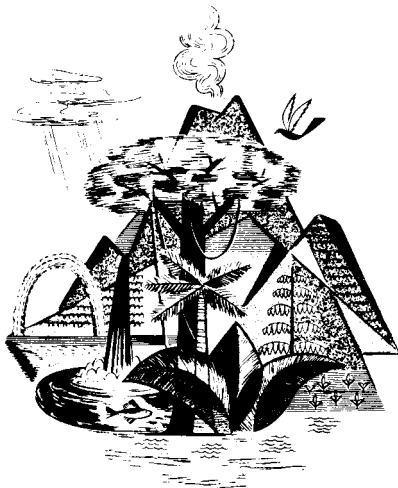


Markets for Hawaii Hardwood Lumber in New Single-Family Houses on Oahu, Hawaii

John D. Zinnikas

R. Sidney Boone



U.S. FOREST SERVICE RESEARCH PAPER PSW-41

1967

Pacific Southwest Forest and Range Experiment Station

P.O. Box 245, Berkeley, California

94701

Zinnikas, John D., and Boone, R. Sidney

1967. **Market for Hawaii hardwood lumber in new single-family houses on Oahu, Hawaii.** Berkeley, Calif., Pacific SW. Forest & Range Exp. Sta. 10 pp., illus. (U. S. Forest Serv. Res. Paper PSW-41)

The total potential market for flooring, siding, and cabinet and millwork in new single-family houses on Oahu was between 10¹/₂ and 11 million board feet of lumber in 1963. The total possible market for lumber in new single-family house construction from 1965 to 1970 is estimated at 18 to 23 million square feet of flooring, 28 to 36 million square feet of siding, and 7 to 9¹/₂ million square feet in cabinets.

Oxford: (969):717:833.1

Retrieval Terms: Hawaii; home construction; timber products; lumber; hardwood; flooring; siding markets; market trends.

Zinnikas, John D., and Boone, R. Sidney

1967. **Market for Hawaii hardwood lumber in new single-family houses on Oahu, Hawaii.** Berkeley, Calif., Pacific SW. Forest & Range Exp. Sta. 10 pp., illus. (U. S. Forest Serv. Res. Paper PSW-41)

The total potential market for flooring, siding, and cabinet and millwork in new single-family houses on Oahu was between 10¹/₂ and 11 million board feet of lumber in 1963. The total possible market for lumber in new single-family house construction from 1965 to 1970 is estimated at 18 to 23 million square feet of flooring, 28 to 36 million square feet of siding, and 7 to 9¹/₂ million square feet in cabinets.

Oxford: (969):717:833.1

Retrieval Terms: Hawaii; home construction; timber products; lumber; hardwood; flooring; siding markets; market trends.

Contents

	<i>Page</i>
Single-Family Housing Construction -----	1
Flooring Market -----	2
House Siding Market -----	2
Kitchen Cabinet Market -----	3
Projection of Lumber Demand to 1970 -----	3
Market for Hawaii Hardwoods -----	4
Appendix -----	5

U.S. Forest Service research in Hawaii
is conducted in cooperation with
Division of Forestry
Hawaii Department of Land and Natural Resources

The Authors

JOHN D. ZINNIKAS was formerly with the Station's forest products marketing research staff, at Berkeley. Native of Wyandotte, Mich., he attended the University of Detroit, where he earned a bachelor's degree in accounting (1960) and a master's degree in economics (1962). He is now with the regional economics analysis group, Kaiser Permanente Services, Oakland, Calif. **R. SIDNEY BOONE** served on the Station's research staff in Hawaii from 1964 until 1967. Headquartered in Honolulu, he studied the uses, properties, and processing of forest products. He is now with the Institute of Tropical Forestry, Rio Piedras, P.R. A native of Paris, Tenn., he is a 1959 forestry graduate of Louisiana State University, and earned a master's degree in wood utilization at Duke University (1960).

Acknowledgments

We wish to acknowledge the cooperation of the Honolulu office, U.S. Federal Housing Administration; Mrs. Nancy C. Fowler, Hawaii Department of Planning and Economic Development; and Roy Imamura, Planning Department, City and County of Honolulu, Hawaii, in providing some of the data reported in this study. Many building contractors also contributed important information.

