Using prescribed fire to build forest resilience – Considerations for post-fire reforestation practices

Prescribed Fire's Role in Reforestation

Management decisions about fuel and vegetation in post-fire environments are critical for long-term success of reforestation efforts. Today's wildfires burn forests that are orders of magnitude denser and more loaded than they were historically, leading to high tree mortality (Williams et al. 2023). The resulting fuel that is deposited on the ground as fire-killed trees fall is a challenge to managers. The creation of large patches of dead trees impacts future fuel loads, fire behavior, and fire effects at a landscape scale. Not only does this pose a challenge for reforestation due to a lack of nearby seed trees for natural regeneration (Collins and Roller 2013), but also allows shrubs grow and compete with seedlings (Tubbesing et al. 2021). As they age, shrubs become increasingly readily available to burn at high severity, especially following climatic disturbances, such as droughts. Intermingled with dead trees and high accumulations of woody debris, dried vegetation acts as fuel, carrying the fire rather than subduing it. This complex of fuel, vegetation, and climatic factors can create an increased potential for post-fire areas to burn at high severity again (Coppoletta et al. 2016; Lydersen et al. 2019). Dense shrub canopies are also very difficult to burn with prescribed fires, which are the most effective way of protecting reforested stands from wildfire related loss.

Successful reforestation, in the context of a changing climate and fire regime, involves investing in treatments that will restore forest structures which will be resilient to future wildfire. Simply, site-preparation treatments improve conditions for seedling establishment; the sequence and type of treatment influence its effectiveness (See Post-fire Competing Vegetation Management Factsheet for more information). Prescribed burning can reduce fuel loads, promote biodiversity and enhance ecosystem health, making forests more resilient to wildfires. *Pyrosilviculture* is a forest management approach that integrates the use of prescribed fire with silvicultural practices to achieve specific ecological and management objectives (York et al. 2022a).**Creating conditions in which prescribed fire can be implemented as soon as possible is likely to be the most effective strategy for forging future forest resilience.** This begins with selecting reforestation practices that reduce fuel loads and promote favorable species composition (Noble and York 2024; York et al. 2022a).

Image 1: Prescribed fire operation in Spring 2023 in Foresthill, CA following a mastication treatment conducted in the previous fall. [Credit: Nic Dutch]

Mechanical site preparation, which reduces fuel loads prior to planting, sets the foundation for the establishment and growth of a new forest stand. Post-fire salvage harvesting can be a cost-effective component of site preparation since it recovers timber value where feasible. It is also a key method to reducing fuels (Post-fire Considerations for Landowners Factsheet). Selling timber products following a fire is time-sensitive and requires a registered professional forester (RPF) to develop the necessary planning documents. However, post-fire logging may not be possible if trees are too small to be merchantable, if the site is too remote, or if there is no sawmill available or willing to purchase the timber. Importantly, salvage logging on its own, does not remove sufficient dead and down woody material on site.

Comprehensive treatments that ensure rapid seedling growth involve managing competing vegetation, reducing fuels, and creating an environment conducive to seedling establishment. Reducing surface fuels and competing vegetation can be accomplished through a variety of mechanical site preparation treatments, including chipping, mastication, piling/burning, and broadcast burning. Stands that have undergone site-

preparation treatments before wildfire have exhibited less severe effects from those fires, thereby protecting regenerating young stands; this site preparation can be more important than tree density in its influence on future fire behavior (Lyons-Tinsley and Peterson 2012). As young stands develop, mechanical treatments, such as mastication, can alter surface fuels to prepare an area for safe and effective prescribed burns during the wetter conditions under which prescribed burns currently tend to occur given permit constraints. Integration with other treatments for competing vegetation with prescribed fire can enhance overall fuel reduction. For example, following an herbicide treatment, prescribed fire can have greater consumption as more fuel becomes available, since the herbicide kills plants which then becomes dead fuel. Considerations for site-preparation treatments include cost-effectiveness and resource availability, as well as site-specific considerations like terrain and slope.

By reducing surface fuels and removing shrubs within two years after the fire, site preparation and vegetation control accomplish an important reduction of both dead and live fuels. Young reforested stands that receive these treatments are more likely to be ready for prescribed fires within the historical fire return interval of 7 to 15 years for Sierra Nevada mixed-conifer. Implementing a range of pyrosilvicultural treatments, from planting to pre-commercial thinning and pruning, influences forest structure and fire behavior and allows the successful use of prescribed fire. Prescribed fire, as part of a long-term management plan, can maintain desired forest structure and reduce fuel loads, thereby promoting forest health and minimizing the risk of high-severity wildfires (Noble and York 2024).

Reintroducing prescribed fire in young stands

For more information on using prescribed fire in young stands, please refer to the Using prescribed fires in young forests: A pyrosilviculture approach research article by UCCE Forestry Specialist Rob York

As the threat of high-severity wildfires in young stands grows, managers need to develop innovative ecological restoration strategies to help young mixed-conifer forests mature and achieve stand level objectives, like reducing wildfire severity (York et al. 2022a). Treatments done after planting, such as controlling competing vegetation, can influence how prescribed fire alters fuel loads and stand structure. In addition, a variety of factors, such as burn season, pruning, and age class impact prescribed fire outcomes (York et al. 2022b).

Conditions at the time of burning also heavily impact post-prescribed burn effects, as seen in areas with higher fine fuel moisture conditions that experience lower mortality (Bellows et al, 2016). Though it may not always be a precise tool, utilizing prescribed fire prompts land managers to consider what their priorities are, such as determining an acceptable range of mortality in exchange for overall higher fuel consumption. Pyrosilviculture treatments promote a multi-aged forest structure and a manageable fuel load. This enables the growth of large and vigorous overstory trees at a lower density, thereby increasing future forest resilience (North et al. 2022).

Landowner Assistance - PBAs

Prescribed Burn Associations (PBAs) are community-based organizations that leverage operational resources and educate private landowners on how to utilize prescribed fire as a land management tool. Contact a local PBA, to find assistance from a prescribed fire professional.

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