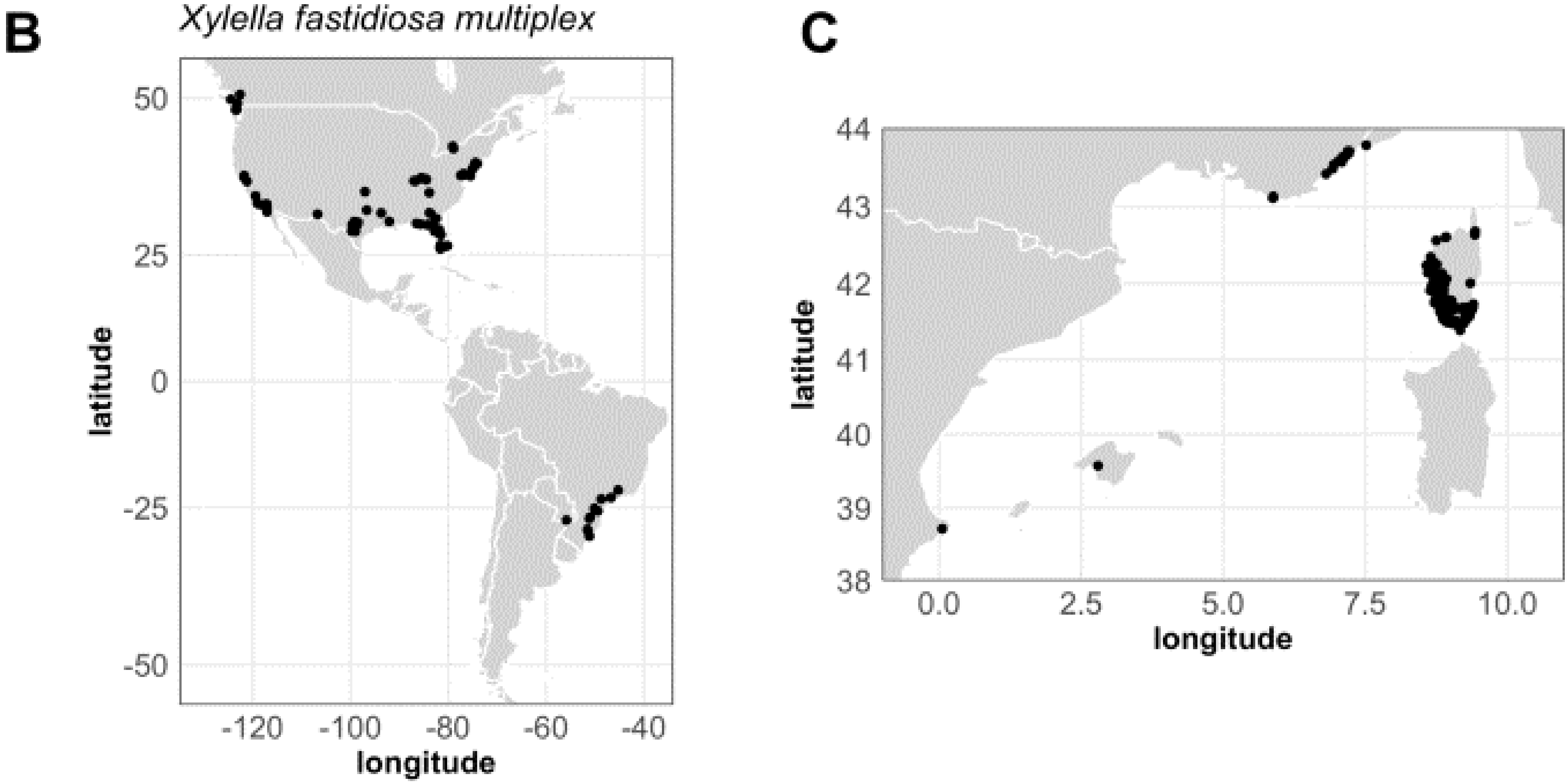

Legend
Not confirmed records
Confirmed records
0
5,000
Delbianco et al., Phytopathology, 2018

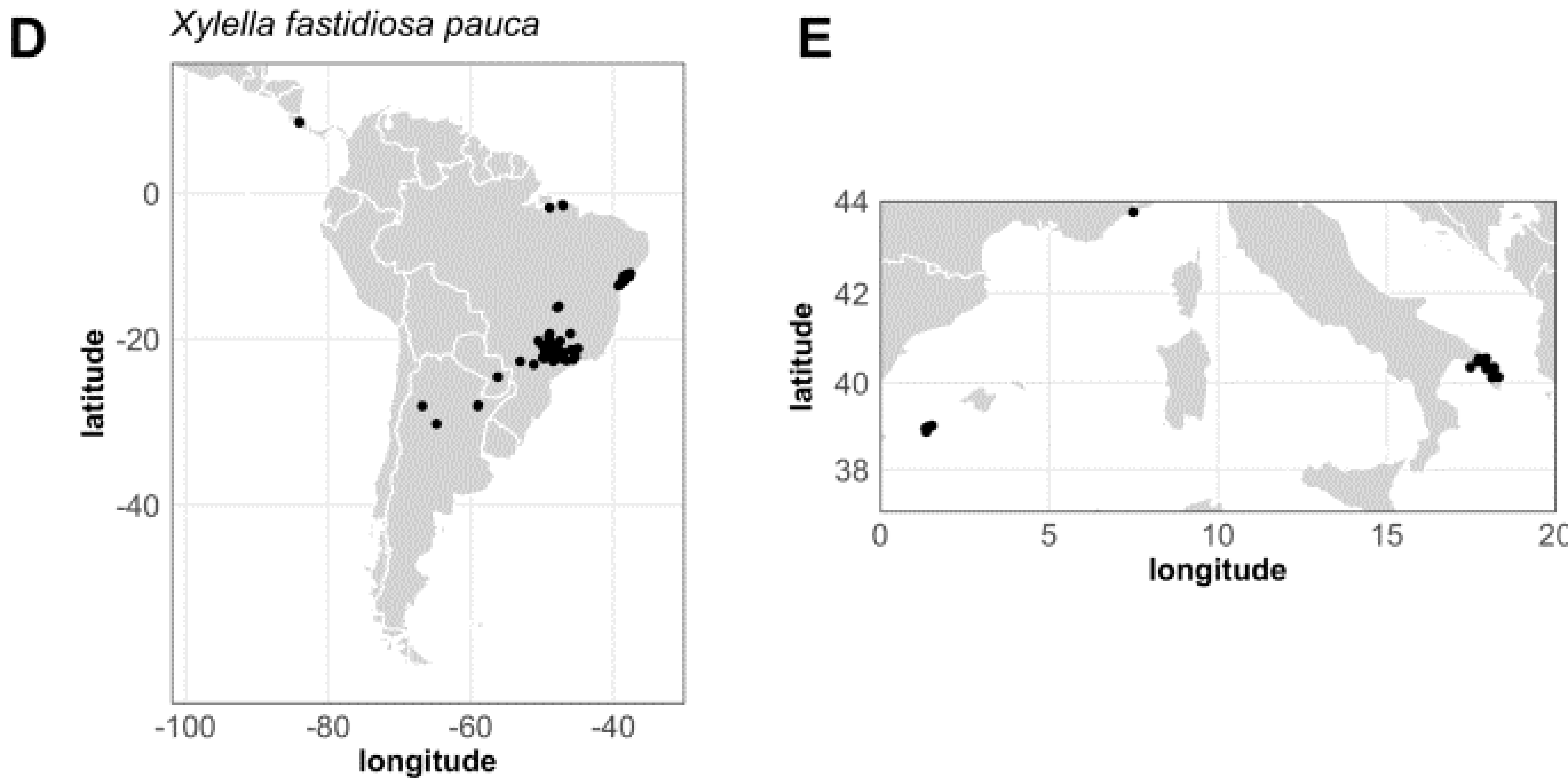

OQDS
ALSD



Moralejo et al., 2020, Nat. Com. Bio.


A
Xylella fastidiosa fastidiosa
40
30
20
10
latitude
-130
-120
-110
-100
-90
-80
-70
longitude


B
Xylella fastidiosa multiplex
50
25
0
-25
-50
latitude
-120
-100
-80
-60
-40
longitude
C
44
43
42
41
40
39
38
latitude
0.0
2.5
5.0
7.5
10.0
longitude


D
Xylella fastidiosa pauca
0
-20
-40
latitude
-100
-80
-60
-40
longitude
E
44
42
40
38
latitude
0
5
10
15
20
longitude

CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

***Xylella fastidiosa* subsp. *pauca* (Wells et al., 1987) Schaad et al. 2004**

Current Pest Rating: none

Proposed Pest Rating: A

Domain: Bacteria; Kingdom: Eubacteria

Phylum: Proteobacteria; Class: Gammaproteobacteria

Order: Xanthomonadales; Family: Xanthomonadaceae


Photo by R. Kruger






Adelges piceae (balsam woolly adelgid)

2021 *L. dispar* Update

Plant Health and Pest Prevention Services

California Department of Food and Agriculture

California 2021

Statewide Detection Trapping

Residential areas

High-hazard sites

10 deep-water ports

~18,000 traps total

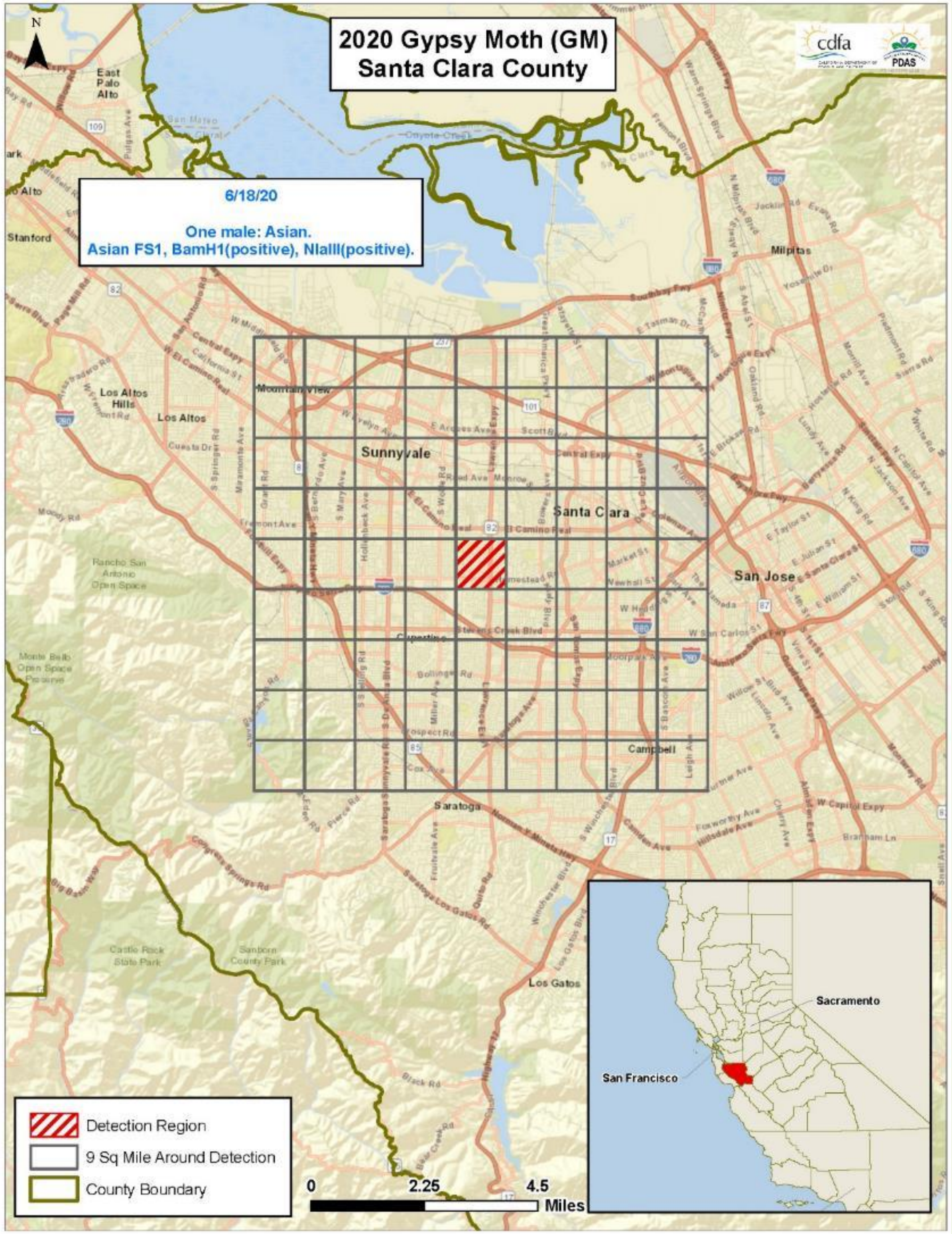
2 detections in 2020

California 2020

Santa Clara County

Sunnyvale

- 1 male at residential park
- Asian strain
- Delimitation in place



Gypsy Moth 2018

Santa Cruz County

Santa Cruz

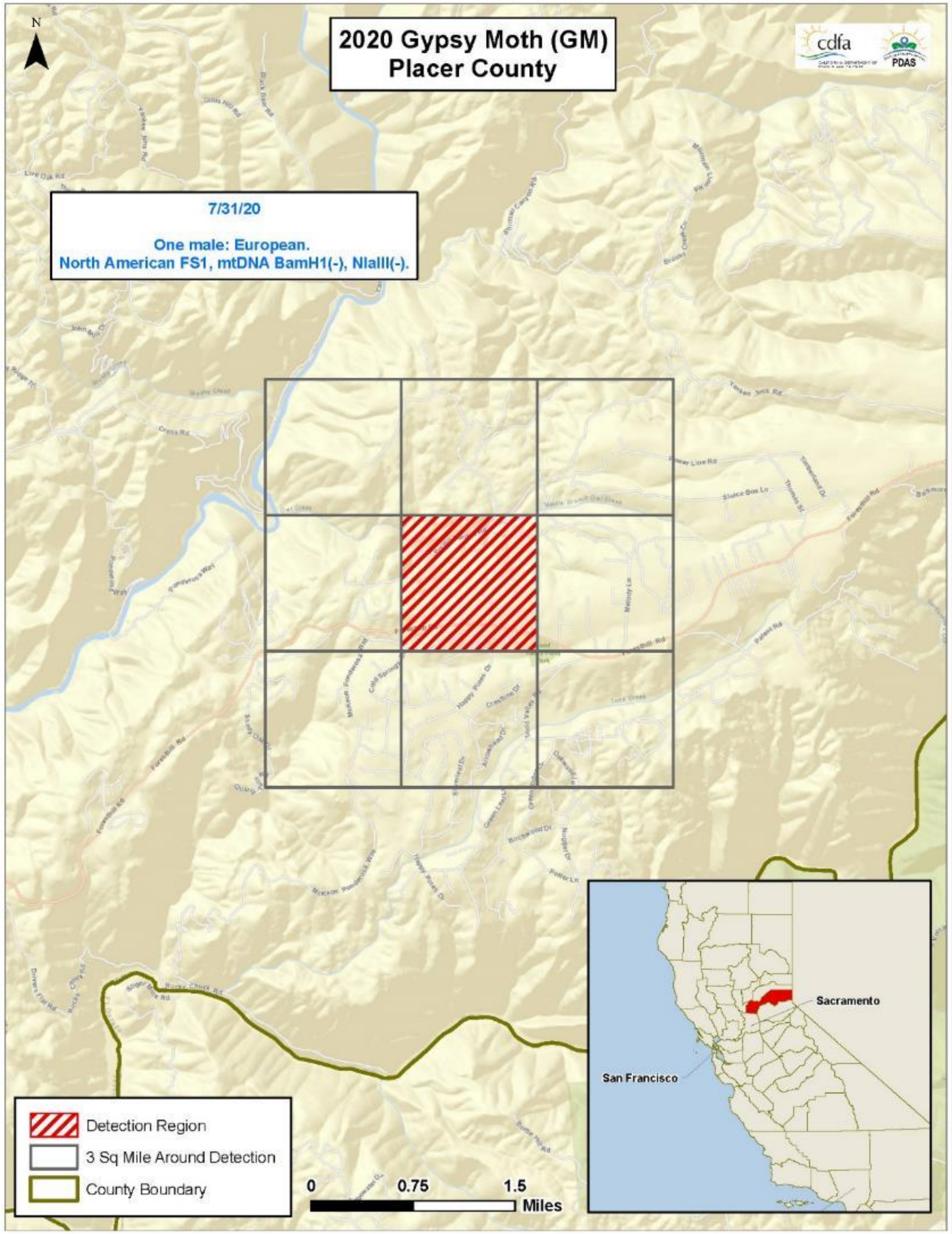
- Asian Gypsy Moth
  - One male trapped in 2017 and one in 2018.
  - Delimitation trapping completed in 2021 with no detections!

California 2020

Placer County

Foresthill

- 1 male at rural residential roadside
- Eur/NA Strain
- Delimitation in place

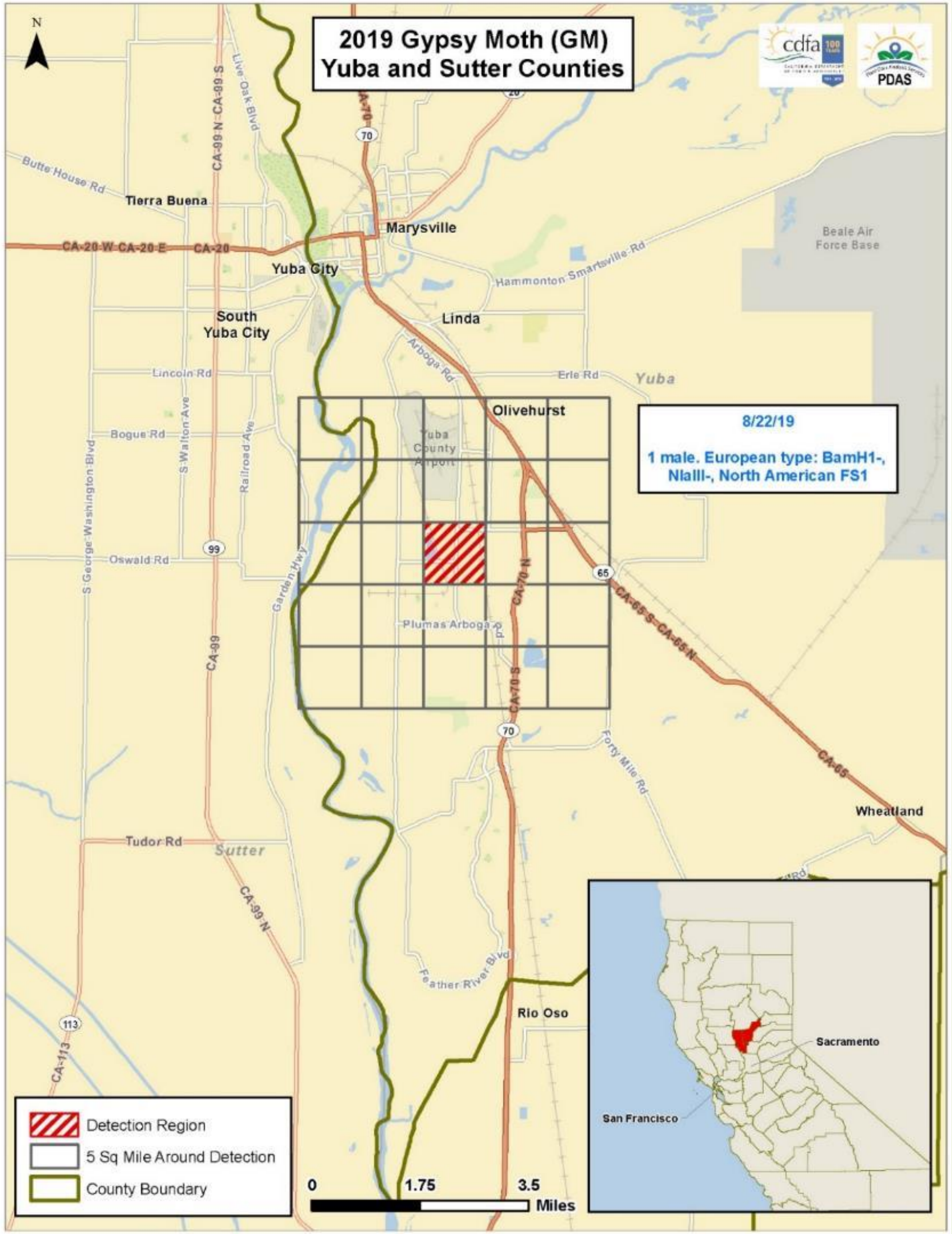


California 2019

Yuba County

Olivehurst

- 1 male at residence
- Eur/NA Strain
- Delimitation in place
- No additional finds



Spotted Lanternfly

- ❖ *Lycorma delicatula* (White) (Hemiptera: Fulgoridae)
- ❖ Large (up to 25 mm long) & colorful
- ❖ Native to East Asia
- ❖ Feeds on Tree of Heaven (*Ailanthus altissima*), but also GRAPES

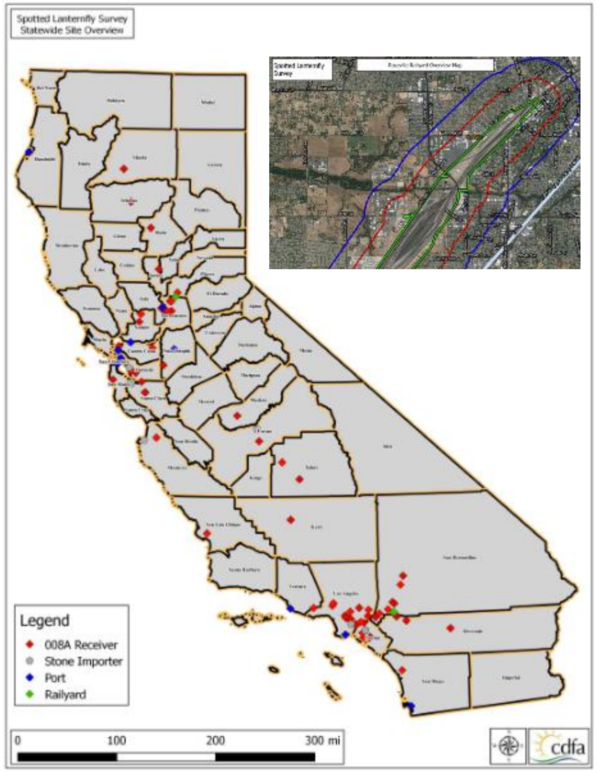
Photos: Lawrence Barringer, PA Dept of Ag, Bugwood.org

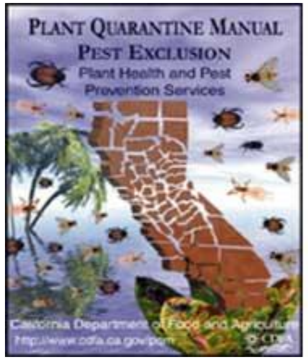
Why should you care about SLF?

Spotted Lanternfly

- Moves between the landscape and grapes (including forest borders)
- Over 100 known hosts including; maples, oaks, walnuts and willows
- Human-mediated dispersal more similar to gypsy moth, regulatory challenges.
- Kills grapes; a key CA crop
- *Significant nuisance*

What We Are Doing





- Risk-Based Survey conducted in 2020 and 2021
- 454 High-risk sites surveyed in 2021
- Master Gardener Sentinel Program
- Harmonized State Exterior Quarantine
- Biocontrol research grant to UC-Riverside

Photos: Liu & Mottern 2017 *J. Insect Sci*.

Thank you!

Questions? Contact Joanna Fisher at joannal.fisher@cdfa.ca.gov

California Forest Pest Council

2021 Annual Business Meeting

Agenda

1. **Approve 2020 Minutes**
2. Remembrance of Tom Gordon
3. Treasurer's Report – Steve Jones
4. Election of Council Officers & Members at Large
5. Appointments
6. Don Dahlsten Memorial Scholarship
7. Chairman's Report
8. Task Forces: PCTF (Kim) FWTF (Curtis), OMTF (Chris)
9. New Business / Resolutions

California Forest Pest Council

2021 Annual Business Meeting

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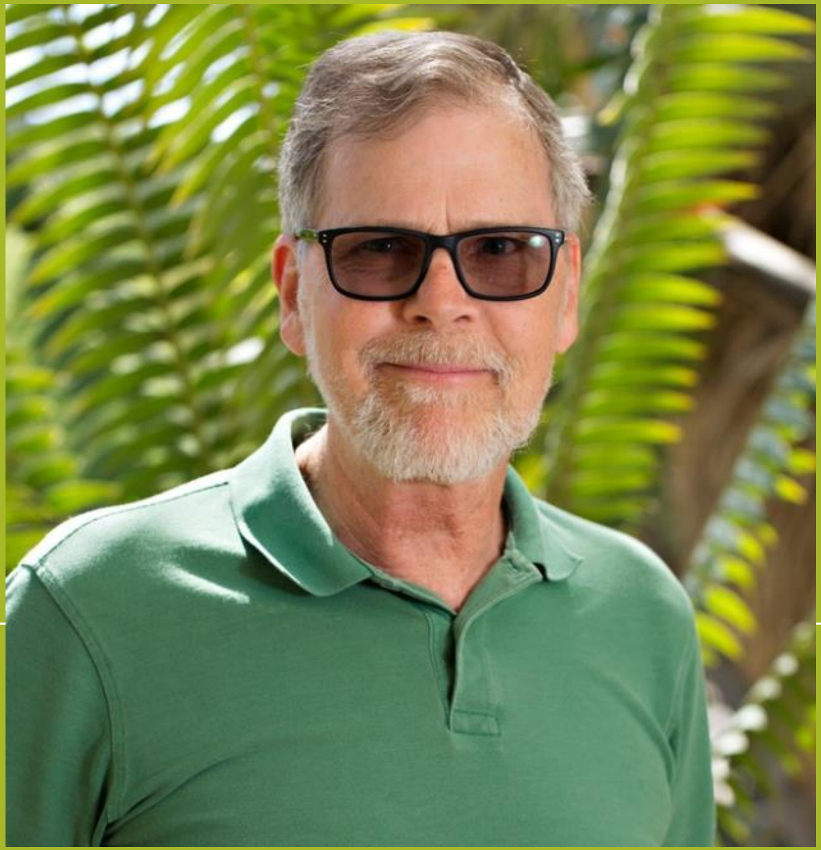
In Loving Memory of
Thomas R. Gordon

In Loving Memory of
Thomas R. Gordon



In Loving Memory of
Thomas R. Gordon

California Forest Pest Council

2020 Annual Business Meeting

Agenda

1. Approve 2020 Minutes
2. Remembrance of Tom Gordon
3. **Treasurer's Report** – Steve Jones / Audit

As of Nov. 16, 2021the bank balances are as follows:

- Calif. Forest Pest Council Checking & Savings: $86,343.72
- Calif. Oak Mortality Task Force: Checking & Savings = $37,902.49
- Pitch Canker Task Force: Checking = $14,683.89
- Firewood Task Force: FWTF grant has expired and final reimbursement of $4,812.70 has been received and is included in the CFPC checking balance.

2020 Audit on Jan. 28, 2021 by Tom Smith & Scott Carnegie: *Steve Jones continues to do an incredible job as the treasurer for CFPC and his service and work are greatly appreciated. His records are impeccable and easy to follow and review. His work has been invaluable to the organization.*

California Forest Pest Council

2021 Annual Business Meeting

Agenda

4. Election of Council Officers:

- **Members at Large (3) –** one-year term (current: Ted Swiecki, Akif Eskalen, Mark Stanley

- **Chairperson** – two-year term (current: Bob Rynearson)
- **Vice Chair** – two-year term (current: Scott Carnegie)
- **Secretary** – two-year term (current: Kim Corella)

November 18, 2021 Nominations: relect all

California Forest Pest Council

2020 Annual Business Meeting

Agenda

5. Appointments:

- Council Treasurer – ***Steve Jones***
- Audit Comm.: **Chris Lee & Scott Carnegie**
- Editorial Comm. Chair *(CAL FIRE):* ***Tom Smith***
    - Editor-in Chief – ***pending***
- 2022 Annual Meeting Program Chair: ***pending***

California Forest Pest Council

2021 Annual Business Meeting

Agenda

1. Approve 2019 Minutes
2. Remembrance of Tom Gordon
3. Treasurer's Report –
4. Election of Council Officers
5. Appointments
6. **Don Dahlsten Memorial Scholarship** – no 2021 award, resume in 2022
7. Chairman's Report
8. Task Forces: PCTF (Kim) FWTF (Curtis), OMTF (Chris)
9. New Business / Resolutions

California Forest Pest Council

2020 Annual Business Meeting

Agenda

1. Approve 2019 Minutes
2. Remembrance of Tom Gordon
3. Treasurer's Report
4. Election of Council Officers
5. Appointments
6. Don Dahlsten Memorial Scholarship
7. **Chairman's Report**
8. Task Forces: PCTF (Kim) FWTF (Curtis), OMTF (Chris)
9. New Business / Resolutions

7. Chairman’s Report

Board of Forestry & Fire Protection’s

2021 Francis Raymond Award to

The California Forest Pest Council

Nominated by Nor Cal Society of American Foresters

Award Ceremony December 8, 2021

During Board of Forestry’s virtual meeting

Weed Committee 2021 Field Tour

North Sierra – Placerville, CA

Robb Fecko, CFPC Weed Comm. Secretary

Steve Kafka, CFPC Weed Comm. Chairman

Weed Committee 2022 Field Tour
June 27 & 28, 2022

Sacramento Canyon – Mt. Shasta, CA

Camila Quintana, CFPC Weed Comm. Secretary

Steve Kafka, CFPC Weed Comm. Chairman

California Forest Pest Council

2020 Annual Business Meeting

Agenda

1. Approve 2019 Minutes
2. Remembrance of Tom Gordon
3. Treasurer's Report –
4. Election of Council Officers
5. Appointments
6. Don Dahlsten Memorial Scholarship
7. Chairman's Report
8. **Task Forces: PCTF (Kim) FWTF (Curtis), OMTF (Chris)**
9. New Business / Resolutions

California Forest Pest Council

2020 Annual Business Meeting

Agenda

1. Approve 2019 Minutes
2. Remembrance of Tom Gordon
3. Treasurer's Report –
4. Election of Council Officers
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6. Don Dahlsten Memorial Scholarship
7. Chairman's Report
8. Task Forces: PCTF (Kim) FWTF (Curtis), OMTF (Chris)
9. **New Business / Resolutions: CFPC letter to HSU**

Effects of pitch canker at Pt. Reyes National Seashore

Characterizing the Impact of Land Ownership on Post-Wildfire Forest Recovery in the Sierra Nevada Mountains, California

Connor Stephens[1], Brandon Collins[2], and John Rogan[3]

Department of Forest and Wildlife Ecology, University of Wisconsin-Madison[1]
Department of Environmental Science, Policy, and Management, UC Berkeley [2]
Graduate School of Geography, Clark University[3]

Trends in California Wildfires

The dry mixed conifer forests of California's Sierra Nevada, are presently burning at a rate and severity far outside of their historic range of variability

-High severity fire effects within individual fires only accounted for <10% of annual burned area prior to European settlement whereas they presently account for than 25-40% (Brown et al. 2008, Mallek et al. 2013)

-The U.S. Forest Service manages 57% of California Forestlands while private timber companies manage 14%. (California Forests, 2018).

Why Monitoring Forest Regeneration?

It is important to track and compare post-wildfire regeneration patterns as they can impact ecosystem services such as:

1. **Water Purification** (Miller et al. 2003)
2. **Carbon Sequestration** (Johnson et al. 2005, Liang et al 2017)
3. **Habitat Quality** (Jones et al. 2016)
4. **Human Welfare\Fire Risk** (Kramer et al. 2018)

Does Land Ownership Impact Post-Fire Regeneration?

The post-fire management paradigms implemented by these two landownerships have been shown to be grouped into 2 generalized categories: Relatively "Active" and "Passive".

1. **Private Timberlands (Active):** Typically managed for maximum sustained timber yield.
   - Expansive salvage logging
   - Seedling planting
   - Chemical vegetation control
   - Forest thinning

2. **National Forests (USFS, Passive):** Typically managed with an emphasis on minimizing human impact on landscape.
   - Reduced salvage logging
   - Increased reliance on natural regeneration
   - Lack of stand maintenance/follow-up treatments

Does Land Ownership Impact Post-Fire Regeneration?

Both paradigms have be criticized

1. **Criticisms of Active Management Paradigm:**
    - Reduced tree and understory plant species diversity
    - Exacerbated soil compaction
    - Degraded habitat quality
    - Delayed understory regeneration

2. **Criticisms of Passive Management Paradigm:**
    - Increased abundance of coarse and fine woody debris
    - Increased likelihood of subsequent high severity wildfires
    - Retention of hydrophobic soil layer
    - Extirpation of non-severe fire adapted species

Research Gap: Both management paradigms have been studied, however their impacts on forest regeneration have rarely been directly compared.

