

REGIONAL PALLET PRODUCTION IN THE UNITED STATES, 1985^{1/}

Dwight R. McCurdy, James T. Ewers, John H. Burde III,
Fan H. Kung, and David B. McKeever^{2/}

Abstract.--The Department of Forestry, Southern Illinois University at Carbondale conducted two studies on the United States pallet industry in 1985. The first study looked at the volume and species of lumber used in pallet production. The second study investigated characteristics of the 2,340 known firms manufacturing pallets in 1985.

The data, stratified by the four Bureau of Census Divisions, indicated that neither the pallet industry nor their products are homogeneous throughout the United States.

In total, 450 million pallets were produced in the United States during 1985. The South Bureau of Census Region was responsible for manufacturing the greatest percentage of these, 35 percent. On a per firm basis, however, the West Region averaged the highest daily production rate at 1,530 pallets.

Keywords: Lumber consumption, pallet, pallet manufacturers

INTRODUCTION

The pallet industry is one of the largest forest product industries in the United States, consuming more domestic hardwood lumber than all other U.S. industries combined. In addition, the demand for wooden pallets in the United States is constantly increasing. Therefore, information about the pallet industry is useful to persons involved in both the demand for pallets and the supply of wood being used in pallet production.

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^{2/}Professor, Researcher, Associate Professor, Professor, Department of Forestry, Southern Illinois University, Carbondale, Illinois and Research Forester, USDA, Forest Service, Forest Products Laboratory, Madison, Wisconsin.

In 1985, the Department of Forestry at Southern Illinois University surveyed all known pallet firms in the United States. Four hundred sixty-eight usable questionnaires were returned. The addresses were obtained from a list of 2,340 firms compiled by the U.S. Forest Service (Emanuel 1985). This study looked, primarily, at the characteristics of the firms manufacturing pallets. More specifically, data were collected on production information, raw material procurement practices and product marketing information.

A second study conducted by the Southern Illinois University Forestry Department looked at the lumber contained in the pallets manufactured in the U.S. during 1985. For this study, 113 pallet manufacturing firms located throughout the U.S. were visited and measurements were obtained on 478 assembled pallets.

METHODOLOGY

The study identifying characteristics of the pallet manufacturing firms utilized a mail questionnaire sent to all 2,340 known pallet manufacturers. This list, compiled by David Emanuel of the U.S. Forest Service, was obtained by merging lists of the National Wooden Pallet and Container Association, Thomas Registry, Dunn and Brad Street and various state directories. A second mailing to the non-respondents was sent several weeks later to improve the response rate. In total, 468 questionnaires comprised the data base.

The second study utilized a stratified sampling procedure. The same manufacturers' list (Emanuel 1985) served as the population base. The states were grouped into regional strata as defined by the U.S. Census Bureau (Figure 1).

The number of pallets to be sampled in each of the nine Census Divisions was determined according to the following formula:

$$N_i = (t * CV_i / DSE)$$

where N_i = the number of pallets to be sampled in the i th Bureau of Census Region.

t = t-value from the t-table.

CV_i = the coefficient of variation in pallet volume in the i th Bureau of Census Region (expressed as a percent).

DSE = the desired sampling error (expressed as a percent).

In practice, two (2) was used as the t-value for a 90 percent confidence level and five (5) for the arbitrary desired sampling error. The coefficient of variation for each strata was derived from the results of a similar study conducted in 1982 (McCurdy et al. 1984).

Having determined the number of sample pallets required for each division, the following procedure was used to identify the plants from which the sample pallets were obtained. Pallet

