

Forest Health Conditions in California 2019

CONDUCTED BY REGION 5 STATE AND PRIVATE FORESTRY AERIAL
SURVEY PROGRAM

PROGRAM MANAGER AND LEAD SURVEYOR JEFFREY MOORE



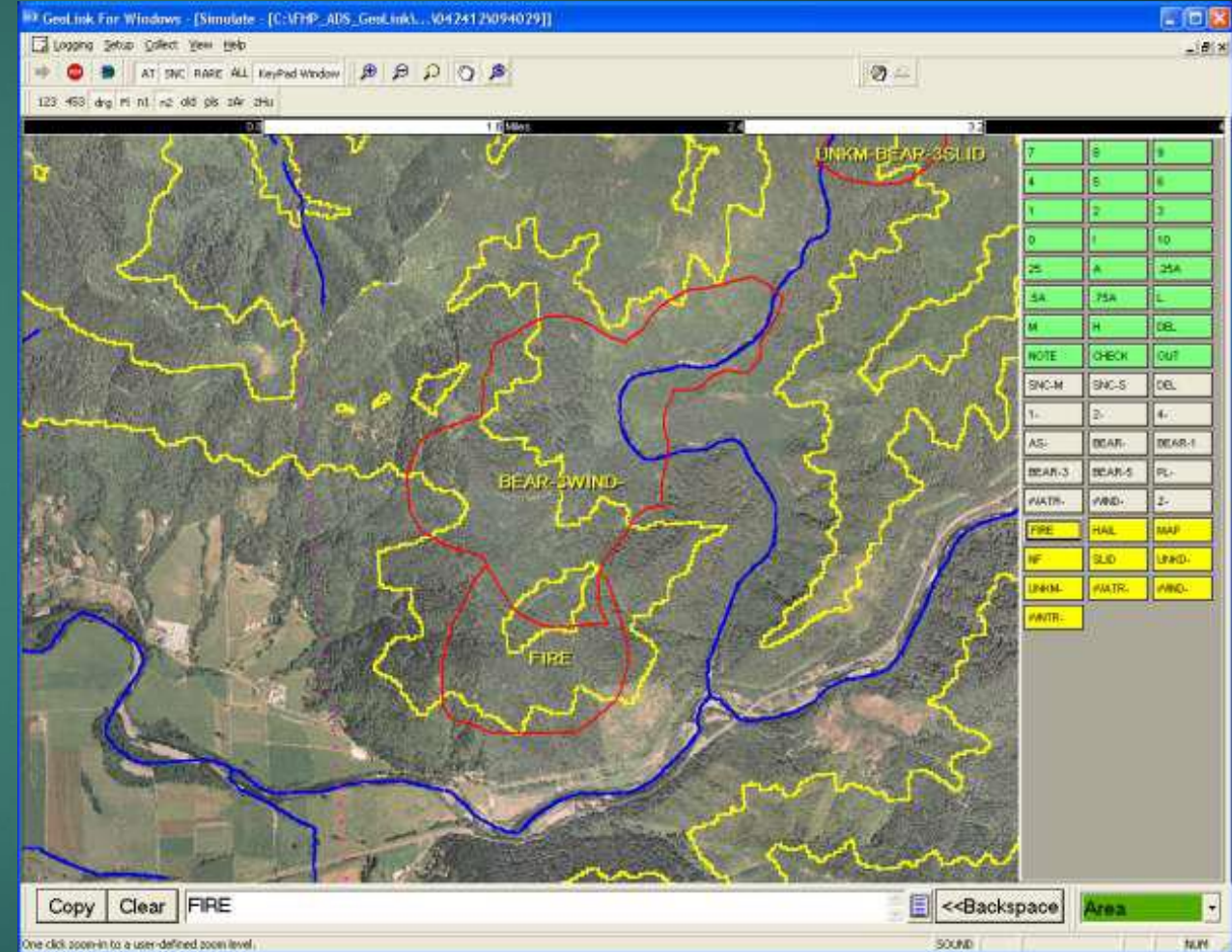
Who We Are

- Small Program
 - One fulltime aerial detection survey specialist
 - Detailed another ADS specialist from R3 Arizona
 - Utilize a contract surveyor in summer
- Plane and Pilot
 - Contracted Cessna 205
 - Operating budget around \$100,000 annually for aircraft services



