

SIMULATIONS OF BRIDGE-TREE REMOVAL IN COASTAL DOUGLAS-FIR INFECTED WITH PHELLINUS ROOT ROT

C O N T R A C T # 6 9 1 9 8

W . J . B 1 O O M B E R G

S E P T E M B E R 1 0 T H , 1 9 9 1

INTRODUCTION

This report examines the effects of bridge-tree removal in coastal Douglas-fir infected with *Phellinus* root rot through simulation with the TASS-ROTSIM model described in a previous report (W.J. Bloomberg, Incorporation of *Phellinus* root rot impacts in the tree and stand simulator (TASS), Progress Report, Contract #49782, March 31, 1991). The latter report examined the effects of inoculum level (number, size, and spatial distribution of infected stumps). A second report dealt with effects of stand density and site index on root rot (W.J. Bloomberg, Preliminary yield tables for coastal Douglas-fir infected with *Phellinus* root rot, Contract #69198, June 10, 1991). Other reports have dealt with the effects of juvenile spacing and stump removal as methods of controlling root rot.

Bridge-tree removal is a method of reducing spread of *Phellinus* in young (<40 yr) stands through falling healthy (symptom-free) trees at the margins of root-rot centers in order to interrupt the tree-to-tree spread via root contacts. *Phellinus* competes poorly with other organisms in colonizing roots of dead trees, so that trees felled between infected and healthy trees should provide barriers to spread. Although there is only observational evidence for this, the method is appealing because it is conservative in the removal of only the trees immediately adjacent to the outermost infected trees.

Factors which will affect control of root-rot spread by bridge-tree removal include the stocking density, i.e., how close the trees are, and stand age, i.e., how large their root systems are. Simulation provides an opportunity of evaluating these factors and estimating the impact of the disease using combinations of factors.

METHODS

Bridge-tree removal is simulated in TASS—ROTSIM by removing trees adjacent to infected stumps or trees within a specified distance which can be set to ensure that only the bridging trees are removed. Normally, these are the immediately adjacent trees (single tree treatment). Initial stocking was set at 1000 and 2000 stems/ha. Treatment was assigned at stand ages 20 and 40. Also, a double bridging tree treatment, in which the first and second trees nearest to each infected tree were removed, was assigned to initial stocking of 2000 stems/ha at stand age 40.

Inoculum levels were represented by five root rot classes: very light, light, moderate, heavy, and very heavy as defined in the above reports. All stands had a site index of 35m, corresponding to a good site.

Methods for simulating root rot in stands and calculating effects on stocking (stems/ha) and volume (cu. in/ha) are described in the above reports.

RESULTS

Treatment (single-tree) at stand age 20 was the most effective in reducing stand volume impact at an initial stocking of 1000 stems/ha and next most effective at 2000 stems/ha (Table 1). Treatment at stand age 40 was somewhat effective in reducing volume impact at initial stocking level of 1000 stems/ha but was ineffective at 2000 stems/ha. Double-tree treatment at stand age 40 was effective in reducing volume impact at initial stocking level 2000 stems/ha.

Bridge—tree treatment reduced stocking impacts less than volume impacts, due to the removal of healthy trees.

T A B L E 1 .

EFFECT OF BRIDGE-TREE REMOVAL ON IMPACT OF HEAVY ROOT ROT IN DIFFERENT STAND DENSITIES

			Treatment at stand age:					
			20		40			
	Untreated		Single tree		Single tree		Double tree	
	Stocking	Volume	Stocking	Volume	Stocking	Volume	Stocking	Volume
Initial stems/ha	Impact (% of healthy) at stand age 90							
1000	43.7	46.7	73.1	88.2	62.5	68.7	N/a	N/a
2000	56.2	58.0	67.3	75.3	62.0	45.6	49.5	87.0

Single-tree treatment at stand age 20 and a initial stocking level of 1000 stems/ha effectively created a barrier to Phellinus spread so that the infection centers did not increase in size (see maps, Appendix). Because infected root systems were small, the fungus had died out by the time the roots of adjacent trees extended into contact with them. Following treatment at stand age 40, spread was temporarily stopped but root systems eventually extended beyond the bridge trees to contact the roots of infected trees. At stand age 40 these were large enough to retain viable fungus for long enough to cause later infection.

At 2000 stems/ha, single-tree treatment at stand age 20 only temporarily restricted spread because the closeness of trees allowed contact with infected roots before the fungus had died out in them. At stand age 40, spread was not restricted because there was rapid contact between roots. Double-tree removal completely restricted spread after treatment because root spread into the infected zone took long enough that even in 40-year-old root systems, the fungus had died out.

