GRASS SEEDING AS A BRUSH SUPPRESSANT IN DOUGLAS-FIR CLEARCUTS - A PRELIMINARY STUDY

by

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GRASS SEEDING AS A BRUSH SUPPRESSANT IN DOUGLAS-FIR CLEARCUTS - A PRELIMINARY STUDY

ABSTRACT: Increased demand for wood fiber has necessarily increased the intensity of forest management in recent years. In the Pacific Northwest the release of deciduous vegetation following clearcutting of Douglas-fir is a major problem. Herbicides which have been used in the past to control this brush competition may no longer be politically feasible tools. The planting of grass in clearcuts is discussed as a possible brush suppressant. Some preliminary measurements are made which compare growth rates of trees which have invaded grassy areas to trees which have regenerated naturally in clearcuts. Compartment models describing alternative systems of forest management are constructed and suggestions for further research are made.

AGRICULTURAL FORESTRY AND THE USE OF HERBICIDES

As consumption of natural resources continues to increase and the resource base continues to shrink, there is an ongoing effort to extract more from less. The forestry resource is no exception. One of our finest forestry resource areas is the Douglas-fir region of the northwestern coast of the United States. Here abundant moisture, moderate climate, and generally deep soils combine to yield one of the most productive timber growing areas in the world.

As timber managers in this region strive to increase production, they turn increasingly to more agriculture-like management techniques. Trees are bred for high production characteristics; typically harvesting is by clearcutting. Site preparation may be fairly intensive; harvested units are nearly always burned, and at times mechanical clearing may be carried out as well. Hand planting of Douglas-fir seedlings insures that there is a "crop in the ground." Immediately after this point in the "cropping cycle" the following problem frequently occurs: the removal of the once-dominant trees from the site results in a tremendous release of residual broadleaf vegetation, often to the exclusion of conifers for many years until natural forest succession restores them once again. The forest manager seeks to bypass this successional stage of predominately deciduous vegetation and to reestablish conifers immediately on the site. To do this he needs some way to suppress broadleaf growth until the planted conifers become dominant. The development of the phenoxy herbicides, 2,4,5-T in particular, seemingly solved this problem for the forest manager. A critically timed 2,4,5-T spraying in the spring can effectively kill most broadleaf plants. As a result 2,4,5-T has been widely used to suppress brush competition on Douglas-fir plantations.

In recent years 2,4,5-T has come increasingly under fire as a threat to human health. In 1970 the U.S. Department of Agriculture banned the use of 2,4,5-T in and around homes, recreation areas or where water contamination was likely to occur. In 1971 the Environmental Protection Agency prohibited the use of 2,4,5-T on most food crops.[1] The issue was highlighted in 1978 when the Environmental

Protection Agency reported that they had established a link between seasonal 2,4,5-T forest spraying in the Alsea, Oregon area and spontaneous abortions in women living near the sprayed areas.[2] The scientific validity of the study was questioned almost immediately.[3] But public pressure was mounting and in August 1979 the EPA imposed a ban on 2,4,5-T use on recreational and forest land until the issue could be resolved.[4]

A Possible Alternative to Herbicides

Even though herbicides with less of a toxic threat may be developed and used to replace 2,4,5-T, it is apparent that a non-chemical means of brush suppression would be highly desirable. Some preliminary research on the Alsea Ranger District of the Siuslaw National Forest in western Oregon has indicated that planting grass, along with trees, following harvest may be effective in checking brush competition in clearcuts.[5]

To thoroughly test the efficacy of this method, it would be necessary to establish identical paired sets of plantations, treating one of each pair with the herbicide currently in use for brush suppression and planting an ecologically adapted grass as a brush suppressant in the other. Since it would be necessary to follow the plantations for 20 to 30 years to obtain conclusive evidence, it may be useful to examine the forest rather carefully to see if a situation currently exists in the field which may be used as a surrogate for the experiment suggested above.

A PRELIMINARY STUDY

At one time there were numerous homesteads scattered thoroughout the Oregon Coast Range. In the last 40 to 50 years most of these were abandoned as agriculture mechanized and concentrated on more productive and easily worked lands. Historically, these homesteads maintained many areas in the Oregon Coast Range in a cleared condition. As abandonment proceeded, trees reclaimed many of these cleared areas.

Close examination of sequential air photos made over a number of years has revealed that these homestead fields remained without either trees or brush for sometime after abandonment. The initial cover during this period was presumed to have been grass.

Study Objectives

Based on this understanding of past events this study was designed to investigate several questions: First is it possible to identify abandoned homestead fields which have grown up directly into Douglas-fir stands, thus bypassing the broadleaf successional stage; and second, how does tree growth on the once grassy, abandoned homestead fields compare with that on clearcut forest sites located on similar physical environments?

Selection of Field Observation Sites

To establish whether, in fact, invasion by Douglas-fir of formerly grassy homestead fields occurred in the Oregon Coast Range, a series of aerial photographs was examined for an area northwest of Willamina, Oregon (Fig. 1). Photos of the area made in the following years were used: 1947, 1953, 1963, 1973, and 1976. The 1947 photography was first examined to locate sites with neither brush nor trees growing on them. Grass was the presumed cover type for the selected 1947 sites. Once such areas were located they were followed carefully on subsequent photography to establish Douglas-fir invasion sites. Once the tree-invaded areas were clearly defined on the photos, their locations were sketched on a USGS 1:24,000 topographic map. These areas were called, collectively, group A.

