

LONG-TIME EFFECTS OF DAMAGE BY RABBITS TO NEWLY PLANTED SOUTHERN PINES

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It is not uncommon for cottontail rabbits (*Sylvilagus spp.*) to bite off large numbers of newly planted southern pine seedlings within an inch or two of the ground. In normal weather and on reasonably favorable sites, many of the injured seedlings recover by sprouting, and no special action is necessary to insure an adequate stand. Because of uncertainty concerning the continued survival and growth of sprouted seedlings, however, planters in localities where damage is extensive sometimes treat their planting stock with rabbit repellents (2, 5). They do so even though the repellents not only increase costs but also may injure stock in storage or transit (1, 3).

Such precautionary treatment may be unwarranted. In a recent study in Texas, Hunt (4) found that loblolly pine seedlings clipped by rabbits not only survived nearly as well as those unclipped but also grew at about the same rate during the first 4 years after planting. The data presented here extend and corroborate Hunt's results by showing that, when recovery by sprouting has been good, the effects of first-year damage to slash, shortleaf, and loblolly seedlings may be moderate to negligible after 30 years.

Study Material

In the winters of 1924-25 and 1925-26, seedlings of slash (*Pinus elliottii* Engelm.), loblolly (*P. taeda* L.), and shortleaf (*P. echinata* Mill.) pines were planted on several soils at Bogalusa, La., at spacings ranging from 5 by 5 to 8 by 8 feet. By the time planting was completed in either winter, rabbits had bitten off considerable numbers of seedlings of each species. After one growing season in plantation, surviving seedlings were classified as damaged by rabbits or undamaged. In parts of the plantations not later used for experimental thinnings, 3,458 undamaged and 938 rabbit-damaged slash pines, 3,082 undamaged and 393 damaged loblolly pines, and 1,603 undamaged and 142 damaged shortleaf pines were available for observation of subsequent survival and growth.

Conditions and sizes of all trees were recorded individually at 5, 10, and 30 years in plantation. Measurements at ages 15 and 20, however, were limited to samples of the populations, and no trees were remeasured at age 25. Aberrations in some of the curves

illustrating this report reflect the paucity or lack of data at ages 15 through 25.

Results were analyzed separately by spacing X soil-type X winter-of-planting combinations within each species. This procedure had the effect of replicating observations, and the consistency of the patterns it revealed both within and among species adds weight to the conclusions.

Although predation ceased at or shortly after planting was completed, injuries were not tallied until the plantations were a year old. By that time most trees that had died during the first growing season had disappeared without a trace. Survivals during the rest of the rotation, therefore, had to be expressed as percents of the numbers of living trees found after 1 year. Expressing survival in this manner can have distorted the ratio of damaged to undamaged trees very little, as the numbers of rabbit-damaged trees found alive after 1 year greatly exceeded the numbers of trees dead or missing from all causes combined.

Results

In few spacing X soil-type X winter-of-planting combinations did the survival-over-age or height over-age curves for rabbit-damaged trees of any species fall grossly below the corresponding curves for undamaged trees. Several times, especially in loblolly and shortleaf pines, damaged trees excelled undamaged ones in survival, height, or both, throughout most or all of the period of study. The curves (fig. 1), showing the performance of the three species, each on a different soil, are representative.

Table I shows, separately by species, the mean survival percentages, total heights, and d.b.h. of

