Forest Health Conditions in California 2018

USDA U.S. FOREST SERVICE
Caring for the land and Serving the people
United States Department of Agriculture

REGION 5 FOREST HEALTH MONITORING
AERIAL SURVEY PROGRAM

CONDUCTED BY REGION 5 STATE AND PRIVATE FORESTRY AERIAL SURVEY PROGRAM

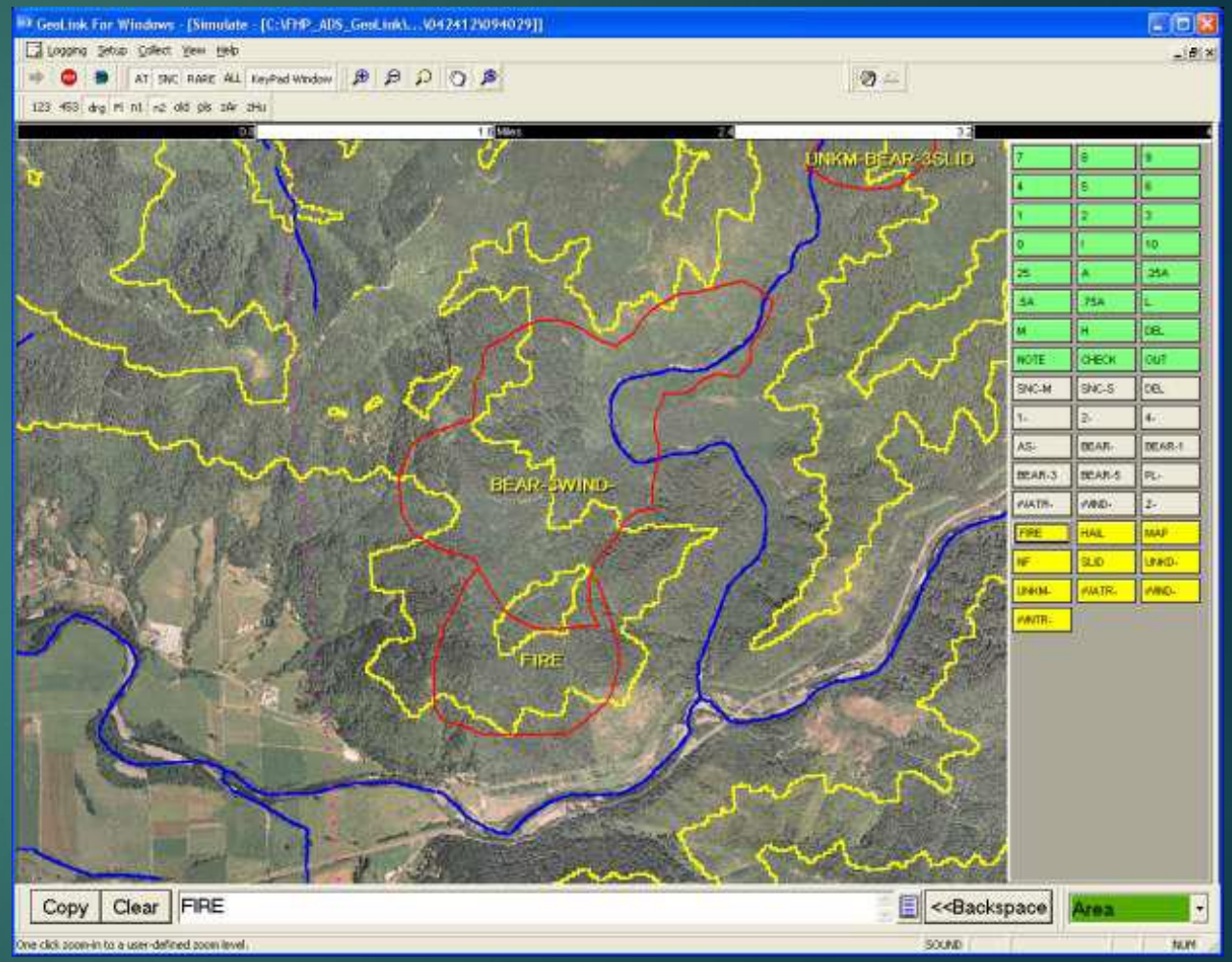
PROGRAM MANAGER AND LEAD SURVEYOR JEFFREY MOORE

Who We Are

- Small Program
  - Two fulltime aerial survey specialists
  - Jaqueline Pope new this year
  - Recently and presently utilize contract surveyors in summer
  - Calfire has shown interest in participating
- 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 2018 Covered approximately 46 million acres over 158 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 Produce

Annual update to a Regional database reflecting the location and extent of recently killed trees

- 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 windthrow, water damage, avalanches etc.