The next task was to select individual regenerated clearcut areas which matched the aspect, slope, and elevation of each area in group A. Thus, matched pairs were created. Location of clearcuts by year of cutting was made possible by examination of maps prepared for another study by the Environmental Protection Agency in Corvallis, Oregon.[6]

Clearcut units of appropriate aspect, slope, and elevation were followed temporally on the air photos and ones that showed relatively uniform regeneration of Douglas-fir were selected for matching with the tree-invaded, formerly grassy areas of group A. These clearcut units, designated group B, were then located on the USGS 1:24,000 map along with group A. Measurements on six plots in each group were performed and are designated 1-A, 1-B, 2-A, 2-B, and so on (Fig. 2).

Two sets of areas were defined: group A, formerly grassy sites subsequently invaded by uniform stands of Douglas-fir; and

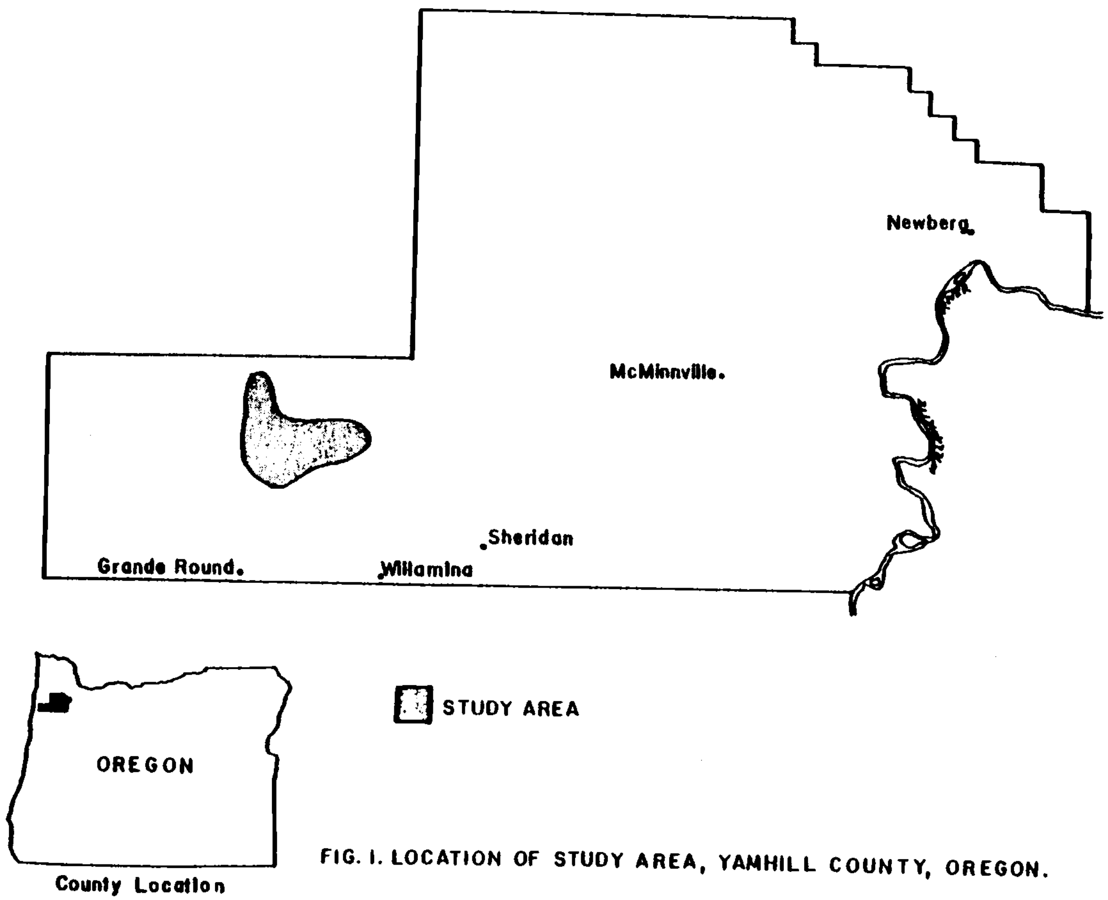

FIG. I. LOCATION OF STUDY AREA, YAMHILL COUNTY, OREGON.

