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The Paper Industry With Special Reference to Louisiana.

Glenn Lundin Hodge
Louisiana State University and Agricultural & Mechanical College

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THE PAPER INDUSTRY

WITH SPECIAL REFERENCE TO LOUISIANA

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Business Administration

by

Glenn Lundin Hodge
B. S., Kansas State Teachers College, 1935
M. S., University of Denver, 1941
August, 1951
MANUSCRIPT THESES

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ABSTRACT

This study of the paper industry deals primarily with the following:

1. Improvements in technology, cost advantages, and increased demands for paper and paper products which brought about management's decision to locate the kraft paper industry in the South;

2. Historical development of the paper industry in the South with special emphasis on Louisiana;

3. Policies and procedures of management concerning procurement of current and future supplies of pulpwood;

4. Position of the paper industry in Louisiana relative to the industry as a whole with respect to products and markets;

5. Trends of consumption for paper and paperboard and some reasons for the hesitancy of the industry to expand productive facilities for kraft paper and paperboard and to enter into production of Southern newsprint.

Primary data were secured through questionnaires, interviews, and correspondence. Secondary sources of information consisted of books, periodicals, governmental documents, and pulp and paper companies' reports.
The principal products of Louisiana's pulp and paper mills are kraft wrapping and bag papers, container board for shipping boxes, bleached and unbleached converting papers. Each company in the state has established converting plants to manufacture one or more end products such as paper bags, multiwall shipping sacks, shipping boxes, and paper milk containers.

Products manufactured in Louisiana's paper mills and converting plants are distributed throughout the United States, and there is a market preference for kraft paper for packaging. Paperboard shipping boxes, multiwall shipping sacks, and converting papers are, in practically all cases, sold directly to industrial users. Paper milk cartons are distributed directly to dairies. Kraft wrapping paper is generally marketed through paper merchants and jobbers, although brokers and mill agents are utilized in some cases.

The paper industry requires tremendous capital investment—approximately $55,000 per daily ton of production. One Fourdrinier paper machine which will produce around 400 tons of paperboard per day costs more than $1,000,000. Governmental policy, particularly with reference to proposals for lower tariffs, has affected decisions to add more productive capacity. Although technology now permits manufacture of Southern newsprint and demand is great, the large, well-established paper corporations have not joined publisher-owned enterprises in the establishment of a
Southern newsprint industry because of the greater comparative advantage for the manufacture of kraft paper and paperboard.

The paper industry is one of the most important industries in Louisiana, and assuming good management of resources, labor, and plant equipment, along with progressive maintenance of markets for products, it is one of the most permanent. In terms of value of products the paper industry is the fifth largest manufacturing industry in Louisiana. Even excluding workers employed in woods operations, paper and paper products industries are exceeded only by food manufacturing and by lumber manufacturing in number employed. Louisiana's pulp and paper mills have had an important part in the economic development of certain communities.
The Springhill mill of the International Paper Company in Louisiana represents an investment of more than $30,000,000. Shown above is the container plant in the right foreground with the pulp and paper mill on the right and left of the woodyard.
CHAPTER I

THE NATURE OF THE INDUSTRY

Introduction

Importance of the industry. If a person were asked to name the most important industries in the United States, he would probably overlook one of the oldest and most important. In respect to value added by manufacture, the paper industry is the eighth largest industry group in the United States out of a series of nineteen shown by the Census of Manufactures for 1947. In billions of dollars the value added by manufacture by these eight industry groups was as follows:¹

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In 1947, the industry had assets of over four billion dollars and manufactured products valued at 3.3 billion dollars. It is estimated that five million people are today

directly or indirectly dependent upon the industry for their livelihood. There are 891 pulp, paper, and paperboard mills located in 37 states. In addition to this primary industry there are several large industries engaged in converting the products of the pulp and paper industry into useful products for consumption. The converters include, among others, manufacturers of paper bags, shipping containers, envelopes, drinking cups, and milk containers. The dynamic growth in this country’s manufacture of pulp, paper, board, and products since the turn of the century places the industry today as one of the major economic assets of the United States in terms of production, employment, and purchasing power. According to the Federal Trade Commission the paper industry in the third quarter of 1948 had property, plant, and equipment with a net value of $1,876,000,000, and total assets of $4,326,000,000.

In 1948 the per capita consumption of paper in the United States was 357 pounds of paper per year. The consumption of newsprint was approximately 70 pounds per person. In what form do Americans use the other 287 pounds of paper?


The average American receives commodities shipped and delivered to him in 125 pounds of paperboard containers and boxes and in 30 pounds of wrapping paper and paper bags. He consumes another 119 pounds of paper and paperboard of many kinds and for many purposes including books, letter paper, railroad tickets, milk and food containers, telephone directories, catalogues, tissues, even paper rugs and window curtains for his home, and automobile seat covers woven from twisted paper strands. It is not difficult to see why today's average American consumes more than six times as much paper as the 54 pounds used by his grandfather in 1898.5

The Dictionary of Paper, published in 1940, which defines paper terms and grades, is 363 pages long and lists thousands of different kinds of paper.

Paper is third on the list of human requirements, and ranks only behind food and shelter as a necessity in the modern world. Cheap paper was the springboard to modern civilization, and is an indispensable item in human progress. It is more important than telegraphy and electricity, and man uses it more than any other one commodity except fresh water. All of our records, our recorded histories, and recorded religions, our evidence and proof of ownership of property and possessions, proof of birth, citizenship, and

death, and our bonds, mortgages and deeds are recorded on pieces of paper.

The development of cheap paper made America one of the most literate countries in the world. Paper gave the masses their dreams of social justice and helped make Americans the freest peoples on earth. Cheap paper has sped culture to the common man, raised his living standards and provided him with more jobs.

A great part of our industrial growth has occurred in the last seventy-five years. In 1875, Carl Engle said: "Of all the people on the face of the globe more than a third have no paper or writing material of any kind." Today the world almost spins on paper. Paper has played an important rôle in developing our mass production economy, and our speed of transportation and distribution. Without an abundant supply of paper, civilization as we know it today could never have been developed.

The free press is the greatest possession of a liberty-loving people. The manufacture of cheap newsprint paper has been a contributing factor in keeping our people well informed on local, national, and international affairs. Newspapers published throughout the United States, consume over 5,000,000 tons of paper a year. Newspapers, magazines, and books are devoted to a public exposition of the truth.

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as the problem is seen by individual writers. It is the privilege of those who read them to analyze both sides of the problem and decide for themselves what to believe. This unlimited mass of information would not be available without low cost paper.

Paper, in a myriad of forms, is the essential structure of all business, because business depends on correspondence, invoices, plans, filing systems, charts, checks, and records. The payroll checks of employees are made out on paper and are cashed with paper currency. Insurance policies and all types of business contracts are written on paper. Without paper or a satisfactory substitute, proof of business dealings would be much more difficult.

Among the most important uses of paper today are the manufacture of paper sacks, packaging boxes, and shipping containers. A great share of the paper manufactured in Louisiana's mills is destined for such purposes. Perhaps nothing has contributed more to the economy and sanitation of marketing food products than has the paper packaging container. The use of individual containers has revolutionized the advertising and sale of many products which were formerly sold in bulk.

Today, the housewife reaches into her kitchen cupboard and picks out one of a dozen or more boxes holding cereal, flour, rice, noodles, crackers and other food products, and thinks nothing of the convenience provided by those paper packages. Yet, only fifty years ago, the nation's foods
were sold to the grocer in bulk form. Sacks and barrels of victuals slumped on the floor where they were a parking place for dust and dirt, and provided a banquet for flies and germs. The open cracker barrel and the cat to keep down the rodents were a tradition.

In 1896, The National Biscuit Company ended the day of the cracker barrel. To tempt the nation's taste, the company developed a new, fine, flaky, soda cracker. The traditional barrel was not satisfactory as protection from breakage and moisture. The enterprising biscuit makers designed a folding paperboard carton lined with waxed paper and covered with a printed wrapping paper. Along with the protective and sanitary box, they gave their product the name: "Oneeda Biscuit." Soon this experiment served as a basis for revolutionary changes in the make-up of American business:

1. National Biscuit advertised its protected cracker in the publications of the day; gave the public a trade name to look for as a mark of quality and sanitation. As readers learned of the advantages of the boxed cracker over the barrel variety—they bought. Sales soared; business expanded.

2. Other manufacturers (the cereal makers were second to package their wares) followed suit; boxed their wares, adopted trade names (hence, improved their products), and also advertised.

3. As more and more manufacturers advertised, the publishers gathered more money in their tills. With more capital, they could add to their news-gathering sources, could offer more news, and

7 Ibid, p. 35.
more features in their papers and magazines. The better the publication, the more readers it acquired. As circulations increased, so did advertising.

4. The more advertising published, the more people there were who bought the advertised product and the more competition was created. The more customers—the more wholesale and retail outlets appeared to meet the demand.

Cheap paper for publishing and packaging has been a great contributing factor to the whole era of mass production, mass packaging, and mass merchandising which the consumer experiences today. Furthermore, it has provided greater industries for the country, more jobs for its people, more sanitary products, and better products. Paper has furnished the raw materials for a long procession of new industries.

Paper has played a major part in our economy. Without it, the modern grocery store and super-market could not exist. Small unit packages have made it possible for foods to be produced at low cost in huge plants near the farms and distributed conveniently and economically to far distant markets.

Paperboard shipping containers have made it possible for goods to be shipped much more economically. Before 1900, goods were protected during shipment by crates, straw wrappings, and wooden boxes. The manufacturers of breakfast cereals were among the first to package and ship their edibles in folding paper cartons. Around the beginning of the century they began to ship in folding paper cartons. Prior
to the use of lightweight cartons the cost of shipping in
the old wooden containers was disproportionately high com-
pared with the inexpensive food product. The wooden boxes
not only increased freight costs, but they were hard to
handle, and thus increased handling costs. The use of cor-
rugated containers brought about enormous savings in freight
and handling costs. The boxes could be stored easily and
were readily disposable. As more and more of the freight
containers were made of kraft board, discarded boxes were
reduced to pulp again and used in making new boxes. As the
paperboard industry progressed, more products were shipped,
and this contributed to the expansion of railroads, truck-
ing companies, and steamship lines.

There are many varied uses for dissolving wood pulp
which few people know about. Today the average American and
his family wear rayon fabrics and their home is furnished
with rayon draperies, furniture coverings, sheets, cover-
lets and rugs—all made from dissolving wood pulp. Com-
pacts, pencils, fountain pens, kitchen equipment, radio
cabinets, and the cellophane which keeps cigarettes, chewing
gum, candy bars, food and other things clean and fresh are
also made from dissolving wood pulps.

A wartime listing of uses for paper showed paper uti-
lized as a substitute for metal foil, wood, glass, silk,
canvas, leather, ceramics, hemp, rubber, felt, sawdust, plastics; cork, mica, shellac, plaster, lead, skins, tin, slate, straw, ink, gold and silver.8

Factors affecting location of plants. Any company in choosing a site for a pulp and paper mill must take into consideration the mill's location in relation to its markets and the transportation facilities available. The most important of all factors, however, in choosing a location is the proximity to an abundant supply of timber, water, and cheap power. Since the wood is of greater weight than the paper made from it, pulp and paper mills are generally located in an area where they are surrounded by forests, or at least in an area where a large percentage of its supply of timber can be obtained within a radius of 100 miles.

Pulp cannot be made from all species of wood. The pulping process depends upon the supply of certain specific types of wood. Kraft paper which is made by the sulphate process can best be made from Southern yellow pine, while spruce is best for newsprint made by the groundwood process. Research, however, has developed new and better processes of pulping, and newsprint is now being made successfully from Southern yellow pine. Dissolving wood pulps for use in making rayon may be made from Southern hardwoods and the International Paper Company has recently completed a large plant for this purpose at Matchez, Mississippi.

The paper industry is the largest user of "process water" of any industry in the country. It is necessary that pulp and paper mills be located immediately adjacent to an abundant supply of clear water. About 2,800,000 gallons of water every 24 hours is required for 100 tons daily capacity. For instance, the Louisiana Mill of the International Paper Company in Bastrop uses 20,000,000 gallons of fresh water daily. This is enough to supply two cities the size of Shreveport. Of course, the quantities shown here vary substantially with individual mills depending upon the grades made, but these figures will serve to illustrate the enormous amount of water required.

Among the other items of cost which enter into the determination of pulp and paper mill locations is power. Power costs average about 15 per cent of total pulp costs and 10 per cent of total paper costs with wide variations among grades and among mills. The importance of this item is indicated by the location of pulp mills on water power.

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sites, in regions of low cost coal or natural gas or in communities with cheap electrical power rates. A paper mill must be in a location where it can purchase its power at low cost, or there must be abundant supplies of low cost fuel which will enable the plant to economically produce its own electric energy. In any case, low cost fuel for generation of steam is of utmost importance.

Louisiana's abundant supplies of natural gas have been used by the paper mills as fuel both to produce the steam that charges the digesters and heats the dryers, and to generate the electricity which is needed to operate the heavy machinery. The large gas fields in this State have been a major consideration of executives in locating their plants.

Paper mills must be situated in a locality that has good railroad facilities, since both the raw materials and the finished products are heavy and bulky. Good highways are also desirable so that trucks can make delivery of raw materials directly to the mill and transport the finished product. Trucks, however, are generally used to deliver timber directly to the mill only when the timber is cut in the woods near the mill. Most of the raw materials come to the mill by rail and the finished products are shipped by rail in carload lots.

Of course, water transportation is desirable if it can be secured along with the necessary supply of timber. In many localities the wood supply is floated downstream to the mill. Barge transportation is economical as far as rates are concerned, but loading and unloading is more difficult and costly. Wood shipped by barge must, after arrival at the dock, be unloaded by hand or by crane, and placed in trucks for transportation to the mill, while wood arriving by rail can be dumped directly into the conveyors for immediate use. The amount of handling is also reduced when the finished product is shipped by rail since the cars may be loaded directly from the warehouse floor.

Sites must be chosen where the enormous quantities of waste may be disposed of economically. Pulp and paper mill waste can best be disposed of by flowing it into a stream of water such as a river or bayou. It has been claimed by some individuals, however, that the black water kills the fish in these streams, and this brings about many lawsuits for damages, and causes controversy between the State Stream Control Commission and the management of various paper companies.

The disposal of waste in such a manner that there will not be trouble with the State or with individuals presents a serious problem which in many plants remains unsolved.

The most significant industry-wide movement toward solution of the problem has been the formation of the National Council for Stream Improvement. This organization is
supported entirely by the pulp and paper industry. Among
its members are mills which represent over 90 per cent of
the tonnage produced in the South.\textsuperscript{12}

Research projects on pollution abatement and waste
utilization are being conducted at eleven educational
institutions throughout the United States under the sponsor-
ship of the National Council. Kraft mill waste research has
been in process at Louisiana State University for more than
four years as a part of this program.

The ad valorem tax rates for the state and the com-
munity, as well as corporation laws and income tax rates,
must be taken into consideration. Tax exemption programs
and free plant sites are to be considered, but are by no
means the most important factors in choosing a location.
Other advantages being equal, however, a free plant site or
a ten-year tax exemption law such as Louisiana’s may be a
major factor in determining upon which side of a state
border the plant should be built.

An abundant labor supply is necessary to a large plant
such as a paper mill. It does not seem, however, that
available labor supply has been given much weight in choos-
ing certain paper mill sites in Louisiana. Two of

\textsuperscript{12} S. C. Crawford, "Mill Operations from Stream
Pollution Point of View," \textit{Southern Pulp and Paper Manu-
facturer}, XIII (November 15, 1950), 41.
Louisiana's mills located in towns that were, in the beginning, small in population. All of the local labor that was suitable was employed, but a large per cent of the laborers and salaried workers were imported. In almost every case the highly skilled workers were brought in from other paper mills over the country, and new homesites had to be established.

Wages and construction costs have had some influence in the choice of mill locations, but either because they form a smaller percentage of total costs, or because their prices vary less among different locations, none of them has had as much influence as raw material or power costs.\(^1\)

**Plant cost and obsolescence.** It is generally known that paper and pulp manufacturing is one of the most heavily mechanized industries in existence. The capital investment in mechanical equipment is very great, and carrying charges are extremely large in terms of output. In spite of the fact that the principles underlying the cylinder and Fourdrinier machines have remained unchanged, the machines themselves have become larger and larger, and unfortunately, more costly. In the competition of today, fast-running large machines have replaced slow-running small machines in the production of the tonnage grades of paper and paperboard.\(^2\)

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\(^1\) *The Paper and Pulp Industry of New York State*, *op. cit.*, p. 45.

With its great machines, the paper mill is one of the biggest, most costly, permanent and stationary establishments in all industry. Mills are first built where the forests are situated. As these forests are cut, the mill cannot move to another location because of its immobility. A geographical obsolescence attacks the mill as pulpwood or pulp must be transported over more and costlier distances. It is thus seen why it is necessary to take every precaution to be sure that the mill will have a continued supply of pulpwood sufficient to meet present output and to allow for expansion.

As the costs of the older mills rise comparatively because of obsolete or outdated equipment, the mill in poor times is either shut down or shifts to grades where the value of the product is high enough that speed becomes less important. During a period of great demand for paper, the older mills continue to manufacture their product, thus adding their high-cost production to the short market supply. Since there cannot be more than one price for the product in the same market at a given time, the price tends to be high enough to cover the high-cost, marginal producer and the low-cost producer reaps extra profits. As

15 The methods and procedures used by Louisiana's pulp and paper mills in providing for a permanent supply of timber is discussed in Chapters IV and V.
new mills are built and old ones are expanded to increase production for a starving market, a point is finally reached when the supply of paper equals the demand. Then, as the price drops the marginal producers must either cease operations, install modern equipment, or change over to the manufacture of a grade of paper which can be manufactured at a competitive price. It is for such reasons that the problem of how to have just the right amount of capacity without having over capacity is one which so far has remained insoluble for the paper industry.

The modern mass production paper plant has always been costly to construct. In 1939 a typical Southern mill cost somewhere in the neighborhood of $30,000 per ton of daily capacity. At current prices a kraft pulp and paper mill costs approximately $55,000 per daily ton of production. Thus, a mill that will produce 200 tons a day (the minimum economical size for a modern mill) will cost $11,000,000. This amount does not include any investment for woodlands, working capital or other capital items. When one learns that one mill in Louisiana produces more than 1,000 tons


17 Presentation of the United States Pulp and Paper Manufacturers before the Senate Sub-Committee on Trade Policies, op. cit., p. 38.
of paper per day, it can be seen that a paper mill is an extremely large concern. Prior to World War II, newsprint mills with pulping operations could be constructed at a cost of $30,000 to $35,000 per daily ton capacity. It is estimated that present cost is in the neighborhood of $75,000 to $80,000 per daily ton, and this does not include expenditures for woodlands.18

A paper mill has a capitalization of $20,700 per worker, the highest for any large industry. This fact, along with the nature of the pulp and papermaking processes makes continuous operation essential.19 In 1948 the net plant and property investment in pulp mills was $17,000 per daily ton of capacity as compared with $10,400 per daily ton of pig iron capacity.20 The rate of capital turnover for the paper industry is low. In 1937 the total investment in pulp and paper was estimated at $2,500,000,000 (including inventories) spread over some 800 large and some small mills. This included $250,000,000 tied up in timberlands with the rest in plants and equipment.


19 Presentation of the United States Pulp and Paper Manufacturers before the Senate Sub-Committee on Trade Policies, op. cit., p. 38.

20 Information furnished by Southern Pulpwood Conservation Association.
Because of the huge fixed investment required, fixed charges are high. Also, the break even point is high, and production must be a continuous process 24 hours per day. Only by such continuous operations can costs and prices be kept down.21

Paper machines are so expensive that they cannot be discarded as long as they can be used to profitably manufacture any of the many grades of paper. In the paper business there is apparently no complete obsolescence of machinery in spite of the constant technical improvements (greater speeds and greater widths) which raise the productivity of a single machine. In 1937 there were six paper machines in use that had been operated since 1860, a period of seventy-seven years.22 Old machines may be speeded up to a certain extent by adding additional dryers, but the width of the machine cannot be changed.

Diversification of production. The pulp and paper industry is homogeneous only in the sense that its products are generally manufactured from either wood, cotton, or waste fibers. The product of the industry is highly diversified. At least 90 per cent of the paper consumed in the

21 Presentation of the United States Pulp and Paper Manufacturers before the Senate Sub-Committee on Trade Policies, op. cit. p. 38.

United States is produced from wood pulp manufactured by four different processes and made into paper and paperboard upon two types of machines.\(^{23}\) The art of papermaking has been known for more than 1800 years and paper has come to be used for a wide variety of purposes. As the uses for paper have broadened, there has come about a corresponding specialization in the kinds of paper manufactured for the various uses. Different kinds of paper are made by utilizing different kinds of raw materials and pulps and varying the process in manufacturing.

The process of paper manufacturing is so simple and so uniform that the product of one mill may differ from another in little other than name, and the paper machine of one mill may, with minor adjustments, be made to produce the product equivalent of hundreds of other mills. The art of papermaking is so old that it is beyond patent protection. There is very little ground upon which an individual producer can build and maintain a price structure of his own.

The flexibility of paper machinery is such that it is easy to produce any kind of paper. The papermaking process is so flexible that merely by varying pulps, speeds,
pressures, and finishing processes, paper machinery turns out some 7,000 different kinds of paper plus 3,000 minor variations.\textsuperscript{24}

In speaking of the flexibility of papermaking process Robert Canfield says:\textsuperscript{25}

The basic form of paper, a felted sheet of cellulose fibers, is modified in a thousand ways. It may be as thin as $\frac{3}{10,000}$ of an inch or more than a thousand times thicker. It may be white or black, or any color between these extremes. It can be as flexible as cloth or as rigid as steel; as soft as cotton or as hard as stone; as tough as leather or as fragile as a flower petal; as smooth as glass or as rough as stucco; transparent or opaque; absorbent as a sponge or completely waterproof. Different methods of treating and processing different mixtures of pulps, the addition of non-fibrous materials, physical and chemical treatments of the paper both during and after manufacture, result in so many varieties of paper with practically infinite variations in qualities, that no one can list them all and new ones are constantly being developed for new uses.

Should a mill find that one kind of paper is being over-produced or underproduced it can easily switch to another kind. This flexibility plagues every class of paper, if the price of a certain kind of paper moves above that for other kinds (taking cost of production into consideration). This flexibility has a leveling effect on price for all producers except the makers of very fine papers which are made as an art.\textsuperscript{26}

\footnotesize
\textsuperscript{24} "Economics of Paper," \textit{op. cit.}, p. 184.
\textsuperscript{25} Canfield, \textit{op. cit.}, p. 19.
\textsuperscript{26} \textit{Ibid.}, p. 19.
When American newsprint mills with old machines found that they could not meet the competition of Canadian newsprint mills with their modern high speed machines, they switched to the manufacture of a higher grade of paper. Of the 98 mills that were turning out newsprint for the United States up to 1934, only six were producing newsprint alone in 1935. Six had been abandoned, 13 were idle, and the other 79 were doing business with other paper products.27

Today, numerous paper, board, and products mills are pressing their marketing and product research divisions for new fields and new items. Many new or completely new products have been introduced on the markets since the war with good results. More companies are becoming interested in a larger variety of products with the hope that diversification will tend to compensate for the impact of a decline in a single specialty field.28

Although the product of the industry is highly diversified, the reader must not be allowed to think that there is no specialization in papermaking. Some paper machines, and even whole paper mills, specialize on certain grades of paper. Many mills specialize on high quality writing papers


while others manufacture only kraft paper or some other tonnage grade. Many machines make nothing except newsprint paper. As an example of an extreme in specialization, one paper mill makes only the very special 100 per cent rag paper which is used by the government for making currency.  

Integration. Few, if any paper mills are integrated to the extent that they own and control resources, transportation facilities, paper producing plants, converting plants, and marketing outlets. A paper mill is, however, considered as fully integrated when the plant not only produces its own pulp and paper, but also owns its own timber resources. Although many mills maintain a part of their supply of timber, few can claim an annual pulpwood yield equal to their annual capacity. Many paper men classify their mill as integrated when the plant produces both pulp and paper, and for all practical purposes the trade considers such to be an integrated mill. In 1937 only one-half the mills were integrated even to this extent, although 80 per cent of the volume came from mills which produced both pulp and paper.  

The large pulp and paper mills in Louisiana are operated as one production unit in which the pulp flows in slush form through pipes from the pulp mill to the paper

29 Canfield, op. cit., p. 20.
Integrated mills must of necessity be located near forests, just the same as a plant which produces wood pulp alone. Some plants are nonintegrated and purchase dry wood pulp. These mills which buy their pulp need not be located near forests, but must be located where an abundant supply of process water is available.

Foreign pulp enters the United States duty free and a sizeable percentage of the pulp used in this country is made abroad. In 1947, 19.3 per cent of the total wood pulp consumption was imported. In 1929 this percentage was 38.7.\(^{31}\) Although there was a decline during the war, the percentage of imports has increased steadily since 1946. Most of these imports come from Canada and Sweden, with Finland and Norway furnishing a minor share.\(^{32}\)

Integration in many mills has proceeded further than mere production of pulp and paper. It extends to the conversion of paper into the finished product in factories located either adjacent to the mill or in factories established in strategic locations throughout the country. All of the paper mills in Louisiana have one or more converting plants nearby to manufacture paper bags, multiwall bags, or shipping containers. The Louisiana mill of the


International Paper Company in Bastrop has a paper milk container factory on its plant site to utilize the paper made on one of its large machines.