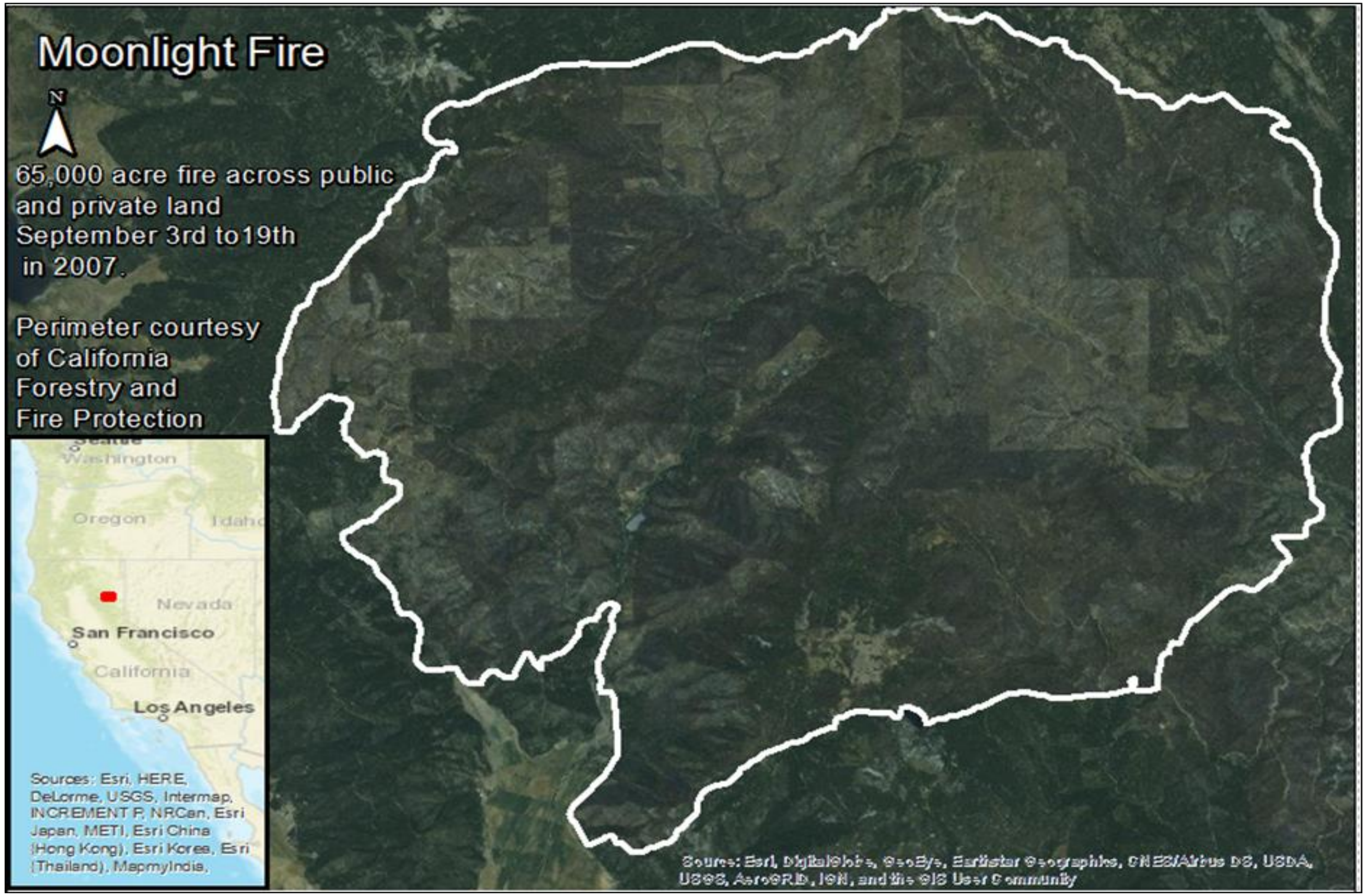
Analysis Outline

Goal: Directly compare trends in post-fire forest regeneration resulting from both active and passive post-fire management paradigms.

General Methodology:

- Selection of a suitable study area (fire) whose ownership/management paradigms are relevant and well documented.
- Track revegetation across management paradigm by implementing an annual spectral unmixing time series analysis.
- Implement a 2-step time series analysis (immediate pre-fire - 2007, 11 years post fire - 2018) of forest structure to provide context on current successional pathways.
- Evaluate for differences in trends forest regeneration across management paradigm

Study Area

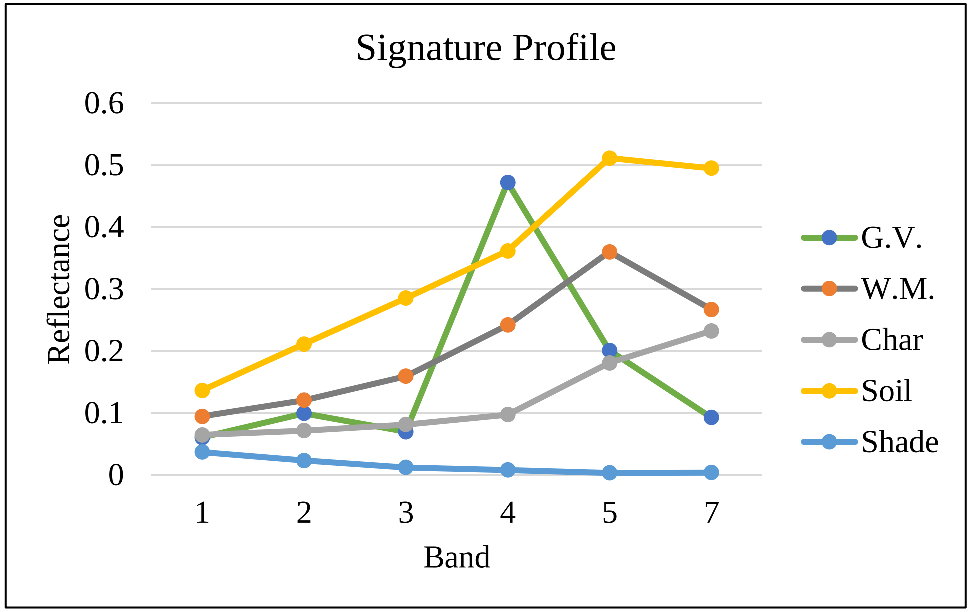


2007 Moonlight Fire

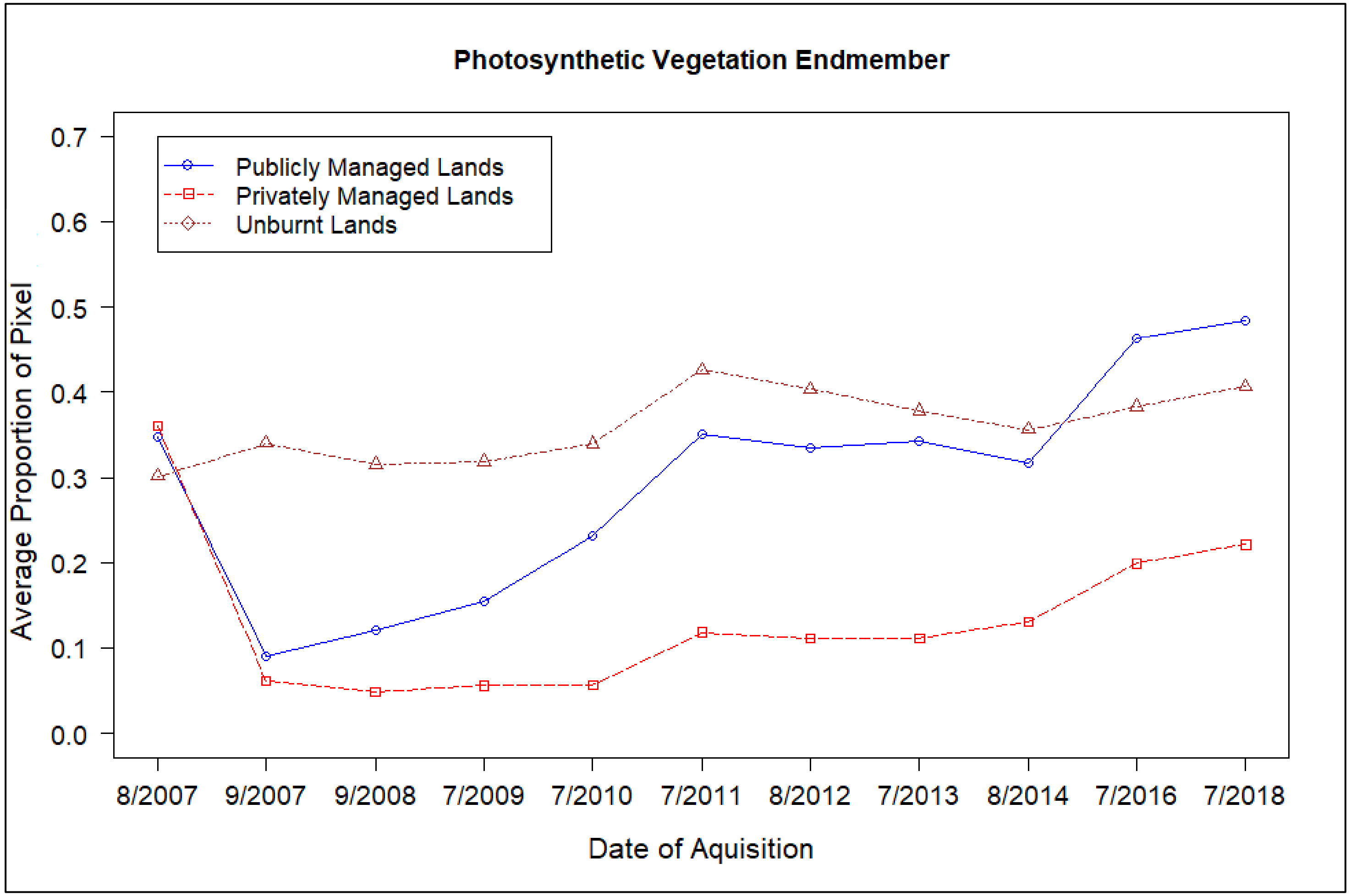
Spectral Unmixing Analysis: Methods

- 5 biophysical endmembers were unmixed to represent landscape conditions.
- Endmember values were averaged across land ownership class by time point allowing for trends in abundance to be compared.

Endmembers	Source	Year
Green Vegetation	JFS Spectral Library	2007 - 2018
Woody Materials	JFS Spectral Library	2007 - 2018
Soil	Image Derived	2007 - 2018
Shade	Image Derived	2007 - 2018
Burnt Area	JFS Spectral Library	2007, 2008



Trends in Green Vegetation Regeneration



Forest Structure Classification Analysis: Methods

- 2 step time series analysis of forest structure was implemented (2007, 2018).

- 5 landcover types were classified. These were selected based on the classical model of coniferous forest succession as described in Oliver and Larson (1990).
  - “Forb/Rock/Soil”
  - “Shurb Dominant”
  - “Young Forest”
  - “Mature Forest – Closed Canopy”
  - “Mature Forest – Open Canopy”

- The Random Forest algorithm was selected to conduct classification.
  - ~600 ground control points were created (120/landcover class)
  - ~100 ground control points taken with handheld GPS, ~500 digitized using NAIP imagery

Forest Structure Classification Analysis: Methods

“Forb/Soil/Rock”

“Mature Forest – C.C.”

TPH: 407.72 (114.69)
Tree Height(m): 14.85 (3.53)
Tree DBH(cm): 31.41 (7.47)

“Shrub Dominant”

TPH: 64.81 (119.49)
Tree Height(m): 0.95 (0.35)
Shrub Height(m): 0.82 (0.25)
% Shrub Cover: 90.0 (9.0)

“Mature Forest – O.C.”

TPH: 244.27 (35.72)
Tree Height(m): 21.27 (7.89)
Tree DBH(cm): 39.23 (15.79)

“Young Forest”

TPH: 440 (-)
Tree Height(m): 2.13 (-)
Tree DBH(cm): 2.54 (-)

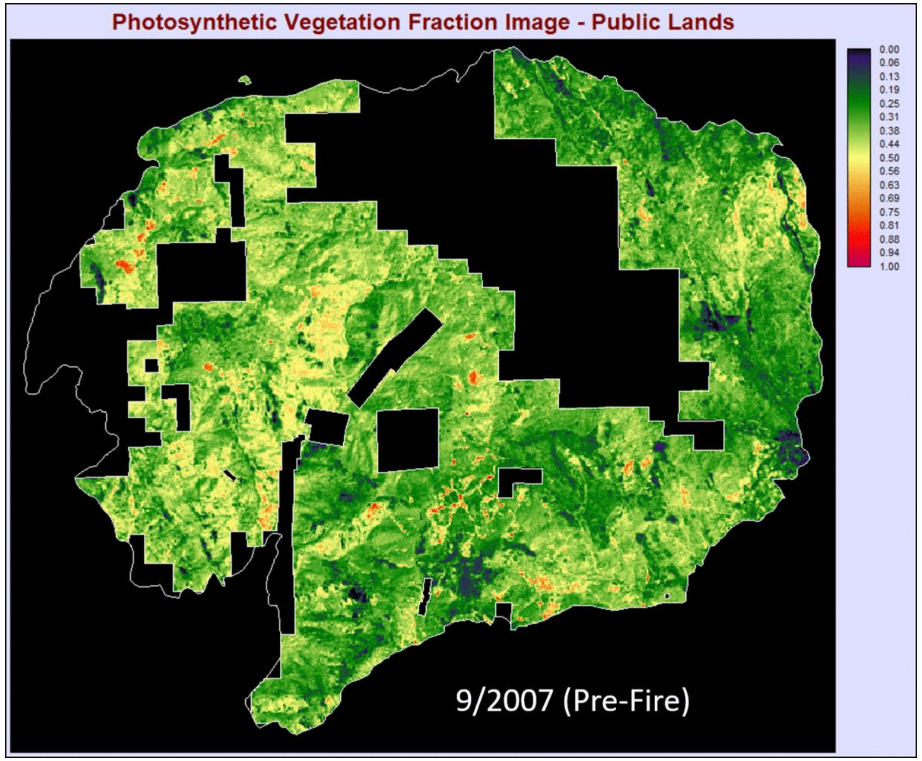
Property Boundary

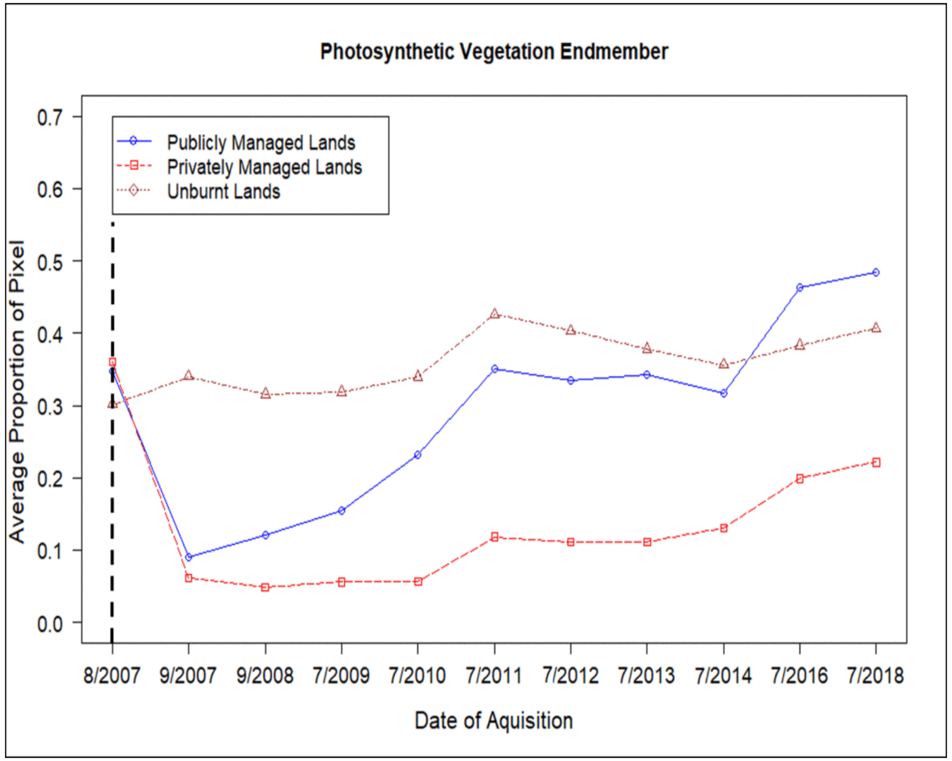
Forest Structure Classification Analysis: Data

Dataset	Coverage	Resolution	Year
TM/ETM+ Optical Bands	Full	30 m	2007, 2018
Unmixed Endmembers	Full	30 m	2007, 2018
NDVI	Full	30 m	2007, 2018
SAVI	Full	30 m	2007, 2018
(NDVI-SAVI)	Full	30 m	2007, 2018
Elevation	Full	30 m	2007, 2018
Slope	Full	30 m	2007, 2018
LiDAR-Derived % Canopy Cover	Federal Only	30 m	2018
Sentinel-1 Surface Texture Products	Full	30 m	2018

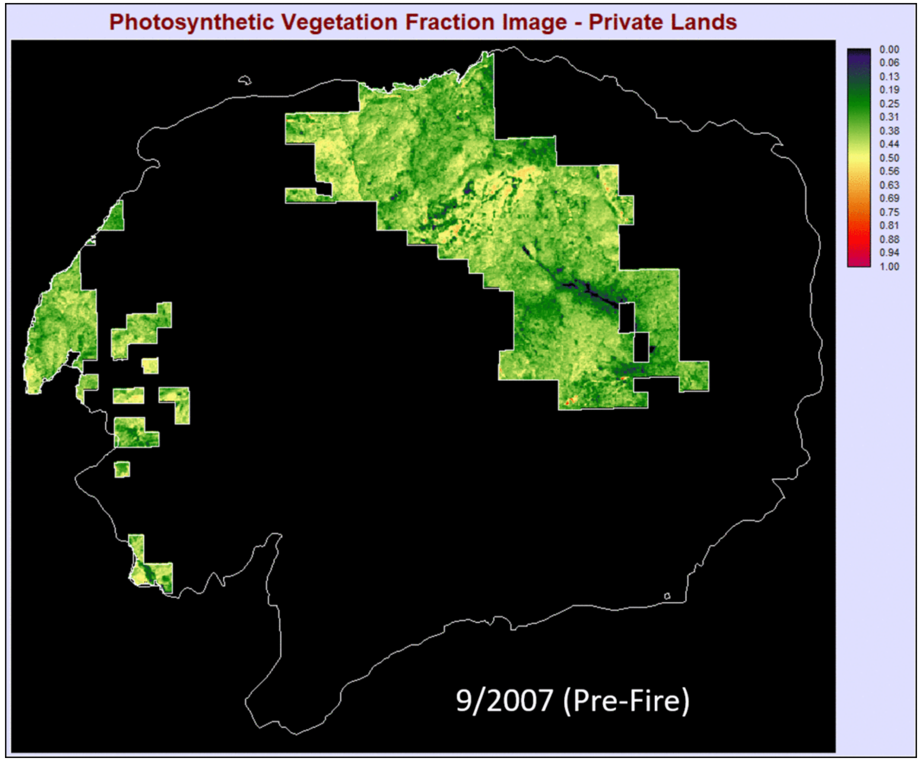
- Datasets were selected using the framework outlined by Franklin (1995).

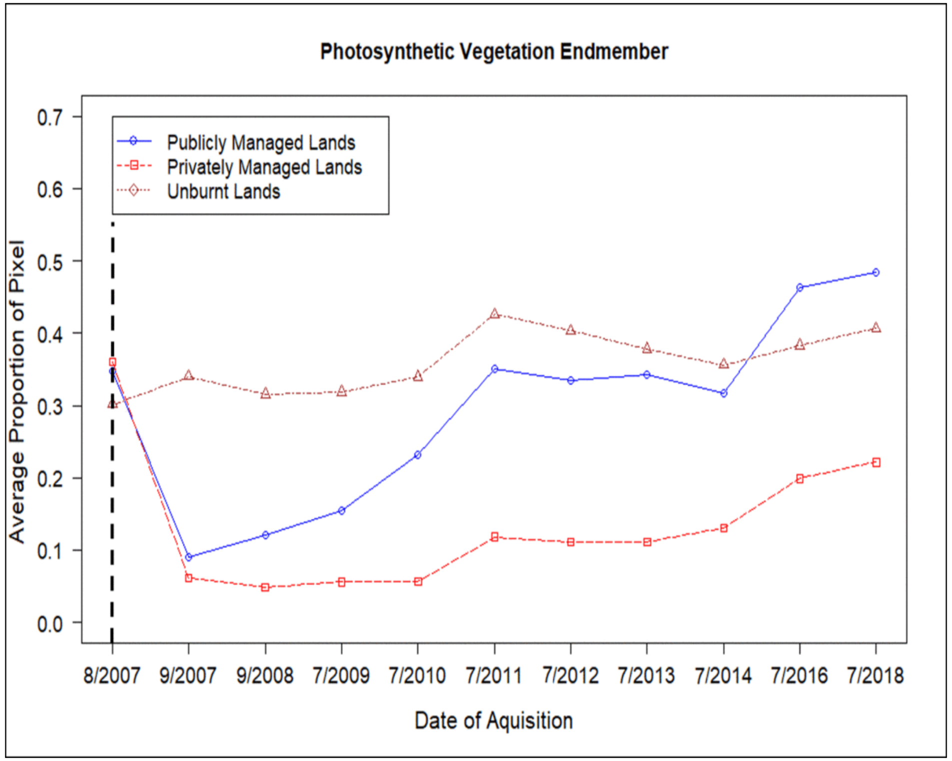
Trends in Green Vegetation Regeneration: Public Lands





Trends in Green Vegetation Regeneration: Private Lands





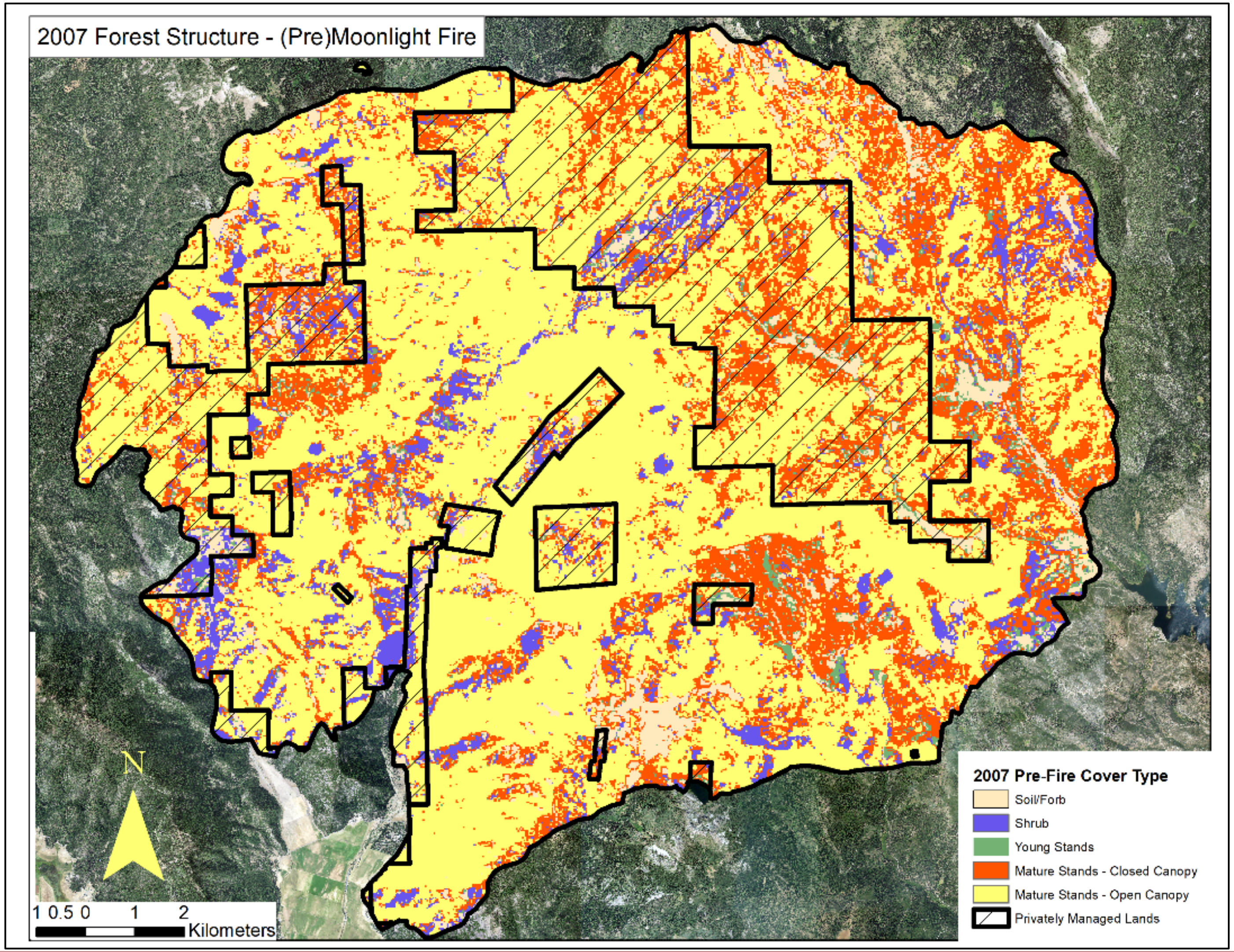
Forest Structure Classification Analysis: Model Results

- Model Out of Bag Error Rates (OBO) were 10.01% (2007) and 9.76% (2018) respectively

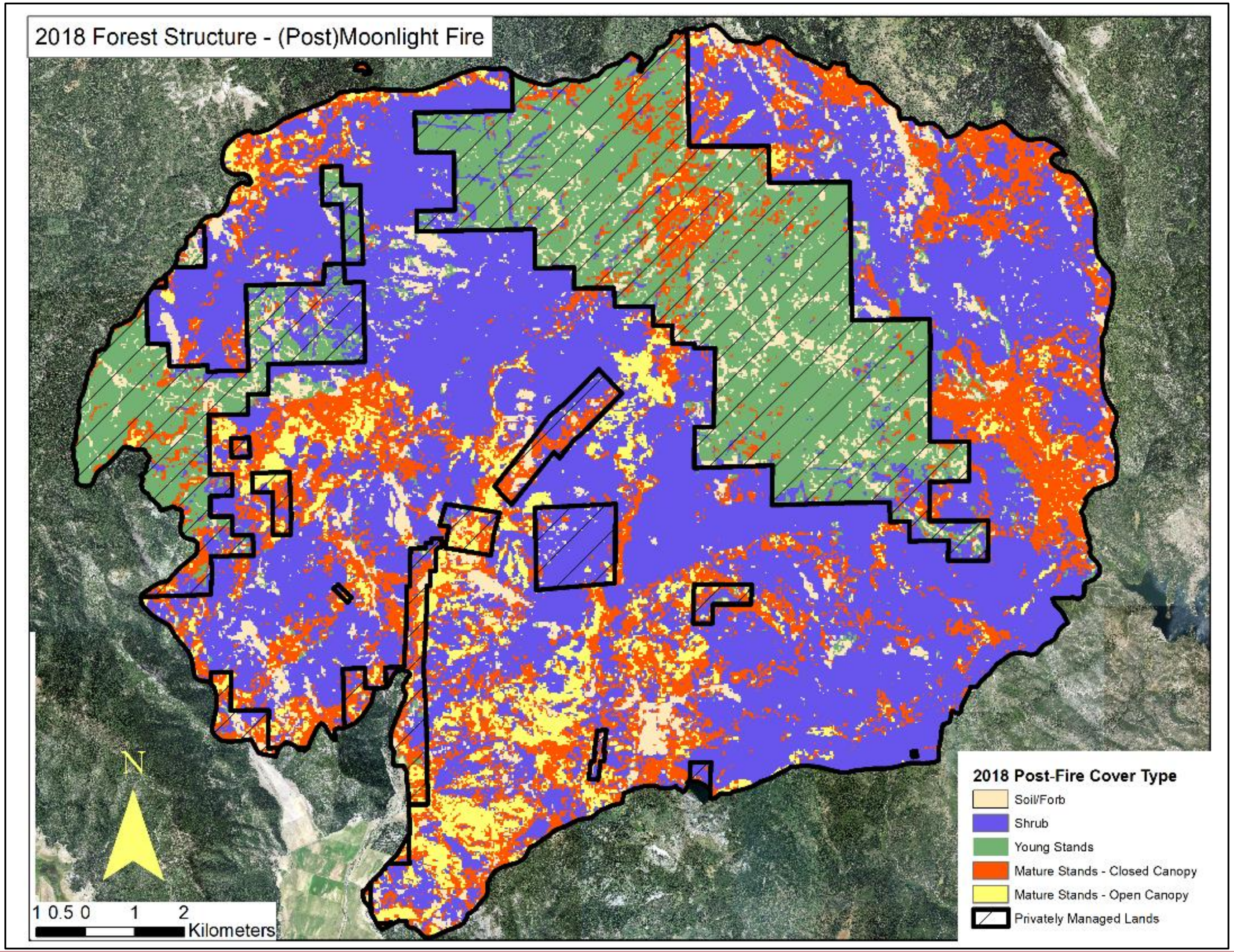
Agreement Matrix (%): Ground Control Point Landcover Class Assignment vs. Random Forest Classification Assignment

GCP Class Assignment	**Random Forest Class Assignment**				
	Forb/Soil/Rock	Shrub Dominate	Young Forest	M.F. Closed Canopy	M.F. Open Canopy
Forb/Soil/Rock	68.3	10	16.7	5	0
Shrub Dominate	0	98.3	0	1.7	0
Young Forest	1.6	0	96.7	1.6	0
M.F. Closed Canopy	1.5	6.2	3.1	89.2	0
M.F. Open Canopy	0	0	0	15	85

Forest Structure Map: 2007(Pre-Fire)

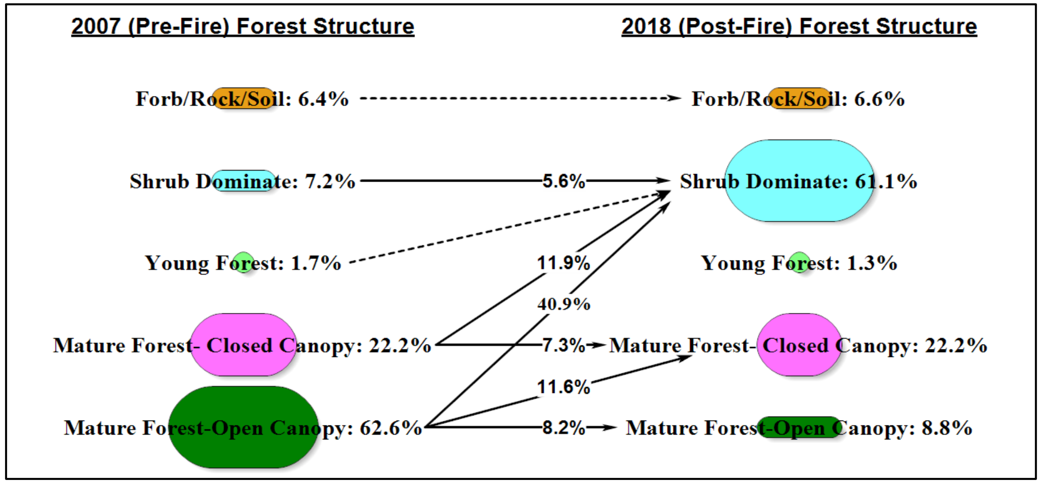


Forest Structure Map: 2018

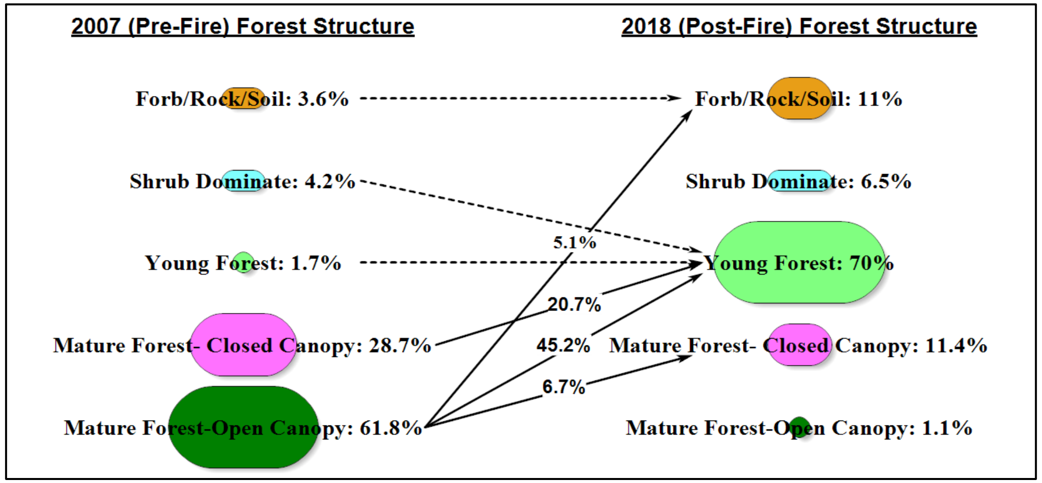


Forest Structure Classification Analysis: Results

Transitions in Publicly Owned Lands



Transitions in Privately Owned Lands



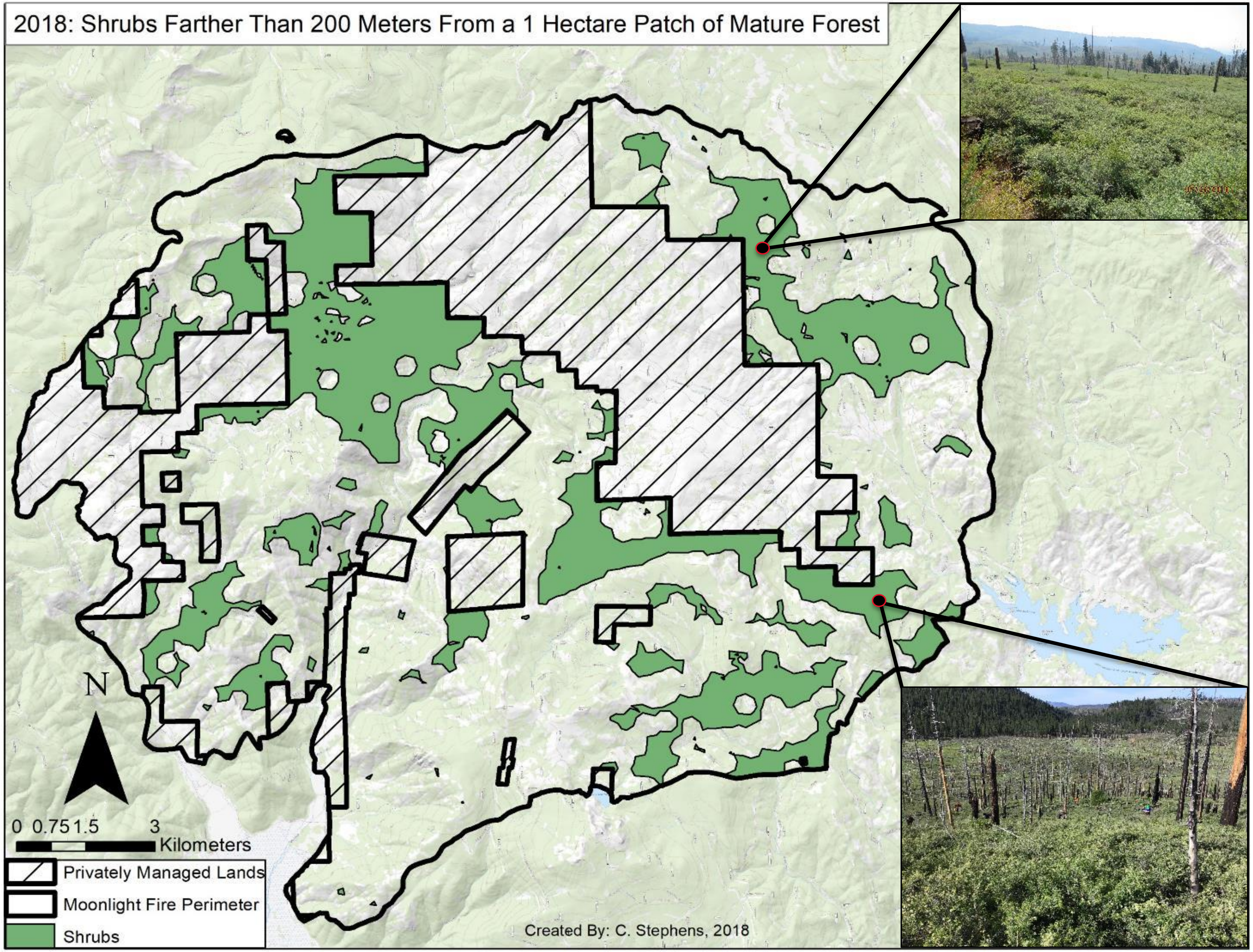
Major Findings:

Privately Owned Lands:

- 78% of privately owned lands transitioned from mature forests to another landcover type over the 11 years post fire.
- 72.8% of mature forests lost on privately owned lands transitioned to the "Young Forest" landcover type.