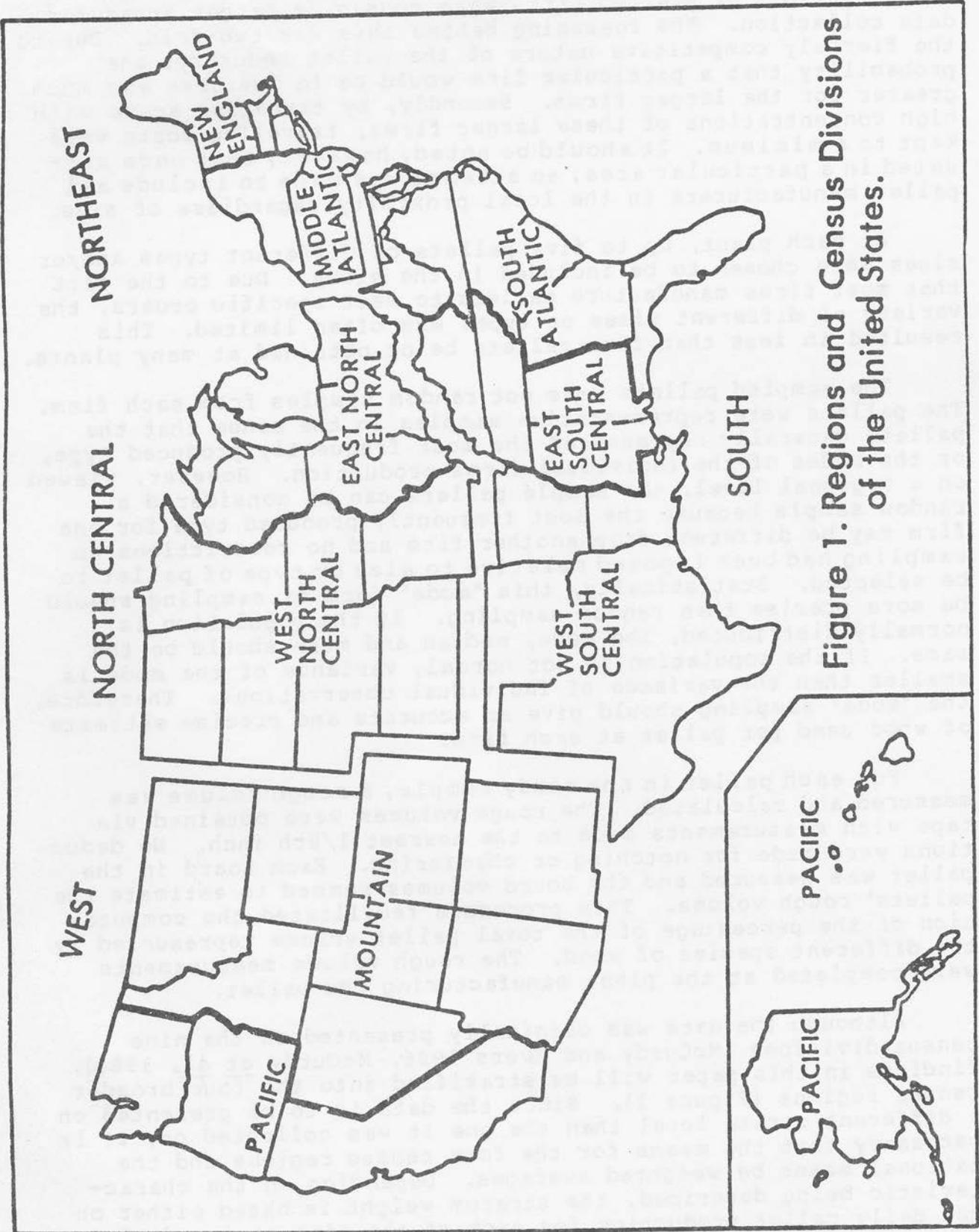


Figure 1. Regions and Census Divisions of the United States.

manufacturers that either employed more than 50 people or were members of the National Wooden Pallet and Container Association were plotted on a regional map. Areas with relatively high concentrations of plotted firms were chosen as target areas for data collection. The reasoning behind this was two-fold. Due to the fiercely competitive nature of the pallet industry, the probability that a particular firm would be in business was much greater for the larger firms. Secondly, by targeting areas with high concentrations of these larger firms, traveling costs were kept to a minimum. It should be noted, however, that once situated in a particular area, an attempt was made to include all pallet manufacturers in the local proximity regardless of size.

At each plant, up to five pallets of different types and/or sizes were chosen to be included in the study. Due to the fact that most firms manufacture pallets to meet specific orders, the variety of different sizes or types was often limited. This resulted in less than five pallets being obtained at many plants.

The sampled pallets were not random samples from each firm. The pallets were representative samples in the sense that the pallets generally represented the most frequently produced type, or the modes of the individual firms production. However, viewed on a regional level, the sample pallets can be considered a random sample because the most frequently produced type for one firm may be different from another firm and no restrictions on sampling had been imposed relative to size or type of pallet to be selected. Statistically, this "mode" form of sampling should be more precise than random sampling. If the population is normally distributed, the mode, median and mean should be the same. If the population is not normal, variance of the mode is smaller than the variance of individual observations. Therefore, the "mode" sampling should give an accurate and precise estimate of wood used per pallet at each firm.

For each pallet in the study sample, a rough volume was measured and calculated. The rough volumes were obtained via tape with measurements made to the nearest 1/8th inch. No deductions were made for notching or chamfering. Each board in the pallet was measured and the board volumes summed to estimate the pallets' rough volume. This procedure facilitated the computation of the percentage of the total pallet volume represented by the different species of wood. The rough volume measurements were completed at the plant manufacturing the pallet.

