AN INVENTORY OF NON-NATIVE TIMBER RESOURCES IN MOLOKAI FOREST RESERVE

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Executive summary:

In 1999 a comprehensive inventory of non-native timber resources was conducted on 2000 acres within, and 100 acres adjacent to the Molokai Forest Reserve (MFR) on the island of Molokai. Primary survey objectives included producing accurate forest type maps, determining forest composition and structure, and providing timber volume estimates by species for non-native timber stands.

The project area was mapped using remote imagery analysis followed by ground truthing, revealing 138 timber stands in 31 forest types. Four organizations manage timber plantations within these areas: The Division of Forestry and Wildlife – 1,314 acres; Molokai Ranch - 599 acres; The Nature Conservancy of Hawaii - 183 acres; and The Department of Hawaiian Home Lands - 35 acres. Forest sampling was conducted on a grid of fixed radius plots over the entire landscape. Grid points were systematically sampled every 20 acres. Supplemental plots were added where important forest cover types were inadequately sampled at the initial survey intensity.

The sum of volume in all forest types exceeded 6,900,000 net cubic feet, or approximately 34,500,000 net board feet assuming a conversion factor of five board feet per cubic foot. Timber plantations within the study area were dominated by *Eucalyptus robusta*, *E. saligna*, and by the Southern pine species *Pinus elliottii,* and *P. taeda.* These species appeared to be only poorly or moderately suited to the growing conditions found in MFR, with mean annual increment (MAI) values typically ranging between 40-100 gross ft^3 $acre^{-1}$ $year^{-1}$. However, this MAI range is probably an underestimate of true growth potential because a majority of the surveyed timber resources were either over mature, or were not actively managed after planting. Some stands located on relatively high rainfall sites within the study area had MAI rates of 160 gross ft^3 $acre^{-1}$ $year^{-1}$ or higher.

The survey intensity and resulting volume analyses of this study were designed to provide guidelines for long-term forest management, and were not intended to be the basis for conducting timber sales.

Introduction:

From January to March 1999, The Hawaii Forestry and Communities Initiative (HFCI) timber survey crew conducted an inventory of non-native timber resources on Molokai. The primary objectives of the inventory were to:

1. Produce accurate forest type maps.
2. Determine forest composition and structure.
3. Provide net wood volume estimates by species.

A majority (1,913 acres) of the surveyed timber resources were located on lands owned or managed by the Division of Forestry and Wildlife (DOFAW) within Molokai Forest Reserve (MFR). The former included 599 acres of plantations on Molokai Ranch (MR) lands that are currently managed by DOFAW under a Surrender Agreement (Hawaii Revised Statues §183-15) through July 3rd, 2001. An additional 183 acres of plantations occurred within the Kamakou Preserve of The Nature Conservancy of Hawaii (TNCH). Approximately 35 acres of plantations extended outside of the lower elevation boundary of MFR, into lands managed by the Department of Hawaiian Home Lands (DHHL). Most non-native timber plantations within the study area were located adjacent to the main MFR access road, and on nearby ridge tops.

The first comprehensive inventory of plantation timber on Molokai reported merchantable wood volume of approximately 3,000,000 cubic feet (Wong et al., 1968). A second survey of plantations that were established after 1960, or had tree diameters ranging from 5-11" in the 1968 report, assessed smaller trees as a biomass resource (Division of Forestry, 1979). The latter survey revealed more than 1,100,000 gross cubic feet of plantation timber volume on Molokai in what were then relatively young timber stands.

Non-native timber stands in the study area were located primarily on ridge tops having an east-west orientation, within an elevation range of 1500-3700 feet. Average annual rainfall on these ridge tops ranged from approximately 35-100 inches, with rainfall positively correlated to elevation. A majority of soils in the study area were ash-derived silty clay loams from the Naiwa Series, or basalt-derived silty clays from the Kahanui and Olelo Series (Soil Conservation Service, 1972). These soils were classified as moderately well- to well-drained. The structure of vegetation communities adjacent to timber plantations in the Molokai study area approximated Lowland Mesic Shrublands and Lowland Mesic Forests (Wagner et al., 1990).

Survey methodology:

Historical survey maps, satellite imagery and aerial photographs were used to develop initial timber stand boundaries. During field inventory work, the survey crew verified and updated these boundaries while concurrently assigning forest types to each stand based on primary timber species, age, and stand composition.

A survey plot grid was created for the island of Molokai with one point for every five acres. Grid points were systematically sampled every 20 acres. In smaller, commercially important forest types that had inadequate plot representation using the standard grid system, additional grid points were randomly selected and sampled to increase the precision of volume estimates. Circular sample plots were 0.10 acres in size, with a fixed radius of 37.24 feet. All tree species larger than 5.5" diameter at breast height (DBH) were measured as "main plot" trees. Each plot tree was numbered and measured for DBH. Total height and defect assessments were recorded for every fifth tree of each species measured on the plot. Defects were visually estimated and recorded as a percentage deduction of wood volume for the bottom-, middle-, and top-third of the tree. Regeneration data were recorded by tallying all tree stems in a DBH range of 1.6-5.5"

within a nested 0.05 acre (26.33 feet in radius) "sub-plot." The field crew tied yellow or orange flagging at 100-foot intervals along all plot access lines.

Three primary overstory, understory, and groundcover species on or near each plot point were recorded in order of decreasing abundance. These data were based on qualitative visual assessments, and did not represent actual stem counts. Other descriptive data collection included slope, aspect, and weather conditions.

Survey data were analyzed using Forestry Projection System software version 5.3a (Forest Biometrics, 1998). Gross wood volume calculations represented volume from tree base to tree tip. Merchantable wood volume calculations were based on 16 foot log sections, a minimum top diameter of four inches, a stump height of one foot, and a minimum DBH of eight inches. Net wood volume calculations were based on merchantable wood volume minus deductions due to tree defects. Defect percentages were calculated using the formula:

Defect (%) = (V_m-V_n / V_m), where V_m = merchantable volume, and V_n = net volume.

Once the initial survey was completed, all stand acreage and plot data were post-stratified by forest type. Acreage from some unique or very small stands that had not been sampled was assigned to the forest type that best approximated their stand structure. Volume calculations were based on data from all cruised stands within each forest type. These data were subsequently used to predict volume in non-cruised stands of the same type. All tree species tallied during the survey were included in volume analyses, though some may currently be considered non-merchantable (Appendix A).

Only one local taper profile was available for volume analyses of species encountered during this survey, necessitating the use of taper profiles from alternate species and regions (Appendix B).

Survey results:

The 1999 timber plantation map contained 138 timber stands totaling 2,112 acres, excluding clearings (Figure 1). Total wood volume estimates from the 1999 Molokai survey exceeded 6,900,000 net cubic feet, with 40% as *Eucalyptus robusta* and 42% as Southern pines (Table 1). All mapped stands were stratified into 31 unique forest types based on dominant overstory tree species, age and stand structure. Some of these forest types were not measured due to their minor occurrence including Norfolk Island pine, (*Araucaria excelsa*), ironwood (*Casuarina equisetifolia*), silk oak (*Grevillia robusta*), brushbox (*Lophostemon confertus*), and Monterey pine (*Pinus radiata*).

Type-level volume summaries by land managing organization exceeded: 4,600,000 net cubic feet on DOFAW lands (Table 2a); 1,500,000 net cubic feet on MR lands (Table 2b); 500,000 net cubic feet on TNCH lands (Table 2c); and 100,000 net cubic feet on DHHL (Table 2d). Additional detail for type-level volume data are presented in Appendix C.

Figure 1. Non-native timber resources represented by primary overstory species within the Molokai study area.

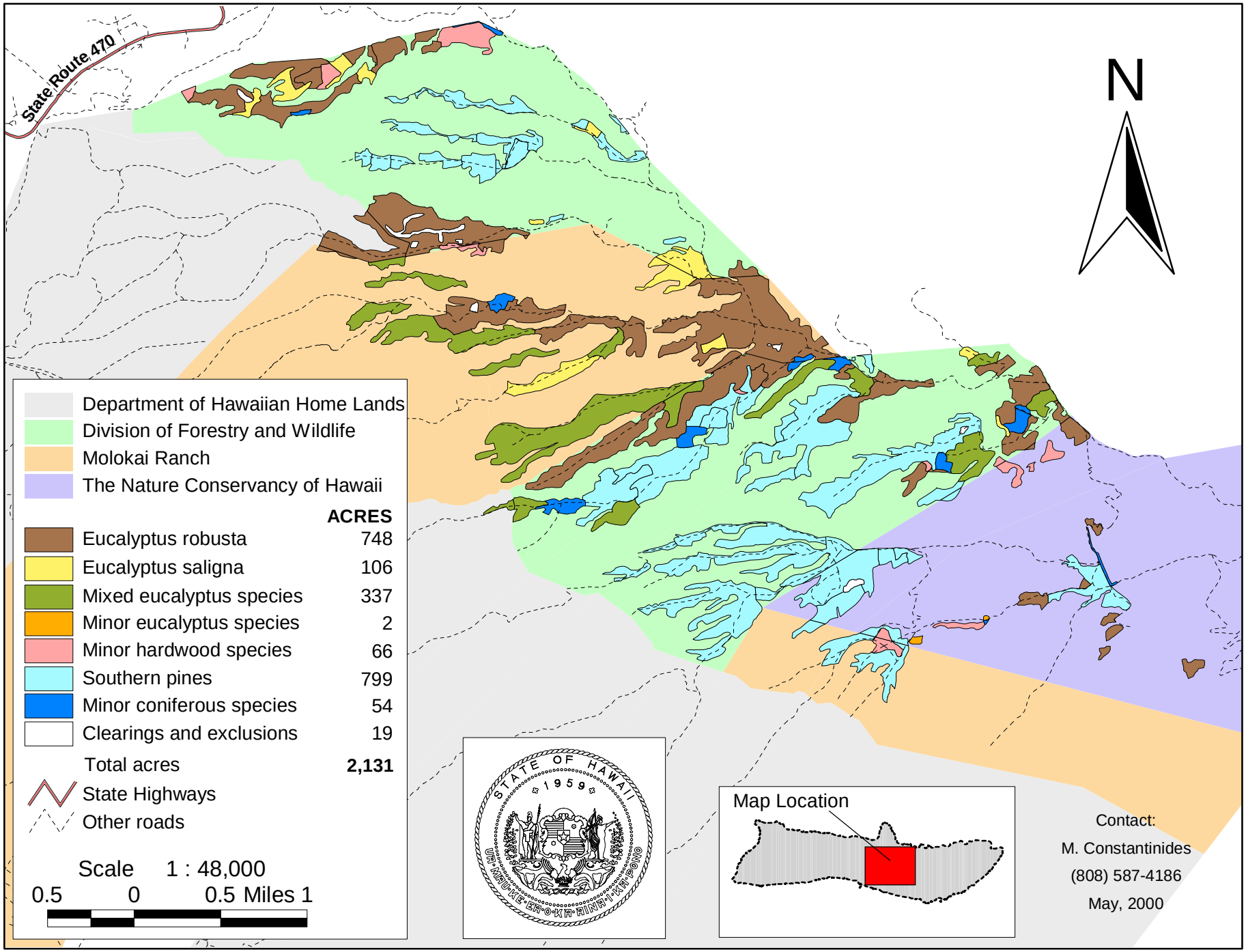

Table 1. Net volume summary for Molokai timber resources by primary species. Values in parentheses represent nearest whole percentages of area and net volume totals.

Species	Total Acres		Total net volume (ft^3)	
Cryptomeria japonica	9	(0)	57,038	(1)
Cupressus macrocarpa	25	(1)	100,399	(1)
Eucalyptus crebra	2	(0)	649	(0)
Eucalyptus robusta	748	(35)	2,790,643	(40)
Eucalyptus saligna	106	(5)	340,064	(5)
Mixed Eucalyptus	337	(16)	465,298	(7)
Fraxinus uhdei	28	(1)	33,296	(0)
Melaleuca quinquenervia	32	(2)	121,898	(2)
Pinus elliottii	346	(16)	1,554,036	(23)
Pinus taeda	39	(2)	140,411	(2)
Mixed pines	414	(19)	1,300,436	(19)
Araucaria excelsa	1	(0)	NA	(0)
Casuarina equisetifolia	5	(0)	NA	(0)
Grevillia robusta	1	(0)	NA	(0)
Lophostemon confertus	0	(0)	NA	(0)
Pinus radiata	19	(1)	NA	(0)
Clearings and exclusions	19	(1)	NA	(0)
Total	2,131		6,904,168	

Approximately 87% of net wood volume occurred on 66% of the surveyed acreage (forest type codes of “33” or higher). These stands contained a high proportion of total volume due to relatively high tree stocking and large tree size. The remaining 13% of net wood volume occurred on 34% of the surveyed acreage (forest type codes of “22” or lower). The latter forest types included stands that had poor survival or growth, were poorly stocked, or were recently planted. If the entire inventory of surveyed trees were harvested at once and cut into sixteen foot logs, wood volume in log diameter classes of 4-8”, 8-12”, and 12+” would equal 1,909,805, 2,252,797, and 2,741,565 net cubic feet, respectively (28%, 32%, and 40% of the total net volume, respectively).