Publicly Owned Lands:

- 53.8% of publicly owned lands transitioned from mature forests to another landcover type over the 11 years post fire.
- 98.1% of mature forests lost on publicly owned lands transitioned to the "Shrub Dominant" landcover type.
- ~47% of shurblands are located greater than 200 meter from a 1 ha patch of mature forest, reducing their likelihood of being naturally regenerated.



2018: Shrubs Farther Than 200 Meters From a 1 Hectare Patch of Mature Forest
N
0 0.75 1.5 3
Kilometers
Privately Managed Lands
Moonlight Fire Perimeter
Shrubs
Created By: C. Stephens, 2018

Major Findings:

- Management actions taken on privately owned lands appear to have more successfully regenerated conifers than those taken on publicly owned lands.

- Control of competing vegetation seems to have played an important role in this success.

- Public lands revegetated far more quickly than would be ecologically rational for coniferous regeneration.

- While an active post-fire management paradigm may have better facilitated the regeneration of conifers, is it worth the documented ecological consequences? Can the two systems be integrated to capitalize on their respective strengths?

Acknowledgments

- Edna Bailey Sussman Foundation - Funding
- Daniel Forester and the USFS field crews – Field Data
- Ryan Thompson, USFS – Forestry Expertise
- W. M. Beaty Land Managers – Management Data
- Spaital Informatics Group – Ancillary Imagery

Sources

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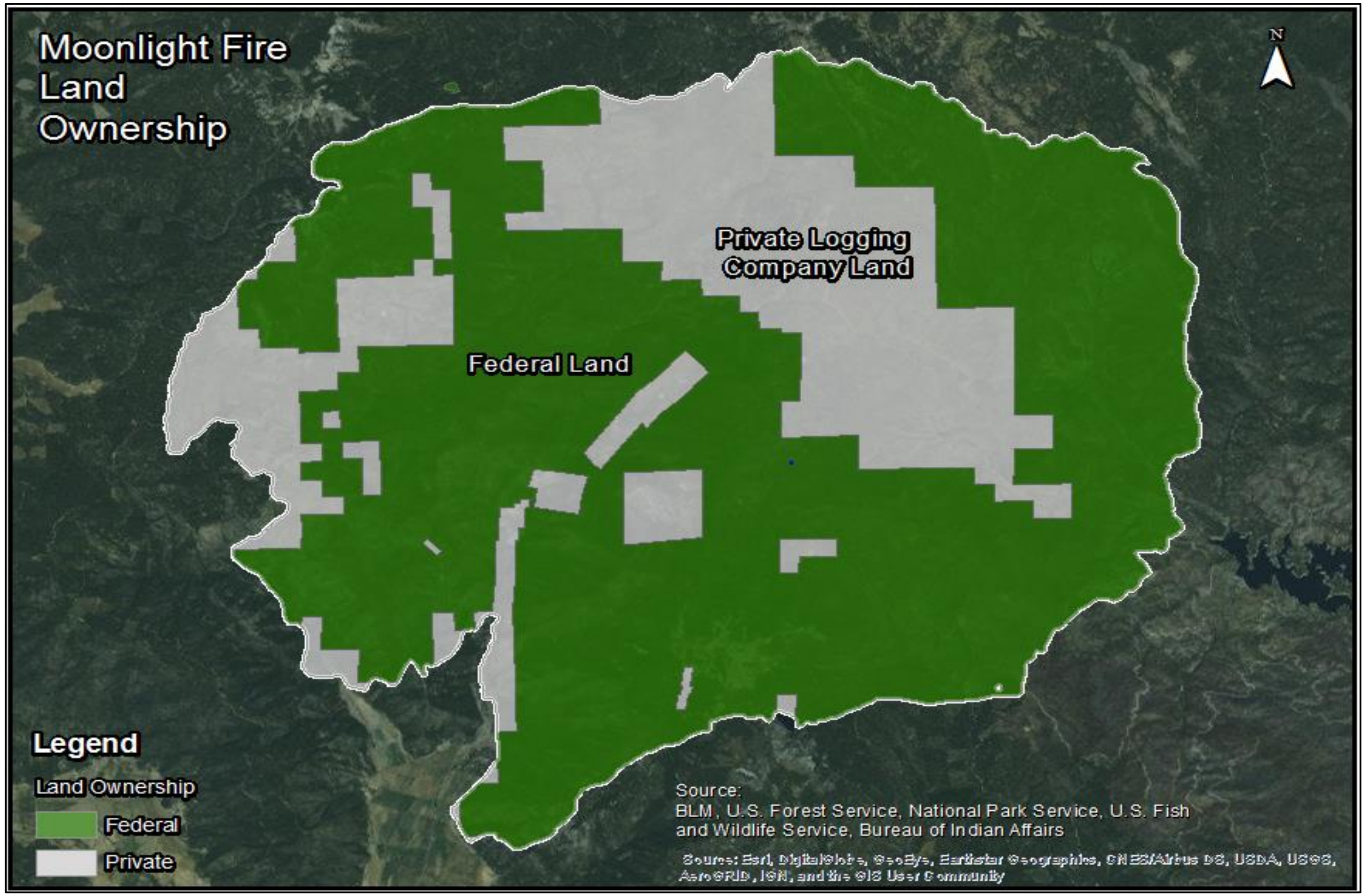
Supporting Information

Study Area



2007 Moonlight Fire

Spectral Unmixing Analysis: Data

Timepoint Represented	Date of Acquisition	Sensor
2007 (Pre-Fire)	2007-AUG-22	Landsat 5 TM
2007 (Post-Fire)	2007-SEP-16	Landsat 5 TM
2008	2008-SEP-09	Landsat 5 TM
2009	2009-JUL-26	Landsat 5 TM
2010	2010-JUL-29	Landsat 5 TM
2011	2011-JUL-25	Landsat 5 TM
2012	2012-JUL-26 2012-AUG-11	Landsat 7 ETM+
2013	2013-JUN-27 2013-JUL-13	Landsat 7 ETM+
2014	2014-AUG-17 2014-SEP-02	Landsat 7 ETM+
2016	2016-JUL-05 2016-JUL-21	Landsat 7 ETM+
2018	2018-JUL-11 2018-JUL-27	Landsat 7 ETM+

Resolution:
30 m (~0.1 HA)

- **Landsat scenes used to represent the 11 years post fire (2007 - 2018)**
- **Years 2015 and 2017 are missing due to cloud-free data availability**

Forest Structure Classification Analysis: Model Results

- Model Out of Bag Error Rates (OBO) were 10.01% (2007) and 9.76% (2018) respectively

Predictor Variable Rank	2007 Model	2018 Model
1	(NDVI-SAVI)	(NDVI-SAVI)
2	TM Band 3 (Red)	ETM+ Band 7 (SWIR)
3	TM Band 2 (Green)	ETM+ Band 3 (Red)
4	TM Band 4 (NIR)	% Canopy 0.15-0.5m
5	TM Band 5 (SWIR)	ETM+ Band 2 (Green)

Agreement Matrix (%): Ground Control Point Landcover Class Assignment vs. Random Forest Classification Assignment

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M.F. Closed Canopy	1.5	6.2	3.1	89.2	0
M.F. Open Canopy	0	0	0	15	85


Phoradendron densum
(leafy mistletoe) on
Sargent cypress

Solistalgia: Forest landowners, post-fire regeneration, and loss

Susie Kocher, University of California Cooperative Extension Forestry Advisor, California RPF #2874

Lulu Waks – University of California Cooperative Extension, Sonoma County

Lynn Huntsinger – Professor of Range Ecology and Management, University of California Berkeley CRM #80

Consequences of Fire Suppression

Spaulding Lake in Nevada County, 1919 and 1993. Source: Gruel 2001

Sierra Nevada Mixed Conifer

Much is overcrowded and fire prone

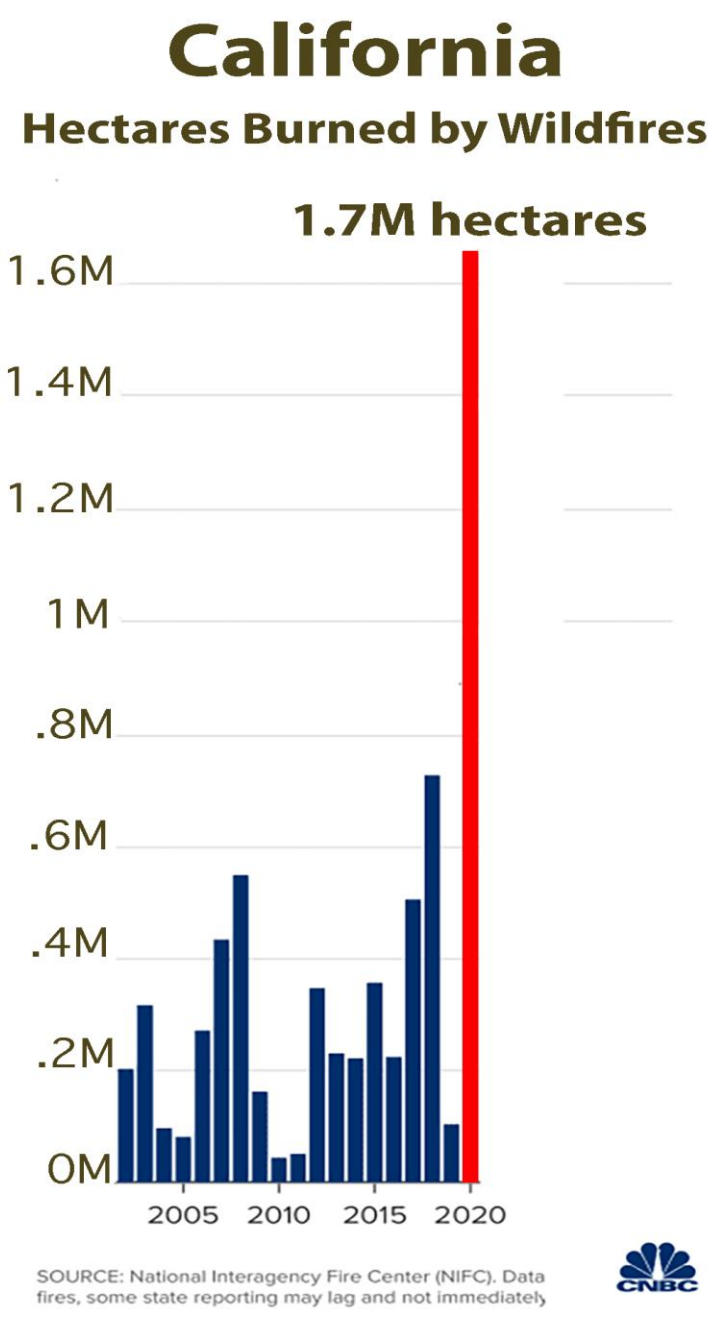
- Areas are 100 years without fire
- Fires not ‘natural’ - high severity fire increasing
- Forest regeneration can be blocked by lack of seed source and competing brush

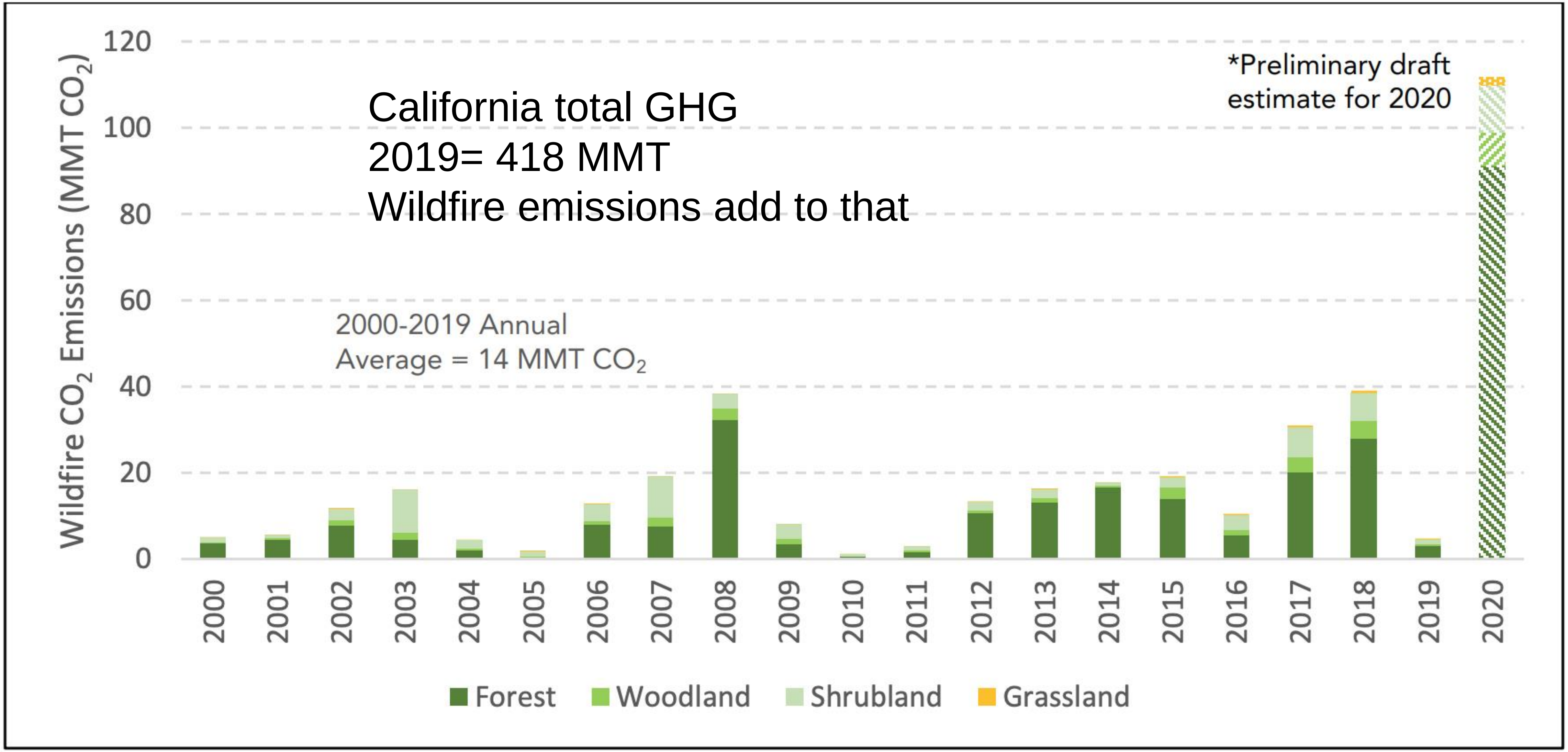
Sierra Nevada: 150-200 million dead trees from drought

This effect could result in a 15 percent to 20 percent increase in tree death for each additional degree of warming

(Bales and Goulden)

Photo PSW


California
Hectares Burned by Wildfires
1.7M hectares
1.6M
1.4M
1.2M
1M
.8M
.6M
.4M
.2M
0M
2005
2010
2015
2020
SOURCE: National Interagency Fire Center (NIFC). Data
fires, some state reporting may lag and not immediately
CNBC



**Preliminary draft estimate of 2020 wildfire emissions will be updated and revised when CAL FIRE's final fire perimeters become available in mid-2021.*

Forest Carbon Plan Goal 3.1.3

Restore ecosystem health of wildfire and pest impacted areas through reforestation

Study Area

2014: Mixed conifer forest ½ burned at high severity, >90% loss of trees

-65% national forest land, 35% in private ownership, mostly a large timber company

-75 smaller family forest owners, 2,500 acres 1,600 acres needed replanting

California Forest Practices Act does not require replanting after major disturbance like fire or bark beetle mortality - only after timber harvest

Goal: to understand landowner:

-experience following high-severity wildfire

-decision-making on post-fire vegetation management

-experience with reforestation assistance programs

-Ideas about climate change and reforestation

Assistance from a local Resource Conservation District

-reforest all small private lands together using same approach, contractors and funds

-CalFire grant of $1.9 million from Greenhouse Gas Reduction Funds (from CA's Cap and Trade program)

-RCD handled contracting – landowners only needed to sign a right of entry form

Post-salvage logging site conditions

-merchantable trees removed

-slash and sub-merchantable trees left

-logging may pay for site clean up - but may not

-fire salvage timber glut - market is typically bad

Site prep needed after dead tree removal

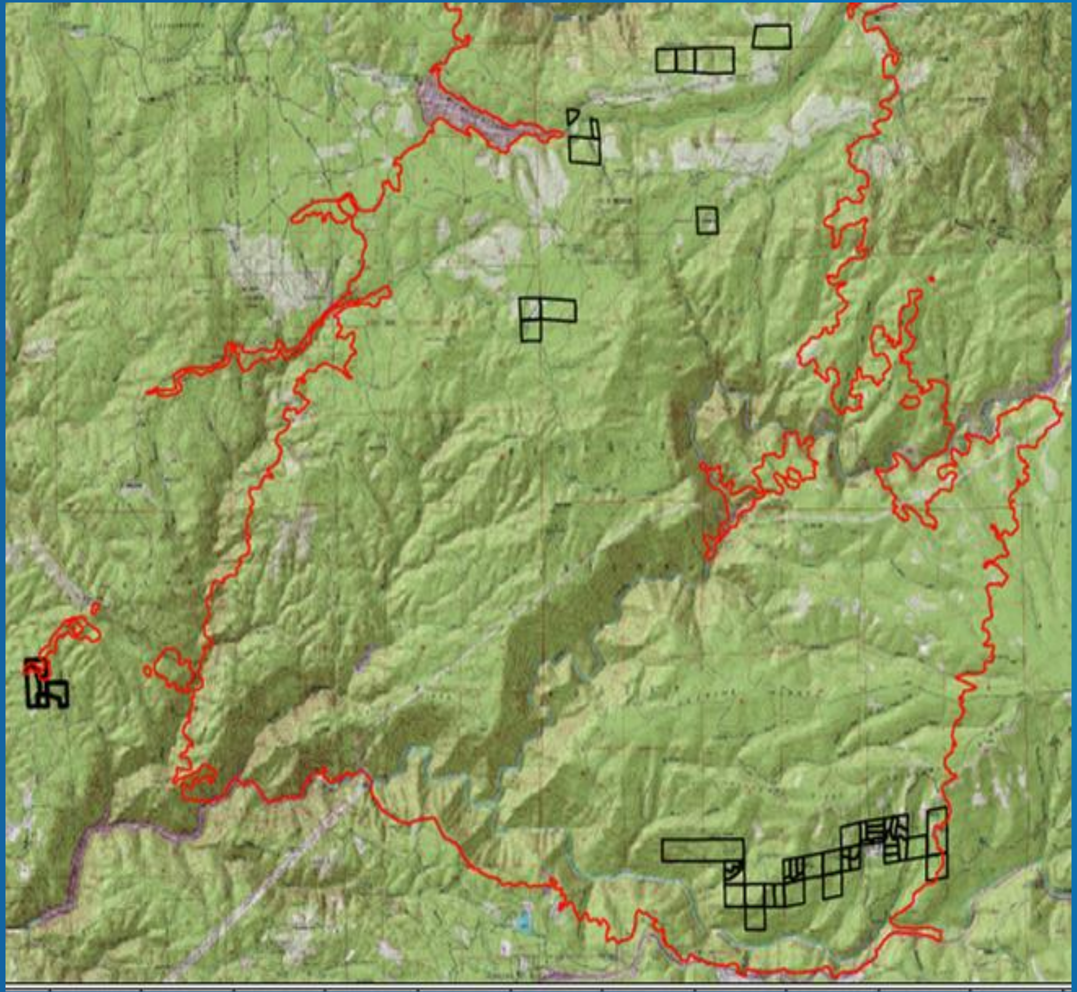
2 years – some done - slash and sub-merchantable trees removed

3 years later – deerbrush resprouts, can slow tree regrowth by decades.

Study Methods
Qualitative

- Lulu Waks – range management masters student at UC Berkeley
- 2017: Interviewed landowners on site and over the phone
- Semi-structured open-ended questions
- Recorded interviews, transcribed and coded using Dedoose qualitative software

Landowners



-46 landowners

-38 participating owning 1,390 acres

-27 interviewed (2 non participants)

-3 participants, 5 non participants unreachabl

-7 participants refused interview

-Age 41-80, majority 60s -70s

-Some college to PhD

-Income variable <$20,000 ->$250,000

- Acreage <10 to 160, most 10-40

-Land uses:

Primary/secondary residences

Recreation, Investment

Limited timber production

Results

- Alternatives to reforestation grant
- Impacts of delays
- Why reforest?
- Solistalgia
- Climate change adaptation

Results – Alternatives to reforestation grant

- 1/3rd would have taken no reforestation actions at all because didn't have equipment, funds, energy or knowhow

Reforestation strategy without grant	#	Acres owned
Sign up for an individual grant program (CFIP/EQIP)	8	470
Do the work themselves or hire contractors	9	240
Take no reforestation action	9	250

Individual grant – “*we're talking about tens of thousands of dollars to put up an advance like that.*”

DIY - “*Do my own mechanical clearing, go to battle with the weeds, and plant 20 trees one summer, plant 20 trees the next.*”

(Rich Pedroncelli / Associated Press)

Nothing - *“If that grant had not come through, we would be doing nothing.”*

Results – impacts of delays

- All glad to have a free reforestation program
- Concerned about delay - emotional impacts and need to battle shrubs

government … timetable doesn't match the biological timetable. … created a lot more work for themselves by being so slow to implement the thing…

I see it all coming back and then it's compromised again.

USDA-FS

“

Results – Why reforest?

- -All wanted to re-establish forest on their properties.
- -Frequently wanted to ***put things back the way they were before*****.**
- -Aesthetics, improved air quality, greenhouse gas reduction, wildlife habitat, erosion control, the benefit to future generations, increased land value, and love of trees.

I want to leave something for my kids to have - some trees -…. it's really a good investment...”

…a brush field of manzanita and ceanothus. Very little for the …bears and deer….

CSERC

…a timber environment, …the natural environment prior to the fire, is the right way to go…

We want everything back*… We want to do as much as we can to make it as close as possible*

Results – Emotional impacts

Solastalgia *- existential distress caused by environmental change*

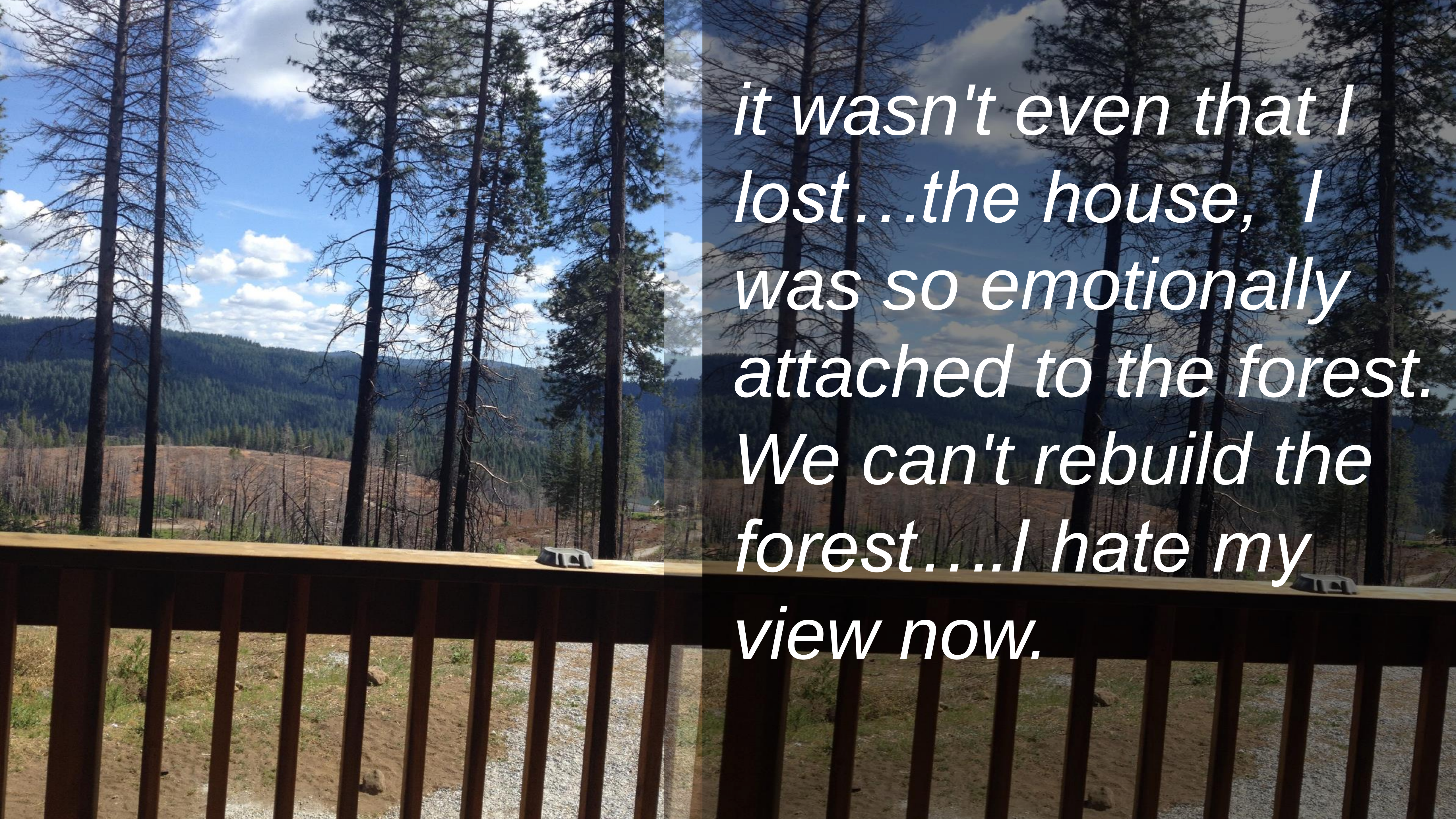
-Major life-disrupting event

-Some focus on landscape rehabilitation right away

-Some on clearing debris, restoring wells, power, grading roads, planning and rebuilding homes

-On-going sadness over loss of landscape

-Landscape and emotional healing were talked about as connected


it wasn't even that I lost…the house, I was so emotionally attached to the forest. We can't rebuild the forest….I hate my view now.

There's nothing pleasurable about going back there now. There's no forest…We used to sit outside and watch – One of my favorite things to do was to sit out on the deck... It was just stunning. We'll never have that again.

it was the trees that really broke my heart. Trees that I grew up with.

Results – Climate change

Sierra Nevada Research Institute UC Merced

- -Most agreed it was happening but split on cause
- -None thought about how it should affect reforestation plans or species, foresters did use lower planting densities, plan for more fire resilient characteristics
- What could my small property have to do with it?
- Want it back

….they say we are gradually warming...
I think that all the species up here
….will generally survive … absent a
major beetle infestation….they're fairly
well-adapted.

It’s pretty scary – bark beetles and drought - it's nasty. So I think because of that, I'm not sure what species are going to be the most resilient.

It’s hard for me to think about climate change in terms of my property.
I think of climate change globally.

….based on climate change, how would we plant our land? No, we have not even thought about that.

Conclusions

- Strong desire to put things back the way they were

  “reforestation is an expression of the human spirit”

- Some not able to reforest without the grant program.
- Concerns about project delay were both ecological and emotional.

Conclusions

The third party grant recipient model appears successful

-increased acres reforested and amo of carbon sequestered to mitigate climate change

(R. York, Cal Ag)

RESEARCH ARTICLE

J. For. 117(1):30–37
doi: 10.1093/jofore/fvy071

fire & fuels management

Landowner Perspectives on Reforestation following a High-Severity Wildfire in California

Lulu Waks, Susan D. Kocher, and Lynn Huntsinger

We interviewed 27 nonindustrial forest landowners whose properties burned in a wildfire in California's central Sierra Nevada in 2014 about postfire reforestation and local and government-assisted reforestation programs. All wanted to reforest, but a third would not have without the free reforestation program offered by the Resource Conservation District. The rest would have tried to do the work themselves or pursued other programs despite complicated logistics and high upfront costs. Many experienced distress, or "solastalgia," at the loss of forest and wanted to "put the forest back the way it was" as quickly as possible. This may limit reforestation suited to climate change. Reforestation is a way of assuring carbon sequestration and regrowth, and may have an important role in helping to heal the emotional distress of those who have lost their forests to wildfire.

forestland was owned by 202,000 NIPF landowners (USDA Forest Service 2018). Most landowners owning 494 acres or less value their land for its natural amenities and as a financial investment more than as an ongoing source of income (Ferranto et al. 2011). These landowners may not have the time, capital, or expertise to reforest on their own, particularly considering the

Thank you!

Questions?

Contact Susie Kocher, sdkocher@ucanr.edu

http://ucanr.edu/forestry

Questions

- How long have you owned the property?
- How many acres is the property?
- Has your property been harvested before?
- What do you use the property for?
- How has your use of the property changed since the fire?
- How much of your property burned?
- What have you done to your property since the fire?
- What are your primary concerns regarding your land?
- At what point was it possible to start thinking about managing your land for recovery?
- Do you think reforestation is important? What kinds of trees do you want to replant? Why?
- What do you think about climate change? Does climate change impact your decisions about what to replant?
- What did you think of the offer to reforest from the Resource Conservation District? What would you have done without it?