Gains in volume/ha at rotation age from treatment increased as root rot severity increased. For example, treatment of very heavy root-rot at stand age 20 and a initial stocking level of 1000 stems/ha increased volume from 537 cu. m/ha in an untreated stand to 1066 cu. m/ha (see figures). By contrast, increase in a very light root-rot stand was from 1031 to 1208 cu. m/ha.

Because a substantial number of trees was removed by the treatment, especially at the high inoculum levels, volumes of treated stands fell below those of untreated until later in the rotation. Thus no gain would result from treatment if stands were harvested at less than about 70 years. In fact, at 2000 stems/ha treated at 40 yr, volume at rotation age was still lower than that of the untreated stand.

CONCLUSION

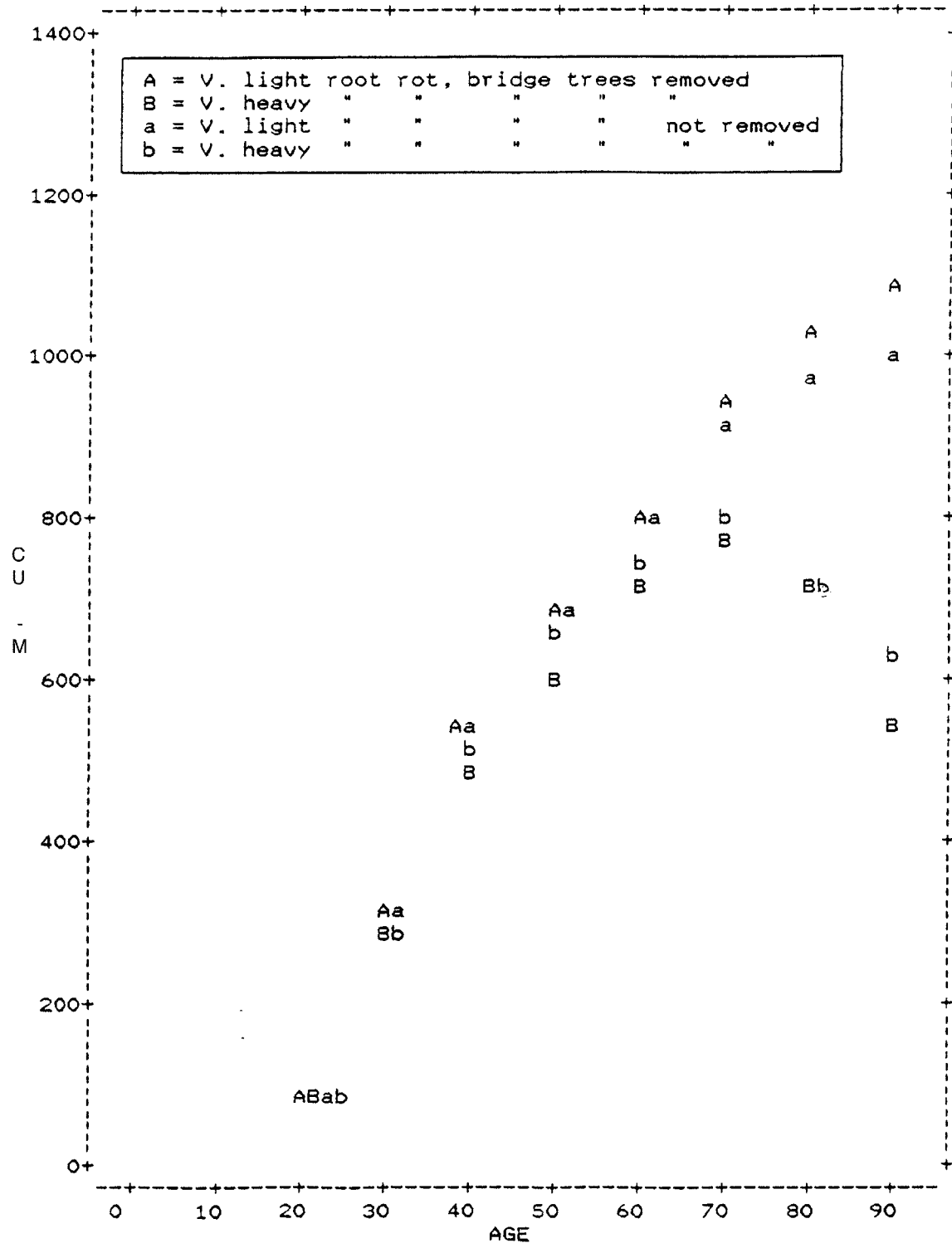
Although there are no experimental data on bridge-tree removal, there is an analagous natural process of removal of trees adjacent to infection centers through non-root-rot mortality. In other words, nature incidentally removes bridge trees. Bloomberg found that in three plantations, spread of *Phellinus* was slowed when it encountered such dead trees (W.J. Bloomberg, Effect of stand conditions On advance of *Phellinus* weirii in Douglas-fir plantations. *Phytopathology* 80:553—559, 1990).