Volume results expressed in units of mean cubic feet per acre were derived from statistical sampling, and are therefore estimates. Standard error (SE) analyses provide one tool for assessing the strength of the field survey data. Because sampling intensity was typically proportional to area, volume analyses for larger forest types were based on a larger number of sample plots. In the sampled forest types, standard error values rarely exceeded 20 percent of the mean (Table 3). Confidence intervals associated with standard error estimates represented the range of net volume per acre that is 80% likely to contain the true mean volume per acre for each

Table 2a. Descriptive statistics for cover types on **Division of Forestry and Wildlife** lands. Stocking and DBH data represent all tree species with a minimum DBH of 2 inches. Maximum DBH data represent planted, non-native trees only.

Species & Cover Type Description		Net Acres	Age in Years	Trees per acre	DBH Range	Mean DBH	-- Mean ft^3 ac^{-1} -- Gross	Net	Total net volume (ft^3) by log minimum diameter class 4-8"	8-12"	> 12"	Row Sub-Totals
Cryptomeria japonica												
CJ22	Low to moderate volume saw timber	3		399	2-47	12.7	7,067	6,074	3,261	2,292	13,840	19,393
Sub-Total CJ:		**3**							**3,261**	**2,292**	**13,840**	**19,393**
Cupressus macrocarpa												
CM22	Low to moderate volume saw timber	2		259	2-23	10.7	2,296	1,413	1,531	1,412	241	**3,184**
CM44	Moderate to high volume pole and saw timber	9		100	8-32	17.9	4,047	3,041	7,399	6,599	13,818	**27,817**
CM55	Moderate volume saw timber	9		178	2-55	20.3	10,282	6,021	6,067	8,127	41,680	**55,874**
Sub-Total CM:		**20**							**14,997**	**16,138**	**55,739**	**86,875**
Eucalyptus robusta												
ER22	Low to moderate volume saw timber	82		391	2-24	7.1	1,650	901	41,356	19,378	12,308	**73,041**
ER44	Moderate to high volume pole and saw timber	70		311	2-50	12.4	5,238	3,676	48,456	76,241	132,092	**256,788**
ER55	Moderate volume saw timber	265		301	2-64	14.0	6,764	4,235	178,737	278,444	662,733	**1,119,914**
Sub-Total ER:		**417**							**268,549**	**374,063**	**807,132**	**1,449,743**
Eucalyptus saligna												
ES22	Low to moderate volume saw timber	24	37	300	2-30	8.6	2,123	1,163	8,888	8,859	10,487	**28,233**
ES44	Moderate to high volume pole and saw timber	6		460	2-31	8.7	5,288	3,910	2,542	5,861	16,531	**24,934**
ES55	Moderate volume saw timber	29		346	2-33	12.2	9,495	7,449	24,007	45,350	148,228	**217,585**
Sub-Total ES:		**59**							**35,437**	**60,070**	**175,246**	**270,752**
Mixed Eucalyptus												
EX22	Low to moderate volume saw timber	71		303	2-39	8.4	1,885	1,166	27,359	20,263	33,598	**81,220**
EX55	Moderate volume saw timber	38		316	2-39	9.0	2,799	2,231	18,521	27,553	38,030	**84,104**
Sub-Total EX:		**109**							**45,879**	**47,816**	**71,628**	**165,323**
Melaleuca quinquenervia												
MQ22	Low to moderate volume saw timber	32		230	6-32	17.3	5,418	3,812	30,245	49,544	42,109	**121,898**
Sub-Total MQ:		**32**							**30,245**	**49,544**	**42,109**	**121,898**
Pinus elliottii												
PE33	Moderate volume pole and saw timber	139	28-38	232	2-17	10.4	3,406	2,974	227,813	175,131	11,757	**414,701**
PE44	Moderate to high volume pole and saw timber	136	28-37	352	2-26	11.4	7,422	6,396	318,718	342,747	206,562	**868,027**
PE55	Moderate volume saw timber	17	37	325	2-26	11.6	7,021	6,123	28,842	40,383	36,907	**106,133**
Sub-Total PE:		**292**							**575,374**	**558,261**	**255,227**	**1,388,861**

Table 2a. Descriptive statistics for cover types on **Division of Forestry and Wildlife** lands (Continued).

Species & Cover Type Description		Net Acres	Age in Years	Trees per acre	DBH Range	Mean DBH	-- Mean ft³ ac⁻¹-- Gross	Net	Total net volume (ft³) by log minimum diameter class 4-8"	8-12"	> 12"	Row Sub-Totals
Pinus radiata												
PR00	Regeneration / low volume poles	11	50	974	2-7	3.1	420	0	0	0	0	**0**
Sub-Total PR:		**11**							**0**	**0**	**0**	**0**
Pinus taeda												
PT44	Moderate to high volume pole and saw timber	34	28-30	402	2-19	9.8	4,924	4,115	78,264	55,729	6,418	**140,411**
Sub-Total PT:		**34**							**78,264**	**55,729**	**6,418**	**140,411**
Mixed pines												
PX22	Low to moderate volume saw timber	135	35-46	292	2-15	6.7	1,487	936	87,142	40,246	0	**127,388**
PX33	Moderate volume pole and saw timber	52	44	429	2-34	6.9	2,654	1,043	25,666	9,757	18,393	**53,816**
PX55	Moderate volume saw timber	34	49	183	2-23	11.8	4,093	3,628	25,118	42,358	55,130	**122,606**
PX66	Moderate to high volume saw timber	85	37	256	2-27	14.5	9,402	7,977	170,767	323,763	189,948	**684,479**
Sub-Total PX:		**306**							**308,693**	**416,124**	**263,471**	**988,289**

Other non-surveyed types

AE55	*Araucaria excelsa*	1
CE22	*Casuarina equisetifolia*	2
FU22	*Fraxinus uhdei*	1
GR22	*Grivillia robusta*	1
PR22	*Pinus radiata*	8
PT00	*Pinus taeda*	5
XX00	Clearings and exclusions	13
Sub-total		**31**

Total acreage: **1,314**

Net volume summary for surveyed cover types:
Cubic foot totals by log diameter and timber type class.

Type Class	Acres	----Log minimum diameter---- 4-8"	8-12"	> 12"	Total
00	11	0	0	0	0
22	349	199,782	141,992	112,582	**454,356**
33	191	253,479	184,888	30,150	**468,517**
44	255	455,378	487,178	375,421	**1,317,977**
55	392	281,292	442,215	982,708	**1,706,215**
66	85	170,767	323,763	189,948	**684,479**
Total	**1,283**	**1,360,699**	**1,580,035**	**1,690,809**	**4,631,544**

Table 2b. Descriptive statistics for cover types on **Molokai Ranch** lands. Stocking and DBH data represent all tree species with a minimum DBH of 2 inches. Maximum DBH data represent planted, non-native trees only.

Species & Cover Type Description		Net Acres	Age in Years	Trees per acre	DBH Range	Mean DBH	-- Mean ft^3 ac^{-1}-- Gross	Net	Total net volume (ft^3) by log minimum diameter class 4-8"	8-12"	> 12"	Row Sub-Totals
Cryptomeria japonica												
CJ22	Low to moderate volume saw timber	6		399	2-47	12.7	7,067	6,074	6,331	4,448	26,865	**37,644**
Sub-Total CJ:		**6**							**6,331**	**4,448**	**26,865**	**37,644**
Cupressus macrocarpa												
CM44	Moderate to high volume pole and saw timber	2		100	8-32	17.9	4,047	3,041	1,415	1,262	2,642	**5,318**
Sub-Total CM:		**2**							**1,415**	**1,262**	**2,642**	**5,318**
Eucalyptus robusta												
ER44	Moderate to high volume pole and saw timber	53		311	2-50	12.4	5,238	3,676	36,826	57,943	100,390	**195,159**
ER55	Moderate volume saw timber	210		301	2-64	14.0	6,764	4,235	143,691	223,847	532,785	**900,323**
Sub-Total ER:		**263**							**180,517**	**281,790**	**633,175**	**1,095,482**
Eucalyptus saligna												
ES22	Low to moderate volume saw timber	42		300	2-30	8.6	2,123	1,163	15,133	15,083	17,855	**48,072**
ES44	Moderate to high volume pole and saw timber	5		460	2-31	8.7	5,288	3,910	2,165	4,993	14,082	**21,240**
Sub-Total ES:		**47**							**17,298**	**20,076**	**31,937**	**69,312**
Mixed Eucalyptus												
EX22	Low to moderate volume saw timber	194		303	2-39	8.4	1,885	1,166	76,815	56,891	94,334	**228,040**
EX55	Moderate volume saw timber	31		316	2-39	9.0	2,799	2,231	15,153	22,544	31,115	**68,812**
Sub-Total EX:		**225**							**91,968**	**79,435**	**125,449**	**296,852**
Fraxinus uhdei												
FU11	Low volume pole and saw timber	7	44	690	2-23	7.1	4,414	3,643	4,937	9,470	9,566	**23,973**
Sub-Total FU:		**7**							**4,937**	**9,470**	**9,566**	**23,973**
Mixed pines												
PX22	Low to moderate volume saw timber	43	42	292	2-15	6.7	1,487	936	27,232	12,577	0	**39,809**
Sub-Total PX:		**43**							**27,232**	**12,577**	**0**	**39,809**

Other non-surveyed types

CE22	*Casuarina equisetifolia*	3
XX00	Clearings and exclusions	3
Sub-Total:		**6**

Total acreage: **599**

Net volume summary for surveyed cover types:
Cubic foot totals by log diameter and timber type class.

Type Class	Acres	----Log minimum diameter---- 4-8"	8-12"	> 12"	Total
11	7	4,937	9,470	9,566	**23,973**
22	285	125,511	89,000	139,054	**353,565**
44	60	40,406	64,198	117,113	**221,717**
55	241	158,844	246,391	563,900	**969,135**
Total	**593**	**329,698**	**409,058**	**829,634**	**1,568,390**

Table 2c. Descriptive statistics for cover types on **The Nature Conservancy of Hawaii** lands. Stocking and DBH data represent all tree species with a minimum DBH of 2 inches. Maximum DBH data represent planted, non-native trees only.

Species & Cover Type Description		Net Acres	Age in Years	Trees per acre	DBH Range	Mean DBH	-- Mean ft^3 ac^{-1} -- Gross	Net	Total net volume (ft^3) by log minimum diameter class 4-8"	8-12"	> 12"	Row Sub-Totals
Cupressus macrocarpa												
CM22	Low to moderate volume saw timber	0		259	2-23	10.7	2,296	1,413	209	192	33	**434**
CM44	Moderate to high volume pole and saw timber	3		100	8-32	17.9	4,047	3,041	2,067	1,844	3,861	**7,772**
Sub-Total CM:		**3**							**2,276**	**2,036**	**3,894**	**8,206**
Eucalyptus crebra												
EA22	Low to moderate volume saw timber	2		529	2-12	4.9	834	359	649	0	0	**649**
Sub-Total EA:		**2**							**649**	**0**	**0**	**649**
Eucalyptus robusta												
ER22	Low to moderate volume saw timber	9		391	2-24	7.1	1,650	901	4,595	2,153	1,368	**8,116**
ER44	Moderate to high volume pole and saw timber	17		311	2-50	12.4	5,238	3,676	11,629	18,298	31,702	**61,629**
ER55	Moderate volume saw timber	10		301	2-64	14.0	6,764	4,235	7,009	10,919	25,990	**43,918**
Sub-Total ER:		**36**							**23,234**	**31,370**	**59,059**	**113,663**
Fraxinus uhdei												
FU11	Low volume pole and saw timber	3	44	690	2-23	7.1	4,414	3,643	1,920	3,683	3,720	**9,323**
Sub-Total FU:		**3**							**1,920**	**3,683**	**3,720**	**9,323**
Pinus elliottii												
PE33	Moderate volume pole and saw timber	52	38	232	2-17	10.4	3,406	2,974	84,260	64,774	4,349	**153,383**
PE55	Moderate volume saw timber	2		325	2-26	11.6	7,021	6,123	3,205	4,487	4,101	**11,793**
Sub-Total PE:		**54**							**87,464**	**69,261**	**8,449**	**165,175**
Mixed pines												
PX22	Low to moderate volume saw timber	34		292	2-15	6.7	1,487	936	21,786	10,061	0	**31,847**
PX66	Moderate to high volume saw timber	31	37	256	2-27	14.5	9,402	7,977	59,999	113,755	66,739	**240,492**
Sub-Total PX:		**65**							**81,785**	**123,816**	**66,739**	**272,340**

Other non-surveyed types

FU22	*Fraxinus uhdei*	17
LC33	*Lophostemon confertus*	1
XX00	Clearings and exclusions	3
Sub-Total:		**21**

Total acreage: 184

Net volume summary for surveyed cover types:
Cubic foot totals by log diameter and timber type class.

