

Bark beetles, drought, and CA forests

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*Thanks to Tom Smith, Don Owen (CALFIRE);
Sheri Smith, Danny Cluck (USDA FS)*

Bark Beetles in California Conifers



Are Your Trees Susceptible?

► R5-PR-023

► June 2012

Native bark beetles cause high levels of tree mortality in California. When, where, and the extent to which mortality occurs is primarily influenced by forest stand and drought conditions. A dramatic rise in the number of dead trees follows one to several years of inadequate precipitation. The more severe and prolonged the drought, the greater number of dead trees. Dense groups of trees are particularly susceptible to bark beetle attacks due to stress caused by competition for limited resources. Stressed trees equate to suitable host material for bark beetles and successful reproduction results in more beetles and higher levels of tree mortality.



HOW CAN SOMETHING SO SMALL KILL SOMETHING SO BIG?

Individual bark beetles are not much larger than a piece of cooked rice. Not only are they small and difficult to see, their activity is often scattered and hardly noticeable.

Bark beetles survive in trees that are stressed, diseased, or injured; either by human activity or during storms or wildfires. Occasionally, small groups of standing trees may be killed but over the landscape they are often unnoticed.

Bark beetles can increase dramatically when sufficient food is available. Typically this is in the form of drought-stressed trees. High numbers of these small beetles (outbreak populations) attack trees *en mass*. Often many trees are killed



WIDESPREAD TREE MORTALITY NEAR IDYLLWILD, CA - 2003

PITCH TUBES



Bark Beetles

Small cylindrical beetles

Brown or reddish brown to black in color

Clubbed antennae



How Bark Beetles Cause Tree Mortality

- Invade the bark of living trees – in mass
- Colonize, mate, and reproduce in nutrient-rich phloem tissues
- Feeding by larvae girdles the tree
- Introduce fungi
- Possibly help overcome tree defenses



Crown Symptoms



Symptoms



Mass Attack



Jeffrey Pine	Jeffrey pine beetles; Engravers; Pandora Moth; needleminers
Ponderosa Pine	Western, Mountain pine beetles; Engravers
5-needled Pine	Mountain pine beetles; Engravers
Lodgepole Pine	Mountain pine beetles; Engravers Lodgepole needleminer
Pinyon Pine	Pinyon engraver, <i>Ips</i> species; pinyon sawfly; needle scale
All Pines	Pine Needle Scale; Black Pine Leaf Scale; Red Turpentine Beetle (sugar)

Giant Sequoia	Woodborers
Incense Cedar	<i>Phloeosinus</i> sp. <i>Xylococculus macrocarpae</i>
Mountain Hemlock	<i>Scolytus</i> sp.
Torrey Pine	Mealybug: <i>Puto</i> sp.
Oaks	<i>Pseudopityophthorus pubipennis</i>; Western Tussock Moth; Gall Wasps; Gold Spotted Oak Borer
Douglas-fir	Flatheaded Fir borer
True Firs	<i>Scolytus</i> sp.; Flatheaded & Roundheaded fir borers; Douglas-fir Tussock Moth

Western Pine Bark Beetle - *Dendroctonus brevicomis*

Two generations per year in northern part of
range; three and sometimes four generations in
southern portion



Western Pine Beetle



Outbreaks often develop during droughts.
Trees are typically killed in groups.
Endemic populations attack diseased, damaged, or otherwise stressed trees.