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 2019 Covered approximately 54 million acres over 160 flight hours
- Survey is conducted in summer once dead trees dry out and turn color
- 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
 - Golden spotted oak borer
- 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 record trees killed by fire

Examples of Non-mortality tree Damage

- Defoliation
 - Defoliating insect activity such as tussock moth and oak leafroller
 - Foliar diseases such as *marsonina* and *anthracnose*
 - *Early leaf drop of deciduous oaks as a drought response*
- *Flagging or Branch Dieback*
 - *Cytospora in true fir*
 - *Engraver beetles in conifers*
- *Dieback*
- *Topkill*
- *Discoloration*

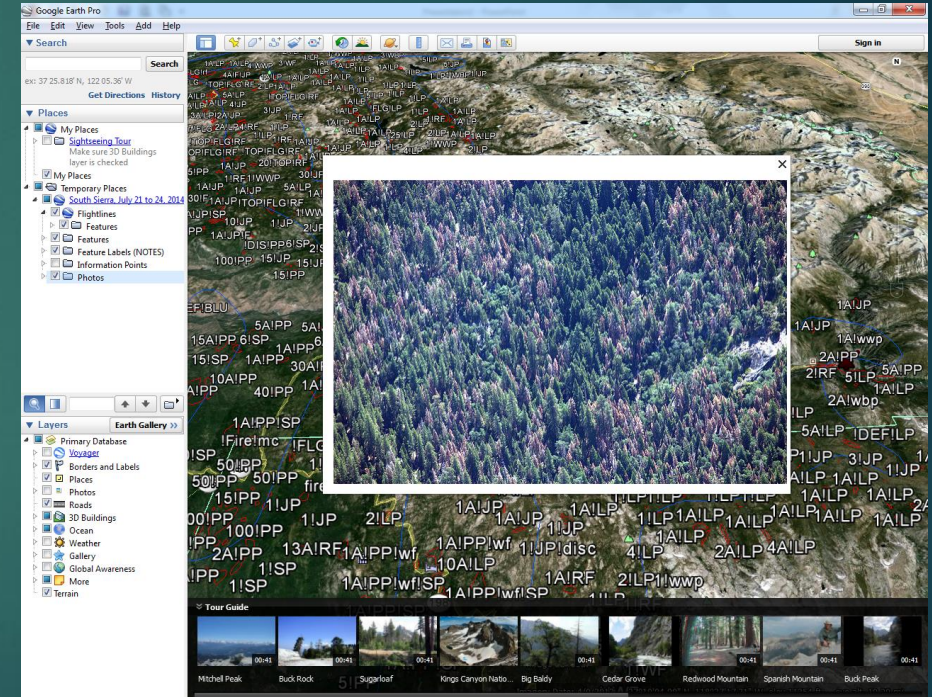
Photos

- ▶ 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 gradations, versatility, poor lighting conditions, etc. but is limited to visible spectrum, direct line of sight and general distance



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 finished for 2019
 - 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 2019
 - 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 2019