There has been a postwar trend toward integration with still more converter plants being purchased and operated by the larger paper or board mills. There has, however been little, if any, recent acquisition of paper or board mills by the consumer, as was evident immediately after the first World War when some publishers and other interests saw fit to acquire primary manufacturing units.33

Raw Materials Used in Papermaking

The basis of paper is pulp which is made from fibers of cellulose, the material which forms the cell walls of plants. Cellulose is found in its purest form in cotton, the cotton boll being composed of nearly all cellulose. Wood, however, is the most abundant source of commercially used cellulose in the plant world. More than one-half of its substance is cellulose fiber,34 and in certain regions where wood and cotton can both be grown, it has been shown


that an acre of land planted in trees will produce five times as much cellulose each year as an acre planted in cotton.35

Theoretically, pulp for paper may be made from any plant, the fibers of which will mat to form a sheet.36 The materials which have been generally considered most suitable are: raw cotton, fibers of flax, jute, hemp, ramie, paper-mulberry, and manila; stems and leaves of straws and grasses, such as esparto, corn, sugar cane, bamboo, and cotton stalks; and various kinds of wood including spruce, hemlock, poplar, pine, balsam, cotton wood, fir, larch, and aspen. Research for methods of utilizing these and other materials is carried on constantly.37

The five basic materials used in sufficient quantities to receive treatment in the reports of the Bureau of the Census are: (1) pulpwood, (2) straw, (3) rags, (4) paper stock, and (5) manila hemp stock.38


36 The Paper and Pulp Industry of New York State, op. cit., p. 78.


The major factors to be considered in deciding on the type of raw material to be used in manufacturing paper are: (1) dependability of supply, (2) cost of collection, (3) cost of transportation to the pulp mill, (4) seasonableness of supply, (5) cost of storage, particularly where the raw material supply is seasonal, (6) deterioration of stock during storage, (7) the yield of usable fiber per ton or per cubic foot, (8) the costs of processing into a usable product and (9) the strength and quality of the fiber produced.

After taking costs of raw materials and processing into consideration, wood has proved to be the most satisfactory raw material. Some waste paper, rags, straw, jute, and hemp are used, but the amount of these materials is negligible when compared to the use of wood.\textsuperscript{39}

One hundred years ago, rags were the chief raw material for paper making. Wrapping paper and cardboard, as well as printing and writing paper were then made of rags. The production of paper was thus limited according to the supply of rags available. Today rags are used only for the manufacture of the high quality rag-content papers used for writing and book purposes, and these papers occupy only a small section in the grade structure of the industry. Cotton and linen rags, and sulphite and soda pulps are the

\textsuperscript{39} \textit{The Paper and Pulp Industry of New York State}, \textit{op. cit.}, p. 76.
raw materials used for manufacturing the better grades of book paper. Esparto has found some application in the production of the medium grades of book and writing paper, and groundwood is used for the cheaper grades.

The great bulk of the paper consumed in the world is made of wood pulp or of waste paper, which in final analysis is simply the reconverted use of wood pulp. Over the years, the pressure for low cost production and greater volume has encouraged research, and today, paper can be made from practically any vegetable matter that grows. The use of materials is dictated, however, by certain technical and chemical conditions surrounding the material. For many years Southern pine was considered unsuitable, but as the result of constant research, methods were discovered which were satisfactory and now Southern pine is one of the most widely used of all woods. Southern pine is today used almost exclusively for the manufacture of kraft paper. This paper is extra strong and is best known for its use in wrapping paper, bags, and shipping containers. Most of the paper in the South is made from yellow pine, but there are also immense stands of other woods such as gum, tupelo, cypress, and chestnut which have been proved suitable for making certain kinds of paper.

All except a fraction of the world's supply of wood pulp comes from softwoods—evergreens like spruce, fir, hemlock, and pine; and the rest is from the temperate hardwoods—poplar, gum, and chestnut. Of course, a sizable
portion of pulp is made from paper which is reconverted into pulp. In 1936, 30 per cent of all paper and 54 per cent of paperboard was made from paper itself. 40

The cost of fibrous raw materials averages about 42 per cent of the value of the product. To be sure, there are wide variations among different grades of paper. Raw materials, in general, account for a smaller percentage of the cost of high grade papers than of the lower-priced, "tonnage" grades. It is this differential in the composition of costs which makes it possible for mills located in regions of high pulp costs to compete more successfully in the production of those papers in which the cost of pulp is relatively less important.

Processing of Wood Into Pulp

Types of processes. Several different methods are used to break a log down into the fiber which is manufactured into paper. Basically, there are two forms of wood pulp. They are (1) mechanical pulp which may be further classified into ordinary mechanical pulp and semi-chemical pulp; and (2) chemical pulp which may be further classified into sulphite pulp, soda pulp, and sulphate or kraft pulp.

In the mechanical method the wood is ground by huge grinding stones which produce a pulp known as groundwood.

40 "Economics of Paper," op. cit., p. 117.
Different chemicals are used for the three chemical processes. Bisulphide of lime is used for the sulphite process, caustic soda is the principal ingredient in the soda process, and a combination of caustic soda and sodium sulphate is employed in the sulphate process. In the chemical process, the wood is first cut into small chips and then cooked with the appropriate cooking liquor under pressure in huge digestors. The cooking process removes the lignin and produces more nearly pure cellulose.

Each type of pulp has its function in the manufacture of paper. Mechanical pulp is the cheapest of all since expensive chemicals are not used. Also the equipment necessary for making the pulp is much cheaper, and only 2 per cent of the raw material is lost as compared with 50 per cent or more in the chemical processes.41 When mixed with some sulphite to make it stronger, mechanical pulp is used in making newsprint.

Mechanical pulp is often referred to as groundwood. In the process, the wood is pressed against a revolving grindstone while a spray of water cools the stone and washes the fibers into a pit below. This process is used mostly on long fibred resin free woods such as spruce, balsam, fir, hemlock, and jack pine. Groundwood may be

readily used where durability and lasting qualities of the paper are not important factors. Groundwood pulp contains the whole wood, and in addition to cellulose, is composed of lignin, fat, and resin. Paper made from this pulp will turn brown in the sunlight and in time will rot.

The semi-chemical process differs from the ordinary mechanical process in that the wood is steamed before it is ground. The steaming causes the wood to be less resinous and brings out characteristics which make the pulp suitable for making certain products. The paper produced is stronger and more flexible than that produced by the ordinary mechanical process. The quantity of pulp manufactured by this method is relatively small when compared with total output. Most of this pulp is produced from chestnut wood in connection with the extraction of tannin and is used in the manufacture of corrugated board.

In the sulphite process, the pulp is manufactured by digesting wood chips with an acid liquor (bisulphide of lime), at a high temperature and pressure. This cooking dissolves all the constituents in the wood except the cellulose. About 49 to 53 per cent of wood is obtained as

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42 Witham, *loc. cit.*
43 See Table I, p. 35.
44 *The Paper and Pulp Industry of New York State*, *op. cit.*, p. 79.
cellulose depending upon the type of cooking. When bleached, this pulp is almost pure cellulose.45

Sulphite pulp is considerably more expensive to make than mechanical pulp. The process necessitates large initial investment in chemical plant and in machines and involves heavy maintenance costs. About 1,300 to 1,500 pounds of coal, 232 pounds of sulphur, and 300 pounds of limestone are required per ton of pulp.46

Even though the cost is higher and the pulp-to-wood ratio is lower, the sulphite process is used instead of the mechanical process in making most of the white papers except for the cheapest grades. There is greater length of fiber, greater pliability and strength, and greater freedom from deterioration.47 It is the most versatile of all kinds of pulp, and in addition to its use in all kinds of white paper, it is used in making rayon.

It was the development of the sulphite process which really established the paper industry as a large-scale business, and caused paper mills to concentrate in the Northeast where there was an abundant supply of spruce, balsam, and hemlock, the most suitable woods for this process. Of course this location was also favorable because of the proximity to markets.

45 Witham, loc. cit.
46 Ibid., p. 18.
47 Ibid., p. 78.
The soda process is the least used of the pure chemical processes, although it was the first of the chemical processes and produces 68 to 78 per cent pure cellulose. The pulp is obtained by dissolving the raw materials in a solution of caustic soda. This process is used for short fibred woods and for other fibers that cannot be satisfactorily treated with the sulphite process. Ordinarily it is used for the reduction of wood fibers such as poplar, beech, and aspen. It is, however, often the best process for materials other than wood—for instance, rags, waste-paper, and bagasse.

Most of the soda pulp is bleached, and it is used in combination with pulps of longer fibers in making high grade book and magazine papers. This pulp adds softness and bulk to book paper in making a uniform, well-filled sheet. Where color is not a consideration, unbleached soda pulp is used to some extent in the manufacture of wrapping paper.

The sulphate process derives its name from the use of sodium sulphate (salt cake) to make up the loss of chemicals used in the stages of manufacturing. Paper made from this pulp has become generally known as "kraft" paper, a term used in Sweden to denote strength.

48 See Table I.
50 Witham, op. cit., p. 18.
In the beginning, the term sulphate pulp was used to designate a thoroughly cooked pulp made by digesting wood chips with sodium sulphate and sulphide liquor. With a reasonable amount of effort this pulp could be bleached and was applicable in the manufacture of papers of a different nature from those made of kraft pulp. In its early use, the term kraft pulp was intended to mean imperfectly cooked sulphate pulp which was further disintegrated by means of a kollergang (a big "edge runner" such as used in foundries) before the pulp was placed on the paper machines. Manufacturing methods have changed as the industry has developed and the treatment in kollergangs in America has been abandoned in favor of machines known as beaters, and Jordan engines. Even though the two terms sulphate and kraft originally had a different meaning, the two have become gradually merged into each other as a result of the decreased output of true sulphate pulp and the increased production and demand for kraft pulp.\(^{51}\)

The sulphate process is a relative newcomer in the field of papermaking. In 1911, Ed Mayo, a practical paperman, perfected the problem of making sulphate pulp from Southern pine, and this process is now used chiefly in the South for pulping this wood. It is adapted to pulping most species of wood, including the resinous, coniferous woods for which the sulphite and soda processes are not generally

\(^{51}\) Witham, loc. cit.
used. The large volume of pitch in Southern yellow pine is successfully dissolved by the sulphate method. Paper made from this pulp is unusually strong, but it is brown in color and is difficult to bleach. An immense amount of bleach is required to bleach sulphate pulp. Kraft pulp in its unbleached state is dull brown in color. It is used for the manufacture of products in which color is not a consideration and where strength and ability to resist wear and tear are of prime importance. The fact that it is adaptable for making tough and durable papers makes it the ideal pulp for manufacturing brown wrapping papers, paper bags, and container board, as well as many special kinds of papers.

In the early years of manufacturing by the kraft process, the pulp was difficult to bleach, but shortly before World War II a method of multiple bleaching was developed which made possible the production of white papers which were suitable for making ledger, offset, and book papers. Since the War the industry has had a wide market for these products as well as for bleached and partly bleached sulphate pulps.

52 Witham, loc. cit.
Table I shows the relative importance of the various processes just described.

### TABLE I

**Pulp Making Equipment and Quantity of Production, 1947**

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Number</th>
<th>Tons</th>
<th>Percent of Total Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestors, total</td>
<td>950</td>
<td>9,231,386</td>
<td>76.4</td>
</tr>
<tr>
<td>Sulphate</td>
<td>387</td>
<td>5,356,710</td>
<td>44.3</td>
</tr>
<tr>
<td>Sulphite</td>
<td>346</td>
<td>2,795,962</td>
<td>23.1</td>
</tr>
<tr>
<td>Soda</td>
<td>103</td>
<td>491,580</td>
<td>4.1</td>
</tr>
<tr>
<td>Semichemical</td>
<td>77</td>
<td>444,033</td>
<td>3.7</td>
</tr>
<tr>
<td>Other (principally rotaries for cotton linter pulp)</td>
<td>37</td>
<td>143,101</td>
<td>1.2</td>
</tr>
<tr>
<td>Grinders for groundwood pulp</td>
<td>709</td>
<td>2,049,814</td>
<td>17.0</td>
</tr>
<tr>
<td>Defibrators, including Asplund defibrators and similar equipment</td>
<td>103</td>
<td>693,282</td>
<td>5.7</td>
</tr>
<tr>
<td>Screenings, unclassified</td>
<td></td>
<td>114,483</td>
<td>.9</td>
</tr>
<tr>
<td>Total Pulp Production</td>
<td></td>
<td>12,088,965</td>
<td>100.0</td>
</tr>
</tbody>
</table>


Table I shows that in 1947 a large percentage (76.4) of the pulp manufactured was made in digestors. Nearly half (44.3 per cent) of all pulp and over half (58 per cent) of the pulp made in digestors was manufactured by the sulphate process.

The sulphite process was next in terms of quantity produced, with 23.1 per cent of all pulp and 30.3\(^{53}\) per cent of the pulp processed in digestors. Groundwood, most

\(^{53}\) This figure is not shown on Table I
of which was used for making newsprint, accounted for 17 per cent of the total of all pulp manufactured.

Although the soda, semi-chemical and miscellaneous processes furnish only a small percentage of the total pulp produced, their importance to the industry should not be underestimated. Some papers could not be made without the proper portion of these pulps.

**The techniques of processing.** Four distinct steps are involved in the complete industrial process. They are (1) Procurement of wood, (2) Processing of wood into pulp, (3) Manufacture of pulp into paper, and (4) Conversion into paper products. Each of these processes must be completed before the finished product is ready for the market. Steps one, three, and four will be described in later chapters. This section will be devoted to a portrayal of step two—processing of wood into pulp. Since all paper mills in Louisiana use the sulphate process, the procedures herein described will be confined mostly to that process.

The procedures necessary to process wood into pulp may be broken down into five divisions in the following order: (1) Barking, (2) Chipping, (3) Digesting, (4) Refining and bleaching, and (5) Chemical recovery.

**Barking.** It is most essential that all bark be removed because any bark left on the wood which goes into the chippers will color the pulp and fill the paper with dirt specks. Bark seems to hold its original state and is unaffected by the chemical cooking process. Three
methods of barking are used in mills throughout the country—barking drums, barking machines, and hydraulic jets. Barking drums are used in Louisiana’s mills, while so-called barking machines are used to some extent in other states.

Barking machines are less efficient both from the standpoint of labor and waste. Tumbling drums will save in many cases 50 per cent of the labor, and 10 per cent of good wood which the barking machines waste. The first cost of drums, however, is higher.54

Recently some paper mills have been barking logs by subjecting them to hydraulic jets under 1300 pounds of pressure. The log must be kept in motion while it has a one-minute passage over the jets as the force of the water would otherwise penetrate the wood fiber.

The barking drums used in Louisiana paper mills consist of motor driven skeleton steel cylinders about 12 feet in diameter and 45 feet long with openings through which bark falls. As the drum revolves in horizontal position, the wood is freed of bark by the rubbing and pounding action of the sticks of wood upon each other and against the sides of the drum. The bark falls through slots into a conveyor belt which carries it to the power plant where it is burned as fuel for the production of steam.

54 Witham, op. cit., p. 107.
The logs, ranging from 4 to 6 feet in length and from 4 to 12 inches in diameter, enter the high end of this barking drum on a conveyor, which consists of a V-shaped trough with a motor driven link chain in the bottom. When the logs have tumbled through the length of the drum, set at a slight incline, the barking process is completed and the logs fall onto a conveyor which takes them to the chippers. While on the conveyors, the logs pass through a spray of water which washes off any loose bark which did not disappear in the drums.

Chipping. The wood must be reduced to small chips one-half to one inch in length along the grain of the wood. This is necessary in order that the cooking liquors will penetrate the wood. The barked logs are fed into a machine called a chipper which consists of a large, rapidly revolving disc in the side of which twelve knives are bolted. These knives are placed at right angles to the axis of the disc and are set at evenly spaced intervals around the edge. The slight projection of these knives from the face of the disc slices off the chips, and these in turn fall into vibrating screens where they are graded according to size. After screening, the accepted chips are conveyed to chip bins for storage, while the larger chips are fed to a breaker where they are reduced to correct size.

Cooking is not dependent upon constant operation of the chipping plant and there is an advantage in having a large reserve of chips, therefore chips are conveyed to
storage bins located above the digesters. This storage
provides for uniformity in the moisture content of the
chips before they enter the digesters. Mill managers know
the rate of chip making and the quantity on hand and a
schedule is worked out in some mills so that by running the
chip plant eight hours a day, the rest of the mill can run
continuously.

**Digesting.** The chemical composition of wood is
approximately 60 percent cellulose, 30 percent lignin and
10 percent sugars.\(^5^5\) Lignin is the organic material which
binds the cellulose fibers together. Since paper is made
from cellulose, it is necessary to process the wood in such
a manner that nearly pure cellulose is obtained. This is
accomplished by cooking the wood chips under steam pressure
in a specially prepared cooking liquor.

The cooking process takes place in huge steel tanks
known as digesters.\(^5^6\) They are about eight feet in diameter
and 30 feet high, and each mill has several digesters. The
Springhill mill of International Paper Company has twenty-
two. Most of these digesters are in upright position and

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\(^5^5\) Robert S. Aries, "Wood Products--Key to the
Future," *Chemurgic Papers*, 1946 Series, No. 1 (New York:

\(^5^6\) In the sulphate process no special lining is
required in the digester because the cooking liquor does
not attack the metal as it does in the sulphite process.
The digesters, however, are well insulated to avoid heat
stationary. Some mills, however, use rotary digesters which are in horizontal position and revolve slowly during the cooking process.\(^5\)

The chips are stored directly above each digester, and when a valve is opened, the force of gravity pulls them into the digesting tanks. An alkaline cooking mixture consisting principally of caustic soda (NaOH) and sodium sulphide (Na\(_2\)S), is pumped into the digester. The digester is then capped tightly and steam is used to heat the contents to the required temperature and to maintain such a pressure that the non-cellulose material is dissolved from the wood. The digester is held at a pressure of 100 to 110 pounds and a temperature of around 350 degrees F. While the pressure and temperature in the digester is being raised to this level a relief valve is opened to aid the circulation. During this period turpentine vapors are released and subsequently condensed and recovered.

At the end of the cooking period the contents of the digester are "blown" by opening a valve at the bottom and the pressure inside forces the contents consisting of pulp and spent liquor into a blow tank. The material which has been blown from the digester must now be separated into its usable parts and the waste matter eliminated. It is

\(^5\) The Monroe mill of the Brown Paper Mill Co., Inc., uses 16 rotary digesters which revolve about one revolution every two minutes. One of these digesters (containing 4,000 pounds of pulp) is "blown" every 10 minutes.
necessary to recover all usable chemicals and reactivate them for use in digesting more wood.

Refining and bleaching. The spent chemicals are separated from the cooked chips in vacuum type washers. These washers consist of vats containing a revolving drum in horizontal position. This drum has a covering of fine wire screen and the pulp forms a thick mat on the drum while the black liquor solution is pulled through the pulp mats to liquor tanks. The washing process is repeated several times until the pulp is relatively free of liquor. Hot water is then sprayed on the pulp for a final washing.

The unrefined pulp now contains some pieces that are not fully cooked and knots which will not digest under any circumstances. To remove these the pulp is run into the screen room where the pulp is diluted and passed through revolving screens which have holes of such size that the pulp fibers pass through and the larger uncooked portions are screened out.

The pulp is now brown in color and when lighter colors are not desired the pulp goes directly to the beaters and refiners. An increasing amount of kraft pulp is now being bleached, however, and for this portion of the pulp additional stages of processing are required. The pulp which is to be bleached is digested to a greater degree in order to remove more lignin and other non-cellulose materials. After washing, the pulp is treated with chlorine gas followed by a treatment of caustic soda to remove chlorinated
and oxidized materials. The pulp is then immersed in a solution containing bleaching powder which results in bleached pulp suitable for many kinds of white paper.

The pulp which comes from the washers and bleachers is known to the trade as "half stuff" and must be subjected to further treatment known as "beating," performed in machines known as beaters. The beater consists of a large metal tank in which a large roll or wheel containing knives revolves on a bed plate also surfaced with knives. This wheel circulates the pulp around the tank and back to the knives over which the pulp must pass in making its circuit.58

The knives of the "tackle"59 are arranged in various ways to secure the maximum effect of disintegration and to aid the mixture and flow of the pulp. These knives may be arranged in zigzag, elbow, knee and similar angle shapes. They are usually constructed from steel or phosphor bronze metal, but where it is desired to produce a greasy, well-milled and tenacious sort of pulp, (as in the case of kraft papers and greaseproofs) stone or lava rolls and bedplates may be used. Such rolls are unsuitable where


59 "Tackle" is the mill term for beating roll and bedplate knives.
a direct cutting action is desired, as in the case of blotting and other absorbent papers. Where hydrated and long drawn out pulp of great strength is being produced, as for loans, banks, and wrappings, blunt "tackle," is used. For writing papers and good printing paper the "tackle" is between blunt and sharp. In the case of filter, duplicating, and blotting papers, sharp "tackle" is used to effect a speedy reduction of fiber and preserve the property of capillary attraction.

The beating process is the most delicate and important process in the whole procedure of paper making. In addition to fulfilling the purpose just explained, the beater is used to add loading, coloring, and sizing.

A gelatinization known as hydration takes place during the beating process. This assists in holding the fibers together in the paper. For some papers rosin is used as size to smooth down the fibers and give the paper a harder surface. In making hard finished writing papers the pulp is passed through a tub of hot size. This is necessary to keep ink from spreading. Tub sizing also helps prevent

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60 Maddox, loc. cit.
61 Ibid., pp. 78-80.
62 The Paper and Pulp Industry of New York State, op. cit., p. 79.
63 It has been said that the blotter industry was born when a paper maker forgot to put in sizing—D. & W. Paper Co., Curious Paper Facts, Vol. 1, No. 2.
the stretching of paper because of differences of atmospheric conditions and tends to hold the moisture that is in the paper and to check outside moisture from entering.

In making some of the cheaper grades of paper, the pulp goes directly to the refiners and the beating process is dispensed with. Regardless of whether the pulp enters the beaters or not, it must be further refinished before it is ready for the paper machine. This refining in most mills takes place in Jordan refiners. These machines contain revolving discs which rub the pulp until it reaches a certain point of hydration or water carrying property suitable for the grade of paper being made. This refining reduces the pulp to its individual fibers and also broom splits and otherwise cuts the fibers.64

When the pulp is destined for use on the company's own paper machines in an integrated pulp and paper mill the pulp is pumped directly from the refiners to the machines in slush form (five to six per cent fiber and the rest water).

Chemical recovery. The chemicals used to digest the wood into pulp are expensive and the successful operation of a mill depends upon their recovery. Without the recovery of the chemicals used in preparing the digesting liquors, the cost of manufacturing pulp would be prohibitive. The process of recovering a large percentage of the

64 The Paper and Pulp Industry of New York State, loc. cit.
cooking liquor involves many chemical reactions which makes it necessary for the mill to have a staff of highly trained technical men.

After the liquor is separated from the pulp in the washing tanks it contains a high percentage of water, along with spent inorganic compounds, and organic matter which was dissolved from around the fiber in the wood. The process of chemical recovery involves (1) evaporating the water from the used liquor, (2) burning off the organic matter, and (3) preparing the inorganic matter (inert sodium carbonate) for re-use.

All except about 30 per cent of the water is evaporated by passing the solution through multiple stage evaporators. After going through this process, the liquor is very viscous and looks like cane sirup. This sirup-like fluid is now mixed with saltcake (sodium sulphate Na₂SO₄) and then sprayed into a large recovery furnace where the remaining water is evaporated by the terrific heat. The temperature of 2,000 degrees F. turns the organic matter to carbon. Upon contact with the carbon the sodium sulphate is reduced to sodium sulphide.

When the molten inorganic chemicals flow from the furnace they enter a tank of water in which they are dissolved.

65 The sulphate process gets its name from the introduction of sodium sulphate into the process at this stage. This chemical is simply the source of soda, and is not a pulping agent.
The resulting solution contains sodium carbonate in addition
to sodium sulphide. The latter chemical is an active ingre-
dient for the wood cooking process, but the sodium carbonate
is still inactive. Quick lime (calcium oxide) is added to
the solution to convert the sodium carbonate to sodium hy-
droxide, another active agent for cooking the wood.

The addition of quicklime to the sodium carbonate pro-
duces insoluble calcium carbonate which is of no value in
the digesting process. This calcium carbonate is not treat-
ed as waste. Instead, it is put into kilns about eight feet
in diameter and nearly 150 feet long in which there is a
temperature of 2,200 degrees F. The intense heat separates
the calcium carbonate into its component parts—calcium
oxide and carbon dioxide. The calcium oxide is retained
and used again in the same manner as explained before, and
the carbon dioxide passes off as gas.66

Research

The manufacture of pulp and paper was in its earliest
days an individual art. The techniques were passed from
father to son and each mill seemed to feel that it had
skills and secret methods unknown to other mills. Many of
the developments sprang from necessity, and were the result
of trial and error experiments where fundamental knowledge

66 It was explained by Mr. Edgar Spruill, Research
Department, Southern Advance Bag and Paper Co., Inc., that
quick lime is used over and over with very little waste.
was almost entirely lacking. The early paper maker on his best days could produce a sheet which would compare favorably with similar sheets made today. He could not, however, do it constantly. 67

In recent years, with the development of printing to its present state, and with the multitude of other uses for paper, the need for specified quantities of paper to suit specific use requirements has made papermaking less and less an art and more and more a science. 68 Research in pulping and manufacturing is carried on by the Federal government, by paper companies, individually and collectively and by universities.

Even though all fibrous vegetable material can be used for making paper, it does not necessarily follow that all of such fibers are readily usable. That which seems a "natural" in theory, often fails when experiments are conducted. Likewise, successful experiments in the laboratory do not mean that the same process carried on commercially will be profitable. It is one thing to make a hundred reams of paper as an experiment in the laboratory, and quite another thing to produce thousands upon thousands of reams of the same which will be continuously marketable. The item of


68 Canfield, op. cit., p. 19.
cost is a controlling factor but there are other considera-
tions such as the quantity and quality of materials avail-
able and the adaptability of the finished product for known
uses and new uses which can be developed.

**Institutions participating in research.** Many companies
have their own research laboratories which are engaged in
experimentation and improvement. A large number of companies
collectively have established the Institute of Paper Chem-
istry at Appleton, Wisconsin. This is a combination research
institute and training school at the college graduate level
for technicians to serve the needs of the industry and its
customers. It has capital assets of over $2,000,000 and an
annual operating cost of $750,000 and is unique among
industrial cooperative efforts.