Type Class	Acres	----Log minimum diameter---- 4-8"	8-12"	> 12"	Total
11	3	1,920	3,683	3,720	**9,323**
22	45	27,239	12,407	1,400	**41,046**
33	52	84,260	64,774	4,349	**153,383**
44	20	13,697	20,142	35,563	**69,401**
55	12	10,214	15,406	30,090	**55,711**
66	31	59,999	113,755	66,739	**240,492**
Total	**163**	**197,328**	**230,167**	**141,861**	**569,356**

Table 2d. Descriptive statistics for cover types on **The Department of Hawaiian Home Lands**. Stocking and DBH data represent all tree species with a minimum DBH of 2 inches. Maximum DBH data represent planted, non-native trees only.

Species & Cover Type Description		Net Acres	Age in Years	Trees per acre	DBH Range	Mean DBH	-- Mean ft^3 ac^{-1} -- Gross	Net	Total net volume (ft^3) by log minimum diameter class 4-8"	8-12"	> 12"	Row Sub-Totals
Eucalyptus robusta												
ER55	Moderate volume saw timber	32		301	2-64	14.0	6,764	4,235	21,028	32,758	77,969	**131,755**
Sub-Total ER:		**32**							**21,028**	**32,758**	**77,969**	**131,755**
Mixed eucalyptus												
EX22	Low to moderate volume saw timber	3		303	2-39	8.4	1,885	1,166	1,052	779	1,292	**3,124**
Sub-Total EX:		**3**							**1,052**	**779**	**1,292**	**3,124**

Total acres: **35**

Net volume summary for surveyed cover types:
Cubic foot totals by log diameter and timber type class.

Type Class	Acres	----Log minimum diameter---- 4-8"	8-12"	> 12"	Total
22	3	1,052	779	1,292	**3,124**
55	32	21,028	32,758	77,969	**131,755**
Total	**35**	**22,080**	**33,537**	**79,261**	**134,878**

Table 3. Inventory precision analyses for the survey of non-native timber resources in the Molokai timber survey. All volume data are presented in units of gross cubic feet.

Cover Type	DOFAW acres	MR acres	TNC acres	DHHL acres	Sample plots	Mean $ft^3\ ac^{-1}$	SE[A] $ft^3\ ac^{-1}$	Percent SE[B]	----80% CI[C]---- Low $ft^3\ ac^{-1}$	High $ft^3\ ac^{-1}$
CJ22	3	6	0	0	1	7,067	NA	NA	NA	NA
CM22	2	0	0	0	2	2,296	540	24	634	3,958
CM44	9	2	3	0	1	4,047	NA	NA	NA	NA
CM55	9	0	0	0	4	10,282	1,392	14	8,002	12,562
EA22	0	0	2	0	1	834	NA	NA	NA	NA
ER22	82	0	9	0	5	1,650	306	19	1,181	2,119
ER44	70	53	17	0	7	5,238	1,064	20	3,706	6,770
ER55	265	210	10	32	25	6,764	710	10	5,828	7,700
ES22	24	42	0	0	9	2,123	198	9	1,846	2,400
ES44	6	5	0	0	3	5,288	799	15	3,781	6,795
ES55	29	0	0	0	5	9,495	1,053	11	7,881	11,109
EX22	71	194	0	3	17	1,885	310	16	1,471	2,299
EX55	38	31	0	0	3	2,799	928	33	1,049	4,549
FU11	0	7	3	0	1	4,414	NA	NA	NA	NA
MQ22	32	0	0	0	2	5,418	48	1	5,270	5,566
PE33	139	0	52	0	8	3,406	608	18	2,546	4,266
PE44	136	0	0	0	10	7,422	776	10	6,349	8,495
PE55	17	0	2	0	4	7,021	375	5	6,407	7,635
PR00	11	0	0	0	2	420	28	7	334	506
PT44	34	0	0	0	4	4,924	470	10	4,154	5,694
PX22	135	43	34	0	9	1,487	189	13	1,223	1,751
PX33	52	0	0	0	3	2,654	670	25	1,390	3,918
PX55	34	0	0	0	6	4,093	502	12	3,352	4,834
PX66	85	0	31	0	6	9,402	1,066	11	7,829	10,975
Total	1,283	593	163	35	138					

[A]SE represents standard error of the mean.

[B]Percent SE = ((standard error / mean) * 100) within each row of data.

[C]Confidence intervals (CI) associated with standard error estimates represent the range of gross cubic foot volume per acre that is 80% likely to contain the true mean volume per acre for each cover type.

forest type. While individual stands were assigned to forest types based on the dominant overstory species, type level volume data also included components of secondary species (Table 4). Most forest types had only one or two principal species components.

Wood volume deductions were estimated for each cover type by comparing the difference between merchantable and net cubic volume data. Deductions attributed to form and visible defects ranged from approximately 5-10% for the Southern pines and 20-35% for other species (Table 5).

Non-native species comprised 100% of the primary overstory species at the sampled plots. More than 60% of the sampled plot points occurred in stands consisting of a single overstory species (Figure 2). Most plot points that did contain a secondary overstory component were either eucalyptus mixes or southern pine mixes. Ohia (*Metrosideros polymorpha*) and koa (*Acacia koa*) were the only non-planted overstory tree species observed, but were recorded as secondary overstory species on less than 1% of all sampled plots.

Relative abundance data for understory species revealed that guava (*Psidium* spp.) and *E. robusta* were common under eucalyptus stands, while southern pine was naturally seeding in the understory of pine stands (Figure 3). Sword fern (*Nephrolepis multiflora*) was the most common groundcover component under eucalyptus plantations, while molasses grass (*Melinis minutiflora*) has appeared to colonize the groundcover layer in the central study area (Figure 4). Other commonly observed understory and groundcover species included pukiawe (*Styphelia tameiameiae*), aalii (*Dodonaea viscosa*), and uluhe (*Dicranopteris linearis*).

Discussion and planning implications:

The non-native timber plantings on Molokai exhibited poor to moderate growth both within, and among species. Site adaptation and climatic conditions appeared to be the primary factors that influenced stand growth. Current within-species productivity differences can not be attributed to varying stand management or maintenance, since little has been conducted historically.

In order to compare species productivity, representative stands within the most important commercial forest types were selected for mean annual increment (MAI) analyses (Table 6). Among the non-native plantation species, MAI values commonly ranged from 40-160 $ft^3\ ac^{-1}\ yr^{-1}$. MAI values appeared to be positively correlated to elevation and rainfall. Most stands with minimum MAI values of 160 $ft^3\ ac^{-1}\ yr^{-1}$ occurred above 3000 foot elevation. Most stands with MAI values of 60 $ft^3\ ac^{-1}\ yr^{-1}$ or lower occurred below 2500 foot elevation.

The low to moderate MAI values for timber stands analyzed in this study may be misleading because many of the stands were over mature and had stagnated. Productivity of the timber species studied would probably increase significantly with intensified stand management and modified species-site selections in future rotations.

Table 4. Component net volume for sampled forest types in the Molokai timber survey.

		---- mean ft^3 ac^{-1} ----			----------Component net volume per acre by species[A] (ft^3 ac^{-1})----------												
Type	**Acres**	**Gross**	**Net**	**% Net**	**ER**	**ES**	**EZ**	**EA**	**LC**	**PE**	**PT**	**CM**	**FU**	**MQ**	**CJ**	**AE**	**OTH[B]**
ER22	90	1,650	901	55	873					29							
ER44	140	5,238	3,676	70	3,259	91	31						6			289	
ER55	519	6,764	4,235	63	3,946	33	207	18					2				29
ES22	66	2,123	1,163	55		1,157											5
ES44	12	5,288	3,910	74		3,910											
ES55	29	9,495	7,449	78	488	6,833											127
EX22	268	1,885	1,166	62	638	160	183	14		11		7	21				132
EX55	69	2,799	2,231	80	1,155	884											192
PE33	191	3,406	2,974	87						1,964	1,010						
PE44	136	7,422	6,396	86						6,177	205		14				
PE55	19	7,021	6,123	87						5,116		297				710	
PT44	34	4,924	4,115	84						1,912	2,203						
PX22	213	1,487	936	63						753	166	17					
PX33	52	2,654	1,043	39					322	476							245
PX55	34	4,093	3,628	89	48				594	2,687		113	186				
PX66	116	9,402	7,977	85						3,869	4,109						
MQ22	32	5,418	3,812	70								101		3,710			
CM22	3	2,296	1,413	62								1,334		80			
CM44	14	4,047	3,041	75	1,325							1,716					
CM55	9	10,282	6,021	59								6,021					
CJ22	9	7,067	6,074	86	4,409										1,666		
PR00	11	420	0	0													
EA22	2	834	359	43				85				274					
FU11	9	4,414	3,643	83						3,504			139				
XX00	19	NA	NA	NA													

[A]ER = *Eucalyptus robusta* ; ES = *E. saligna* ; EZ = Unknown eucalyptus; EA = *E. crebra* ; LC = *Lophostemon confertus* ; PE = *Pinus elliottii* ; PT = *Pinus taeda* ; CM = *Cupressus macrocarpa* ; FU = *Fraxinus uhdei* ; MQ = *Mellaluca quinqenervia* ; CJ = *Cryptomeria japonica* ; AE = *Araucaria excelsea* ; XX00 = Clearings and exclusions

[B]OTH = Most cover types had one genus or species dominating the "other species" component: ES55 with 127 as *Casuarina equisetifolia* ; EX22 with 127 as *Eucalyptus citriodora* , *E. microcorys* (EM), and *E. sideroxylon* ; EX55 with 178 as EM; and PX33 with 245 as EM.

Table 5. Defect analyses for forest types measured during the Molokai timber survey.

Species & Type	Description	--Mean ft^3 ac^{-1}-- Merch	Net	% Defect
Eucalyptus robusta				
ER22	Low to moderate volume saw timber	1,162	901	22
ER44	Moderate to high volume pole and saw timber	4,869	3,676	25
ER55	Moderate volume saw timber	6,380	4,235	34
Eucalyptus saligna				
ES22	Low to moderate volume saw timber	1,816	1,163	36
ES44	Moderate to high volume pole and saw timber	4,826	3,910	19
ES55	Moderate volume saw timber	9,055	7,449	18
Mixed eucalyptus				
EX22	Low to moderate volume saw timber	1,560	1,166	25
EX55	Moderate volume saw timber	2,560	2,231	13
Pinus elliottii				
PE33	Moderate volume pole and saw timber	3,083	2,974	4
PE44	Moderate to high volume pole and saw timber	6,895	6,396	7
PE55	Moderate volume saw timber	6,491	6,123	6
Pinus taeda				
PT44	Moderate to high volume pole and saw timber	4,313	4,115	5
Mixed pines				
PX22	Low to moderate volume saw timber	964	936	3
PX55	Moderate volume saw timber	3,841	3,628	6
PX66	Moderate to high volume saw timber	8,967	7,977	11
Mellaluca quinquenervia				
MQ22	Low to moderate volume saw timber	5,039	3,812	24
Cupressus macrocarpa				
CM22	Low to moderate volume saw timber	1,900	1,413	26
CM44	Moderate to high volume pole and saw timber	3,822	3,041	20
CM55	Moderate volume saw timber	9,725	6,021	38
Cryptomeria japonica				
CJ22	Low to moderate volume saw timber	6,379	6,074	5
Pinus radiata				
PR00	Regeneration / low volume poles	0	0	NA
Eucalyptus crebra				
EA22	Low to moderate volume saw timber	387	359	7
Fraxinus uhdei				
FU11	Low volume saw timber	3,681	3,643	1

Figure 2. Secondary overstory species at sample plot locations in the Molokai study area.