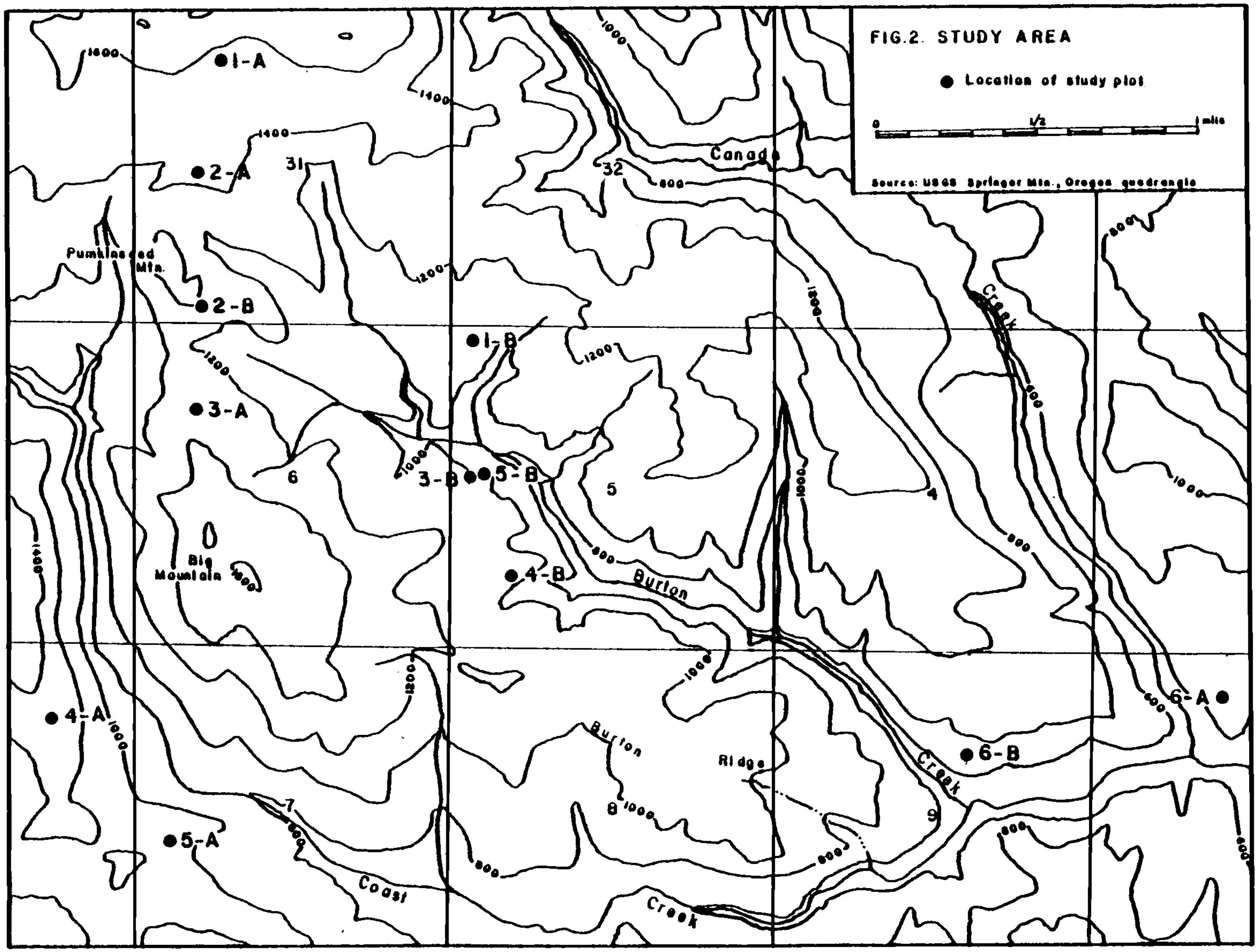

FIG.2. STUDY AREA

group B, regenerated clearcut areas of similar aspect, slope, and elevation matched to individual sites in group A.

Measurements Performed at Each Site

Groups A and B were established for the growth measurements to ascertain if the apparent suppression of brush by grass resulted in any increase in Douglas-fir growth. If this can be shown, there is reason to investigate further the management possibilities of planting grass as a brush suppressant.

A uniform stand was selected in the field at each site of the two groups. Uniform stands were chosen to minimize the competitive advantage gained by trees in open areas of non-uniform stands.

Research by Weyerhaeuser Company on establishing site index curves for Douglas-fir in western Washington has shown a roughly circular or square 50-tree sample plot to be sufficient for selection of individual trees for measurement.[7] Although some workers have found that measuring as few as 4 trees per plot to be sufficient in determining site index,[8] Weyerhaeuser Company used 10 tree samples to minimize error.[9] Researchers at Weyerhaeuser Company have further determined that selection of dominant trees is least subject to error when based on diameter breast height (dbh) rather than height.[10] This sampling method evolved as part of an effort to develop more reliable site index curves for Douglas-fir. It effectively chooses the most stable element in the stand, the dominant trees, for measurement. Any differences in growth of these dominants on different sites may reflect the effect of some extrinsic factor, such as presence or absence of brush. It is important to point out however, that the site indices of the areas where the plots were located are not known, and differences in measurements of trees between sites could be due to inherent differences in site potential rather than a reflection of presence or absence of brush on the site.

Within each uniform stand at each site a 50-tree plot was established. The largest ten trees by dbh were sight identified within each plot. These ten trees were assumed to be the dominant trees in each plot and hence least affected by competition with other trees.