POC Root Disease education

United States Department of Agriculture

Burgeoning Biomass: Opportunities to improve forest health

Debbie Page-Dumroese (Research Soil Scientist)
USDA Forest Service Rocky Mountain Research Station

Outline

- Defining soil health and some threats
- How to increase soil carbon/organic matter in forest soils
- Biochar opportunities
- Benefits

What is soil health?

- 42 attributes identified (e.g., carbon, pH, water holding, nitrogen, infiltration, fungi, etc.)
- Chemical, physical, and biological, and environmental flux properties

Soil organic matter content is key across all health measures

The triple threat to soil health

Forest Health

Climate change, insects, diseases, drought

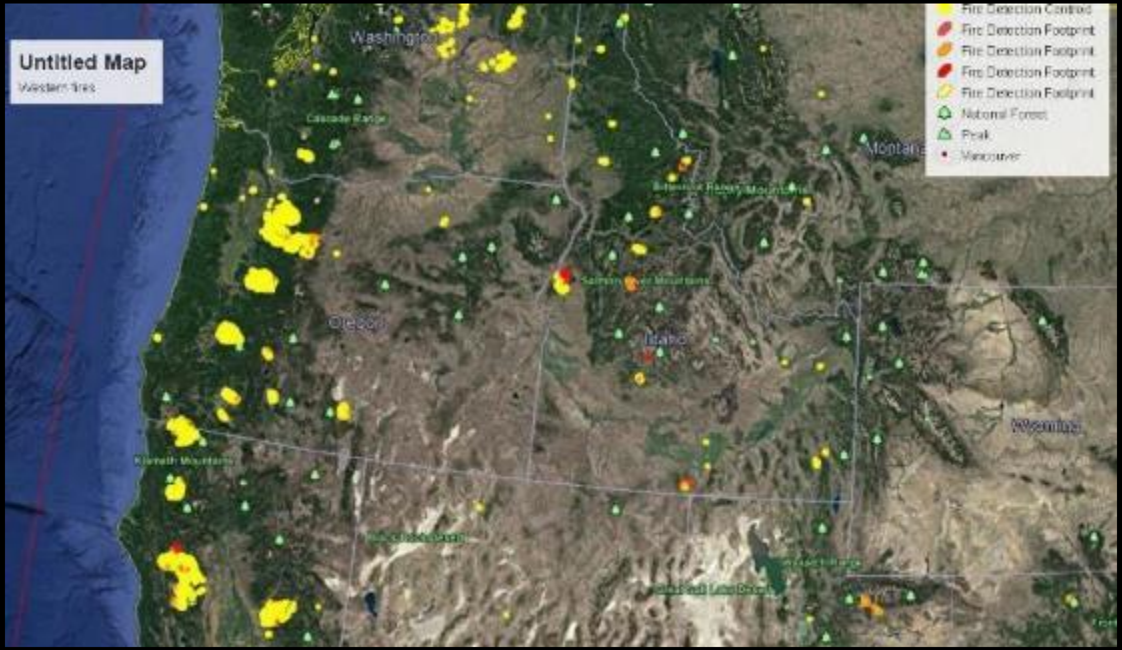
Low value wood

Open burning, Coarse wood

Loss of Organic Matter

Erosion, no vegetation

Threat 1: Forest health



CalFire FHP Nov 2021

- Longer, more severe wildfire season
- Increased insect, disease, drought
- Overstocked stands
- Bioenergy markets don’t cover most of the west
- Small-diameter material not valued
- Limited acceptance of prescribed fire

Threat 2: Low value wood (slash pile burning)

CalFire FHP Nov 2021

Large slash pile burns can result in:

- Legacy of burn scars
- Loss of OM
- Nutrient volatilization
- Few trees or shrubs
- Often non-native species

Threat 3: Degraded soil

- Contaminated
- Overused, low organic matter soil
- Rocky (lost topsoil)
- Compacted or rutted

These result in:

- Degraded water quality, erosion (wind and water), and human health concerns

Soil health and organic matter

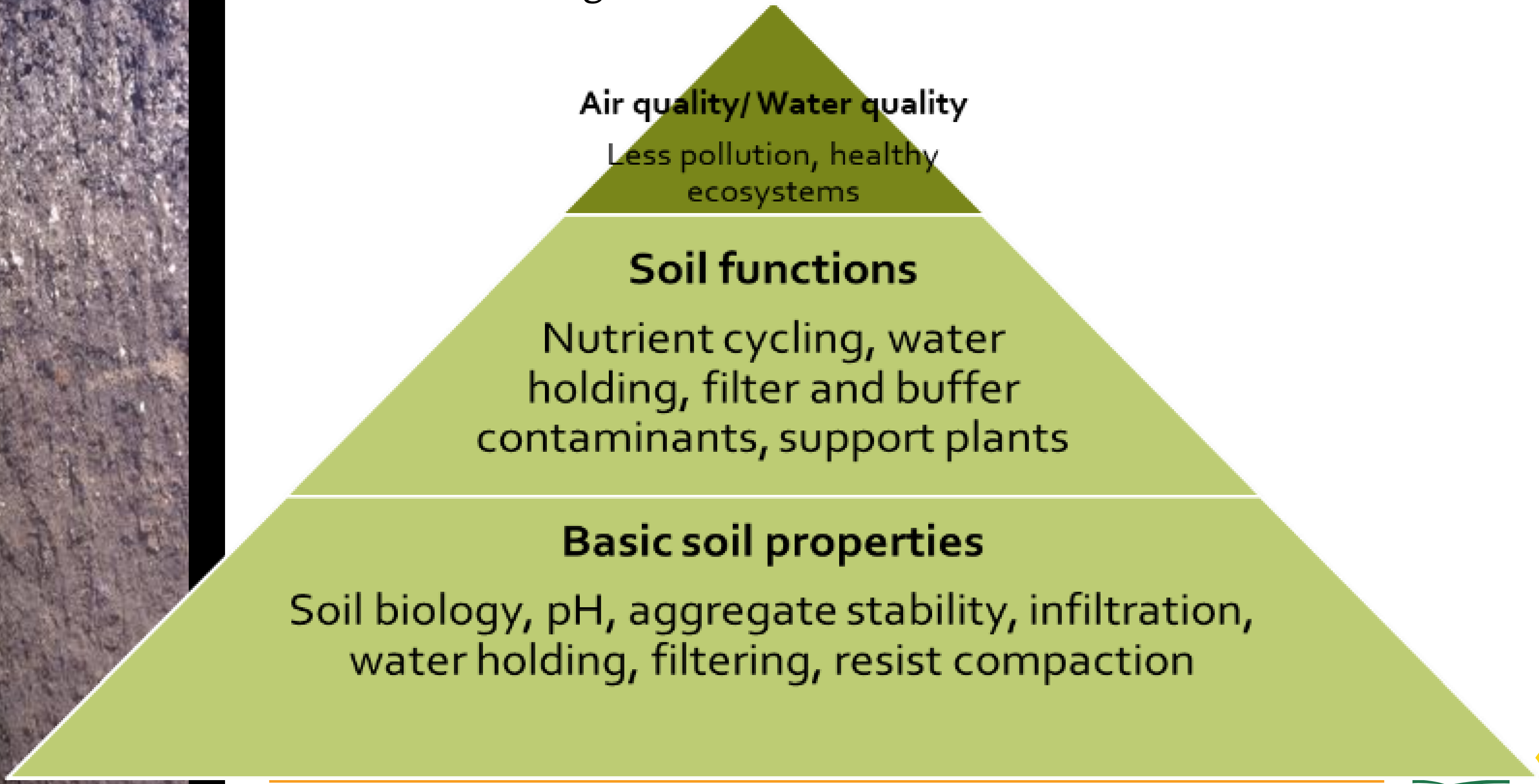
Forest soils

- Slower rate of change
- Climate smart forest operations
  - Harvest operations maintain or increase soil C and organic matter
- Healthy wildland soils:
  - Grow healthy forage
  - Raise healthy animals
  - Provide healthy forests and ranges
  - Resilient to climate change

What does it take to change soil health?

Add organic matter

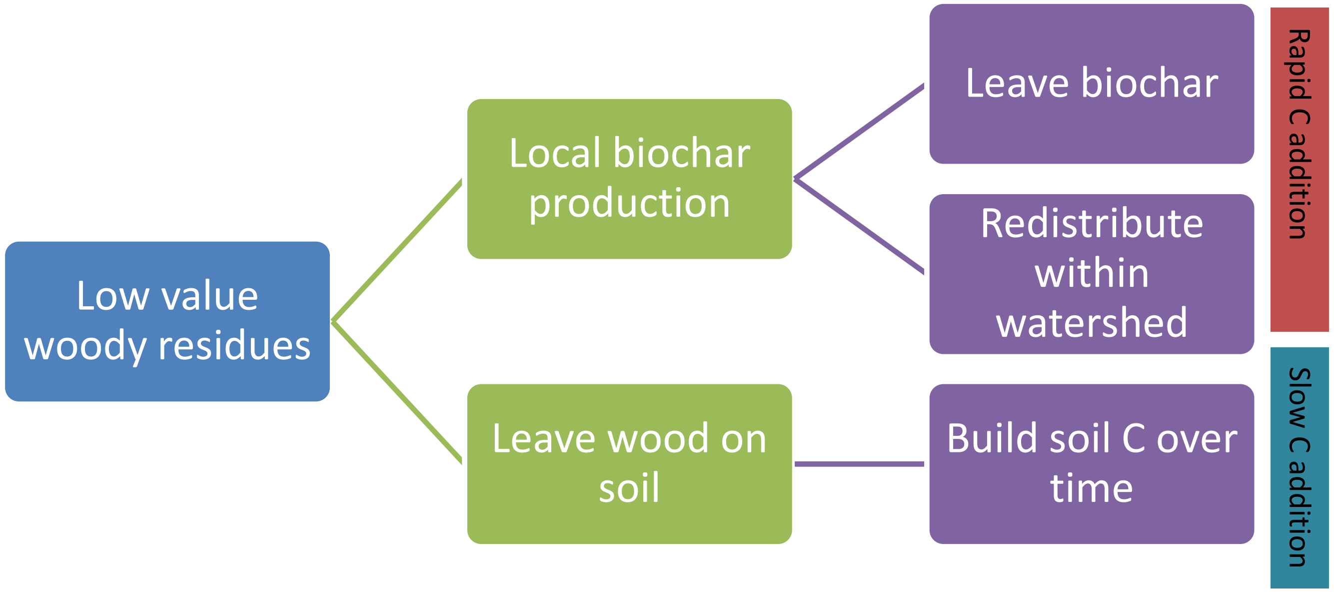
- Composts
- Manure
- Cover crops
- Biochar, wood chips, biosolids
- Intact organic horizons



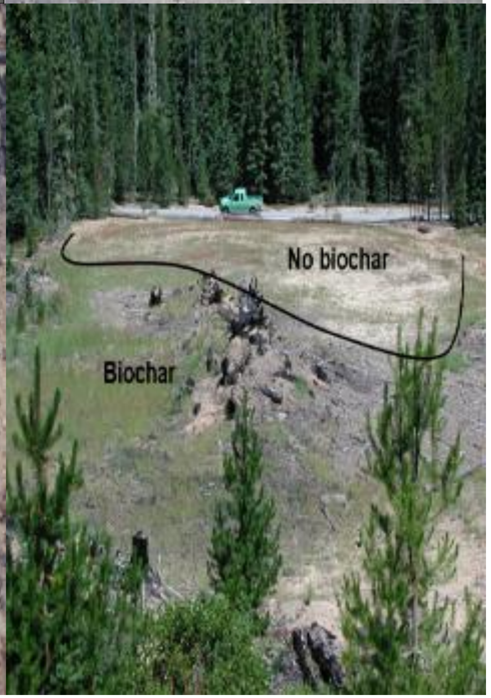
Forest harvest residues – balancing act

- Too much biomass
- Often burned in slash piles
  - Smoke and particulate emissions
  - Soil impacts
- Difficult to handle
- Not uniform shape and size
- Low bulk density
- High transportation costs

Organic matter or biochar? Two ways to soil health



Making biochar on-site: Slash piles



- Jack Daniels rick piles create 'biochar' for filtering whiskey
  - Easily extinguished or self-extinguishing
- Similarly created forest biochar can be made on-site and used as a soil amendment
- Heat dissipated away from the soil
- Char increased soil cover and moisture holding

Making biochar on-site: Kilns

- Kilns hold 10 cubic yards of tightly packed wood
- Produce about 660 pounds of 'low' (25%) carbon biochar in 2 days
- Wood volume reduced by 65%; mass reduced 71%
- Not as uniform as fast pyrolysis
- Can be driven over to crush
- Good for forest restoration

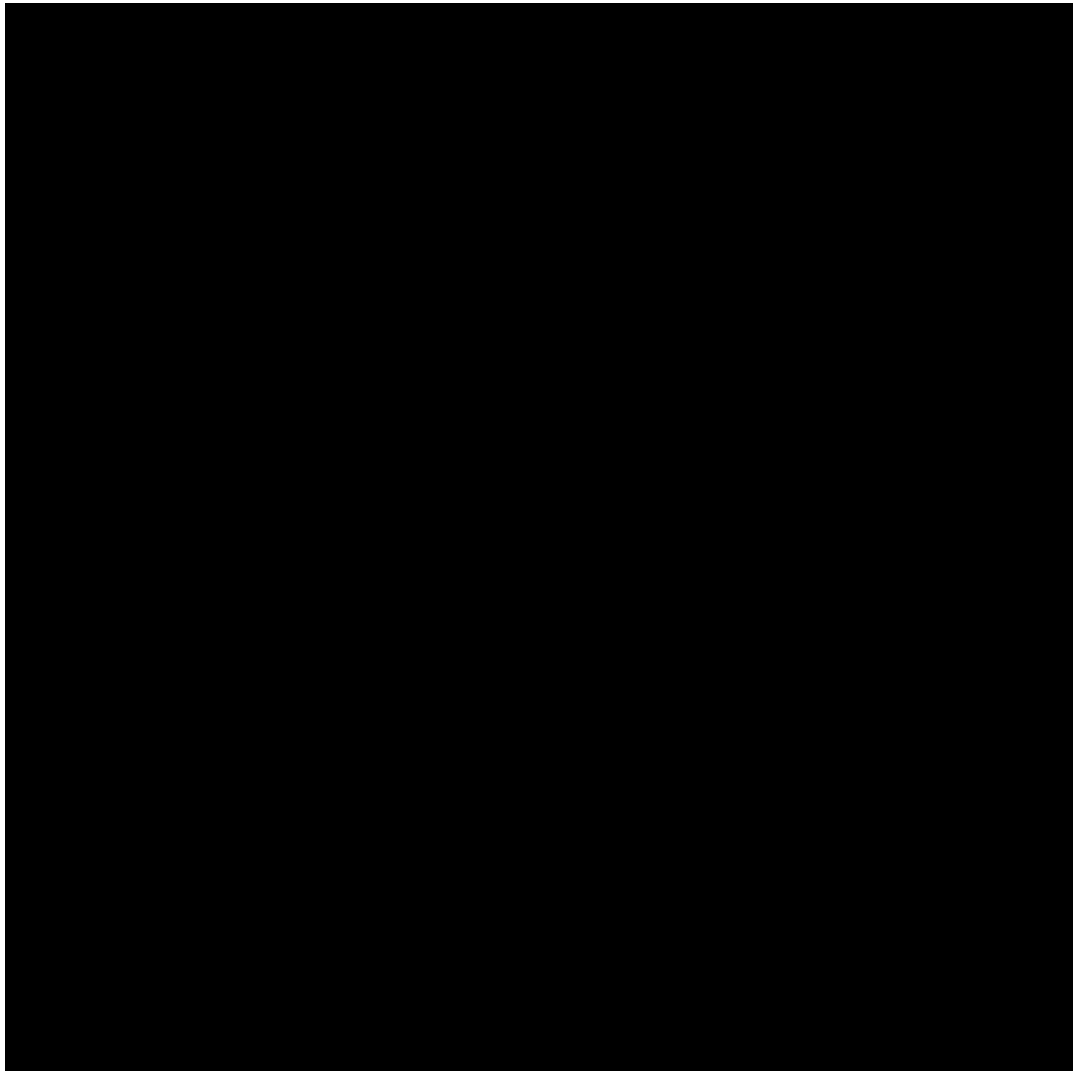
Making biochar on-site: Kilns

- Big Box Kilns: Developed by Darren McAvoy (Utah State University)
- Ring of Fire Kilns: Developed by Kelpie Wilson (Wilson Biochar)

Making biochar on-site: Air curtain burner (retooled)

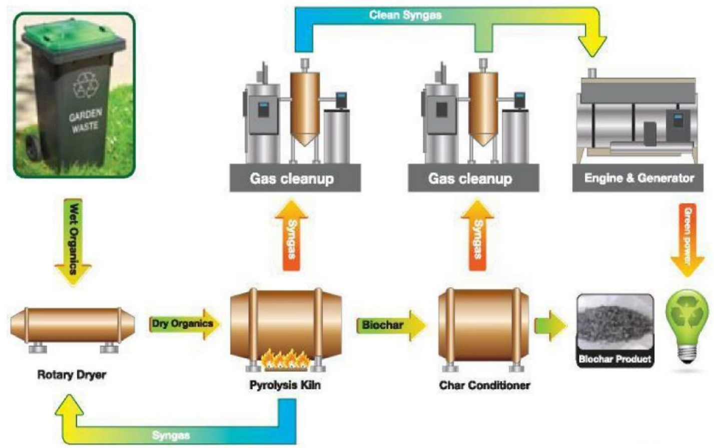
- Patented new technology:
  - Move biochar to the bottom of the burner
  - Quench the biochar
  - Spread or sell
- field testing in progress
- Cooperative work with Air Burner, Inc., U.S. Biochar Initiative, and U.S. Forest Service

New Air Curtain Burner – Demonstration model



CalFire FHP Nov 2021

Making biochar on-site: Mobile pyrolyzers



WAG LIMITED

"slow" pyrolysis

FarmBio3 mobile fast pyrolysis unit

Options for local woody biomass biochar creation

- Salvage logging
  - Create biochar from dead trees
- Thinning operations
  - Create biochar from excess woody residues
  - Not burned in slash piles
- Disease trees
  - High temperature conversion to biochar can eliminate disease inoculum
- Use on-site, urban areas, or within a watershed
- Created in a variety of ways to scale to your project

Sustainability concerns

- Bioenergy harvesting could degrade long-term productivity
  - Many studies point out that forests are pretty resilient to bioenergy harvests
  - Must leave the organic horizons intact to maintain productivity
- Biochar applications can replace C removed during harvesting
- Retain nutrients leached from twigs and needles before conversion
- Improve soil conditions to lessen drought or nutrient stress

How much biochar to add to forest sites?

- Our best results have occurred at 10 tons/acre
- Other rates are possible, but 20 tons/acre seems to overload the forest floor and movement into the mineral soil is slow
- Any rate will sequester C

Water (building a soil sponge)

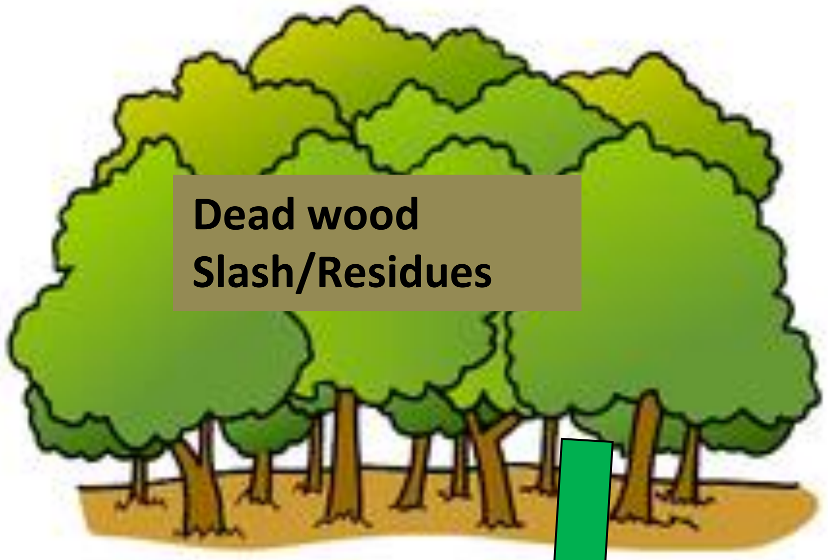
- Decrease overland flow
- Increase infiltration
- Increased yields, soil health, resilience, ecosystem services
- Reduced invasive species

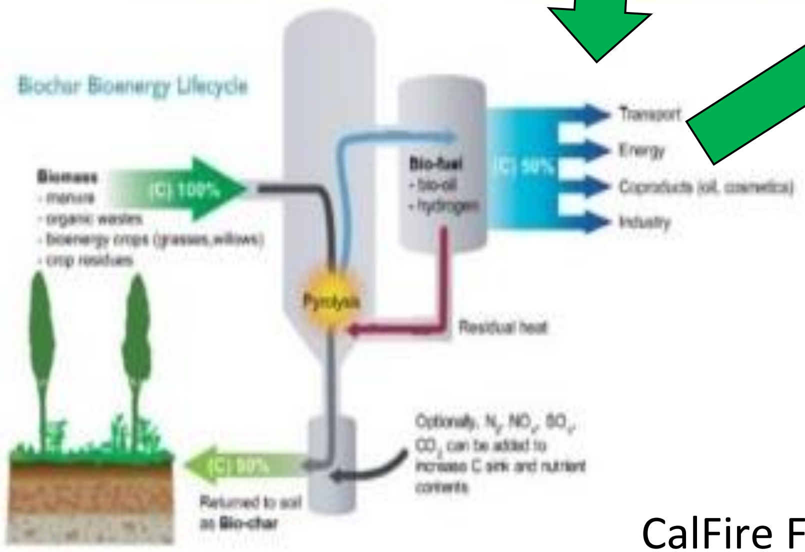
Biochar increased available water:

- 38%: coarse-textured soil
- 19%: medium-textured
- 16%: fine-textured soil

Data from: Blanco-Canqui, 2017; Edeh et al., 2020; Razzaghi et al. 2020

Forest to Farm to Food





- Manure filtering
- Increase crop yields
- Reduce methane
- Food supplement
- Animal bedding

Biochar and invasive species

- Weeds challenge restoration efforts
- Alter soil properties and processes
- Biochar can:
  - Be used by heterotrophic microbes
  - Alter CEC, pH, water, nutrients to limit invasive species
  - Increase biomass of native grasses
- Consider combining biochar with compost

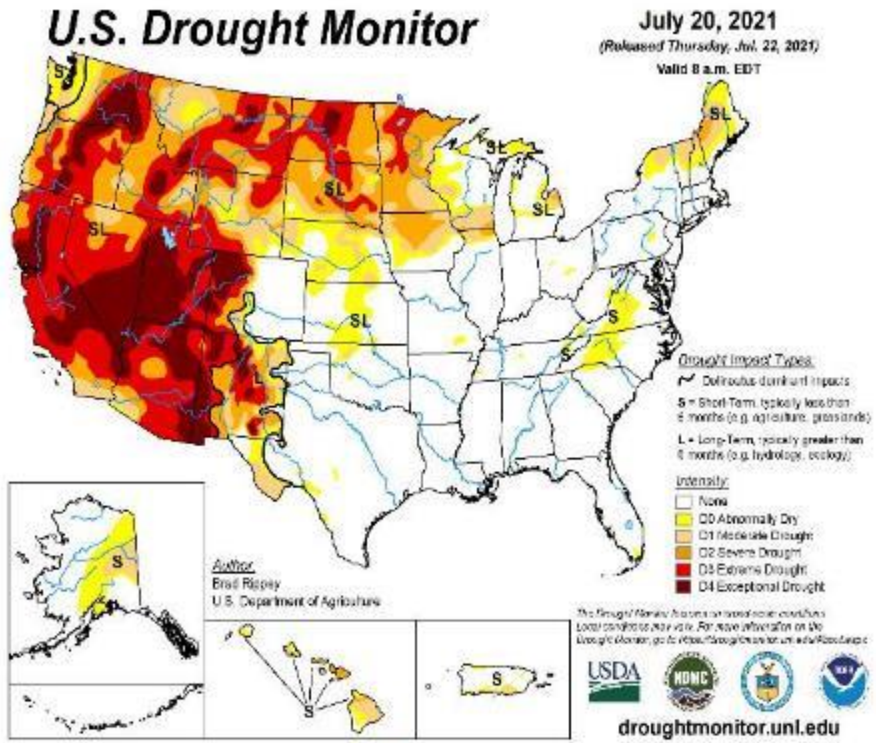
Adams et al. 2013. The effect of biochar on native and invasive prairie plant species. Invasive Plant Science and Management 6: 197-207

Biochar and mine site restoration

- 1000's of abandoned mine sites
- Contaminated or non-contaminated
- Biochar can alter soil properties
- Increase vegetation cover
- Reduce wind/water erosion
- Bring non-productive soil into production
- Funding in the infrastructure bill to reforest abandoned mine sites

Rodriguez-Franco, C. and Page-Dumroese, D. 2020. Woody biochar potential for abandoned mine land restoration in the U.S.: A review. doi: 10.1007/s42773-020-00074-y

Biochar tools for a changing environment



- Increase soil organic matter and water storage
- Carbon sequestration
- Increase ecosystem resilience by increasing soil health
- More data needed on fungi and insects….
- Revitalize rural communities
  - Biochar as part of Biomass Utilization Campuses (BUCs)

Thank you!

Contact information:
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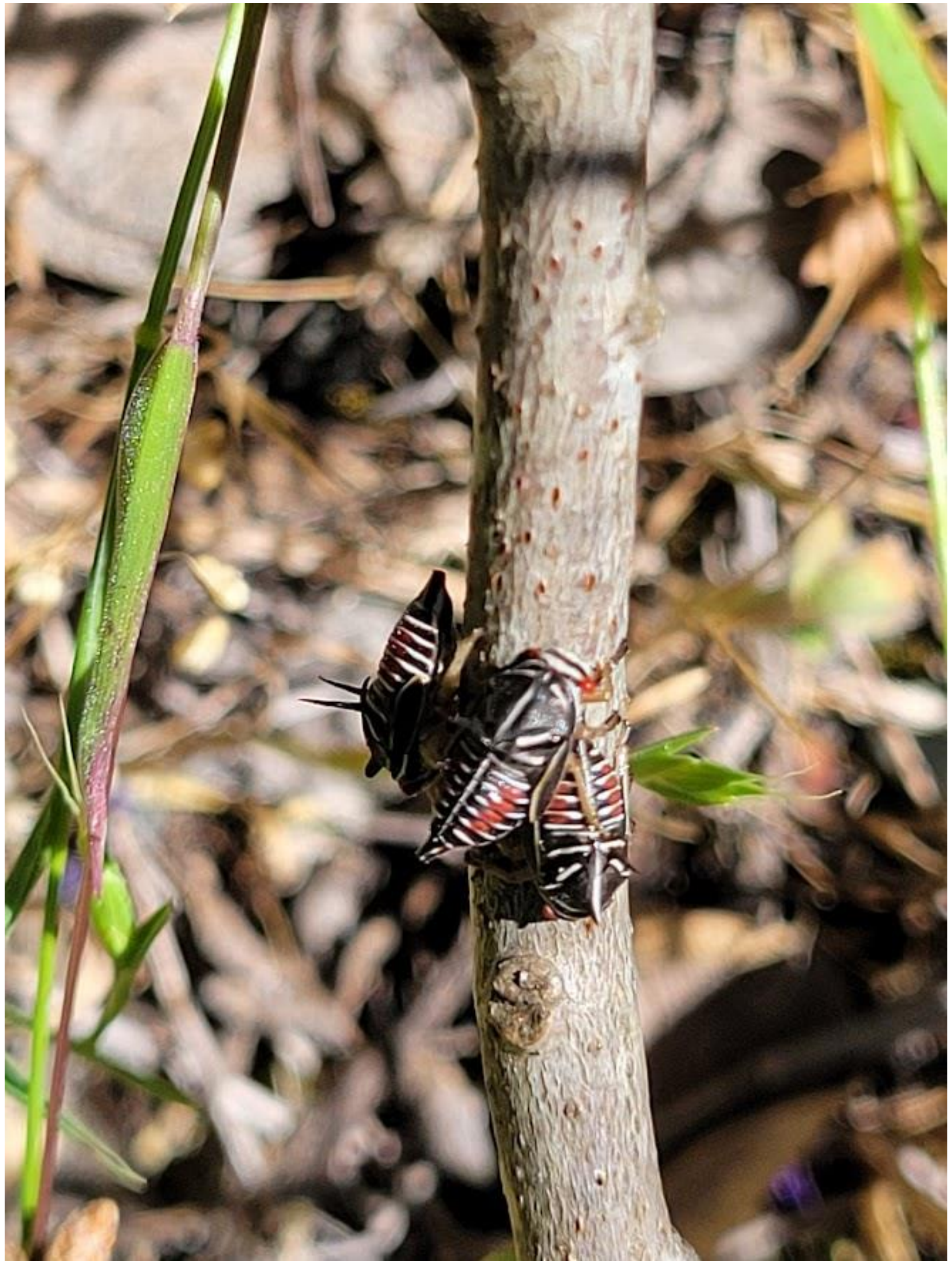
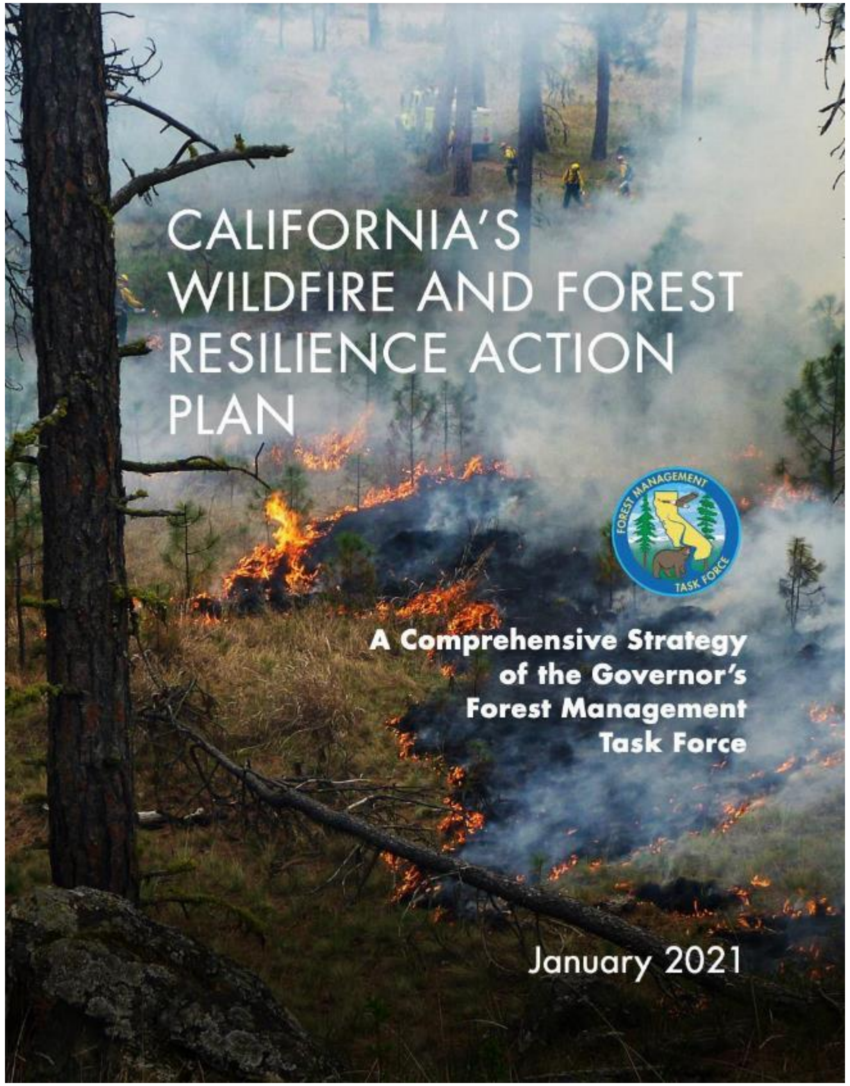
ddumroese@fs.fed.us
Moscow, ID
208.883.2339



Platycotis vitata
(oak treehopper)

Woody Feedstock Aggregation Pilot Program
California Forest Pest Council
2021

NOVEMBER 18, 2021



OPR's Key Actions:

GOAL 3: MANAGE FORESTS TO ACHIEVE THE STATE'S ECONOMIC AND ENVIRONMENTAL GOALS

Task: Create a Sustainable Wood Products Market in California

- 3.5, 3.7, 3.9, **3.10**

3.10 ADDRESS FEEDSTOCK BARRIERS THROUGH PILOT PROJECTS

"OPR will develop five pilot projects to test new mechanisms for developing long-term feedstock contracts. Information and templates from the pilot projects will be shared broadly to provide a menu of options for broader adoption."