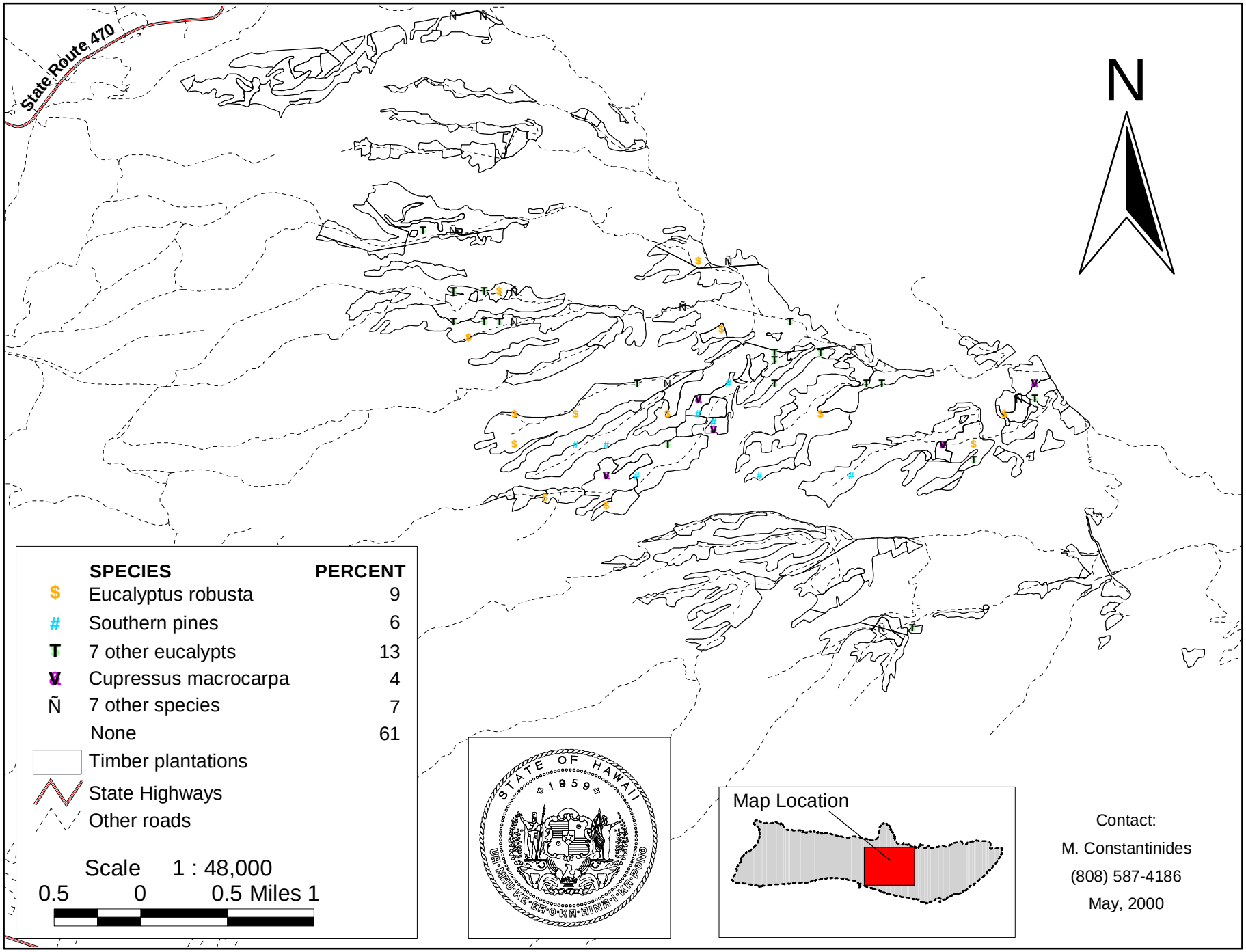

Figure 3. Primary understory species at sample plot locations in the Molokai study area.

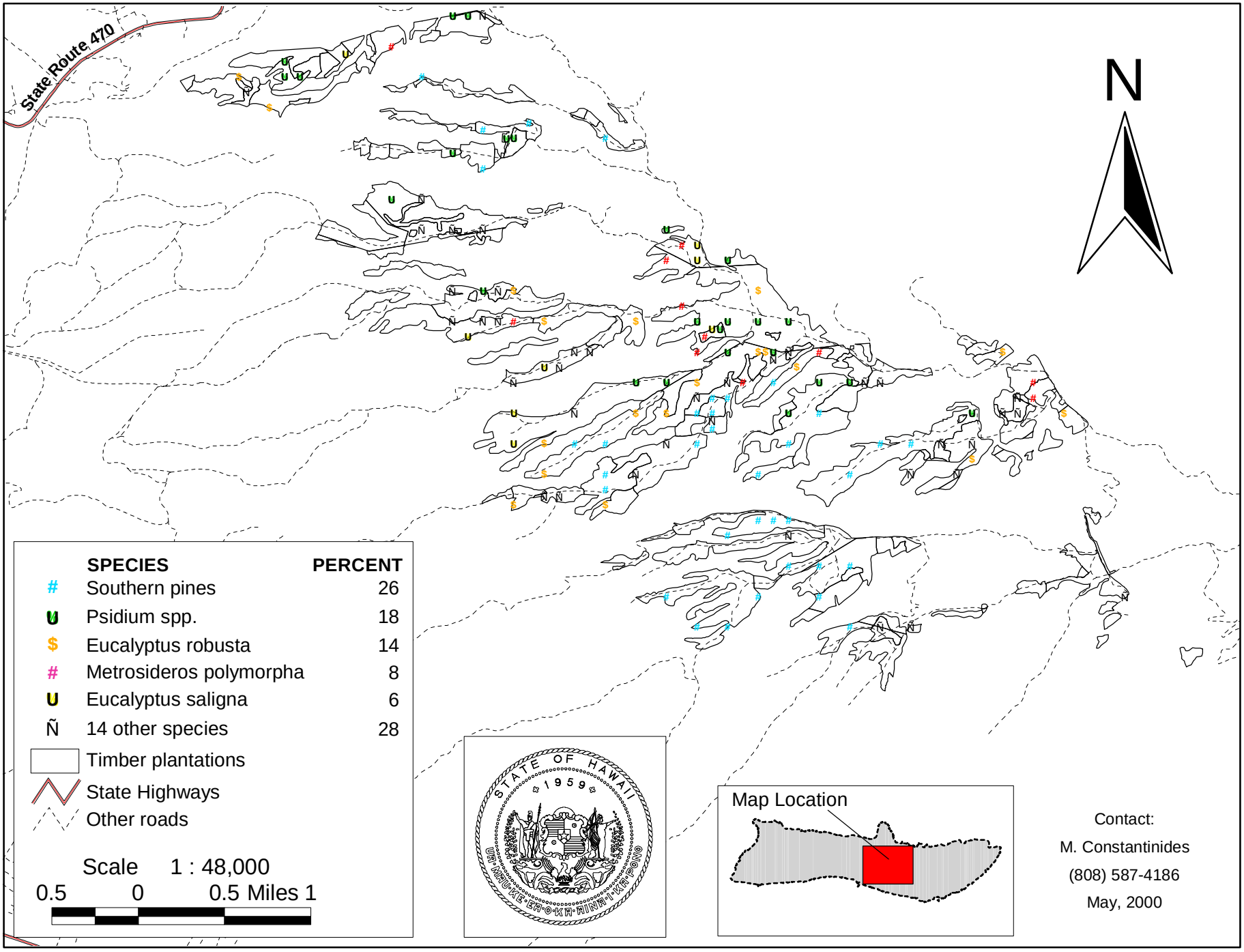

Figure 4. Primary groundcover species at sample plot locations in the Molokai study area.

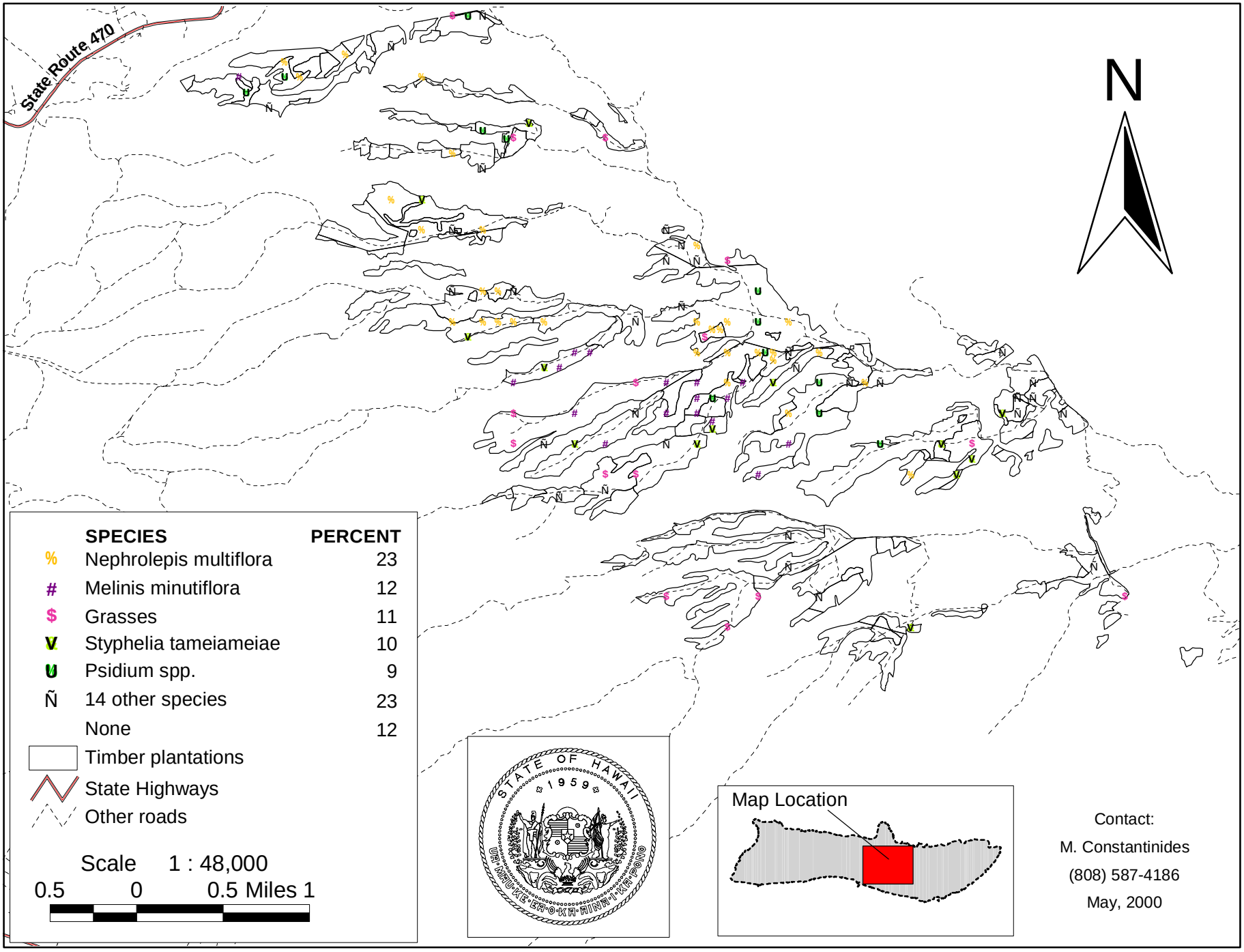

Table 6. Mean annual increment (MAI) analyses for selected stands in the Molokai timber survey based on 1999 data. Data for each forest type exclude all secondary species components, and represent trees with a minimum DBH of two inches.

Species & Type	Stand ID	Net Acres	Plots	Age (Yr)	Trees Per Acre	Maximum DBH	Mean DBH	Basal Area (ft^2)	Gross Volume ($ft^3\ ac^{-1}$)	MAI ($ft^3\ ac^{-1}\ yr^{-1}$)
Eucalyptus robusta										
ER44	1073	53	3	60	207	50	15	269	5,699	95
ER55	4078	81	5	60	192	45	16	273	6,228	104
ER55	1082	163	8	60	237	65	17	381	9,540	159
Eucalyptus saligna										
ES22	4219	21	3	37	140	19	11	101	1,746	47
ES22	1047	25	5	60	160	30	12	126	2,277	38
ES44	1044	5	3	60	110	31	17	164	5,053	84
ES55	4008	13	3	60	127	33	19	261	9,628	160
Pinus elliottii										
PE33	4263	39	4	38	120	17	11	85	2,368	62
PE44	4250	80	5	37	152	26	14	173	5,951	161
Pinus taeda										
PT44	4208	15	3	30	190	19	9	85	1,780	59
Mixed pines										
PX22	4270	76	4	37	240	13	8	75	1,663	45
PX55	4221	34	6	49	88	23	14	98	2,956	60
PX66	4253	85	4	37	267	23	13	272	9,109	246
Cupressus macrocarpa										
CM55	4098	7	3	59	162	55	22	414	10,420	177

Qualitative data collection for the relative abundance of primary and secondary species in the study areas revealed a predominance of non-native overstory trees, underlain by seedlings and saplings of the same species. The groundcover layer was dominated by invasive non-native weed species. If current commercial timber resources were harvested, control of these weed species would probably be required at some locations prior to planting and establishment of future timber plantations.