As a preliminary measure of the growth rates of the trees, the following measurement of the ten dominants at each site was carried out: the distance between the first and sixth nodes above breast height (4.5 feet) was measured using a telescoping rod.[11] This measurement was also used initially in developing a method of determining site index, but suited the purposes of this study also.[12] The five internodal spaces represented the growth achieved by the tree during a five year period immediately after reaching 4.5 feet in height. Once the tree is greater than 4 to 5 feet tall most of growth-retarding hazards, such as browsing and rodent damage, encountered by seedlings and very small trees are past.[13] Measurement of these 5 internodal spaces was interpreted as a direct measurement of growth rates of the trees. Mean values for the ten tree samples show no significant differences in tree growth on the formerly grassy sites (group A) when compared to the clearcut sites (group B) (e.g. Table 1).

TABLE 1. MEAN INTERNODAL DISTANCES (FEET) OF EACH TEN TREE SAMPLE

Plot	(Grassy)	Plot	(Clearcut)
1-A	9.5	1-B	11.9
2-A	10.9	2-B	12.3
3-A	12.6	3-B	11.6
4-A	10.7	4-B	10.2
5-A	11.7	5-B	11.4
6-A	12.2	6-B	12.9

Although the growth of deciduous brush was suppressed on sites in group A, the results reported in Table 1 are a tentative indication that this did not result in any greater tree growth rates on those sites.

It has been suggested that continuous cropping of areas in Group A before abandonment may have depleted the nitrogen to the point of depressing the growth of invading Douglas-fir somewhat.[14]

It was also noted in the field that in every case areas from which the plots for group A were chosen had an almost continuous cover of trees, while on the areas from which plots for group B were chosen the trees grew much more in clumps with numerous natural openings. Brush, totally absent on group A areas, was present on group B areas, but tended to be scattered. The most obvious competitor in openings in both areas was bracken fern, which frequently grew rank and 6 to

8 feet in height. In the plot stands understory was scant or completely absent in group A and was present predominately as salal, bracken, and sword fern, in varying densities, in group B. In any case, the generally more open nature of the areas where group B stands occurred possibly resulted in a tendency for trees at the edges of openings there to grow somewhat faster than they would have inside a continuous stand. Due to the small size of stands found in group B areas, frequently the 50 tree plot included trees, often dominants, on the edge of openings. Since the dominants were the trees measured, this effect may have raised the mean values for tree growth on the group B (clearcut) sites.

From the measurements reported here no statement can be made about the growth rates on tree-invaded formerly grassy areas compared to growth rates on regenerated clearcuts. It was noted however, that on the tree-invaded grassy sites an almost continuous cover of trees established, while regeneration on the clearcuts resulted in a discontinuous and spotty tree cover. Increment borings revealed that trees on the clearcut areas were 15-20 years old, versus 35 to 45 years for trees on the invaded grassy sites, so that many of the open areas on the clearcuts would be expected to fill in. Whether the invaded grassy areas would support a stand of greater volume than the clearcut areas in the long run is uncertain.

TENTATIVE MODELS OF DOUGLAS-FIR GROWTH AND HARVEST CYCLES

Reflection on this research suggests several different possibilities for the Douglas-fir growth and harvest cycle (Figs 3 - 6).