Continued development of Hawaii's timber products industry depends upon identifying markets for those species of wood that are and can be grown in the State. Residential construction provides the major market in Hawaii for both softwood and hardwood lumber, plywood, and other wood products. If Hawaii-grown hardwood timber can penetrate this important market, continued expansion and development of the local industry should follow. An important prerequisite is to have information about the potential size of the market.

This paper reports on a study of the potential market for hardwood lumber and wood products which might be produced in Hawaii for use as residential flooring, house siding, and millwork and cabinets on Oahu. It provides estimates of the total potential volume of lumber and wood products which could have been used in flooring, siding, and interior millwork and cabinets for 1962 and 1963. The total potential volume is projected for lumber and wood products in each of these uses. And some characteristics of Hawaii hardwoods and their ability to replace presently used species are discussed.

Single-Family Housing Construction

The State of Hawaii is characterized by a heavy concentration of people and economic activity on the Island of Oahu. According to the Bank of Hawaii, "with less than one-tenth of the land area of the State, Oahu contains over four-fifths of its population and represents nearly nine-tenths of retail sales, construction, and personal income.² Therefore, an investigation of the residential construction market on Oahu would cover a major portion of the total demand for housing and lumber in the State (*table 1*).

Single-family building permit records for calendar years 1962 and 1963 were obtained from the City and County of Honolulu. From this information the number of permits issued classified by house square footage and the total square feet of living area were determined (*table 3, Appendix B*).

¹ For the purposes of this paper, the terms "City and County of Honolulu" and "Island of Oahu" are used interchangeably.

² Department of Business Research, Bank of Hawaii Annual Economic Report. p. 9. 1964.

Table 1. --Single-family dwelling construction, 1960-1964, determined by building permit

Year	State	Oahu	On Oahu
	<i>Percent</i>		
1960	4,867	4,189	86.1
1961	4,113	3,412	82.9
1962	4,448	3,654	82.1
1963	4,321	3,352	77.6
1964	4,551	3,671	80.7

Source: Redevelopment and Housing Research, Honolulu Redevelopment Agency, July 1965, p.6.

Also examined were plans and blueprints of houses insured by the U.S. Federal Housing Administration in 1962-63. From these plans we obtained detailed data on the amount of wood used in flooring, siding, and cabinet and millwork in various sizes and designs of houses.

Using these two sources of data, estimates were made of the total possible market for flooring,

siding, and cabinet and millwork for 1962 and 1963 (*tables 4 to 7, Appendix B*). Also estimated was the total possible market for lumber in single-family house construction for these uses for the period 1965-70.

In 1962, builders put up 3,422 single-family units on Oahu, representing almost 3.8 million square feet of living area. In 1963, there were 3,164 units built consisting of 3.5 million square feet (*table 3, Appendix B*).³

Flooring Market

An estimate of the total potential market for hardwood flooring on Oahu can be derived by reducing the total square feet of living area by the estimated area of bathrooms and kitchens. After adjusting for kitchens and baths, the total potential market on Oahu for wood flooring is about 3 million square feet (*table 4, Appendix B*). When a 25-percent allowance is made for scraps and tongue and groove overlap, this market probably represents a potential of about 3.75 million board feet of hardwood lumber.

It should be recognized that this estimate is of the total possible market. The use today of many substitutes for wood flooring indicates that the market share for wood is less than the total possible flooring market.

Federal Housing Administration data indicate that about 85 percent of the homes built on Oahu in the past 3 to 5 years have used a concrete slab-type foundation.⁴ The principal floor covering in these homes has been asphalt or vinyl tile. Wood flooring can be installed on concrete slab foundations--a common practice in some parts of the mainland--but this is not now being done in Hawaii. A primary reason probably is the in-place price differential. With present construction prac-

tices and the high cost of imported hardwoods, wood is more expensive than tile. In addition, there has been some concern over termite damage.

It is estimated that 95 percent of the homes built in Hilo (County of Hawaii) have crawl space foundation and wood flooring. There were 418 building permits issued in 1963 by the County of Hawaii for single-family dwellings, and 428 in 1964. Using the median calculated living area for FHA houses in Hawaii (1,041 square feet), this number of dwelling units represents about 435,000 square feet of living area in 1963 and 445,500 square feet in 1964.