The growth of the research department of the Insti-
tute of Paper Chemistry has in large part followed the pre-
sentation of problems to the Institute by pulp and paper
companies. In the beginning there were only a few chemists
and practical men, but it has become necessary to build up
a staff trained in highly specialized technical fields such
as lignin, microanalysis, chemistry of carbohydrates, water
and waste treatment, fiber microscopy, cellulose, pulp and
paper technology, wood chemistry, wood technology, colloid
chemistry, technical bibliography, pulp and paper engineer-
ing, and the conventional branches of physics and chemistry.

The most complete facilities for research in the manu-
facture of pulp and paper are located at the Forest Products
Laboratory. This laboratory is under the supervision of the Forest Service of the United States Department of Agriculture and operates in cooperation with the University of Wisconsin. Here a completely equipped pulp and paper laboratory is maintained as one of the eight major research divisions. The purpose of research in this laboratory is to increase possibilities of economical production, obtain higher yield, and to produce better quality pulp from native woods including those of little or no present utility.

The constantly growing demand for the many and varied pulp and paper products has made it advisable to supplement supplies of the relatively few coniferous woods with other species and to develop satisfactory conversion methods for them. Although the coniferous woods are the mainstay of the industry, the utilization of other available species, many of which have little or no value at present, would not only aid in supplying the increased demand for pulpwood, but would also enable improved forest management and provide for higher returns from forest land.

Research in the pulp and paper laboratory at Madison has the following objectives:


70 Ibid., p. 1.
1. Investigations to improve yield and quality of pulps obtained in the sulphate, sulphite, soda, semichemical and mechanical process.

2. Development and improvement of chemical and mechanical processing of pulp in such operations as bleaching.

3. Studies of the relationship of fiber properties to the properties of pulps and papers.

4. Investigation and improvement of paper machine operation.

5. Evaluation of pulp and paper products.

6. Studies directed toward more complete utilization of species characteristic of various geographical regions.

The accomplishment of such objectives requires a wide range of equipment. Facilities are therefore available for conducting investigations and demonstrations through both laboratory and pilot plant stages. A description of these facilities is beyond the scope of this paper, but it should be stated here that this equipment consists of machinery for handling and preparing wood through the entire sequence of pulp and paper processing, and includes several laboratories for testing pulps and papers. The equipment is designed to meet a major objective in evaluating various species of wood for pulp and paper and is also adapted to investigations designed to improve and perfect techniques in pulp and paper manufacturing. The chemical and semi-chemical pulping research is conducted in vessels varying in capacity.
from beaker-size to a 225-cubic-foot digester. Machinery is also available for groundwood pulping.71

The Crossett Lumber Co. in Crossett, Arkansas, has recently completed a laboratory which conducts research in pulping and papermaking. Small scale equipment is designed to permit close observation, and may be rearranged for the study of plant lay-out. The interior wood stud walls may be rearranged in order to permit wide latitude in allocating space to various departments as needed.72

**Pulping research.** During the years 1915 to 1921, the Forest Products Laboratory carried on a series of preliminary pulping trials using all standard pulping processes with as many American woods as appeared to have commercial possibilities. Groundwood, sulphite, soda, and sulphate pulps were made from practically all the Southern species and the data was assembled and published in bulletin form. During this period such commercial organizations as the Champion Fibre Company of Canton, North Carolina, the Carolina Fibre Company at Hartsville, South Carolina, the West Virginia Pulp and Paper Company at Covington, Virginia,


and other mills, experimented on a mill scale with the processes developed in this laboratory. 73

From 1921 to 1927 the Forest Products Laboratory conducted extensive research on the pulping of Southern woods. Improved methods for cooking and bleaching pulps from Southern yellow pine were developed. Also chlorination bleaching procedures were tried which resulted in stronger white pulps from these species. During this period the laboratory made newsprint papers from various combinations of pine sulphite along with both pine groundwood, and black gum groundwood. Pulp suitable for corrugating board was also made by the semi-chemical process from Southern hardwoods. 74

Since the year 1927, a great deal of effort has been directed toward the improvement of quality of pulps and papers using the various standard pulping methods with Southern pines and hardwoods. Using black oak the laboratory has produced products ranging from corrugating board and newsprint to high-quality bond papers. 75

During the war and in recent years technical men have developed and put into operation processes that once seemed

74 Ibid.
75 Ibid.
Impossible for use with Southern yellow pine. The sulphite process was for many years believed unsuitable for use with these woods. The laboratories of the Rayonier Company, however, developed a successful method, and later a plant was built at Fernandina, Florida, to produce sulphite pulps. 76

Until a few years before World War II resinous Southern yellow pine was believed unsuitable for making groundwood newsprint. The combined research of the Forest Products Laboratory at Madison, Wisconsin, and the Herty Laboratory at Savannah, Georgia, developed and perfected a satisfactory process through years of experiments, and as a result, two newsprint mills have been erected in the South. In 1939, the first mill was built at Lufkin, Texas. A second newsprint plant was constructed along the banks of the Coosa River at Childersburg, Alabama. It began operations in January, 1950 with an annual production of 100,000 tons.

As the result of technical research the South is now playing a leading role in the production of corrugating paper made from hardwoods cooked by a semi-kraft process. Oak and gum which were once considered unusable are now utilised, and two companies in Louisiana are now manufacturing high-grade corrugating sheets from this wood. 77


77 Gaylord Container Corporation at Bogalusa, and International Paper Company at Bastrop.
Great strides have been made in the more efficient use of raw materials. Materials formerly considered waste are now utilized as by-products or are used in the manufacturing process. In 1905 in Washington Parish, the Great Southern Lumber Company erected one of the greatest saw mills in the world. Three years later the company erected a huge incinerator at Bogalusa to burn the refuse of the saw mill. Prior to its demolition this huge incinerator bore this inscription: 78

Epitaph of the incinerator—Born October 1, 1908, died July 4, 1924. Everyday during my life of 16 years, I consumed daily 560 cords of waste material or a total of 2,688,000 cords. I cost $25,000 to build, but my fire has destroyed $1,344,000 worth of what was formerly considered waste. The complete utilization of saw mill refuse in the manufacture of paper has my fire forever extinguished.

Raw material research. All plant life contains cellulose, and for centuries man has been seeking practical methods of utilizing the cellulose contained in various kinds of plants. Cellulose may be produced in the laboratory by putting together, in a specific way, molecules of glucose, the kind of sugar found in corn sirups. Nature manufactures abundant supplies of cellulose through the use of water, air and sunlight. 79


79 Aries, loc. cit.
Bagasse, a by-product of sugar manufacturing, contains a high percentage of cellulose which is the basis of both paper and rayon. Only a small part of this material is used for its one commercial purpose—the manufacture of cellotex boarding. The rest is burned as fuel.

In 1946, Dr. P. M. Horton, Head of the Department of Chemical Engineering at Louisiana State University developed a process to make paper from bagasse.\(^{80}\) He separated the pith from the fiber before treatment. The depithed fiber was then treated with nitric acid. The pith can be used in the manufacture of dynamite and tests made have met the requirements of companies manufacturing dynamite.

Although the process developed at L. S. U. is satisfactory on a laboratory basis, much research is necessary to make the manufacture of paper from bagasse profitable on a commercial scale.

Recently a new and significant development took place in the utilization of bagasse. On January 27, 1950 a special edition of the Holyoke Daily Press, Holyoke, Massachusetts, was printed on paper made from bagasse pulp. The raw bagasse from which this paper was made was pulped and bleached

\(^{80}\) This research project was sponsored by the Louisiana Department of Commerce and Industry. During the sugar-making season of 1945-1946, the L. S. U. Board of Supervisors appropriated $50,000 for the work—\textit{Reveille}, May 21, 1944 (Baton Rouge: Louisiana State University), p. 2.
by a process developed by the Kinsley Chemical Co., Cleveland, Ohio, and the paper was run off in the plant of the Chemical Paper Manufacturing Company in Holyoke.  

Both bleached and unbleached bagasse pulp were used to manufacture different weights and grades of paper including corrugating medium. Although the details of preparing bagasse pulp or the costs of manufacturing were not revealed by the Kinsley Chemical Co., it was stated that yields were obtained of over 60 per cent for unbleached bagasse, and over 50 per cent for bleached grades.  

The main purpose of this demonstration was to show that 100 per cent bagasse pulp could be employed to make commercial grades of paper suitable for printing of newspapers. This development is particularly significant to those countries which do not have adequate pulpwood resources, but which have large quantities of bagasse. Paper manufacturers and other interested persons from many foreign countries, including Argentina, China, Australia, Brazil, Peru, Mexico, Santo Domingo, Haiti, India, Pakistan, and South Africa, witnessed the demonstration. The Argentine government is vitally interested because of the fact that Argentine capitalists, industrialists and technicians have organized to finance an Argentine pulp and paper project known as Fibrocel.


82 Ibid., p. 1294.
S. A. which proposes to utilize the techniques and processes of the Kinsley Chemical Co. in the manufacture of newsprint from bagasse, wheatstraw, and fibers of other annual growths. 83

There has also been much research conducted on the use of corn stalks. In 1927 a series of investigations on the utilization of agricultural wastes was started by the National Bureau of Standards. Some of these studies were carried out in cooperation with the engineering experiment station of Iowa State College, Ames, Iowa. 84

Cornstalks have proved feasible for use in the making of insulation board, but this does not provide an outlet for all the available raw material. The experiments conducted at Iowa State College showed the successful use of cornstalks as a raw material for making press boards. 85

The paper produced from cornstalks is of low quality. The fibers are short in comparison with other raw materials, (Table II), and the paper does not compare favorably with kraft paper produced from wood (Table III).

Brown wrapping paper on the cornstalk experiments yielded 23.7 per cent, and probably 25 per cent could be obtained. At an estimated cost of $7.15 per ton for bailed

83 Ibid., p. 1294.


85 Ibid., p. 2.
cornstalks delivered to the mill and $1.00 per ton for separating the cortex the cost for raw materials was approximately $32.60 per ton of pulp which in the year of this investigation (1935), was about four times the cost of the pine wood required for a ton of No. 2 kraft. Also, the cost of manufacturing was much higher. The material was so light and bulky that it was impossible to charge a satisfactory amount into a digester, and the cost of chemicals ran high.

TABLE II

Comparison of the Fiber Lengths of Cornstalks and Wood

<table>
<thead>
<tr>
<th>Fiber Length (millimeters)</th>
<th>Cornstalks;</th>
<th>Woods:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cortex</td>
<td>Hemlock</td>
</tr>
<tr>
<td></td>
<td>.65</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td>Nodes</td>
<td>Yellow Pine</td>
</tr>
<tr>
<td></td>
<td>.62</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td>Leaf Sheath</td>
<td>Spruce</td>
</tr>
<tr>
<td></td>
<td>1.17</td>
<td>2.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poplar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.46</td>
</tr>
</tbody>
</table>


After considering the poor quality of the paper and its relatively high cost, the utilization of cornstalks for manufacturing ordinary wrapping papers does not appear to have commercial possibilities. Even if the price of wood

86 Same as source for Table II this page.
were to be quadrupled, cornstalks could not compete success­fully with present raw materials used for kraft paper.

Before cornstalks can be satisfactorily used in making paper, a use must be found for the pith as a by-product. 87

TABLE III

Comparison of Cornstalk Paper With Kraft Specifications of Government Printing Office

<table>
<thead>
<tr>
<th></th>
<th>Ratio of Bursting Strength to Weight (Percent)</th>
<th>Folding Endurance Average (Double Folds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2 Kraft (Spec. GP0)</td>
<td>70</td>
<td>500</td>
</tr>
<tr>
<td>Cornstalk Paper</td>
<td>51</td>
<td>93</td>
</tr>
</tbody>
</table>

Source: Same as Table II, p. 58.

Straw contains a large percentage of cellulose and this has suggested its use as a raw material for the manufacture of paper pulp. On large laboratory equipment pulps made from straw show a yield of 36 to 43 per cent of dry weight of raw wheat straw, 42 to 46 per cent for rye straw, and 40 to 45 per cent for oat straw. 88

Cereal straws have been employed from time to time in this country for the production of paper, but recent eco­nomic considerations have limited such use. Mr. Wingfield stated in 1936 that approximately 600,000 tons was used

87 Ibid., p. 9.

annually for the manufacture of strawboard and eggcase paper. He also stated that in Argentina, Chili, and some other countries, straw is used in making high quality papers.89

Development of pulp and paper for special uses—Paper-making has progressed from an art to a science. There is available today a vast body of technical information which makes possible exact control over the chemical and physical properties of the paper. Characteristics such as physical strength, (including thickness, burst, tear, bendability, stiffness), color, type of surface, absorbency, waterproofness, and others, can be controlled with precision. Paper can be designed for particular purposes. For instance, ability to be folded and lightness of weight are characteristic of the paperboard from which milk containers are made.

During the last war an invasion map paper was developed which had special ability to withstand water. It stood crumpling, creasing, and rough treatment that ordinary papers would not stand. Also, a special waterproof paper was produced for wrapping war materials that were floated ashore or that had to withstand the elements for days. This paper has a layer of asphalt between two layers of heavy kraft paper. Such paper is now used as an added protection for wrapping skids of paper before loading in cars.

89 Ibid., p. 2.
Not so many years ago, it was thought that only dark kraft papers could be made from Southern pine, and the first mills in Louisiana were devoted entirely to the manufacture of unbleached kraft paper and paperboard. Research, however, has developed a system of multiple stage bleaching, and now many of Louisiana's mills are producing a good grade of a large variety of white papers.

Research on multiple stage bleaching was conducted at the Forest Products Laboratory in Madison, Wisconsin, from 1915 to 1921. These experiments produced on a laboratory scale, satisfactory bleached book paper from a combination of sulphate pulps produced from Southern yellow pine and black gum.  

Practically all paper now contains some kind of sizing to make a smooth, hard surface and give more body to the sheet. Rosin is used quite extensively. Until 1807, rosin was a by-product of the manufacture of turpentine. It had few uses and most of it was discarded. One barrel of turpentine yielded three barrels of rosin. In 1807 a German by the name of Illig discovered the suitability of rosin soap as a sizing or waterproofing agent for paper.

Research has been conducted to determine the suitability of sweetpotato starch for sizing. Tests have indicated that sweetpotato starch is as satisfactory for beater sizing as commercial corn and cassava starches commonly used. The

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90 Winslow, loc. cit.
papers sized with sweet potato starch were equal to the best papers sized with the other starches with respect to strength, opacity, and degree of sizing.

Paper is used in the manufacture of artificial leather and many other treated products that hardly resemble paper. Paper is soaked with resin and put under heavy pressure to produce a product called Papreg. It is half as heavy as aluminum, yet strong as steel. When used in airplanes Papreg needs no special finish, it is not affected by salt water, and it does not splinter or tear when pierced.

Today, people are using clothing made from rayon and are wearing coats and sleeping under blankets made from wood wool. Prior to World War II, the field of dissolving pulps (used for rayon production and nitrating) was confined to Western and Northern mills which produced pulp by the sulphite process. The war brought about a shortage of pulp for nitrating use in smokeless powder. Pulp and paper technicians met the crisis through the production of a successful nitrating pulp made from Southern pine. Two mills located in Louisiana manufactured this pulp.91

The International Paper Company has been one of the pioneers in the production of dissolving wood pulps. Canadian International's Kipawa mill at Temiskaming, Quebec, was the

91 W. F. Gillespie, op. cit., p. 4.
first mill especially designed and equipped exclusively for
the manufacture of dissolving wood pulp. Canadian Interna-
tional now has two other mills producing this product in
Canada. The mill at Hawkesbury, Ontario, includes one of the
world's finest research and control centers. The laboratory
is equipped with every modern facility for developing wood
pulps and developing new processes of technical control.
The laboratory's pilot plants make rayon yarns, transparent
films, and related products in order that performance may be
studied under actual operating conditions.

International Paper Company recently completed a new
dissolving pulp mill at Natchez, Mississippi, at a cost of
$20,400,000 for the first unit of this plant. This is the
first large scale operation designed to produce top grade
dissolving wood pulps by the sulphate process with hardwoods
as the primary raw material. The Natchez mill has a capacity
of 300 tons a day, which will increase the capacity of the
Company and its Canadian subsidiaries to 325,000 tons of
rayon pulp a year.

The process of making dissolving wood pulps from hard-
woods was developed after many years of intensive research
and plant studies by International's Southern Kraft Division

92 International Paper Company After Fifty Years, 
op. cit., p. 56.

93 Ibid., p. 58.

94 International Paper Company, Fifty-First Annual 
with the technical advice of the staff of Industrial Cellu-
lose Research Limited, a wholly owned research affiliate of
Canadian International Paper Company. Pulp was manufactured
in substantial quantities by the new process in 1948, and
the product was accepted by the makers of rayon yarns.95

Dissolving wood pulp is formed and dried in much the
same manner as paper. The dried pulp is cut into sheets of
exact size and packed in bales for shipment to manufacturers
of rayon yarn, plastics, and allied products.96

By-Products

The pulp processing operation produces lignin, turpen-
tine, and tall oil as by products. This section will be
devoted to a description of these products and a statement
of some of their uses.

It has already been pointed out that about one-third
of the composition of wood is lignin, a tough, durable sub-
stance which acts as a sort of binder in the tree to cement
the cells together. Scientists have for many years been
experimenting with ways to use this substance, and present
day chemical research, conducted in dozens of laboratories,
may transform this field into a profitable source of income.

When compared with cellulose, the field of lignin chem-
istry is relatively unexplored. Lignin is often given the

95 Ibid., p. 10.

96 International Paper Company After Fifty Years, op. cit., p. 57.
name of "the largest waste in industry." This statement has been made because sulphate and soda mills burn the lignin as fuel in the process of reclaiming their chemicals, while sulphite mills dump it.

About three million tons of lignin is wasted annually by North American paper mills. In addition to this waste, lignin pollutes the streams of water into which the discharge is thrown, and thus, creates a social nuisance since the pollution kills the fish.97

Some progress has been made in lignin research and various uses have been discovered. Lignin is used in tanning leather, as a binder in mixing concrete, as a water softener and purifier, and is used in the manufacture of vanillin. In substance it is a good deal like humus in rich soils and is used as a base for fertilizers.

Lignin is also used in making plastics and during the war it was utilized in various capacities such as for bomb fuses, shell cases, instrument panels for airplanes and vehicles, and in the cases of storage batteries. In regular commercial use such items as fountain pens, automobile instrument boards, telephones, radio cabinets, much electrical equipment, combs, kitchen utensil handles, and even jewelry may be made of lignin plastics.

At present, the greatest production of turpentine comes as a by-product in the pulping process of resinous woods.

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97 Aries, op. cit., p. 9.
The relief gases captured from the digesters yield almost 50 per cent turpentine by volume. This product is refined by fractional distillation and the result is a colorless, and scentless product that compares most favorably with turpentine derived from other sources.

Tall oil is a by-product of the kraft cooking process. Fine wood naturally contains fatty materials and resin acids. These are cooked out of the chips in the pulp-making process in the form of black liquor soap. This soap is skimmed from the spent liquor and after acidulation with sulphuric acid produces a product known as crude tall oil.

The Springhill mill of the International Paper Company, includes a large plant for processing black liquor soap into crude tall oil. This plant also serves the Bastrop and Camden mills. Many other tall oil processing plants are located throughout the South.

The Arizona Chemical Company recently completed a refinery costing $1,700,000 at Panama City, Florida to make refined tall oil, a product which is suitable for use in higher quality products than is crude tall oil.

Tall oil is available in large quantities and is the lowest priced fatty material on the market. In its crude form it can be used where its natural black color is not objectionable. It serves as a flotation agent in the

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98 Fifty per cent of the stock of this company is owned by International Paper Company.
concentration of phosphatic rock ore, as an emulsifier or an additive in asphalt road construction, as material for low-priced industrial cleaning soaps, in linoleum manufacture, and for many other purposes. When combined with various reagents, refined tall oil performs, at lower prices, the same function as similar oils, such as linseed in the manufacture of paints and varnishes. It is also used in manufacturing insecticides, emulsifiers, disinfectants, and cutting oils.

The production of tall oil was increased considerably during the last war, and served as a great contribution in helping to alleviate a national and worldwide shortage of fats and oils. The crude tall oil which went into cutting oils for use in machining operations was of utmost importance.

Methyl alcohol and resins are also being recovered on a commercial scale from the kraft process. The increasing cost of raw materials, labor, and overhead have necessitated much research on the utilization of by-products. The enormous quantity of by-products is offering an incentive approaching that which resulted in the remarkable development of the Carbide and Carbon Chemicals Corporation in the field of petroleum materials.99

It seems appropriate to close this section with excerpts taken from an address by John H. Hinman, President of

99 Lewis, loc. cit.
International Paper Company, delivered at the Fiftieth Anniversary Dinner in New York on January 31, 1948.100

The increasing use of dissolving wood pulp for the manufacture of rayon and other synthetic products reminds us that once wood is reduced to a pure and stable chemical it provides a base on which the chemist can build a hundred different products.

More and more the wood pulp and paper industry is joining forces with the chemical industry. For example, in the South the Arizona Chemical Company, which is owned jointly by International Paper Company and American Cyanamid Company, is already processing by-products of our mills at its Panama City plant into pinenes (which are chemicals closely related to turpentine). Now Arizona is building a large chemical plant to make tall oil... and separate it into its component parts—vegetable fats and rosin. Developments of this kind are of great potential significance.

...It is conceivable that the forests of the United States and Canada within the next half-century will supply us not only paper for many varied purposes, and dissolving pulps as the base for a variety of chemical synthetics, but also quantities of foodstuffs, alcohol, and chemical raw materials from parts of the wood which we are only beginning to use today.

100 International Paper Company After Fifty Years, op. cit., p. 107.
CHAPTER II

HISTORY OF PAPERMAKING

Ancient Papermaking

The preparation and use of substances for the preservation of records is one of the oldest of arts. Before the discovery of paper, man used for this purpose such materials as baked clay brick, waxed wood, metal plates (usually copper), plates made of ivory, human skins, animal skins, leaves and bark of trees, and bamboo.

Paper was invented because of necessity. The process of civilization demanded that records be kept and that messages be conveyed. The manufacture of paper from fibrous materials was first attempted in 105 A. D. when the Chinese student Ts'ai Lun developed the method of making paper from bark, old linen, and fish nets. Prior to this invention the Chinese used pieces of lacquered bamboo for records. These were bound together by passing a string through a hole in the end of each piece. The procedure was cumbersome and the records were heavy and bulky.

After Ts'ai Lun's invention most of the Chinese paper was made from the inner bark of the bamboo and mulberry tree and from hemp rags. The Chinese made pulp paper for six centuries before the secret was known to anyone else and the basic process then was much the same as that used in our own modern paper mills. Then, as now, the process consisted of breaking up bundles of cellulose fibers into individual fibers, suspending them in water, draining the water through a fine screen, which retains the fibers as a thin, wet, felted mass, and removing most of the remaining water from the sheet by absorption, pressure, and heat. The Chinese paper makers did by hand what modern machines do automatically and scientifically today. This ancient Chinese paper was so good that some of it is still in existence. The Chinese were not only the inventors of rag paper, raw fiber paper (mulberry bark and bamboo), and paper made from a combination of raw fibers and rags, but were also the inventors of loading, sizing, and coating of paper.

Using camels as beasts of burden, the Chinese carried cargoes of valuable paper to all of available Asia and to the Near East in Persia. The Chinese held tight to their secret of papermaking for seven hundred years. In 751 A.D.,

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2 Ibid. (unpublished).


4 Ibid., p. 16.
the Arabs of Samarkand captured some Chinese prisoners of war, several of whom were experienced papermakers, and forced the secret from them. The secret of papermaking then traveled to Bagdad, to Cairo, and to Morocco, but four hundred years passed before it reached Europe.5

In Egypt a fairly satisfactory form of paper had been prepared from papyrus, a native plant, Papyrus was in use for writing many centuries before the Chinese discovered pulp paper. Some religious, official, and domestic documents on papyrus are still in existence which are assigned to dates ranging to 2,000 years B. C. This substance was employed as a writing material down to the middle of the tenth century of our own era.6

Papyrus was an aquatic plant with a soft cellular flower stem growing from 15 to 20 feet high, and these stems were used for making paper. Each stalk made as many as 20 thin sheets of paper.7 Egyptian slaves placed layer upon layer of papyrus alternately, horizontal and vertical, until a sheet was made to the required size and thickness. The sheets were then wet down with water, pressed together, dried


in the sun, and polished with shells and stones until smooth enough to write upon.8

The Greeks, to whom much of the Egyptian papyrus paper was exported, gave the product the name paper. When the Romans learned of papyrus they improved the quality by sizing it with flour. This made the paper white, where the Egyptian product had been brown or yellow. The Romans used much of this paper in keeping their records.9

Parchment which was made from plentiful sheep and goat skins was known in Asia and in Europe as early as the second century A. D. It was so costly that priests and monks washed and scraped the parchment free of inks. The Romans used mostly parchment and papyrus as they believed that paper made from pulp was fragile and brittle and not durable.10

The Egyptian papyrus paper was entirely different from the Chinese paper made from pulp. According to Robert Canfield:11

Paper and pulp were entirely Chinese made, and handmade. Their manufacture began to spread—to Turkestan; to Mesopotamia in about 800 A. D.; to Egypt, 900, to Morocco, 1100; Spain 1150—but paper was still handmade. The Spaniards were lazier, or smarter, than their predecessors, and began the use of water power in pulp beating to separate the fibers. The industry continued to spread—to France, 1200; Italy, 1275; Germany, 1300; England, 1500; and finally the United States in 1690.

8 Ibid., p. 8.
9 Ibid., p. 8.
10 Maddox, loc. cit.
Early Papermaking in the United States

Early papermaking as used in this section will include papermaking in the United States from the founding of the first mill in 1690 to the installation of the first Fourdrinier paper machine in 1827. This seems to be a logical division point since that date represents the beginning of a period of change-over from hand to machine methods.

Paper was not a vital necessity to the early colonists, and their needs were supplied by importing from England and Holland. There were no newspapers in existence until after 1700, and there were few books except those brought from abroad. A printing press was put in operation in Cambridge in the Massachusetts Bay Colony in 1638, and others were established in Boston, New York, and Philadelphia before the end of the seventeenth century. The printed output was small. Less than 1,000 books and pamphlets were printed in the sixty-two years from 1639 to 1700. There was not a great amount of correspondence, and writing was left largely to ministers and government officials.12

Location of mills. The starting of the first paper mill in 1690 was not the result of an urgent call from the community. Many excellent paper makers slowly had emigrated to America. Among these was William Rittinghuysen (William Rittenhouse) who sailed from Holland in 1690.

