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PERENNIAL GRASSES REDUCE WOODY PLANT SEEDLINGS . . . on mixed conifer fuel-break

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ABSTRACT: After initial clearing, parts of a fuel-break on the Stanislaus National Forest, central California, were planted to perennial grasses; other parts were not. After 5 years, a comparison between adjacent seeded and unseeded strips shows that the perennials had reduced the number of woody plant seedlings by a factor of 8, height of seedlings by 50 percent, and amount of annual plant ground cover by 33 percent. Without perennial grass, the site would be reoccupied by woody plants in a very few years.
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RETRIEVAL TERMS: fuel-break cover; perennial grass; woody plant cover; seedling repression; Stanislaus National Forest.

The forest manager is faced with speedy regrowth of brush and trees on fuel-breaks following removal of the original cover in the central Sierra mixed conifer zone. To prevent this, he must respond with some combination of herbicides, mechanical equipment, hand labor, and competing vegetation.

During fuel-break construction on the Stanislaus National Forest in central California in 1962-63, perennial grass was planted on 10-foot-wide drill strips on one fuel-break segment, and alternate strips were unseeded.[1] Pine trees were to be planted on these unseeded strips, but never were. Now, some 5 years later, the unseeded strips are dominated by naturally regenerated pine and brush seedlings. The strips and areas seeded to perennial grasses are occupied primarily by seeded grasses. This suggests that perennial grasses can be of considerable help in fuel-break maintenance.

METHODS

The study site has a scattering of ponderosa pine trees, a few sugar pines, and before being cleared for fuel-break had an understory of brush—mostly whiteleaf manzanita *(Arctostaphylos viscida* Parry*)*. Exposure is east to south to west in a "U" shape around a slope ranging from 0 to 20 percent gradient. Elevation is about 4,000 feet. The soil is Mariposa silt loam, contains small rock fragments, and is about 20 inches deep. The site is marginal for timber production.

Perennial grasses were seeded with a rangeland drill in strips along the contour shortly after bulldozer clearing early in winter 1962-63. Seeded species and approximate rates were: hardinggrass, 3½ pounds; pubescent wheatgrass, 3 pounds; and smilo, ½ pound —a total of 7 pounds per acre. The seeded strips were fertilized with ammonium phosphate (16-20-0) at

100 pounds per acre, applied through the drill with the seed.

Paired plots, each a mil-acre in size, were established by randomly locating 30 plots in the center of the contour drilled strips, then locating the unseeded "mate" in the strip immediately above the seeded plots.

The following data were gathered on each plot in June 1968:

1. Number of pine and brush seedlings.
2. Estimated area of plot covered by pine and brush seedlings.
3. Height of a representative sample of pine and brush seedlings.
4. Area of plot drill strips occupied by perennial grasses as determined by measuring linear distance in each drill row occupied by perennial grasses.
5. Estimated area of plot covered by herbaceous plants other than perennials.

RESULTS

The difference between the seeded and unseeded areas was marked *(table 1; fig. 1)*. After 5 years, the unseeded plots averaged 15.4 tree seedlings; the seeded plots, 1.9. The unseeded plots averaged 19.8 brush seedlings; the seeded plots, 2.2. Thus, there were 35,200 woody plants per acre, or one brush or tree seedling for each 1.2 square feet, where no grass competition existed. Seeding grass reduced the average total woody plant count to 4,100 plants per acre, or one for each 10.6 square feet. Most of these plants were concentrated in breaks in the grass stand. Few brush or tree seedlings grew where the grass stand was continuous.

The competition afforded by perennial grasses reduced both the size and number of tree and brush seedlings. Both trees and brush on seeded strips were about half as tall as those on unseeded strips. Because of this difference, and the greatly reduced number of plants, woody plants occupied almost one-fourth (23 percent) of the unseeded plot area, but only 0.5 percent of the seeded plot.

Growth of annual grasses and forbs was also restricted by perennial grass, but not as severely as were tree and shrub seedlings. Winter annuals, such as soft chess, red brome, and cheatgrass were most abundant in this group. Common forbs included alfilaria and chickweed.