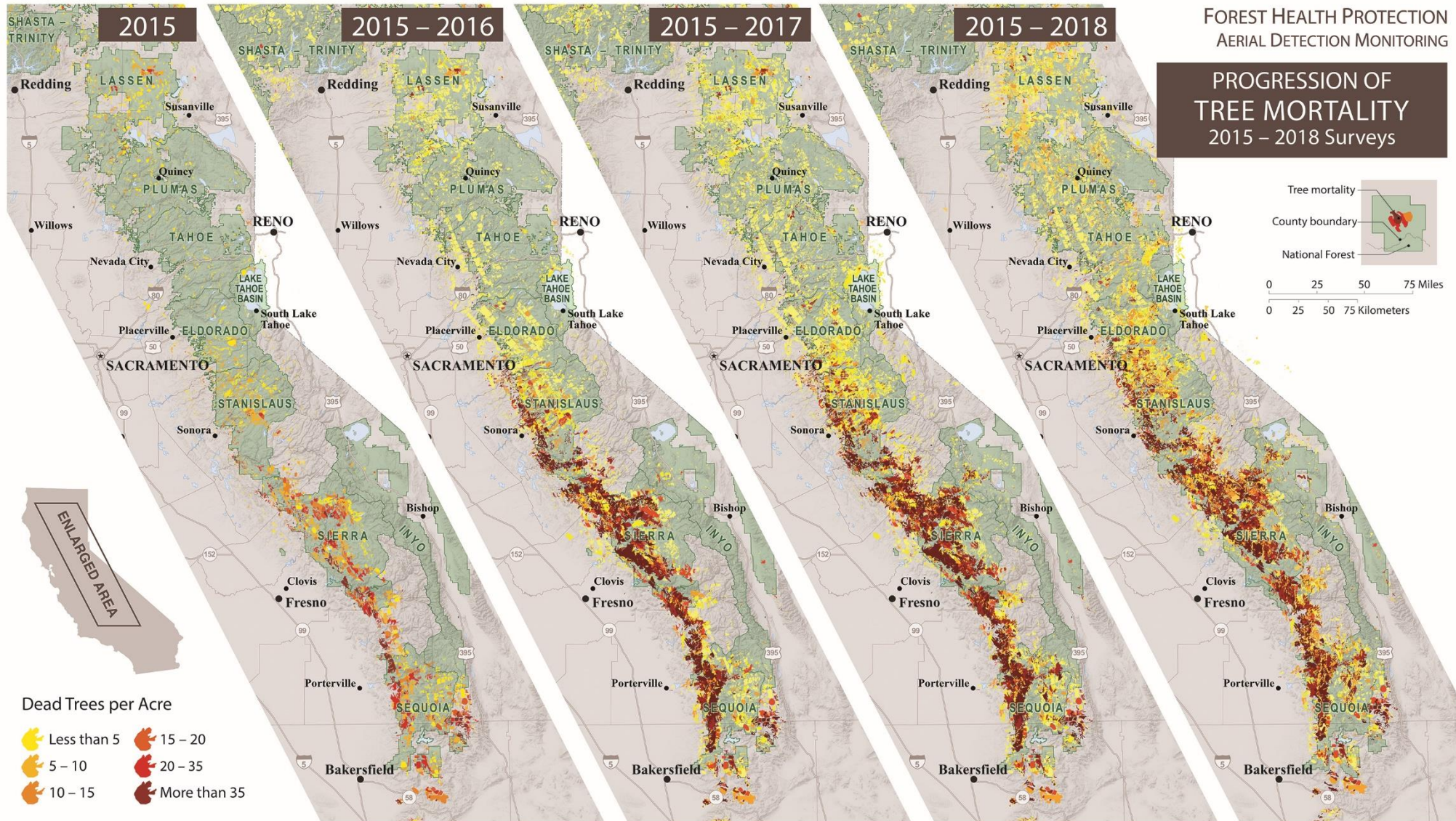
- ▶ Statewide six year drought from 2010 to 2016 resulted in an estimated 129 million dead trees.
- ▶ Each successive year mortality was greatly expanded both in area affected and overall intensity until 2017 a year after the end of the drought.
- ▶ In 2017 and 2018 an estimated additional 45 million trees died.
- ▶ Early in the drought, mortality was most concentrated in low elevation pine especially ponderosa in the southern Sierra Nevada Range.
- ▶ In 2016 pine and fir within the mixed conifer zones at higher elevations were greatly impacted for the first time.
- ▶ In 2017 mortality was primarily concentrated in white fir at mid elevation mixed conifer stands and in red fir at higher elevations.
- ▶ In 2018, areas of heavy fir mortality steadily progressed into higher elevations.
- ▶ Recent mortality was concentrated primarily in both white and California red fir and was generally also most intense in the Southern Sierra Nevada Range at mid to high elevations.



