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Plant Community Development After 28 Years in Small Group-Selection Openings

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Abstract

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Thirty openings, 9, 18, and 27 meters in diameter, were created by group-selection harvest on a high quality site in northern California in 1963. In 1991, or 28 years after site preparation, the plant community in the openings had stabilized at 55 species. A major shift was from annuals to perennials. New seedlings of ponderosa and sugar pine were able to become established for the first 15 years and those of Douglas-fir and California white fir for the first 25 years. Density and development of conifer and hardwood saplings, shrubs, forbs, graminoids, and ferns were examined for differences in openings size and aspect. In general, plants in almost all classes of vegetation were more numerous and developed better in the larger openings and on the south aspect. Tanoak was an exception, with significantly more seedlings in the smallest opening size and on the north aspect. After 28 years, conifer and hardwood saplings averaged more than 25,230 per hectare, and shrubs, forbs, graminoids, and ferns averaged more than 220,700 per hectare. Conifer and hardwood species grew two to four times faster in height the last 18 years than during the first 10 years. The tallest saplings were 9 to 12 meters in height after 28 years.

Retrieval Terms: group selection, mixed-conifers, plant community dynamics, regeneration, Sierra Nevada, silviculture

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Metric-English Conversions

From	To	Operation
Centimeter (cm)	Inch	x 0.39
Hectare (ha)	Acre	x 2.47
Kilometer (km)	Mile	x 0.62
Meter (m)	Foot	x 3.28
Millimeter (mm)	Inch	x 0.039
Square meter per hectare (m^2/ha)	Square foot per acre	x 4.36

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Contents

In Brief ii

Introduction 1

Methods 2

Species and Site 2

Treatments, Measurements, and Analysis 3

Results 4

Plant Community Dynamics 4

Age Distribution of Conifer Seedlings 5

Conifer and Hardwood Saplings 7

Shrubs, Forbs, Graminoids, and Ferns 10

Discussion and Conclusions 12

References 16

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The trend toward forest management methods that are perceived as more gentle on the land, its vegetation, and its creatures continues to grow. Sustaining ecosystems and maintaining ecosystem components are key to modern forest practice. The group-selection cutting method, which involves the removal of trees in small aggregations, promotes a landscape that has the appearance of continuous forest cover with small openings. Such openings can resemble those created when wildfire creeps through a stand and flares through tree crowns in areas of heavy fuels. Because it has this natural counterpart, limits the harvest to a small fraction of the trees in a stand at any one time, and promotes many age classes, the group-selection method is regarded as both gentle on the land and one that promotes a complex stand, resilient to major damage.

The group-selection cutting method is perhaps the least used and poorest understood of all the silviculture regeneration harvesting methods. Consequently, some knowledge gaps exist, and one of the most serious is a lack of long-term information on plant species composition, succession, and development within the small openings inherent to the method.

In 1963, 48 small openings, 9, 18, and 27 meters in diameter, were created by timber harvest on the Challenge Experimental Forest in northern California. The dominant overstory species in the study area was ponderosa pine. A gentle scraping with a bulldozer bared the soil and created a seedbed that was receptive to colonization by tree, shrub, and herbaceous species. All vegetation had to become established and develop in an environment characterized by openings that were impacted by roots and crowns of adjacent trees.

In 1991, 30 openings (10 of each diameter) were remeasured. Conifer and hardwood saplings, shrubs, forbs, graminoids, and bracken fern were sampled in each opening for density and height. Root-collar diameter was recorded for conifers and hardwoods, and all plant species in the openings were listed.

Results from this study showed that the number of plant species increased from 40 in 1973 to 55 in 1977 and remained at 55 in 1991. The plant community in 1991 consisted of 5 conifers, 5 hardwoods, 16 shrubs, 24 forbs, 4 graminoids, and 1 fern. Almost all were perennials.

Unlike even-aged silvicultural regeneration methods where the first few seedcrops stock the land, many seedcrops are effective for establishing regeneration in group-selection openings. Ponderosa pine and sugar pine seedcrops were effective for the first 15 years after site preparation; Douglas-fir and California white fir seedcrops provided new seedlings for an additional 10 years.

In 1974 the total number of conifer and hardwood seedlings was almost 27,800 per hectare with stand composition of 71 percent ponderosa pine, 16 percent tolerant conifers, and 13 percent hardwoods. In 1991 the total number of conifer and hardwood saplings was more than 25,230 per hectare with stand composition of 22 percent ponderosa pine, 37 percent tolerant conifers, and 41 percent hardwoods. Thus, the composition of the stand has shifted toward the more tolerant conifers and hardwoods at the expense of ponderosa pine. Comparative height values support this trend. Among the five conifer species and the combined hardwoods, ponderosa pine ranked no better than fourth in average sapling height in 1973 and 1991 and for tallest trees in 1991. However, in

spite of the large decrease in ponderosa pine numbers, this species will continue to be a significant component of the stand, particularly near centers of larger openings.

Size of opening and aspect had a major influence on plant density and development. In general, almost all statistically significant differences for all classes of vegetation were between the largest opening sizes and the smallest and between the north and south aspect. Plainly, more plants, and plants that developed better, occurred in the larger openings and on south aspects. Tanoak was a partial exception, having significantly more plants in the smallest opening size and on a north aspect, but developing better in both mean height and root-collar diameter on south aspects.

Several shrub species that develop rapidly and reach large size in more sunlit environments did not grow well in group-selection openings. This finding suggests that vegetation managers can use the environment, especially components like shade and organic material, to control undesirable vegetation; thus, *indirect* methods can be added to their repertoire of vegetation control techniques. We also found that because the entire 9-m opening probably was impacted by shade and roots from adjacent trees, and conifer and hardwood sapling growth was poorest in 9-m openings, this size of opening probably is too small for operational application in group-selection cutting.

Finally, the density and development data for the conifer and hardwood saplings, plus the finding that their growth rate was two to four times faster the second 18 years than the first 10 years, suggest that this application of group-selection cutting will produce a spatially distinct age class. Furthermore, it shows promise as a way to convert from essentially a ponderosa pine stand to a mixed conifer-hardwood stand.

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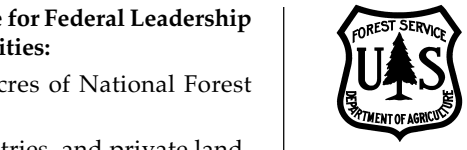
- Research on all aspects of forestry, rangeland management, and forest resources utilization.

The Pacific Southwest Research Station

- Represents the research branch of the Forest Service in California, Hawaii, American Samoa, and the western Pacific.



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