



Image 1. View of tree mortality on east shore of Bass Lake from west shore in Sierra National Forest. (Photo by Larry Swan, November, 2015.)

An estimated 29 million trees across 3 million acres died in 2015 alone. Mortality is occurring statewide, but is particularly high and dramatic on the west side of the southern Sierra Nevada range and in parts of the Transverse range.

HIGH LEVELS OF TREE MORTALITY IN DROUGHT STRICKEN FORESTS IN CALIFORNIA

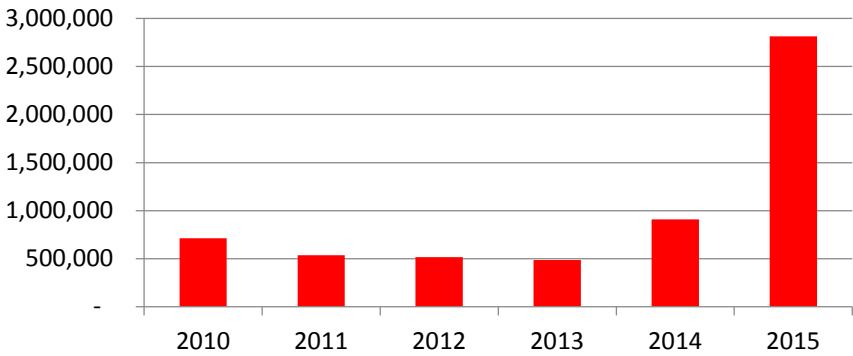
WHAT'S THE ISSUE?

TREE MORTALITY LEVELS HAVE SUBSTANTIALLY INCREASED IN FORESTS IN CALIFORNIA OVER THE PAST FEW YEARS CORRESPONDENT TO THE ONGOING 4 YEAR DROUGHT. An estimated 29 million trees across 3 million acres died in 2015 alone. Mortality is occurring statewide, but is particularly high and dramatic on the west side of the southern Sierra Nevada range and in parts of the Transverse range. Factors contributing to the mortality include drought induced water stress, bark beetles and tree density. During water deficit periods trees become suitable host material

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Mapped Mortality Acres (2010- 2015)



High Levels of Tree Mortality in Drought Stricken Forests in California

for bark beetles; individual tree stress is exacerbated by high tree densities. High trees densities can also affect spread and intensity of wildfire. In some drier areas, trees are dying outright from drought alone, regardless of tree competition. In other areas, high numbers of bark beetles are overwhelming limited tree defenses, even in less dense or thinned stands. Continued mortality should be expected in forests until precipitation returns to normal or above for 1-2 years. Forests immediately upslope from the central valley, those that do not see any drought relief this year, and those where mortality was up dramatically in 2015 will have the highest amounts of mortality in 2016.

High levels of tree mortality in western US forests has been recorded numerous times over the past 100 years. Over 40 million acres were affected in the West between 1997-2009, which prompted the

development of the Western Bark Beetle Strategy (2011 USFS). In California, drought is a recurring event, and is the “trigger” that creates thousands of acres of stressed trees, induces bark beetle outbreaks and results in extremely high levels of tree mortality.

IMPACT ON EMPLOYEES AND THE PUBLIC

The high number of dead trees on the landscape has significant direct effects on the people who work, live and/or visit affected areas. Most visible is the high number of hazard trees along roads, trails and powerlines and in and around administrative sites, campgrounds and communities. Hazard trees will require felling and removal to ensure employee and public safety and reduce fuel loadings. Access to public lands may be restricted when trees are being felled and transported. Roads, trails, and campgrounds may be closed, and a large increase



Image 2. Picnic area after dead tree removal near Bass Lake in Sierra National Forest. (Photo by Larry Swan, November, 2015.)