FIG. 3. TENTATIVE MODEL OF EVENTS ON GRASSY SITES INVADED BY DOUGLAS-FIR

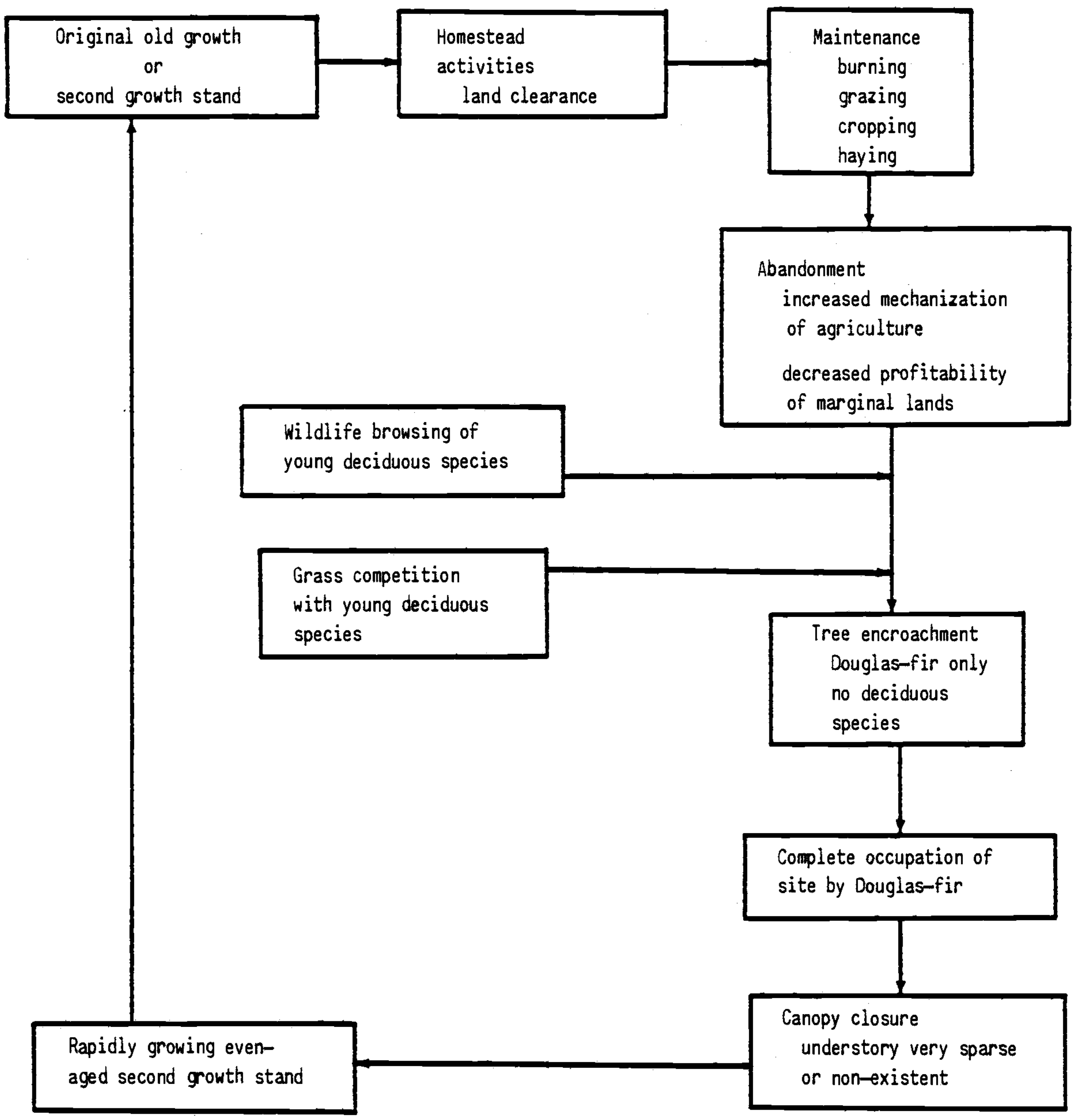

FIG. 4. TENTATIVE MODEL OF EVENTS ON CLEARCUT SITES WITH NO POST-HARVEST MANAGEMENT

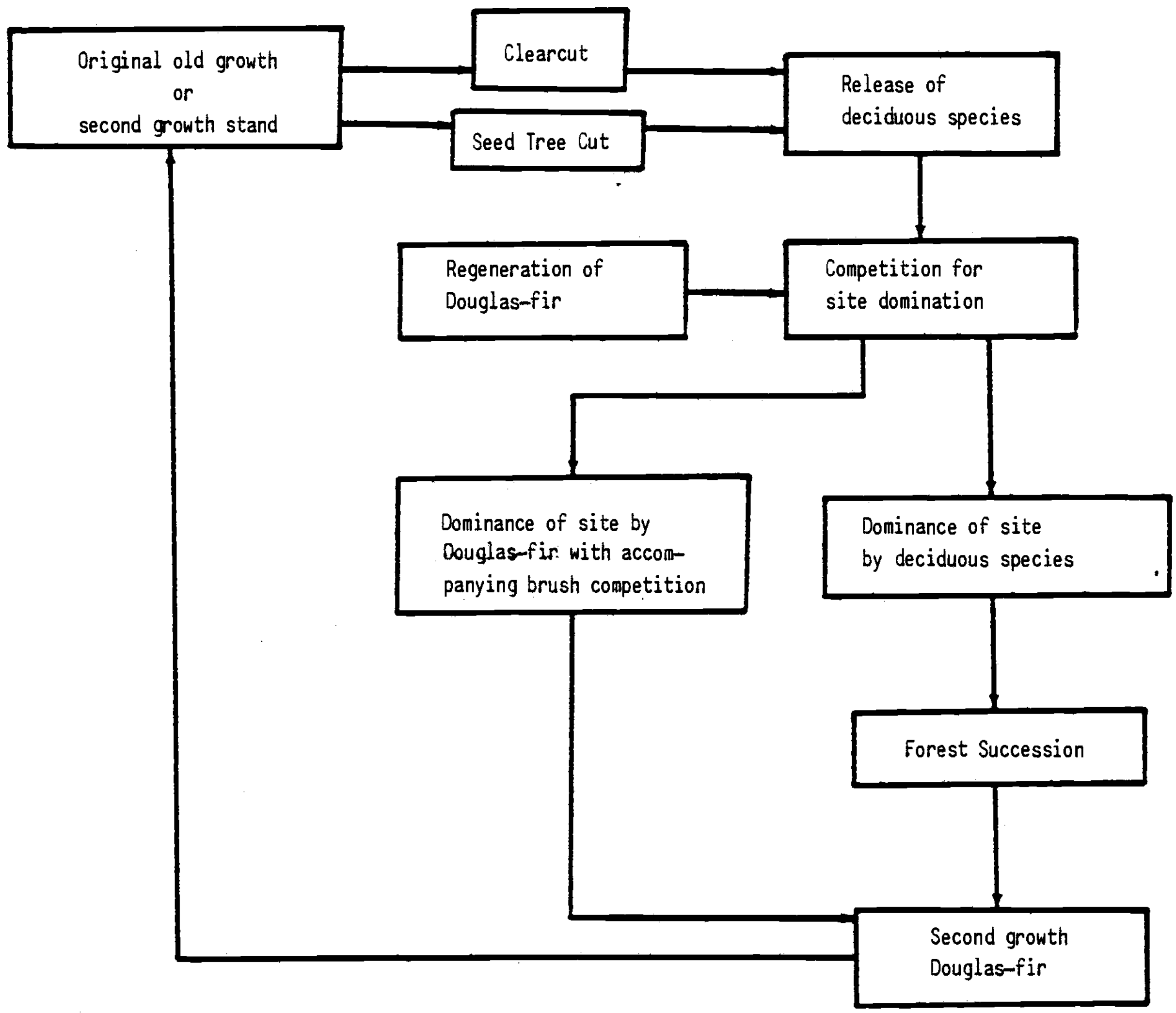

FIG. 5. TENTATIVE MODEL OF EVENTS ON CLEARCUT SITES WITH CONVENTIONAL POST-HARVEST MANAGEMENT

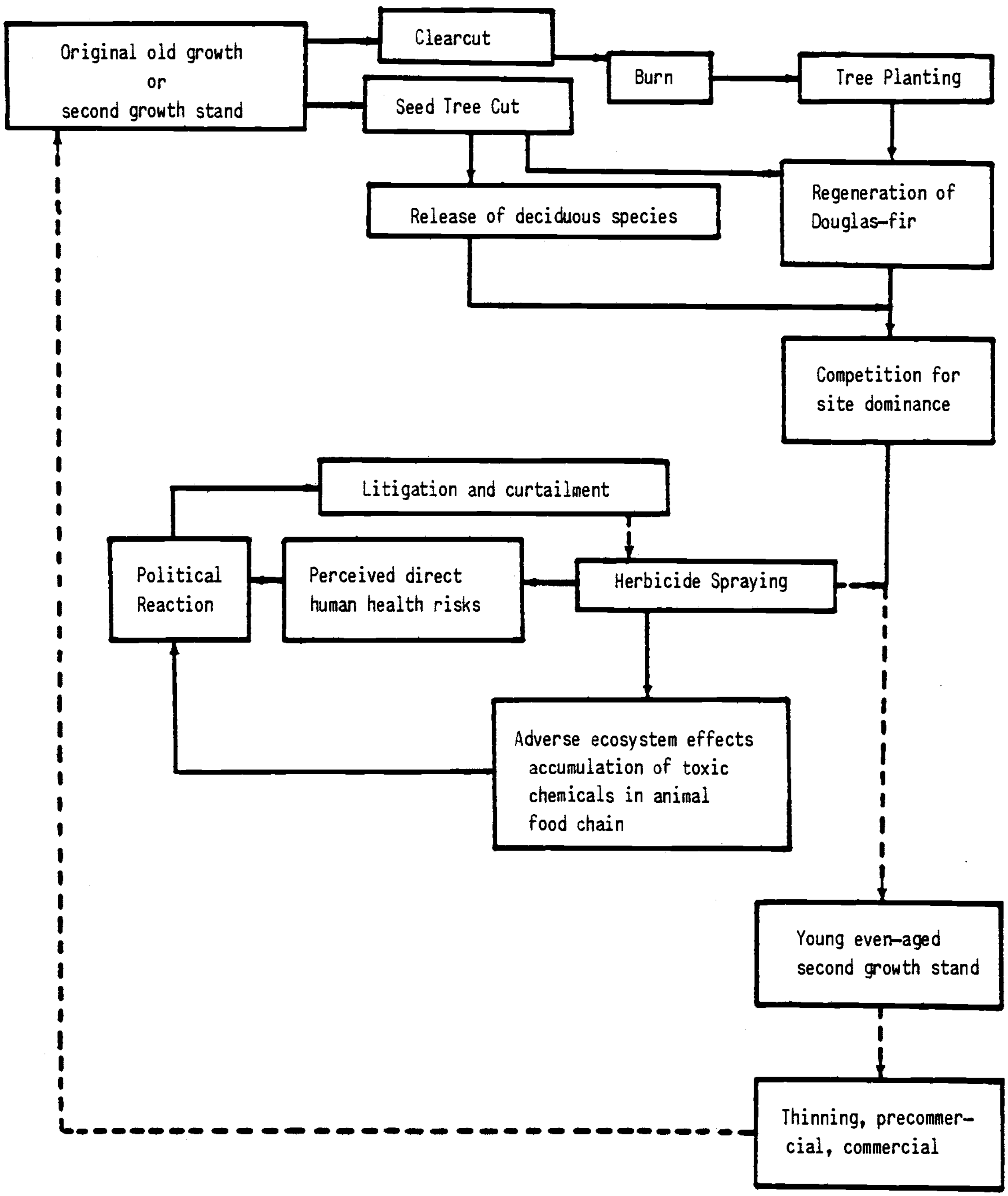

FIG. 6. TENTATIVE MODEL OF EVENTS ON CLEARCUT SITES WHERE GRASS HAS BEEN PLANTED

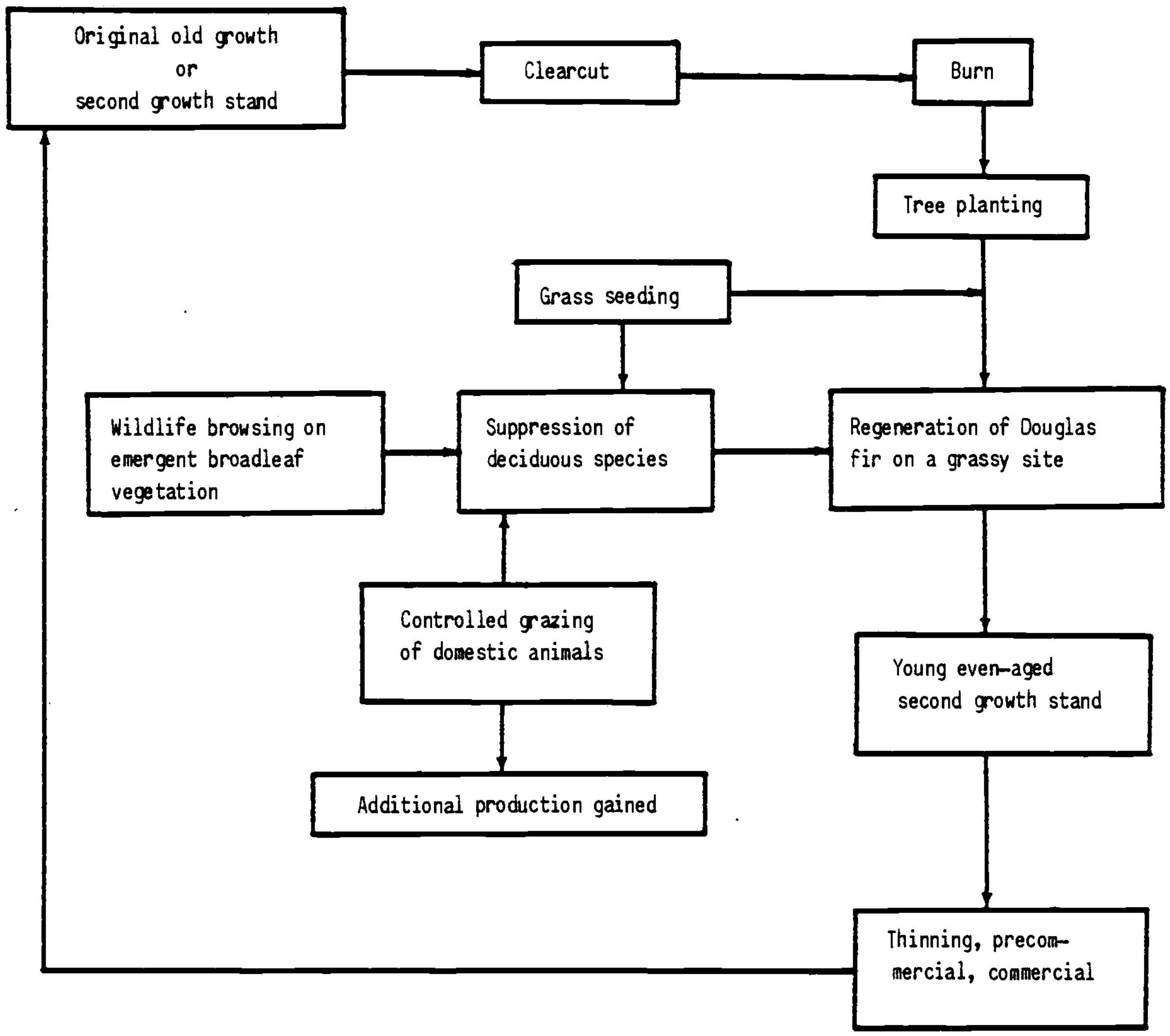

Fig. 3 hypothesizes a sequences of events for areas in group A. Studies carried out by the Oregon Department of Fish and Wildlife in cooperation with the U.S. Forest Service and Soil Conservation Service indicate that the attraction of deer and elk to grass-seeded clearcuts results in suppression of young deciduous species by browsing.[15] Apparently the deciduous species can establish in the grass-seeded areas but are kept browsed down to almost ground level. The deer and elk seem to be more attracted to the grass-seeded clearcuts resulting in more browsing pressure on deciduous species there than on non-seeded clearcuts where they spend less time. Figure 3 postulates that deer and elk do not browse young Douglas-fir enough to interfere with stand establishment. In the presence of continued browsing pressure on deciduous species, Douglas-fir comes to dominate the site and an even-aged rapidly growing stand is the result.

Fig. 4 illustrates probable sequences of events following Douglas-fir harvest with no post-harvest management. In almost every case an immediate and significant release of deciduous species can be expected following harvest. Douglas-fir from adjoining stands or seed trees left will attempt to establish and may do so to some extent, but the path back to a rapidly growing, fully stocked stand will be unacceptably slow to the timber manager, particularly if the site becomes dominated by deciduous species.