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FOREST HEALTH PROTECTION AERIAL DETECTION MONITORING

PROGRESSION OF TREE MORTALITY 2015 – 2018 Surveys



Dead Trees per Acre

- Less than 5
- 5 – 10
- 10 – 15
- 15 – 20
- 20 – 35
- More than 35



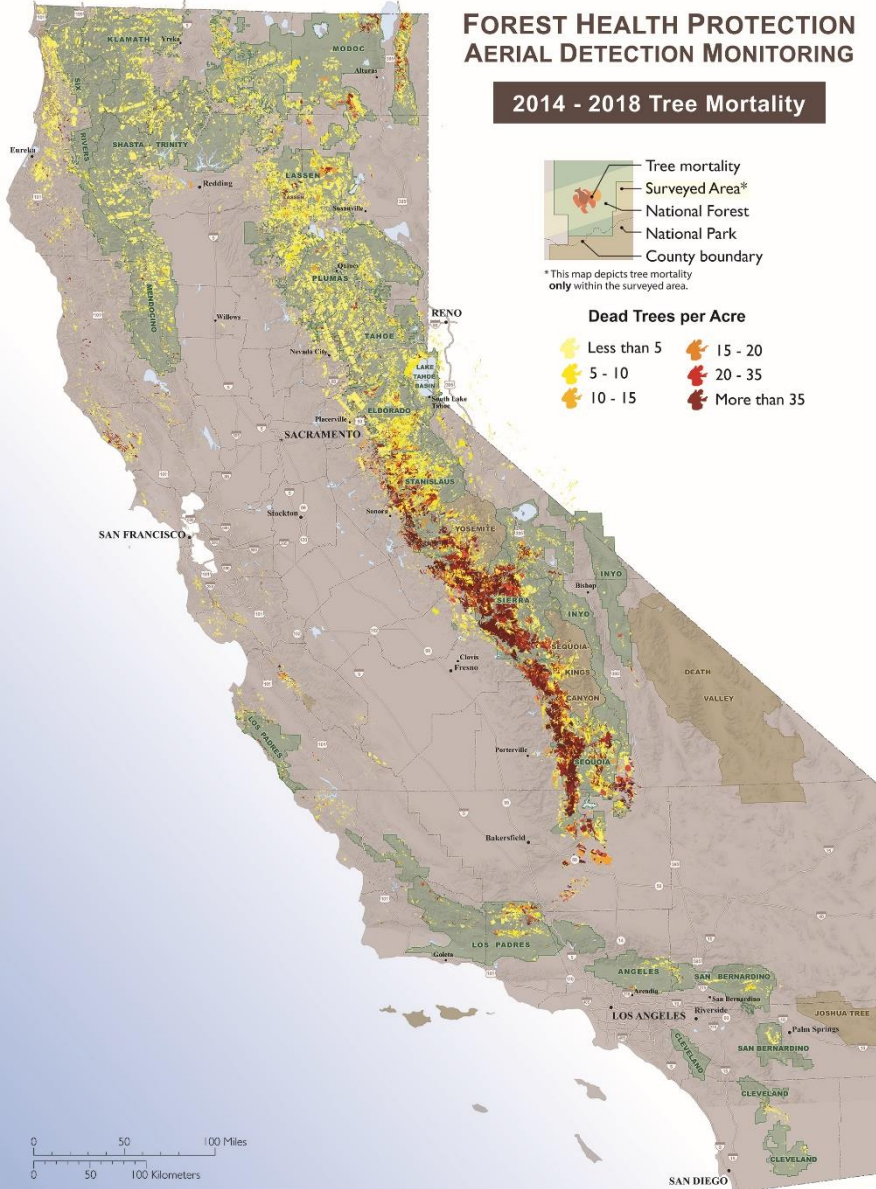
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FOREST HEALTH PROTECTION AERIAL DETECTION MONITORING

2014 - 2018 Tree Mortality



- Tree mortality
- Surveyed Area*
- National Forest
- National Park
- County boundary

* This map depicts tree mortality only within the surveyed area.

Dead Trees per Acre

- Less than 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 35
- More than 35



