



Achieving Long-Term Forest Health and Resilience in California¹ (Objective 4 from the Tree Mortality Task Force Incident Action Plan)

The Forest Health and Resilience Working Group of the Governor's
Tree Mortality Task Force

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Forests cover about 33 percent of California's area, providing timber, water, jobs, recreation, homes and numerous other benefits to people and wildlife. Although much of the forestland is in public ownership, approximately 40% of California's forests are in private ownership, with much in small properties of 50 acres or less. Creating resilient forests in this state is critical for both types of ownership. Resilient forests build upon and leverage natural forest functions. A healthy forest that remains resilient over the long-term will reflect the natural diversity and distribution of ecological functions for that area. It achieves resilience to disturbance by maintaining a diverse set of structures, compositions, and functions at multiple scales across the landscape. Resilience requires maintaining or reestablishing the ecological disturbances that forests and wildlife evolved with. A resilient forest has the ability to absorb and recover from stress and disturbance, both natural and manmade. Stressors and disturbances may include fire, drought, insects and diseases, air pollution, past management actions, and climate change impacts.

Characteristics of a healthy, resilient forest

- **Diversity** – Healthy forests include a range of natural seral stages as well as naturally occurring species of flora, fauna, and microbiota. Generally, insect and disease populations target one type or species of tree. A diversity of species will help reduce the possibility of one insect or disease killing all the trees in a region. Control of non-native invasive species (insects, diseases and invasive plants) will also encourage naturally occurring species.
- **Capacity** – With enough space, sunlight, nutrients, and water trees have the capacity to grow and thrive. They become stressed when lacking these elements, which make them more susceptible to attack by insects and diseases, as well as large scale disturbances such as drought or wildfire. They are also stressed by rapidly and dramatically changed conditions, such as fragmentation through adjacent land management activities or climate patterns that reduce available water or elevate average air temperature.

¹ This white paper is a broad guidance document, and not meant as a substitute for management assistance provided by a Registered Professional Forester when required.



- Complexity -- Forest complexity includes the naturally occurring range of tree species; stand density diversity (including openings of various sizes, tree sizes and ages); and the presence of shrubs, meadows, open ground and natural regeneration. Managing for greater natural complexity generally improves a forest's ability to respond to disturbance, and supports wildlife that feed on insects that may be attacking trees.
- Fire-adapted – California's forests have evolved with fire as a major part of ecosystem function and healthy resilient forests both survive and benefit from fire. Fire is a natural and necessary component of a healthy forest ecosystem. Forests that experience appropriate frequencies and severities of fire, or other vegetation treatment practices that mimic fire, are more likely to support species and genotypes that will survive wildfire, as well as other types of disturbances.
- Intact – Forest landscapes that are free from fragmentation by land development, or forest type conversion, allow ecological processes to occur at natural, historic scales.

Achieving healthy, resilient forests over the long-term

Achieving and maintaining long-term healthy and resilient forests will require managing forests to include natural forest processes and developing the full range of forest characteristics. Some key attributes of resilient forests only occur over long time periods as natural and anthropogenic processes shape them. Actions that help achieve resilient conditions should:

- Restore more natural stand forest structure, including appropriate stand density, diversity, complexity and capacity to support a full range of age classes, species, and habitat types;
- Prevent land use conversion or forest fragmentation, in order to maintain large, contiguous, functioning forest ecosystems; and
- Recognize and facilitate the role of fire as a natural ecological process.

Management actions that support forest health and resilience

Long-term forest health and resilience requires actions in both the near-term and over the long-term. People are now an integral part of California's forest ecosystems, and their impacts and management actions can help maintain or place forests on a trajectory toward more resilience, limiting risks of adverse outcomes. Forest landowners and managers can support forest health through their actions.

Near-term actions that can be used to increase resiliency and reduce risks include:



- Monitoring forests to assess risks due to wildfire, drought, insects, and disease, as well as making the monitoring results available and understood by all stakeholders.
- Thinning overcrowded trees to maintain tree vigor, increase growing space and available moisture for residual leave trees, and accelerate healthy forest development.
- Maintaining optimal stand density for forest health through regular timber harvests.
- Using prescribed fire and managed wildfire to reduce tree, grass, shrub and other vegetation density and connectivity that creates fuel for more intense wildfires, to reduce over-all fuel loads, to recycle nutrients, to create wildlife habitat, to prepare soils for tree regeneration, and to help restore complex forest structures.
- Timely removal of trees downed by storms, wildfires, or other natural disturbance events to manage threat of insect or disease outbreaks.
- Planting a variety of species from appropriate seed sources for the area and at appropriate spacing to achieve natural regeneration patterns, or provide other forest values such as meadow and watercourse recovery. Favoring more drought tolerant genotypes or species when thinning or planting.
- Creating fuel breaks utilizing strategic designated areas such as ridges and roads, including shaded fuel breaks where canopy density and shade is maintained but low growing and dead vegetation is eliminated. In addition, existing fuel breaks should be maintained.
- Retaining some large wood on the ground as critical wildlife habitat structure and to maintain natural levels of structural complexity and diversity.
- Monitoring and controlling invasive non-native insects, diseases, and weeds wherever possible.

Actions to maintain and increase resilience over the long-term include:

- Overcoming regulatory and infrastructure constraints.
- Exercising instruments such as binding plans, contracts, or easements that foster development of forest characteristics that occur over time, including well-spaced, large mature trees, clumps, openings and stand structure diversity that are key parts of the desired resilient condition within a forest and yet are under-represented on the landscape under current and historic management.
- Landscape-scale planning for predicted future climate conditions, wildlife adaptation, and watershed health and resiliency, in order to place project level activities in a regional framework across multiple land ownerships.
- Monitoring to assess for improving conditions and change over time (i.e., improving trends in key landscape characteristics).



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