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William Rittenhouse and three associates in September, 1690, established the first paper mill in the United States. It was located in what is now Fairmont Park, Philadelphia, Pennsylvania. One of the partners in this business was a printer in Philadelphia. Printer and paper maker made an ideal partnership for establishing an infant industry in a field that had not yet been entered, and the business, flourished.

The best day's work for three men in the Rittenhouse mill was four and a half reams of paper 20" x 30". Approximately 1,200 to 1,500 reams of paper were made per year. Even though the capacity of this mill was small it became very important to the community and the home supply of Pennsylvania was dependent on it.\(^\text{13}\)

The second paper mill of the colonies was an outgrowth of the Rittenhouse mill and was built in 1710 in Germantown, Pennsylvania close to the original mill. The third paper mill was established in 1729 in the township of Concord, 20 miles from Philadelphia. Forty years had thus elapsed between the establishment of the first and third paper mills in the country.\(^\text{14}\)

The literary and typographic center of the colonies was in Eastern Massachusetts during the first quarter of the eighteenth century, and it is not clear why Philadelphia

\(^{13}\) Ibid., p. 63.

\(^{14}\) Ibid., p. 63.
should have established the paper industry so far in advance of Boston. Printers in Boston outnumbered those of the rest of the colonies two to one. Out of six American newspapers, four were published in Boston, and two-thirds of the books and pamphlets were made in that settlement.15

There were three mills in Pennsylvania and one in New Jersey before the first mill in New England began operations in 1728. It has been conjectured that Boston got a later start in manufacturing paper because adequate importations were available from England.16

The early American colonists were hungry for paper, and they pleaded, begged, and bargained for the product. The industry grew slowly in the colonies. The stamp tax which resulted in the Boston Tea Party applied also to paper. This tax created a virtual monopoly for English mills.

At the same time the British used much effort to hinder production of paper in the Colonies, they did not furnish enough importations to supply the demand. England was behind in this branch of manufacturing and was unable to supply the starved Colonial market. Domestic mills were so few in number and their production was so limited that they were not able to make up the deficiency.

Many make-shifts were used to meet the difficulties arising from the shortage of paper. Newspapers were the

15 Ibid., p. 63.
16 Ibid., p. 64.
largest consumers, and therefore, suffered most. In some cases regular issues were omitted because there was no paper. Frequently issues were printed on paper of diverse sizes, colors and quantities. Printed matter was often placed on that part of the paper which was usually considered as margin.¹⁷

The Stamp Act of 1765 declared that all instruments of writing used in the American Colonies were null and void unless executed upon stamped paper or parchment charged with a duty by Parliament. Also, the Townsend Act of 1767 involved imposts on glass, paper, pasteboard, lead, printer's colors, and tea, and probably had an adverse effect on the Colonial paper industry.¹⁸

It was most difficult to start a paper mill in the early part of the eighteenth century. Papermaking, the same as many other manufacturing industries, was regarded as a sort of public utility. It was under the supervision and control of government commissions and officers. Permission to engage in the business of papermaking was a right of the government, and a monopoly for an indicated number of years was requested and was generally included when a permit was accorded. It was impossible for an enterprising young man

¹⁷ Ibid., p. 71.

to establish the smallest possible mill and work unrestrainedly.\textsuperscript{19}

During the Revolution, paper was necessary to prosecute the war and paper makers were removed from the armies and sent back to the mills to manufacture cartridge and other papers considered vital to the war effort. The Revolutionary War proved the essentiality of paper. The necessity of paper was so clearly realized that the first Congress, in its second act, provided for a tariff on paper.\textsuperscript{20}

In spite of the shortage of capital, skilled labor, and raw materials the number of paper mills increased. Early Massachusetts paper mills were sometimes established by the sale of lottery tickets. Such sale was legalized under an act of the General Courts of Massachusetts passed May 6, 1782. Some of these lottery tickets are now on display in the Dard Hunter Paper Museum in the Massachusetts Institute of Technology.\textsuperscript{21}

The early paper mills were built near population centers on a site which provided a large volume of clear and pure process water. Old rags were the principal source of raw material, and the population centers furnished both the raw materials for making the paper and the market for the finished product.

\textsuperscript{19} \textit{Progress of Paper}, \textit{op. cit.}, p. 64.

\textsuperscript{20} Canfield, \textit{op. cit.}, p. 17.

Methods of manufacture. The early paper makers of the United States manufactured their paper entirely by hand and the only raw materials used were linen and cotton rags. Many of the small mills were at first run by the owners with the help employed from the neighborhood. As the industry expanded and the demands upon the mills for paper gradually increased, a class of professional paper makers sprang up, and the mill proprietors found themselves more and more dependent upon them. These paper makers were a wandering lot of vagrants quite like the old-time tramp printers. Many of them, in fact, were veritable tramps travelling about the country from mill to mill, as they might wish to have employment.

Only primitive methods were used in the process of the early paper mills. All of the work was done by hand. The pulp was prepared in large stone or iron vats or mortars. Some mills had several vats but many had only one. In these vats, filled with water, the rags were beaten to a pulp by heavy hammers which were wielded by hand. The pulp was ladled into rectangular molds made of wire cloth. Thin layers of pulp were interlayed with sheets of felting cloth. This mass was then placed on a crude machine where heavy pressure was applied through the use of a screw press to squeeze out the water and to further flatten the pulp into sheets of paper. After this pressing had eliminated most
of the water the sheets were removed one by one and placed on wooden bars to dry.22

Some of the larger Colonial mills used Hollander beating engines. This machine was invented by the Dutch the latter part of the seventeenth century, but the first record of one used in the American Colonies was in 1755 in a mill in Central Massachusetts. The Hollander consisted of a roll shod with knives which brushed the wet rags against a bed plate similarly equipped with knives. The rag stock was circulated among these knives until the proper pulp consistency was obtained. Water power was used to turn these machines and they produced a much larger quantity of pulp than was produced in stamp mills.23

One of the greatest problems faced by the early paper makers was how to secure an adequate supply of raw materials. Cotton and linen rags were hard to find since the Colonists were frugal by necessity and patched and mended their clothing as long as it could be worn. A long and tedious process of education was necessary to get people to save rags. Advertisements appealed to patriotism and newspapers urged the saving of rags. Legislative bodies even urged the common need by passing resolutions at frequent intervals.24

22 Ibid., p. 74.


24 Progress of Paper, loc. cit.
A typical newspaper notice is this one printed when a mill was started in western Pennsylvania in 1796:

The advantages accruing to our community from this addition to its manufacture will be very great, and it behooves every well-wisher to the community to contribute his mite toward the supporting it. It cannot be carried on without a supply of rags. Of these every family can supply more or less, and there will be stores in every town and various parts of the country ready to receive them. Every patriotic family then will doubtless cause all their rags to be preserved and forwarded to some place where they are collected, not so much for the pecuniary advantage to be derived from them as for the pleasure arising from having deserved well of their country. We shall shortly be furnished with a list of such storekeepers as can make it convenient to receive them, and shall then announce their names to the public.

Quality and quantity of production. Prior to the Revolutionary War, and for many years thereafter, paper was scarce, expensive, and generally of poor quality. The number of reams turned out each month was by no means equal to the demand and the quality of the paper was not much better than that which is at present used for printing hand bills and posters. It is not correct, however, to say that all paper was of poor quality. The best papers were very good, and many books printed 150 years ago on such paper are still in existence and in almost perfect condition.

White rags were sorted out and used in making the better qualities of paper. Careful sorting of raw materials


26 Progress of Paper, op. cit., p. 78.
in such a manner as to keep rags of different qualities and color entirely separate was not always practicable. Generally all rags gathered were dumped into the vats together and this produced a pulp of a dirty white, gray or brownish color. Purification of process water was considered unnecessary since clear and unpolluted streams were available.

Bleaching was not known to the trade and no method had been devised for producing a smooth surface beyond that which was imparted by heavy pressure. Occasionally, an artificial coloring matter, most frequently blue, was added to the pulp and a bluish writing or printing paper went to the market.

The Revolutionary War temporarily stopped the advance of the paper industry. Some of the productive capacity was destroyed and raw materials became more difficult to get at the same time that demand increased. There is no definite data available on the number of paper mills in operation at the close of the Revolution. One author has stated that the number was probably not above eighty or ninety. Through the stimulus of increased demand and protective tariff legislation new mills began to appear throughout the states of Pennsylvania, Delaware, Massachusetts, Connecticut, New York, and North Carolina, Rhode Island and

27 Weeks, op. cit., p. 79.
New Jersey. The first mill west of the Susquehanna River was built in Georgetown, Kentucky in 1793.28

A Government Census report submitted to Congress in 1813 included a statement on the location and value of product of paper mills. There were many errors and shortcomings in taking this census, but nevertheless the returns represent the first systematic official statement on American paper manufacturing. The report submitted was as follows:29

<table>
<thead>
<tr>
<th>States, Territories and Districts</th>
<th>Mills</th>
<th>Reams</th>
<th>Value of Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>2</td>
<td>4,500</td>
<td>$16,000</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>23</td>
<td>95,129</td>
<td>290,951</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>6</td>
<td>---</td>
<td>42,450</td>
</tr>
<tr>
<td>Vermont</td>
<td>11</td>
<td>23,350</td>
<td>70,050</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>3</td>
<td>14,625</td>
<td>53,297</td>
</tr>
<tr>
<td>Connecticut</td>
<td>19</td>
<td>---</td>
<td>82,188</td>
</tr>
<tr>
<td>New York</td>
<td>28</td>
<td>77,756</td>
<td>233,268</td>
</tr>
<tr>
<td>New Jersey</td>
<td>14</td>
<td>10,380</td>
<td>49,750</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>64</td>
<td>165,981</td>
<td>626,749</td>
</tr>
<tr>
<td>Delaware</td>
<td>4</td>
<td>---</td>
<td>75,000</td>
</tr>
<tr>
<td>Maryland</td>
<td>9</td>
<td>22,200</td>
<td>77,515</td>
</tr>
<tr>
<td>Virginia</td>
<td>4</td>
<td>3,000</td>
<td>22,400</td>
</tr>
<tr>
<td>Ohio</td>
<td>2</td>
<td>---</td>
<td>10,000</td>
</tr>
<tr>
<td>Kentucky</td>
<td>6</td>
<td>6,200</td>
<td>18,600</td>
</tr>
<tr>
<td>North Carolina</td>
<td>3</td>
<td>2,400</td>
<td>6,000</td>
</tr>
<tr>
<td>East Tennessee</td>
<td>2</td>
<td>---</td>
<td>15,500</td>
</tr>
<tr>
<td>South Carolina</td>
<td>1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>202</td>
<td>425,521</td>
<td>$1,689,718</td>
</tr>
</tbody>
</table>

Paper mills at this time were located in or near the centers of population. This was the natural place for them to be established because these centers furnished not only

28 Ibid., p. 97.

the markets, but also raw materials and labor. Then too, transportation was a problem and mills were of necessity located close to the consumer. It will be noted from the Census report that Pennsylvania, New York and Massachusetts led in number with 64, 28 and 23 mills respectively. The rest of the 202 mills recorded were scattered throughout the states. Even though Massachusetts had fewer mills than New York, the quantity produced and the value of product was greater in Massachusetts.

Paper hangings or wall paper was seen in the Colonies as early as 1737. They were used only in scant amounts, however, until well into the middle of the century. Hangings were not then pasted on the wall as in later generations, but were suspended against the wall, or on wood frames as tapestries. Their use was frowned upon by the church as a sinful display of luxury. Also, all hangings were imported from England and France and were costly. These two reasons combined, prevented for a long time the general adoption of decorative wall papers. In 1766 some domestic production began to appear.30

Government assistance and prices. After the Revolution, government assistance was given to those engaged in paper making. It was the object of government leaders not only to stimulate and develop the industry, but also to protect it from competition. In 1785 the Legislature of

30 Progress of Paper, op. cit., p. 80.
Massachusetts imposed a duty on all foreign vellum and paper. The people, however, had not overcome their repugnance to taxation, and by popular demand it was repealed.

The first Tariff Act passed by the Congress of the United States set a duty of seven and one half per cent ad valorem on blank books, writing, printing and wrapping paper, paper hangings, and pasteboard. At the same time provision was made for admission of rags free of duty. Our lawmakers were so hesitant about matters of taxation and tariffs that this Tariff Act was created only for a temporary period—from August 1, 1789, to August 31, 1790.31

Alexander Hamilton, first Secretary of the Treasury, in his famous report on manufactures which was communicated to the House of Representatives on December 5, 1791, made the following reference to paper:32

Manufactories of paper are among those which are arrived at the greatest maturity in the United States, and are most adequate to national supply. That of paper-hanging is a branch in which respectable progress has been made. Nothing material seems wanting to the further success of this valuable branch which is already protected by a competent duty on similar imported articles. In the enumeration of the several kinds made subject to that duty, sheathing and cartridge paper have been omitted. These being the most simple manufactures of the sort, and necessary to military supply, as well as

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ship building, recommend themselves equally with those of other descriptions to encouragement, and appear to be as fully within the compass of domestic exertions.

Congress renewed the first Tariff Act in 1790 and made some additions to it which included parchment and vellum. In 1792 the duty on paper-hangings was set at 15 per cent and that on sheathing and cartridge paper at 10 per cent. On June 7, 1794, Congress added 5 per cent more to the duty on sheathing and cartridge papers.33

Benjamin Franklin's activity as a printer and publisher brought him into contact with the paper industry. He patronised and encouraged the new mills, particularly those in Pennsylvania, in every way he could both as a private individual and as a public official. He is reported to have been instrumental in starting eighteen mills, and he wrote and spoke on the subject of the paper industry.34

There was a depression in 1820 and the paper industry lost heavily on sales of its manufactured products. Imports of paper continued to be heavy. Even the United States Senate prior to 1820 used paper manufactured in Europe. There were demands for a duty of 25 cents per pound on all writing, printing, and copper plate papers, and 15 cents per pound on all others.35 The manufacturers of paper, however,

33 House Document 671, loc. cit.
34 Weeks, op. cit., p. 93.
35 Progress of Paper, op. cit., p. 83.
did not take an active part in the tariff agitation which prevailed between 1825 and 1860. Most of the demands came from the iron, cotton, and wool industries.\footnote{36}

There is little information available on the prices of paper in the early period of United States production. There is, however, a record of some prices which were presented in a report to the House of Representatives in January 1821, by the committee on manufactures. This committee favored higher tariffs on manufactured goods and included in their report a statement of the kinds of paper then made in the United States with ream weights and wholesale prices. The report contained a list of prices as follows:\footnote{37}

<table>
<thead>
<tr>
<th>KIND OF PAPER</th>
<th>POUNDS PER REAM</th>
<th>VALUE PER REAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarto post</td>
<td>7</td>
<td>$ 4.00</td>
</tr>
<tr>
<td>Folio post</td>
<td>16</td>
<td>9.00</td>
</tr>
<tr>
<td>Stout demy writing</td>
<td>22</td>
<td>10.00</td>
</tr>
<tr>
<td>Stout medium writing</td>
<td>28</td>
<td>22.00</td>
</tr>
<tr>
<td>Stout royal writing</td>
<td>34</td>
<td>16.00</td>
</tr>
<tr>
<td>Stout super-royal writing</td>
<td>40</td>
<td>18.00</td>
</tr>
<tr>
<td>Stout imperial writing</td>
<td>45</td>
<td>20.00</td>
</tr>
<tr>
<td>Foolscap writing No. 1</td>
<td>15</td>
<td>4.00</td>
</tr>
<tr>
<td>&quot; No. 2</td>
<td>13</td>
<td>3.50</td>
</tr>
<tr>
<td>&quot; No. 3</td>
<td>12</td>
<td>3.00</td>
</tr>
<tr>
<td>Demy</td>
<td>16</td>
<td>5.00</td>
</tr>
<tr>
<td>&quot; No. 2</td>
<td>16</td>
<td>4.50</td>
</tr>
<tr>
<td>&quot; No. 3</td>
<td>16</td>
<td>4.00</td>
</tr>
<tr>
<td>&quot; No. 4</td>
<td>16</td>
<td>3.25</td>
</tr>
<tr>
<td>&quot; No. 5</td>
<td>16</td>
<td>2.75</td>
</tr>
<tr>
<td>Medium</td>
<td>18</td>
<td>6.00</td>
</tr>
<tr>
<td>&quot; No. 2</td>
<td>18</td>
<td>5.00</td>
</tr>
<tr>
<td>&quot; No. 3</td>
<td>18</td>
<td>4.50</td>
</tr>
<tr>
<td>&quot; No. 4</td>
<td>18</td>
<td>3.75</td>
</tr>
</tbody>
</table>

\footnote{36} Weeks, \textit{op. cit.}, p. 195.

\footnote{37} Gales and Seaton, \textit{American State Papers, Class III, Finance III.} (1832), p. 628 (as given in Weeks, \textit{op. cit.}, pp. 119, 120).
### KIND OF PAPER

<table>
<thead>
<tr>
<th>KIND OF PAPER</th>
<th>POUNDS PER REAM</th>
<th>VALUE PER REAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium writing No. 5</td>
<td>18</td>
<td>$3.00</td>
</tr>
<tr>
<td>Royal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>20</td>
<td>7.00</td>
</tr>
<tr>
<td>No. 2</td>
<td>20</td>
<td>6.00</td>
</tr>
<tr>
<td>No. 3</td>
<td>20</td>
<td>5.00</td>
</tr>
<tr>
<td>No. 4</td>
<td>20</td>
<td>4.00</td>
</tr>
<tr>
<td>No. 5</td>
<td>20</td>
<td>3.50</td>
</tr>
<tr>
<td>Super-royal No. 4</td>
<td>22</td>
<td>4.50</td>
</tr>
<tr>
<td>Super-royal No. 5</td>
<td>22</td>
<td>4.00</td>
</tr>
<tr>
<td>Imperial No. 4</td>
<td>25</td>
<td>4.75</td>
</tr>
<tr>
<td>Imperial No. 5</td>
<td>25</td>
<td>4.25</td>
</tr>
</tbody>
</table>

Fullers press papers were generally sold at twenty cents per pound. Sheathing paper and paper used by sugar refiners sold for about eight cents per pound. Common wrapping paper sold by the ream, was graded in different sizes, as cap, pot, crown, demy, royal, super-royal, and so on, and sold at from six to eight cents per pound. Tissue paper, used mostly for protecting copper-plate engravings in books, was commonly made on medium-sized molds, weighed about six pounds per ream and was worth about six dollars per ream, commanding its high price on account of its being made in part out of new stuff. Super-royal printing was seldom finer than No. 4.

Standard sizes of molds used in the manufacture of handmade paper were: Foolscap, 14½ x 16 ⅜ inches; littrice, 15½ x 16 ⅜; demy, 16 x 21; extra royal, 21¼ x 25½; super-royal 20¾ x 27½; imperial 22½ x 30½; post 17 x 21½; medium 18 x 23; royal 21 x 2½; manslaughter 22 x 32; atlas, 26½ x 33. Bank paper was made of foolscap. Papers were assorted into four grades, styled in the order of their perfection; whole, first retree, second retree, third retree or broken. Each ream consisted of eighteen quires of its particular grade and two quires of broken sheets, one on the top and one on the bottom of the ream. Newspapers were often printed on paper of the second or third quality.

**Mechanization and Expansion of Papermaking**

The expansion of papermaking may be attributed primarily to three important factors:

1. The invention and development of papermaking machinery.
2. The search for new and better raw materials and the discovery of satisfactory methods of pulping them.

3. The increased demand through growing population and the discovery of new uses for the product.

It is the purpose of this section to show some of the important mechanical and technical developments and to point out the effect they have had in expansion of the industry.

Papermaking is now, in most mills, a mass production industry. As a result of invention and research the American people, as well as the people of many other nations, have a plentiful supply of cheap paper of all kinds. Paper is so common that most people take it for granted, but there are few who realize the importance which the many variations of the product play in our economy.

Papermaking machinery. Paper was made by hand for more than seventeen hundred years after its invention by the Chinese in 105 A.D. Some improvements had been made in the tools used, in the methods of manufacture, and in the treatment of raw materials. These developments improved the character of the product, but the production was low and the cost high.

By 1800, the Hollander rotary beating engine, described in a previous section, came into general use. This machine could equal the output of several batteries of stampers in changing rags into pulp. Each sheet, however, was still formed by hand. Papermaking was rugged work and one could
always tell a papermaker by his red hands and stooped back. The paper maker's hands were always in and out of warm water and his back was stooped from leaning over the dipping vat.38

After the invention of the Hollander for preparing the pulp a faster method of transforming the pulp into paper was an economic necessity. Two machines were developed about the same time—the Fourdrinier machine in 1799, and the cylinder machine in 1809.39

The Fourdrinier was invented by Nicolas Louis Robert while managing a paper mill in Essones, France, owned by St. Leger Didot, a French publisher. Robert obtained a patent in 1799 and later transferred it to Didot. Didot joined with John Gamble, his brother-in-law, and the two took out patents in England. They entered into arrangements with Henry and Sealey Fourdrinier, wholesale stationers, who financed the invention in England. The Fourdrinier brothers spent over 60,000£ in experimenting with and improving the machine and engaged Bryan Donkin, a practical mechanic and machinist. New patents on a much improved machine were obtained in 1807. Several years later the business went into bankruptcy and Robert, Didot, and Gamble, along with the Fourdriniers, were ruined financially. Bryan Donkin continued to devote his efforts to manufacturing and improving the machine. He did well and eventually was

38 Paper: Pacemaker of Progress, op. cit., p. 15.
successful in establishing a large business in the manufac-
ture and sale of Fourdriniers. 40

The first Fourdrinier machines were crude. A hand
crank operated an endless wire screen which took the place
of the hand mold. This crank also turned a paddle wheel
which raised the paper stock and poured it over the screen
where a side-to-side motion matted the fibers and elimi-
nated a large portion of the water. The layer of pulp then
passed under a felt-covered press roll after which the paper
was wound on a pole. Later it was cut into sheets, and
then left dried. 41

Two Fourdrinier machines were imported from England
and installed in United States mills in 1827, and a third
English machine was put into operation in 1829. The first
Fourdrinier manufactured in the United States was made by
the Smith & Winchester Manufacturing Company in their shops
in South Windham, Connecticut, in 1829, and it was installed
in a mill in Norwich, Connecticut. 42

The cylinder papermaking machine was invented by John
Dickinson in England in 1809. Thomas Gilpin, who owned and
operated a mill near Wilmington, Delaware also built a
cylinder type machine in his mill and put it into operation
in 1817. The machine was built with great secrecy, and it

40 Ibid., p. 173.
41 Paper: Pacemaker of Progress, op. cit., p. 17.
42 Hunter, op. cit., p. 351.
is not definitely known whether he copied Dickinson's idea or whether he worked independently. It is thought, however, that he had obtained some idea of the principles of the Dickinson machine.\textsuperscript{43}

The cylinder machine patented in the United States by Gilpin in 1816 consisted of a hollow wire mesh covered cylinder which revolved in a vat filled with pulp. Water passed through the screen and left a film of fiber on the surface of the screen. The cylinder was turned by an endless felt which picked up the film of pulp and carried it through a set of press rolls for removal of the excess water.\textsuperscript{44}

Increase in speed and power, as well as economy in cost of production was demonstrated by the cylinder machine. It later proved to be less efficient than the Fourdrinier in the production of most papers, but it gave great impetus to the manufacture of paper in this country. It is used to some extent in present day mills for the manufacture of various grades of paperboard.\textsuperscript{45}

Gilpin's cylinder machine gained great notoriety for producing a paper of uniformity and freshness of color.\textsuperscript{46} His mill furnished machine-made paper to the \textsl{American Daily}\textsuperscript{43} Hunter, \textit{op. cit.}, p. 351.

\textsuperscript{44} \textit{Paper: Pacemaker of Progress}, \textit{loc. cit.}

\textsuperscript{45} Several greatly improved models of the cylinder machine are in use in paperboard and building board mills in Louisiana.

\textsuperscript{46} Hunter, \textit{loc. cit.}
Advertiser of Philadelphia and many other newspapers. He also marketed much of it for use in books and in writing.47

The machine gave such a great competitive advantage to Gilpin's mill that others used both fair and unfair means to learn his secret. Several new and improved cylinder machines were brought out by 1830. They were put into use in many mills and Gilpin found that he could not permanently retain his advantage over competitors.48

John Ames, a clever inventor and mechanical genius, made a better machine for his mills and succeeded in getting a patent in 1822. He tried to maintain a monopoly on the machine, but others copied it. There are many court cases on record in which Ames filed suit for patent infringement.49 In one of these cases, John Ames v. Charles Howard et al. in which the court found for the plaintiff, the patentee testified that he did not claim invention of "the felting, vats, rollers, presses, wire cloth, or any separate parts of the machinery" but did claim as his specific invention "the construction and use of the peculiar kind of cylinder."50

47 Weeks, op. cit., p. 176.
48 Ibid., p. 176.
49 Ibid., p. 178.
50 Charles Summer, Reports of Cases Argued and Determined in the Circuit Court of the United States for the First Circuit, I, p. 482 (as given in Ibid., p. 178).
These patent infringements and suits continued for years with great expense to the Ameses. They too, found that they could not maintain their monopoly.\textsuperscript{51}

Most of the experimentation and development of the cylinder machines took place in the United States while the work and improvements on the Fourdrinier machine were carried on in England. The first machine-made dryer was attached to the cylinder machine. At first the drying device consisted of an iron cylinder about ten feet in diameter which contained a wood-burning stove fed through a door in the cylinder. A great improvement was made when this stove was eliminated and a steam dryer substituted in its place. In 1830 Phelps & Spafford, machinery manufacturers in Connecticut, manufactured a complete machine with making-cylinder, press rolls, steam-drying cylinder, reels and cutter. For the first time, it was possible for the paper maker to put in pulp at one end of the machine and turn it out ready for finishing and packing at the other end.\textsuperscript{52}

The old mill men were slow in approving the new machines and for a long time held tenaciously to the hand process. In those days of hand methods, men who had learned the trade had considerable antagonism against the introduction of machines. It was inevitable, however, that the

\textsuperscript{51} Weeks, \textit{op. cit.}, p. 178.