Fig. 5 represents conventional post-harvest management as often practiced today. Clearcutting followed by burning and planting is the standard practice. As competition between the young conifers and deciduous brush ensues, a well-timed herbicide spraying insures the dominance of the conifers. However, as indicated earlier in this paper, herbicide spraying generates problems so severe that use of them as a management tool may no longer be possible. The dotted lines in Fig. 5 indicate the uncertain nature of this management scheme.

Fig. 6 suggests a superior approach to stand establishment. Suppression of brush competition is accomplished without the environmental and political problems of herbicide spraying. Additional production is a real possibility through domestic livestock grazing, which if properly timed, will cause little damage to the trees.[16] This is clearly an alternative which needs to be investigated further.

SUGGESTIONS FOR FURTHER RESEARCH

Many possibilities exist for further investigation of questions arising out of this paper. First, examination of aerial photographs over a much broader area would identify many more sites falling into either group A or B. Once a sufficiently large number of matched sites were identified tree measurements would be carried out and statistically analyzed to see if there is a significant difference in tree growth on the two types of sites. A related possibility is to match a large number of group A sites with a large number of herbicide-treated group B sites and again analyze for a significant difference in tree growth.

The identification of sites now in the process of abandonment is needed. Analyzing the plant communities on these sites through time would reveal how plant succession proceeds and if abandoned cleared areas in the Coast Range go primarily to grass and then Douglas-fir.

Further elucidation of the role of browsing animals on the suppression of brush regrowth is also needed. In particular, how does browsing affect vegetation on clearcuts under the different schemes suggested in Figs. 3-6? Does seeding clearcuts to grass result in some net benefit to browsing wildlife?

A historical study of Coast Range farming is necessary to establish what the land use practices actually were on homestead fields prior to abandonment. For instance, did certain farming practices result in a better grass seed source on abandoned homestead fields than occurred on clearcuts? How widespread and frequent was burning? How commonly were nitrogen depleting crops grown? This type of knowledge would place a study using tree growth on abandoned fields as one of its components on a much firmer footing.

CONCLUSION

The tentative conclusion of this study is that growth rates of Douglas-fir which have invaded grassy, abandoned homestead sites are similar to growth rates of Douglas-fir which have regenerated naturally on clearcuts. The presence of grass on a site seems to suppress the regrowth of deciduous species while allowing Douglas-fir to become established and dominate the site with a uniform and well stocked stand. The use of grass-seeding as a brush suppressant in clearcuts has management implications that clearly merit further investigation.

FOOTNOTES

[1] Alan S. Miller, "2,4,5-T: Chemical Time Bomb," Environment, Vol. 21 (June 1979), p. 4.

[2] The study which lead to this announcement, known as the Alsea II Study is titled: Preliminary Report of Assessment of a Field Investigation of Six-Year Spontaneous Abortion Rates in Three Oregon Areas in Relation to Forest 2,4,5-T Spray Practices. It is available on loan from the Seattle, Washington EPA library. The study is also outlined in Federal Register, Vol. 44, No. 52 pp. 15874-15890, March 15, 1979.

[3] Sheldon L. Wager M. D., et al., A Scientific Critique of the EPA Alsea II Study and Report, Environmental Health Sciences Center, Oregon State University, (Corvallis, Oregon: October 23, 1979), pp. 1-2.

[4] Miller, Ibid.

[5] Gene Klingler, Alsea Ranger Station, Alsea, Oregon. Personal communication.

[6] James Omernick, Environmental Protection Agency, Corvallis, Oregon. Personal communication.

[7] James E. King, Site Index Curves for Douglas-fir in the Pacific Northwest, Weyerhaeuser Forestry Paper No. 8, (Centralia, Washington: Weyerhaeuser Forestry Research Center, July 1966) pp. 9-10.

[8] John W. Ker, "An Evaluation of Several Methods of Estimating Site Index of Immature Stands," Forestry Chronicle, Vol. 28, No. 3 (1952), pp. 67-68.

[9] King, Ibid.

[10] Ibid.

[11] The term node is used here to refer to a whorl of branches which grows out from the trunk of a Douglas-fir and which denotes one year's growth of the tree.

[12] G. S. Warrack and A. R. Fraser, Evaluation of Site Quality in Juvenile Douglas-fir Stands, Research Note No. 28 (Victoria, British Columbia: BC Forest Service, 1955) p. 1.

[13] T. N. Stoate and E. C. Crossin, "Site Quality Determination in Young Douglas-fir," Forestry Chronicle, Vol. 25, No. 1 (March, 1959) p. 23.

[14] C. T. Youngberg, Dept. of Soil Science, Oregon State University, Corvallis, Oregon. Personal communication.

[15] B. Clery, Oregon Department of Fish and Wildlife, Corvallis, Oregon. Personal communication.

[16] Paul J. Edgerton, The Effect of Cattle and Big Game Grazing on a Ponderosa Pine Plantation, Research Note PNW-172, (Portland, Oregon: U.S. Forest Service Pacific Northwest Range and Experiment Station, December 1971) p. 5.