BUDGET DETAILS

- **$2.5 million** has been allocated through SB 85 (Section 2) to address feedstock barriers through pilot projects
- **$500,000** per project

Problem Statement Overview

- Sustainably managing California forests and promoting community fire resilience, requires large investments beyond the capacity of public funding.
- New and existing wood product businesses across California are struggling to secure long-term feedstock contracts necessary to access financing and to assure business stability.

Goals and Outcomes

Goals

- **Establish reliable access to woody feedstock** through a variety of feedstock aggregation mechanisms and organizational innovations.
- **Improve feedstock supply chain logistics** within each target region through an institutional arrangement with the structure, authority and resources to aggregate and initiate long-term feedstock contracts.
- **Explore and assess market opportunities** of potential woody biomass businesses in each target region.
- **Increase feedstock aggregation** on all relevant land types, including private and non-commercial land, especially where opportunity exists to produce community fire resilience benefits.

Outcomes

- A **body of information and guidance** will be curated and provided publicly to support local actors interested in tackling feedstock aggregation.
- **Roadmaps for grantees** to create the organizational, policy, and financing structures necessary to aggregate feedstock in their region.
- A **learning cohort** sharing information and continuing to expand opportunities to create long-term feedstock contracts.

Project Deliverables

- Near-Term
  - **Organizational Studies**: Financial and Economic Analysis, Carbon Analysis, Feedstock Analysis, Legal Analysis, Community Analysis, Wood Product Market Analysis, Infrastructure Assessment, etc.
  - **Plans**: Legal Structure Implementation Plan, Entity Action Plan, Long-Term Action Plan
  - **Infrastructure Development**: Sort Yard and/or Log Deck
  - **Feedstock Mapping and Aggregation Tool** (Satellite and LiDAR data)
  - **Community Engagement Workshops**
  - **Progress Reports**

- Final Report
  - Lessons Learned Report
  - Overview of Study Findings

Pilot Project Timeline

Key Action	Target Dates	Status
Level-setting meetings with potential proponents	June – July 2021	COMPLETED
Develop and finalize project criteria	July – August 2021	COMPLETED
Issue criteria to project proponents	September 1, 2021	COMPLETED
Proposal support for programs	September – October	COMPLETED
Deadline for submission	November 1, 2021	COMPLETED
Review and Contracting	October 2021 – January 2022	IN PROGRESS
Project support and cohort collaboration	October 2021 – June 2022	IN PROGRESS
Funds encumbered	June 30, 2022	INCOMPLETE

Pilot Regions

- **Central Sierra Project**
  - Counties: Alpine, Amador, Calaveras, Mariposa and Tuolumne
- **Marin Biomass Project**
  - County: Marin
- **North Coast Resource Partnership**
  - Counties: Del Norte, Humboldt, Mendocino, Modoc, Siskiyou, Sonoma, and Trinity
- **Northeast California Project**
  - Counties: Shasta and Lassen
- **Tahoe Central Sierra Initiative**
  - Counties: Amador, El Dorado and Placer

Resources Under Development

- Continued Funding FAQ
  - http://grants.ca.gov/ (State of California Grants)
  - https://www.grants.gov/ (Federal Grants)
- Quick-Start Permitting Guide for Biomass Facilities and Operations
- Communication and Resource-Sharing Platform

Learning Cohort Meetings

Frequency:

- Bimonthly
- Next meeting: December 7th

Topics:

Shared Platform Ideas

- Google Drive
- SharePoint
- Box
- OneDrive

Our Contact Information

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Associate Planner	Graduate Student Assistant	Chief Deputy Director
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Thank you!

Elatobium abietinum (green spruce aphid)

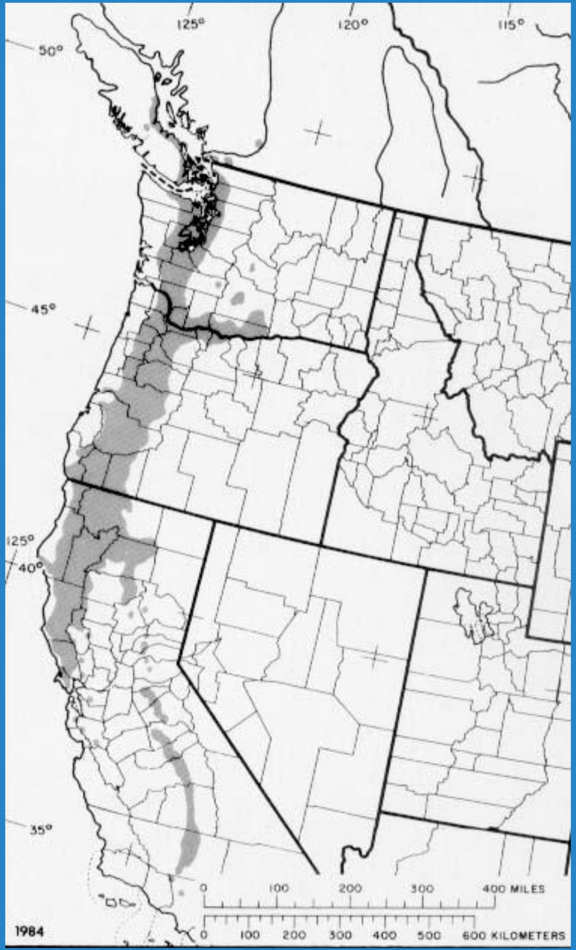
Douglas-fir encroachment reduces drought resistance in Oregon white oak of northern California

Annual Meeting of the California Forest Pest Council 2021

Jill J. Beckmann*; Rosemary L. Sherriff; Lucy P. Kerhoulas; Jeffrey M. Kane

Humboldt State University, Arcata, CA

Oregon white oak woodlands



Little, 1984

Quercus garryana Douglas ex Hook.

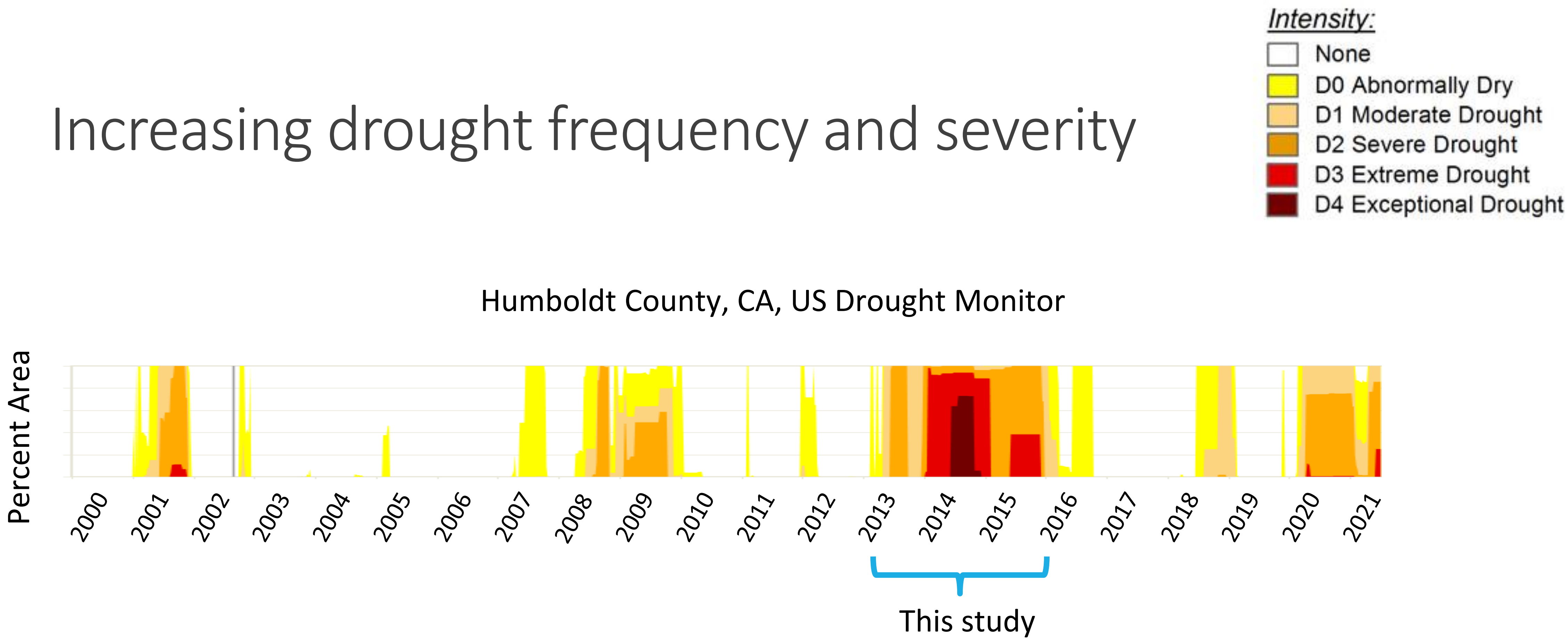
Fire-adapted and dependent ecosystem

Douglas-fir establishes and grows through oak canopy

Hunter and Barbour, 2001

Decline of encroached oaks

Increasing drought frequency and severity



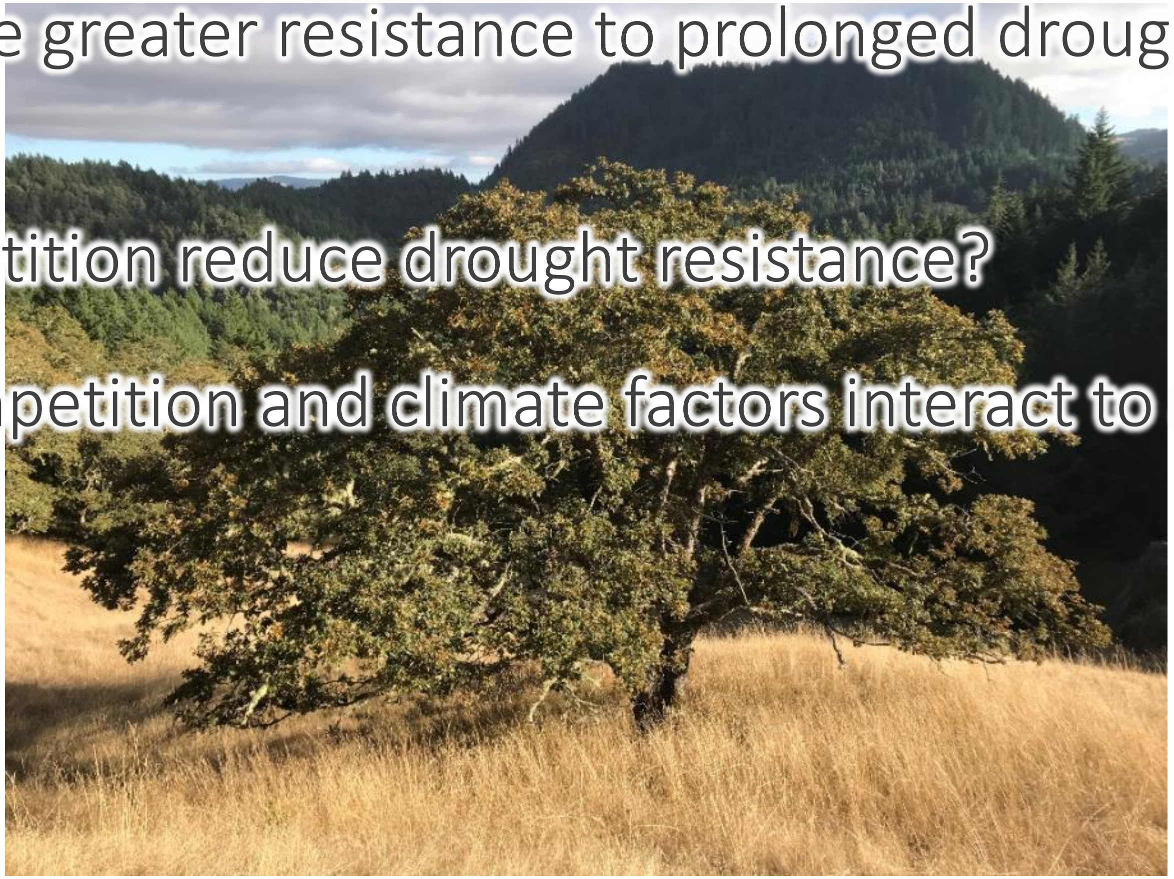
United States Drought Monitor, 2021

Research Questions

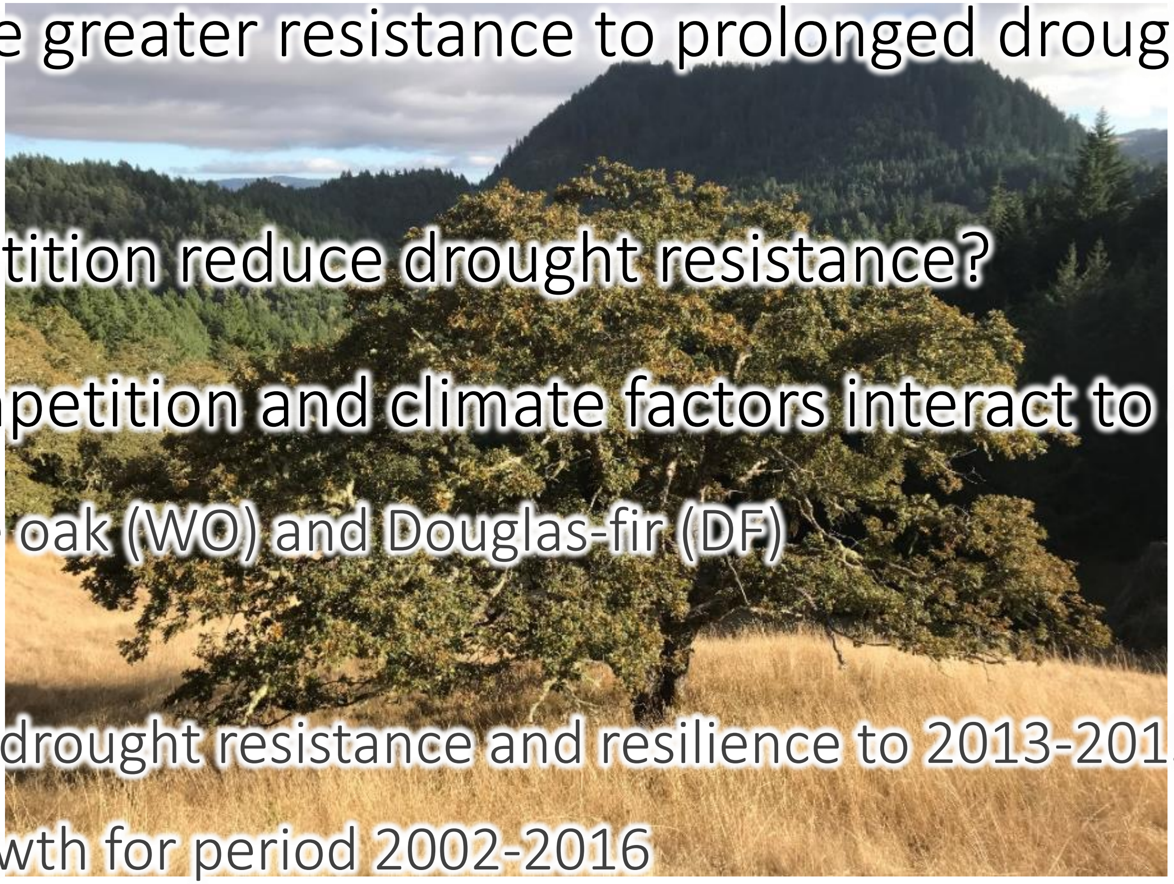
1. Do oaks have greater resistance to prolonged drought than Douglas-fir?

2. Does competition reduce drought resistance?

3. How do competition and climate factors interact to affect growth?



Research Questions



1. Do oaks have greater resistance to prolonged drought than Douglas-fir?

2. Does competition reduce drought resistance?

3. How do competition and climate factors interact to affect growth?

For Oregon white oak (WO) and Douglas-fir (DF)

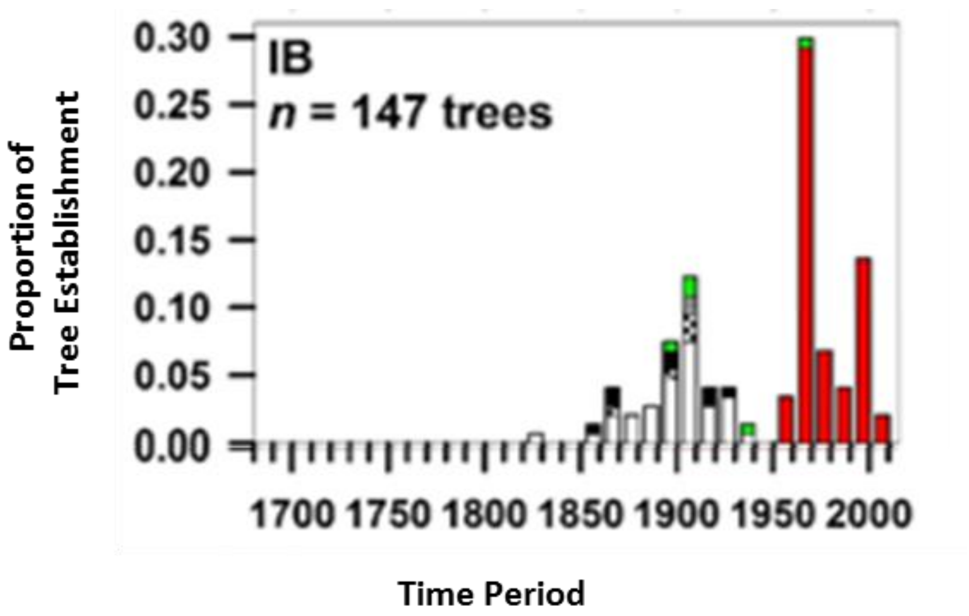
We evaluate:

- Growth-based drought resistance and resilience to 2013-2015 drought
- Radial tree growth for period 2002-2016

Iaqua Buttes
Kneeland, CA

Variability in encroachment condition

Douglas-fir established after 1950



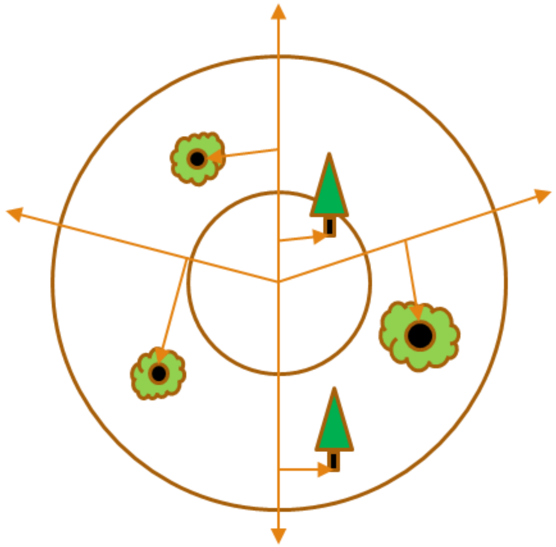
Schriver, 2015

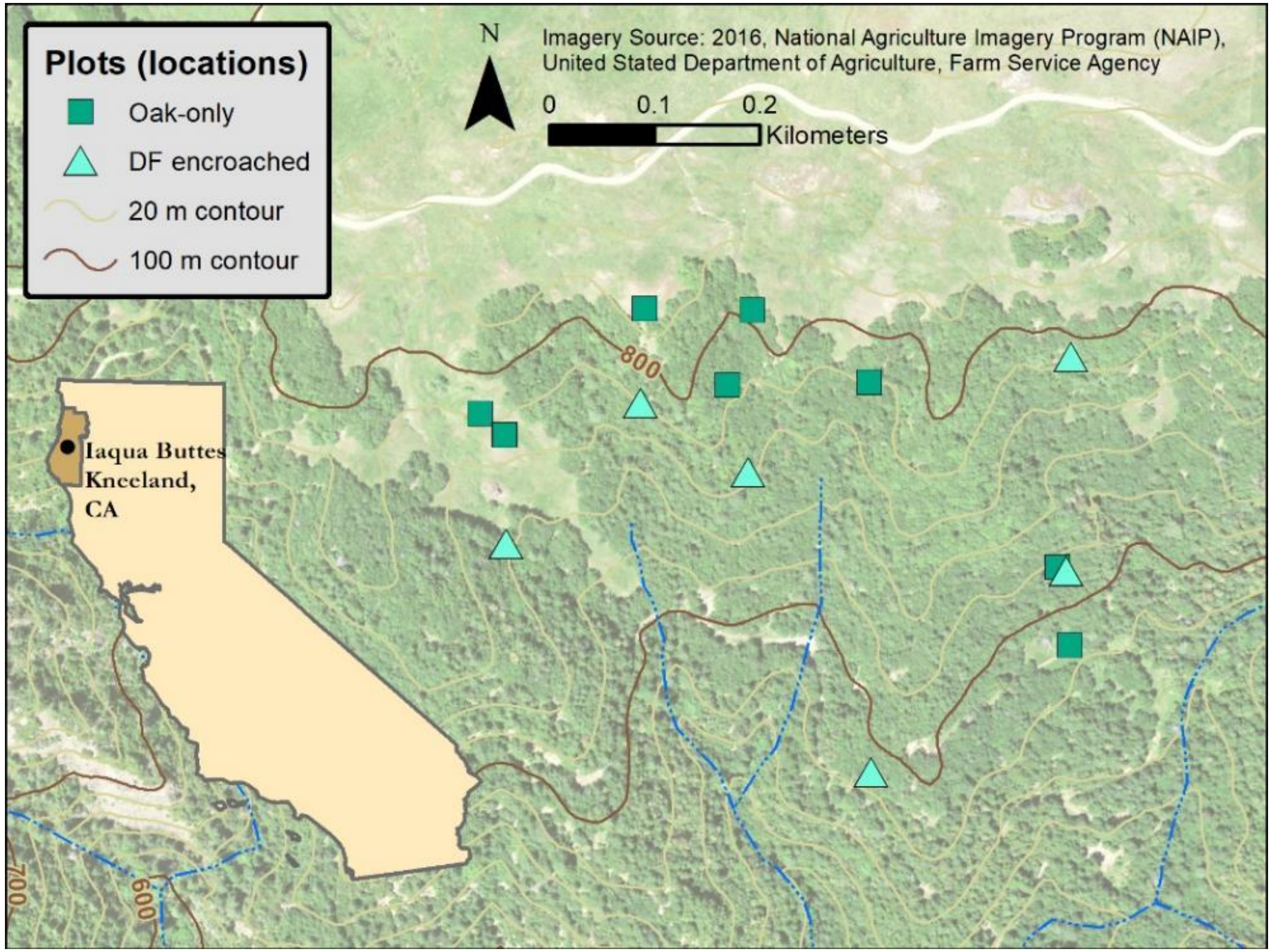
Study design

n=104 Oregon white oak (WO) trees

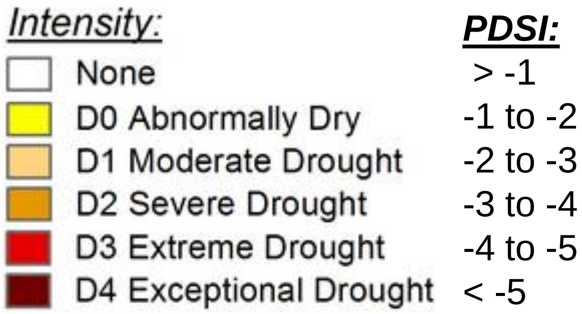
- n = 44 ‘oak-only’ condition
- n = 60 ‘DF encroached’ condition

n=104 Douglas-fir (DF) trees

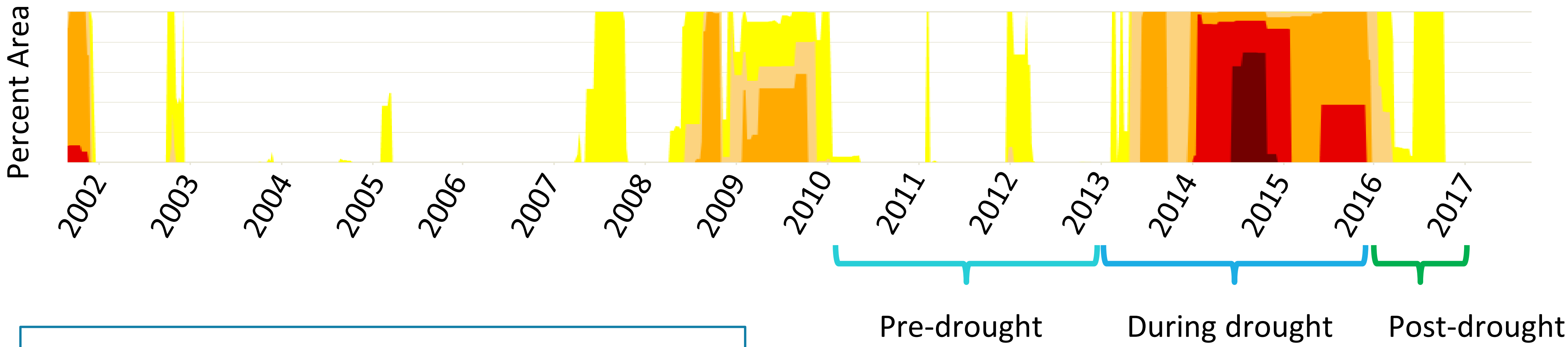




Drought resistance and one-year drought resilience



Humboldt County, CA, US Drought Monitor



$$drought\ resistance = \frac{BAI\ during\ drought}{BAI\ prior\ to\ drought}$$

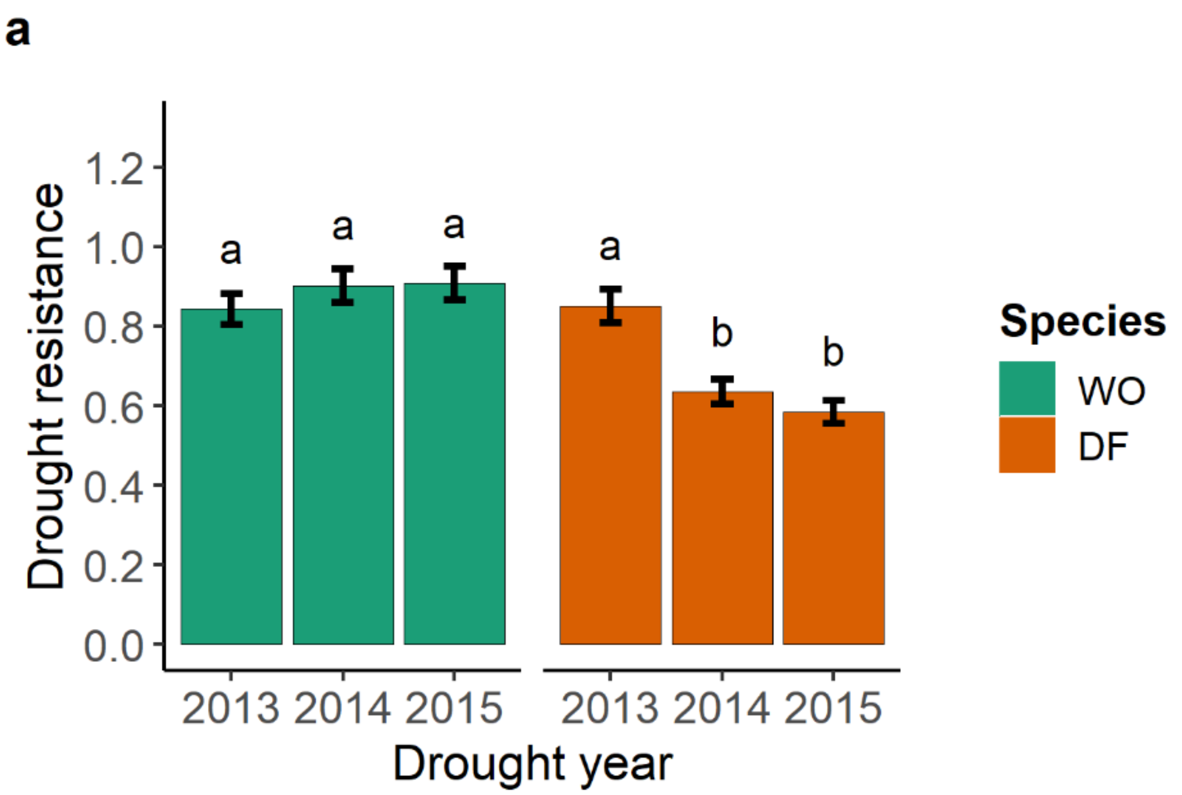
$$drought\ resilience = \frac{BAI\ after\ drought}{BAI\ prior\ to\ drought}$$

Lloret et al, 2011

United States Drought Monitor, 2021

Results 1. Did oaks have greater resistance to prolonged drought than Douglas-fir?