\textsuperscript{52} \textit{Ibid.}, p. 188.
efficiency of the machines would prevail over the objections of men.

The introduction of machines and the application of water, steam, and finally electric power to run them, brought about decided changes in the industry. Prior to this, production was so low and costs were so high that the use of paper was limited. Mill managers turned their attention to producing the best qualities of paper and were soon able to place their machine-made products in successful competition with foreign hand-made paper.

The Fourdrinier is now the machine most universally used in paper mills. Its use is so important to the manufacture of paper by mass production methods that it seems worthwhile to explain the principles of the machine. The machine may be divided into two main parts—the wet end and the dryer section.

The pulp from the beaters and refiners is conveyed through a large pipe to the head box where it is diluted to a consistency suitable for the kind of paper called for by the production order. The stock here may consist of 1/2 to 4 per cent pulp and 99 1/2 to 96 per cent water. As the pulp leaves the box it passes through sand traps to remove any foreign particles and through a series of strainers to prevent the passage of coarse fibers, splinters, knots and other foreign particles.

An adjustable gate controls the flow of pulp and regulates the thickness of the sheet as the pulp flows onto the
endless fine mesh wire of the machine. To keep the pulp from flowing over the side of the wire and to control the width of the sheet, endless belts called deckle straps are used.

The fine mesh endless wire of the Fourdrinier runs over a series of rollers which are in close contact with each other directly beneath the traveling wire and form a partial vacuum. A large amount of water is thus drawn from the pulp as it travels for 30 to 50 feet on the wire mesh. Several suction boxes toward the end of the wire create a vacuum which removes more of the water. Any pulp which seeps through the wire is strained out and saved. The water which falls into a pit under the wires is recycled for further use.

To overcome the tendency of the fibers to fall in the direction in which the wire is moving a slight shake at right angle to the forward movement is produced on the wire. This shake is most vigorous at the point where the fibers suspended in water enter the wire, and is graduated downward to an almost imperceptible movement toward the end. Most of the value of the shake occurs at the beginning when the fibers are just beginning to settle down. The shake aids the fibers in matting uniformly in both directions, and thus gives greater tearing strength to the paper.

The wire usually runs downward at a slight angle toward the suction boxes. The pitch of the wire is adjustable according to the speed of the machine and the type of pulp.
Plate II

Diagram of Fourdrinier Paper Machine
Between the suction boxes the paper passes under a dandy or watermarking roll. This roll consists of a light skeleton drum covered with fine wire mesh. The device always serves the purpose of evening up and closing the fibrous surface of the wet web. It also is frequently used to make a watermark impression on the web just before the web enters the felt dryers. Where a watermark is desired the design is woven into or soldered on the wire mesh of the roll. In like manner, the roll may be used to impart a woven or linear mark on the paper. As the dandy roll rides lightly over the top side of the web, the raised wires on its surface push back a part of the web in such a manner as to thin it at the points of deepest contact, thus leaving a permanent impression on the paper.

As the web leaves the Fourdrinier wire it is carried on endless felts through several sets of presses where moisture is absorbed by the felts. Any impression left on the web from the felt is corrected in the next press by reversing the side of the web so that the impressed side runs against the roll. After this process is continued through several sets of presses there remains only a slight impression of the felt, and the paper passes onto an endless dry felt.

At this point the paper is strong enough to travel on its own and passes through a battery of cylinders about four or five feet in diameter which are heated on a graduated plan. The highest temperature is reached at the end.
Some paper is run through a series of rollers called callenders. These callender rolls exert great pressure on the paper to give it a smooth, hard finish before it is wound on a reel. Not all paper, however, is callendered. The finished product generally has a moisture content of seven to ten per cent.

At times, when a new type of pulp is used or when a break occurs in the web of paper, the machine must be threaded. The web travels unaided until it leaves the felts. Then, it must be guided into the proper channels. A workman runs along beside the machine and uses a compressed air hose to shoot a stream of paper between the proper drying cylinders and through the callender rolls. Often several tries are necessary before the feat is accomplished.

When a reel is wound to required size, a new reel is lifted into position by a crane. A workman uses a knife blade to cut the paper and the sheet is directed to the dampened surface of the new reel without slowing down the machine.

Modern high speed paper machines are capable of running 1,800 feet of paper per minute. Generally, however, they are run around 1,000 to 1,400 f.p.m. One manufacturer stated that machines in his plant were not run at full speed because there had never been enough pulp to keep them running at that speed. He explained that the increased sales and profit thereon would far outweigh the costs for increased wear and tear on the machines.
The speeds on all sections of the Fourdrinier must be synchronized so the paper will not buckle or tear. The machines are so noisy that it is difficult to talk close to them. When difficulty develops any place along the machine a siren or whistle is sounded and workmen begin to correct the problem. An experienced paper maker is always on hand ready to go into action when he is needed.

**Discovery of new raw materials.** The Fourdrinier and cylinder machines could turn out paper fast enough and cheap enough to meet the growing demand provided there were sufficient supplies of raw materials to make the pulp required to feed the machines. The dearth of rags created a serious bottleneck to progress.

The supply of rags was so limited in comparison to the demand that there was a brisk market in the United States for the cloth in which Egyptian mummies had been wrapped centuries before. In spite of efforts to use straw, cotton waste, rope and bagging, as late as 1854, at least 90 percent of papermaking fiber came from rags. 53

It would have been impossible for the paper industry to have grown great had it not been for the discovery that wood pulp was a substance out of which paper could be made. It will be remembered that the Chinese made paper from mulberry bark. The French scientist, Renne de Reaumur, however, was the first man to recognise the possibility of

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53 Canfield, *op. cit.*, p. 17.
making paper from the wood itself. He closely observed the wasp in building its nest. The insect tore a strip of wood off an old fence, chewed it to a pulp mass, pressed it, then spread it.

Reamur informed the French Royal Academy in a treatise dated November 15, 1719:

The rags from which is made paper are becoming rare. While consumption of paper increases every day, production of linen remains the same. The wasp seems to teach us that paper can be made from fibre without the use of rags and linen and to invite us to try whether we cannot make fine and good paper from the use of certain woods.

For many years after Reamur's statement no research was carried on for the use of wood as a pulp. Many times during his lifetime Reamur criticized the paper makers for their apathy and failure to appreciate and attach some value to his observation. The early eighteenth century experiments were conducted on such vegetation as moss, hemp, straw, cabbage stalks, pine cones, walnut and tulip leaves, thistles, hops, dandelion roots, and potatoes. The first record of any work on paper formed from wood fibers was that of a German, Dr. Jacob Christian Schaffer. In the years 1765-1772 he made some crudely formed paper from beech, willow, aspen, mulberry, spruce, and other kinds of vegetation.

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55 Hunter, op. cit., p. 374.
56 Ibid., p. 375.
In 1800 Matthias Koops published in London a book printed on paper that he had made by his own process from straw. Koops declared that wood fiber could be converted into a substance of great strength by using layers of paper. He even predicted that paper would become valuable as a building material when treated so as to become impenetrable and incombustible, and would displace tiles and slates. 57 The use of straw as a papermaking material on a commercial scale preceded the use of wood by several decades. In 1829, William McGaw in Pennsylvania made paper successfully from straw. One American manufacturer saw such a great possibility in this material that he abandoned the manufacture of paper from rags and began making straw paper exclusively. In 1871, the production of straw paper in the United States was estimated at 100 tons a day. It was used for printing, decorative purposes, wrapping, and binders board. 58

Much could be written on the experiments carried on by English, French, German, and American Scientists, but such is beyond the scope of this writing. The most important developments were the following inventions:

1. The soda process by Hugh Burgess and Charles Watt in England in 1852.

2. The groundwood process by Henry Voelter in Germany in 1858.

3. The sulphite process by Benjamin Tilghman in the United States in 1870.

57 Ibid., p. 375.

58 Ibid., p. 395.
4. The sulphate or kraft process by Carl Dahl in Germany in 1884.

For sometime after the discovery of soda pulping methods, many manufacturers held stubbornly to the opinion that, while wood pulp might be a good filler, it was not a good fiber. Gradually, however, soda and other wood pulps won the favor of manufacturers, and wood became the principal raw material for making most kinds of paper.

Increased demand. It must not be assumed that the development of papermaking machines and development of new processes alone gave impetus to the great paper industry in this country. Other inventions outside of papermaking, and the development of new uses which created a demand for the products the machines produced, deserve some attention.

Man's first motive in inventing paper was to get a satisfactory substance upon which his records could be kept, his business transactions could be recorded, and to serve for the dissemination of written messages. From the time that written characters were conceived by the Chinese in 2700 B.C.\textsuperscript{59} there has been a search for substances upon which messages could be transcribed.

The invention of paper and inks, along with the development of printing methods went together to aid man in achieving his goal. Christian nations desired to print and read the Bible. The first printing press to use movable

\textsuperscript{59} Hunter, \textit{op. cit.}, p. 464.
type was developed in Germany in 1447-1448. In 1535 there appeared the first complete Bible in English (Myles Coverdale's translation). Printing was first accomplished in Louisiana in 1764 on paper imported from France.

Soon after papermaking machinery was put into practical use, Robert Hoe, in 1846, invented a new type of revolving printing press which was capable of printing 12,000 impressions an hour. The Walter rotary press, the first to use stereotype plates for newspaper printing, was developed for The Times in London in 1868. In 1870 a device was invented for folding newspapers as they came off the press. Just a few years later patents were taken out on a machine which was the forerunner of the modern linotype machine. The rotary press led to the development of today's high-speed press which is capable of printing 60,000 two-page newspapers an hour.

All of these inventions brought an increased demand for paper. Likewise, the invention of paper and the development of machines for producing great quantities of paper at low cost have made it possible for millions of people to enjoy reading newspapers, magazines and books. Also, the developments just mentioned have made advertising possible,

60 Stevenson, op. cit., p. 4.
61 Hunter, op. cit., p. 478.
62 Ibid., p. 579.
so that people know of the products industry produces. The purchase of these products has provided a higher standard of living for people and has created jobs for the laborers manufacturing such products and markets for wrapping paper and container board.

For many years paper has had varied uses besides that of a medium for printing. Paper has for centuries been used to some extent for wrapping. As early as the year 1035 in Cairo, sellers of vegetables, spices, and hardware marketed their goods wrapped in paper. In the fourteenth century paper money was used in China. Paper money was first used in the American colonies in 1690, and today this type of money serves as our every day medium of exchange. During the fiscal year ending June 30, 1944, the Government consumed 1723 tons of paper in printing the currency for the United States.

Paper bags were first made entirely by hand. The invention of the automatic paper bag machine in 1876 made possible cheap production and the paper bag is now such an important commodity that billions of them are sold every year. In 1941, 50 billion paper bags of all sizes were consumed.

64 Hunter, op. cit., p. 471.
65 Ibid., p. 483.
66 Ibid., p. 584.
67 Ibid., p. 555.
The first commercial paper boxes in America were made by Colonel Andrew Dennison, a cobbler at his home in Brunswick, Maine in 1844. This was the beginning of a large business which today is known as the Dennison Manufacturing Company. Automatic machines for making paper boxes have been in general use since 1894.

Corrugated fibre containers were first used in the United States in 1903. Their use was authorized by the railroads in 1906. Gradually, they have replaced wooden boxes to a great extent and are now the principal type of container used in shipping practically all types of manufactured goods. Paper milk bottles were first made in San Francisco in 1906.

Since the year 1868 paper has been converted into articles of almost every conceivable purpose. It has been used, and in many cases is still being used, for cups, plates, barrels, table tops, window blinds, roofing, collars, vests, cuffs, aprons, towels, napkins, shirts, buttons, hats, handkerchiefs, raincoats, corsets, slippers, petticoats, curtains, carpets, and machine belts. Coffins made of laminated sheets of paper were manufactured and sold in

68 Ibid., p. 552.
69 Ibid., p. 580.
70 Ibid., p. 580.
this country shortly after the Civil War. These had been used by the Persians many centuries before.71

No attempt has been made here to list all of the uses of paper. The list given, however, does give some idea of the multitude of ways in which paper can be utilized. When this is accompanied by an increasing population and the uncovering of vast new sources of raw materials, it can be readily seen why the American paper industry has undergone such a phenomenal expansion.

According to estimates, by 1820 the average annual production of paper mills in the United States was about $3,000,000, the cost of labor and materials in manufacturing was about $2,000,000, the number of persons employed five thousand, of whom seven hundred were males over sixteen years of age, and the others women and children.72 An average two, three, or four-vat mill usually represented an investment of $3,000 to $8,000. There were very few mills considered worth as much as $10,000. It required four men and a boy to man a one-vat mill and they produced around 2,500 sheets per day.73 By 1828 the newspapers in the United States consumed about 104,000 reams costing from four to

71 Ibid., pp. 568,569.
73 Weeks, op. cit., pp. 145-146.
five dollars a ream. In that year rag importations amounted in value to $279,041.

The 1850 Census which did not include manufacturing establishments with an annual production value of less than $500, and which was not considered accurate, showed the following: In the United States there were 123,025 manufacturing establishments of all kinds, with a capital of $533,245,351 using raw material valued at $555,123,822, employing 731,137 males and 225,922 females, and producing annually goods valued at $1,019,106,160. Paper production then was only a small part of the total. There were 443 mills, with a capital of $7,260,864 using raw material worth $5,555,929, employing 3,835 male and 2,950 female workers, and the industry had an annual product of $10,187,177. Compared with 1840, this represented an increase of about four per cent in number of mills, while the capital investment increased more than 50 per cent.

Table IV shows the phenomenal increase in the paper industry from the time that machinery began to come into general use in 1840 until the last Census of Manufactures (1947). Between 1840 and 1850 there was an increase of 80 per cent in the value of production. Although the number of mills increased only 75 per cent (from 443 to 777) in the 60 years between 1850 and 1910, capital investment increased

74 Ibid., p. 193.
75 Ibid., p. 219.
from $7,260,864 to $409,348,505 and the value of product increased from $10,187,177 to $267,656,964. During the same period the number of wage earners rose from 6,785 to 75,978, an increase of 1,120 per cent.

### TABLE IV

General Statistics for Paper Industry 1840-1947

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Mills</th>
<th>Capital Invested</th>
<th>Number of Wage Earners</th>
<th>Value of Product</th>
<th>Per Cent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1840</td>
<td>426</td>
<td>$4,745,239</td>
<td>4,726</td>
<td>$5,641,495</td>
<td>80</td>
</tr>
<tr>
<td>1850</td>
<td>443</td>
<td>7,260,864</td>
<td>6,785</td>
<td>10,187,177</td>
<td>108</td>
</tr>
<tr>
<td>1860</td>
<td>555</td>
<td>14,052,683</td>
<td>10,911</td>
<td>21,216,802</td>
<td>131</td>
</tr>
<tr>
<td>1870</td>
<td>677</td>
<td>34,556,014</td>
<td>18,021</td>
<td>48,849,285</td>
<td>18</td>
</tr>
<tr>
<td>1880</td>
<td>742</td>
<td>48,139,652</td>
<td>25,631</td>
<td>57,366,860</td>
<td>38</td>
</tr>
<tr>
<td>1890</td>
<td>649</td>
<td>89,829,548</td>
<td>31,050</td>
<td>78,937,184</td>
<td>61</td>
</tr>
<tr>
<td>1900</td>
<td>763</td>
<td>167,507,713</td>
<td>49,646</td>
<td>127,326,162</td>
<td>61</td>
</tr>
<tr>
<td>1910</td>
<td>777</td>
<td>409,348,505</td>
<td>75,978</td>
<td>267,656,964</td>
<td>110</td>
</tr>
<tr>
<td>1920</td>
<td>729</td>
<td>905,794,583</td>
<td>113,759</td>
<td>788,059,377</td>
<td>194</td>
</tr>
<tr>
<td>1930</td>
<td>883</td>
<td>NA</td>
<td>128,049</td>
<td>1,206,114,305</td>
<td>53</td>
</tr>
<tr>
<td>1940</td>
<td>832*</td>
<td>NA</td>
<td>137,445</td>
<td>1,159,867,486</td>
<td>-4</td>
</tr>
<tr>
<td>1947</td>
<td>921*</td>
<td>NA</td>
<td>174,096</td>
<td>2,612,987,604</td>
<td>142</td>
</tr>
</tbody>
</table>

Note: Beginning with 1940, pulp mills were listed separately by the Census of Manufactures. The 1940 and 1947 figures include 194 and 226 pulp mills respectively.

Source: Bureau of Census data.

The closing years of the nineteenth century saw a great wave of consolidation in the paper industry similar to that experienced in other industries. Capital increased tremendously in order to purchase the expensive equipment needed for modern mass production. An example of this consolidation movement was the International Paper Company which was formed in 1898. Eighteen pulp and paper companies with twenty mills in the northeastern section of the United States were joined in the consolidation. At that time the bulk of the production was newsprint and these mills in Maine, Massachusetts,
New Hampshire, Vermont, and northern New York produced close to 60 per cent of the newsprint consumed in the United States. 76

The following excerpt taken from the Fiftieth Anniversary book of the International Paper Company points out some of the reasons for the consolidation: 77

The pulp and paper industry at the end of the 19th century stood on the threshold of vastly expanded social usefulness. But it was in many ways chaotic and insecure. There had been two panics in the 1890's; many paper mills, particularly newsprint mills had stood on the edge of disaster. Paper companies often led a prince-and-pauper existence.

International came into existence in large measure because new approaches to organization were necessary if the industry was to meet the new challenges of the 20th century. The new Company was formed in a search for a broader economic base. Management recognized lower costs as offering the best road to security and stability, and was reaching out for them.

It can be seen from Table IV that there was tremendous growth in the paper industry in the twenty years between 1890 and 1910. These figures show that most of the growth took place in the size of mills. This came about through modernization of many old mills and the building of many new ones. Wider and faster machines were put into operation. By 1910 some machines were 150 to 186 inches wide and ran at a speed of 630 to 650 feet per minute, whereas the older machines were 100 to 160 inches wide and ran at speeds ranging from 100 to 200 feet per minute.

76 International Paper Company After Fifty Years, op. cit., p. 17.
77 Ibid., p. 17.
During the twenty years just mentioned (1890-1910) the number of mills increased only 20 per cent (from 649 to 777) yet the capital investment increased 355 per cent (from $89,829,548, to $409,348,505) and the value of product rose 240 per cent (from $78,937,184 to $267,656,964). Employment in the industry more than doubled (increased 238 per cent) and in 1910 the United States Census showed 81,473 were employed. Of this number 75,978 were wage earners and 5,495 were salaried employees.

Between 1910 and 1920 the number of mills decreased from 777 to 729 while capital investment increased 121 per cent (from $409,348,505 to $905,794,583), the number of wage earners increased 50 per cent (from 75,978 to 113,759), and the dollar value of product increased 194 per cent (from $267,656,964 to $788,059,377).

During the twenty-seven years between 1920 and 1947, the large southern kraft paper and paperboard mills were established. These mills had some Fourdrinier machines which turned out paperboard 198 inches wide at speeds in excess of 1,000 lineal feet per minute. Modern machines enabled the industry to increase the value of product by 257 per cent (from $788,059,377 to $2,812,987,604). The number of wage earners increased 53 per cent (from 113,759 to 174,096).

78 The United States Bureau of Labor Statistics wholesale price index for all commodities for 1920 and 1947 was 154.4 and 152.1 respectively.
CHAPTER III

DEVELOPMENT OF PAPERMAKING IN THE SOUTH

The first pulp and paper mills were located in the Northeast near their source of raw materials and markets, and this section is still an important producing area. The industry, however, has spread to other parts of the United States including the Lake States, the Pacific Northwest, and the South. The paper industry is now distributed throughout thirty-seven states.

The South includes sixteen states as follows: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The land area of this territory (947,120 square miles) comprises one-third that of the United States, (2,977,128 square miles). The largest state in total area is Texas (267,339 square miles) and the smallest is Maryland (10,577 square miles). The South's population of 50,493,271 is one-third that of the United States (150,520,198).¹

¹ Bureau of Census data on population, April, 1950.
Reasons for Southern Expansion

As the market for paper increased, and as wood became the principal raw material, the paper companies sought locations that possessed the greatest combination of advantages. Each company was forced to expand whether it wished to or not, if it was to expand at any future time.

Three important factors have contributed to the establishment of the paper industry throughout the Southern states. They are: (1) Improvements in technology, (2) Increased demand and new markets, and (3) Cost advantages. These factors will be discussed in the following paragraphs.

Improvements in technology. The paper industry probably could not have grown into a large mass production industry had it not been for the discovery of wood pulp. The development of the mechanical and chemical processes for obtaining this pulp from wood opened up new possibilities for the production and use of paper. Paper found new uses as technological developments made possible a lower-priced product.

The introduction of Carl Dahl’s sulphate process made possible the profitable utilization of Southern pine. The first kraft paper mill in the South was built at Orange, Texas, in 1910, but the important development in kraft paper did not come until the 1920’s.  

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The invention of the Fourdrinier and cylinder paper machines and the development of improvements thereon put the industry on a mass production basis. In 1871, the ordinary speed of improved Fourdrinier machines was 60 to 80 feet per minute. The highest speed known at that time was 175 feet a minute on a machine which produced 25 tons of paper a week.\(^3\)

Prior to 1919 the paper machine was a gear driven series of machines which ran at slow speeds and required tremendous power. Speeds did not go beyond 500 feet per minute and widths were also limited. In 1919 experiments were made which resulted in the successful use of synchronized electric motors. This made possible modern mass production in the industry.\(^4\)

After the development of synchronized electric motors only a few mills could change their whole production organization because of structural and lay-out difficulties. Nevertheless, the capacity of existing machines was increased by 30 per cent.\(^5\) Today many Fourdrinier machines operate at speeds in excess of 1,000 feet per minute in the manufacture of kraft paper. Some machines are capable of running 1,800 feet per minute if the pulp supply is available. Just

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\(^5\) Ibid., (unpublished).
recently one of the South's newest mills produced a record of over 800 tons of Fourdrinier liner from a single machine in a 24-hour period.\textsuperscript{6}

New mills were built to produce the mass production grades. Newsprint mills were built in Canada during the 1920's and it was in these mills that the mass production idea really began. The designers took advantage of the opportunity to streamline the whole Canadian industry, making it a mass production industry of one standardized product. Integration from raw material to customer delivery played an important role in the whole organization scheme.\textsuperscript{7}

When opportunity came to the South in the late 1920's, the experiences of other streamlined industries, particularly the Canadian newsprint industry, formed a substantial background from which Southern manufacturers drew heavily. The building of the Southern kraft paper industry, however, was by no means a simple case of duplication. Because of differences in product, processes, and raw materials, substantial modification was necessary, particularly in the preparing of pulps. Also, the integration of operations was extended back into the woods because storage of pulpwood for any appreciable time is impossible in the South. "Building upon

\textsuperscript{6} W. F. Gillespie, "The Trends in the Sulphate Pulping Industry in the South" (Speech given before Joint Industry - Faculty Conference, L. S. U. College of Engineering, April, 1949).

\textsuperscript{7} Ibid., (unpublished).
accumulated experience of the entire industry, the Southern kraft industry has perhaps now reached the point of World supremacy in mass production of paper and paperboard.\(^8\)

In 1830 Dickinson had patented a method of making paper in two layers brought together from separate cylinders. This made a superior thicker paper.\(^9\) Later more cylinders were added in the making of strong laminated papers. It was not until the 1920's however that paperboard was successfully manufactured on the Fourdrinier machine.

In the late 1920's Richard J. Cullen of the International Paper Company became interested in the vast possibilities of producing an all-kraft board for shipping containers on Fourdrinier paper machines. This type of board had been produced experimentally and to a limited extent commercially during the 1920's, but large-scale commercial production did not begin until 1931, when International's mill was built at Panama City, Florida. This mill, which was designed by Mr. Cullen, was the first kraft mill to be devoted entirely to container board production. Its present capacity is 900 tons per day.\(^10\)

*Increased demand and new markets.* There were many social influences which increased the demand for paper and

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made it more and more a necessity. Universal free education created by the North American democracy had a great influence on the demands of the people. As greater numbers of people learned to read, the thirst for knowledge grew and illiteracy was rapidly reduced. This brought about a great expansion, not only in newspapers, but in books, magazines and printed literature of many kinds.

The growth which occurred in the reading of newspapers and magazines made possible two other developments—mass advertising and mass distribution. In turn, these developments brought about basic changes in methods of packaging merchandise for delivery to consumers. The wide use of printing papers thus helped create an expanding need for shipping and converting papers.

Before 1900 all goods were protected during shipping by straw wrappings and wooden crates and boxes. Wooden boxes were heavy and hard to handle and thus freight and handling charges were high. Once the practicality of pre-packaging in folding paper cartons and shipping in paperboard containers was demonstrated, the use and demand for paperboard grew rapidly. Today the paperboard container has almost completely replaced the wooden box for shipping. Some products are still shipped in wooden boxes, but research and product development in the paperboard container industry is creating new boxes in an attempt to more completely capture the market for shipping containers.
In the short space of fifty years when papermaking was changing from hand methods to a fully developed machine manufacture, the consumption of paper grew rapidly. Sales were increased through the development of new uses for paper. This was a period of discovery and adaptation. Many industries were using paper and paper products which had never used such material previously.

The tremendous increase which has taken place in the consumption of paper, paperboard and manufactured products is shown in Table V.

### TABLE V

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions of Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1899</td>
<td>198</td>
</tr>
<tr>
<td>1909</td>
<td>413</td>
</tr>
<tr>
<td>1919</td>
<td>1,250</td>
</tr>
<tr>
<td>1929</td>
<td>1,892</td>
</tr>
<tr>
<td>1939</td>
<td>2,022</td>
</tr>
<tr>
<td>1947</td>
<td>5,526</td>
</tr>
</tbody>
</table>


To meet increased demands, the nation's mills as a whole in 1937 were operating at 89 per cent of capacity. Just five years before they had been drooling along at 58 per cent of capacity. The paper industry operated at near capacity all during World War II, and in 1947 most mills
were operating at better than 90 per cent of capacity. Sulphate mills were operating at 91.6 per cent of their capacity.  