Total wood volume estimates for surveyed non-native timber resources exceeded 6,900,000 net cubic feet, or approximately 34,500,000 net board feet. Forest types coded "22" or lower could be considered to represent pre- or non-commercial timber acreage as of 1999 due to their low volume or heterogeneous composition. Well-stocked stands in these forest types could have significant commercial value in future years, while others will have salvage potential at best unless they are replaced. Forest types coded "33" or higher contained a majority of the timber resources with current commercial value, where total net volume exceeded 6,000,000 cubic feet, or approximately 30,000,000 board feet.

The study area is currently accessible via an extensive 4-wheel drive road network. In order to implement intensive forest management activities, some road sections would have to be improved prior to heavy equipment operations. Portions of some stands extend into gulch areas where slopes exceeding 25% are common. Such slopes and slick road conditions during rainy periods could also limit heavy equipment operation. DOFAW, MR, and TNCH manage a majority of the study area, each with differing mandates and objectives. Most resource management activities and road access will require cooperation between these three organizations.

Analyses of survey precision indicated that reported mean values for timber volume were moderately robust. In the principal cover types comprising 90 acres or more, standard error values ranged from 10-20% of mean volume estimates (Table 3). These principal cover types represented 78% and 82% of the total acreage and volume surveyed, respectively.

The volume data in this report are not intended to be the basis for negotiation of timber sale contracts, but rather a guideline to long term timber management planning within the surveyed areas. Careful weighing or scaling of timber removed from harvest sites is highly recommended for all harvest contracts.

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Appendix A. Botanical classification for species tallied during the Molokai timber survey.

TREE SPECIES

Latin genus and species	Common name
Acacia confusa	Formosa koa
Acacia koa	Koa
Acacia mearnsii	Black wattle
Araucaria excelsa	Norfolk Island Pine
Casuarina equisetifolia	Ironwood
Cryptomeria japonica	Sugi
Cupressus macrocarpa	Monterey Cypress
Eucalyptus citriodora	Lemon-Scented Gum
Eucalyptus crebra	Narrow-Leaved Red Ironbark
Eucalyptus microcorys	Tallow-wood
Eucalyptus robusta	Swamp mahogany
Eucalyptus saligna	Sydney blue gum
Eucalyptus sideroxylon	Red Ironbark
Fraxinus uhdei	Tropical Ash
Lophostemon confertus	Brushbox
Melaleuca quinquenervia	Paper bark
Metrosideros polymorpha	Ohia
Pinus elliottii	Slash pine
Pinus radiata	Monterey pine
Pinus taeda	Loblolly pine
Schinus terebinthifolius	Christmas berry

Appendix A (continued)

UNDERSTORY AND GROUNDCOVER SPECIES

Latin genus and species	Common name
Cheirodendron trigynum	Olapa
Cibotium spp.	Hapuu
Cordyline terminalis	Ti Leaf
Dicranopteris linearis	Uluhe fern
Dodonaea viscosa	Aalii
Freycinetia arborea	Ieie
Melinis minutiflora	Molasses grass
Nephrolepis multiflora	Sword fern
Psidium spp.	Guava
Psychotria spp.	Kopiko
Rubus spp.	Raspberry
Styphelia tameiameiae	Pukiawe
Wikstroemia oahuensis	Akia

Plants in other families	
Zingiberaceae	Ginger family

Appendix B. Species assignments by taper profile class for volume analyses.

Species analyzed using a Hawaiian *Flindersia brayleyana* taper profile:

1. *Acacia confusa*
2. *Acacia koa*
3. *Acacia mearnsii*
4. *Casuarina equisetifolia*
5. *Fraxinus uhdei*
6. *Metrosideros polymorpha*

Species analyzed using a Hawaiian *Eucalyptus saligna* taper profile:

1. *Eucalyptus crebra* (bark thickness coefficients 1.5 times those of *E. saligna*)
2. *E. microcorys* (bark thickness coefficients 1.5 times those of *E. saligna*)
3. *E. robusta* (bark thickness coefficients 2.0 times those of *E. saligna*)
4. *E. saligna*
5. *E. sideroxylon* (bark thickness coefficients 1.5 times those of *E. saligna*)
6. *Lophostemon confertus*
7. *Melaleuca quinquenervia* (bark thickness coefficients 2.0 times those of *E. saligna*)

Species analyzed using a Hawaiian *Eucalyptus grandis* taper profile:

1. *Eucalyptus citriodora*

Species analyzed using a Pacific Northwest *Pinus contorta* (lodgepole pine) taper profile:

1. *Pinus elliottii*
2. *Pinus taeda*
3. *Pinus radiata*

Species analyzed using a Pacific Northwest *Thujua plicata* (Western red cedar) taper profile:

1. *Araucaria excelsa*
2. *Cryptomeria japonica*
3. *Cupressus macrocarpa*

Appendix C. Stand tables by forest type.

Guidelines for interpreting stand table data:

1. Stand tables summarize sample plot analyses using one-inch DBH classes. Statistics provided for each DBH class include trees per acre, basal area per acre (ft^2), average tree height (feet), and cubic foot volume per acre. Gross cubic volume represents the tree bole from tree base to tree tip. Merchantable wood volume calculations were based on 16 foot log sections, a minimum top diameter of four inches, a stump height of one foot, and a minimum DBH of eight inches. Net wood volume represents merchantable volume minus deductions due to tree defects.

2. For each forest type, statistics are first presented by tree species. The last row of each species section gives a species summary (species codes typically use the first initial from both genus and species names). The species summary shows average DBH, total trees per acre, total basal area per acre, and total volume per acre.

3. After all species for a particular forest type have been listed, two final rows provide type level summary statistics. The first row represents all trees with a DBH of two inches or larger. The second row represents only trees with a minimum DBH of eight inches. Type level summaries show average DBH, total trees per acre, total basal area per acre, and total volume per acre. Type level volume totals may differ slightly from those reported in Tables 2-5 due to rounding errors.

Appendix C (Continued).

Forest type ER22: Low to moderate volume *Eucalyptus robusta* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus robusta				
	2	6	72.0	2	18	0	0
	4	18	64.0	6	39	0	0
	6	27	20.0	4	35	0	0
	7	38	36.0	10	114	0	0
	8	42	22.0	8	96	0	0
	9	48	20.0	9	128	110	97
	10	53	6.0	3	52	47	38
	11	57	6.0	4	63	57	47
	12	61	8.0	6	112	104	84
	13	32	8.0	7	77	69	53
	14	42	12.0	13	161	147	92
	15	50	4.0	5	74	69	38
	16	71	6.0	8	170	161	127
	17	74	2.0	3	63	60	47
	18	76	2.0	4	77	74	58
	21	79	2.0	5	98	94	77
	24	84	2.0	6	141	135	109
ER summary:	8	54	292.0	103	1529	1133	873
			Metrosideros polymorpha				
	2	6	200.0	0	6	0	0
MP summary:	2	6	20.0	0	6	0	0
			Pinus elliottii				
	2	89	64.0	1	38	0	0
	4	55	40.0	0	6	0	0
	6	42	2.0	0	7	0	0
	7	48	4.0	1	21	0	0
	8	35	2.0	1	10	0	0
	9	36	20.0	1	14	13	13
	10	35	2.0	1	16	15	15
PE summary:	4	72	80.0	6	115	29	29
			-- Type Level Summary --				
All trees:	7.1		391.0	109	1650	1162	901
Merch trees:	13.1		81.0	76			

Appendix C (Continued).

Forest type ER44: Moderate to high volume *Eucalyptus robusta* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus saligna				
	12	70	1.4	1	28	26	16
	22	89	1.4	4	114	110	74
ES summary:	18	79	2.9	5	143	137	91
			Unknown eucalyptus				
	6	48	2.9	1	10	0	0
	7	18	1.4	0	4	0	0
	12	75	1.4	1	34	32	31
EZ summary:	8	47	5.7	2	49	32	31
			Metrosideros polymorpha				
	2	15	20.0	0	3	0	0
	4	27	8.6	1	8	0	0
MP summary:	3	19	28.6	1	11	0	0
			Eucalyptus robusta				
	2	15	40.0	1	5	0	0
	4	27	22.9	2	17	0	0
	6	37	7.1	1	15	0	0
	7	34	12.9	3	36	0	0
	8	20	5.7	2	15	11	9
	9	33	5.7	3	27	22	20
	10	32	14.3	8	81	70	46
	11	8	7.1	5	35	25	15
	12	57	5.7	4	74	68	54
	13	50	8.6	8	116	107	87
	14	70	8.6	9	181	171	140
	15	64	10.0	12	225	212	149
	16	49	8.6	12	171	159	71
	17	69	5.7	9	173	164	114
	18	71	14.3	25	498	474	412
	19	72	4.3	8	168	161	110
	20	74	4.3	9	190	181	124
	21	82	2.9	7	152	146	122
	23	79	2.9	8	174	167	123
	24	71	5.7	18	341	326	237
	27	84	1.4	6	125	120	87
	28	86	1.4	6	135	130	94
	29	87	1.4	7	146	141	101
	30	88	1.4	7	158	152	112
	32	90	2.9	16	364	351	257
	35	94	1.4	10	220	213	155
	39	97	1.4	12	277	268	194
	50	125	1.4	19	563	548	413
ER summary:	14	80	210.0	238	4695	4399	3259

Appendix C (Continued).

Forest type ER44 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Fraxinus uhdei				
	8	45	1.4	1	8	7	5
FU summary:	8	45	1.4	1	9	8	6
			Acacia mearnsii				
	2	10	22.9	0	3	0	0
	6	20	1.4	0	2	0	0
AW summary:	2	11	24.3	1	6	0	0
			Cupressus macrocarpa				
	2	15	20.0	0	3	0	0
	4	27	5.7	0	4	0	0
CM summary:	3	18	25.7	1	8	0	0
			Araucaria excelsa				
	2	6	2.9	0	0	0	0
	8	49	1.4	0	9	0	0
	11	55	2.9	2	40	37	37
	13	74	1.4	1	34	32	32
	17	87	2.9	5	117	112	111
	22	120	1.4	4	115	111	108
AE summary:	13	60	12.9	12	317	293	289
			-- Type Level Summary --				
All trees:	12.4		311.0	261	5238	4869	3676
Merch trees:	18.0		141.0	249			

Appendix C (Continued).

Forest type ER55: Moderate volume *Eucalyptus robusta* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus robusta				
	2	13	20.0	0	2	0	0
	4	30	26.4	2	21	0	0
	6	39	8.4	2	19	0	0
	7	37	7.6	2	22	0	0
	8	41	7.6	3	33	26	22
	9	63	10.1	4	80	69	44
	10	28	8.4	5	43	36	19
	11	58	5.2	3	58	53	42
	12	35	8.9	7	77	68	36
	13	68	5.3	5	93	87	80
	14	30	8.1	9	84	74	55
	15	59	8.0	10	166	156	98
	16	53	8.1	11	172	160	114
	17	86	6.4	10	238	228	181
	18	70	6.1	11	209	199	176
	19	57	7.6	15	242	228	111
	20	90	4.2	9	222	213	166
	21	97	6.9	17	430	416	333
	22	136	3.2	8	299	292	266
	23	93	3.8	11	272	263	222
	24	93	1.8	6	135	131	87
	25	68	2.8	10	175	167	99
	26	82	3.0	11	236	227	180
	27	60	2.9	11	183	173	113
	28	81	4.8	21	434	417	257
	29	99	0.4	2	46	44	31
	30	77	0.8	4	78	75	65
	31	75	3.3	17	329	315	197
	32	101	0.4	2	56	54	36
	33	102	0.8	5	120	116	77
	34	103	0.8	5	127	123	81
	35	104	0.9	6	149	144	95
	36	104	0.4	3	71	69	45
	37	105	1.6	12	302	293	182
	38	116	1.3	10	281	273	65
	40	115	0.4	3	95	92	83
	42	108	0.4	4	96	93	61
	45	110	0.4	4	110	106	69
	62	112	0.4	8	198	191	83
	64	150	0.4	9	275	268	53
ER summary:	17	92	198.0	297	6295	5960	3946
			Fraxinus uhdei				
	10	40	0.4	0	3	3	2
FU summary:	10	40	0.4	0	4	3	2

Appendix C (Continued).

