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Management To Improve Forest Resilience and Reduce Wildfire Risk

America's forests are increasingly vulnerable to fire, drought, severe storms, and outbreaks of insects and diseases. These disturbances are not new to forests, but the magnitude of their impact is growing. When scaled appropriately, disturbances regulate the flow of energy and nutrients to maintain healthy and productive forests. However, severe wildfires and drought in recent years have exceeded the capacity of forests and grasslands to recover to a healthy ecological state in a timely manner.

Past practices, such as fire suppression, have created densely packed forests with an overabundance of woody vegetation. Live or dead, this vegetation can fuel severe wildfire. Overcrowded growing conditions also prevent trees and other plants from obtaining sufficient nutrients, light, or water to bounce back and remain healthy following a stressful event. The warming climate further stresses vegetation and can foster tinderbox conditions on the landscape, especially under widespread persistent drought.

To remedy these vulnerable forest conditions, today's land managers need to take more aggressive action to restore forest integrity where consistent with forest plans and laws. To support these efforts, U.S. Department of Agriculture (USDA), Forest Service researchers and partners are developing the foundational and applied science and modeling to inform proactive management strategies that enhance forest and grassland resilience.

Departures from Historical Norms Provide Insight for Management and Restoration

Tree and shrub communities, and the frequency and intensity of disturbances that regulate them, differ greatly across our diverse landscapes. Forest Service scientists and partners study how much forests have changed throughout the past few centuries. This research provides context in planning treatments. Recent takeaways include:

- Pollen records, tree rings, and Indigenous oral histories show that forest biomass in the western Klamath Mountains has doubled over the past 3,000 years.
- Over a century of fire exclusion in western North America has resulted in drastic changes to forest structure and function, even in forests that experienced very little fire prior to European settlement.
- Between 1911 and 2011, tree densities in the Western United States increased roughly 7-fold, and average tree size shrank by half.

These studies and others report the need—particularly in forests adapted to frequent fire—for aggressive and large-scale management efforts to create low-density forests with large trees that can tolerate future disturbances and thrive after them.

Encouraging Forest Resilience to Climate Change and Disturbances

More of our forests are simultaneously vulnerable to disturbance than at any other time since European colonization, which means that land managers must prioritize treatment areas in both proactive and reactive approaches. The climate is also changing rapidly and with uncertainty in the magnitude and seasonality of change in different locations. This makes it difficult to predict which tree species and varieties will be most suitable for future conditions in specific areas. Important advances by Forest Service scientists and partners on navigating these challenges include:

- A synthesis that analyzes specifics on whether current and planned management efforts will be enough to restore resilient conditions to our western landscapes, given changing trends in climate and wildfire.
- The Adaptive Silviculture for Climate Change (ASCC) project, which tests a range of operational climate adaptation treatments through a multiregion, multiownership network of research sites across North America.

Experimental treatment in a red pine forest, Adaptive Silviculture for Climate Change project, Chippewa National Forest, MN. USDA Forest Service photo by Laurel Haavik.

- Experimental Forests and Ranges and similar administrative areas provide locations for long-term forest management studies, like the ponderosa pine demonstration at Lick Creek. Another example explores the potential for forests to store carbon across the Lake States and the Northeast.
- A national synthesis that informs and guides managers in evaluating options to minimize impacts and recover from drought and create forests that are more adapted to future drought conditions.
- Integrating the latest knowledge about the Pacific Northwest to restore ecosystem integrity and resilience, while simultaneously addressing the impacts of climate change and invasive species.

Using Prescribed and Managed Fires, and Learning What To Do After Wildfire

Using fire in a safe, controlled manner is key to restoring America's forests and grasslands. This includes planned prescribed fire and letting wildfires burn in certain situations to achieve management objectives, termed managed fire.

- Experts explain why prescribed fire is needed to help restore our fire-adapted landscapes. Prescribed fire is also essential to improving understanding of wildland fire behavior and how best to use managed fire.
- Over a 50-year timeframe, a study found that repeated fire was critical to reducing tree density by about half in several forests and savannas throughout tropical and temperate regions. Fire was also important in maintaining the soil nutrients necessary for tree growth.
- Deciding when to allow a wildfire to transition into a managed fire is often complicated by an array of safety and practical concerns, according to a review that compiled findings from 1976 to 2013.
- Scientists can help land managers evaluate whether to let a burned landscape recover naturally, harvest some burned trees for timber, or replant it entirely.

USDA Forest Service photo.

Resources To Help Managers Plan, Prioritize, and Select Location-Specific Management Actions

Forest Service scientists and partners gather and synthesize current knowledge to provide managers with easy, go-to resources that interpret the latest and most effective management techniques. Some recent resources include:

- A synthesis that outlines options for creating open forests reminiscent of historical conditions in eastern North America.
- A broad synthesis on fire ecology for every major forest type in the United States that outlines management options for reducing wildfire risk while maintaining biological diversity and ecosystem integrity.
- A synthesis of over 1,000 studies on pinyon and juniper woodlands to help land managers prioritize areas where conservation and restoration will have the greatest benefits and identify appropriate management actions.
- A forest management handbook, which outlines strategies for landowners in the Sierra Nevada and southern Cascades regions for improving general forest health and reducing risks of wildfire.
- Coproduced research by managers and scientists in the southeastern United States, which investigates how fire can be used to improve wildlife habitat, tree regeneration, and biodiversity.

Assessing How Forest Management Affects Wildlife, Water, and Soil

Forest Service scientists and partners are studying how management actions impact forest-dwelling animals and the sustainability of other important resources that forests provide. Recent advances include:

- Understanding how management affects habitat for fishers, lynx, owls, bats, woodpeckers, and other birds.
- Developing a user-friendly tool that managers can use to evaluate the effect of treatments on drinking water supplies.
- Synthesizing the latest knowledge on how land management activities affect soil health.
- Developing recommendations for retaining soil nutrients during timber harvests.

For more information on related topics: See factsheets on "Treating Hazardous Fuels at a Scale that Makes a Difference," "Reducing the Risk of Severe Wildfire Across Boundaries," and "Postfire Stabilization and Recovery."

About Forest Service Research and Development: The Research and Development (R&D) arm of the USDA Forest Service works at the forefront of science to improve the health and use of our Nation's forests and grasslands.

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