Examples of Non-mortality tree Damage

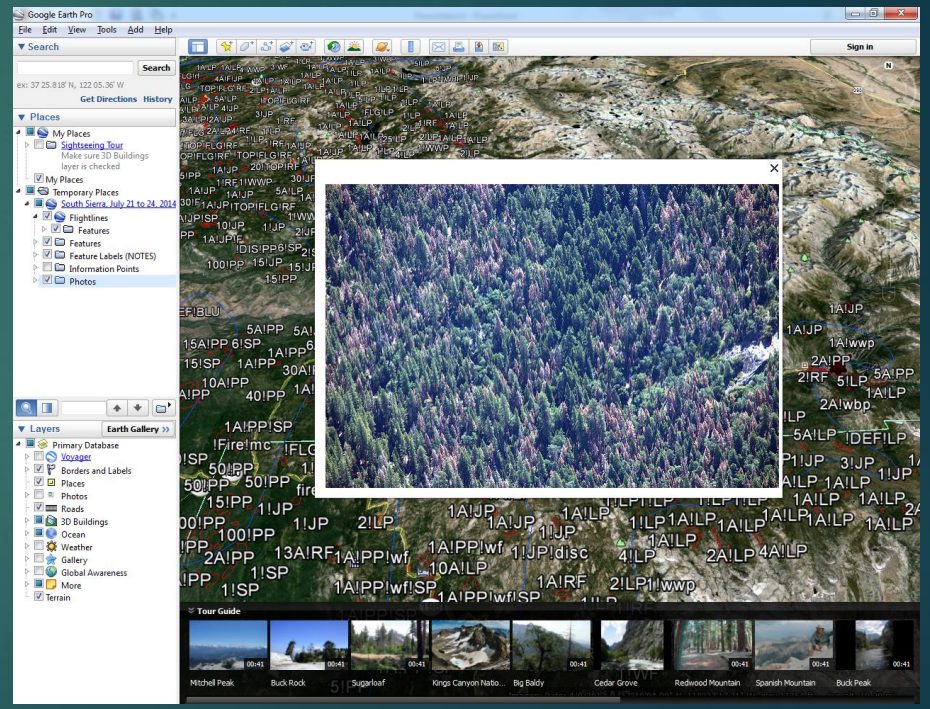
- Defoliation
  - Defoliating insect activity such as tussock moth and oak leafroller
  - Foliar diseases such as *marsonina* and *anthracnose*
  - *Early leaf drop of deciduous oaks as a drought response*
- *Flagging or Branch Dieback*
  - *Cytospora in true fir*
  - *Engraver beetles in conifers*
-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

Photos

- Photos are taken and freely shared via our Flikr 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 small scale 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