Although the data was originally presented on the nine census divisions (McCurdy and Ewers 1986, McCurdy *et al.* 1986), findings in this paper will be stratified into the four broader census regions (Figure 1). Since the data is to be presented on a different strata level than the one it was collected on, it is necessary that the means for the four census regions and the national means be weighted averages. Depending on the characteristic being described, the stratum weight is based either on the daily pallet production for each of the nine census divisions reported by the 468 firms responding to the mail questionnaire or

on the number of firms reported by the Forest Service to be in operation in each census division (Table 1).

Table 1. Weighting ratios for adjusting regional and national means.

Census Census	Regions & Divisions	Number of Firms Per Region	Firm Weighting Ratio	Avg. Daily Production Per Region (thousands)	Production Weighting Ratio
NORTH EAST		450	450/2340	260	260/1948
	New England	156	156/450	78	78/260
	Mid-Atlantic	294	294/450	182	182/260
NORTH CENTRAL		883	883/2340	611	611/1948
	East North Central	702	702/883	481	481/611
	West North Central	181	181/883	130	130/611
SOUTH		776	776/2340	723	723/1948
	South Atlantic	333	333/776	300	300/723
	East South Central	267	267/776	199	199/723
	West South Central	176	176/776	224	224/723
WEST		231	231/2340	354	354/1948
	Mountain	52	52/231	36	36/354
	Pacific	179	179/231	318	318/354

FINDINGS

Distribution of Firms

Pallets were manufactured in every state of the U.S. during 1985. However, more than two-thirds of the pallet manufacturing firms were located in the the North Central and South Bureau of Census Regions (Table 2). The West Region, although greatest in land mass, reported the lowest number of manufacturing facilities at 231.

Distribution of Production

In 1985, approximately 450 million pallets were manufactured in the United States. The average number of pallets produced per firm was 193,000 units. The median, however, was 100,000 units. The mean was skewed by a few firms producing over one million pallets.

The distribution of production did not mirror the distribution of firms. Relative to average daily production per firm,

the West surpassed other regions by as much as 164 percent, averaging 1,530 pallets per firm per day. Also note, however, that the average number of employees per firm was also much higher in the West Region. By comparing the average number of employees per firm (including any managerial personnel, clerical personnel, etc.) to the average daily production per firm, we can derive an interesting comparative figure of average pallet production per employee per day for each region. Here again, the West is highest at 49 pallets per person per day followed by the North East at 48, the North Central at 41 and the South at 39.

In terms of total production, the South was responsible for producing 156,177,000 pallets which represented 35 percent of all pallets produced nation-wide. Next was the North Central Region followed by the West and North East manufacturing 29, 21 and 15 percent of the national production, respectively.

Table 2. Pallet production in the United States, 1985.

Census Region	Number of Firms	Total Production (Thousands)	Avg. Daily Production Per Firm	Avg. No. Employees Per Firm
North East	450 (19) ^{1/}	66,889 (15) ^{1/}	580	12
North Central	883 (38)	129,845 (29)	690	17
South	776 (33)	156,177 (35)	930	24
West	231 (10)	97,130 (21)	1,530	31
United States	2,340	450,000	83 5	19

^{1/}Percentage of total

Volume of Wood Per Pallet

The nation-wide average for lumber contained in a manufactured pallet for 1985 was 13.89 board feet (Table 3). Dividing the sample into expendable (disposable) and non-expendable (re-usable) pallets results in averages of 11.23 and 16.24 board feet, respectively. These figures are weighted averages based on the total average daily production for the nine census divisions. Also note that volume figures do not include wood residue resulting from the manufacturing process.

On a regional level, the volume of wood ranged from a low of 12.13 board feet reported in the North East, to a high of 16.75 board feet reported in the West. It is hypothesized that the

reason for the disproportionately higher volume in pallets manufactured in the West is two-fold. Compared to the rest of the country, a greater percentage of the pallets manufactured in the West Region are non-expendable and, thus, must be designed for repeated use. Secondly, the primary wood species used in western pallet manufacturing are softwoods (primarily Douglas-Fir and Ponderosa Pine). These softwood species don't have the same strength properties as oak and most other hardwoods. Therefore, it is necessary that a greater volume of these softwoods be used in order to support the same load.

Species of Wood

Almost three-fourths (74 percent) of wood used in the production of pallets in the United States in 1985 was hardwoods. This percentage was fairly evenly split between oak at 35 percent and other hardwoods at 39 percent. Softwoods accounted for 24 percent of the volume, with the remaining two percent coming from plywood and particle board.