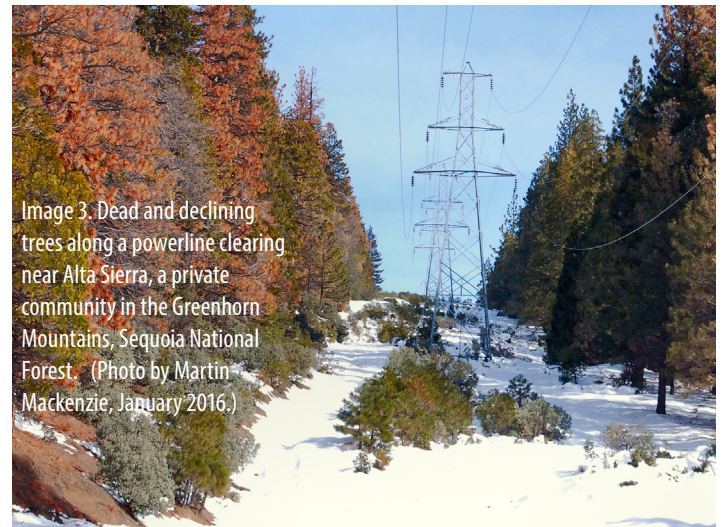


Image 3. Dead and declining trees along a powerline clearing near Alta Sierra, a private community in the Greenhorn Mountains, Sequoia National Forest. (Photo by Martin Mackenzie, January 2016.)



Image 4. Dead pines killed by bark beetles surrounding Camp Tawonga, Groveland Ranger District, Stanislaus National Forest. Note: 2013 Rim Fire in the background. (Photo by Beverly Bulaon, December 2015.)

High Levels of Tree Mortality in Drought Stricken Forests in California

in the presence of log trucks will be apparent. Availability of up-to-date information regarding facility/road closures will be paramount for Forest/District front-liners and on Forest websites. There may also be reduced visitor use in campgrounds where aesthetics have been greatly affected. Mitigating the high number of hazard trees may alter employee programs of work and planned forest capabilities.

Although fewer live trees in an area might result in more water being delivered in a watershed, the tradeoff is that less cover may result in increased soil erosion and an increased potential for land or mudsliding – all of which can affect water quality. An increase in soil erosion could impact water storage facilities leading to expensive sediment removal projects.

Many people get concerned that numerous standing dead trees contribute to the already ominous fire situation in many of our forests. Typically, beetle-killed trees shed their needles within a few months of dying, so they don't create as big a threat to fire spread as one might imagine. High amounts of new snags do present a threat of spotting when a forest fire is burning around them, and that threat will have to be considered every time a fire is burning near beetle-killed trees. Once trees fall, a fire in these large fuels could potentially burn longer and hotter, damaging soils and adversely affecting the site in the long-term.

Finally, mitigating the high number of dead trees is expensive for land owners and managers, communities, and taxpayers. California's wood processing infrastructure has been declining for decades resulting in limited capacity to capture the value of the wood in the dead and dying trees. Lack of adequate infrastructure also limits the options for quickly removing the material from affected areas. Associated subsequent fuel loading and fire risk will need to be evaluated in areas where trees are felled and not removed. With limited ability to sell the trees, private land owners and public land managers will have to finance transporting wood to temporary disposal areas or further treating it on site.

THE FOREST SERVICE'S RESPONSE

The US Forest Service is implementing several actions to address this situation. We are:

- prioritizing our efforts by removing hazardous trees near communities, along roads and powerlines, and in our recreation sites.
- continuing to re-assess areas for new hazards as more trees die.
- compiling a toolbox of tools and resources for federal, private, and state landowners and managers to assist in managing affected areas and support decision-making on the best course forward.
- providing public education via a number of media (both print and electronic) and are a key participant in the Governor's Tree Mortality Task Force.
- along with state and private partners, we are assessing California's wood processing capacity and helping to develop biomass energy markets that are responsive to changing needs.
- continuing to reduce tree density and restore resilience against forest pests and wildfires.

Collaboration with other agencies and local communities of interest is a key component of our response. Partnerships will aid in increasing public awareness of the threat posed by dead and dying trees, and assist in identifying priority areas in which to conduct hazard tree and fuels reduction mitigation work. An "all lands" approach is the most strategic and efficient way to reduce duplicity of efforts and focus initial work in the highest priority areas to meet our shared goals. We do anticipate the need for additional funding and resources to address this large-scale