These estimates indicate that more new houses are built with wood floors in Hilo than in the City and County of Honolulu. In Honolulu, most houses with wood floors are the larger custom-built houses rather than tract homes.

The difference in type of construction seems attributable to two factors: (a) it has been the custom, in Hilo, to build crawl space foundations up to heights of 7 or 8 feet and (b) most homes there are built as individual units rather than as tract homes, whereas most homes on Oahu are tract developments.

House Siding Market

An even larger and perhaps more attainable outlet for Hawaii hardwoods is the house siding market. The most common type of house in Hawaii is of single wall construction, with wood siding providing both inner and outer wall area. The

material generally used for this vertically oriented siding is clear, all-heart redwood in 1- by 8-inch tongue and groove boards.⁵

In 1964, the FHA reported 85.7 percent of the new single family dwellings in Hawaii had wood siding.⁶ The estimated siding market amounted to

³ Discrepancies in data between table 1 and table 3 (Appendix B) are due to differences in collection procedures.

⁴ Data for states and selected areas-1964. Federal Housing Administration, Division of Research and Statistics. Washington, D.C. 1964.

⁵ Sharp, William. *Comparison of residential construction costs in Hawaii and on the mainland*. College of Business Administration, University of Hawaii. p. 36. May 1963.

⁶ Federal Housing Administration, *op. cit.*

4.8 million square feet in 1962, and 4.4 million square feet in 1963 (*table 5, Appendix B*). Allowing 25 percent increase for tongue and groove, and overlap and scrap, the present house siding market represents nearly 6 million board feet of lumber annually.

On the basis of individual units, it is estimated that a 1,000-square-foot house requires 1,688 board feet of siding, a 1,500-square-foot house requires 2,216 board feet, and a 2,000-square-foot house uses 2,722 board feet of siding.

Two other housing studies provide estimates that add some perspective to the ones already cited. The Stanford Research Institute⁷ estimated that about 3,000 board feet of siding was required for a 1,000 square foot house in Hawaii in 1963. In a study of lumber requirements for housing in California, Vaux used sampling and regression techniques for estimating wood siding required for

frame dwellings.⁸ He estimated that siding for a house in the 1,000 to 1,099 class required 958 board feet; in the 1,500 to 1,599 class house, 1,270 board feet of siding; and in the 2,000 to 2,099 class house, 1,581 board feet.⁹

Vaux does not report whether he allowed for a wastage factor in his calculations. If not, this would tend to understate his estimate. The estimates made in this study fall between those of Vaux and of the Stanford Research Institute and include a wastage estimate.

Interior partitions in the single-wall houses are usually of the same material as the siding, i.e., 1-by 8-inch tongue and groove redwood. In the FHA blueprints examined, each house averaged 94 lineal feet of partition, ranging from 75 to 120 lineal feet. While partitions are not included in the estimates on siding, they must be considered as a potential use of siding material.

Kitchen Cabinet Market

Kitchen cabinets require large amounts of lumber and appear to be a reasonable outlet for Hawaii hardwood lumber. The total potential market is estimated to be between 1 and 1¼ million board feet annually, about two-thirds in base cabinets and one-third in wall cabinets (*table 6, Appendix B*). Since no adjustment was made for wastage, these estimates are understated. Several U.S. mainland cabinet makers have estimated that a 15- to

25-percent allowance should be made for wastage.

The estimates were made with the assumption that the entire cabinet--sides, drawers, doors, framing, etc.--was made of lumber. This is an unrealistic assumption because an important market for plywood and particle board is in counter tops, shelves, drawers, and door fronts. To this extent these estimates are overstated.

Projection of Lumber Demand to 1970

Between 1965 and 1970, an estimated 20,000 to 26,000 new houses are expected to be constructed in Hawaii.¹⁰ Using this forecast, it is possible to estimate the potential market for lumber

in flooring, siding, and cabinets (*table 2, Appendix B*).

The estimate is based on the assumption that the proportion of houses in each size class in 1963 will not change. Table 2 does not adjust for overlap in tongue and groove flooring and siding, nor for wastage. The adjustment factors, e.g., 889,000 square feet per house were developed from *tables 4-6 (Appendix B)*. For example, the 2.8 million square feet of flooring developed in table 4 was divided by the number of new house permits issued in 1963 to obtain the average square feet of floor area per house. *Tables 3-6 (Appendix B)* are presented in such a manner that the reader can develop his own forecast under chosen assumptions concerning the size distribution of houses and the amount of wood estimated in construction.