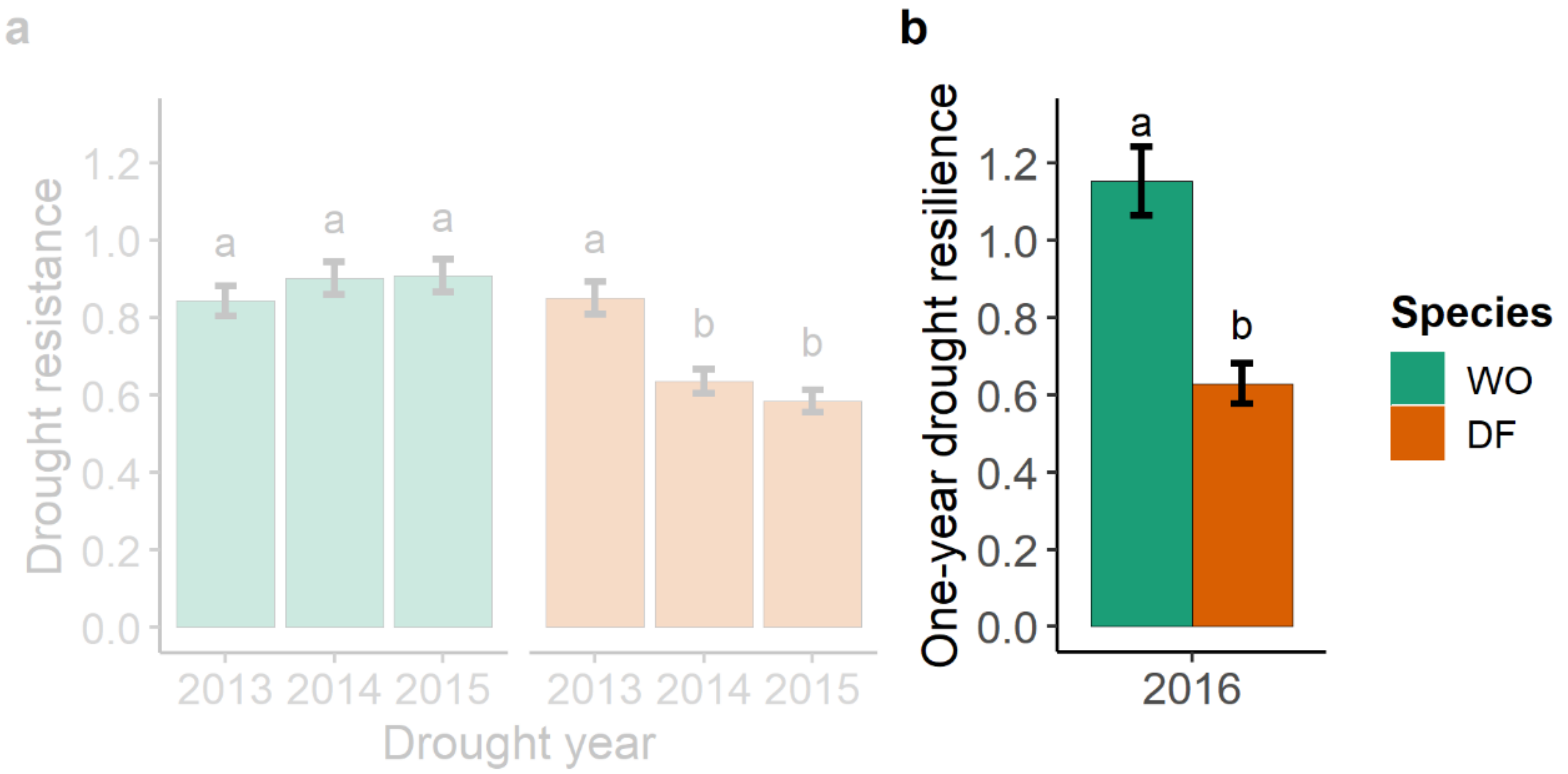
Greater drought resistance in WO



27% greater drought resistance in WO

DF drought resistance declines throughout prolonged drought period

WO growth resilient one-year post-drought



27% greater drought resistance in WO

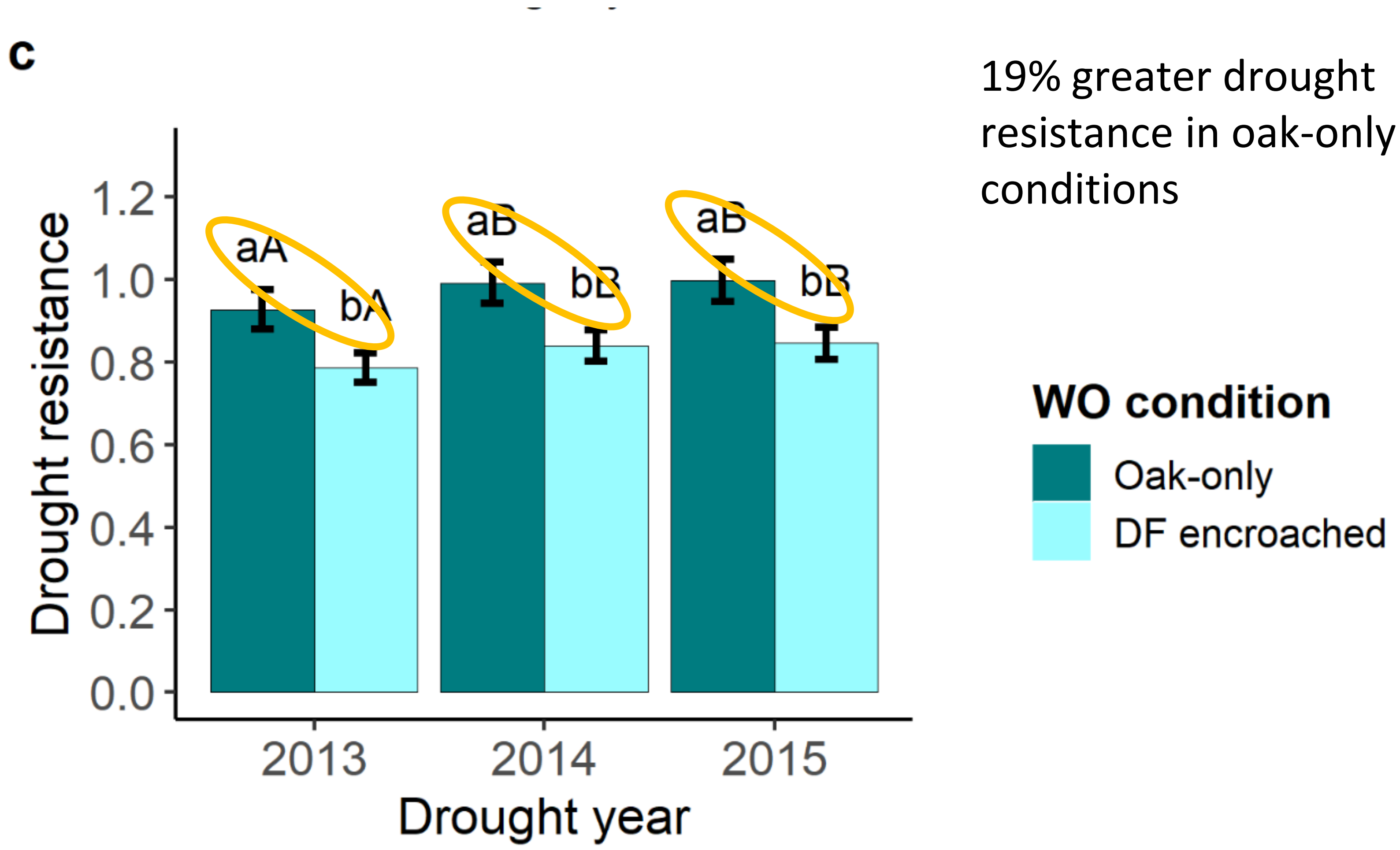
DF drought resistance declines throughout prolonged drought period

83% greater one-year drought resilience in WO

No sign of recovery in DF one year after drought

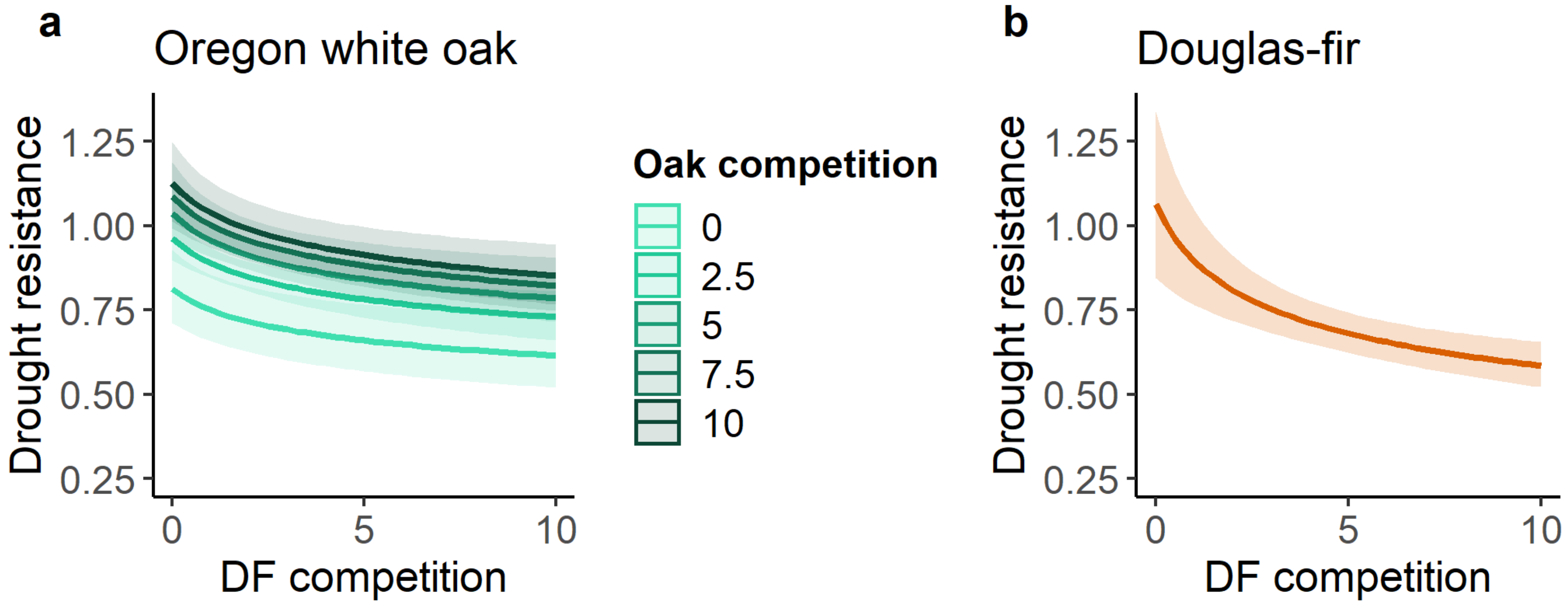
Results 2. Does competition reduce drought resistance?

Reduced drought resistance in DF encroached oaks



19% greater drought resistance in oak-only conditions

Effect on drought resistance varies by competitor species



Results 3. How do competition and climate factors interact to affect growth?

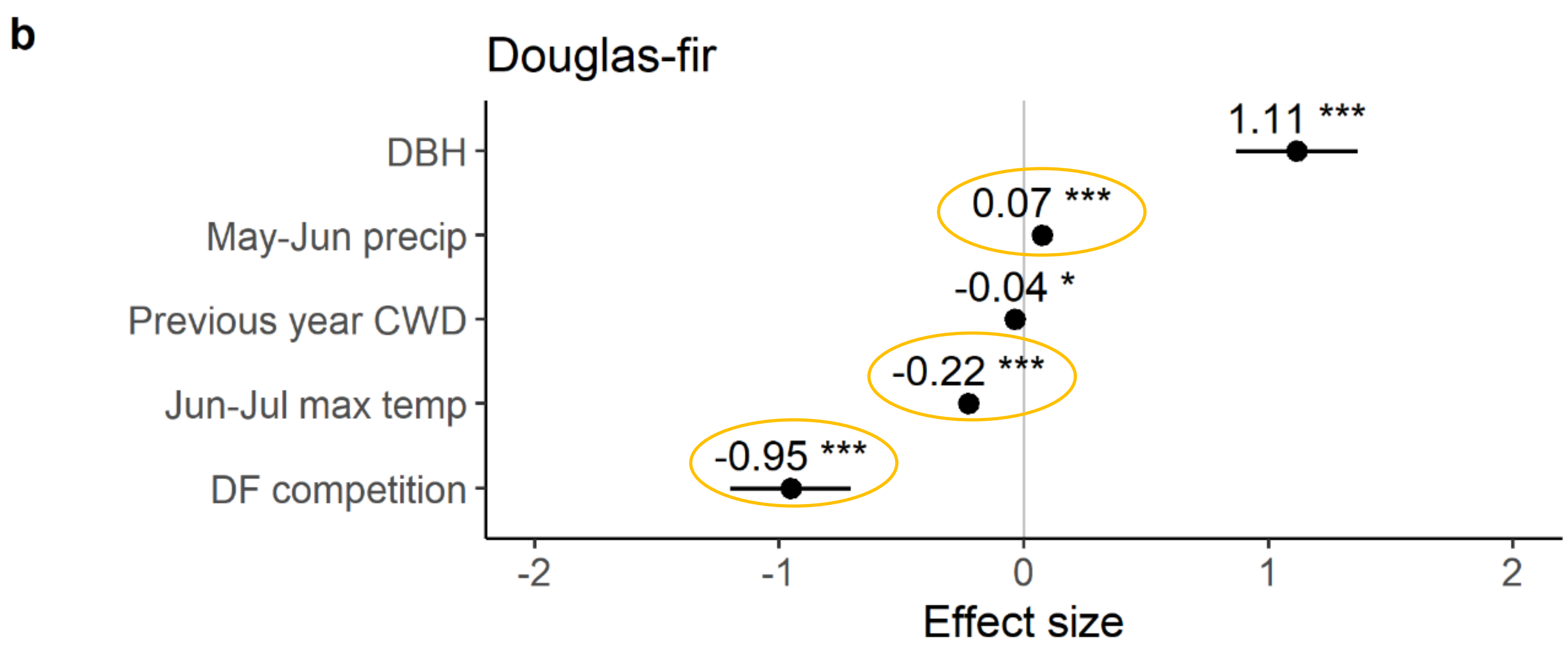
DF tree growth

Related to:

Intraspecific competition -

Late spring precipitation +

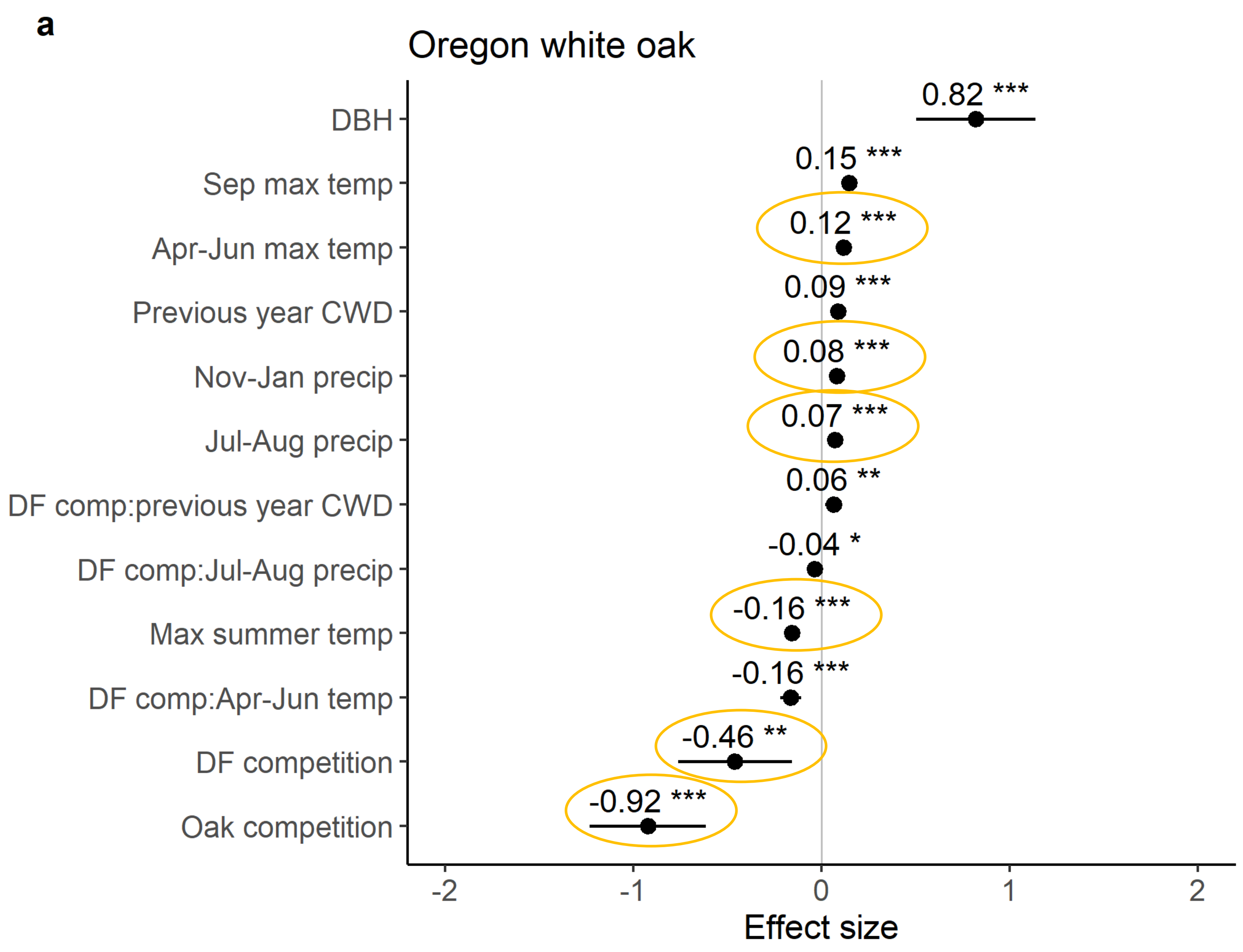
Early summer temperature -



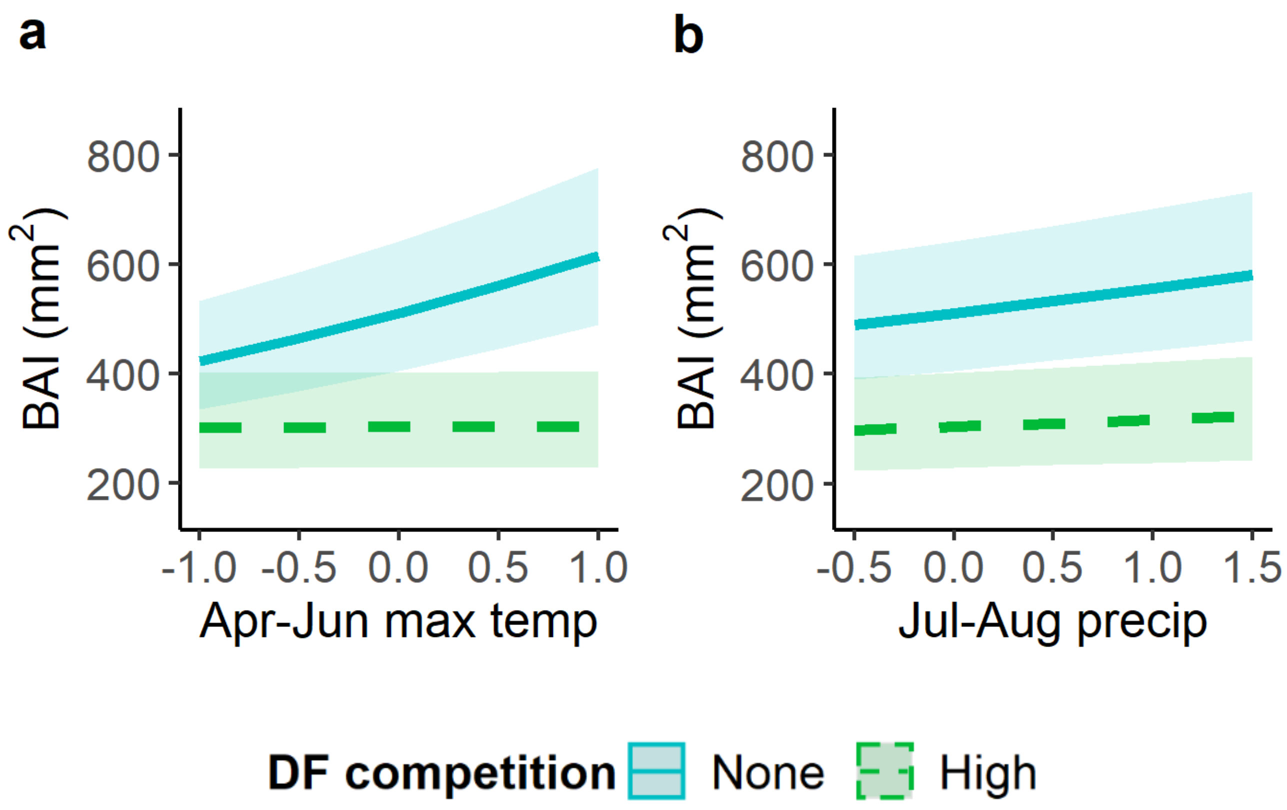
WO tree growth

Related to:

- Intraspecific and DF competition -
- Winter precipitation +
- Spring temperature +
- Max summer temperature -
- Summer precipitation +



WO tree growth:
DF competition interacted with climate effects



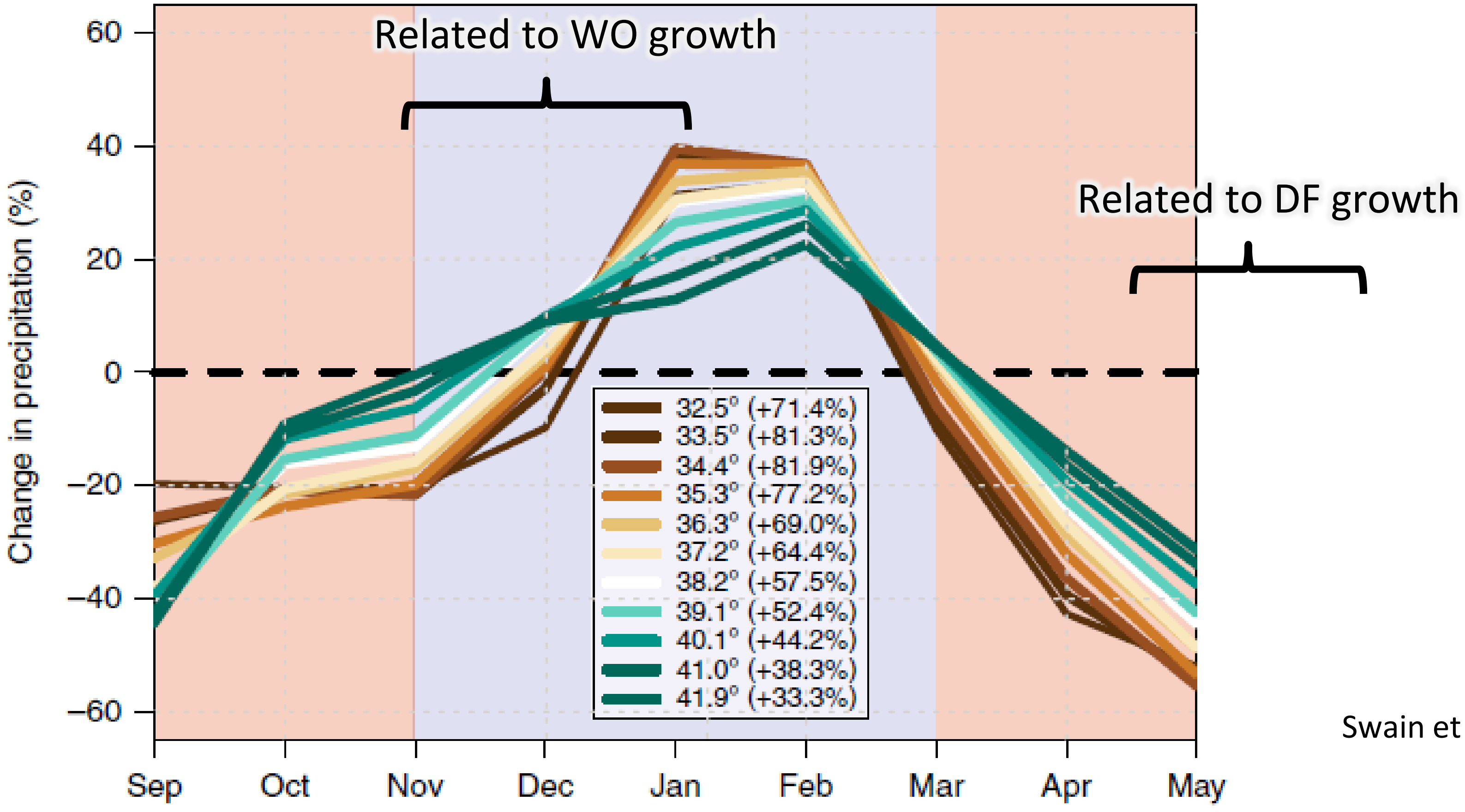
Conclusion and Discussion

Oaks more drought resistant but…

Oak drought resistance compromised by Douglas-fir encroachment

Competition has a greater influence on tree growth than climate

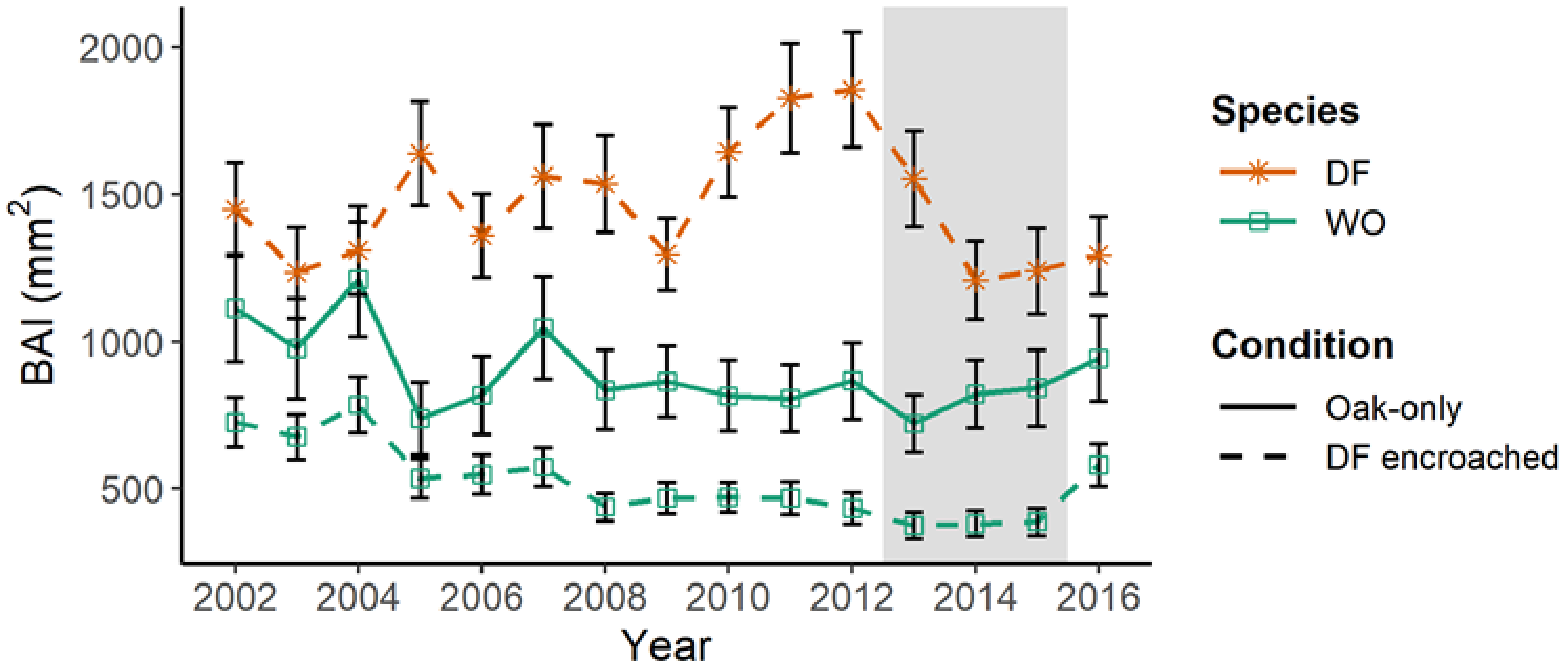
Increasing precipitation seasonality may negatively impact DF more than WO



Swain et al, 2018

Contrasting effects of oak and DF competition on WO drought resistance may relate to light availability

DF maintained greater growth than WO
Lowest growth in DF encroached oaks



High understory diversity in oak woodlands

Livingston et al., 2016

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Cronartium harknessii (western gall rust) damage to gray pine

A PHYSIOLOGICAL PERSPECTIVE ON CONIFER DROUGHT RESPONSE IN NORTHERN CALIFORNIA

Wallis Robinson: UC Cooperative Extension Humboldt-Del Norte (HSU Master's Program)

Lucy Kerhoulas: Humboldt State University

Rosemary Sherriff: Humboldt State University

Gabriel Roletti: Humboldt State University

Phillip van Mantgem: US Geological Survey

Northern CA: Ecologically and topographically complex

2013 - 2015 drought: A new norm?

Questions:

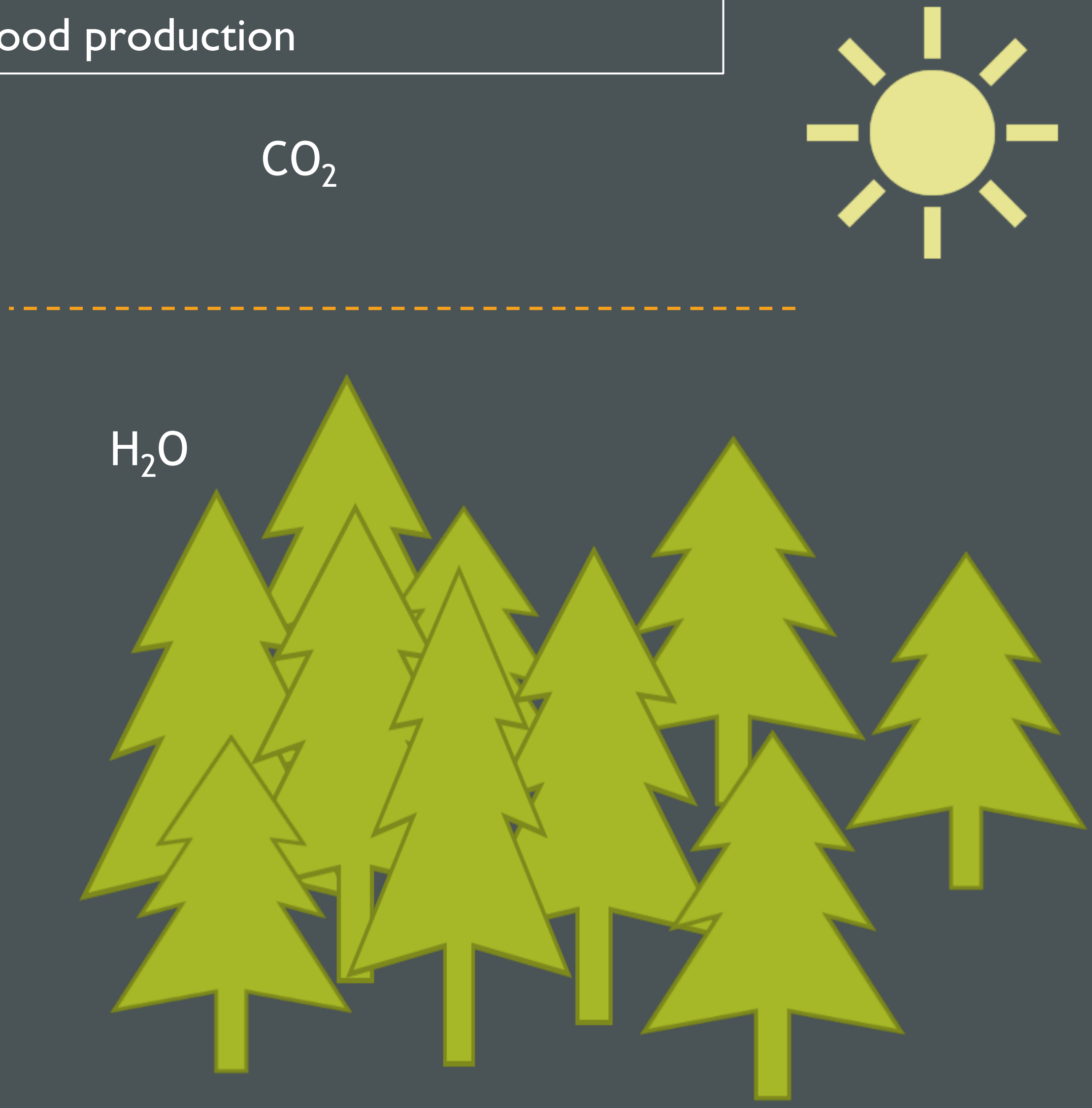
1) How does drought response in coastal and montane conifers compare?

2) What factors affect $\Delta^{13}C$ in different conifers?

