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P.O. BOX 245, BERKELEY, CALIFORNIA 94701

PACIFIC SOUTHWEST
Forest and Range
Experiment Station

COPPICING TO CONVERT SMALL CULL TREES TO GROWING STOCK

Gerald A. Walters

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Abstract: Several tree species are now being planted in Hawaii to reforest areas on which firetree *(Myrica faya* Ait.*)*–a plant pest of little commercial value–has been killed. The potential of converting cull trees of five of the replacement species into growing stock trees by coppicing was evaluated. Australian toon and tropical ash showed the greatest potential for conversion; hoop-pine and Moreton-Bay-chestnut, intermediate potential; and Queensland-maple, least potential. Stump decay was not a factor with any species. And pruning paint did not affect decay or sprout behavior in any species.

Oxford: 226–176.1 *Myrica faya* (969): 176.1 *Fraxinus uhdei* [+ 176.1 *Toona australis*].
Retrieval Terms: Myrica faya; conversion; *Toona australis; Fraxinus uhdei;* treatment (silviculture); coppice regeneration.

Firetree *(Myrica faya* Ait.*)* is an aggressive plant pest in Hawaii. An earlier report[1] described a study to control it in infested areas of the Hamakua Forest Reserve, island of Hawaii, by injecting herbicides. In its place, several tree species have been planted for reforestation. All of the sawtimber species selected appeared well adapted to the site.[2] The species planted were Australian toon *(Toona australis),* tropical ash *(Fraxinus uhdei),* Queensland-maple *(Flindersia brayleyana),* hoop-pine *(Araucaria cunninghamii),* and Moreton-Bay-chestnut *(Castanospermum australe).* After about 2 years, Australian toon averaged about 12.5 feet tall, and hoop-pine, about 2 feet tall.

The firetrees, although dead, are continuing to imperil the planted trees. Two years after treatment, about 60 percent of the firetree overstory limbs and stems had fallen, damaging many of the planted trees. Some of the damaged trees had parts broken off, knocked over, or scraped. The amount of damage was generally related to size–the larger trees were more heavily damaged than the small ones:

	Average height (feet)	*Stem damaged (percent)*
Species:		
Australian toon	12.5	27
Tropical ash	10.0	36
Queensland-maple	5.5	23
Moreton-Bay-chestnut	3.5	15
Hoop-pine	2.0	0

Although none of the hoop-pine were severely damaged by falling firetrees, a number of trees were deformed, probably because of weed competition.

Few of the damaged trees will recover. Because of this loss and the number of trees affected I decided to determine the potential of converting damaged trees into growing stock trees by coppicing. I also wanted to determine the relative susceptibility of each species to stump decay, and the effect of pruning paint on decay prevention and sprouting behavior. That Aus-

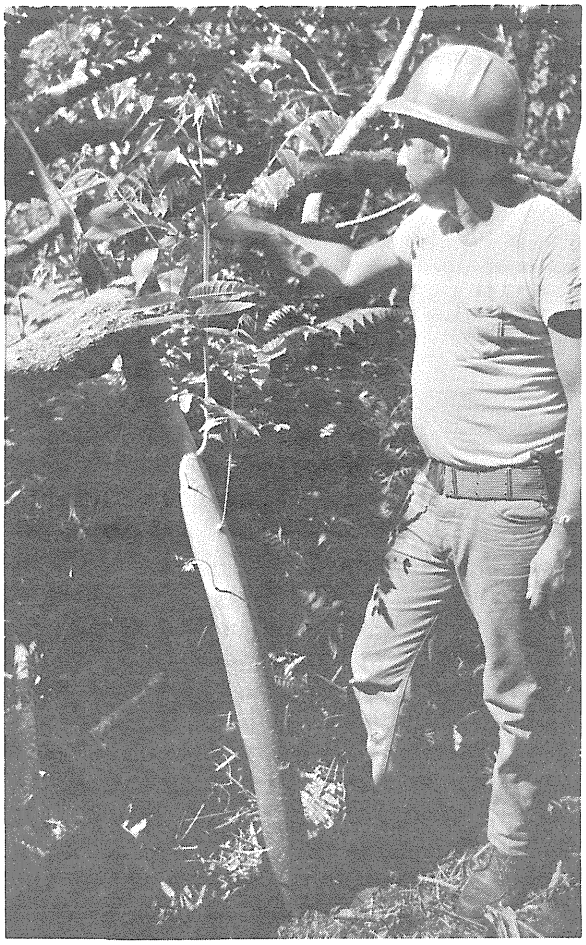

Figure 1—An Australian toon tree broken off by falling firetree branches has several sprouts.

tralian toon and tropical ash can coppice was evident from the many sprouts which developed when the stems were broken off *(fig. 1)*. Swain[3] reported that Queensland-maple coppices freely from young trees. Jolly[4] found that hoop-pine and Moreton-Bay-chestnut coppice.