⁷ Cited in Sharp, *op. cit.* p. 37.

⁸ Vaux, Henry J. *An economic-statistical analysis of lumber requirements for California housing*. Hilgardia. p. 484. March 1950.

⁹ The mid-point of each class was used as the permit area in Vaux's equation: MBF of wood siding/structure = $0.304 + 0.623$ (M sq. ft. total permit area); $R = 0.810$; $SYXK = 0.241$ (standard error of the estimate); $GB = 0.0921$ (standard error of regression coefficient).

¹⁰ Zinnikas, John D., and Boone, R. Sidney. *Requirements for new housing in Hawaii, 1965-1970 . . . a forecast*. U.S. Forest Serv. Res. Paper PSW-40. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 6 pp., illus. 1967.

Market for Hawaii Hardwoods

Frazier has made long-range predictions of hardwood and softwood lumber demand in Hawaii's economy. He forecast that, by the year 2000, hardwood consumption will have increased $2\frac{1}{2}$ times over that in 1965. The estimates were based on the assumption that present consumer tastes and preferences would undergo no radical change. In assessing the growth in consumption, Frazier concludes that

At the present time Hawaii's forest products industry provides about one-sixth of the hardwood lumber requirements of the State. If the industry only maintains its present share of the market, it will necessitate a growth of over $2\frac{1}{2}$ times its present size of about one million board feet per year. There is no reason to assume that the industry could not undergo even greater growth and develop into a major supplier of Hawaii's hardwood lumber needs.¹¹

Entry into the potential markets described in this paper indicates that it is possible to go beyond Frazier's estimates by a large margin. This paper is concerned with estimates of the potential markets for certain lumber products used in new home construction. These products are flooring, siding, cabinets; all three represent potential markets for Hawaii produced hardwoods at the present time.

In assessing the extent to which the lumber industry in Hawaii can share in these markets, an analysis of the species composition of existing hardwoods must be made. The acceptability of locally grown timber depends upon the characteristics inherent in the wood related to its use, the availability of a continuing supply to satisfy con-

sumer demands, and the production costs of Hawaii lumber compared to imports F.O.B. Hawaii.

The siding market appears to offer the best potential outlet for Hawaii hardwoods. Since most houses have a siding exterior and the demand for new houses is expected to be a continuing one, a large and relatively stable demand exists for wood siding. For Hawaii-grown woods to penetrate this market, they will have to compete successfully in both price and quality with imported species. One locally grown species--robusta eucalyptus (*Eucalyptus robusta*)--has many of the characteristics necessary to compete in the siding market. It is heavier and stronger than redwood (*Sequoia sempervirens*) and compares favorably in durability and appearance. There also are enough stands of maturing robusta eucalyptus to satisfy an expected continuing demand. Locally grown woods have one advantage in that the shipping cost is much less than for imports from the mainland. If Hawaii hardwoods can compete in price, then they should be able to capture a portion of the siding market.

As a beginning step, an analysis was made of the species composition or mix in the Hawaii hardwood lumber market (table 8, Appendix B). The results suggest that wood utilization is broadening among many different species, implying the acceptance of new and different hardwood varieties in the market. Noteworthy is the important change in the "other" category. This classification includes such imported species as teak, Japanese ash, and maple. It also includes the more common mainland hardwoods, such as ash, alder, and walnut. This trend is significant, since a continuing broadening of species lines would indicate a favorable outlet for some of Hawaii's introduced hardwood species.

¹¹ Frazier, George D. *The estimated demand for lumber and plywood in Hawaii by the year 2000*. U.S. Forest Serv. Res. Paper PSW-23. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. p. 8. 1965.

Appendix

A. Calculation of number of board feet of lumber per linear foot of kitchen cabinet

Minimum requirements of the Federal Housing Administration for single family houses in Hawaii specify that shelving must be 11 to 12 inches deep, base cabinets 22 to 24 inches deep (fig. 1). The linear feet of cabinets, shelving, and drawer space varies by the number of bedrooms in the house. In

the typical kitchen that meets FHA minimum standards there are $9\frac{1}{2}$ linear feet of wall cabinets and 10 linear feet of base cabinets. From this diagram in fig. 1, the number of surface feet can be calculated. Under the assumption that lumber of 1-inch thickness is used, the calculated surface feet is equivalent to board feet.