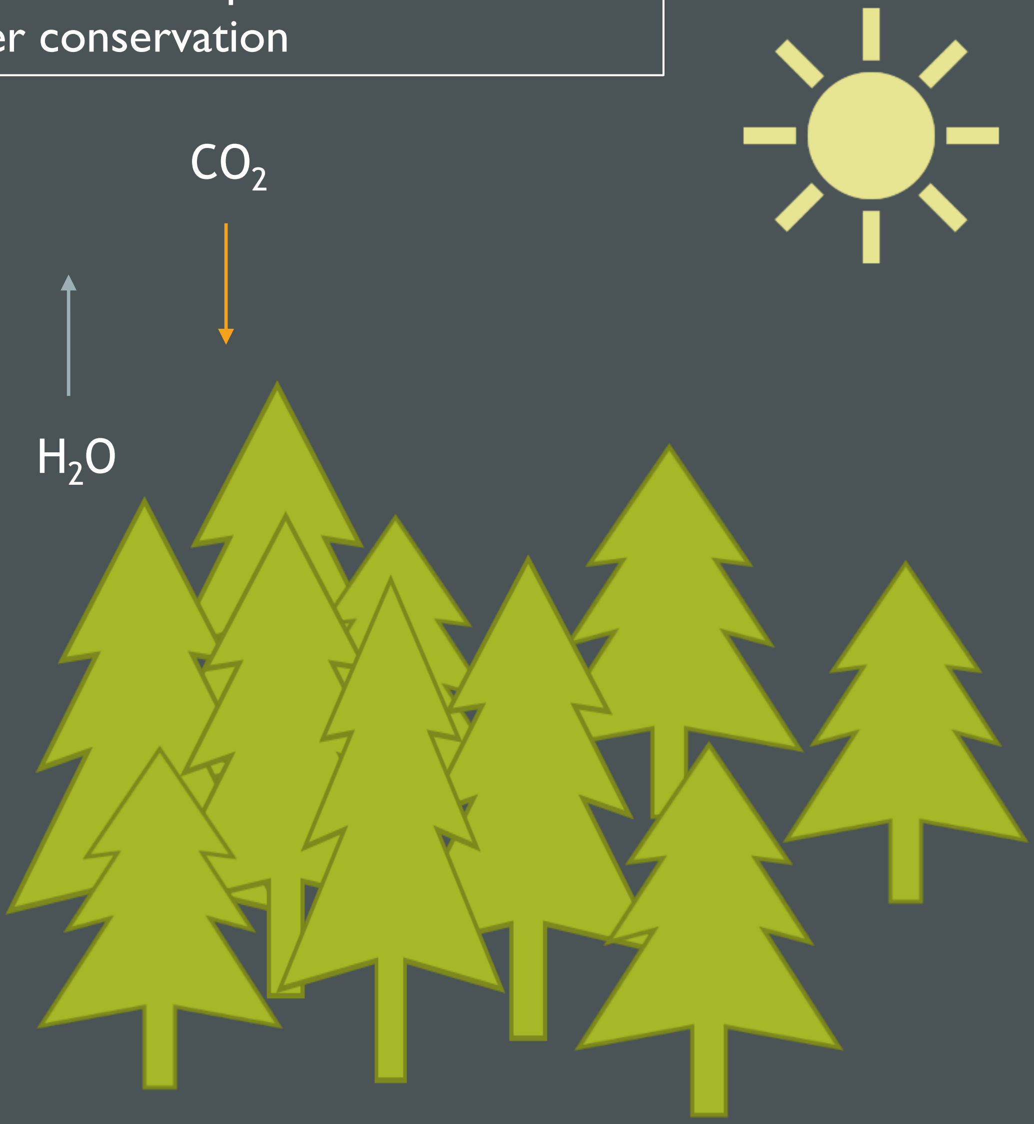
Basal Area Increment (BAI)
Measure of resource production as measured through annual radial growth

Carbon[13] Discrimination (Δ^{13} C)
Measure of prioritization of food production (photosynthesis) to water conservation (stomatal conductance)

Scenario 1: High Stomatal Regulation
(Δ^{13} C decreases)
Prioritizes water conservation over food production



Scenario 2: Low Stomatal Regulation
(Δ^{13} C stays the same)
Prioritizes food production over water conservation



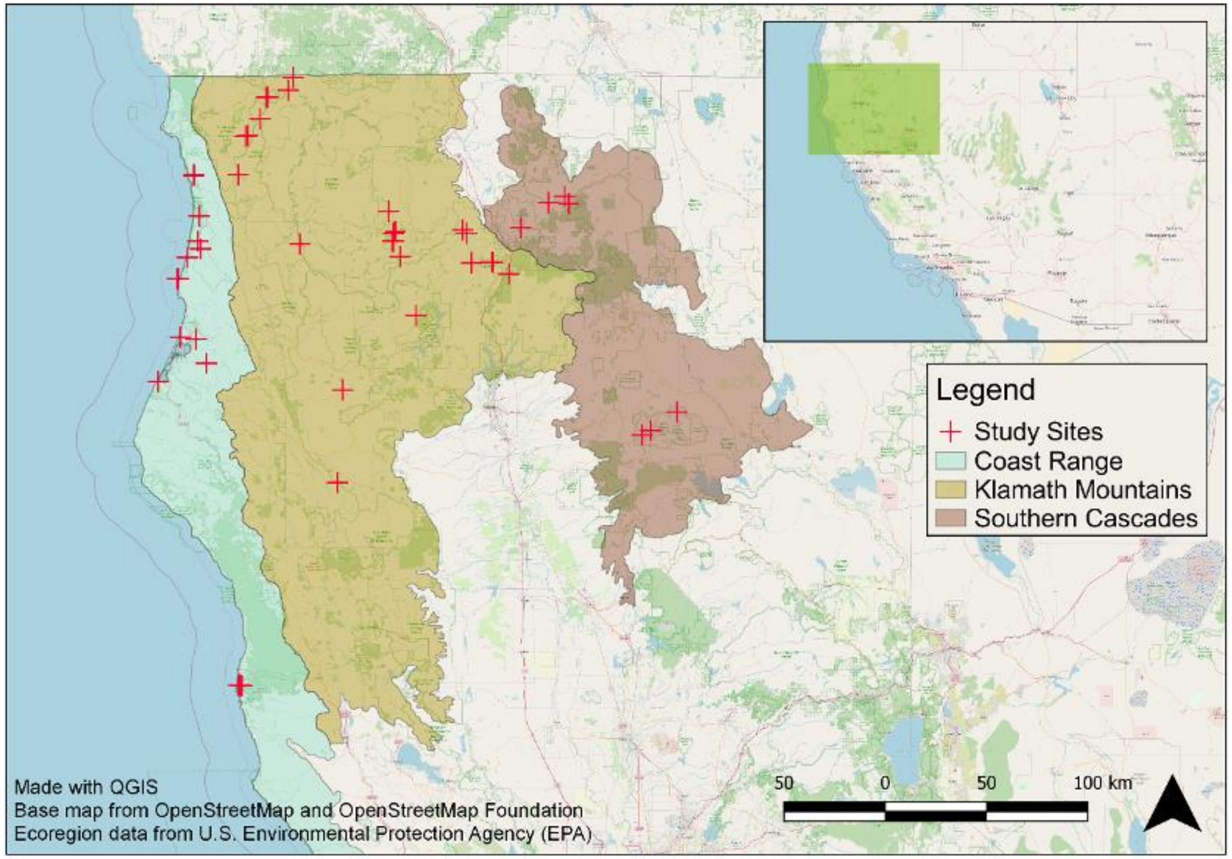
STUDY DESIGN

Study Species:

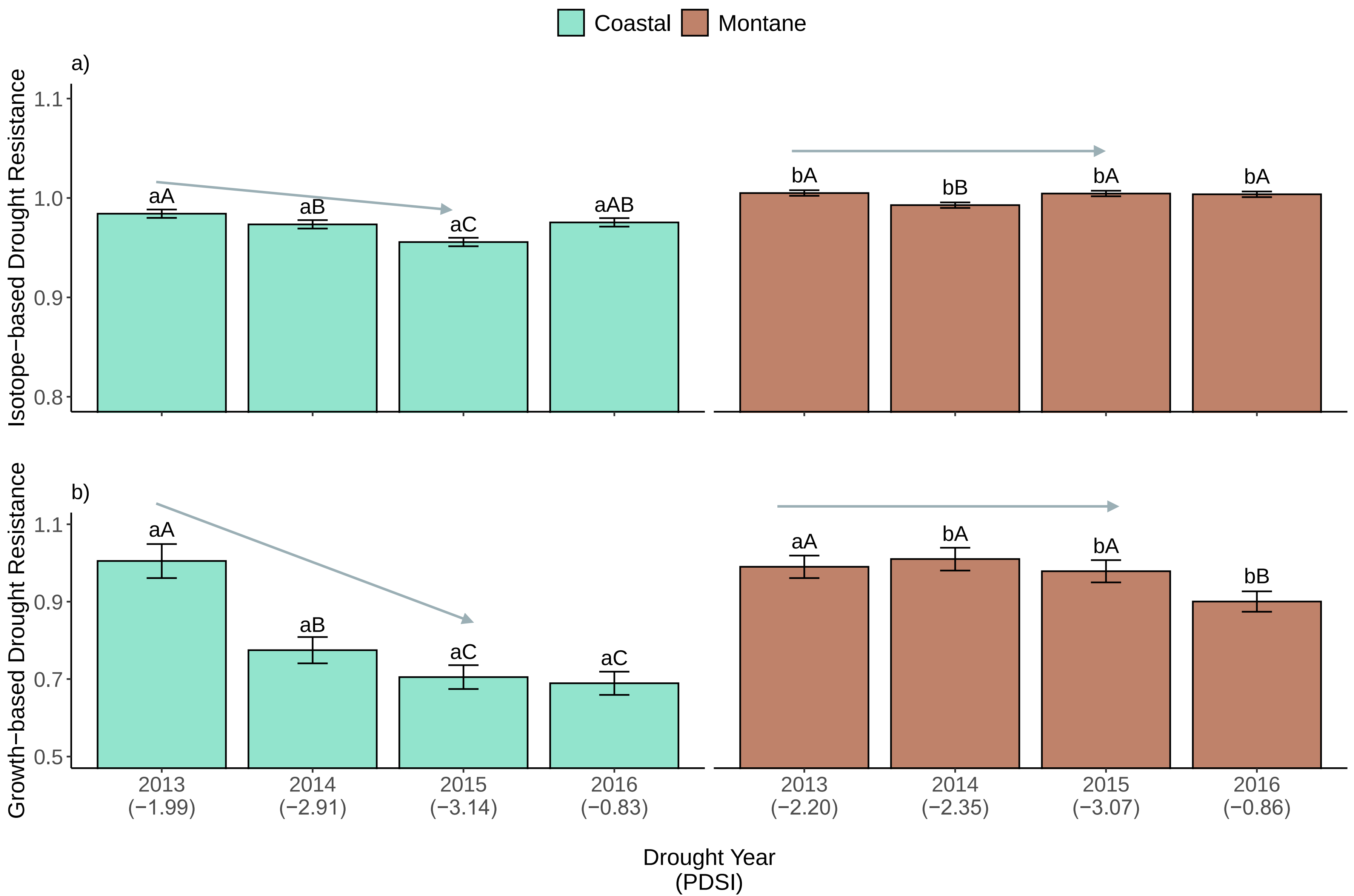
- Sitka spruce
- Western hemlock
- Sugar pine
- Western white pine
- Shasta fir
- Brewer spruce

9 Sites per Species

- Along moisture gradient



Question 1a: How does drought **resistance** in coastal and montane conifers compare?
Answer: Coastal species are more drought sensitive (lower resistance) than montane species.



Response Metrics

2013 - 2015:
Resistance = Drought/Pre-Drought

2016:
Resilience = Post-Drought/Pre-Drought

Dataset

Coastal: All Sitka spruce and western hemlock sites

Montane: All Shasta fir, Brewer spruce, sugar pine, and western white pine sites

DROUGHT SURVIVAL STRATEGIES AND MECHANISMS OF MORTALITY

Coastal species

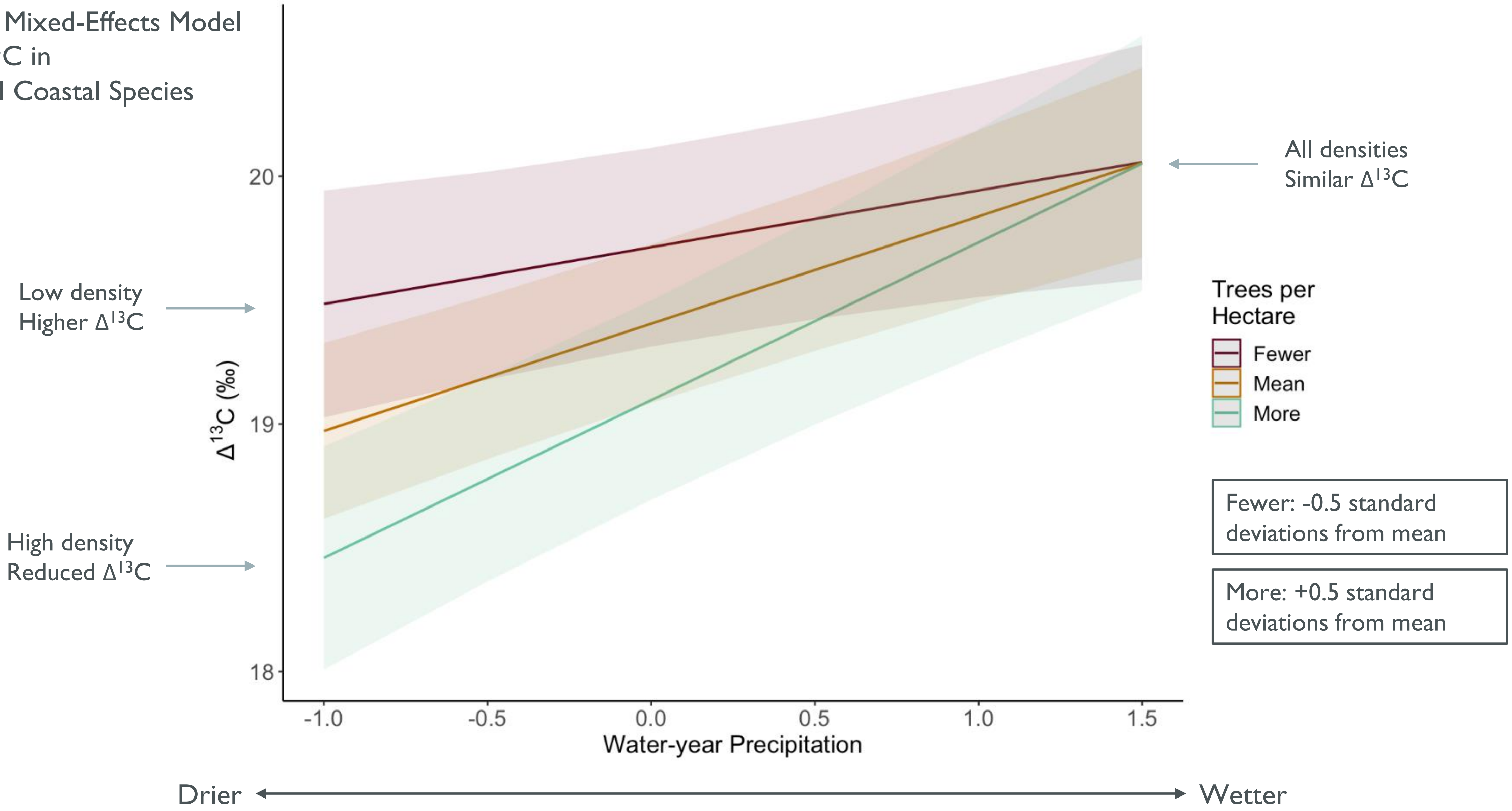
“Low” isotope-based drought resistance > High stomatal regulation > Less carbon fixation > potential for death by starvation

Montane species

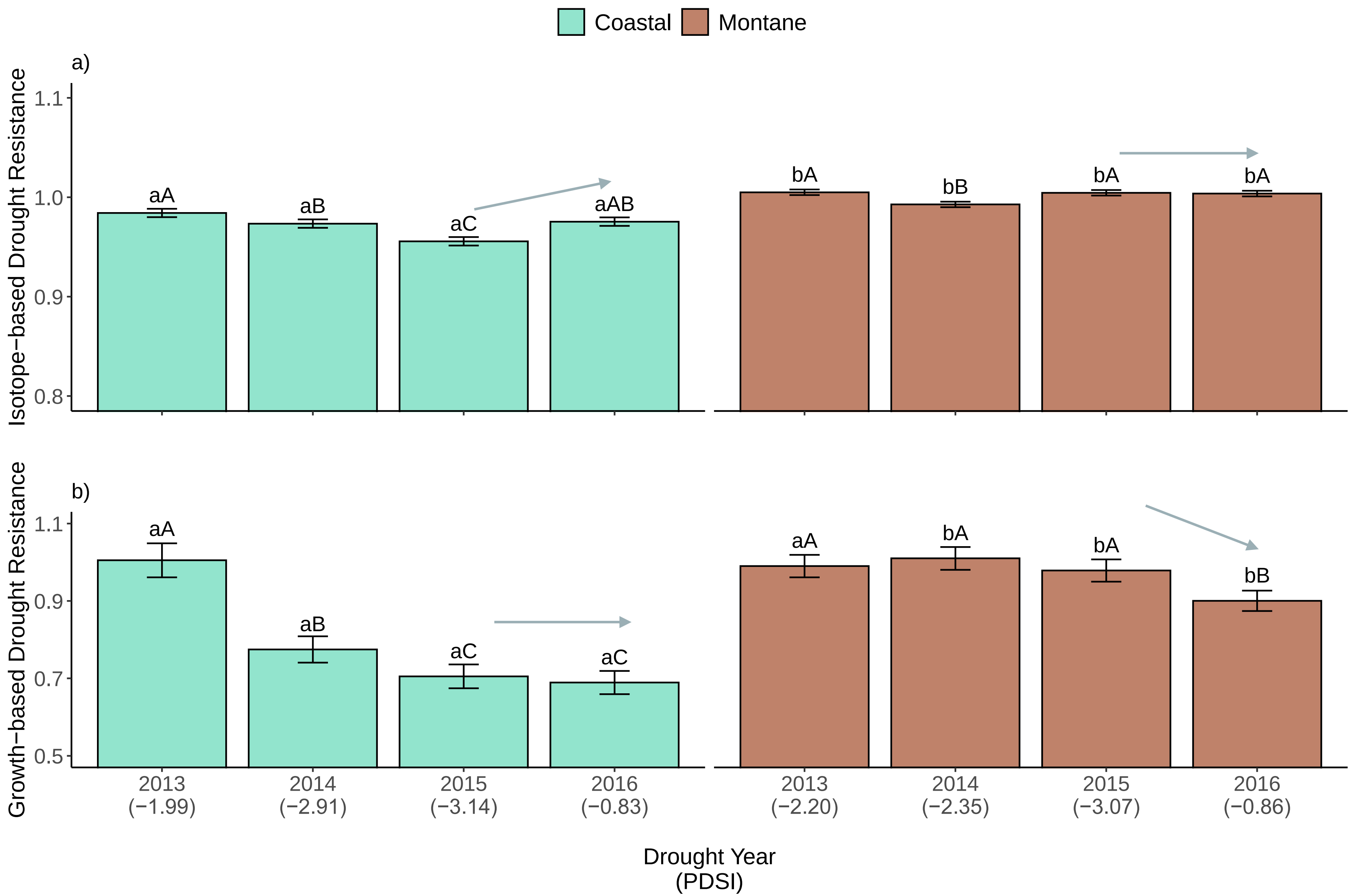
High isotope-based drought resistance > Low stomatal regulation > More water loss > potential for death by hydraulic failure

Question 2: What factors affect $\Delta^{13}C$ in different conifers?
Answer: $\Delta^{13}C$ varies with stand density and precipitation in coastal species.

Interaction Plot from the Linear Mixed-Effects Model for $\Delta^{13}C$ in Pooled Coastal Species



Question 1b: How does drought **resilience** in coastal and montane conifers compare?
Answer: Species in both range types experience a lag in growth-based resilience.



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Resilience =
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Dataset

Coastal: All Sitka spruce and western hemlock sites

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CONCLUSIONS

Different drought survival strategies

- Different mortality risks: carbon starvation vs hydraulic failure
- Similar resilience lags: consecutive droughts could slow recovery

Carbon stores important for coastal species

- Potential for climate-pest interaction
- Stand density matters

Drought tolerance unknown for montane species

- Would lack of stomatal regulation persist in more severe drought?

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Elizabeth Hinojosa

Gabe Goff

Rosalio Gonzalez

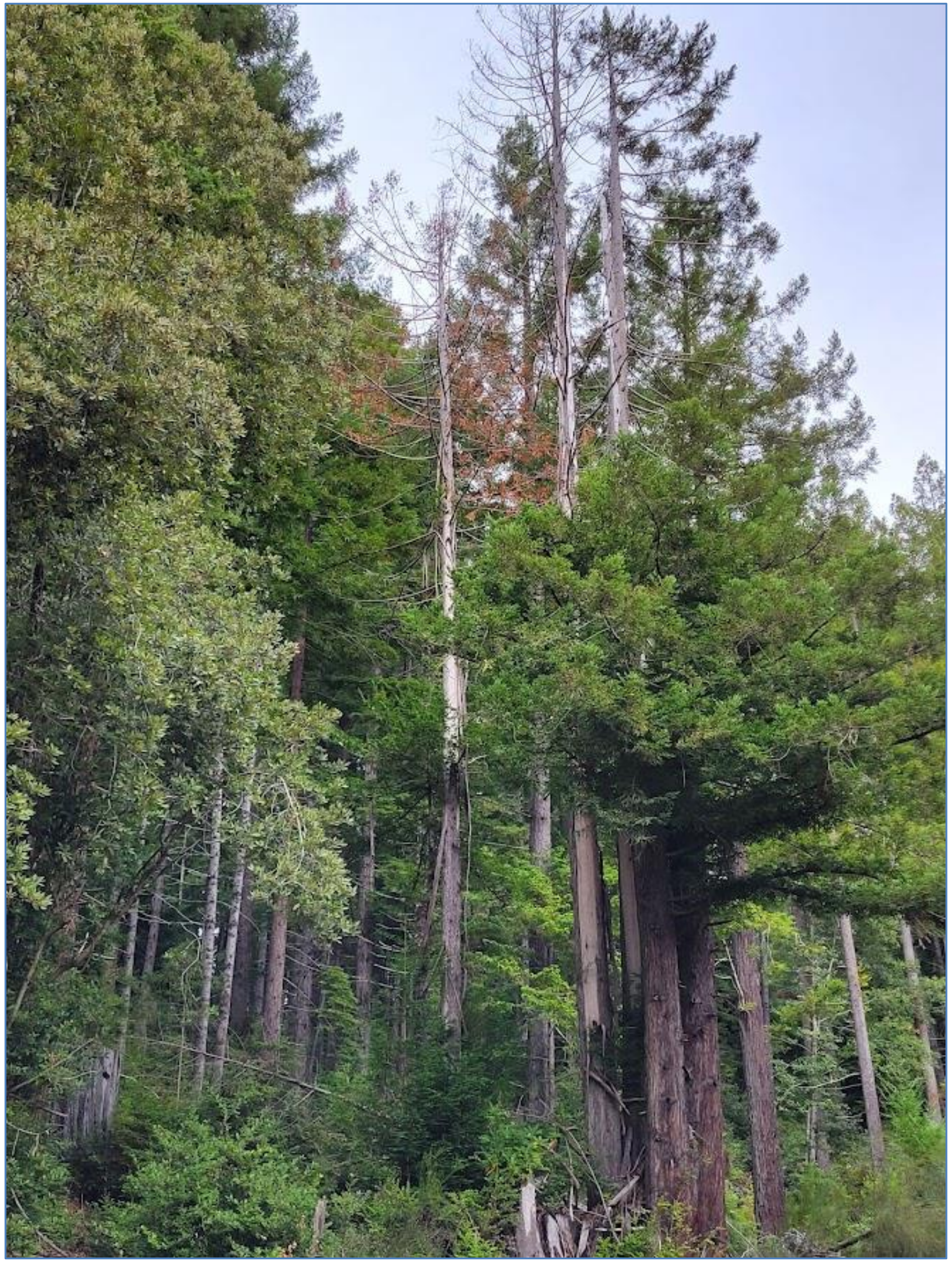
Suzanne Melendez

Diana Orozco

Brigette Price

Ashley Shannon

Colleen Smith



Black bear (*Ursus americanus*) damage to coast redwood

Recent California tree mortality portends future increase in drought-driven forest die-off

Gavin D. Madakumbura (UCLA)

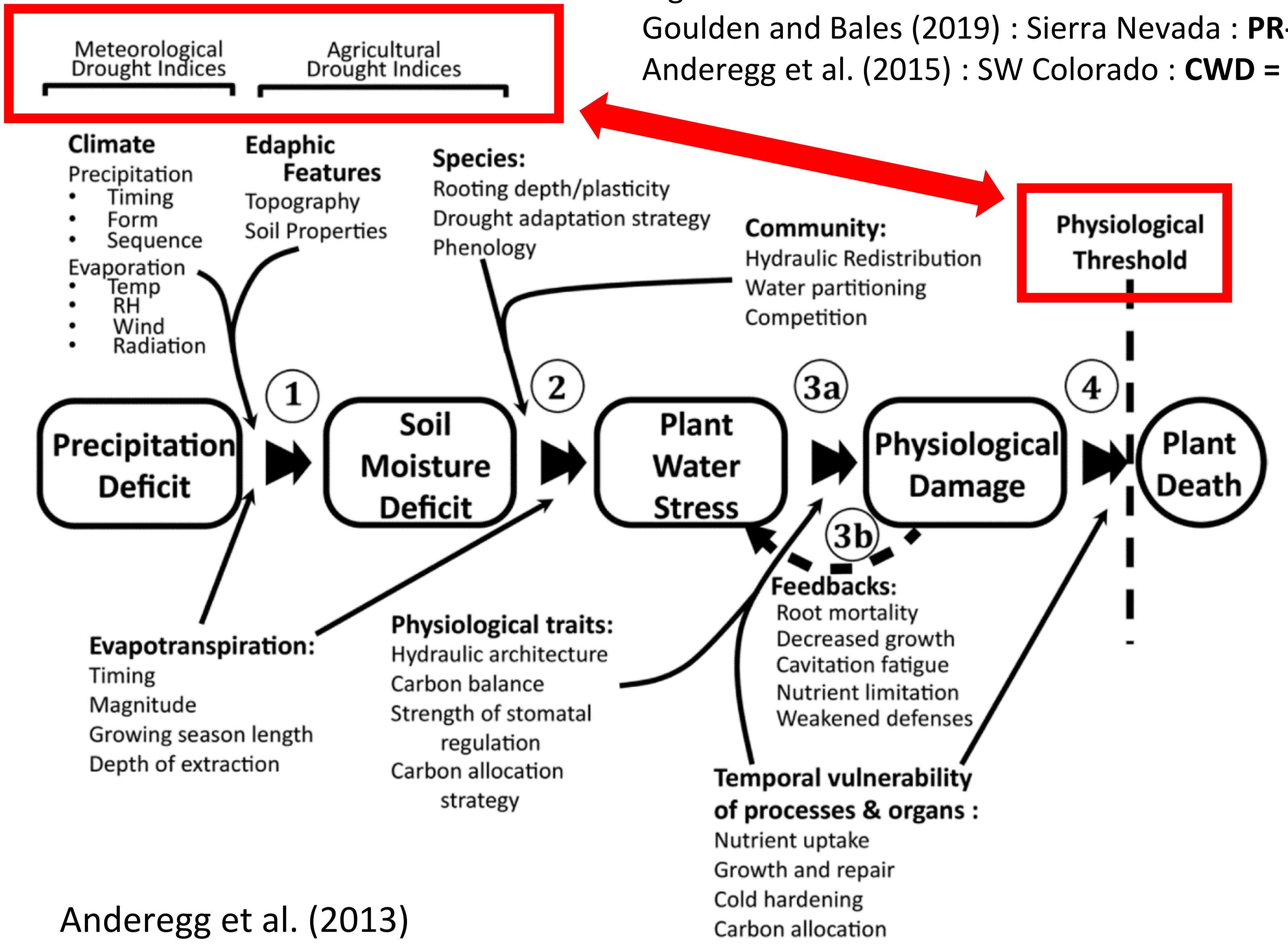
with ***California Ecosystem Futures*** project group:

Michael L. Goulden (UCI), Alex Hall (UCLA), Rong Fu (UCLA), Max A. Moritz (UCSB), Charles D. Koven (LBL), Lara M. Kueppers (UCB), Carl A. Norlen (UCI) and James T. Randerson (UCI)

https://doi.org/10.1088/1748-9326/abc719

Droughts and forest die-off

e.g.
Goulden and Bales (2019) : Sierra Nevada : **PR-ET = 1500mm**
Anderegg et al. (2015) : SW Colorado : **CWD = 5500mm**



Anderegg et al. (2013)

Research questions :

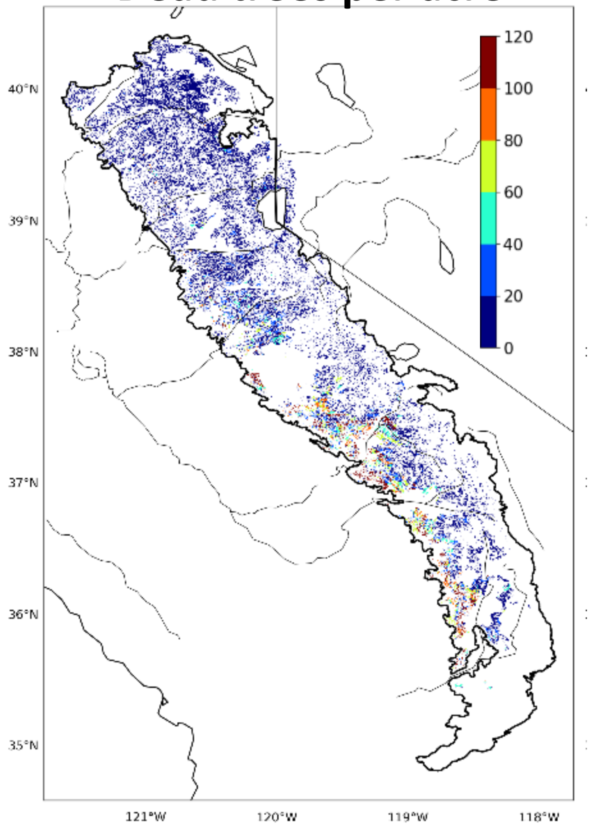
1. Identify the drought timescales strongly associated with forest die-off (drought sensitivity timescale) in Sierra Nevada forests

2. Interpretation of this ‘drought sensitivity timescale’

Research questions :

3. **Explain the forest die-off in Sierra Nevada during the exceptionally severe 2012-2015 drought**

Dead trees per acre



- over 147 million dead trees
- Why was the forest die-off concentrated in the Southern Sierra?
  - Drought severity and/or drought resistance ?

4. **What are the future implications?**

Methods :

Correlation analysis between multidecadal (1981-2011) tree mortality proxies and drought indices for different drought integration periods

- Tree mortality proxies : Canopy moisture content obtained using remote sensing (NDMI, CWC)
- Drought metrics : SPI, PR-ET, SPEI, CWD

Random forest regressions to,

- explain the spatial variation of the drought sensitivity timescale
- model 2012-2015 forest die-off

NDMI : Normalized difference moisture index
CWC : Canopy water content
NDVI : Normalized difference vegetation index

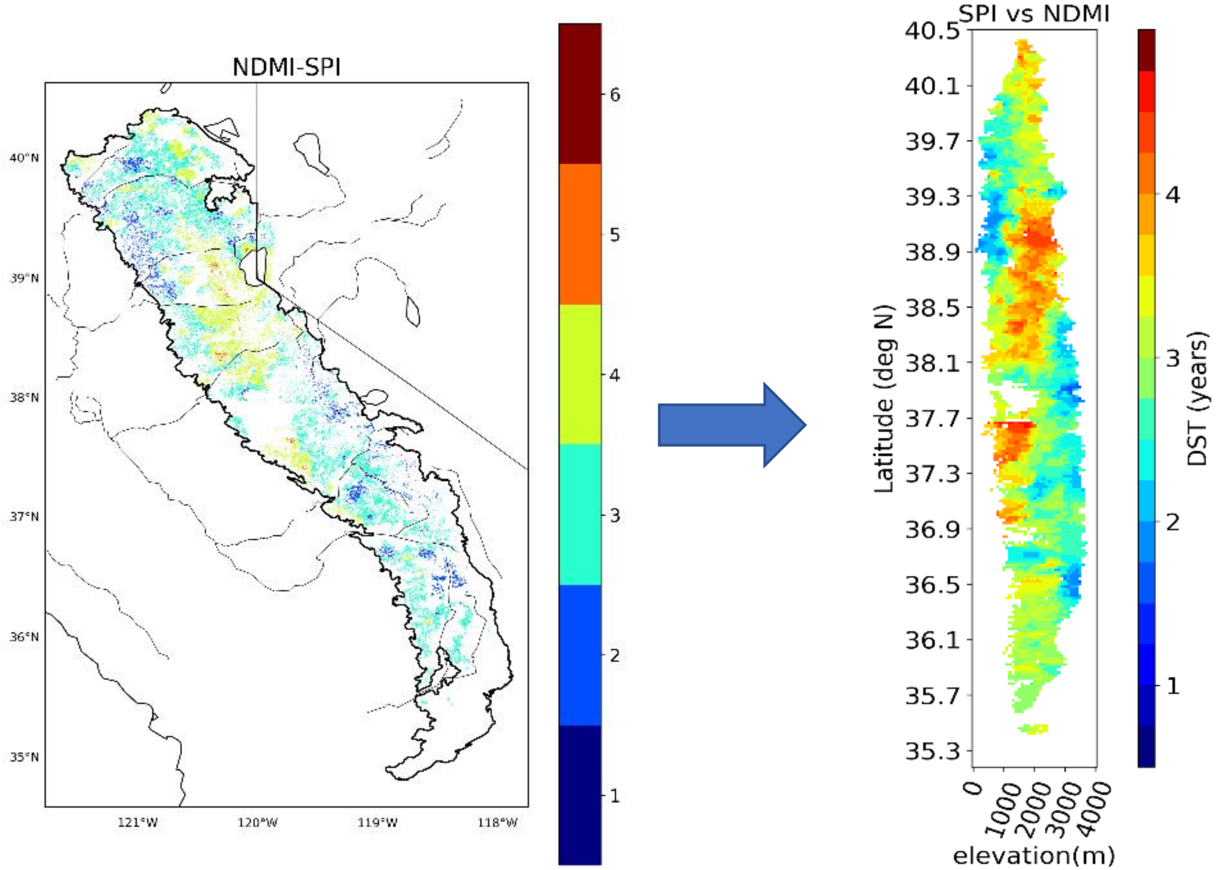
Data :

Vegetation : NDMI and NDVI (Landsat), CWC (Landsat + imaging spectroscopy + LiDAR)

Climate : PR (downscaled PRISM data),
PET, CWD (from USGS basin characterization model)
ET (based on obs NDVI-ET relationship)

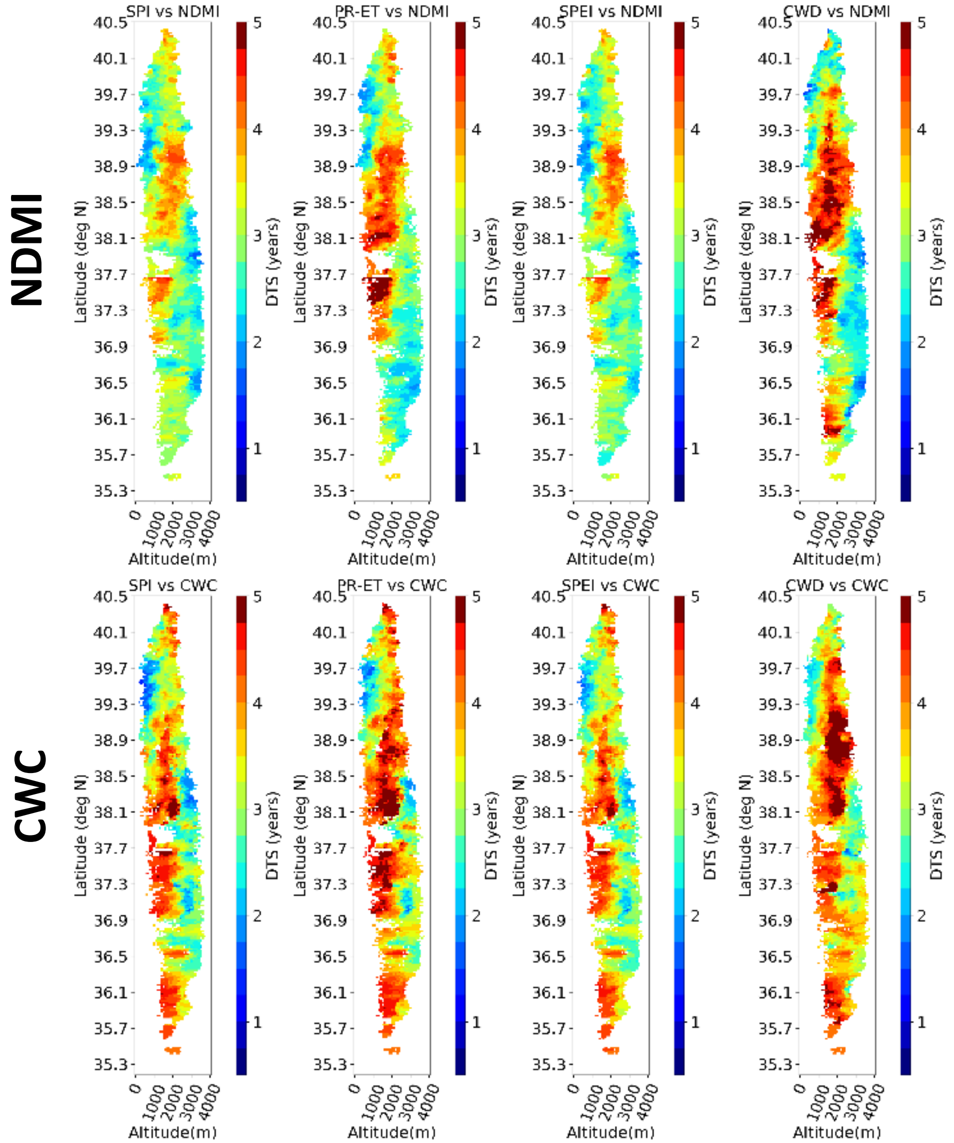
270m resolution

1. Drought sensitivity timescale (DST) :



- Coherent spatial patterns of DST can be seen

1. Drought sensitivity timescale (DST) :



- spatial patterns of DST are qualitatively similar for different drought and canopy moisture indices