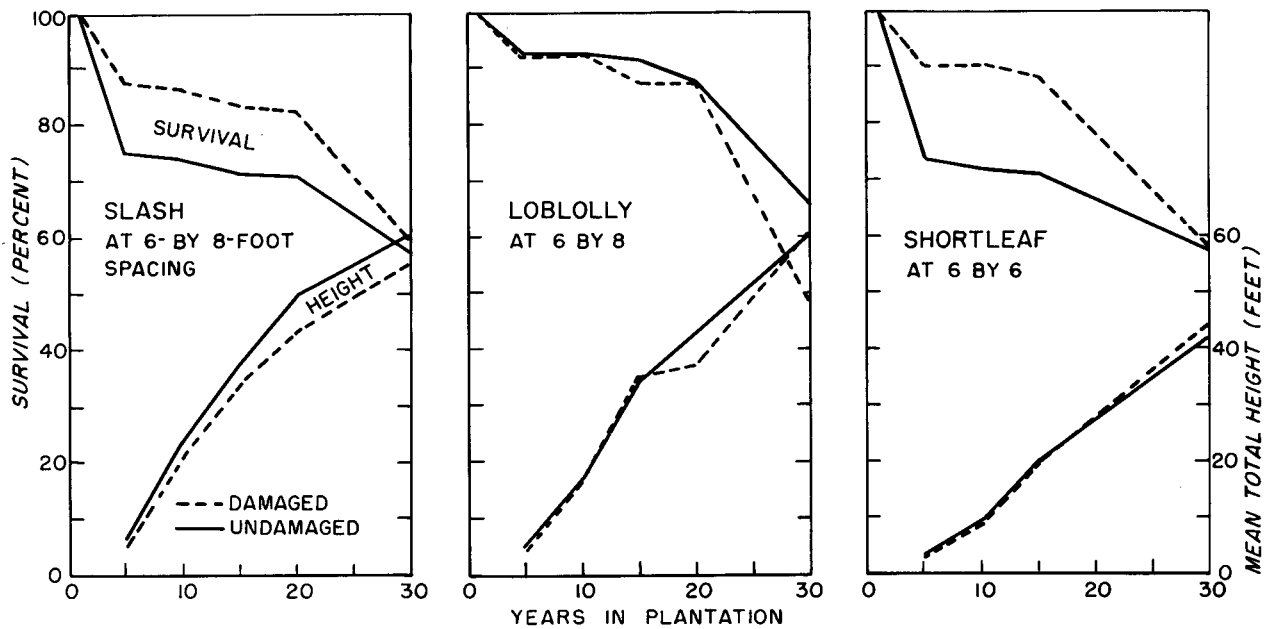


Figure 1.—Survivals from first year onward, and mean total heights from fifth year onward, of undamaged and rabbit-damaged pines in unthinned stands. Slash pine on Susquehanna very fine sandy loam, loblolly on Kalmia very fine sandy loam, shortleaf on Norfolk very fine sandy loam.

TABLE 1.—Survival and mean dimensions of undamaged and rabbit-damaged trees at age 30 years in plantation

Species ¹	Survival		Mean total height		Mean d.b.h.	
	Undamaged	Rabbit-damaged	Undamaged	Rabbit-damaged	Undamaged	Rabbit-damaged
	Percent ²	Percent ²	Feet	Feet	Inches	Inches
Slash.....	63	54	62	56	7.7	6.8
Loblolly.....	57	56	58	59	7.6	7.5
Shortleaf.....	59	64	44	45	6.9	7.2

¹ All spacings and soils and (in slash and loblolly) both winters of planting combined.

² Based on trees alive at age 1 year in plantation.

undamaged and rabbit-damaged trees after 30 years. In slash pine, adverse after-effects of damage, although appreciable, were not extreme. In loblolly and shortleaf they were negligible or absent.

Table 2 confirms the species effects evident in table 1. It shows that, in slash pine at age 30, the percentages of pulpwood and sawtimber volumes that were contributed by rabbit-damaged trees were somewhat smaller than the percentages of trees tallied as damaged at the end of the first year. In loblolly and shortleaf, by contrast, the percentages that damaged trees contributed to final vol-

umes were about equal to, or slightly larger than, the percentages of trees found damaged at age 1.

It should be noted that the variation between species in percentages of trees found damaged at age 1 probably resulted from differences in dates of planting, rather than from the effects of species. Both in 1924-25 and 1925-26 the great majority of slash pine seedlings were planted before those of other species, and hence were exposed to rabbits during a longer and more critical period.

The trees, contributing to the sawtimber volumes (table 2) included 5.2 percent of the surviving

TABLE 2.—Extent of first-year rabbit damage, and contribution of damaged trees to volume at age 30 years

Species ¹	Rabbit-damaged trees at age 1	Volume in rabbit-damaged trees at age 30	
		Pulpwood	Sawtimber
	Percent ²	Percent ³	Percent ³
Slash.....	21	15	14
Loblolly.....	11	11	12
Shortleaf.....	8	10	9

¹ All spacings and soils and (in slash and loblolly) both winters of planting combined.

² Of all trees alive at age 1 year in plantation.

³ Of total volume in undamaged plus rabbit-damaged trees.