Calculations:

Wall cabinets		Base cabinets		(3) drawers		(5) backs of drawers	
(1) shelving		(1) shelving					
$2 \times 6 = 12$		$4 \times 2 = 8$		$3 \times 2 = 6$		$6 \times 1 = 6$	
$2.5 \times 2 = 5$		$5 \times 1 = 5$		$4 \times 4 = 16$		$1.5 \times 1 = 1.5$	
$3 \times 3 = 9$		$6 \times 3 = 18$				$1.25 \times 1 = 1.25$	
	26 sq. ft.		31 sq. ft.		22 sq. ft.		8.75 sq. ft.
(2) sides of cabinets		(2) counter top		(4) sides of drawers		(6) front area	
$3.5 \times 6 = 21$ sq. ft.		$4 \times 2 = 8$		$6 \times 2 = 12$		$6 \times 2 = 12$	
(3) doors		$6 \times 1 = 6$		$1 \times 6 = 6$		$1.25 \times 1 = 1.25$	
$7 \times 2 = 14$			14 sq. ft.		18 sq. ft.	$9 \times 2 = 18$	
$10.5 \times 1 = 10.5$							31.25 sq. ft.
$5 \times 1 = 5$							
	29.5 sq. ft.					(7) sides of cabinets	
Total =	76.5 sq. ft.					$6 \times 5 = 30$ sq. ft.	
						Total =	156 sq. ft.