The simulation results from TASS-ROTSIM bear out the relationships that should logically be found in the effect of bridge-tree removal on spread of *Phellinus*.

EFFECT OF BRIDGE-TREE REMOVAL ON VOL OF D. FIR WITH ROOT

Initial Stocking 2000 sph, Site Index 35

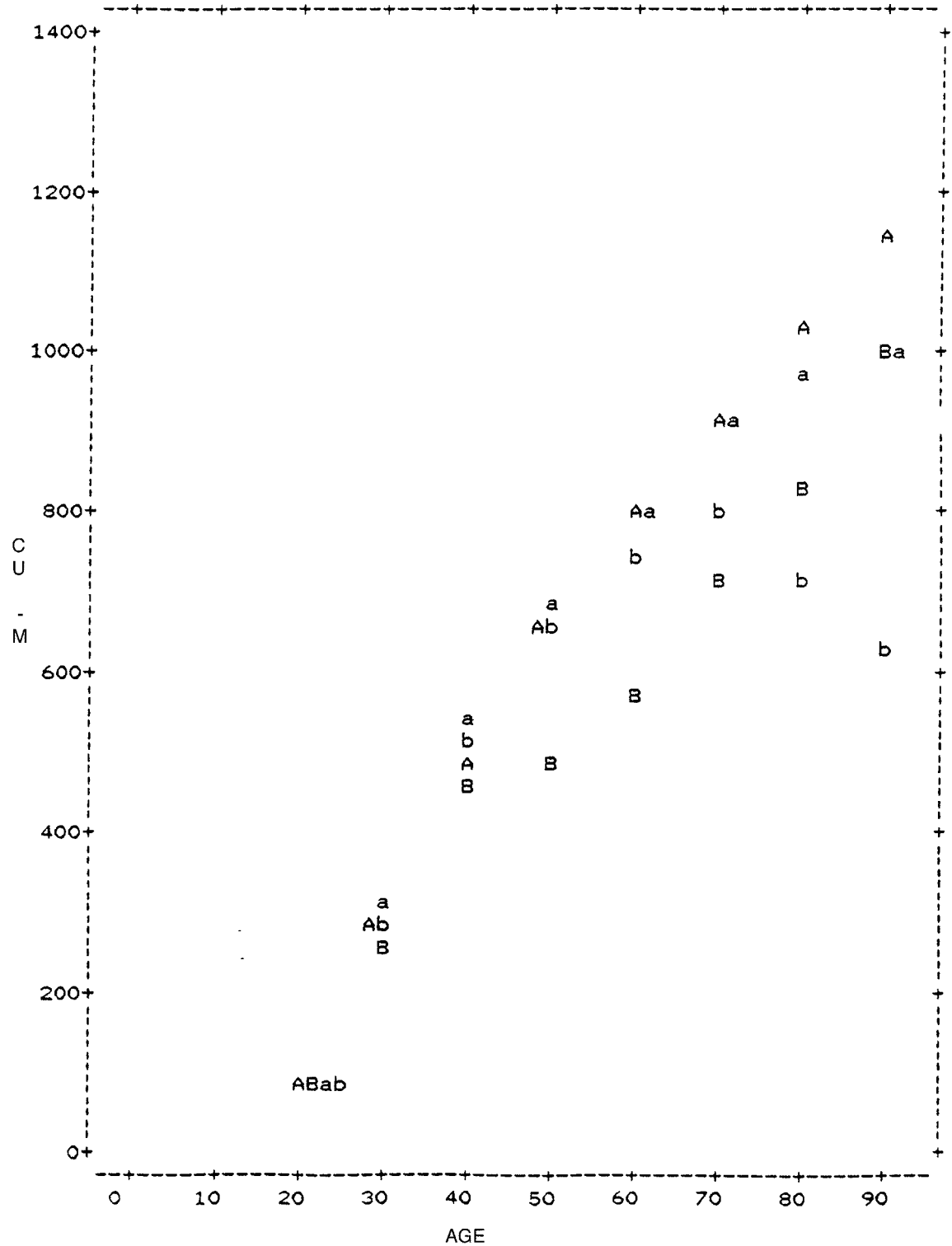
Single Bridge Trees Removed at Age 40



EFFECT OF BRIDGE-TREE REMOVAL ON VOL OF D. FIR WITH ROOT