Among the five species evaluated, Australian toon and tropical ash showed the greatest conversion potential on the basis of numbers of stumps with sprouts, sprout growth, and percent of vigorous and acceptable sprouts. Hoop-pine and Moreton-Bay-chestnut were intermediate in conversion potential. Queensland-maple showed the least conversion potential.

Decay was not a factor with any species—if the stump sprouted, no decay developed; if no sprouts developed, the stumps decayed. Pruning paint did not affect decay or sprouting behavior. After all but the dominant sprouts were removed, some trees of each species resprouted. And as many as three reprunings were required to stop sprouting.

METHODS

The study site is on the Hamakua Forest Reserve on the island of Hawaii, at 2,700 feet elevation. Annual rainfall averages about 80 inches. Topography is undulating, the general aspect being north with a 10 percent slope. The soil is Honokaa silty clay loam. A dense firetree stand averaging about 55 feet tall and 12.7 inches in basal diameter once occupied the area.

Twenty trees of each planted species were selected at random and cut, leaving about a 4-inch high stump. Cuts were slanted about 45° to allow water drainage. The stump surfaces of 10 trees of each species were painted with a commercial pruning paint. After sprouts developed, all but the dominant sprouts were removed. Sprout wounds on the painted stumps were also painted with pruning paint. Resprouts were also pruned, and the wounds painted, if required. Observations were recorded over a 24-month period.

Figure 2—The tropical ash trees on either side of the man are 2-year-old sprouts. Other trees are 4 years old. The poorly formed trees in the background have been damaged by falling firetree branches and stems.

RESULTS AND DISCUSSION

All stumps that developed sprouts did so within 2 months of the initial cutting treatment. Some stumps remained sproutless, but alive for 4 months. The first signs of decay were observed 6 months after the stems were cut, and these signs were only on sproutless stumps. If the stumps supported at least one sprout, no decay appeared. Painting the cut surfaces with pruning paint did not affect the occurrence of decay. If no sprouts developed, the stumps died and decayed regardless of treatment with pruning paint.

Treating cut surfaces with pruning paint did not affect sprout development for any species *(table 1)*. About the same percent of sprouts developed on both painted and unpainted stumps. The growth, vigor, form, and development of resprouts were similar for painted and unpainted stumps of all the species studied.

Australian Toon and Tropical Ash

Two months after cutting, all tropical ash and 95 percent of the Australian toon stumps supported vigorous sprouts. Each species averaged five sprouts per stump. Little natural pruning occurred during the first 6 months, so all but one dominant sprout per stump were cut. Resprouts, which grew on stumps of both species, were also pruned until no further resprouting occurred. Only about 15 percent of the Australian toon stumps resprouted; these were pruned and no further sprouting occurred. Tropical ash sprouts developed after each of several prunings over an 18 month period, but the number of prunings needed varied. It took one repruning for 35 percent of the stumps, two reprunings for 35 percent of the stumps, and three reprunings for 5 percent of the stumps. Only 25 percent of the tropical ash stumps failed to resprout.

After 2 years, the percent of stumps with sprouts remained unchanged *(table 1)*. Australian toon sprouts averaged 15.5 feet tall, and the tropical ash sprouts averaged 18 feet tall *(fig. 2)*. More than 90 percent of the sprouts of both species had high vigor, but only about 66 percent of the sprouts had good form. The percent of sprouts with good form of both species would have been much higher, but for damage caused by falling firetree branches and stems.

Within 2 years, the sprouts of both species had grown enough so that they blended in with the undamaged 4-year-old trees. Undamaged Australian toon trees averaged 34 feet tall. Although on the average they were shorter, the taller sprouts and the shorter undamaged trees overlapped in height. The undamaged tropical ash trees averaged 22 feet tall, just 4.5 feet more than the average height of the sprouts. Generally, it is not possible to identify a sprout from an original stem *(fig. 2)*, until the base of a tree is examined.