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February 6, 2019

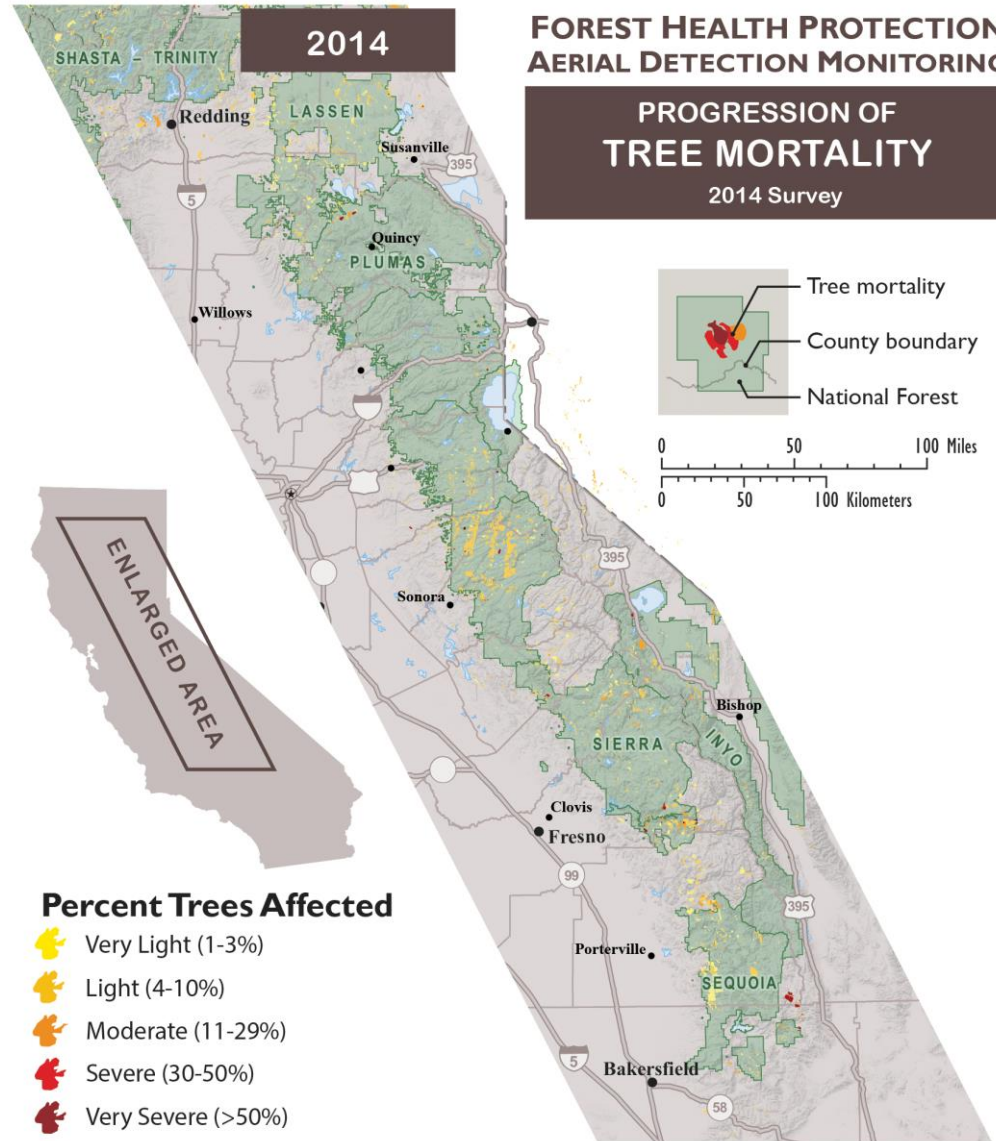


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FOREST HEALTH PROTECTION AERIAL DETECTION MONITORING

PROGRESSION OF TREE MORTALITY

2014 Survey



- Tree mortality
- County boundary
- National Forest

0 50 100 Miles
0 50 100 Kilometers

Percent Trees Affected

- Very Light (1-3%)
- Light (4-10%)
- Moderate (11-29%)
- Severe (30-50%)
- Very Severe (>50%)



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2019 Aerial Survey Draft Highlights

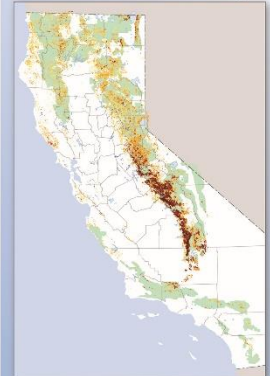
- ▶ Approximately 2.4 million acres with elevated levels of tree mortality were recorded in 2019 up from 2 million acres recorded in 2018 and similar to 2017
- ▶ Areas of pine most heavily impacted in previous years are now bereft of viable host
- ▶ Fir was the most impacted and mortality was common throughout the Sierra Nevada Range closely correlated with heavy stocking
- ▶ New mortality was again most concentrated in higher elevation fir within the southern Sierras Nevada Range
- ▶ Farther north new fir mortality was most intense in heavily stocked mixed conifer stands and top kill was common
- ▶ Pine mortality was again relatively minor and typically widely scattered at low intensities
- ▶ 3 years after a wet spring in 2016, sudden oak death related mortality was again greatly elevated from previous years
- ▶ GSOB activity continues to spread