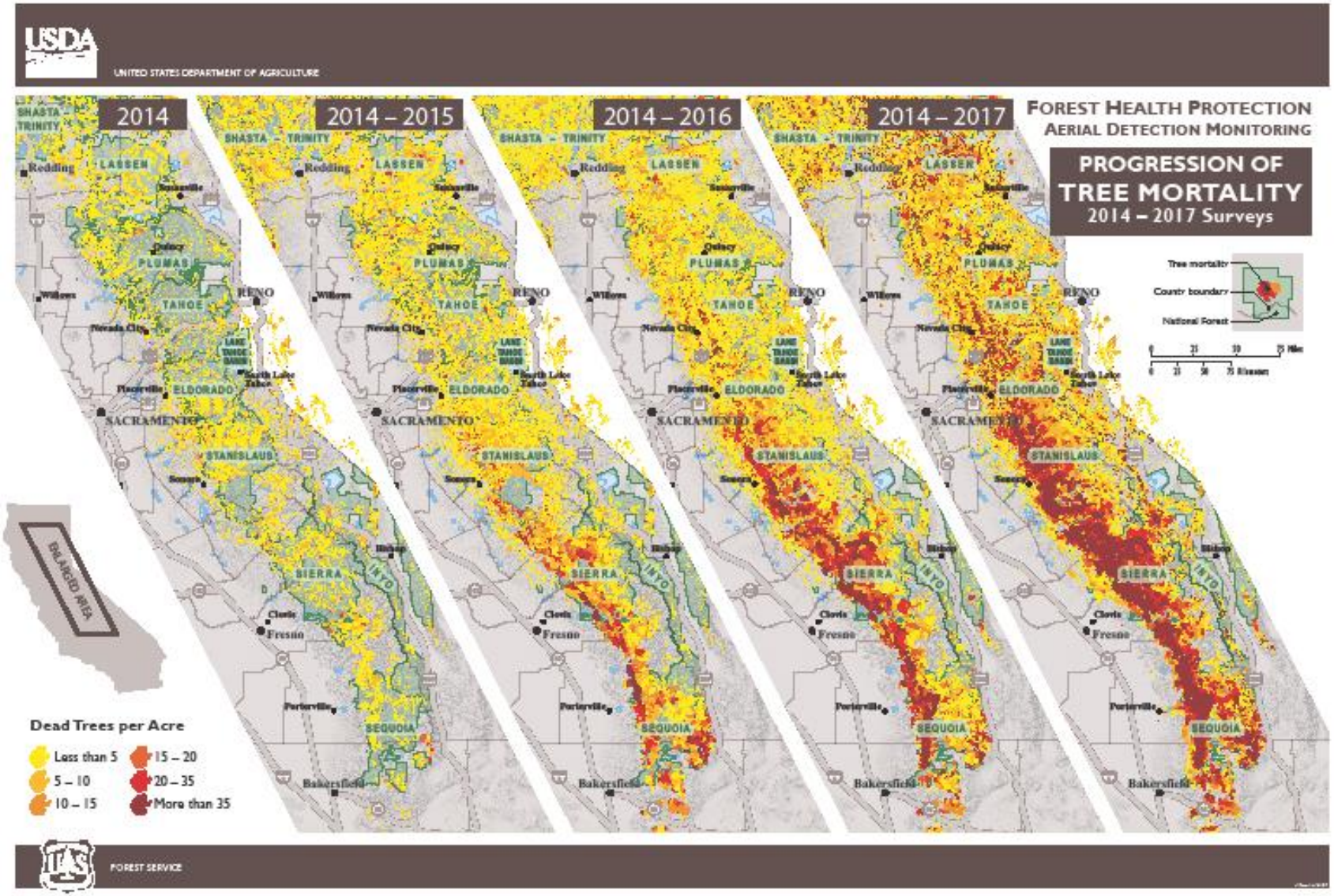
Deliverables

- 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 2018
  - Final report summary – not yet finished for 2018
  - National Aerial Survey Report
- GIS Data
  - Once finalized, a statewide Geodatabase is shared for use in Esri and other GIS applications
- Special Surveys, data and reports.
  - Large wind and Blowdown events
  - Wildfire areas