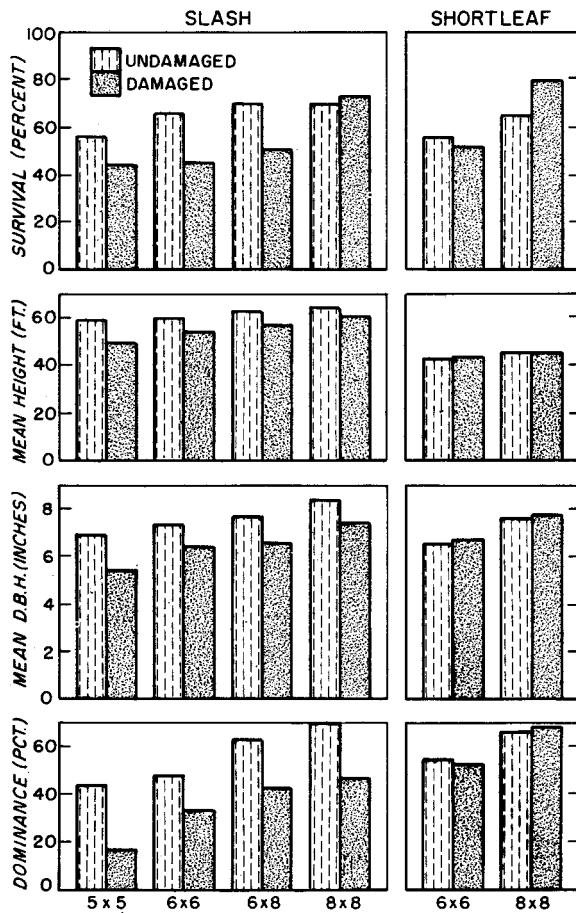


Figure 2.—Effects of plantation spacing upon survival, size, and amount of dominance of undamaged and rabbit-damaged slash and shortleaf pines at age 30 years in plantation. Survivals are computed from trees alive after 1 year.

rabbit-damaged slash pines, 9.6 percent of the damaged loblollies, and 2.2 percent of the damaged shortleaf pines. Considerably larger proportions of rabbit-damaged trees—43 percent of the slash, 54 percent of the loblolly, and 62 percent of the shortleaf—were dominant or codominant after 30 years in plantation. Clearly, therefore, first-year damage did not limit any of the three species to subordinate positions in the crown canopy.

Initial plantation spacing affected the performance of both slash and shortleaf pines. Slash had been planted at spacings of 5 by 5, 6 by 6, 6 by 8, and 8 by 8 feet, and shortleaf at 6 by 6 and 8 by 8 feet. At 30 years the survival, height, diameter, and degree of dominance of trees of these species increased with increased original distance between trees (fig. 2). In addition, the performance of rabbit-damaged trees approached that of those undamaged most closely at the wider spacings.

The results of another experiment conducted in the Bogalusa plantations throw a sidelight on the effects of rabbit damage. In the slash pine at 5- by 5-, 6- by 6-, and 8- by 8-foot spacings, blanks resulting from initial mortality had been replanted at the end of the first year, with seedlings comparable in quality to the trees originally planted (6). Records of the survival and growth of the replacement trees

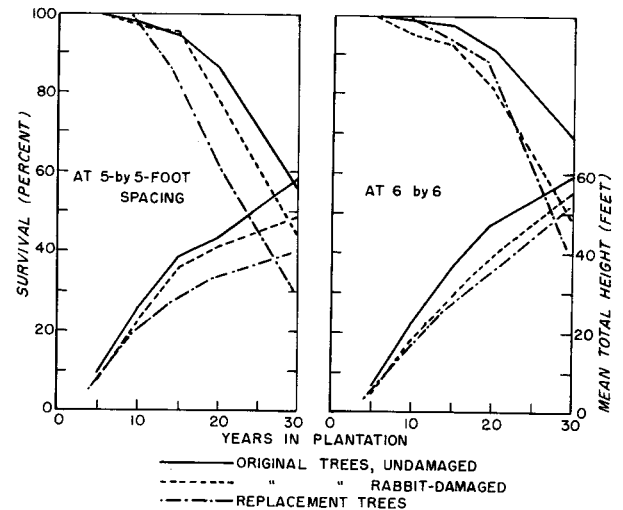


Figure 3.—Survivals and mean total heights of originally planted slash pines (both undamaged and rabbit-damaged) from fifth year onward, and of replacement trees from fourth year onward. The 5- by 5-foot spacing was on Kalmia very fine sandy loam; the 6- by 6-foot spacing was on Myatt very fine sandy loam.

Literature Cited

were kept separate from those of undamaged and rabbit-damaged original trees intermingled with them in the same plantations. The curves (fig. 3) are representative of the results observed on all soils at each of the three spacings. Under the conditions existing at Bogalusa, slash pines appeared to be harmed less when bitten off within an inch or two of the ground than when planted a year later than the main seedling stand.

The results reported here suggest that rabbit repellents need not be applied to shortleaf or loblolly or even to slash pine planting stock unless there is some positive reason (such as an adverse planting site) for expecting rabbit damage to cause considerable mortality immediately after planting.

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