With the exception of the West Region, manufacturers relied primarily on hardwoods other than oak. The percentage for the three non-western regions ranged from 45 to 51 percent for other hardwoods. Oak followed closely by comprising 41 to 43 percent of the volume. Softwoods made up 8 to 12 percent, with the volume of plywood and particle board being negligible. The West region, on the other hand, relied primarily on softwoods (88 percent) followed by plywood and particle board (10 percent). It is logical to hypothesize that the variation in species used in each region is directly related to the species endemic to that particular region.

Table 3. Selected characteristics of Pallets Manufactured in the United States, 1985.

Census Region	Percent Expendable	Bd. Ft. Volume	----- Species of Wood -----			
			Oak	Other Hdwds.	Soft-woods	Other ^{1/}
			(Percentage of Volume)			
North East	55	12.96	43	48	10	--
North Central	55	12.13	41	51	8	--
South	54	14.31	43	45	12	1
West	42	16.75	1	1	88	10
United States	52	13.89	35	39	24	2

^{1/}Includes plywood and particle board.

Form of Raw Material

Table 4 indicates that 70 percent of the pallet manufacturing firms in the United States purchased some or all of their raw material in the form of lumber during 1985. Note that this lumber category also includes pre-cut pallet stock. Almost half (48 percent) purchased some or all of their raw material as cants, 31 percent of the firms purchased logs delivered to the mill and only 15 percent purchased stumpage.

Regionally, the West relied almost entirely on lumber while the rest of the nation used a mix primarily of lumber and cants, and to a lesser extent, logs and stumpage.

Table 4. Percent of pallet manufacturing firms purchasing various forms of raw material.

Census Region	-----Raw Material-----			
	Stumpage	Logs	Cants	Lumber
North East	21	30	53	66
North Central	20	40	47	67
South	9	26	57	69
West	--	3	9	92
United States	15	31	48	70

Pallet Markets

The industries responsible for the largest percentage of U.S. manufactured pallets include the food, paper/fiber, chemical/fluids, and steel/metal industries (Table 5). These are the industries which were reported as customers by 40 percent or more of the responding pallet manufacturers. The markets differed by region with the "top" five industries for each region listed as follows:

North East	Paper/Fiber, Chemical/Fluids, Steel/Metal, Steel/Metal Primary Products, and Printing
North Central	Transportation, Food, Steel/Metal, Steel/Metal Primary Products, and Paper/Fiber

South	Food, Paper/Fiber, Chemical/Fluids, Printing, and Agriculture
West	Agriculture, Food, Petroleum, Paper/Fiber, and Chemical/Fluids

Table 5. Percent of pallet manufacturing firms selling to selected industries.

Industry	-----Bureau of Census Region ^{1/} -----				U.S.
	1	2	3	4	
<u>General:</u>					
Agriculture	17	27	32	61	29
Mining	13	7	20	12	13
Military	4	12	15	29	13
Fisheries	4	1	3	16	3
Construction	17	13	17	32	16
Landscaping	7	6	7	24	8
Transportation	29	41	31	47	36
<u>Manufacturing:</u>					
Food	34	44	52	63	46
Clothing	12	4	11	19	9
Furniture	10	7	11	16	10
Petroleum	20	20	25	59	25
Glass	25	17	24	36	22
Electric Equip.	33	29	29	43	31
Misc. Products	48	41	41	35	43
Tobacco	-	2	8	-	3
Paper/Fiber	54	37	54	71	48
Chemical/Fluid	48	35	53	63	45
Rubber	21	21	27	19	22
Steel/Metal	44	47	29	38	40
Clothing/Fabric	3	3	12	5	6
Printing	36	35	36	46	36
Other Forest Prod.	3	2	8	19	5
Leather	9	3	2	5	4
Steel/Metal Pri- mary products	37	42	27	33	36

^{1/}Regions: 1-North East 2-North Central 3-South 4-West

SUMMARY

Two nation-wide studies conducted on pallet production in 1985 found that although pallets were manufactured in every state, the firms, their production, and their markets varied by region. The greatest number of firms were located in the North Central region while the greatest volume production was in the Southern Region. The largest firms, based on daily production, were in the Western Region. The Western Region also manufactured

the greatest percentage of reusable pallets using primarily soft-wood lumber. Finally, the major markets for pallets are the food, paper/fiber, chemical/fluid, and steel/metal industries. Some industries unique by region include agriculture in the West and South, electrical equipment and petroleum in the West, Steel/Metal in the North and transportation in the North Central and West.

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