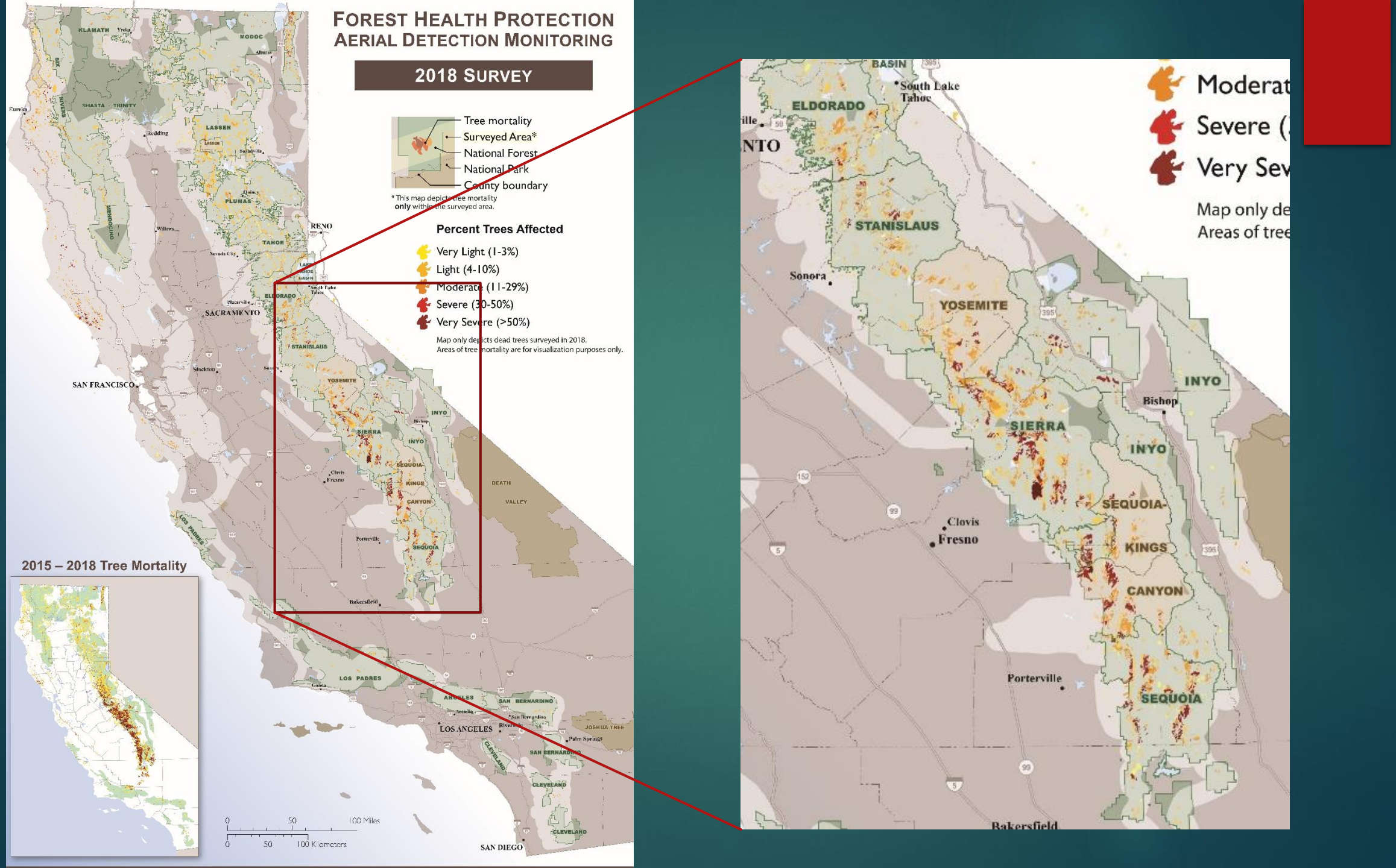
Forest Health Conditions Prior to 2018

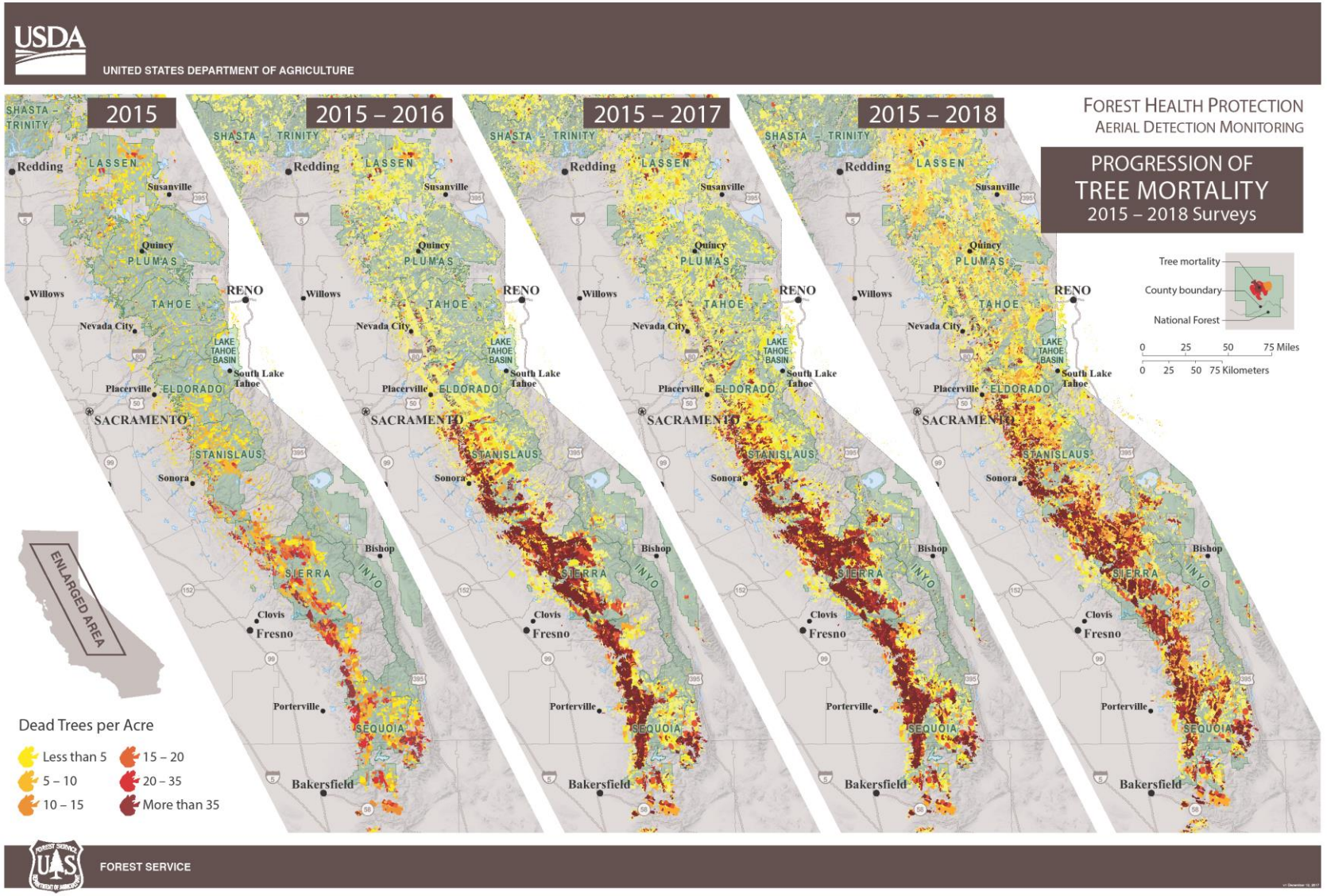
- Statewide six year drought from 2010 to 2016 resulted in an estimated129 million dead trees. Each successive year mortality was greatly expanded both in area affected and overall intensity until 2017 a year after the end of the drought.
- In 2017 alone an estimated additional 27 million trees died down from the estimated high of 62 million dead trees in 2016.
- Ongoing mortality was concentrated primarily in both white and California red fir and was generally most intense 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


USDA
UNITED STATES DEPARTMENT OF AGRICULTURE
2014
2014 – 2015
2014 – 2016
2014 – 2017
FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
PROGRESSION OF
TREE MORTALITY
2014 – 2017 Surveys
Tree mortality
County boundary
National Forest
SHASTA - TRINITY
LASSEN
PLUMAS
TAHOE
RENO
ELDORADO
SACRAMENTO
STANISLAUS
SIERRA
INYO
SEQUOIA
Redding
Quincy
Willows
Nevada City
Placerville
Fresno
Clovis
Porterville
Bakersfield
Bishop
BALANCED AREA
Dead Trees per Acre
Less than 5
5 – 10
10 – 15
15 – 20
20 – 35
More than 35
FOREST SERVICE

2018 Aerial Survey Highlights

- Approximately 2 million acres with elevated levels of mortality were recorded in 2018 down from 2.5 million acres recorded in 2017
- Areas 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 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
- Pine mortality was again relatively minor and typically widely scattered at low intensities
- 2 years after a wet spring in 2016, sudden oak death related mortality was greatly elevated from previous years
- GSOB activity continues to spread


FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING
2018 SURVEY
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%)
Map only depicts dead trees surveyed in 2018.
Areas of tree mortality are for visualization purposes only.
2015 – 2018 Tree Mortality
0 50 100 Miles
0 50 100 Kilometers
KLAMATH
MODOC
SHASTA
TRINITY
LASSEN
PLUMAS
TAHOE
RENO
ELDORADO
SACRAMENTO
STANISLAUS
YOSEMITE
INYO
SIERRA
SEQUOIA
KINGS
CANYON
DEATH
VALLEY
LOS PADRES
ANGELES
SAN BERNARDINO
LOS ANGELES
JOSHUA TREE
CLEVELAND
SAN DIEGO
SAN FRANCISCO
Bakersfield
Fresno
Clovis
Porterville
Sonora
Bishop
South Lake Tahoe
Moderat
Severe (
Very Sev
Map only de
Areas of tree


