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Development of a Mixed Shrub–Tanoak–Douglas-fir Community in a Treated and Untreated Condition

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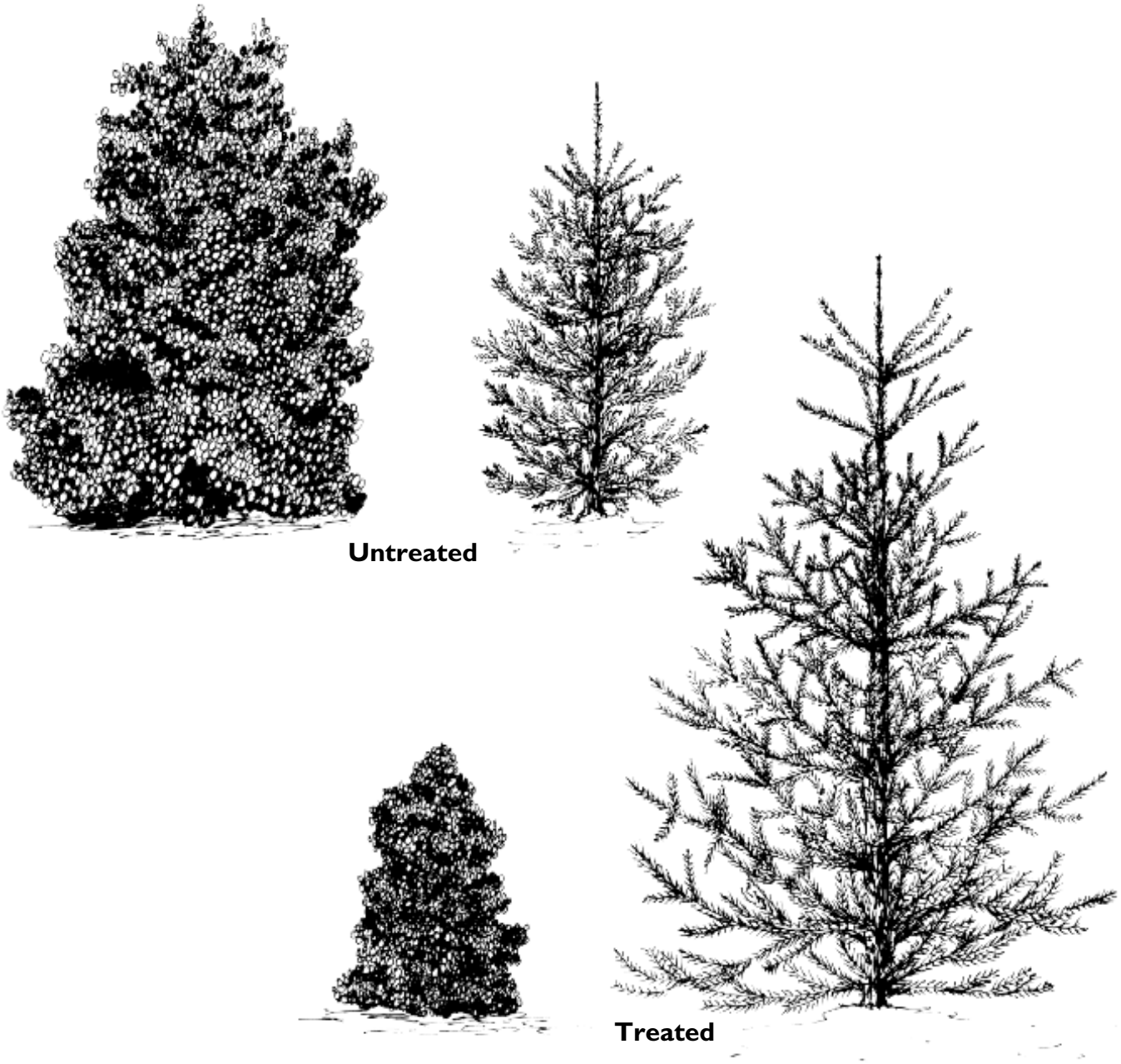