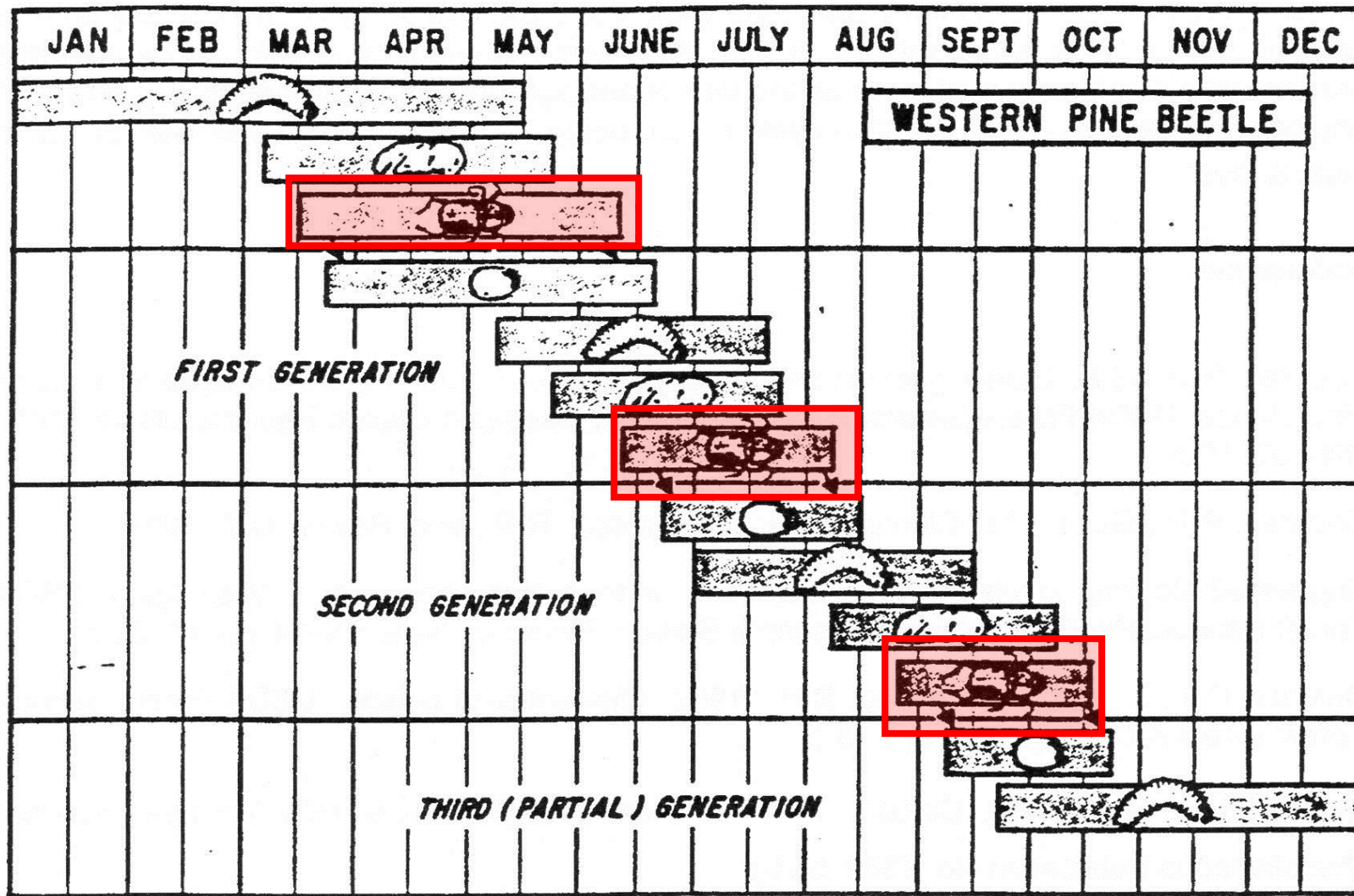
