

A Long-Term Research-Practice Partnership Leads to Successful Reforestation in Northern California

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Overview:

- A partnership between forest researchers and practitioners called Sierra Cascade Intensive Forest Management Research Coop has been established since 2000 to tackle reforestation problems in Northern California and Southern Oregon.
- Major obstacles were identified and techniques have been developed for various reforestation stages from seed, seedling culture and handling, site preparation, competing vegetation control, plantation pre-commercial thinning, and future density management.
- Although new problems appear and research continues to be proposed to address them, the developed techniques have assured an average of 36 million of seedlings to be successfully established on wildfire-burned ground in Northern California for the last several decades.

Summary:

Management problem: The successful reestablishment of native conifer tree stands is a key step in forest restoration. In recent years, high severity wildfires have burned tens of millions of acres of forests in the western United States. Many of these lands require artificial reforestation and subsequent management in order to be fully restored and resilient to future drought, wildfire, and widespread insect attacks. Even though some seed trees may remain in the burned landscapes, natural regeneration has not guaranteed a resilient forest that can withstand the next wildfire. Furthermore, following regeneration, young stands require appropriate density and fuels management to promote or enhance tree stands toward resilient forest.

Management need: To successfully restore forests on these massively burned landscapes, forest managers need all available techniques in their toolbox, from appropriate seed selection to quality seedling production, from site preparation to effectively controlling competing vegetation, and from precommercial thinning to later plantation density and fuel



management. All these techniques must be developed from the carefully designed studies on particular climate and soil.

Research purpose: During the last half century, a long-term collaboration between forest researchers and forest practitioners in national forests and privately owned forests has developed highly successful practices for young stand establishment and density and/or fuels management. This cooperative process involved endeavors and efforts to work with, learn from, and communicate the results among generations of scientists and field foresters. Success has been demonstrated by many large-scale postfire reforestation projects across Northern California.

Silvicultural Concepts:

- Successful reforestation must be done by breaking the project into ecological/operational units based on soils, aspect, elevation, vegetation type, access, slope, operability, and other attributes. A series of steps or techniques will vary with different conditions.
- Selecting appropriate seeds and seed sources enables managers to not only raise high quality seedlings, but also enhance seedling survival. In addition, managers can choose seed sources from the lower end of suitable seed zones to assist species migration in response to future climate warming.
- Conifer seedlings require a period of chilling to complete dormancy before they resume growth. Seedling handling times such as sowing, blacking out, lifting, and storing directly relate to seedling dormancy and cold hardiness; both are very important to the seedling field performance.
- Given the Mediterranean climate in California, soil water availability is the key limiting factor for tree survival and growth. Therefore, effectively controlling competing vegetation has made a significant contribution for the success of stand establishment. The most effective and efficient methods are applying herbicide; considerable studies on efficacy and conifer tolerance have developed some successful treatments.
- Before stand canopy closure, an appropriate precommercial thinning must be conducted for stand growth potential and for the planted forest to remain healthy and resilient as it grows.

Management Applications:

- The key to success of any reforestation project is proper planning that consists of a series of steps and requires paying much attention to detail. Failing on any one of these steps often spells failure for the whole effort. One common failure that people often see while travelling around Northern California is a lack of vegetation control (fig. 1). Forest



managers have used the results from our research-practice partnership group to effectively control competing vegetation with herbicide application. The data were also used for the herbicide registration in the states of California and Oregon. As a result, any reforestation project with competing vegetation controlled by herbicide has produced better outcomes (more successful) than by manual grubbing, with the added benefit of being much cheaper.

- Successful plantation establishment is not possible without high-quality seedlings, which requires nursery managers not only to understand how to grow seedlings in nursery beds or containers, but also how to lift, pack, store, and deliver seedlings while maintaining quality. Our partnership research has focused on studying the effects of seedling culture and handling on field performance of containerized Douglas-fir seedlings and found that using an appropriate seedlot and seedling culture would significantly increase reforestation success. Regeneration foresters can use the results to obtain planting stocks matching the planting seasons and sites.
- As trees grow larger in either natural stands or plantations, competition develops among them. Competition weakens trees and weak trees are potentially more susceptible to bark beetles and climate change. Lowering stand density was found to enhance remaining tree growth, reduce mortality, and increase stand resiliency to disturbance and climate change. Since neither climate nor disturbances can be easily controlled, forest managers can manage stand density based on stand age and environmental conditions to potentially mitigate the threats from climate change and potential disturbances.





Figure 1—Successful post-fire reforestation on the 1992 Fountain Fire at Shasta County, California. The fire burned through 64,000 acres. Most industry-owned 40,000 acres were reforested within next 5 years.



Figure 2—Eleven-year-old ponderosa pine plantations at the same area within the 2007 Moonlight Fire with herbicide controlling competing vegetation applied at second and fourth years after planting at top one that was pre-commercially thinned 3–4 years earlier and with manual grubbing shrubs around each tree at the bottom one. Both photos were taken in 2019.

References

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