DISCUSSION

Some of the reduction in size and numbers of woody plant seedlings could be attributed to cultivation by the drill during seeding, a treatment the alternate strips did not get. But this difference was not significant, we believe, for several reasons: (a) This type of disturbance usually promotes growth of brush seedlings; (b) all of the ground was tractor-cleared to mineral soil before planting; (c) the grass drilling was done during the same winter as the tractor clearing and before woody plant emergence; (d) the rangeland drill disturbs only about one-third of the ground surface, and numerous woody plant seedlings would have survived; and finally, (e) there are spots that were disturbed by the drill but where

Table 1—*Differences in vegetation growth*[1] *on strips of fuel-breaks drill-seeded to perennial grass and on strip not seeded, Stanislaus National Forest, California*

Item	Per mil-acre plot		Height[2]		Ground cover			
	Tree	Brush	Tree	Brush	Tree	Brush	Annuals	Perennial grass
	No.		*Inch*		*Percent*			
Average of unseeded	15.4	19.8	9.5	9.9	7.8	15.6	32.1	0.6
Average of seeded	1.9	2.2	5.2	5.3	.2	.3	19.2	64.0
Difference	13.5**	17.6**	4.3*	4.6**	7.6**	15.3**	12.9*	-63.4**
Standard error of difference	2.71	4.40	1.65	.85	2.19	3.31	5.68	4.33

* Statistically significant at 5 percent level.
**Statistically significant at 10 percent level.
[1]Woody vegetation was principally 5-year-old ponderosa pine and whiteleaf manzanita seedlings.
[2]Measured only when both paired plots had trees, brush, or both. If all heights were included, averages are:
Unseeded strip: Trees—9 inches, brush—9.1 inches
Seeded strips: Trees—2.3 inches, brush—3 inches.

Figure 1—*A thick stand of woody plant seedlings developed on "leave" strips,* left, *but very few on strips occupied by perennial grass.*

seed was not planted, or if planted it did not germinate for some reason. Such spots are now occupied by manzanita and pine seedlings.

The results are important to the forest manager who must consider fuel-break maintenance. Fuel-break that was originally cleared at great expense without seeding can quickly become choked with woody vegetation, and after a few years, lose much of its value as a fuel-break. Areas with a good perennial grass stand give no indication after 6 years that they will not function as fuel-breaks for many more years. On seeded portions of the fuel-breaks at the Stanislaus National Forest, woody growth is concentrated in voids in the grass stand. Scattered clumps of woody growth can often be tolerated, and may help provide wildlife cover and improve fuel-break appearance.

If woody plant seedlings are abundant and distributed so they threaten fire control values of the fuel-break, they must be removed by herbicides or prescribed fire. This removal is generally accomplished most easily while the woody plants are small. Experience elsewhere[2] in California suggests that once woody plant growth is eliminated from a perennial grass stand, woody plant reinvasion will be slow. Schultz and Biswell[3] and Bentley[4] suggested that annual ryegrass may suppress seedling growth during the year following seeding better than perennial grasses. But annual ryegrass usually disappears within 3 to 5 years, and therefore cannot be recommended for longtime fuel-break use.

Perennial grasses provide the best fuel-break cover we have. They are low in volume and in burning intensity. They do not spot much when burning, and provide a relatively safe area for firefighting operations. And because soil on gradients normally seeded is stabilized and protected, little erosion occurs. Perennial grass also increases the livestock and deer carrying-capacity of a forest. These advantages of perennials, together with their competitive value, should encourage their use on all fuel-breaks to which they are adapted.

Notes

[1]A research and action program aimed at conflagration control through forest management, carried out by the California Region, Stanislaus National Forest, and Pacific Southwest Forest and Range Experiment Station of the Forest Service.

[2]Bentley, Jay R.; Green, Lisle R.; and Evanko, A. B. *Principles and techniques in converting native chaparral to stable grassland in California.* Proc. X Int. Grassland Congress, Helsinki, Finland 1966: 55-59. 1966.

[3]Schultz, A. M., and Biswell, H. H. *Competition between grasses reseeded on burned, brushlands in California.* J. Range Manage. 5(5): 338-345. 1952.

[4]Personal correspondence with Jay R. Bentley, Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. Jan. 6, 1969.

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