What could have been done to avoid California's increase in forest mortality?

California Forest Management Task Force's Science Advisory Panel

***Note**: The following is a perspective offered by the California Governor's Forest Management Task Force Science Advisory Panel based upon the literature referenced below and the scientific expertise of the Panel. These viewpoints are meant only to elucidate the complexity of forest mortality and management.*

Purpose

The Forest Mortality Working Group within California's Forest Management Task Force requested that the Science Advisory Panel consider what could have been done to avoid the recent forest mortality dynamic and look at European forests as an analog.

Conclusion

Two primary factors are leading to current trends in forest mortality in California: climate and management. How climate and forest structure, resulting from management, interact dictate whether catastrophic forest mortality may occur. California could have avoided some of the current increase in forest mortality, but not all of it. If California had less dense stands and more heterogeneous landscapes (scattered patches of varying management types, tree sizes, stand age classes, and species), then beetle and drought related mortality could have been softened. However, increased droughts would still have resulted in an increase in forest mortality, especially for those forest stands located on their climactic fringe. Some forested areas, however, are not as threatened by climate change, and in those areas, forest management has a larger role in influencing vulnerability to catastrophic mortality.

Forest management's role in reducing forest mortality

Dr. Chris Fettig (2007) a research entomologist at USFS-PSW in Davis CA reviewed the literature about the effectiveness of thinning on bark beetle related forest mortality. The main pertinent points are:

1) Bark beetles and forest mortality are natural parts of CA forests and should not/cannot be eliminated. Natural processes and management practices have increased tree competition leading to more easily stressed trees, elevating susceptibility to beetles. Competition should be reduced through active management to increase tree vigor and resistance to beetles.
2) On a larger scale (i.e., entire watershed, county or state level), forests are largely homogeneous. To prevent epidemic levels of beetle caused mortality, management on equally large scales is needed to match the problem, by spatially varying forest types, structures and ages.
3) Reduce stand density, by thinning or other means, to reduce susceptibility to bark beetles.
4) Prescribed fires can injure surviving trees, leaving them susceptible to subsequent beetle attacks. Plan prescribed fires carefully (e.g., consider seasonality) to avoid this.
5) Quarantining and removing infected stands may or may not work in some instances.

This paper discusses how bark beetle related mortality could be reduced by taking a multi-scale approach by decreasing stand density on the local-level, while creating heterogeneity by differing management practices on the larger scale (to produce patchy, varying forests). Implicit in this paper is that management has its limits and no one approach will resolve all challenges faced by California forests.

Climate as a driver of forest mortality

Additionally, climate (temperature and precipitation) has and will continue to play a decisive role in affecting forests, irrespective of management practices. Some forests, no matter the management approach, will experience increased mortality due to prevailing climactic conditions. This is especially relevant to forests on the edges of their climactic range. For example, in the case of mixed pine/oak stands or open oak woodlands, these forests may only need small climactic nudges to shift to conditions that are no longer suitable to support the same composition of species that historically lived there.

Dr. James Thorne (2017) at UC Davis examined California's current and potential exposure to this type of climate change impact. In the near future, forests most at risk of climate-induced mortality may be the northern Sierra and Coastal ranges, and eastern and southern forests. Beyond 2040, this issue will become worse and more widespread, decreasing the mitigation potential of forest management as forest types shift with climate. Some areas may be less affected by climate change, such as the Coastal range south of San Francisco. In those forests, management plays a larger role in forest mortality trends.

European forests compared to California

European forests provide an example of the limits to forest management in influencing forest mortality. In Europe, almost all forests are actively managed. Central and northern European forests are poor analogs to California because they receive most of their rainfall in the summertime, as opposed to conditions in the western United States, which receive the majority of its precipitation in the winter. This means that Central and Northern European forests get rain during the hot growing season, when the trees need it most. Southern Europe, however, is comparable to California, with a Mediterranean climate and little rainfall in the summer. Dr. Jofre Carnicer (2011) of the University of Barcelona examined forest mortality trends in Europe. This study shows that forests in Southern Europe, despite the active management they undergo, are experiencing an increase in mortality attributed to drought. This information suggests that at least some increase in California's forest mortality may have been unavoidable, even if Californian forests were more actively managed as they are throughout Europe.

Management implications

Moving forward, forest management must take a landscape level approach on county and state levels. It is necessary to vary forest management throughout the state creating a patchier landscape in terms of size/age classes, and species. Forest management on the stand level should reduce the overall density of Californian forests in general. Additionally, some forests are undergoing a forest type shift and restoration and mitigation efforts should be taken in coordination with foresters and scientists to identify whether this is happening in particular stands to ensure effectiveness of treatments and funds.

References

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