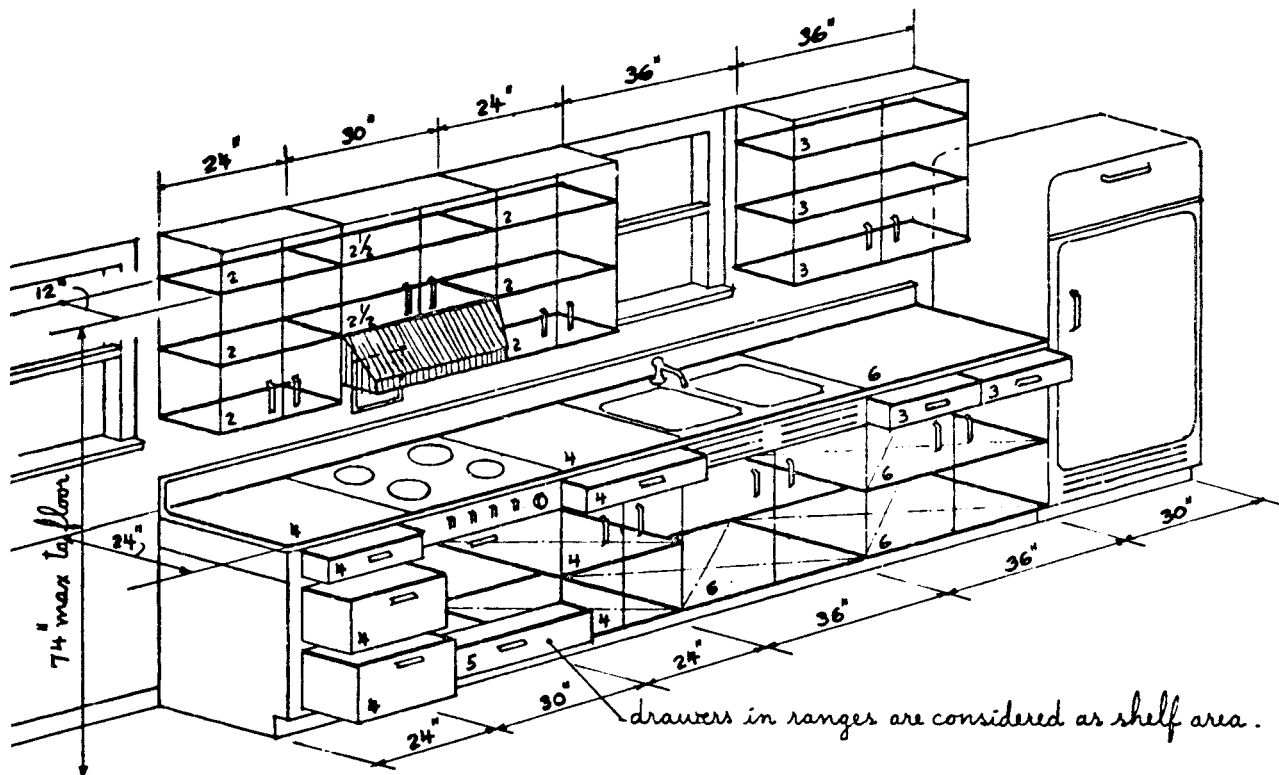


Figure 1. -- Typical kitchen that meets minimum standards of the
Federal Housing Administration for one and two living units.

B. Tables

Table 2.--*Estimated total possible market for lumber in single family house construction, 1965-70*

Estimated number of houses	Wood flooring ¹	Siding ²	Cabinets ³
	----M sq. ft.-----		M bd. ft.
Lower prediction: 20,000	17,780	27,920	7,320
Upper prediction: 26,000	23,114	36,296	9,516

¹889 square feet per house.

²1,396 square feet per house.

³366 board feet per house.

Table 3.--*Permits issued for single-family houses, by house area, in city and county of Honolulu, 1962 and 1963*

Area of house (sq. ft.)	1962		1963	
	Permits ¹	Total Living area ²	Permits ¹	Total Living area ²
	No.	Sq. ft.	No.	Sq. ft.
500- 599	80	46,248	156	87,885
600- 699	229	148,761	290	187,707
700- 799	284	212,814	275	208,809
800- 899	389	333,408	256	217,229
900- 999	620	586,140	351	331,151
1,000-1,099	399	417,209	309	324,986
1,100-1,199	331	379,963	407	462,539
1,200-1,299	288	362,060	336	422,196
1,300-1,399	193	260,407	184	247,961
1,400-1,499	218	317,815	201	292,740
1,500-1,599	103	159,332	91	140,499
1,600-1,699	78	128,315	75	123,649
1,700-1,799	52	90,610	67	117,044
1,800-1,899	38	70,321	43	79,383
1,900-1,999	29	56,390	30	58,326
2,000-2,099	33	67,811	22	45,144
2,100-2,199	14	30,091	20	42,743
2,200-2,299	11	24,660	9	20,073
2,300-2,399	5	11,712	11	25,811
2,400-2,499	2	4,956	5	12,267
2,500 or more	26	79,979	26	81,363
Total	3,422	3,789,002	3,164	3,529,505

¹ In 1962, 71 permits were issued for houses less than 500 square feet. The total area covered by these permits, amounting to 20,196 square feet, was not included in the classification. In 1963, 84 similar permits totaling 31,005 square feet were also not included.

² The city and county building permit area has been adjusted to reflect 'inside' living area of each house. Since the city and county data included the area of carports and lanais, these items were eliminated to show actual living area of the housed.

Table 4. --*Estimate of total possible market for wood flooring in new single-family houses, in city and county of Honolulu, 1962 and 1963*

Area of house (sq. ft.)	1962			1963		
	Total area of housing	Adjustment for kitch en and bath ¹	Total area available for wood flooring	Total area of housing	Adjustment for kitch en and bath ¹	Total area available for wood flooring
	----- Sq. ft. -----					
500- 599	46,248	14,000	32,248	87,885	27,300	60,585
600- 699	148,761	14,220	107,541	187,707	52,200	135,507
700- 799	212,814	52,540	190,274	208,809	50,875	157,934
800- 899	333,408	71,965	261,443	217,229	47,360	169,869
900- 999	586,140	117,800	468,340	331,151	66,690	264,461
1,000-1,099	417,209	79,800	337,409	324,986	61,800	263,186
1,100-1,199	379,963	76,130	303,833	462,539	93,610	368,929
1,200-1,299	362,060	73,440	288,620	422,196	85,680	336,516
1,300-1,399	260,407	53,075	207,332	247,961	50,600	197,361
1,400-1,499	317,815	65,400	252,415	292,740	60,300	232,440
1,500-1,599	159,332	30,900	128,432	140,499	27,300	113,199
1,600-1,699	128,315	23,400	104,915	123,649	22,500	101,149
1,700-1,799	90,610	15,600	75,010	117,044	20,100	96,944
1,800-1,899	70,321	11,400	58,921	79,383	12,900	66,483
1,900-1,999	56,390	8,700	47,690	58,326	9,000	46,326
2,000-2,099	67,811	9,900	57,911	45,144	6,600	38,544
2,100-2,199	30,091	4,200	25,891	42,743	6,000	36,743
2,200-2,299	24,660	3,300	21,360	20,073	2,700	17,373
2,300-2,399	11,712	1,500	10,212	25,811	3,300	22,511
2,400-2,499	4,956	600	4,356	12,267	1,500	10,767
2,500 or more	79,979	7,800	72,179	81,363	7,800	73,563
Total	3,789,002	--	3,026,332	3,529,505	--	2,813,390