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Abstract

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On a medium site in northern California, a tanoak-mixed shrub community was given several treatments (manual release two and three times, a combination chainsaw and cut surface herbicide treatment, two foliar herbicides, and a tank mix of the two herbicides) to study its development in both a natural (control) and treated condition. The herbicides were 2,4-D, Garlon 3A, and Garlon 4, each applied two times. Survival of planted Douglas-fir seedlings was recorded for 11 years and growth was quantified for 9 years after the last treatment application. In addition to Douglas-fir, data are presented individually for the two most abundant species (tanoak and snowbrush), for greenleaf manzanita, and for the hardwood tree and shrubs combined. At the study's end in 1992, combined vegetation in the control had a mean density of 1,800 plants per acre, foliar cover of 23,700 ft^2 per acre, and height of 11.2 feet. In contrast, combined tree and shrubs in the most effective treatment for controlling them—cut and spray Garlon 3A—had a mean density of 150 plants per acre, foliar cover of 150 ft^2 per acre and height of 5.9 feet at study end. And because competition for site resources was low, Douglas-fir seedlings developed best in this treatment. Mean Douglas-fir diameter was 4.6 inches at 12 inches above mean ground line, height averaged more than 21 feet, and mean foliar cover was 39,850 ft^2 at the end of the study. The cost was $227 per acre. The treatment response data, cost information, and plant community relationships provide the forest land manager with knowledge on how to attain some specific plant communities in the future, and their developmental potentials.

Retrieval Terms: Douglas-fir seedlings, manual and chemical release, northern California, shrubs, tanoak sprouts

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In Brief

Most conifer plantations in California are located in areas that have been created by wildfire or timber harvest. In many instances, the preharvest stands are devoid of conifers or poorly stocked with them and have a large component of hardwoods and shrubs. A forestry goal is often to create a new stand with a higher conifer component. How to limit the hardwoods and shrubs in the new stand is a problem, especially on steep ground, because few treatment alternatives are available. Falling the hardwoods and burning them and the conifer slash is the most practical. If this technique is effective, the soil surface is mostly bare mineral soil with scattered burned logs on it. If the broadcast burn takes place in the spring when the debris and litter layers are dry, but the organic material next to the soil is wet, an unburned layer remains to protect the soil, at least for a year or two.

Bare mineral soil does not last long, however, because many native hardwoods and shrubs have a regeneration strategy of rapid expansion after disturbance (Grime 1979). This is manifest in extensive sprouting from the root crown or burl. Each sprout captures a portion of the parent tree's root system, and fueled by water and nutrients from it, develops rapidly. Rapid regrowth and concomitant capture of site resources combine to make establishment and subsequent development of conifer seedlings difficult, if not impossible.

In this atmosphere of burgeoning competition, natural conifer seedlings from seed produced by adjacent trees would have difficulty becoming established. Planted conifer seedlings would fare no better. If conifers are to regain their place as the dominant vegetation, manipulation by humans has to be done. Specifically, the hardwood and shrub sprouts have to be reduced in number and vigor. Treating them as soon as possible after broadcast burning is cost effective. Early treatment denies competing plants the chance to recover from damage sustained in harvesting and site preparation. It also prevents them from using the high levels of site resources typically present after disturbance. And because they are young and small, they are easier to treat at a lower cost. The two manual treatments, three chemical treatments, and combination of manual and chemical treatment evaluated in this study created a plant community dominated either by planted Douglas-fir, or with various proportions of Douglas-fir, tanoak, and snowbrush. Several other shrubs, forbs, and grasses were present, but never became abundant.

The most effective treatments (chainsaw and spray cut surfaces with Garlon 3A herbicide two times, and foliar spray with 2,4-D plus Garlon 4 two times) created a plant community whose foliar cover was 99 and 95 percent Douglas-fir at the end of the study. A moderately effective treatment, such as manually releasing a 5-foot radius around Douglas-fir seedlings three times, led to a community whose foliar cover had the proportion of 33 percent tanoak, 14 percent snowbrush, and 53 percent Douglas-fir seedlings at the study's end. Applying no further treatment after broadcast burning, as in the control, created a plant community whose foliar cover was evenly distributed among tanoak, snowbrush, and Douglas-fir. The future of this community, however, is in doubt as the Douglas-fir seedlings are so slender that they would fall over if not supported by the shrubs and hardwoods. Precedent suggests that the Douglas-fir component here is likely to be much reduced in the future.

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Consequently, the trend in the control is toward a plant community much like that before harvest or one composed primarily of hardwoods and shrubs.

The most effective treatments in this study led to a full component of rapidly growing Douglas-firs with potential to create a stand composed of mostly conifers. The moderately effective treatments created a mixed stand of vegetatively propagated tanoak trees, snowbrush shrubs, and slower growing planted Douglas-fir seedlings. The untreated control promoted a stand composed mostly of hardwoods and shrubs. These different plant communities, developmental potentials, and associated treatment costs give the forest land manager of the future choices for manipulating the vegetation in the landscape. And if one treatment is not politically or economically desirable, another treatment may attain the desired condition.