Forest type ER55 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Volume (ft3): Merch	Volume (ft3): Net
			Eucalyptus saligna				
	13	63	0.4	0	8	7	6
	15	69	0.4	0	11	10	8
	19	77	0.4	1	20	19	17
ES summary:	16	70	1.2	2	40	38	33
			Eucalyptus citriodora				
	9	35	0.4	0	2	2	1
	13	52	0.4	0	8	8	5
EC summary:	11	43	0.8	1	12	11	8
			Eucalyptus microcorys				
	7	75	0.5	0	2	0	0
	8	81	0.5	0	3	0	0
	18	31	1.0	2	18	16	8
EM summary:	14	55	1.9	2	25	17	9
			Eucalyptus crebra				
	2	26	1.6	0	0	0	0
	8	50	0.4	0	2	1	1
	28	65	0.4	2	32	31	15
EA summary:	12	36	2.4	2	35	33	18
			Unknown eucalyptus				
	15	59	0.4	0	12	11	10
	16	60	0.8	1	28	26	22
	17	61	0.5	1	19	18	15
	18	62	0.5	1	21	20	17
	19	63	0.5	1	24	23	18
	21	65	0.5	1	30	28	21
	22	75	0.5	1	37	36	23
	26	85	0.4	1	48	46	32
	27	69	0.4	2	42	40	23
	31	50	0.5	3	51	49	20
EZ summary:	21	64	4.9	12	315	302	207
			Metrosideros polymorpha				
	2	5	67.2	1	0	0	0
	4	12	19.6	2	12	0	0
	6	30	1.6	0	3	0	0
	7	29	0.8	0	2	0	0
	9	39	0.8	0	5	4	2
	10	31	0.4	0	2	2	1
MP summary:	3	11	90.4	4	27	7	4

Appendix C (Continued).

Forest type ER55 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Volume (ft3): Merch	Volume (ft3): Net
			Acacia koa				
	16	48	0.4	1	9	8	8
AK summary:	16	47	0.4	1	9	9	8
			Pinus elliottii				
	2	13	0.8	0	0	0	0
PE summary:	2	13	0.8	0	0	0	0
			-- Type Level Summary --				
All trees:	14.0		301.0	320	6764	6380	4235
Merch trees:	19.7		146.0	310			

Appendix C (Continued).

Forest type ES22: Low to moderate volume *Eucalyptus saligna* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Eucalyptus saligna				
	2	13	8.9	0	1	0	0
	4	24	22.2	2	18	0	0
	6	33	13.3	3	33	0	0
	7	30	16.7	4	53	0	0
	8	30	13.3	5	57	47	41
	9	42	13.3	6	93	82	61
	10	44	6.7	4	60	54	45
	11	52	10.0	7	124	114	93
	12	53	10.0	8	150	139	69
	13	51	3.3	3	57	53	35
	14	50	4.4	5	87	81	63
	15	10	7.8	10	78	60	0
	16	60	5.6	8	164	155	74
	17	46	5.6	9	145	135	95
	18	60	4.4	8	165	156	100
	19	62	1.1	2	46	44	28
	20	63	2.2	5	105	100	65
	21	69	2.2	5	124	119	73
	22	66	1.1	3	65	62	40
	25	90	1.1	4	111	107	75
	28	73	1.1	5	113	108	69
	29	74	1.1	5	122	117	74
	30	39	1.1	5	74	67	47
ES summary:	12	49	156.7	114	2057	1809	1157
			Metrosideros polymorpha				
	2	7	95.6	2	20	0	0
	4	20	46.7	4	36	0	0
	9	47	1.1	0	8	7	5
MP summary:	3	20	143.3	7	66	7	5
			-- Type Level Summary --				
All trees:	8.6		300.0	121	2123	1816	1163
Merch trees:	14.1		96.0	105			

Appendix C (Continued).

Forest type ES44: Moderate to high volume *Eucalyptus saligna* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus saligna				
	2	23	6.7	0	1	0	0
	4	40	6.7	1	8	0	0
	7	58	6.7	2	36	0	0
	9	67	3.3	1	35	31	25
	10	70	3.3	2	45	41	40
	11	60	6.7	4	95	87	57
	12	78	6.7	5	143	134	117
	13	60	6.7	6	131	123	86
	14	60	16.7	18	381	358	276
	15	87	3.3	4	122	117	96
	16	90	6.7	9	284	273	232
	18	94	3.3	6	187	180	150
	19	80	6.7	13	356	342	276
	22	105	3.3	9	303	294	289
	23	104	6.7	19	657	638	512
	24	106	6.7	21	723	702	561
	26	109	3.3	12	432	420	332
	27	111	3.3	13	470	457	359
	31	117	3.3	17	636	619	496
ES summary:	17	100	110.0	164	5053	4826	3910
			Metrosideros polymorpha				
	2	11	133.3	3	20	0	0
	4	17	180.0	16	135	0	0
	6	23	30.0	6	60	0	0
	7	24	6.7	2	18	0	0
MP summary:	4	23	350.0	26	235	0	0
			-- Type Level Summary --				
All trees:	8.7		460.0	190	5288	4826	3910
Merch trees:	18.1		89.0	161			

Appendix C (Continued).

Forest type ES55: Moderate volume *Eucalyptus saligna* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus saligna				
	4	37	4.0	0	4	0	0
	7	85	6.0	2	46	0	0
	8	52	6.0	2	39	34	15
	9	69	6.0	3	64	58	47
	10	74	2.0	1	28	26	21
	11	74	2.0	1	34	32	23
	12	65	10.0	8	181	169	122
	13	87	6.0	6	166	157	127
	15	94	4.0	5	157	151	123
	16	95	10.0	14	451	434	386
	17	85	4.0	6	182	175	138
	18	104	4.0	7	245	237	191
	19	118	14.0	28	1072	1041	899
	20	110	4.0	9	317	307	175
	21	113	4.0	10	355	345	296
	22	115	6.0	16	595	579	510
	23	117	6.0	17	658	641	516
	24	120	6.0	19	727	708	568
	25	122	2.0	7	266	259	207
	26	124	2.0	7	291	284	227
	27	135	2.0	8	338	330	304
	28	128	4.0	17	690	674	549
	29	130	4.0	18	748	730	594
	32	135	2.0	11	464	453	383
	33	137	2.0	12	500	489	400
ES summary:	19	122	122.0	233	8632	8325	6833
			Eucalyptus robusta				
	6	59	2.0	0	6	0	0
	7	61	2.0	1	9	0	0
	10	70	4.0	2	43	39	35
	11	67	2.0	1	25	23	20
	14	69	2.0	2	42	39	34
	18	57	2.0	4	57	53	43
	19	73	2.0	4	79	75	63
	21	74	4.0	10	193	185	152
	26	90	2.0	7	173	167	138
ER summary:	16	69	22.0	31	630	584	488
			Metrosideros polymorpha				
	2	19	32.0	1	6	0	0
MP summary:	2	19	32.0	1	6	0	0

Appendix C (Continued).

Forest type ER55 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Casuarina equisetifolia				
	2	6	96.0	2	0	0	0
	4	15	52.0	5	34	0	0
	6	28	6.0	1	13	0	0
	7	34	2.0	1	7	0	0
	8	9	4.0	1	11	8	8
	9	45	2.0	1	14	12	10
	10	50	2.0	1	19	17	15
	11	53	2.0	1	25	23	19
	18	73	2.0	4	87	83	72
CE summary:	4	26	168.0	17	215	146	127
			Cryptomeria japonica				
	8	47	2.0	1	12	0	0
CJ summary:	8	47	2.0	1	13	0	0
			-- Type Level Summary --				
All trees:	12.2		346.0	282	9495	9055	7449
Merch trees:	18.7		141.0	270			

Forest type EX22: Low to moderate volume Mixed eucalyptus saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus saligna				
	2	7	15.3	0	3	0	0
	4	22	4.7	0	3	0	0
	6	38	2.9	1	8	0	0
	8	51	1.8	1	12	10	9
	10	105	0.6	0	11	10	10
	13	73	0.6	1	13	12	10
	14	72	1.2	1	31	30	27
	15	79	0.6	1	20	19	17
	16	75	0.6	1	20	19	14
	22	60	0.6	2	31	29	24
	24	95	0.6	2	57	55	45
ES summary:	7	27	29.4	9	213	187	160
			Eucalyptus microcorys				
	9	35	1.2	1	6	5	4
	16	96	0.6	1	24	23	23
EM summary:	12	55	1.8	1	31	29	28

Appendix C (Continued).

Forest type EX22 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus citriodora				
	2	76	1.2	0	0	0	0
	4	58	3.5	0	6	0	0
	6	52	1.8	0	7	0	0
	7	50	0.6	0	3	0	0
	8	48	1.2	0	8	7	7
	9	51	0.6	0	6	5	4
	10	42	0.6	0	6	5	4
	16	41	0.6	1	14	13	8
	21	40	0.6	1	24	23	10
	25	39	0.6	2	35	32	9
EC summary:	10	53	11.2	6	114	88	45
			Eucalyptus robusta				
	2	9	30.6	1	3	0	0
	4	25	27.1	2	19	0	0
	6	45	7.1	1	17	0	0
	7	30	7.6	2	19	0	0
	8	37	4.7	2	18	15	13
	9	25	4.1	2	15	13	0
	10	51	4.7	3	38	34	31
	11	30	2.4	2	15	13	6
	12	56	2.4	2	30	27	21
	13	29	2.9	3	26	23	20
	14	30	5.3	6	55	49	39
	15	59	5.9	7	122	114	91
	16	48	1.8	2	34	32	16
	18	35	1.2	2	22	20	14
	20	71	1.8	4	75	71	46
	21	56	1.2	3	44	41	24
	22	69	0.6	2	29	27	20
	29	65	1.2	5	91	87	78
	30	73	0.6	3	54	52	38
	33	85	0.6	3	74	72	58
	35	75	0.6	4	73	70	52
	39	76	0.6	5	90	87	64
ER summary:	10	46	114.7	65	975	854	638
			Eucalyptus sideroxylon				
	4	28	1.2	0	1	0	0
	9	38	0.6	0	3	2	1
	10	40	0.6	0	4	3	2
	11	41	0.6	0	5	4	3
	12	42	1.2	1	13	12	8
	18	47	0.6	1	15	14	11
	26	52	0.6	2	34	32	26
EE summary:	13	40	5.3	5	78	71	54

Appendix C (Continued).

Forest type EX22 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus crebra				
	2	20	21.2	0	3	0	0
	4	41	5.9	1	6	0	0
	6	52	3.5	1	12	0	0
	7	57	1.2	0	5	0	0
	9	61	0.6	0	4	3	2
	9	33	0.6	0	3	2	2
	10	60	0.6	0	6	5	5
	11	30	1.2	1	9	8	4
EA summary:	4	30	34.7	4	52	20	14
			Unknown eucalyptus				
	6	56	1.2	0	6	0	0
	8	48	1.2	0	9	8	5
	9	68	0.6	0	8	7	7
	12	60	0.6	0	11	11	10
	13	47	1.2	1	23	21	16
	15	30	1.8	2	30	27	18
	16	35	0.6	1	12	11	7
	18	44	1.2	2	40	37	29
	20	43	0.6	1	23	22	17
	22	42	0.6	2	29	27	21
	34	40	0.6	4	66	62	48
EZ summary:	16	45	10.0	14	263	239	183
			Fraxinus uhdei				
	2	8	4.7	0	0	0	0
	4	22	2.4	0	1	0	0
	6	45	1.2	0	3	0	0
	7	37	1.2	0	4	0	0
	8	37	0.6	0	3	2	2
	9	48	1.2	1	9	8	7
	10	51	1.2	1	12	11	10
FU summary:	6	26	12.4	2	37	23	21
			Metrosideros polymorpha				
	2	17	37.6	1	6	0	0
	4	19	11.8	1	9	0	0
	6	21	1.8	0	3	0	0
	7	21	0.6	0	1	0	0
	8	24	1.8	1	6	5	2
	11	22	0.6	0	3	3	1
MP summary:	3	18	54.1	3	31	9	5

Appendix C (Continued).

Forest type EX22 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Volume (ft3): Merch	Volume (ft3): Net
			Acacia confusa				
	6	43	0.6	0	1	0	0
	7	47	1.8	0	8	0	0
	8	52	0.6	0	3	3	0
	9	57	0.6	0	5	4	0
	13	65	0.6	1	12	11	0
AC summary:	8	51	4.1	2	31	20	0
			Cryptomeria japonica				
	2	5	1.2	0	0	0	0
	6	21	0.6	0	1	0	0
	7	27	0.6	0	1	0	0
CJ summary:	5	14	2.4	0	3	0	0
			Cupressus macrocarpa				
	2	19	1.2	0	0	0	0
	7	33	0.6	0	1	0	0
	14	42	0.6	1	9	8	7
CM summary:	8	28	2.4	1	11	8	7
			Pinus elliottii				
	2	9	8.2	0	1	0	0
	4	23	4.7	0	3	0	0
	6	31	2.9	1	8	0	0
	7	40	4.1	1	20	0	0
	8	43	0.6	0	3	3	3
	11	51	0.6	0	8	7	7
PE summary:	5	23	21.2	3	45	11	11
			-- Type Level Summary --				
All trees:	8.4		303.0	116	1885	1560	1166
Merch trees:	15.1		79.0	98			

Appendix C (Continued).