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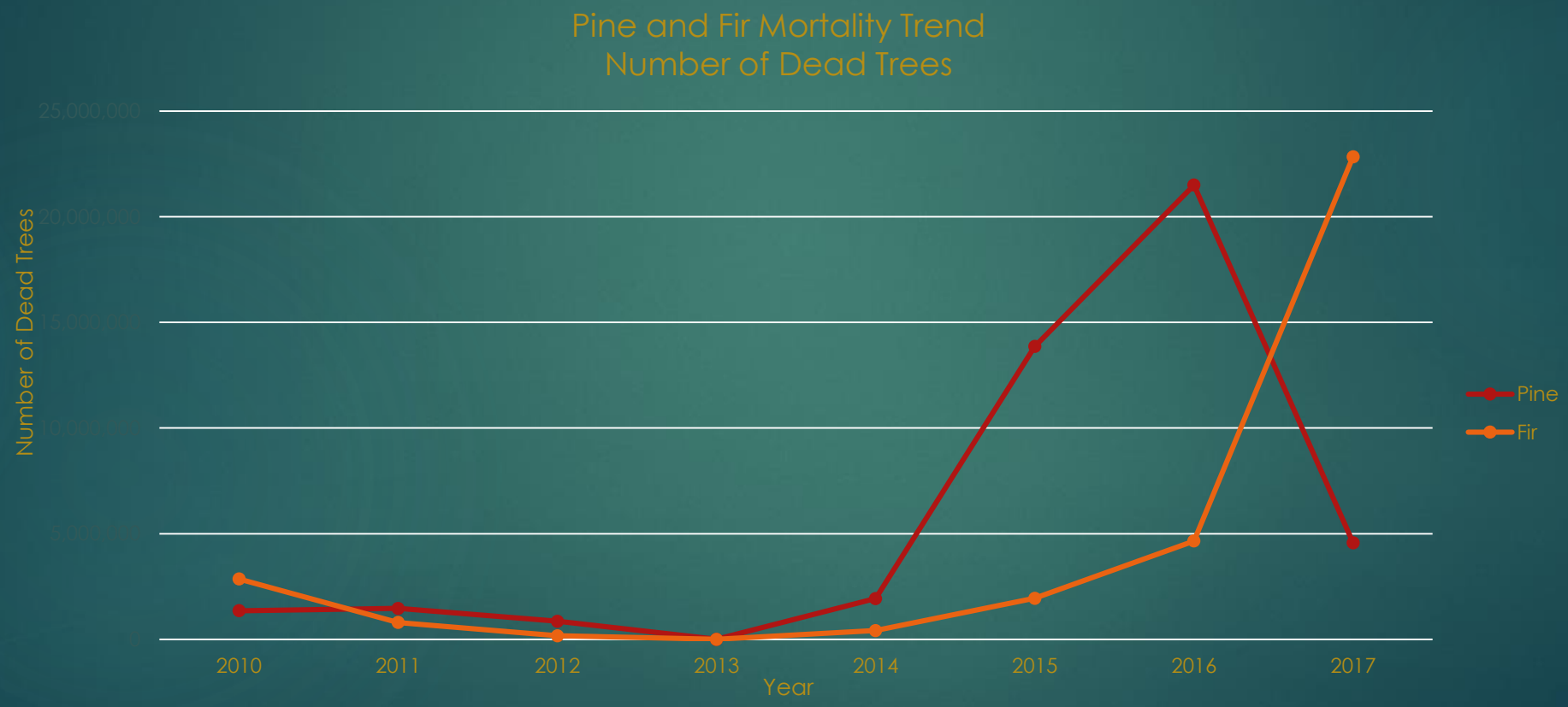
FOREST SERVICE

Pine vs Fir Mortality Trendline



Was 2018 a "Typical" Year for Aerial Survey?

- Typically red dead are apparent the year following actual mortality and this is known as a lag
- Did the immense pine bark beetle populations suddenly disappear?
- Were fir trees greatly compromised by other agents such as fir engraver, cytospora, mistletoe and/or heterobasidian? Over mature? Over Stocked?
- Did the drought effects take longer to affect high elevation ecotypes? Climate?
- A more typical year in CA will see 1-1.5 million trees die and 2018 was again several times that amount

Expectations for 2019

- Pine bark beetle populations are greatly reduced
- Overall health of surviving trees are now much improved
- Fir engraver beetle populations are still immense but success is likely tied to precipitation levels
- SOD cankers are numerous on the landscape
- GSOB expansion will continue

Low Elevation Pine on Sierra National Forest East of Shaver Lake

Fir Mortality in Mixed Conifer Ansel Adams Wilderness Sierra NF