Hoop-Pine and Moreton-Bay-Chestnut

Coppicing shows limited promise for converting damaged hoop-pine and Moreton-Bay-chestnut trees to growing stock trees. By 2 months, sprouts had developed on 85 percent of the hoop-pine and 60 percent of the Moreton-Bay-chestnut stumps. By 6 months, the percent of stumps with sprouts increased to 95 for hoop-pine and 80 for Moreton-Bay-chestnut. Each species averaged about four sprouts per stump. Little natural pruning had occurred, so all but one dominant sprout per stump were pruned. Resprouting occurred on only 5 percent of the hoop-pine stumps, but on 25 percent of the Moreton-Bay-chestnut stumps. After these sprouts were pruned, neither species resprouted.

By 2 years, stumps with sprouts decreased to 75 percent for hoop-pine and to 60 percent for Moreton-

Table 1—*Development of coppice sprouts on fire tree species 24 months after original stems were cut, Hamakua Forest Reserve, Hawaii*

Species	Stumps with sprouts	Height		Diameter breast height		High vigor	Good form
		Average	Range	Average	Range		
	Percent	*Feet*		*Inches*		*Percent*	
Australian toon	95	15.5	2 to 24	1.9	0.6 to 2.6	90	68
Tropical ash	100	18.0	11 to 26	1.6	1.3 to 2.2	95	65
Hoop-pine	75	2.0	1 to 4	–	–	100	100
Moreton-Bay-chestnut	50	2.5	1 to 4	–	–	75	75
Queensland-maple	15	6.5	4 to 9	.7	.7 to .7	100	100

Bay-chestnut *(table 1)*. About one-half of the decrease for both species was caused by falling firetree branches and stems. Sprouts of both species averaged only about 2 feet tall. All the sprouts of hoop-pine and 75 percent of the Moreton-Bay-chestnut were vigorous and had good form. Damage from falling firetree branches and stems were responsible for the low vigor and poor form of the Moreton-Bay-chestnut sprouts.

After 2 years, it does not appear that the sprouts of hoop-pine or Moreton-Bay-chestnut will ever become a part of their respective stands. The sprout of both species remain shorter than the weeds, while the undamaged trees are well above the weeds and vigorous. Undamaged hoop-pine trees averaged 8 feet tall and Moreton-Bay-chestnut trees 13.5 feet tall, after three growing seasons.

Queensland-Maple

Queensland-maple shows the poorest sprouting capability. After 2 months, sprouts had developed on only 55 percent of the stumps, and they averaged three sprouts. After 6 months, the percent of the stumps with sprouts dropped to 20 percent. I found no visible cause of the sprout mortality. Little natural pruning occurred on the stumps with sprouts, so all but the dominant sprouts were removed. Of the stumps pruned, resprouting occurred on 66 percent. After they were repruned, no further resprouting occurred.

By 2 years, the percent of stumps with sprouts decreased to 15 percent *(table 1)*. Sprouts averaged 7 feet tall. Vigor and form were good for all sprouts.

The sprouts are growing well, but they average less than one-third the height of undamaged trees. Undamaged trees averaged 22 feet tall after four growing seasons. The sprouts have not yet become an integral part of the stand.

NOTES

[1] Walters, Gerald A., and William S. Null. *Controlling firetree in Hawaii by injection of Tordon 22K.* U.S. Forest Serv. Res. Note PSW-217, Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif. 3 p., illus. 1970.

[2] Walters, Gerald A. *Selecting timber species to replace killed firetree in Hawaii.* U.S. Forest Serv. Res. Note PSW-211, Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif. 4 p., illus. 1970.

[3] Swain, E. F. H. *A silvicultural note on maple-silkwood (Flindersia brayleyana).* Queensland Forest Serv. Bull. 8, 18 p. 1928.

[4] Jolly, N. W. *Silvicultural notes on forest trees of Queensland.* Forestry Bull. 6, Part 1, 27 p. 1917.

The Author

GERALD A. WALTERS is assigned to timber and watershed resource development studies at the Station's Institute of Pacific Islands Forestry, Honolulu, Hawaii. He received B.S. (1965) and M.S. (1967) degrees in forestry from the University of Missouri.

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