**Cost advantages.** With an ever increasing market demand and with knowledge of techniques that would put the industry on a mass production basis, the paper industry underwent a process of great expansion. Naturally, management sought those locations which offered the greatest combination of advantages. The advantages and disadvantages of certain areas had to be compared. The cost factors which had to be considered were (1) nearness to raw materials and permanency thereof, (2) nearness to markets, (3) availability of cheap fuel and power, (4) availability of adequate skilled and unskilled labor, (5) transportation facilities and costs, (6) comparative advantages in taxation and (7) facilities for disposal of waste.

The management policies of the leading paper companies determined to a great extent the pattern which the paper industry would follow. These policies are so important that it seems well to outline those of one of the leading paper manufacturers which has established many mills throughout the Southern states.

On January 31, 1898, eighteen pulp and paper companies in the northeastern part of the United States consolidated

to form the International Paper Company. This Company has now passed through three stages in management policy.

The first stage was a period lasting about 15 years during which chief attention was given to achieving the advantages which were believed to lie in uniting the predecessor companies. The management was drawn from the founding mills, and the policies followed were highly conservative. Little new building was undertaken. The tonnage of newsprint produced in the Company's mills increased, but not in proportion to the growth in total United States consumption. International Paper Company's share of the total United States newsprint market dropped from an initial level of around 60 per cent in 1898 to about 26 per cent in 1913.\(^{12}\)

The second period began in 1913 and covered a span of almost a quarter of a century. New foundations were laid—at first, slowly, then with great force. The company followed a policy of diversifying its operations. Significant developments during this period were:\(^{13}\)

- Newsprint moved to Canada, where conditions for large-scale economical production were far more favorable;
- Canadian International Paper Company was born;
- United States mills of the company began to turn more and more to specialized papers utilizing the skill of master paper makers of northern New York and New England;

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\(^{13}\) Ibid., pp. 17-18.
A beginning was made in the expansion of converted products;

The most important step came in 1925 when the Company—seeking new large-volume opportunities and more adequate profit margins—entered the kraft field in the South.

The third period in the history of International Paper Company's management policies began in 1936. It has been a period of:

Greatly expanded output;

Concentration of production in fields where International Companies can demonstrate a capacity to earn adequate profits;

The development of new paper products in order that International can have the advantages of a pioneer;

A substantial increase in the company's interest in converted products made from the paper it manufactures;

Decentralization of operations and responsibility in order to develop initiative, efficiency, and a strong corps of leadership;

Financial reconstruction.

Why did International Paper Company decide to enter the kraft field and expand into the South in 1925? Also, why did the Company's policy of greatly expanded output in the late 1930's lead to the South and particularly to Louisiana? Why did this Company, as well as several other companies, concentrate on production of kraft paper and board? More than half (55.4 per cent) of International's total production in 1947 was devoted to kraft paper and board.\(^{15}\)

\(^{14}\) Ibid., p. 19.

\(^{15}\) Ibid., p. 20.
The executives of the great paper companies carefully analyzed the cost and market advantages mentioned heretofore. The largest single material cost item in the manufacture of pulp is pulpwood. In 1939 pulpwood accounted for two-fifths of the value of pulp produced in the United States. Of course the relative importance of wood costs varies among the different types of pulp and among the several pulp producing regions.

Wood is heavy and costly to ship great distances. It is a great advantage to a paper mill to be located in an area where unlimited supplies of pulpwood are available within a reasonable range. Generally, the market for the finished product does not coincide with available pulpwood supplies and the cost of shipping the paper must be balanced against the cost of shipping pulpwood and other raw materials.

Total transportation cost is the cost of transporting raw materials to the mill plus the cost of transporting finished products to market. In the paper industry, transportation cost is generally lower for mills located near raw materials than for those located near markets.

Strong kraft paper is made by the sulphate process and the fast growing Southern pines—longleaf, shortleaf, loblolly, and slash—are ideally suited for this process. The

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16 The Paper and Pulp Industry of New York State (Albany: Executive Department, Division of Commerce, 1942), p. 44.
South has relatively low pulpwood costs. The rapid growth of trees permits cutting on a sustained yield basis on a much shorter cycle than is possible in the Northeastern region. The South has a great amount of negro labor which can be secured cheaply for such manual labor as cutting, hauling, and handling of wood. The Southern forests are accessible throughout the year, while Northeastern and Northwestern forests are often located in mountainous country and are bound with snow during the winter months.

Table VI shows the consumption of pulpwood and the average value per cord delivered to the mill. It will be noted that the South has the largest pulpwood consumption and the lowest delivered cost of any region in the United States.

**TABLE VI**

Pulpwood Consumption, Quantity and Value By Pulpwood Regions: 1947

<table>
<thead>
<tr>
<th>Region</th>
<th>Quantity (cords)</th>
<th>Pulpwood Value f.o.b. plant (thousands of dollars)</th>
<th>Consumption Average cost per cord delivered at mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>19,345,311</td>
<td>$344,959</td>
<td>$17.83</td>
</tr>
<tr>
<td>Appalachian</td>
<td>1,735,138</td>
<td>27,802</td>
<td>16.02</td>
</tr>
<tr>
<td>Northeast</td>
<td>3,421,328</td>
<td>83,979</td>
<td>24.45</td>
</tr>
<tr>
<td>Lake States</td>
<td>2,642,647</td>
<td>57,987</td>
<td>21.94</td>
</tr>
<tr>
<td>South</td>
<td>8,168,491</td>
<td>117,593</td>
<td>14.39</td>
</tr>
<tr>
<td>Pacific Coast</td>
<td>3,377,707</td>
<td>57,598</td>
<td>17.05</td>
</tr>
</tbody>
</table>

The Southern region consumed nearly half (42.2 per cent) of the nation's pulpwood. The $14.39 cost per cord delivered at the mill is the average cost for all mills throughout the South. The cost of wood in some sections of the South was lower than this average.

New York has for many years been the leading state in production of paper and board. In order of rank for individual states, the 1947 Census of Manufactures reports the following production figures for paper and board: (1) New York, 1,849,873 tons; (2) Michigan, 1,536,490 tons, (3) Ohio, 1,463,461 tons, (4) Louisiana 1,342,559 tons.

It may be asked how New York can maintain its leadership considering the high cost of pulpwood in that area. There are several reasons. New York is a large state in both area and population. Most of the mills in that area were established in the early days of papermaking when rags were the principal raw material and when spruce was "king" of the pulpwoods. The New York mills are in the vicinity of the largest markets in the country and the high cost of pulpwood is partially compensated for by the savings of transporting the finished product to market.

New York's lead in paper manufacturing is slipping, however. Prior to 1916 New York was the leading pulp producing state, but by 1940 it had fallen to sixth place. A decline of 37 per cent in terms of absolute quantities of pulp produced was recorded between 1920 and 1940. In 1925
New York accounted for 16.4 per cent of United States production, while in 1940 the state accounted for only 10.1 per cent.17

New York state is dependent upon Canada for approximately half of its pulpwood supply, and if it had not been for this source of raw materials, the industry would have started to decline long before it did. Pulp could be imported more cheaply than many New York and other Northeastern mills could produce it, and this fact, no doubt, had great influence on the closing of many pulp mills in that section of the country.18

The decline of the pulp industry in the Northeastern states changed the character of the paper industry. While New York was formerly dominated by integrated pulp and paper mills, the State's paper industry now consists principally of paper mills which purchase pulp. The leading class of paper produced formerly was newsprint, which almost universally is produced by integrated pulp and paper mills. The leading class now is paperboard which is produced principally from waste paper.19

The relatively old and inefficient equipment in New York is an important factor contributing to present high production costs. This situation is largely a result of the

18 Ibid., p. 42.
19 Ibid., p. 7.
shortage of wood and of high wood costs which have dis- 
couraged the erection of new mills and major improvements 
in old ones.

Mills in high wood cost areas can better their position 
by concentrating production more in those grades of paper 
where the disadvantage of high wood pulp prices is least 
serious. In the manufacture of high-grade papers, wood pulp 
is a smaller proportion of total cost than in the production 
of the lower priced tonnage grades. When attention is 
directed to high-grade papers made from rags and to paper-
board made from waste paper the cost of materials is not 
so unfavorable in comparison with costs in other states. 20

It is hoped the explanation given above will throw some 
light on the management policy of one of the leading paper 
companies which was outlined in this section. The shortage 
and high cost of pulpwood, no doubt, was a strong contrib-
buting factor in management's decision to establish its 
newsprint mills in Canada and to purchase and erect new 
mills in the South for production of kraft paper.

Other Northeastern mills also went into business in 
the South. The founders of the Southern Advance Bag and 
Paper Company formerly owned and operated mills in Maine. 
It does not pay to build new productive capacity in worn-
out areas. The low cost and permeability of Southern

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20 Ibid., p. 7.
pulpwoods have probably been the most important factor in turning management's attention to the South and to Louisiana.

The South also has vast quantities of minerals which are used in papermaking. Salt and sulphur are used in making salt cake, the principal chemical used in the sulphate process. In 1945 the South produced 100 per cent of the sulphur and 20 per cent of the salt which was mined in the United States. 21

Vast reserves of natural gas are available for use in industry, particularly in Louisiana and Texas. The state of Louisiana has 25 trillion cubic feet of proven reserves and more gas is being discovered each year than is being used. Texas has even greater reserves than Louisiana. 22

Louisiana's first natural gas was discovered in Caddo Parish in 1905.23 The Monroe field began commercial production in 1916. The pioneer well was brought in near Monroe by Louis Lock who drilled against the advice of geologists to a depth of 2,200 feet. The well had a rock pressure of 1,050 pounds and the discovery attracted the attention of oil and gas men throughout the country. It has been estimated that over $30,000,000 was spent in the

22 "Oil and Gas Output for Louisiana totaled 190 Million Barrels in '48," Manufacturers Record, September, 1949, p. 93.
23 Ibid., p. 93.
first six years in the development of the Monroe gas fields.24 The area around Monroe now has five proven gas fields which serve four of Louisiana's paper mills. In addition, these gas fields furnish fuel for the Southern Carbon Company in its manufacture of carbon black, and for the great Sterlington power plant which furnishes steam generated power for much of Louisiana and some communities in other Southern states.

The South has large quantities of both ground water and surface water for industrial use. There are also many bayous which serve to dispose of the great quantities of waste which comes from paper mills.

Southern labor has been plentiful, and management and labor relations have been exceptionally good. Until recently, labor has not been as well organized in the South as it has in the North. The possibility of fewer strikes has, no doubt, been a consideration of management in choosing a location.

In order to encourage new manufacturing plants to locate within its boundaries, and to promote the expansion of resident manufacturing plants, Louisiana has provided a ten-year tax exemption plan. The law provides that the Board of Directors of the State Department of Commerce and Industry, with the approval of the Governor, may contract with the owner of any proposed new manufacturing plant (or with the owner of any proposed addition to plants already

24 Monroe Morning World, October 31, 1935, p. 3.
existing in the State), for the exemption of both State and local ad valorem taxation. This exemption includes only buildings and machinery but cannot be granted where such exemption will give a competitive advantage over the same kind of industries in the locality unless those industries give their consent in writing.

The State Department of Commerce and Industry has field representatives which make a careful investigation of every application for tax exemption. These representatives make a full and complete report to the Board which must approve all applications.

Although new industries must still pay taxes on land and on all inventories (raw materials, goods in process, and finished goods) the exemption provides a tremendous saving to new industries. It enables new manufacturing plants to get a good start with a light tax load.

The location and availability of markets has always been a major consideration of management in choosing a location. After the Civil War New York became the financial and nerve center of American industry and there was a tendency to concentrate manufacturing plants in the Northeastern states and around the Great Lakes. Since the close of World War I the tendency has been toward diversification, and it was inevitable that the South with its vast quantity of natural resources would have its share of industrial growth.
The South was ahead of other sections of the country in rebounding from the depths of the depression in the early thirties. States below the Mason-Dixon line were on their road to recovery before other states had reached the bottom of their slump. During the depression there was a noticeable migration of industry southward. New productive capacity meant employment and purchasing power.  

The land and water area of the South aggregates 967,368 square miles out of 3,022,387 square miles for the nation. Ninety-eight per cent of the South's population is native born while the native born in other sections averages eighty-eight per cent.

The South has facilities to take care of both domestic and foreign trade. In 1945 the Southern states had 80,963 miles of railroads in comparison with 145,733 for the rest of the nation. Also, there were 127,126 surfaced miles of primary highways in comparison with 184,462 for all other states.

Many of the nation's large seaports are located in the South. New Orleans has the second largest port in the United States in the handling of international trade. This port is served by the Public Belt Railroad whose tracks

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25 *Blue Book of Southern Progress, 1947, op. cit.*, p. 34.
parallel the wharf apron. This is a terminal switching railroad operating more than 128 miles of track within the Port of New Orleans, and it makes connections with nine major railroads. Fifty thousand miles of railroad track fan out of New Orleans to the East, North and West. The Intra-Coastal Canal, famous land protected all-water route gives the Port direct access to all coastal points westward in Texas and to the East. Barge lines operate on the Mississippi River from New Orleans to Minneapolis and St. Paul; on the Illinois River to Chicago; on the Ohio to Pittsburgh; on the Missouri to Kansas City; on the Intra-Coastal Canal from Brownsville, Texas to Appalachianola, Florida; and on the Warrior River to Birmingham. New Orleans is the heart of the world's most extensive inland waterway system. 28

Seventy-five trucking systems run in and out of New Orleans with service to every major market in America. The city has three major airports and scheduled flights are made by six domestic and three international air lines. 29

Greater New Orleans itself is a major market as the South's largest city with a population of 666,000. 30 Within a 300-mile outer circle of Louisiana including Louisiana's

29 Ibid., p. 13.
own population of 2,360,000 there are approximately 24,000,000 persons with a total cash income of $18,223,000,000.31

The Port of New Orleans provides 11½ miles of wharves with room to accommodate 89 ships at one time. Steel transit sheds parallel the wharves and provide seven million square feet of storage space. The fact that the wharves of the port parallel the river and do not extend out perpendicularly as do piers in many other ports makes possible large economies in operation. Modern facilities, special freight handling machinery, and operational efficiency give New Orleans the lowest per ton cost of any port in the country. United States Army reports show a loading cost at New Orleans of $1.80 per ton against $3.08 for New York. The costs of discharging were $1.25 per ton as compared with New York's $4.55.32

The Port of New Orleans has no hidden charges. The shipment is delivered ship side within reach of ship tackle. The shipper has seven days free storage on cars and 10 days free storage at the wharf. This makes a total of 17 days which the shipper has to catch a ship before demurrage charges are incurred.33


New Orleans provides a Foreign Trade Zone in which imported goods may be regarded as still in foreign territory and not subject to duty and customs requirements until the goods are removed. 34

The Port of New Orleans is progressive in reaching out for domestic, Caribbean, South American and other world markets. Recently the International Trade Mart was put into operation. This is a non-profit, tax-free, wholesale Trading Center where in one modern building, raw materials and manufactured products of many countries are displayed.

In addition to New Orleans, the South has other ports that are of importance. They are: Beaumont, Texas; Charleston, South Carolina; Corpus Christi, Texas; Galveston, Texas; Hampton Roads, Virginia; Houston, Texas; Jacksonville, Florida; Miami, Florida; Mobile, Alabama; Pensacola, Florida; Port Aransas, Texas; Port Arthur, Texas; Port Everglades, Florida; Savannah, Georgia; Tampa Florida; Texas City, Texas; and Wilmington, South Carolina.

Southern Kraft Mills

The Southern pulp and paper industry is not a new development except when it is compared relatively with the

34 Ibid., p. 27.
industry in other parts of the country. Some quantities of Southern pine were being used for pulp as early as 1909.35

The first paper mill in the South was established in 1774 in Williamsburg, Virginia. This mill made paper from waste linen rags and other materials by beating them into pulp. Southern pine was first used for the manufacture of paper by the Marietta Paper Manufacturing Company near Atlanta, Georgia, in 1878. This company made paper from shortleaf and loblolly pine groundwood mixed with rags. In 1891, the Carolina Fibre Company of Hartsville, South Carolina, was making sulphite pulp on a commercial scale.36

Louisiana's first paper mill was built at Braithewaite in 1898 by the United Railway and Trading Company, an English syndicate.37 It produced twenty tons of pulp per day from bagasse for several years, but the mill was not too successful. The mill was bought by the E. Z. Opener Bag Company in 1917 after the sulphate process had been proved successful in pulping resinous woods. This company served as a pioneer in Louisiana in the new kraft industry and

35 Carlile P. Winslow, "Contributions of Forest Products Laboratory Research to Southern Pulp and Paper Developments" (Speech given at Fifth National Farm Chemurgic Conference, March 30, 1939).

36 Information furnished by Southern Pulpwood Conservation Association.

produced more than 45 tons of kraft wrapping and bag paper daily. The plant was purchased in 1931 by the Gulf States Paper Company, and the machinery was moved to a new mill built at Tuscaloosa, Alabama.  

The first attempt to make paper exclusively from Southern pine was undertaken at Pensacola, Florida, in 1903. The soda process was used, but the operation did not prove entirely successful, and the equipment was later moved to Orange, Texas, where a change was made to the sulphate process. This mill in 1910 produced on a commercial scale the first all-kraft pulp from yellow pine. Although this kraft mill was successful, the real development in the Southern kraft paper industry did not come until the 1930's. Louisiana's production of paper was first listed separately in the Census of Manufactures: 1929. In 1929 the census showed that 11 establishments employed 1150 wage earners to produce a total product valued at $18,058,539.  

The second mill to operate on Southern pine was built at Moss Point, Mississippi, in 1913. Before this mill was erected, Southern wood was sent to Sweden, where it was  

39 Chapman, loc. cit.  
made into bleached and unbleached sulphate pulp. Some of this pulp was shipped to England where it was converted into wrapping paper and white book paper. As a result of the successful demonstration, English investors furnished a large part of the money required to finance the Moss Point mill.\footnote{Chapman, loc. cit.} This mill was purchased by the International Paper Company in 1928, and in 1934 was rebuilt to manufacture kraft wrapping and specialty papers.\footnote{Springhill News Journal, June 11, 1948.}

A mill was built at Bogalusa, Louisiana, in 1909 to utilize saw mill refuse. It was not successful, and was rebuilt in 1911-1912 to use the sulphate process. This was really the first step toward manufacturing paper from pine in Louisiana. This sulphate mill, owned by the Louisiana Fibre Boxboard Company had one cylinder machine with a daily capacity of 50 tons of a product then known as \textit{jute container}. The mill was closed in a very short time when the owners found the profits were too lean. The property remained idle for about two years until it was acquired by new interests in 1916.\footnote{Cody, op. cit., p. 62.}

Under the management of Richard J. Cullen, a man who later became a leader in the development of the Southern paper industry and president of
International Paper Company, the mill was remodeled and operated successfully until it was sold in 1919.\(^4\) The town of Bogalusa was founded in 1905 when the Great Southern Lumber Company established the largest saw mill in the world. This mill went into operation in 1908 with a rated capacity of 1,000,000 board feet per day.\(^5\)

As a result of the successful use of the sulphate process for the pulping of Southern resinous woods, and with a desire to convert its waste into a usable product, the executives of the great Southern Lumber Company created a subsidiary, the Bogalusa Paper Company and authorized construction of a second pulp and paper mill in Bogalusa. This new mill was constructed between 1916 and 1918.\(^6\)

After this new mill had been in operation little more than a year the Bogalusa Paper Company purchased the mill which operated under the name of the *Louisiana Fibre Boxboard Company*.\(^7\) On June 16, 1937, the Bogalusa Paper Company merged with Robert Gaylord, Inc. to form the Gaylord Container Corporation. Since that time the mill has undergone great expansion, and has become one of the South's largest paper mills.


\(^6\) *Cody*, *op. cit.*, p. 62.

Two kraft paper mills were built in Bastrop, Louisiana, in the early 1920's under the supervision of Richard J. Cullen. The Bastrop Pulp and Paper Company mill was put into operation in 1921. The second plant, known as the Louisiana Mill, was much larger than the first, and began operations in 1925. These two mills operated independently until they were sold to the International Paper Company. International acquired the Bastrop Mill on June 15, 1925 and the Louisiana Mill on March 12, 1927.48

The Brown Paper Mill Company, Inc., was organized by H. L. Brown, then of Orange, Texas, in 1923. Monroe was chosen as the site for their mill which began operations in 1924. In 1927 a second unit was installed to double the output. Two years later, additional expansion brought the mill's capacity up to 500 tons per day. At that time it was the largest single kraft mill in the United States.49 This mill is still the principal industry of the twin cities of Monroe and West Monroe.

Until 1927 the town of Hodge, Louisiana, was the site of a prosperous saw mill, the Hodge-Hunt Lumber Company. The properties of that company were sold to the Southern Advance Bag and Paper Company which constructed a kraft paper mill and bag plant. The plant began operations on


September 7, 1927. It now manufactures 12 million paper bags a day and its motto is "from a log to a paper bag in a day."

The Calcasieu Sulphate Paper Company constructed a small but modern mill at Elizabeth, Louisiana, in 1926. This mill in 1938 had a capacity of 40 tons of kraft wrapping paper and 55 tons of sulphate pulp. In 1947 this company added a paper bag plant with six bag machines. In 1948, a second Fourdrinier machine was added to give the paper mill a capacity of 200 tons every 24 hours and 29 more bag machines were installed.

The greatest developments in the kraft paper industry occurred after the International Paper Company entered the Southern Kraft field in 1925 by purchasing the mill of the Bastrop Pulp and Paper Company. At that time Richard J. Cullen, who had designed and built both of the paper mills in Bastrop, was made President of Southern International Paper Company. In 1927 International purchased the Louisiana Mill. A new subsidiary, Southern Kraft Corporation, was organized to control all of International's Southern kraft operations. Mr. Cullen became President of the new subsidiary and was elected vice-President of International Paper Company. Mr. Cullen continued in direct charge of all Southern Kraft operations, and in 1935 was

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appointed manager of manufacturing of all mills of International Paper Company. In 1936 Mr. Cullen became President of International Paper Company where he served until he was made Chairman of the Corporation in 1943. Southern Kraft Corporation operated as a subsidiary until June, 1941 when it was merged with International Paper Company. At that time Southern Kraft's President, J. H. Friend, became a vice-president of International in charge of the Southern Kraft Division.

Kraft paper and board has now become the leading product of International Paper Company. In 1947 that product accounted for 55.4 per cent of the company's total production of 2,983,132 tons of papers of all kinds. Newsprint, which before the war years had been the leading product, now accounted for 23.1 per cent of the total. This, no doubt, is some evidence that the company's decision to enter the Southern Kraft field was a major policy decision.

The new Southern industry grew rapidly as technical possibilities developed and as markets were created for kraft paper. Executives knew that local consumption could

51 "International Paper Company's Board Chairman Dies at 73," op. cit., p. 65.

52 International Paper Company After Fifty Years, op. cit., p. 19.


54 International Paper Company After Fifty Years, op. cit., p. 20.
not absorb the volumes that must be produced in order to provide for most economical production. They knew that they must reach out for new markets, and that they had to establish the southern product in the world's great paper markets in the Northern part of the United States. At first management was troubled by its inability to obtain comparable qualities, and development was blocked by the prejudices of users and consumers to whom the new sheet was unproved. 55

The South's kraft industry first concentrated on the manufacture of kraft wrapping paper. As the use of paper bags grew, the production of bag paper, which is but slightly different from wrapping paper, was added to the production list. These two papers offered possibilities, but their market was not sufficient to justify a rapid expansion of the industry. The real opportunity came in 1925 when research and development provided a method of making kraft boards. The possibilities of mass production were fully realized when it was found that certain Fourdrinier machines could be used interchangeably in making kraft wrapping paper, bag paper, and kraft board. Then a real expansion of the industry began. 56

Between 1925 and 1931 International bought three and built three large kraft mills in Alabama, Arkansas, Florida,


56 Ibid., (unpublished).
Louisiana, and Mississippi. In 1928, after the purchase of the Bastrop and Louisiana mills, the Company built a new mill at Camden, Arkansas, and purchased the mill at Moss Point, Mississippi. In 1929 the Mobile, Alabama, and in 1931, the Panama City, Florida, mills were built as plants of the Southern Kraft Corporation.57

As the Panama City mill was nearing completion in 1931, kraft paper mills were starving for business and it looked as though this new mill would produce kraft paper for a market which was already saturated. The development of a new product—kraft container board—prevented this catastrophe. Executives and product engineers had become interested in the commercial possibilities of Fourdriner kraft container board. Test runs were made at the Bastrop mill in 1928. That year 300 tons of this board were produced.58

In 1929 production of board jumped to 6,200 tons, and in 1930, to 37,300 tons. When the Panama City mill started operating in 1931, 100 per cent of its product was container board. This was the first time that kraft container board had been produced on a mass production basis. The following year, 1932, International's production of Fourdriner container board totaled 133,900 tons.59

57 International Paper Company After Fifty Years, op. cit., p. 67.
58 Ibid., p. 67.
59 Ibid., p. 66.
The new product had a strong selling point—lighter weight for equal strength. Vigorous sales effort convinced converters of the product's advantages and a tremendous demand was created. Even during the worst years of the depression, when demand for kraft wrapping and bag papers had shrunk as business generally declined, the Southern Kraft Corporation earned a profit. During the depression years there was a constant increase in the proportion of the market for wrapping paper, bag paper, and paperboard which was supplied by Southern mills.

Another example of the development of a new product is that of Chemifibre, a corrugating medium manufactured from waste gum wood. Again, this product was developed at the Bastrop mill which has always carried on much experimental work. This mill is one of the oldest in the South, and during the depression it became apparent that the new and modern machinery of other mills was putting the Bastrop mill in a position where it operated at a competitive disadvantage. The company, therefore, used the equipment for research and new product development.