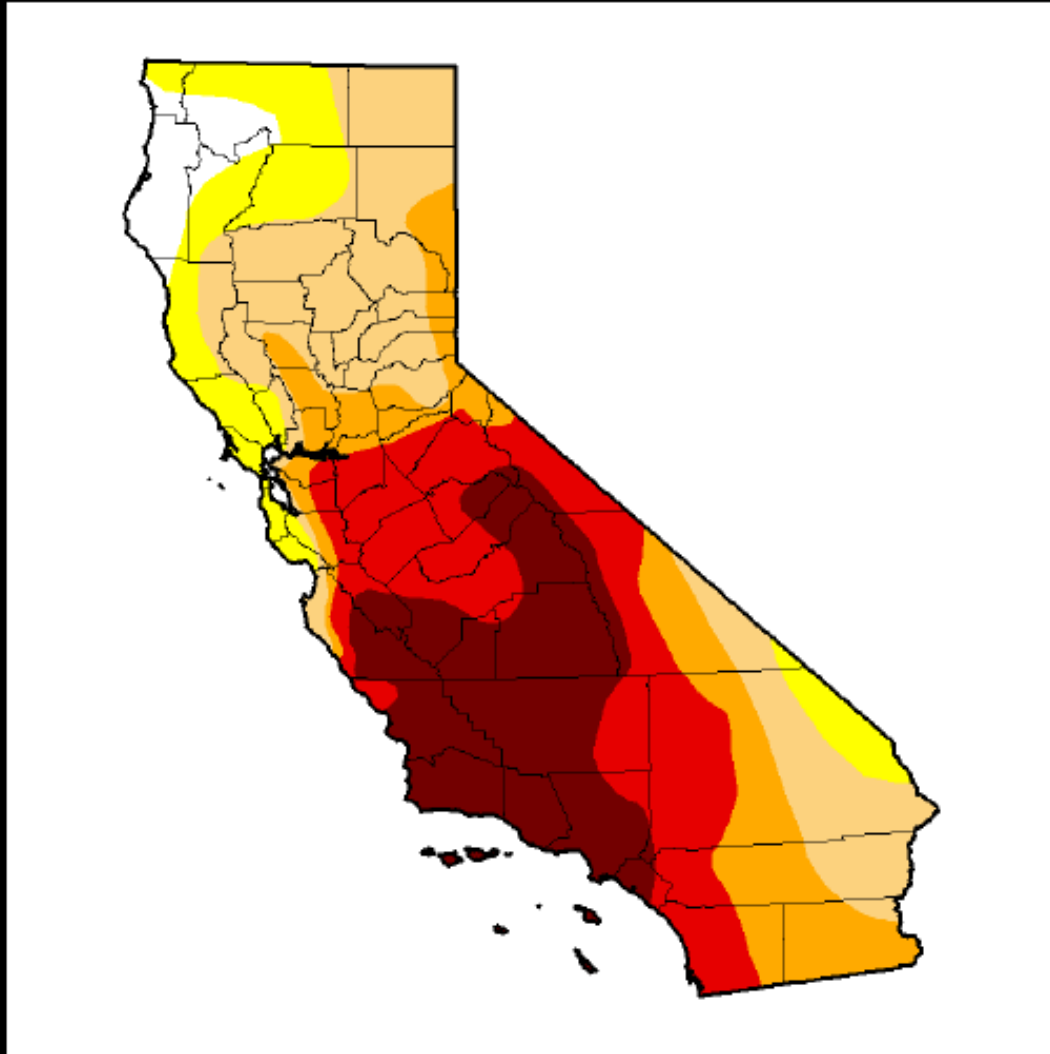