Forest type EX55: Moderate volume Mixed eucalyptus saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus saligna				
	2	9	33.3	1	5	0	0
	4	27	13.3	1	12	0	0
	8	55	3.3	1	23	20	18
	10	64	3.3	2	41	38	34
	11	72	6.7	4	111	104	93
	12	71	3.3	3	65	61	55
	13	74	3.3	3	79	75	68
	14	76	3.3	4	94	90	83
	18	84	3.3	6	168	161	156
	20	80	6.7	15	393	378	372
ES summary:	9	65	80.0	39	996	929	884
			Eucalyptus robusta				
	2	21	6.7	0	1	0	0
	4	42	13.3	1	13	0	0
	7	55	6.7	2	28	0	0
	8	62	13.3	5	82	67	67
	9	12	13.3	6	39	30	0
	11	75	3.3	2	46	43	43
	12	70	6.7	5	103	95	84
	17	68	3.3	5	100	95	80
	18	79	6.7	12	256	245	236
	21	78	3.3	8	169	162	149
	39	83	3.3	28	560	538	492
ER summary:	13	54	80.0	74	1402	1278	1155
			Eucalyptus microcorys				
	4	10	13.3	1	8	0	0
	11	42	3.3	2	31	28	25
	17	22	3.3	5	49	41	0
	26	75	3.3	12	273	262	152
EM summary:	13	25	23.3	21	362	332	178
			Metrosideros polymorpha				
	2	5	113.3	2	0	0	0
	4	9	13.3	1	9	0	0
	6	18	3.3	1	5	0	0
	10	35	3.3	2	23	20	13
MP summary:	3	10	133.3	6	38	20	14
			-- Type Level Summary --				
All trees:	9.0		316.0	140	2799	2560	2231
Merch trees:	15.4		99.0	129			

Appendix C (Continued).

Forest type PE33: Moderate volume *Pinus elliottii* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Pinus taeda				
	2	8	2.5	0	0	0	0
	4	23	10.0	1	7	0	0
	6	30	6.3	1	17	0	0
	7	55	11.3	3	72	0	0
	8	46	3.8	1	26	23	23
	9	49	12.5	6	117	107	107
	10	53	18.8	10	229	212	210
	11	60	16.3	11	264	248	242
	12	58	10.0	8	185	175	173
	13	62	5.0	5	112	106	105
	14	64	2.5	3	66	63	62
	15	66	1.3	2	38	36	36
	17	69	1.3	2	49	47	46
PT summary:	10	59	101.3	52	1188	1022	1010
			Pinus elliottii				
	2	5	5.0	0	0	0	0
	6	33	6.3	1	19	0	0
	7	22	5.0	1	16	0	0
	8	51	13.8	5	109	98	89
	9	58	15.0	7	168	155	152
	10	59	18.8	10	253	236	230
	11	69	27.5	18	509	481	470
	12	70	13.8	11	307	292	270
	13	77	3.8	3	103	98	90
	14	60	8.8	10	224	213	191
	15	74	10.0	12	341	326	317
	16	80	2.5	3	101	97	93
	17	91	1.3	2	62	60	58
PE summary:	11	71	131.3	84	2218	2061	1964
			-- Type Level Summary --				
All trees:	10.4		232.0	136	3406	3083	2974
Merch trees:	11.2		186.0	128			

Appendix C (Continued).

Forest type PE44: Moderate to high volume *Pinus elliottii* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Fraxinus uhdei				
	2	6	2.0	0	0	0	0
	4	19	2.0	0	1	0	0
	6	34	2.0	0	5	0	0
	7	42	1.0	0	4	0	0
	11	63	1.0	1	15	14	14
FU summary:	6	28	8.0	2	28	15	14
			Pinus taeda				
	2	9	32.0	1	5	0	0
	4	28	16.0	1	13	0	0
	6	49	9.0	2	38	0	0
	7	54	4.0	1	25	0	0
	8	69	7.0	2	71	64	64
	9	66	4.0	2	49	45	45
	10	71	2.0	1	31	29	29
	11	75	1.0	1	20	18	18
	12	79	1.0	1	24	23	23
	14	57	1.0	1	24	22	22
PT summary:	6	51	77.0	13	303	205	205
			Pinus elliottii				
	4	34	4.0	0	3	0	0
	6	31	6.0	1	17	0	0
	7	60	11.0	3	76	0	0
	8	60	17.0	6	153	138	132
	9	91	21.9	10	361	337	326
	10	58	34.3	19	459	428	400
	11	73	35.0	23	684	647	613
	12	65	36.3	29	747	707	678
	13	77	24.0	22	660	630	571
	14	77	18.3	20	576	552	539
	15	99	19.0	23	852	822	795
	16	93	9.3	13	436	420	397
	17	81	9.0	14	415	399	331
	18	70	5.3	9	235	225	196
	19	73	4.3	8	217	208	173
	20	136	3.0	7	290	283	275
	21	112	4.6	11	402	391	325
	22	92	1.0	3	78	75	67
	23	80	1.0	3	73	70	43
	24	95	1.3	4	117	113	103
	25	96	1.0	3	96	93	85
	26	97	1.3	5	133	128	117
PE summary:	13	90	267.9	236	7091	6675	6177
			-- Type Level Summary --				
All trees:	11.4		352.0	250	7422	6895	6396
Merch trees:	12.9		263.0	240			

Appendix C (Continued).

Forest type PE55: Moderate volume *Pinus elliottii* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Cupressus macrocarpa				
	11	58	2.5	2	34	32	30
	18	85	2.5	4	109	103	100
	23	97	2.5	7	181	172	166
CM summary:	18	80	7.5	13	325	308	297
			Araucaria excelsa				
	14	85	5.0	5	147	139	134
	15	87	2.5	3	81	77	75
	19	93	7.5	15	383	365	353
	22	95	2.5	6	159	151	146
AE summary:	18	90	17.5	30	772	735	710
			Pinus elliottii				
	2	19	50.0	1	7	0	0
	4	35	40.0	3	41	0	0
	6	40	10.0	2	35	0	0
	7	50	25.0	7	147	0	0
	8	70	15.0	5	156	141	141
	9	72	22.5	10	298	276	275
	10	69	20.0	11	309	290	275
	11	64	25.0	16	435	409	375
	12	76	15.0	12	357	339	338
	13	82	10.0	9	292	279	263
	14	89	12.5	13	449	432	411
	15	80	5.0	6	183	176	172
	16	90	7.5	10	341	329	311
	17	81	17.5	28	805	774	770
	18	107	5.0	9	326	316	174
	19	89	2.5	5	150	145	142
	20	100	5.0	11	365	353	333
	21	110	5.0	12	429	416	405
	23	107	2.5	7	238	231	218
	24	109	2.5	8	257	249	234
	26	113	2.5	9	294	285	270
PE summary:	11	96	300.0	195	5924	5448	5116
			-- Type Level Summary --				
All trees:	11.6		325.0	239	7021	6491	6123
Merch trees:	14.4		200.0	225			

Appendix C (Continued).

Forest type PT44: Moderate to high volume *Pinus taeda* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Unknown eucalyptus				
	7	22	2.5	1	6	0	0
EZ summary:	7	22	2.5	1	7	0	0
			Pinus taeda				
	2	17	10.0	0	1	0	0
	4	29	5.0	0	4	0	0
	6	38	10.0	2	34	0	0
	7	41	27.5	7	137	0	0
	8	50	35.0	12	268	239	239
	9	55	15.0	7	156	144	132
	10	43	27.5	15	284	261	255
	11	58	30.0	20	472	443	434
	12	60	15.0	12	286	270	249
	13	59	12.5	12	269	255	225
	14	62	15.0	16	384	364	329
	15	64	2.5	3	74	71	68
	16	66	5.0	7	172	164	156
	19	71	2.5	5	122	117	111
PT summary:	10	62	212.5	118	2671	2333	2203
			Pinus elliottii				
	2	11	10.0	0	1	0	0
	4	22	10.0	1	7	0	0
	6	32	15.0	3	46	0	0
	7	48	15.0	4	81	0	0
	8	45	22.5	8	157	140	140
	9	47	27.5	12	253	231	224
	10	58	30.0	16	394	367	363
	11	59	25.0	17	406	382	364
	12	63	10.0	8	193	183	173
	13	67	7.5	7	181	172	164
	14	71	7.5	8	215	206	196
	15	75	5.0	6	168	161	154
	18	86	2.5	5	139	134	128
PE summary:	10	68	187.5	94	2247	1980	1912
			-- Type Level Summary --				
All trees:	9.8		402.0	212	4924	4313	4115
Merch trees:	10.9		297.0	194			

Appendix C (Continued).

Forest type PX22: Low to moderate volume Mixed pines saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Cupressus macrocarpa				
	14	47	1.1	1	20	18	16
CM summary:	14	47	1.1	1	20	19	17
			Pinus taeda				
	2	8	33.3	1	5	0	0
	4	22	11.1	1	7	0	0
	6	26	8.9	2	23	0	0
	7	43	6.7	2	33	0	0
	8	40	12.2	4	77	0	0
	9	49	5.6	2	53	48	48
	10	45	3.3	2	37	34	34
	11	49	3.3	2	47	44	42
	12	40	1.1	1	14	13	13
	15	56	1.1	1	30	28	27
PT summary:	6	41	86.7	19	330	170	166
			Pinus elliottii				
	2	20	51.1	1	8	0	0
	4	33	37.8	3	36	0	0
	6	44	18.9	4	73	0	0
	7	48	32.2	9	184	0	0
	8	50	21.1	7	163	146	146
	9	50	13.3	6	127	116	115
	10	52	10.0	5	120	111	102
	11	57	4.4	3	69	65	63
	12	62	8.9	7	174	164	160
	13	62	3.3	3	75	71	69
	14	64	1.1	1	29	28	27
	15	71	2.2	3	73	69	66
PE summary:	7	56	204.4	52	1136	775	753
			-- Type Level Summary --				
All trees:	6.7		292.0	72	1487	964	936
Merch trees:	10.3		79.0	46			

Appendix C (Continued).

Forest type PX33: Moderate volume Mixed pines pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus microcorys				
	2	21	33.3	1	5	0	0
	4	42	40.0	3	45	0	0
	6	52	23.3	5	74	0	0
	7	65	20.0	5	109	0	0
	8	62	10.0	3	69	58	52
	9	64	6.7	3	61	53	50
	10	67	6.7	4	77	70	66
	11	65	6.7	4	92	84	75
EM summary:	6	64	146.7	29	536	268	245
			Lophostemon confertus				
	2	7	46.7	1	9	0	0
	4	23	6.7	1	5	0	0
	7	47	3.3	1	17	0	0
	8	53	3.3	1	21	0	0
	22	94	3.3	8	263	254	62
	25	97	3.3	12	367	356	89
	34	105	3.3	21	662	643	170
LC summary:	11	40	70.0	44	1348	1254	322
			Acacia mearnsii				
	6	35	6.7	1	17	0	0
	8	43	3.3	1	18	15	0
AW summary:	7	38	10.0	2	36	16	0
			Pinus elliottii				
	2	11	86.7	2	12	0	0
	4	23	40.0	3	29	0	0
	6	28	26.7	5	70	0	0
	7	45	16.7	4	89	0	0
	8	41	13.3	5	86	76	75
	9	49	13.3	6	125	114	113
	11	50	3.3	2	46	43	42
	22	97	3.3	9	273	264	244
PE summary:	6	50	203.3	37	734	500	476
			-- Type Level Summary --				
All trees:	6.9		429.0	112	2654	2038	1043
Merch trees:	13.6		76.0	78			

Appendix C (Continued).