During World War II the Bastrop mill had difficulty in getting pine wood. When the wood supply was insufficient, the Bastrop mill was the one that had to do without since that mill was old and operated at a higher cost than the

60 Ibid., pp. 65, 66.
61 Friend, loc. cit.
other mills. Officials of the Company thought of the possibility of making paper from the gum and scrub oak trees which were growing up to replace the cut-over pine lands. Thus far, no way had been found to utilize this kind of timber in papermaking. Experiments resulted in the product now known by its trade name—Chemfibre. This is a board used as a corrugating medium in the manufacture of containers. In June 1944, the Bastrop mill went into full production of this product, and later other mills of the Southern Kraft Division of International Paper Company began to devote a part of their equipment to the manufacture of Chemfibre.

No other company has been able to manufacture Chemfibre, and the formula and techniques of production are a carefully guarded secret. Chemfibre sells in competition with kraft corrugating medium which is used between the layers of linerboard in the manufacture of paperboard shipping containers. Bastrop is close to an ample supply of gum wood which is used in making the product. As yet, the Bastrop mill has not been able to use the scrub oak which covers the cut-over pine lands, but officials believe that the time will come when research will uncover a method of utilizing this timber.

The demand for paperboard and the discovery that it could be made on Fourdrinier machines gave impetus to

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further expansion in the latter part of the depression years. In 1937 International completed a mill with two machines at Georgetown, South Carolina. These machines had a capacity of 750 tons of kraft board a day. In 1942 a third machine was added and the capacity of the mill was increased to 1,350 tons of board per day, which made this mill the largest in the world. One of the machines of the Georgetown mill has now been converted exclusively to the production of Chemfibre. 63

International's mill at Springhill, is the largest paper mill in Louisiana. It started production in 1938 and has since been expanded and modernized three different times to bring its daily capacity to 780 tons of kraft container board and 230 tons of fine grades of bleached kraft paper and board. Prior to the opening of this mill, stock for paper milk containers had never been produced from all-kraft pulp. Also, it had never been produced on Fourdrinier machines. Entirely new techniques had to be developed to achieve the desired quality goals. Research and experimentation provided a method and one machine at Springhill is used for production of heavy-weight bleached kraft grades. 64

63 International Paper Company After Fifty Years, op. cit., p. 66.
64 Ibid., p. 66.
The Southern Kraft Division of International Paper Company is still expanding. It was announced by John H. Hinman, International's president, in October 1947, that the Company would carry on a $22,000,000 expansion program of its eight Southern mills. The largest amounts were to be spent on the two mills at Bastrop, the mill at Springhill, and the mill at Moss Point, Mississippi. This expansion program was designed to increase International's capacity by 900 tons of kraft board and 100 tons of kraft paper per day.65

International has expanded vertically as well as horizontally. In 1927 the Company acquired control of a company manufacturing multi-wall shipping sacks.66 Demand for paper shipping sacks has grown steadily as many new uses have been developed. The Company now has two multi-wall sack plants—one each located adjacent to the Camden and Louisiana (Bastrop) mills, which manufacture the paper used.67 In 1940, International entered the shipping container field on a large scale by acquiring a company with plants at Whippany, New Jersey; Somerville, Massachusetts; Chicago, Illinois; and Kansas City, Kansas.68 Since then

65 New Orleans Item, October 24, 1947.
67 International Paper Company After Fifty Years, op. cit., p. 89.
new container plants have been added in Chicago, Illinois; Georgetown, South Carolina; Los Angeles, California; Springhill, Louisiana; and St. Louis, Missouri. International is now the second largest producer in the shipping container field and practically all of the board for these plants is produced in mills of the Company's Southern Kraft Division. 69

In 1946 the International Paper Company acquired Single Service Containers, Inc., a manufacturer of paper milk containers. International greatly enlarged the facilities of this company, and in 1947 constructed a new plant at Bastrop. This plant, along with two others at Kalamazoo, Michigan, and Norristown, Pennsylvania, have a capacity of 54,000 tons or one and one-half billion milk containers a year. All of the paper for these three plants is produced at the Springhill and Louisiana mills. 70

The trend toward integration is manifested in all of Louisiana's paper mills from the largest to the smallest. The Gaylord Container Company's paper mill located at Bogalusa, Louisiana, has an adjoining container plant and the company has twelve other container plants distributed over the United States. In 1949 this company constructed a

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69 *International Paper Company After Fifty Years*, op. cit., p. 89.

70 Ibid., p. 90.
$2,000,000 bag plant in Bogalusa.\(^{71}\) The Southern Advance Bag and Paper Company at Hodge, Louisiana, consumes a large part of its paper production in its own bag factory located adjacent to the paper mill. In 1947, the Calcasieu Paper Company at Elizabeth, Louisiana, added a paper bag factory on its mill site. In 1949 the Brown Paper Mill Company, Inc., of Monroe, Louisiana, constructed a new container plant.

A list of pulp mills in production in eleven Southern states and their daily capacity is given in Appendix A. The states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia had a total of 51 wood consuming pulp mills in 1947. Figure 1 (Chapter IV) gives the location of these mills.

**Southern Newsprint Mills**

It will be noticed that most of the Southern mills produce sulphate pulp. There are now two mills which are making newsprint. The Lufkin, Texas, mill of the Southland Paper Mills, Inc., went into production in 1940 and was the first mill to produce newsprint from Southern pine. A second newsprint mill costing $32,000,000 has recently been

\(^{71}\) *Bogalusa Daily News*, March 29, 1949.
constructed on the Coosa River at Childersburg, Alabama. It began operations in January, 1950.\textsuperscript{72}

The Lufkin mill started operations on an original outlay of $4,000,000 and a loan of $3,425,000 from the Reconstruction Finance Corporation. In two years it was turning out 50,000 tons of newsprint annually on a one-machine operation. In April, 1948, a new $1,250,000 machine was added and the mill is now manufacturing 115,000 tons a year of newsprint made of 80 per cent groundwood pulp and 20 per cent sulphate pulp.\textsuperscript{73}

Southland Paper Mills, Inc., has $17,000,000 invested in the Lufkin project when timberlands are included. Newspaper publishers in Southern cities own 16 per cent of the stock. That the mill is making progress is evidenced by the fact that the Company has repaid its indebtedness to the Reconstruction Finance Corporation and has enlarged its plant. The Lufkin mill is supplying 75 newspapers in Texas, Arkansas, Louisiana and Oklahoma with either a part or all of their newsprint.\textsuperscript{74}

The Coosa River mill manufactures 100,000 tons of newsprint a year in addition to 77,000 tons of sulphate pulp. The $32,000,000 project is financed by 127 Southern


\textsuperscript{73} \textit{Christian Science Monitor}, April 18, 1949.

\textsuperscript{74} Ibid.
publishers and a group of Alabama industrialists. Newspaper publishers own ten-eighteenths of the common stock. A $14,000,000 loan was obtained from a group of insurance companies including the Metropolitan Life Insurance Company. 75

The newsprint manufactured by the Coosa River mill is sold on a ten year contract to every daily paper in Alabama except two small ones. In addition, the product is sold to leading newspapers in other cities in the Southeast and Southwest as well as to well-known papers like the Cleveland Plain Dealer, Kansas City Star, St. Louis Post-Dispatch, and Washington Star. 76

The new Coosa River mill is in an ideal location for procurement of pulpwood. Within a 50-mile radius there are 4,000,000 acres of forest land with an annual growth of 1,500,000 cords of wood. The mill will use around 240,000 cords of pulpwood per year. 77

There is much speculation as to whether or not these two newsprint mills are just the beginning of a vast Southern newsprint industry. In the 1930's Dr. Charles Herty discovered a way to extract the gummy resin from southern pine. Many technical problems which before 1938 hindered

75 Ibid.
76 Ibid.
77 Ibid.
the development of a southern newsprint industry have been mastered. Does this mean a great expansion will take place?

In answering this question many things must be considered. Unless subsidized, or unless owned and operated by its consumers, private industry will manufacture those products in which it enjoys the greatest comparative advantage. One executive of a mill manufacturing kraft paper and board told the writer that, with slight adjustments in machinery and some few changes in equipment, his mill could manufacture newsprint. He pointed out, however, that such would not be profitable because, after taking into consideration costs of production and the sales price of the two products, his mill had a greater advantage in manufacturing kraft paper.

The market price of kraft paper and board is higher than that for newsprint. At present (February, 1950) newsprint sells for $100 per ton in rolls and $115 per ton in sheets. Kraft 40 pound paper is quoted at $6.00 per cwt. for standard bag, $6.50 per cwt. for standard wrapping rolls and $7.25 per cwt. for No. 1 wrapping rolls. Of course these prices mean nothing until production and administrative costs are taken into consideration. Production cost figures for a ton of southern newsprint are not available.


79 Paper mills consider actual figures on tonnage costs to be strictly confidential.
Some comparisons, however, can be made from profit data collected by the Office of Price Administration as shown in Tables VII and VIII. These figures were compiled from OPA Profit History Cards and are representative of over 50 per cent of the industry. Since practically all of the kraft paperboard is manufactured in the South, the figures given for that type of paper may be accepted as representative of the industry in the southern states. The profit figures given for newsprint, however, cannot be taken as representative of the southern newsprint industry. The OPA figures include the Pacific Northwest, Lake States, and the Northeast producing areas. The costs of producing southern newsprint may be lower or they may be greater. The selling price, after taking into consideration freight costs, is approximately the same for all newsprint.

It will be noticed in Table VII that the net profit on sales before the war years was greater for the newsprint paper industry than it was for manufacturers of kraft paperboard. The 1939 average was 14.7 per cent of newsprint as compared with 7.5 per cent for kraft paperboard. It was not until 1941 that the per cent of profit to sales was greater for the kraft paper industry. The great demand for kraft paper made it possible for the kraft industry to operate at capacity. At the same time, the price of kraft paper and paperboard increased on the market. Peak performance made

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<table>
<thead>
<tr>
<th>Item</th>
<th>1936</th>
<th>1937</th>
<th>1938</th>
<th>1939</th>
<th>Average 1936-39</th>
<th>1940</th>
<th>1941</th>
<th>1942</th>
<th>1943</th>
<th>1944</th>
<th>1945</th>
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<td>7.3</td>
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<td>7.1</td>
<td>8.0</td>
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<td>11.0</td>
<td>10.3</td>
<td>8.0</td>
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<td>17.6</td>
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<td>13.7</td>
<td>11.4</td>
<td>12.8</td>
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<tr>
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<td>6.2</td>
<td>1.6</td>
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<td>5.5</td>
<td>7.3</td>
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<td>10.0</td>
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<td>9.8</td>
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<td>10.3</td>
<td>9.6</td>
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### TABLE VIII

**Percent of Net Profit Before Income Taxes to Net Worth by Types of Paper 1936-1945**

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<tr>
<th>Item</th>
<th>1936</th>
<th>1937</th>
<th>1938</th>
<th>1939</th>
<th>Average (1936-1939)</th>
<th>1940</th>
<th>1941</th>
<th>1942</th>
<th>1943</th>
<th>1944</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Corrugated and solid fiber box</td>
<td>7.5</td>
<td>9.7</td>
<td>2.6</td>
<td>6.3</td>
<td>6.6</td>
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<td>21.6</td>
<td>21.1</td>
<td>21.9</td>
<td>21.1</td>
<td>19.1</td>
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<tr>
<td>Folding and set-up box</td>
<td>10.2</td>
<td>12.9</td>
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<td>10.0</td>
<td>11.8</td>
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<td>35.1</td>
<td>41.6</td>
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<td>9.0</td>
<td>13.3</td>
<td>11.8</td>
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<td>24.7</td>
<td>24.2</td>
<td>22.7</td>
<td>17.0</td>
</tr>
<tr>
<td>Kraft paperboard</td>
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<td>17.6</td>
<td>3.5</td>
<td>9.3</td>
<td>10.5</td>
<td>15.0</td>
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<td>23.5</td>
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<tr>
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<td>22.9</td>
<td>22.7</td>
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<td>Book</td>
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<td>13.9</td>
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<td>21.0</td>
<td>18.4</td>
<td>17.0</td>
<td>14.9</td>
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</table>

possible lower unit costs at the same time a higher price was received for the product. The result was a greater margin of profit.

When taking per cent of profit to net worth, however, (Table VIII), a somewhat different picture is obtained. Except for two years, 1938 and 1939, the per cent of profit in the years shown (1936-1945), was always greater for kraft paper than for newsprint, and in many years the per cent of profit was double and in a few years it was three times as much for kraft paperboard as it was for newsprint. The 1936-1939 average was not so much greater for kraft paperboard (5.5 per cent as compared with 5.3 per cent for newsprint, but this was because of two bad years for kraft paperboard. In 1938 and 1939 kraft paperboard returned a profit of only 0.9 and 4.7 per cent respectively. During the other prewar years shown, kraft paperboard returned a greater profit on investment than newsprint. During all of the war years the profit for kraft paperboard was far greater than it was for newsprint. Listing the profit figures in percentages for kraft paperboard first and those for newsprint second, the comparisons are: 1940, 16.7 and 8.7; 1941, 27.7 and 9.9; 1942, 22.0 and 6.7; 1943, 19.2 and 5.8; 1944, 20.9 and 7.7; and 1945, 16.4 and 5.0.

From this analysis of profit on investment it appears that for most years the kraft paperboard industry as a whole has been a much more lucrative business than newsprint manufacture in the United States.
One reason for the lower percentage of profit on investment for American newsprint is probably the fact that the American product must sell in competition with the output of Canadian mills whose newsprint enters the United States duty free. 81 There are many high-cost, marginal mills in the Northeastern section of the United States. With more efficient mills in other areas of the United States and in Canada setting the price, the average profit margin for American mills is greatly reduced.

In his book entitled, *The Newsprint Paper Industry*, 82 John A. Guthrie came to the conclusion that there was not any great possibility of a southern newsprint industry expanding to the extent that the product could be sold in the northern cities in competition with established mills in Canada and northern sections of the United States. Furthermore, Mr. Guthrie pointed out at the time he wrote (1941) that "the entire consumption of eleven southern states, extending from North Carolina to Texas, is only about 350,000 tons, an amount which could be supplied by four average mills." Thus, he concluded that southern mills might eventually supply the market in southern cities, but any great expansion of the southern newsprint industry was impossible without reaching to capture well established

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81 The tariff on paper is discussed in Chapter VII.

northern markets. That, he said, was highly improbable in view of the competitive advantages of northern newsprint mills and the comparative advantage of manufacturing kraft paper in the South.

In the words of Mr. Guthrie:

In view of the many hindrances to the establishment and operation of a newsprint industry in the South—the technical difficulties, the reluctance of publishers to use a different and probably slightly inferior product, the competition of the lumbering and kraft paper industries for wood, the cost of transportation, and the difficulty of penetrating a market already well supplied—it is safe to predict that newsprint made from southern pine will not penetrate the northern consuming markets to any appreciable extent for a considerable period of time. The possibility of Alaskan newsprint entering the eastern market is greater, but even that is somewhat remote, particularly as there is still a large amount of excess capacity in eastern Canada.

It is quite probable, however, that when general economic conditions are favorable, newsprint mills will be built in the South to supply the cities of that area, particularly those situated inland. The present high cost of shipping newsprint to Texas and Oklahoma from the Pacific Coast, and to the inland cities in Tennessee, Mississippi, Alabama, Georgia, North and South Carolina, could be reduced; and on shipments to these markets the southern mills would have a very considerable advantage in transportation. Furthermore, southern publishers would prefer southern paper, even if it were somewhat inferior.

In regard to the possibility of northern markets for southern newsprint, Mr. Guthrie stated:

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83 Ibid., p. 219.
84 Ibid., p. 218.
Another difficulty southern mills would face is that of entering a market already well supplied with newsprint. About 40 per cent of the capital invested in Canadian newsprint mills belongs to American companies whose selling organizations are in intimate contact with publishers. Publishers who own or control northern mills would never buy from southern mills operated by different interests; and where no such bond exists, the change to a new source of supply would be made rather slowly. Publishers would be loath to sever their long-established connections, and cautious about changing to a new and unproven paper.

After careful analysis of historical data consisting of prices for newsprint and for pulpwood, Mr. Guthrie proved that for newsprint, "wood costs are price determined more than price determining." Canadian pulpwood is almost wholly dependent on the newsprint paper industry for markets. Therefore, the price of Canadian pulpwood is highly responsive to changes in the price of newsprint. This would not be true in regard to the price of pulpwood for southern newsprint mills.

Kraft paper mills are already well established in the most favorable areas for procurement of pulpwood. The southern lumber industry, with its many saw mills, also creates a heavy demand on forest growth.

In regard to prices for pulpwood, Mr. Guthrie states: "A newly established newsprint industry would soon be forced to compete with these two (the southern Kraft paper industry and the lumber industry) for its pulpwood, and the price which it

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85 Ibid., p. 225.
86 Ibid., p. 216.
87 Words in italics ours.
would have to pay for pulpwood would before long, be largely controlled by the other two industries just as the price of pulpwood on the west coast is largely determined for the newsprint industry there by the larger lumbering industry. It is quite likely that there would be sufficient timber for all three industries, but the composite demand could only result in a higher cost for the wood than would otherwise obtain.

The price which a southern newsprint mill could pay for pulpwood could not, for any great length of time, exceed the proportionate amount which pulpwood cost ordinarily bears to the selling price of newsprint. This could put southern newsprint mills in a terrible predicament when newsprint prices (controlled by northern and Canadian mills) fall. As to possible success from this point of view, Mr. Guthrie states: 88

The success of the newsprint venture... would be largely influenced by the price prevailing for southern pine lumber and wrapping paper. At times, the price for newsprint would be sufficiently high to attract the wood from these other two industries, but at other times the price of newsprint would be so low as to force its producers to pay an unprofitable price for pulpwood.

Mr. Guthrie conjectures that the newsprint industry is so important to Canada, and also to Canadian railroads, that in case of a serious threat to the newsprint market in northern cities of the United States, Canadian costs of production and transportation could and would be greatly contracted.

In Mr. Guthrie's words: 89

88 Ibid., p. 216.
89 Ibid., p. 219.
One further important deterrent to the establishment of a large newsprint industry in the South is the greater "squeezability" of Canadian costs. If, as seems very unlikely at this time, southern newsprint mills should threaten serious competition for the northern market, many of the costs in eastern Canadian mills could be substantially reduced. Wood costs would be contracted through reduction of Crown dues and wages of labor in the woods. Power companies, unable to find alternative buyers for their power, would be forced eventually to reduce their contract rates. The valuation of capital investment in timber limits, mills, and subsidiary plants would necessarily be scaled down, or as a last resort, written off almost entirely. Canadian railways, rather than lose their lucrative newsprint traffic, would be forced to reduce their rates. Most of these contractions, of course, would be desperate measures to be used only as a last resort. The newsprint industry, however, is of such vital importance to Canada, and protective tariffs so limit the paper products which could be profitably manufactured in place of newsprint, that the existing markets would not be surrendered without a desperate struggle. If it came to a test of endurance, the "squeezability" of Canadian costs would be found to be much greater than those of Southern mills.

In accordance with Mr. Guthrie's prediction, the South did construct newsprint mills to supply its own market. The mills at Lufkin, Texas, and Childersburg, Alabama, now supply 200,000 tons of newsprint a year, which is about two-fifths of the total needs of southern newspapers. It seems safe to predict that the next ten years will see the construction of additional southern newsprint mills to supply most of the remaining southern market.

Economic Effects of the Paper Industry on Louisiana Communities

The paper industry is one of the most important and most permanent industries in Louisiana. Table IX shows the major industries of the state ranked in order of importance when value of products is considered. The industries in their order of rank are (1) petroleum-coal, (2) food, (3) chemicals, (4) lumber and furniture, and (5) paper. In per cent of gain between 1939 and 1948 the paper industry ranked high when compared with other major industries. Although paper's 406 per cent increase was not as great as petroleum-coal's 521 per cent and chemical's 486 per cent gain, it was greater than lumber and furniture's 397 per cent and food's 242 per cent gain.

Table X shows the relative importance of the paper industry in terms of employment for 1948. It will be noted that in the manufacture of non-durables, paper ranked second in the number of people employed in Louisiana. Food manufacturing ranked first with 33,600 employees. The 30 firms manufacturing paper and paper products, employed 17,300 while the 34 firms shown in the manufacture of petroleum-coal employed 16,400 and the 146 firms in the chemical industries employed 14,500. When durables are included in the list, lumber ranks first in employment (36,000). In the non-durable group of manufacturing industries, paper ranks fourth in the amount spent for general expenses and
materials, ($169,100,000) and it also ranks fourth in net income ($84,200,000).

**TABLE IX**

<table>
<thead>
<tr>
<th>Manufacturing Industry</th>
<th>Value of Products (millions of dollars)</th>
<th>Per cent Gain</th>
</tr>
</thead>
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<tr>
<td></td>
<td>1948</td>
<td>1939</td>
</tr>
<tr>
<td>Petroleum—Coal</td>
<td>718.9</td>
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<tr>
<td>Food</td>
<td>700.9</td>
<td>204.9</td>
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<tr>
<td>Chemicals</td>
<td>317.5</td>
<td>54.2</td>
</tr>
<tr>
<td>Lumber &amp; Furniture</td>
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<td>53.0</td>
</tr>
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<td>Paper</td>
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<td>Metals Industries</td>
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<tr>
<td>Apparel</td>
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<td>Leather</td>
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<td>.5</td>
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<td>Rubber</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>2572.5</td>
<td>565.3</td>
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</tbody>
</table>


The figures of employment for the paper manufacturing industry shown in Table X do not include those employed outside the mill in cutting and transporting wood. There is at least one person engaged in these activities for every person employed in the mill.

Most of the 17,300 persons employed in paper manufacturing were working in the large pulp and paper mills as
shown in Table XI. Pulp and paper mills accounted for
$46,300,000 of the total of $48,500,000 in payrolls distri-
buted by the industry.

**TABLE XI**

**Employment, Sales, and Net Income of Louisiana Manufacturing Industries, 1946**

<table>
<thead>
<tr>
<th>Manufacturing Industry</th>
<th>No. of Firms</th>
<th>Employment (thousands)</th>
<th>Income ($Million)</th>
<th>General Expense and Materials ($Million)</th>
<th>Sales ($Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>671</td>
<td>33.6</td>
<td>100.4</td>
<td>600.5</td>
<td>700.9</td>
</tr>
<tr>
<td>Tobacco</td>
<td>8</td>
<td>1.0</td>
<td>1.8</td>
<td>2.9</td>
<td>4.7</td>
</tr>
<tr>
<td>Textiles</td>
<td>11</td>
<td>2.3</td>
<td>7.0</td>
<td>11.7</td>
<td>18.7</td>
</tr>
<tr>
<td>Apparel</td>
<td>74</td>
<td>6.9</td>
<td>14.7</td>
<td>39.7</td>
<td>54.4</td>
</tr>
<tr>
<td>Paper</td>
<td>30</td>
<td>17.3</td>
<td>84.2</td>
<td>169.1</td>
<td>253.3</td>
</tr>
<tr>
<td>Printing</td>
<td>108</td>
<td>4.6</td>
<td>17.0</td>
<td>21.4</td>
<td>38.4</td>
</tr>
<tr>
<td>Chemicals</td>
<td>148</td>
<td>14.5</td>
<td>91.1</td>
<td>266.4</td>
<td>317.5</td>
</tr>
<tr>
<td>Petroleum-Coal</td>
<td>34</td>
<td>16.4</td>
<td>189.0</td>
<td>529.9</td>
<td>718.9</td>
</tr>
<tr>
<td>Rubber</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Leather</td>
<td>3</td>
<td>--</td>
<td>.3</td>
<td>.4</td>
<td>.7</td>
</tr>
<tr>
<td><strong>Non Durables</strong></td>
<td><strong>1,088</strong></td>
<td><strong>96.7</strong></td>
<td><strong>$505.5</strong></td>
<td><strong>$1,602.0</strong></td>
<td><strong>$2,107.5</strong></td>
</tr>
<tr>
<td>Lumber</td>
<td>873</td>
<td>36.0</td>
<td>100.1</td>
<td>150.7</td>
<td>250.8</td>
</tr>
<tr>
<td>Furniture</td>
<td>67</td>
<td>1.7</td>
<td>4.4</td>
<td>8.0</td>
<td>12.4</td>
</tr>
<tr>
<td>Stone, etc.</td>
<td>102</td>
<td>3.9</td>
<td>14.3</td>
<td>16.9</td>
<td>31.2</td>
</tr>
<tr>
<td>Primary Metals</td>
<td>17</td>
<td>.7</td>
<td>3.5</td>
<td>7.2</td>
<td>10.7</td>
</tr>
<tr>
<td>Fab. Metals</td>
<td>79</td>
<td>3.8</td>
<td>15.3</td>
<td>28.8</td>
<td>44.1</td>
</tr>
<tr>
<td>Machinery</td>
<td>63</td>
<td>2.9</td>
<td>10.2</td>
<td>14.5</td>
<td>24.7</td>
</tr>
<tr>
<td>Electrical</td>
<td>3</td>
<td>.1</td>
<td>.3</td>
<td>.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Trans. Equipment</td>
<td>60</td>
<td>7.6</td>
<td>28.3</td>
<td>56.1</td>
<td>84.4</td>
</tr>
<tr>
<td>Instruments</td>
<td>15</td>
<td>.2</td>
<td>.8</td>
<td>.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>54</td>
<td>.6</td>
<td>1.6</td>
<td>2.5</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Durables</strong></td>
<td><strong>1,333</strong></td>
<td><strong>57.5</strong></td>
<td><strong>$178.8</strong></td>
<td><strong>$286.2</strong></td>
<td><strong>$465.0</strong></td>
</tr>
<tr>
<td><strong>Total Manufacturing</strong></td>
<td><strong>2,421</strong></td>
<td><strong>154.2</strong></td>
<td><strong>$684.3</strong></td>
<td><strong>$1,888.2</strong></td>
<td><strong>$2,572.5</strong></td>
</tr>
</tbody>
</table>

Source: *Manufacturers Record*, CVIII (September, 1949), p. 78.
### TABLE XI

Employment, Payrolls, and Sales in Louisiana's Paper Manufacturing Industries, 1948

<table>
<thead>
<tr>
<th>Industry</th>
<th>Employment (thousands)</th>
<th>Payrolls ($Million)</th>
<th>Sales ($Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulp-Paper Mills</td>
<td>16.4</td>
<td>46.3</td>
<td>240.2</td>
</tr>
<tr>
<td>Paper Boxes</td>
<td>1.2</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Paper Bags</td>
<td>1.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17.3</strong></td>
<td><strong>46.5</strong></td>
<td><strong>253.3</strong></td>
</tr>
</tbody>
</table>

Source: *Manufacturers Record*, CVIII (September, 1949), p. 78.