¹ Kitchen and bath adjustment developed by averaging area of kitchens and baths computed from blueprints filed with FHA homes in the above size classifications. Lowest two classes (500 and 600 square feet) are estimates, as are houses larger than 1,700 square feet; these comprised only about 15 percent of the total.

Adjustment was separately computed for each class based on measurements taken from model house blueprints filed with FHA corresponding to that particular class. An average was then computed for each class of house. Total adjustment in square feet for each class is product of number of permits issued in that class and the adjustment factor.

Table 5.--*Estimate of total possible market for wood siding in new single-family houses, city and county of Honolulu, 1962 and 1963*¹

Area of house (sq. ft.)	1962	1963
	----- Sq. ft. -----	
500- 599	71,280	138,996
600- 699	226,710	287,100
700- 799	306,720	297,000
800- 899	455,130	299,520
900- 999	781,200	442,260
1,000-1,099	538,650	417,150
1,100-1,199	476,640	586,080
1,200-1,299	440,640	514,080
1,300-1,399	310,923	296,424
1,400-1,499	368,856	340,092
1,500-1,599	182,619	161,343
1,600-1,699	144,612	139,050
1,700-1,799	100,620	129,645
1,800-1,899	76,950	87,075
1,900-1,999	61,074	63,180
2,000-2,099	71,874	47,916
2,100-2,199	31,626	45,180
2,200-2,299	25,740	21,060
2,300-2,399	12,105	26,631
2,400-2,499	5,004	12,510
2,500 or more	66,924	66,924
Total	4,755,897	4,419,216

¹Computed as product of number of houses constructed in a class times an average computed perimeter for a house in that class times an average height of 9 feet for all houses. Where FHA plans were available (85 percent of the time), perimeters were scaled from plans, giving consideration to glass door walls and windows (carports, garages, and lanais not included.) For classes where FHA plans were unavailable, an estimate was made of the perimeter available for siding; estimated perimeter computed as average of a minimum perimeter = four times the square root of class midpoint and a maximum perimeter. Maximum perimeter = 2(L + W) where a minimum width of 15 feet is assumed and area is given as midpoint of class (thus L = area/15).

Table 6.--*Estimate of total possible market for kitchen wood cabinet, in new single-family houses, in city and county of Honolulu, 1962*

Area of house (sq. ft.)	Base cabinets		Wall cabinets		Total market
	Linear feet ¹	Board feet ²	Linear feet ¹	Board feet ²	Board feet ²
500- 599	1,040	1.6.120	800	7.128	23.352
600- 699	2,977	46.144	2,519	20.404	66.845
700- 799	3,692	57.226	3,124	25.304	82.899
800- 899	5,057	78.384	4,279	34.660	113.549
900- 999	8,060	124.930	9,920	80.351	206.090
1,000-1,099	6,384	98.952	6,384	51.710	151.300
1,100-1,199	5,958	92.349	5,627	45.579	138.524
1,200-1,299	5,184	80.352	4,896	39.658	120.528
1,300-1,399	3,474	53.847	3,281	26.576	80.770
1,400-1,499	3,924	60.822	3,706	30.019	91.233
1,500-1,599	1,854	28.737	1,751	14.183	43.105
1,600-1,699	1,404	21.762	1,326	10.741	32.643
1,700-1,799	936	14.508	884	7.160	21.762
1,800-1,899	684	10.602	646	5.233	15.903
1,900-1,999	522	8.091	493	3.993	12.136
2,000-2,099	594	9.207	561	4.544	13.810
2,100-2,199	252	3.906	238	1.928	5.859
2,200-2,299	198	3.069	187	1.515	4.604
2,300-2,399	90	1.395	85	689	2.093
2,400-2,499	36	558	34	275	837
2,500 or more	468	7,254	442	3,580	10,881
Total	52,788	818,215	51,263	415,230	1,238,723