Forest type PX55: Moderate volume Mixed pines saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Pinus elliottii				
	2	5	6.7	0	0	0	0
	4	11	3.3	0	2	0	0
	7	20	13.3	4	37	0	0
	8	39	1.7	1	10	9	8
	9	47	1.7	1	15	13	12
	10	54	3.3	2	41	38	35
	11	64	3.3	2	57	54	54
	12	65	5.0	4	102	97	95
	13	77	1.7	2	45	43	42
	14	80	8.3	9	271	260	251
	15	82	5.0	6	187	179	166
	16	93	6.7	9	312	301	300
	17	90	6.7	11	338	327	304
	18	90	5.0	9	278	268	263
	19	85	5.0	10	288	278	276
	20	87	3.3	7	213	205	202
	21	105	1.7	4	136	132	122
	22	108	5.0	13	451	437	403
	23	110	1.7	5	163	158	146
PE summary:	14	92	88.3	98	2956	2807	2687
			Eucalyptus robusta				
	2	5	3.3	0	0	0	0
	4	10	3.3	0	1	0	0
	6	21	1.7	0	2	0	0
	7	26	1.7	0	3	0	0
	8	32	1.7	1	6	5	5
	10	30	3.3	2	17	15	14
	15	59	1.7	2	35	33	28
ER summary:	8	23	16.7	6	67	53	48
			Lophostemon confertus				
	9	90	1.7	1	22	20	16
	16	108	1.7	2	84	81	77
	18	115	3.3	6	225	218	217
	20	116	1.7	4	138	134	134
	21	117	1.7	4	153	149	148
LC summary:	17	110	10.0	17	625	605	594
			Fraxinus uhdei				
	2	11	26.7	1	4	0	0
	8	57	1.7	1	12	10	8
	9	62	1.7	1	16	14	10
	20	90	1.7	4	106	103	78
	21	91	1.7	4	121	117	89
FU summary:	7	23	33.3	10	261	245	186

Appendix C (Continued).

Forest type EX22 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Metrosideros polymorpha				
	2	5	10.0	0	0	0	0
	4	11	3.3	0	2	0	0
MP summary:	3	6	13.3	1	2	0	0
			Cupressus macrocarpa				
	6	40	10.0	2	34	0	0
	7	42	1.7	0	7	0	0
	8	50	1.7	1	11	10	9
	9	55	3.3	1	31	28	26
	10	58	3.3	2	40	36	33
	16	79	1.7	2	56	53	43
CM summary:	9	49	21.7	9	182	130	113
			-- Type Level Summary --				
All trees:	11.8		183.0	139	4093	3841	3628
Merch trees:	15.6		98.0	130			

Forest type PX66: Moderate to high volume Mixed pines saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Pinus taeda				
	7	64	1.7	0	12	0	0
	8	77	11.7	4	131	119	119
	9	73	6.7	3	89	83	79
	10	55	8.3	5	106	98	96
	11	80	10.0	7	211	200	191
	12	100	21.7	17	662	634	598
	13	88	20.0	18	626	600	582
	14	67	10.0	11	277	264	244
	15	60	6.7	8	188	179	166
	16	95	11.7	16	561	542	487
	17	94	3.3	5	176	170	162
	18	92	8.3	15	473	456	382
	19	120	3.3	7	264	257	250
	20	100	3.3	7	242	235	223
	21	102	3.3	8	266	257	245
	22	103	1.7	4	144	140	133
	23	105	1.7	5	156	151	143
PT summary:	14	95	133.3	140	4592	4392	4109

Appendix C (Continued).

Forest type PX66 (Continued):

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Pinus elliottii				
	6	63	1.7	0	8	0	0
	7	72	5.0	1	41	0	0
	8	71	1.7	1	17	15	15
	9	74	3.3	1	45	42	42
	10	70	3.3	2	52	49	46
	11	78	8.3	5	173	164	161
	12	72	13.3	10	298	283	278
	13	86	10.0	9	304	291	282
	14	90	13.3	14	484	465	425
	15	93	10.0	12	420	404	344
	16	86	13.3	19	584	562	552
	17	110	11.7	18	711	689	642
	18	70	5.0	9	221	211	178
	19	92	3.3	7	206	199	126
	20	83	6.7	15	407	391	252
	21	89	3.3	8	235	226	162
	22	89	1.7	4	126	122	84
	24	91	1.7	5	144	139	88
	25	91	1.7	6	153	147	90
	27	92	1.7	7	171	164	91
PE summary:	15	92	120.0	154	4809	4575	3869
			Metrosideros polymorpha				
	2	29	3.3	0	0	0	0
MP summary:	2	29	3.3	0	1	0	0
			-- Type Level Summary --				
All trees:	14.5		256.0	294	9402	8967	7977
Merch trees:	14.8		245.0	292			

Appendix C (Continued).

Forest type MQ22: Low to moderate volume *Melaleuca quinquenervia* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Melaleuca quinquenervia				
	6	11	20.0	4	26	0	0
	9	21	10.0	5	37	30	29
	10	24	10.0	5	47	39	38
	12	31	20.0	16	159	140	111
	16	43	10.0	14	180	166	132
	17	45	10.0	15	202	187	147
	18	44	70.0	124	1605	1487	1185
	19	65	10.0	20	367	348	272
	20	52	5.0	11	157	147	113
	21	54	15.0	36	541	509	386
	24	55	10.0	31	463	436	284
	26	63	10.0	37	614	584	422
	28	70	5.0	22	397	379	272
	32	71	5.0	27	493	471	314
MQ summary:	18	60	210.0	366	5295	4930	3710
			Cupressus macrocarpa				
	8	22	10.0	4	39	33	30
	10	31	5.0	3	34	30	28
	11	36	5.0	3	49	45	42
CM summary:	9	27	20.0	10	123	109	101
			-- Type Level Summary --				
All trees:	17.3		230.0	376	5418	5039	3812
Merch trees:	18.0		210.0	372			

Appendix C (Continued).

Forest type CM22: Low to moderate volume *Cupressus macrocarpa* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Melaleuca quinquenervia				
	4	7	20.0	2	16	0	0
	16	43	5.0	7	92	85	79
MQ summary:	8	14	25.0	9	109	85	80
			Metrosideros polymorpha				
	2	24	20.0	0	4	0	0
	4	30	10.0	1	9	0	0
MP summary:	3	26	30.0	1	14	0	0
			Cupressus macrocarpa				
	4	30	10.0	1	9	0	0
	6	29	30.0	6	78	0	0
	7	35	15.0	4	61	0	0
	8	36	20.0	7	107	93	69
	9	37	20.0	9	136	121	89
	10	32	25.0	14	184	164	138
	11	32	20.0	13	175	157	146
	12	39	5.0	4	58	53	38
	13	40	10.0	9	136	124	89
	14	40	10.0	11	157	143	102
	15	41	15.0	18	266	242	171
	17	42	5.0	8	111	100	70
	18	42	5.0	9	124	112	77
	21	43	10.0	24	350	310	211
	23	44	5.0	14	214	189	127
CM summary:	12	42	205.0	151	2173	1815	1334
			-- Type Level Summary --				
All trees:	10.7		259.0	161	2296	1900	1413
Merch trees:	13.2		154.0	147			

Appendix C (Continued).

Forest type CM44: Moderate to high volume *Cupressus macrocarpa* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus robusta				
	10	90	10.0	6	148	135	135
	20	100	10.0	21	570	550	548
	21	101	10.0	25	665	643	641
ER summary:	18	97	30.0	52	1384	1329	1325
			Cupressus macrocarpa				
	8	95	10.0	3	127	114	91
	9	68	10.0	4	114	104	83
	11	71	10.0	7	168	157	121
	14	74	10.0	11	262	248	186
	19	78	10.0	20	435	412	294
	20	55	10.0	22	353	322	228
	32	85	10.0	56	1201	1132	711
CM summary:	18	73	70.0	123	2664	2493	1716
			-- Type Level Summary --				
All trees:	17.9		100.0	174	4047	3822	3041
Merch trees:	17.9		99.0	174			

Appendix C (Continued).

Forest type CM55: Moderate volume *Cupressus macrocarpa* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Metrosideros polymorpha				
	2	5	10.0	0	0	0	0
	4	8	15.0	1	12	0	0
MP summary:	3	6	25.0	2	13	0	0
			Cupressus macrocarpa				
	4	18	10.0	1	6	0	0
	6	29	25.0	5	64	0	0
	7	38	3.8	1	16	0	0
	8	44	3.8	1	23	20	14
	9	49	3.8	2	32	28	21
	10	73	10.0	5	146	135	132
	12	100	6.3	5	167	158	150
	13	64	3.8	3	76	71	50
	14	66	3.8	4	89	84	59
	15	69	3.8	5	102	96	68
	16	71	2.5	3	77	73	52
	17	57	3.8	6	104	97	72
	18	70	10.0	18	364	342	202
	19	77	7.5	15	323	305	215
	21	80	8.8	21	455	429	302
	22	82	7.5	20	426	401	282
	23	126	2.5	7	225	216	211
	25	86	2.5	9	185	174	122
	27	88	2.5	10	220	207	147
	29	90	5.0	23	518	490	293
	30	90	2.5	12	278	263	186
	31	91	2.5	13	299	283	200
	32	75	5.0	28	547	512	169
	33	93	3.8	22	516	489	346
	34	93	3.8	24	551	523	370
	39	96	2.5	21	496	472	334
	51	67	3.8	53	1053	999	550
	55	104	3.8	62	2900	2844	1462
CM summary:	22	90	153.8	399	10269	9725	6021
			-- Type Level Summary --				
All trees:	20.3		178.0	400	10282	9725	6021
Merch trees:	25.0		115.0	392			

Appendix C (Continued).

Forest type CJ22: Low to moderate volume *Cryptomeria japonica* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3) Gross	Volume (ft3) Merch	Volume (ft3) Net
			Eucalyptus robusta				
	7	51	10.0	3	38	0	0
	14	78	10.0	11	233	220	219
	34	100	10.0	63	1533	1484	1479
	47	104	10.0	123	2819	2721	2709
ER summary:	30	83	40.0	199	4624	4426	4409
			Metrosideros polymorpha				
	2	14	40.0	1	6	0	0
MP summary:	2	14	40.0	1	6	0	0
			Cryptomeria japonica				
	2	14	40.0	1	6	0	0
	4	23	80.0	7	59	0	0
	6	30	40.0	8	108	0	0
	7	33	30.0	9	130	0	0
	8	38	30.0	11	172	151	151
	9	37	10.0	5	69	62	57
	10	41	30.0	16	267	242	208
	11	43	10.0	7	110	101	87
	12	45	10.0	8	132	122	105
	13	46	10.0	9	147	135	116
	15	50	20.0	25	420	388	206
	29	65	10.0	46	810	748	731
CJ summary:	9	53	320.0	150	2436	1952	1666
			-- Type Level Summary --				
All trees:	12.7		399.0	350	7067	6379	6074
Merch trees:	19.2		159.0	322			

Appendix C (Continued).

Forest type PR00: Recent *Pinus radiata* plantings/sapling stands.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus robusta				
	7	26	5.0	1	9	0	0
ER summary:	7	26	5.0	1	10	0	0
			Pinus radiata				
	2	7	580.0	13	123	0	0
	4	15	370.0	32	243	0	0
	6	21	20.0	4	42	0	0
PR summary:	3	18	970.0	49	410	0	0
			-- Type Level Summary --				
All trees:	3.1		974.0	50	420	0	0
Merch trees:	0.0		0.0	0			

Forest type EA22: Low to moderate volume *Eucalyptus crebra* saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Eucalyptus crebra				
	2	20	180.0	4	31	0	0
	4	29	60.0	5	52	0	0
	6	35	40.0	8	94	0	0
	7	35	30.0	8	98	0	0
	11	44	10.0	7	97	88	85
EA summary:	4	37	320.0	32	374	88	85
			Cupressus macrocarpa				
	4	19	60.0	5	38	0	0
	6	26	10.0	2	24	0	0
	7	25	10.0	3	31	0	0
	8	28	20.0	7	90	78	72
	9	30	10.0	4	58	51	47
	10	32	10.0	6	78	70	64
	12	35	10.0	8	109	98	90
CM summary:	7	31	130.0	35	432	299	274
			Pinus elliottii				
	2	20	60.0	1	10	0	0
	4	29	20.0	2	17	0	0
PE summary:	3	25	80.0	3	28	0	0
			-- Type Level Summary --				
All trees:	4.9		529.0	70	834	387	359
Merch trees:	9.9		60.0	32			

Appendix C (Continued).

Forest type FU11: Low volume *Fraxinus uhdei* pole and saw timber.

	DBH (in)	Average Height (ft)	Values per acre: Number of Trees	Basal Area	Volume (ft3): Gross	Merch	Net
			Fraxinus uhdei				
	2	8	240.0	5	42	0	0
	4	25	260.0	23	230	0	0
	6	40	70.0	14	204	0	0
	7	47	20.0	5	92	0	0
	11	68	10.0	7	157	145	138
FU summary:	4	50	600.0	54	727	146	139
			Pinus elliottii				
	10	58	10.0	5	132	123	122
	14	71	20.0	21	585	558	556
	15	73	10.0	12	339	325	323
	16	76	20.0	28	780	748	743
	17	78	10.0	16	443	425	422
	20	83	10.0	22	613	590	584
	23	87	10.0	29	791	761	752
PE summary:	16	81	90.0	133	3686	3535	3504
			-- Type Level Summary --				
All trees:	7.1		690.0	187	4414	3681	3643
Merch trees:	16.0		99.0	140			