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2019 SURVEY

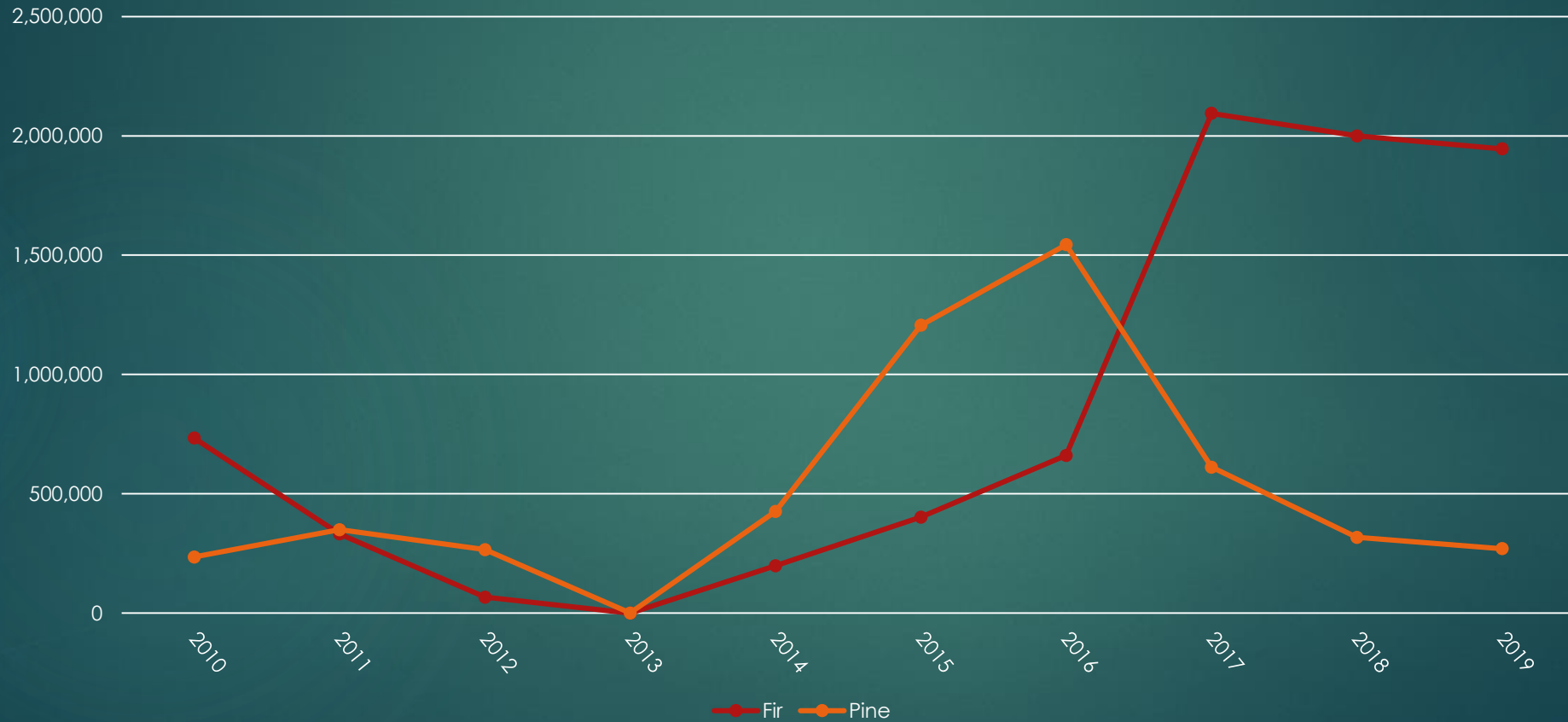


2015 – 2019 Tree Mortality



Pine and Fir Mortality Trend Line

Acres With Mortality



Was 2019 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 2019 was again several times that amount
- ▶ Fir trees are now often greatly compromised by other agents such as fir engraver, cytospora, mistletoe and/or heterobasidian and 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 2020

- ▶ Pine bark beetle populations are greatly reduced
- ▶ Overall health of surviving pine trees are now much improved
- ▶ Fir engraver beetle populations are still immense but success is likely tied to precipitation levels
- ▶ Topkill, root disease and other damage causal agents in fir are abundant throughout the host range
- ▶ SOD cankers are numerous on the landscape
- ▶ GSOB expansion will continue
- ▶ Invasive shothole borers are also expanding, but ADS has had little success in detecting this type of mortality
- ▶ Dry summer and fall as well as warm temperatures may enable successful bark beetle reproduction and other damage agent activity

White Fir Mortality in Mixed Conifer on Sierra National Forest



CA Red Fir Mortality in the Ansel Adams Wilderness Sierra NF



Thank You



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



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United States Department of Agriculture