¹ Obtained by multiplying number of permits issued in each class by average linear feet of kitchen cabinets for houses in that particular size class. Linear feet estimates were obtained from FHA blueprints of houses in size classes up to 1,700 square feet. For houses greater than 1,700 square feet, linear feet of kitchen cabinets is established at a constant 18 feet.

² Scaled from a model cabinet meeting FHA standards for houses in Hawaii (see appendix A). For wall cabinets there were 8.1 board feet per linear foot, and for base cabinets 15.5 board feet; no allowance made for wastage. Estimates from individual cabinet makers ranged from 15 to 25 percent of lumber used.

Table 7.--*Estimate of total possible market for kitchen wood cabinet, in new single-family houses, in city and county of Honolulu, 1963*

Area of house (sq. ft.)	Base cabinets		Wall cabinets		Total market
	<i>Linear feet¹</i>	<i>Board feet²</i>	<i>Linear feet¹</i>	<i>Board feet²</i>	<i>Board feet²</i>
500- 599	2,028	31,434	1,716	13,900	45,537
600- 699	3,770	58,435	3,190	25,839	84,651
700- 799	3,575	55,413	3,025	24,503	80,273
800- 899	3,328	51,584	2,816	22,810	74,727
900- 999	4,563	70,727	5,616	45,490	116,673
1,000-1,099	4,944	76,632	4,944	40,046	117,172
1,100-1,199	7,326	113,553	6,919	56,042	170,326
1,200-1,299	6,048	93,744	5,712	46,267	140,616
1,300-1,399	3,312	51,336	3,128	25,337	77,004
1,400-1,499	3,618	56,079	3,417	27,678	84,119
1,500-1,599	1,638	25,389	1,547	12,531	38,084
1,600-1,699	1,350	20,925	1,275	10,328	31,388
1,700-1,799	1,206	18,693	1,139	9,226	28,040
1,800-1,899	774	11,997	731	5,921	17,995
1,900-1,999	540	8,370	510	4,131	12,555
2,000-2,099	396	6,138	374	3,029	9,207
2,100-2,199	360	5,580	340	2,754	8,370
2,200-2,299	162	2,511	153	1,239	3,766
2,300-2,399	198	3,069	187	1,515	4,604
2,400-2,499	90	1,395	85	689	2,093
2,500 or more	468	7,254	442	3,580	10,881
Total	49,694	770,258	47,266	382,855	1,158,081

¹Obtained by multiplying number of permits issued in each class by average linear feet of kitchen cabinets for houses in that particular size class. Linear feet estimates were obtained from FHA blueprints of houses in size classes up to 1,700 square feet. For houses greater than 1,700 square feet, linear feet of kitchen cabinets is established at a constant 18 feet.

²Scaled from a model cabinet meeting FHA standards for houses in Hawaii (see appendix A). For wall cabinets there were 8.1 board feet per linear foot, and for base cabinets 15.5 board feet; no allowance made for wastage. Estimates from individual cabinet makers ranged from 15 to 25 percent of lumber used

Table 8.--*Hardwood lumber consumption in the State of Hawaii, 1951-61¹, by species*

Year	Phillipine mahogany	Oaks	Koa	Other
	-----Percent-----			
1951	76	3	20	1
1952	77	5	17	1
1953	81	4	14	1
1954	81	7	11	1
1955	73	16	9	2
1956	57	30	9	4
1957	53	34	10	3
1958	55	29	11	5
1959	56	21	13	10
1960	54	15	16	15
1961	45	13	19	23

¹Lucas, Ernesto dela Cruz. *Evaluation of market data as a guide for forest development in Hawaii*. 1963. (Unpublished master's thesis on file, Graduate School, Univ. of Hawaii, Honolulu, Hawaii.)