Initial Stocking 2000 sph, Site Index 35

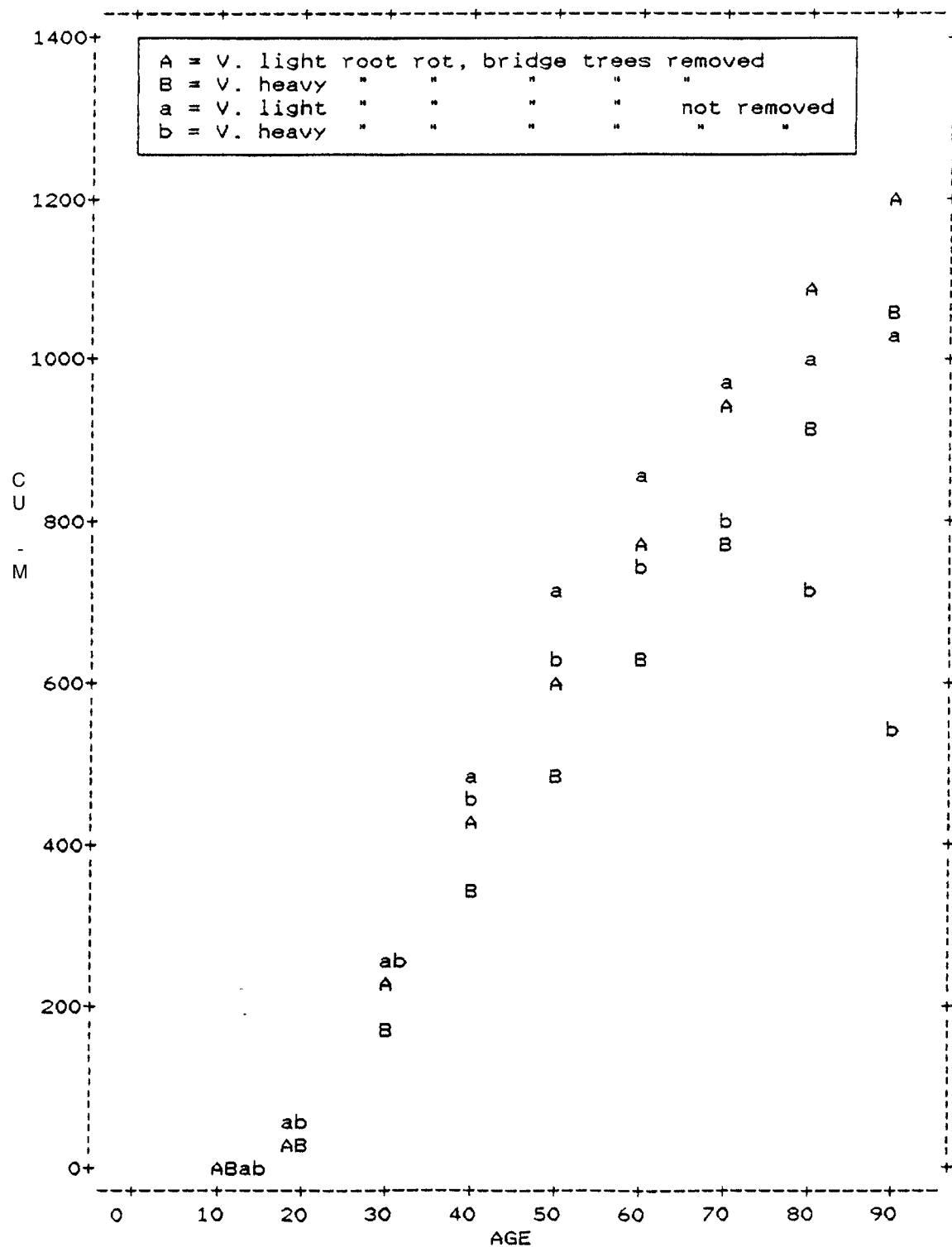
Double Bridge Trees Removed at Age 20



EFFECT OF BRIDGE-TREE REMOVAL ON VOL OF D. FIR WITH ROOT

Initial Stocking 1000 sph, Site Index 35

Single Bridge Trees Removed at Age 20



EFFECT OF BRIDGE-TREE REMOVAL ON VOL OF D. FIR WITH ROOT

Initial Stocking 1000 sph, Site Index 35

Single Bridge Trees Removed at Age 40