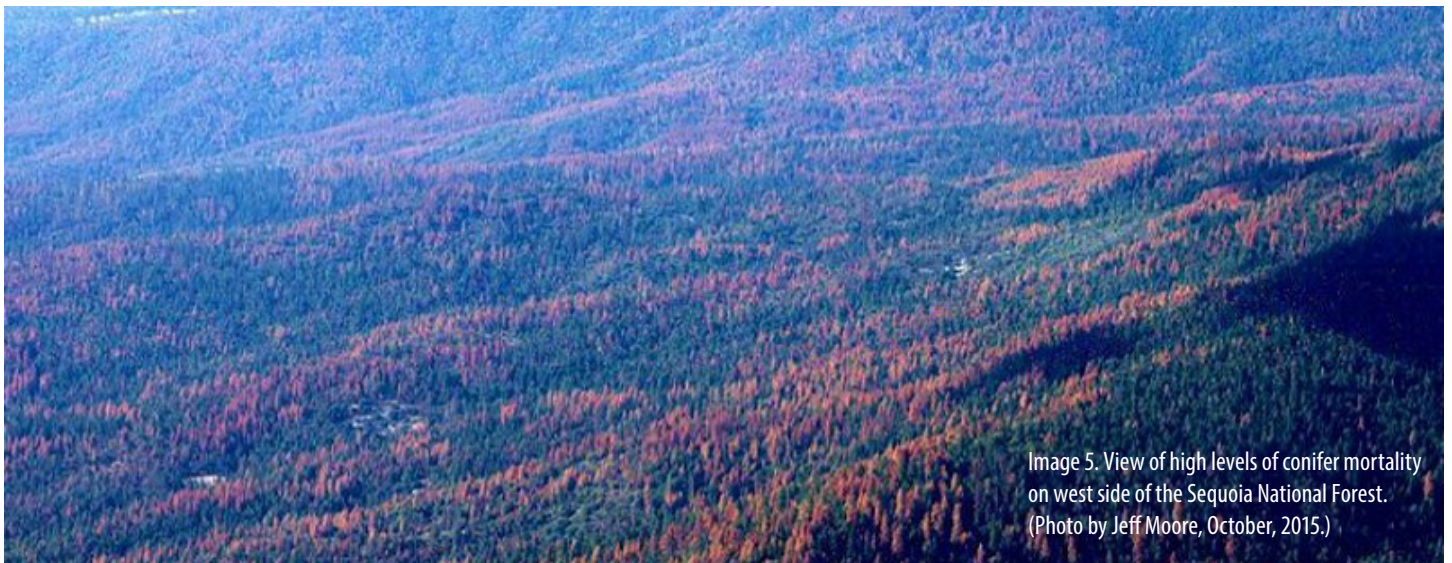


Image 5. View of high levels of conifer mortality on west side of the Sequoia National Forest. (Photo by Jeff Moore, October, 2015.)

High Levels of Tree Mortality in Drought Stricken Forests in California

Image 6. Dead ponderosa pines killed by bark beetles surrounding private homes along the north shore of Bass Lake, Bass Lake Ranger District, Sierra National Forest. (Photo by Martin MacKenzie, October 2015.)



issue. Effective coordination and consistent messaging both internally and with the public will be required. We are working with regulatory agencies to determine ways to streamline processes, while still meeting resource protection objectives. A variety of environmental planning tools are available to facilitate project implementation.

MUCH TO LEARN

Given the unprecedented nature of this mortality event, there is an opportunity to improve management effectiveness and efficiency through targeted research to fill knowledge gaps on interactions between previous management, bark beetles, fire, fuel loads, drought and climate change in forest ecosystems. Specifically we can use the current event to further our knowledge regarding:

- How active forest management can reduce drought-related impacts to our forests.
- The factors that influence whether a given tree or stand will die in response to drought and bark beetles.
- How bark beetle outbreaks and subsequent tree mortality influence future fuel loads and fire behavior.
- The factors that influence whether attempts to reforest an area will be successful.
- The social and economic factors that determine whether new wood-processing infrastructure will be economically viable and adaptable to future conditions.

The Regional Office will be engaging leadership at the Pacific Southwest Research Station, Universities and with other partners to gauge their interest and capacity in helping address these important research opportunities.

IN CONCLUSION

The drought-induced tree mortality in the Southern Sierra's is one of the largest events we have seen in recent history. Millions of trees have died, more have succumbed over the winter, and more will be die over the next several years. This unprecedented amount of mortality is affecting entire landscapes and ecosystems. Forest managers are recording 50% to >75% conifer mortality between 3,000 to 6,000 feet elevation. Currently there are over a million acres with high levels of mortality across the Stanislaus, Sierra and Sequoia NFs.

While we are working to increase restoration efforts and address the critical concerns of the increasing tree mortality across California, it is imperative that we are collaborative and cooperative with our various communities, users and interest groups. Partnerships are essential to address the extremely high levels of hazard trees and to support increasing the pace and scale of restoration efforts to combat the ever growing threats to our resources. ■