Figure 10. Life cycle of western pine beetle

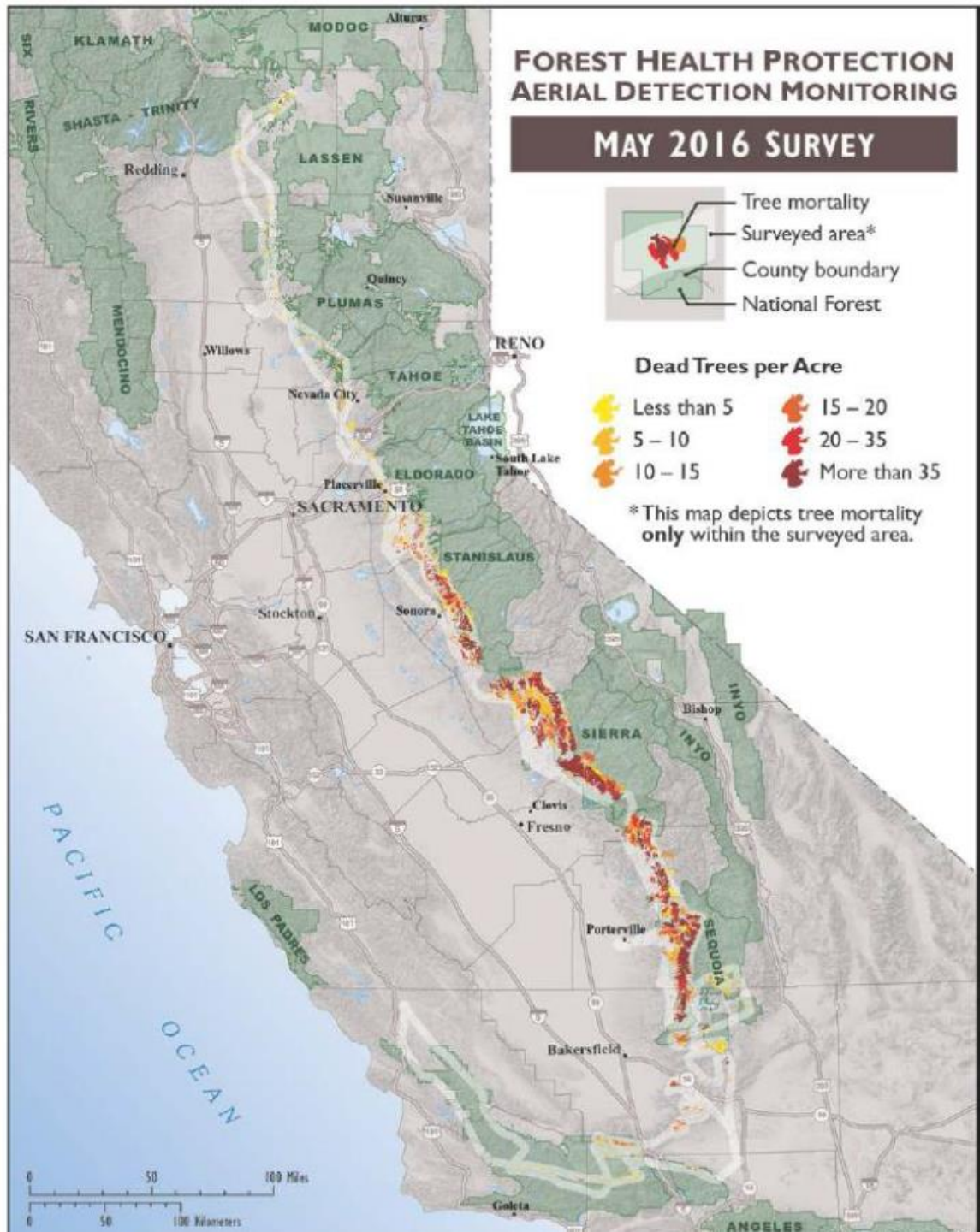
that leads to the... the... that leads to more attacks of the host tree and

Causes of Attack - Drought



June 7, 2016

California is in its fifth year of drought
Rainfall increased in the 2015/2016 rainfall year but was still behind average
Trees throughout the state are stressed and suffering due to the drought



Statewide Aerial Surveys have mapped tree mortality throughout California

Mortality has been observed in the southern Sierra Nevada and Southern California forested areas.