2. Interpretation of the drought sensitivity timescale (DST)

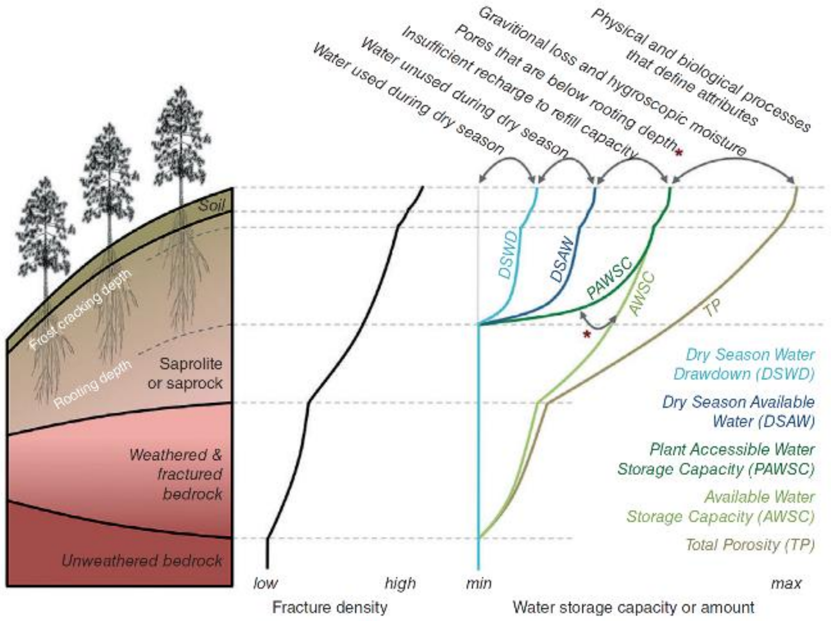
In steady state :

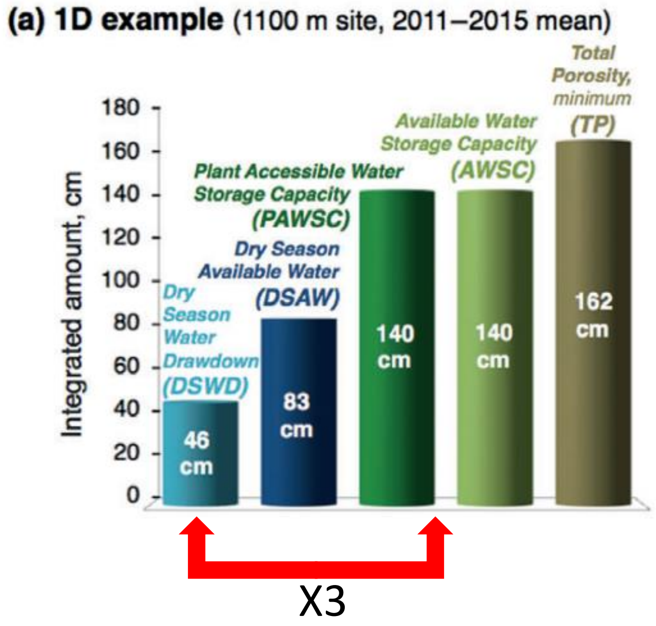
Subsurface storage capacity = Plant water uptake (U) x DST

mm **mm/year** **year**

Motivation behind this hypothesis :

P. Zion Klos, Michael L. Goulden et al (2018) Subsurface plant-accessible water in mountain ecosystems with a Mediterranean climate, *WIREs Water*





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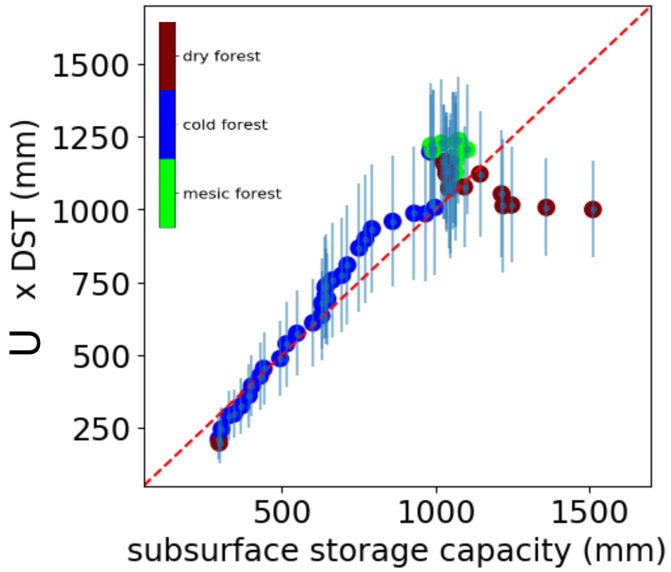
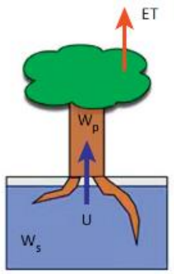


- This suggests that the DST is essentially a representation of the **plant water buffer :** **i.e. this is a new drought resistance measure!**

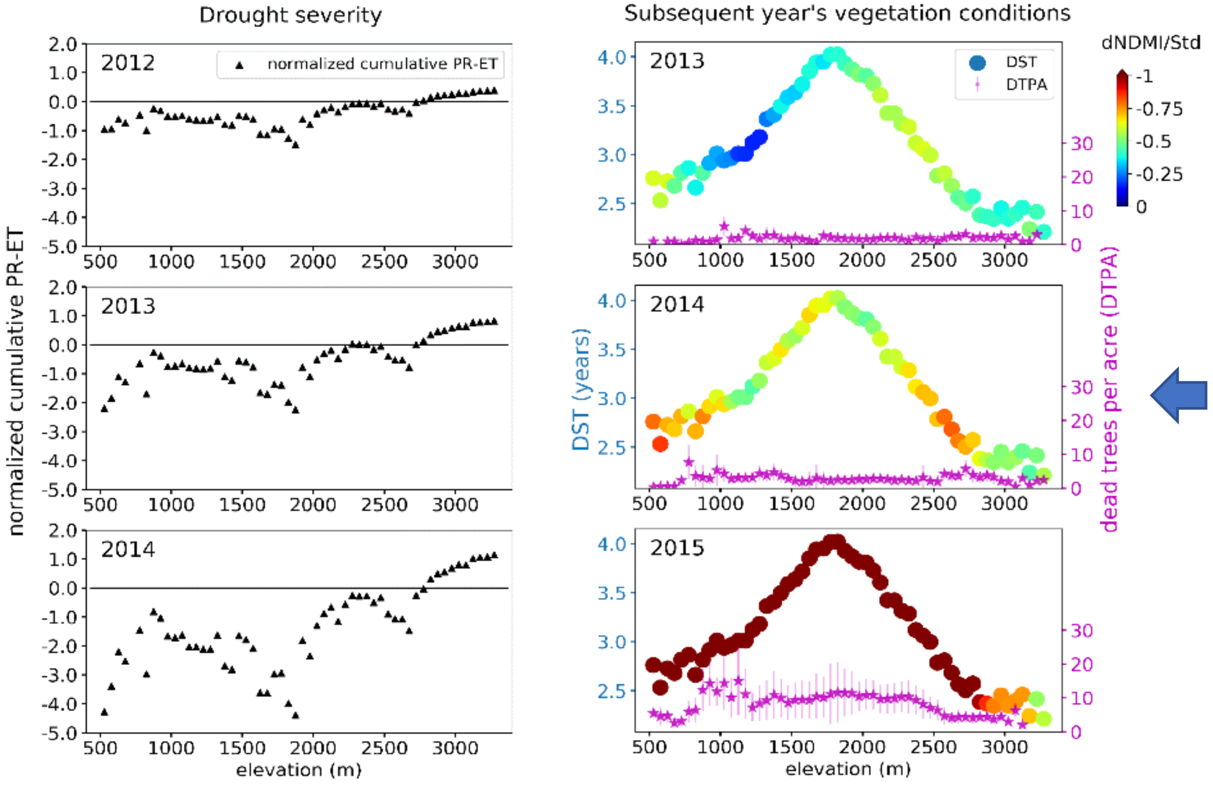


- DST is controlled by the factors determine U (in supplementary)

3a. Usefulness of drought sensitivity timescale (DST) :

Drought severity is increasing yearly, from 2012-2014

Drought is severe in all elevations below ~2700m



During 2013, drought impact is not high yet

By 2014, lower DST regions with high drought severity are first showing the vegetation stress

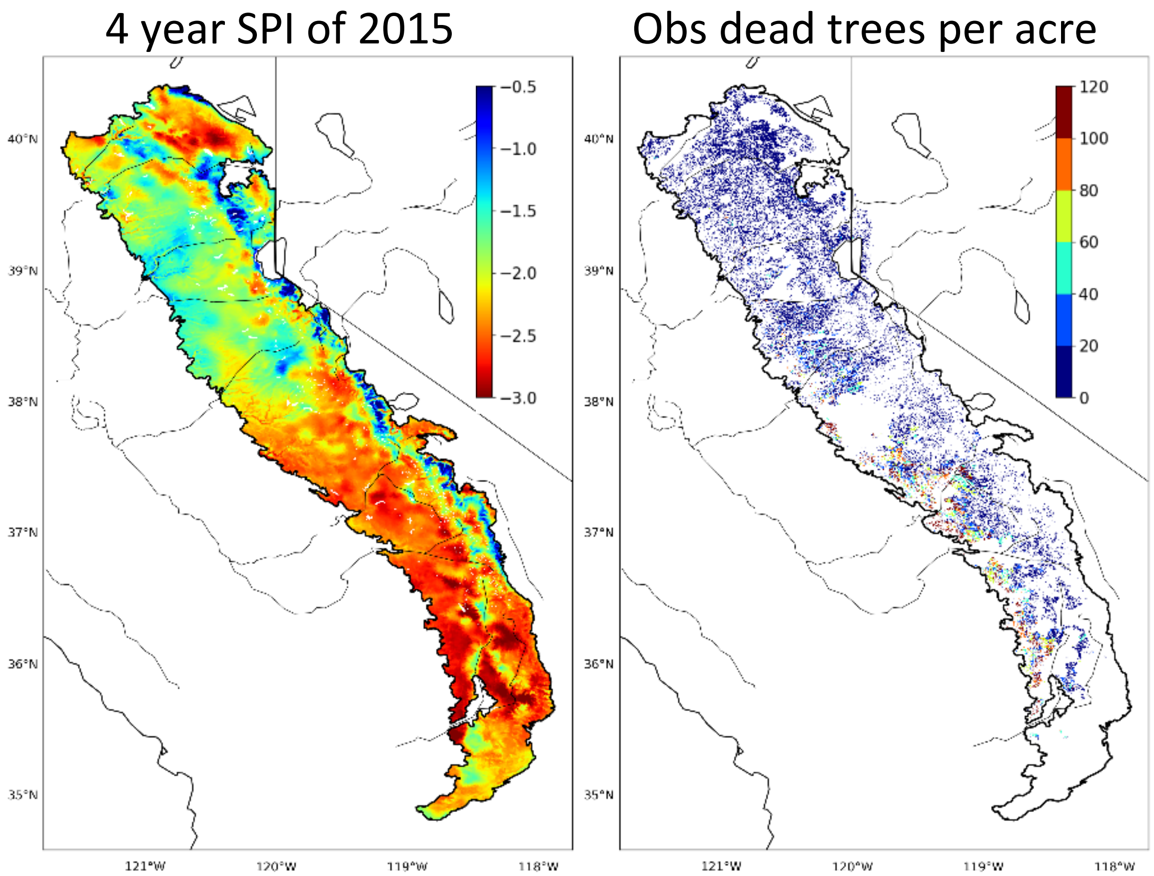
Direct tree mortality also starting to show in these low DST regions (purple stars)

By 2015, all regions are stressed

Tree death can be seen in everywhere

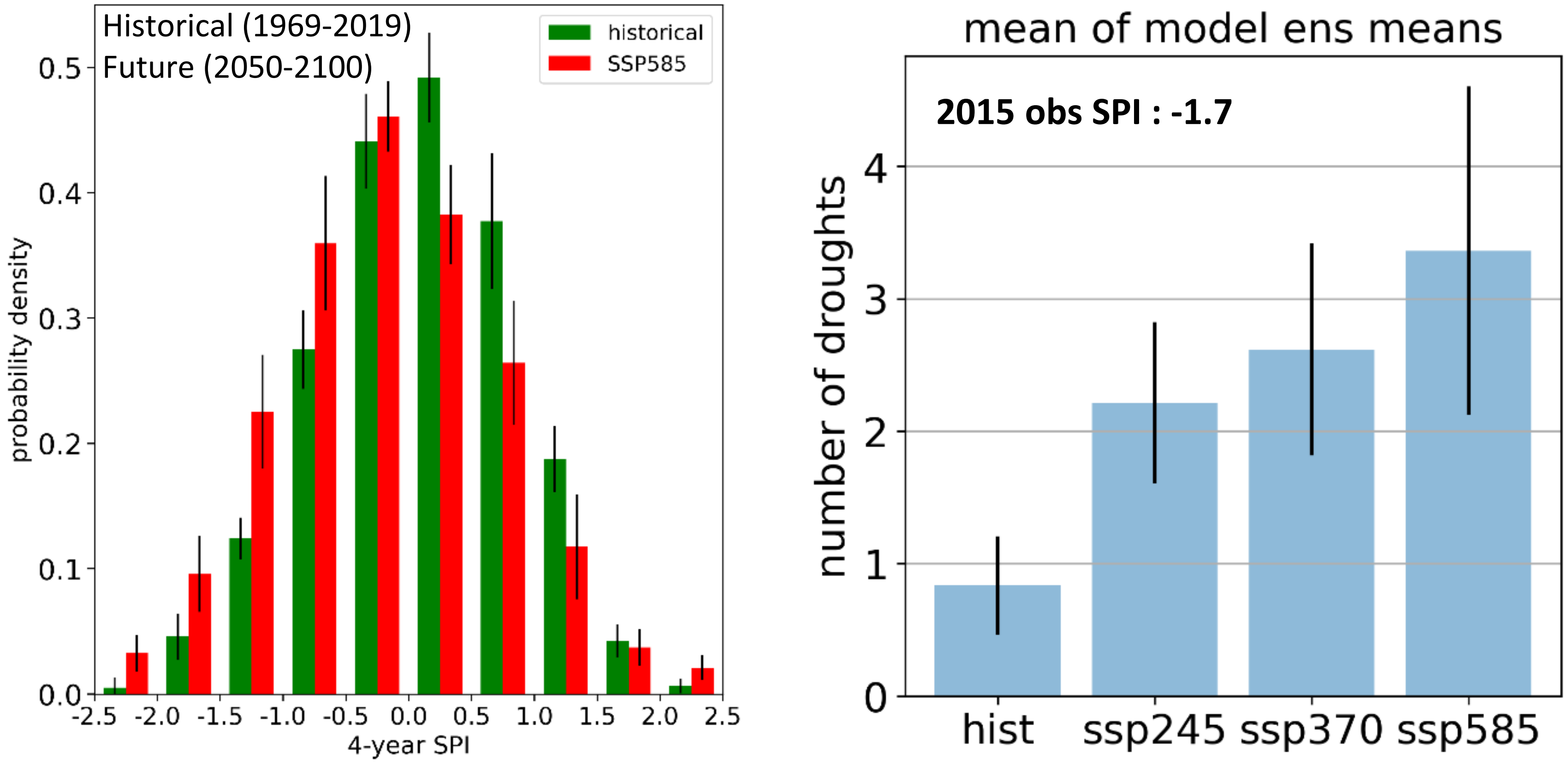
- Drought severity with DST seems to be useful in anticipating the drought induced vegetation stress during the drought evolution

3b. Forest die-off, drought severity and drought resistance



- Final, total tree death during the drought seems to be dominated by the drought severity (concentrated in Southern Sierras)
- If the drought severity was uniform and similar to Southern Sierra (SPI=-2.5), random forest regression based results show that tree die-off could be widespread, covering central and northern sierra forests

4. Future implications : CMIP6 CA average drought conditions



- Using 10 CMIP6 models with two or more ensembles available for all three future scenarios (total 90 ensembles per scenario)
- Future precipitation distribution shifts to a drier regime
- More 2012-2015 like droughts could occur in the future (~ three fold increase)

Supplementary Information

2. Interpretation of the drought sensitivity timescale (DST)

In steady state :

Subsurface storage capacity = Plant water uptake (U) x DST

mm **mm/year** **year**

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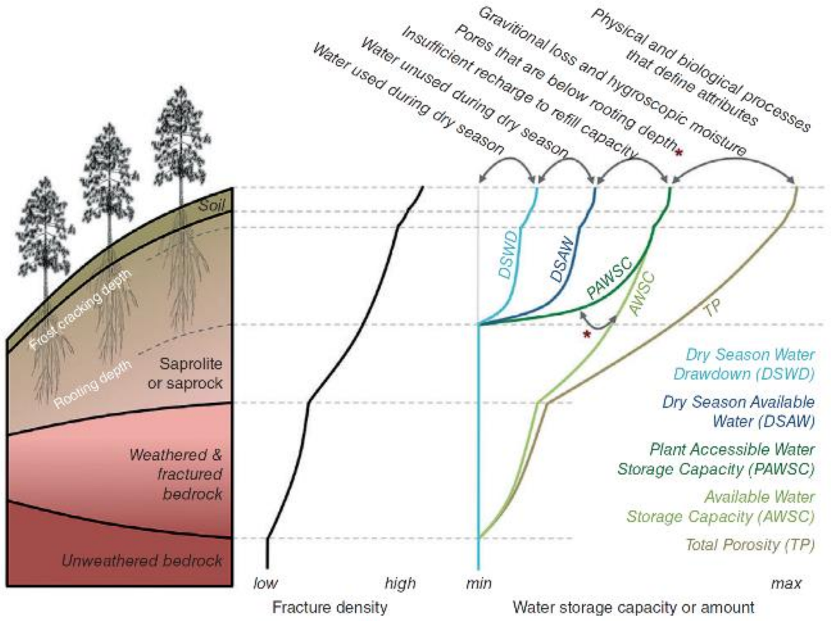
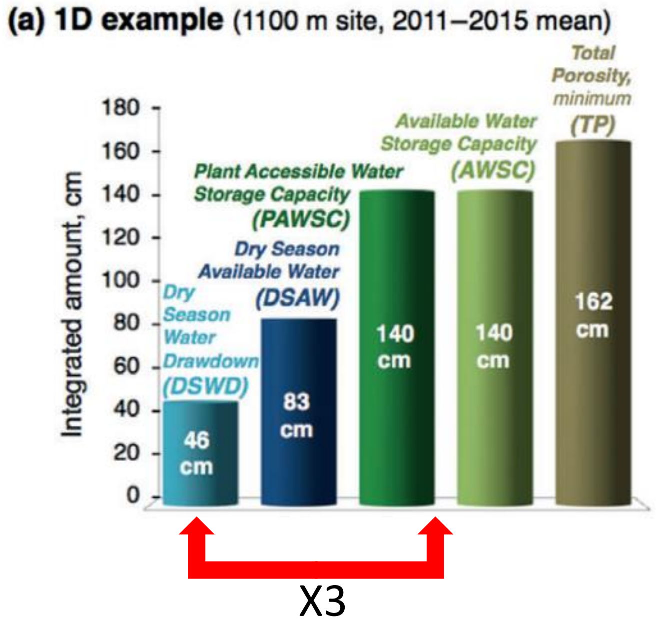
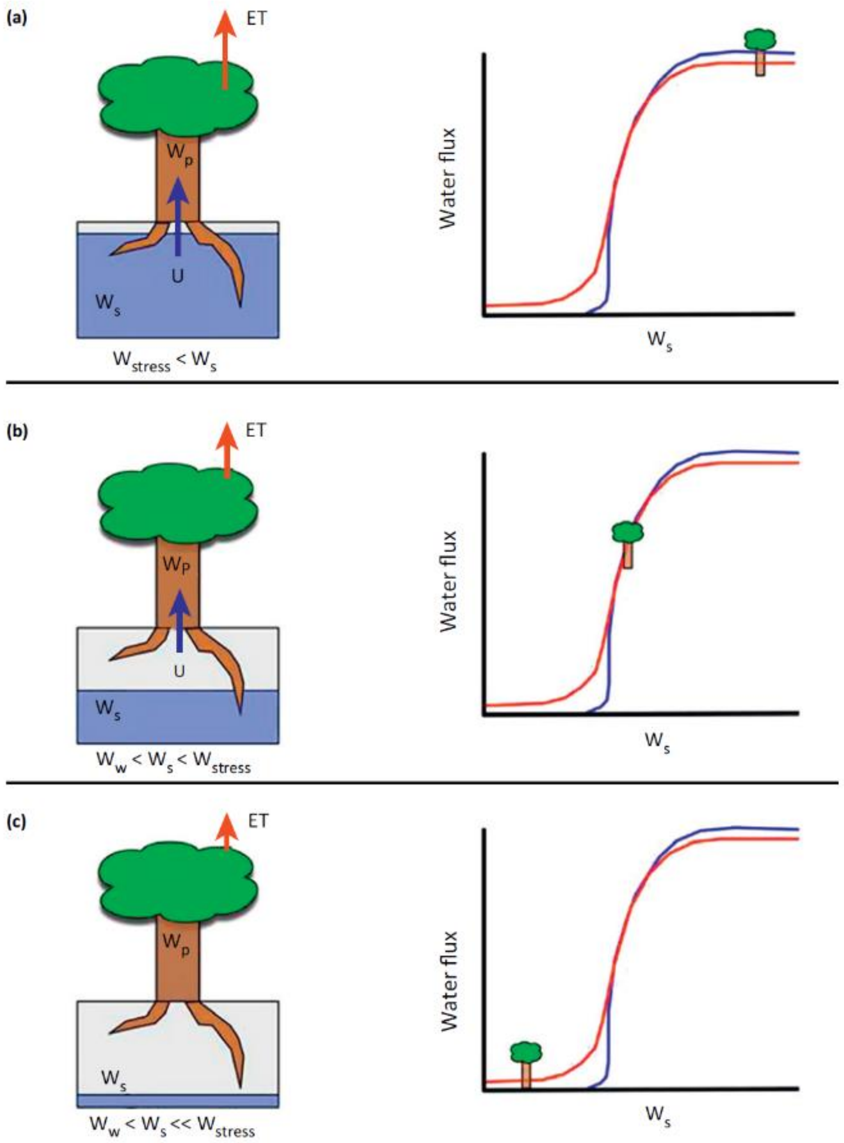
P. Zion Klos, Michael L. Goulden et al (2018) Subsurface plant-accessible water in mountain ecosystems with a Mediterranean climate, *WIREs Water*



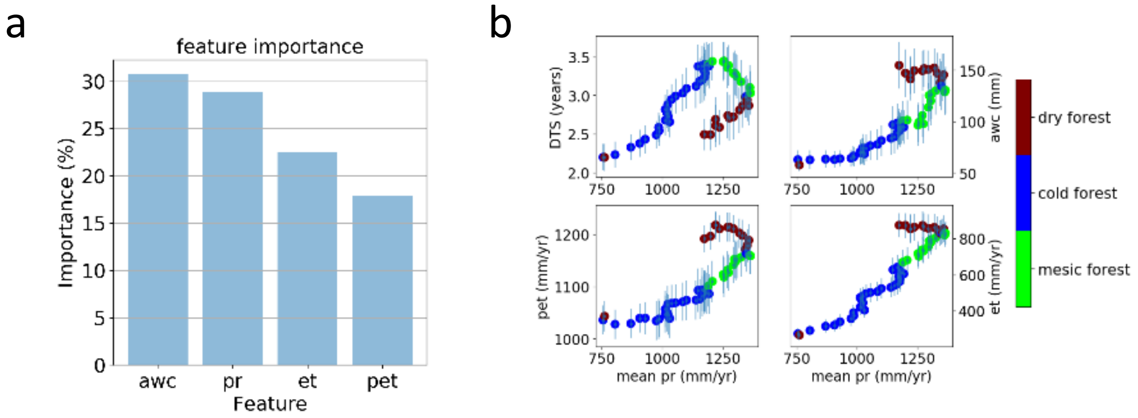


Droughts and forest die-off

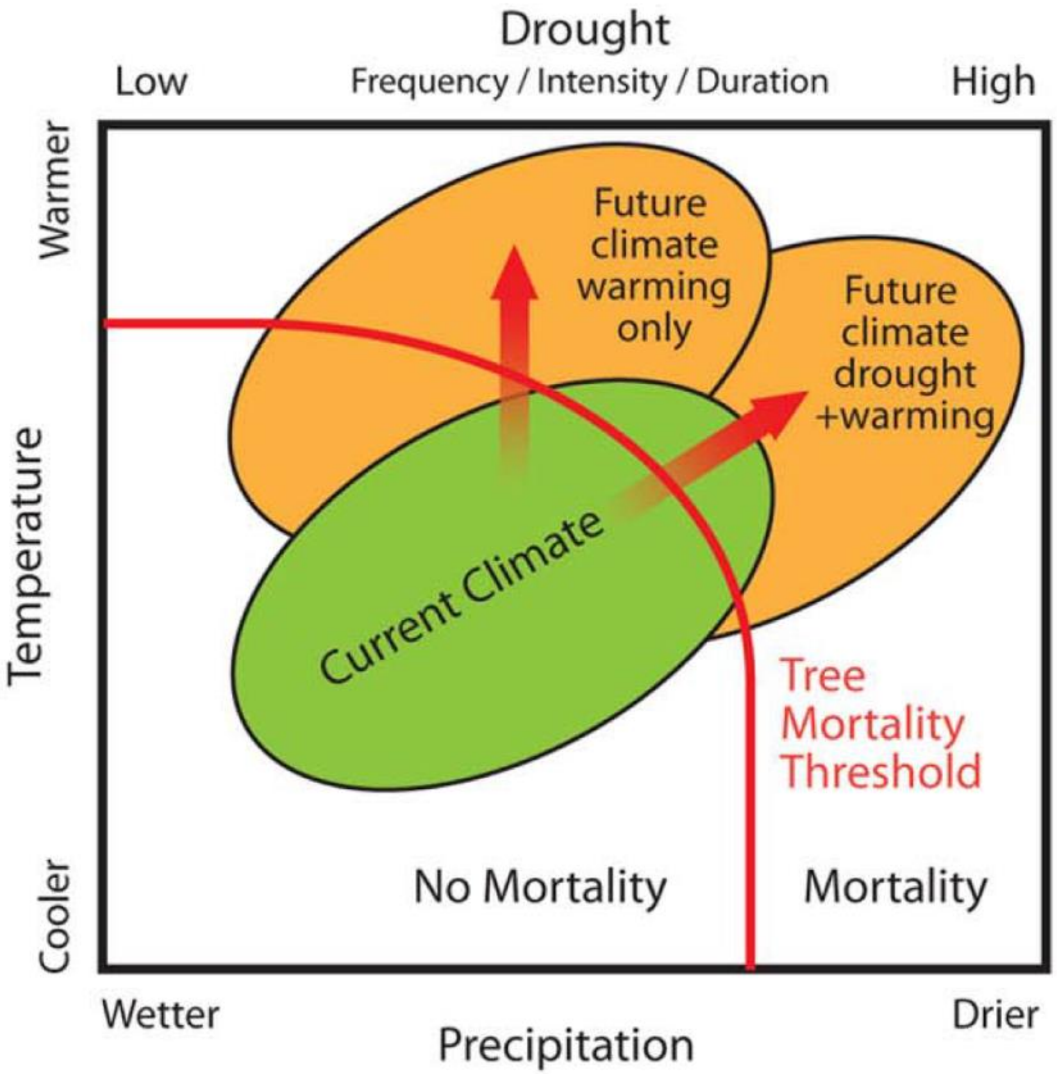


Anderegg et al. (2012)

Controls of the drought sensitivity timescale (DST)

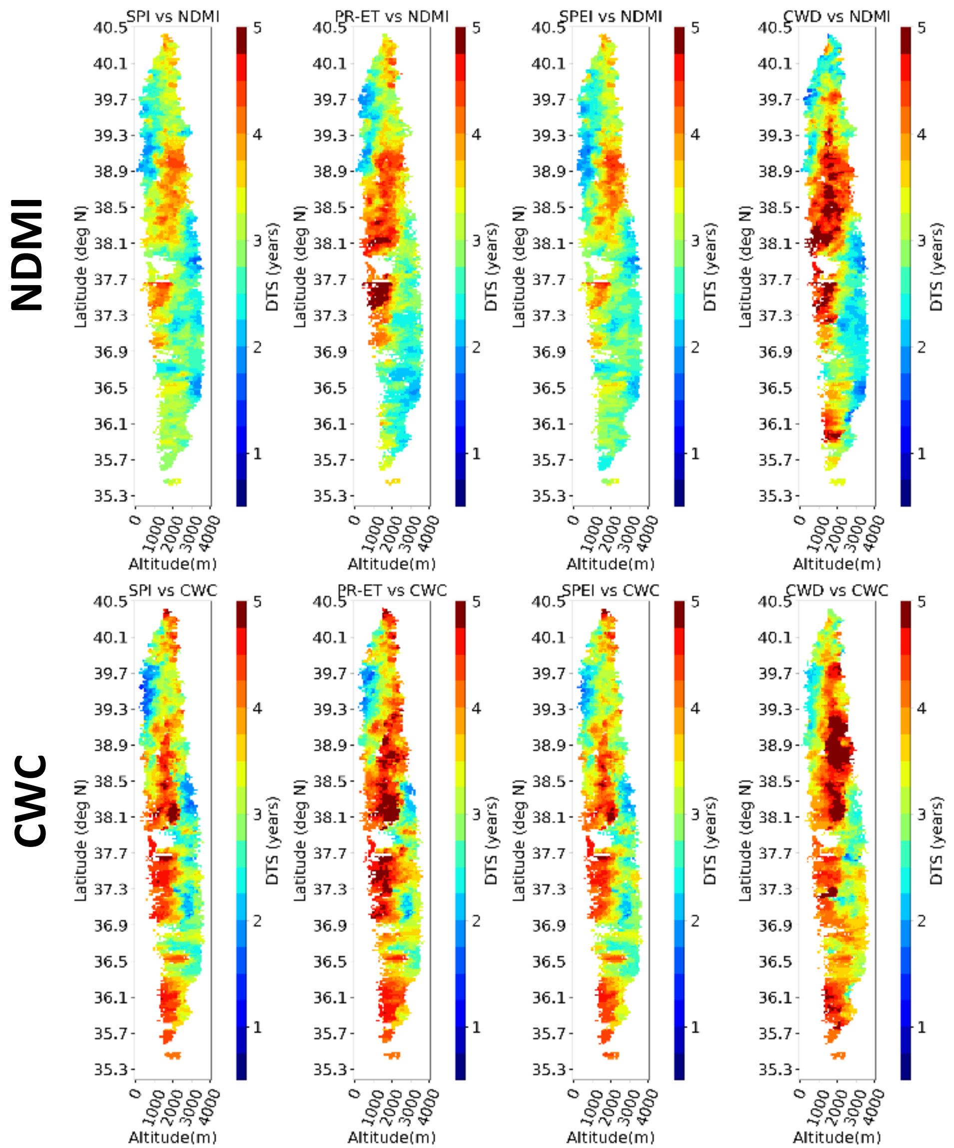


4. Future implications



Allen et al. (2015)

1. Drought sensitivity timescale (DST) :



- spatial patterns of DST are qualitatively similar for different drought and canopy moisture indices

Dendroctonus valens (red turpentine beetle) and Don Owen (Cal Fire, retired)

Curtis's Talk