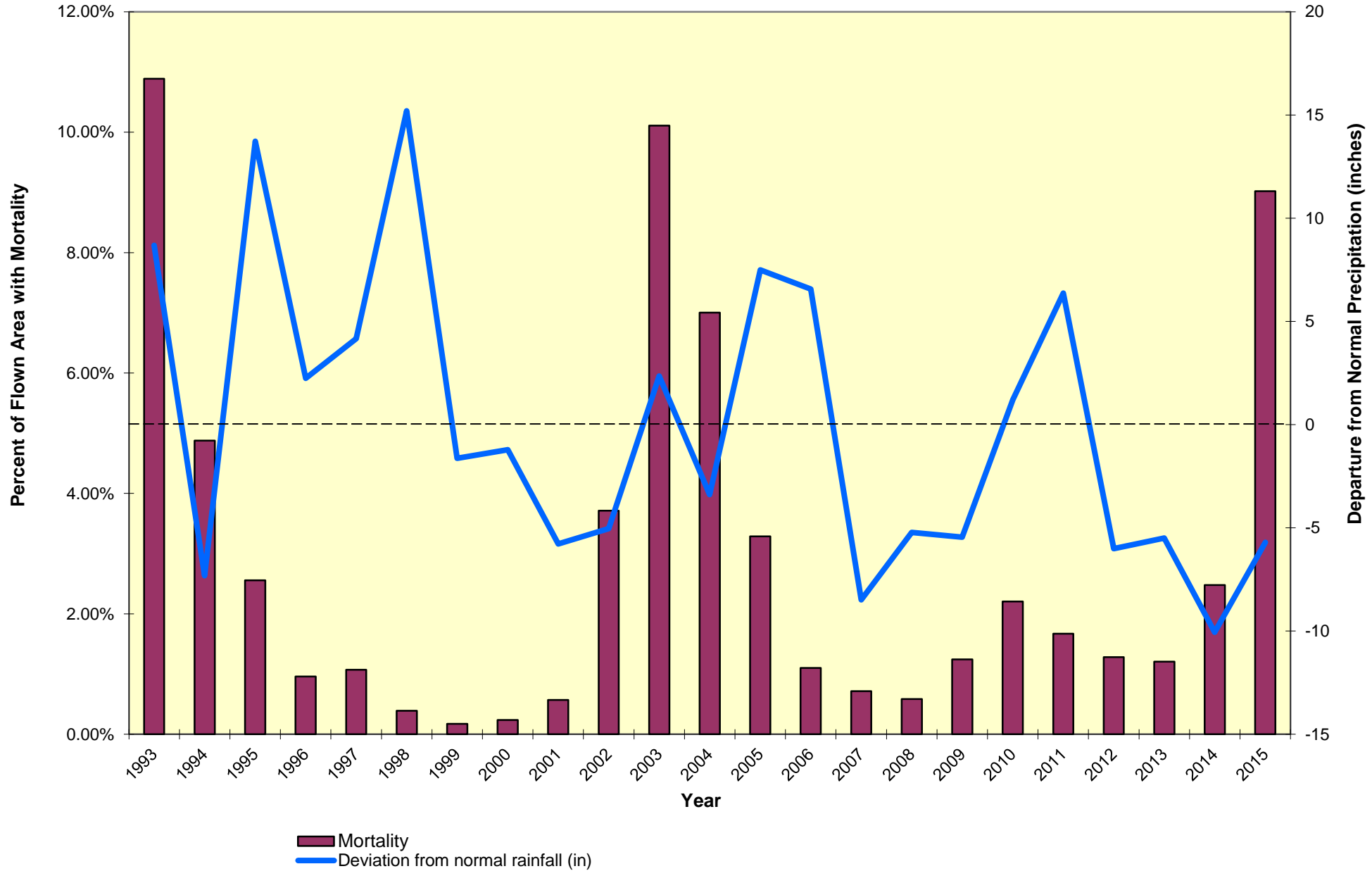
Drought

- Previous significant droughts have happened in California and resulted in large amounts of mortality
- 1930's
- Early 1970's
- Early 2000's in southern California
- The severity of this drought and the amount of mortality is unprecedented



Precipitation vs Mapped Mortality for Region 5

Bark Beetle Mortality only



**27 million trees estimated dead, over 4.5 million acres
of southern Sierra Nevada, 2016**



Conifer mortality observed southeast of Barnes Mountain, High Sierra RD, Sierra National Forest

Current Drought Effects on Trees



Secondary metabolites are responsible for defense mechanisms in plants from insects/disease attacks.



1909



1938



1958



1979

Changes in Fire Regimes



Other Forest Health Issues



Management and Control



Natural Control

- Natural Enemies (Insects, Woodpeckers, Etc.)
- Cold Temperatures
- Loss of Food Source
- Return of Normal Rainfall Patterns

Control - Suppression

- Removing Infested Trees by Logging
- Felling Infested Trees and Peeling and Burning the Bark
- Use of Pesticides
- Needs to be done across a landscape
- Poor Results!



Control - Prevention



- Diversity
- Forest Management
- Thinning! Thinning!
- Thinning! Thinning!



Additional thoughts. . . .

- Proper slash/debris clean up
- Dead and dying trees on the landscape

CALFIRE

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<http://www.fs.usda.gov/CATreeMortality>