The Louisiana Parishes in which the large paper mills are located have showed a notable increase in employment, payrolls, and sales of manufactured products. The comparison between the years 1939 and 1948 are shown in Table XII. In four of these parishes (Jackson, Moorehouse, Washington, and Webster) the paper mills are the chief source of employment. In fact, the paper mills are so important in these parishes, that the Census of Manufactures for 1947 in its general statistics by parishes, gives no figures for salaries and wages, or for value added by manufacture. This information is "withheld to avoid disclosing figures for individual companies." The information which the Census did not wish to disclose was the payrolls of the Southern Advance Bag and Paper Company at Hodge, the two mills of the International Paper Company at Bastrop and one at Springhill, and the Gaylord Container Corporation at Bogalusa.
The other parishes in which there is manufacturing of paper and paper products (Allen, Caddo, Jefferson, and Orleans) have other industries of comparable size or in most cases greater in size. The Census of Manufactures gives the salaries and wages paid in these parishes. It is not in these parishes, however, that the heavy tonnages of paper and paper products are produced.

**TABLE XII**

Employment, Payrolls, and Sales in Major Paper Manufacturing Parishes of Louisiana, 1939 and 1948

<table>
<thead>
<tr>
<th>Parishes</th>
<th>Population (1940)</th>
<th>Employment (thousands)</th>
<th>Payrolls ($Million)</th>
<th>Sales ($Million)</th>
<th>Employment (thousands)</th>
<th>Payrolls ($Million)</th>
<th>Sales ($Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen</td>
<td>17,540</td>
<td>1.6</td>
<td>$1.3</td>
<td>$3.4</td>
<td>.7</td>
<td>$1.1</td>
<td>$10.3</td>
</tr>
<tr>
<td>Jackson</td>
<td>17,807</td>
<td>2.0</td>
<td>$1.8</td>
<td>$22.2</td>
<td>2.6</td>
<td>$5.8</td>
<td>$42.8</td>
</tr>
<tr>
<td>Morehouse</td>
<td>27,571</td>
<td>1.5</td>
<td>$1.5</td>
<td>$18.2</td>
<td>3.4</td>
<td>$8.5</td>
<td>$57.0</td>
</tr>
<tr>
<td>Ouachita</td>
<td>59,168</td>
<td>3.0</td>
<td>$3.1</td>
<td>$18.4</td>
<td>3.9</td>
<td>$8.5</td>
<td>$65.2</td>
</tr>
<tr>
<td>Washington</td>
<td>34,443</td>
<td>1.7</td>
<td>$2.1</td>
<td>$13.6</td>
<td>3.8</td>
<td>$9.7</td>
<td>$63.1</td>
</tr>
<tr>
<td>Webster</td>
<td>33,676</td>
<td>1.7</td>
<td>$1.7</td>
<td>$8.2</td>
<td>4.5</td>
<td>$11.0</td>
<td>$75.4</td>
</tr>
</tbody>
</table>


It is interesting to note from Table XII that in 1948 Webster Parish, which contains the huge Springhill mill of the International Paper Company, exceeded Ouachita Parish in employment, payrolls, and sales for manufacturing industries. Ouachita Parish contains the cities of Monroe and West...
Monroe, which together (1950 Census) have a population of 48,661. This parish has 70\(^{91}\) manufacturing establishments including the Brown Paper Mill. Springhill, in Webster Parish, has a population of around 8,000. There are 31\(^{92}\) manufacturing establishments in all of Webster Parish. According to the 1947 Census of Manufactures, except for the paper company, only four other firms in Webster Parish employed 100 persons or over. These firms were three lumber mills and one small oil refinery. As pointed out before, the paper industry is of such relative importance in Webster Parish that the Census of Manufactures withheld information on number of employees, salaries and wages, and value added by manufacture in order to avoid disclosing figures for individual companies.

The employment furnished by the paper industry is not seasonal. During the year 1947 the number of persons employed in the manufacture of paper and allied products steadily rose month by month with few exceptions. As shown in Table XIII the number of employees rose from 13,543 in January to 14,936 in December, an increase of 1,396 (or 10.3 per cent) for the year. During the year 1947 an average of


\(^{92}\) Ibid., Table 2, p. 2.
14,156 employees received $37,853,000 in salaries and wages.

TABLE XIII

Monthly Employment in Louisiana Plants
Manufacturing Paper and Allied Products, 1947

<table>
<thead>
<tr>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 13,543</td>
</tr>
<tr>
<td>February 13,495</td>
</tr>
<tr>
<td>March 13,556</td>
</tr>
<tr>
<td>April 13,587</td>
</tr>
<tr>
<td>May 13,878</td>
</tr>
<tr>
<td>June 13,955</td>
</tr>
<tr>
<td>July 14,133</td>
</tr>
<tr>
<td>August 14,487</td>
</tr>
<tr>
<td>September 14,719</td>
</tr>
<tr>
<td>October 14,673</td>
</tr>
<tr>
<td>November 14,907</td>
</tr>
<tr>
<td>December 14,936</td>
</tr>
</tbody>
</table>

Source: Census of Manufacture, 1947, Louisiana, p. 9, Table 8.

It takes more man hours to convert 1,000 cubic feet of wood into paper than it does to manufacture some other products which have their beginning in the forest. The following statistics are given by Mr. R. E. Paxton in the Bogalusa Daily News.

<table>
<thead>
<tr>
<th>Product</th>
<th>Woods</th>
<th>Plant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber</td>
<td>80</td>
<td>140</td>
<td>220</td>
</tr>
<tr>
<td>Poles &amp; Piles</td>
<td>120</td>
<td>150</td>
<td>270</td>
</tr>
<tr>
<td>(Treated)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperage</td>
<td>155</td>
<td>190</td>
<td>345</td>
</tr>
<tr>
<td>Pulpwood</td>
<td>120</td>
<td>270</td>
<td>390</td>
</tr>
</tbody>
</table>

The paper industry ranks fourth among the state's manufacturing industries in value added by manufacture, fourth

93 March 29, 1949.
in expenditures for new plant, and second in expenditures for new equipment. Only food, petroleum and coal products, and chemicals rank ahead of paper in value added by manufacture. Table XIV shows a comparison of Louisiana's industries on the points mentioned above, and also shows the increase which has taken place since 1939 in the value added by manufacture.

Tremendous value is added to growing timber through processing. For instance, pine trees sufficient to make one ton of paper are worth about $3.50 as growing trees in the forest. When cut into pulpwood and shipped to the mill, the labor, trucking, and freight charges have increased the value to about $25. After being processed into pulp, the original $3.50 worth of trees are worth about $60. When made into paper the value is increased even more, and still additional value is added when the paper is converted into bags and boxes. When 40 establishments including pulp and paper mills and converting plants are included, 38 per cent ($37,853,000 + $99,217,000) of the value added by manufacture by converting wood into paper is wages and salaries. Of course, it must be noted here that the value added by manufacture as used in this analysis starts with the wood and other raw materials as they enter the mill. The percentage of value added by labor would be much higher if the figures started with the uncut wood in the forest.

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95 Census of Manufactures: 1947, "Louisiana,"
TABLE XIV

Value Added by Manufacture and Expenditures for New Plant and Equipment for Louisiana Manufacturing Industries

(Money Figures in Thousands)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and kindred products</td>
<td>780</td>
<td>61,940</td>
<td>139,137</td>
<td>17,147 5,658 11,489</td>
</tr>
<tr>
<td>Textile mill products</td>
<td>16</td>
<td>3,418</td>
<td>7,838</td>
<td>378 71 307</td>
</tr>
<tr>
<td>Apparel and related products</td>
<td>70</td>
<td>6,027</td>
<td>18,986</td>
<td>710 247 463</td>
</tr>
<tr>
<td>Lumber and products except furniture</td>
<td>626</td>
<td>25,993</td>
<td>84,089</td>
<td>5,024 1,315 3,709</td>
</tr>
<tr>
<td>Furniture and fixtures</td>
<td>51</td>
<td>2,056</td>
<td>4,613</td>
<td>234 61 173</td>
</tr>
<tr>
<td>Paper and allied products</td>
<td>40</td>
<td>24,245</td>
<td>99,217</td>
<td>16,771 3,492 13,279</td>
</tr>
<tr>
<td>Printing and publishing Chemicals and allied products</td>
<td>248</td>
<td>9,740</td>
<td>23,005</td>
<td>945 204 741</td>
</tr>
<tr>
<td>Petroleum and coal products</td>
<td>147</td>
<td>29,717</td>
<td>113,482</td>
<td>27,067 6,007 21,060</td>
</tr>
<tr>
<td>Leather and leather products</td>
<td>25</td>
<td>16,609</td>
<td>121,998</td>
<td>21,562 12,909 8,653</td>
</tr>
<tr>
<td>Stone, clay, and glass products</td>
<td>5</td>
<td>87</td>
<td>216</td>
<td>9 -- 9</td>
</tr>
<tr>
<td>Primary metal industries</td>
<td>115</td>
<td>5,640</td>
<td>16,589</td>
<td>4,110 1,622 2,488</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>600</td>
<td>2,458</td>
<td>199 94 105</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Fabricated metal products</td>
<td>78</td>
<td>4,521</td>
<td>15,985</td>
<td>1,266</td>
</tr>
<tr>
<td>Machinery (except electrical)</td>
<td>47</td>
<td>2,391</td>
<td>6,533</td>
<td>604</td>
</tr>
<tr>
<td>Transportation equipment</td>
<td>53</td>
<td>2,871</td>
<td>34,162</td>
<td>809</td>
</tr>
<tr>
<td>Instruments and related products</td>
<td>5 (withheld)</td>
<td>248</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Miscellaneous manufactures</td>
<td>53</td>
<td>849</td>
<td>3,396</td>
<td>313</td>
</tr>
<tr>
<td>All other major industry groups</td>
<td>11 (withheld)</td>
<td>2,122</td>
<td>56</td>
<td>33</td>
</tr>
<tr>
<td>Total (all industries)</td>
<td>2,389</td>
<td>198,527</td>
<td>694,074</td>
<td>97,210</td>
</tr>
</tbody>
</table>

Source: Census of Manufactures, 1947, Louisiana, op. cit., p. 3, Table 3.

Table XIV shows that in 1947, the paper and allied products industries spent $3,492,000 for new plants and $13,279,000 for new equipment—a total capital expenditure of $16,771,000.

Louisiana is the largest consumer of pulpwood and produces more tons of pulp than any other southern state. The State ranks third in the production of pulp in the United States. Only the States of Washington and Maine produce
more pulp.\textsuperscript{96} In producing nearly 3,500 tons of pulp every 24 hours, Louisiana's pulp mills consume more than 6,000 cords of pulpwood per day. In 1948, the industry consumed over 2,000,000 cords. Approximately 12,000 workers in Louisiana receive employment in cutting and delivering wood to the mills located in Louisiana and adjoining states. Some of the pulpwood cut in Louisiana is, of course, consumed by mills in adjoining states. Less than half of the pulpwood consumed by Louisiana's mills is produced in this state. Mills in Louisiana disburse around $32,000,000 per year for pulpwood.\textsuperscript{97}

The current annual payroll of International Paper Company in the South runs around $45,000,000. In 1947 Approximately $33,000,000 was paid out for rail and water transportation, and over $33,000,000 was paid for the purchase of pulpwood.\textsuperscript{98}

Some idea of the economic importance of one large mill may be gained by examining a list of expenditures for the Springhill mill of the International Paper Company. Annual

\textsuperscript{96} Census of Manufactures: 1947, Pulp, Paper, and Board, op. cit., p. 6, Table 6-C.

\textsuperscript{97} Information furnished by H. J. Malsberger, Forester and Director, Southern Pulpwood Conservation Association, September 1, 1948.

\textsuperscript{98} International Paper Company After Fifty Years, op. cit., p. 67.
expenditures run more than $31,625,000 including approxi-
mately: (1) $350,000 in taxes,\(^9\) (2) $3,500,000 in freight
charges, (3) $10,000,000 for pulpwood including wages of
3,500 forest workers, (4) $7,250,000 in wages to 2,500 plant
workers.\(^1\) This is the largest single payroll in North
Louisiana.

What will a $7,250,000 payroll do for a community's
economic development? The town of Springhill furnishes an
excellent example.

When construction of the plant began in July 1937,
Springhill was a village of around 750 people with an indus-
trial payroll of around $100,000 a year provided largely by
sawmills in the area.\(^1\) In addition to serving the needs
of the sawmill employees, Springhill served a fertile farm
area lying between two bayous, Dorcheat four miles away on
the east, and Bodcau four miles to the west. The area be-
tween these bayous afforded all types of farm land, including

\(^9\) The company's taxes are now much higher since
the 10-year ad valorem tax exemption expired in 1947.

\(^1\) The Manufacture of Pulp and Paper (Springhill:
International Paper Company, Southern Kraft Division,
1948).

\(^1\) "The Town Pulpwood Built," Louisiana Municipal
Review (January, 1949), (Reprint from Shreveport Magazine)
July, 1947, p. 3.
rich bottom land that would grow a bale of cotton to the acre and hill ground which grew fine sweet potatoes. 102

When it was learned that the International Paper Company was seeking a site for a new mill in the sector, a group of interested business men and citizens of the town purchased options on 1,700 acres of land south of town, and when International made its choice of a location, the land was ready.

For nine months, more than 1,700 men were employed in construction of the $12,000,000 plant and Springhill "boomed." The town faced a severe housing shortage and many of the construction workers drove to work from surrounding towns.

The new mill began operations in 1939 using mostly local labor from Springhill and nearby communities. By 1941 Springhill was a modern city which served a trading area of 15,000 people. It had fine stores, over five and one-half miles of blacktop streets in the city limits, a modern water, light and sewage system, a fine school system with newly added gymnasium, auditorium, and grade building, a lighted football field, four churches, and hundreds of new homes. Since the war the city has constructed a paved main street 60 feet wide, with parking meters, street lights, and sub-surface drainage.

In 1947, Springhill had 4,000 residents within the city limits and 6,000 within a three-mile radius of the city. In 1938, two additional school buildings were constructed and in 1947, $268,000 in bonds was voted for improvements.\textsuperscript{103} In 1949 residents voted another $400,000 bond issue for further improvement and expansion of the school system. Springhill had plans for more than $1 million of new construction in 1950. This included 20 miles of sidewalks, eight miles of curb and gutter, another new school, a municipal swimming pool (to be built with parking meter returns), a negro subdivision and hundreds of other housing units.

Construction of a container plant was started in 1941. Since it began operations in July 1946, it has employed about 300 men and women and has converted approximately 250 tons of kraft board into all types and sizes of shipping containers each day.\textsuperscript{104}

The paper mill operates 24 hours a day, and its three Fourdrinier machines manufacture in excess of 1,000 tons of paper daily. Eight hundred tons go into unbleached kraft board or paper, 200 tons into bleached stock for paper milk containers, tags, file folders, food containers, paper plates, milk bottle hoods and many other uses.

\textsuperscript{103} "The Town Pulpwood Built," \textit{op. cit.}, p. 3.

\textsuperscript{104} \textit{Ibid.}, p. 6.
Five 45-car trains bring raw materials into the plant and take away the finished product daily. Around 40 car-loads of finished products leave the plant each and every day.

A substantial portion of the $2,500,000 spent each month, no doubt, finds its way into the Ark-La-Tex trade channels, and thus stimulates growth of the area, and adds to the community's prosperity. Thirty-eight per cent or more of the value added by manufacture is paid in wages and salaries to employees, some of which travel as much as 40 miles to work.\textsuperscript{105} Much of this money goes into payments or rent for homes, purchases of groceries and other household needs, and for purchases of automobiles and the fuel to run them. All this helps the community and provides the funds to build the churches, schools, and paved streets which provide a better place for all to live.

Local industry means jobs for men and women who will spend money with local merchants, taxable wealth to pay for community advancement, new accounts for banks, tonnage for railroads and truck lines, and a greater market for agricultural products. The Manufacturers Record estimates that a plant investment of $100,000 and a payroll of $200,000 will provide for the support of a thousand people, a dozen

\textsuperscript{105} Approximately 65 per cent of the 2,300 presently employed by the Springhill paper mill and container plant live in Springhill and Cullen in the immediate vicinity of the mill. The other 35 per cent drive in or ride one of the 15 busses which daily transport employees to and from work.
stores, a ten room schoolhouse, sales and service for 200 cars, $60,000 annually for the railroads, opportunity for a dozen professional men, yearly markets for $300,000 in agriculture and other farm products, and an annual expenditure in trade of a million dollars, as well as many public improvements.

The story which has just been reviewed for Springhill is a duplication of that which has happened in three other Louisiana towns—Bogalusa, Bastrop, and Hodge. The paper industry has also played an important part in the development of Monroe and especially West Monroe. The Brown Paper Mill is by far the largest employer of the Twin Cities.

At the turn of the century only ten or twelve families resided in Bogalusa. The town has grown with its forest products industries, starting with the Great Southern Lumber Company in 1906, and later the Bogalusa Paper Company, and now the Gaylord Container Corporation. Bogalusa, at present, is a thriving city with a population of 17,722 and eight wood-using industries besides Gaylord.

The pulp and paper mill in Bogalusa employs about 1,800 persons and the container plant an additional 800 men and women. It is estimated that 1,300 more men are employed in the forests cutting pulpwood and hauling it to

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the mill. Five sawmills, a stave mill, a wood preserving plant, and a furniture frame factory employ a total of 360 workers. 107

A recent survey conducted in the pulp and paper mill shewed that on the average each employee supported 3.61 individuals. When this figure is applied to the 2,960 individuals directly employed in Bogalusa's wood-using industries, it is found that more than 10,000 of the city's people are directly dependent for their livelihood on industries supported by the forest. 108

It will be noted that with one exception (Monroe) the major pulp and paper mills of Louisiana are located in rural communities. Likewise, it is noted that these communities are almost completely dependent upon a single industry. Isn't that a dangerous situation, one might ask? It could, no doubt, become catastrophic to employees and to the community if the mills should close. A complete shutdown of the paper industry would have a serious effect on the state's economy.

The successful future of the paper industry depends primarily upon (1) the adequacy and permanency of the pulp-wood supply, and (2) the extent to which present markets

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107 Paxton, loc. cit.
108 Ibid.
for the industry's products can be maintained and new markets developed.

Is present management doing everything possible to insure the continuance of this great paper industry? Two analyses must be made before a definite conclusion can be reached. Chapters IV and V which discuss procurement of raw materials will throw some light upon the first proposition. Later chapters of this work are devoted to a study of marketing problems.
CHAPTER IV

RAW MATERIALS AND THEIR PROCUREMENT

The principal raw materials used in the manufacture of paper in Louisiana are pulpwood, water, fuel and power, and chemicals. Each of these is of equal importance to the operation of a paper mill, and this chapter will be given to a general discussion of the problems involved in their procurement. Chapter V contains a more detailed treatment of the procedures involved in providing a perpetual supply of pulpwood.

Since the quality of the papermaker's product depends largely on the quality and uniformity of the pulpwood procured, management's interest in wood must start long before the wood reaches the plant. Paper mill executives are interested not only in securing an adequate supply of pulpwood at low cost for current operations, but in taking every precaution to make certain that timber will be available for continuous operation throughout the future.

A study of the problems encountered in procurement of pulpwood involves a discussion of forest areas; statistics on growth and drain; the woods division of paper companies; and forest management, conservation, and reforestation.
Pulpwood procurement men realize that theirs is a job which is becoming increasingly difficult. Today they are confronted with a declining timber resource, competition from other paper mills, and from other forest products industries.

**Forest Areas**

**Forest areas of the World.** According to Zon and Sparhawk, authors of *Forest Resources of the World*, the United States with its possessions has 9.1 per cent of the world's total forest area. Russia has 21.1 per cent; British Commonwealth of Nations 21 per cent; Brazil 13.4 per cent; and the balance is divided among other nations.¹ Space will not permit a discussion of these forests. Figure 1, however, shows a map of world timber areas divided into two types of wood—conifers, and hardwood and mixed types. It will be noted that the United States, Canada, Alaska, Russia, China and the Scandinavian countries contain the heaviest stands of timber.

Coniferous trees are softwoods and are generally some form of evergreen. Although some hardwoods are used, it is the coniferous types which are used as the principal raw material in the manufacture of paper. This map is mentioned here because there may come a time when these forest areas

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¹ *Paul Bunyan Quiz, Questions and Answers about the Forests* (Washington: American Forest Products Industries, Inc.), Question No. 36.
Figure 1
will become of prime importance in the competition for world trade and perhaps even world power.

Forest areas of the United States. It is estimated that the original forests of the United States covered more than 820,000,000 acres or about 42 per cent of the land area of the United States. In 1944 it was estimated that there were 462,000,000 acres of forest land in continental United States capable of producing timber in commercial quantities. There were also 168,000,000 acres of non-commercial forest land or low-grade forest and scrub. Less than one-half the total acreage of commercial forest land bears saw timber. An additional 100,000,000 acres bear some timber of which most is too small for sawlog production, although it is large enough for pulpwood. Of the remainder, some 71,000,000 acres contain young growth in varying amounts, but there are nearly 77,000,000 acres of land suitable for producing commercially valuable timber that are now almost entirely deforested and non-productive. In final analysis, our 462,000,000 acres of commercial forest land are growing only about half as much timber as could be raised.²

As shown by the map in Figure 2, there are five principal forest regions in the United States—west coast,

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Areas of Renewable Natural Wealth

This map shows that nearly a third of our country consists of forest lands. It tells you where we obtain our principal crops of trees and where the leading kinds grow.

Figure 2

western, northern, central hardwood, and southern. In addition, there is a small tropical forest area.

Alaska, which is now a part of the United States, has 16,074,000 acres which contain 1,500,000,000 cubic feet of timber. This is mostly Sitka spruce and hemlock in southeastern Alaska's Tangass National Forest. These woods are suitable for making paper, and the Ketchikan Pulp and Paper Company, a subsidiary of the Puget Sound Pulp and Paper Company of Bellingham, Washington, is scheduled to build a mill at Ward Cove. Five or six mills like the one being planned could produce 3,500 tons of newsprint daily.3

Forest areas of the South. The timber supply upon which the southern paper industry depends is distributed rather thinly over 183 million acres, which is 56 per cent of the land area in the South.4 Figure 3 shows the states in the southern region and the various types of forests throughout.

No state, with the exception of Texas and Oklahoma, has less than 40 per cent of its area in commercial forest, and Florida has over 60 per cent. As shown in Figure 4, Oklahoma is the only state which has less than 10 million

3 Christian Science Monitor, January 31, 1949, Section 2.

Figure 3

Source: James V. Dr. Frank, Southern Pulpwood Production and the Paper Supply (Asheville: Southeastern Forest Experiment Station, February 15, 1948), p. 5.
acres of commercial forest land, and Florida and Georgia each has over 20 million acres.

Figure 5 shows the volume of each species of timber in the South in 1944. The total stand of all species is 1.9 billion cords. Softwoods total 833 million cords which is nearly one-half loblolly pine. The 1.1 billion cords of hardwoods run heavily to the smaller sized trees. A large part of the hardwood volume is in the various species of oak which are not now considered suitable for pulpwood. Almost one-third, however, is sweetgum, blackgum, and tupelo--species which are used to a limited extent in many southern pulpmills. These have a total volume greater than the combined volume of shortleaf and longleaf pine.6

Paper mills at present are dependent mostly on pine softwoods although hardwoods are used to a limited extent.7 Figure 3 gives the location of types of forests. In explanation of this map it seems well to quote from Mr. Cruikshank's study:

Bordering the Atlantic and Gulf coasts from South Carolina to East Texas is the longleaf-slash pine forest of the flat coastal plain. It

5 Commercial includes all forest land except that in National and State owned forests. It embraces private and industrial ownership and farm woodlots.


7 According to the Southern Pulpwood Conservation Association, the proportions run about 87 per cent softwood and 13 per cent hardwood.

8 Ibid., pp. 4, 5.
**Figure 4**

**Commercial Forest Land in the South, 1944**

<table>
<thead>
<tr>
<th>State</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>1.4M</td>
</tr>
<tr>
<td>Georgia</td>
<td>1.0M</td>
</tr>
<tr>
<td>Arkansas</td>
<td>0.8M</td>
</tr>
<tr>
<td>Alabama</td>
<td>0.5M</td>
</tr>
<tr>
<td>N.C. Carolina</td>
<td>0.5M</td>
</tr>
<tr>
<td>Louisiana</td>
<td>0.4M</td>
</tr>
<tr>
<td>Miss.</td>
<td>0.3M</td>
</tr>
<tr>
<td>Virginia</td>
<td>0.2M</td>
</tr>
<tr>
<td>Tenn.</td>
<td>0.1M</td>
</tr>
<tr>
<td>S.C.</td>
<td>0.1M</td>
</tr>
<tr>
<td>Texas</td>
<td>0.1M</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>0.1M</td>
</tr>
</tbody>
</table>


**Figure 5**

**Volume of Timber in the South, 1944**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loblolly Pine</td>
<td>257M</td>
</tr>
<tr>
<td>Red Oaks</td>
<td>110M</td>
</tr>
<tr>
<td>Shortleaf Pine</td>
<td>91M</td>
</tr>
<tr>
<td>Sweetgum</td>
<td>65M</td>
</tr>
<tr>
<td>White Oaks</td>
<td>49M</td>
</tr>
<tr>
<td>Tupelo, Bl. Gum</td>
<td>43M</td>
</tr>
<tr>
<td>Longleaf Pine</td>
<td>31M</td>
</tr>
<tr>
<td>Yellow Poplar, SF</td>
<td>60</td>
</tr>
<tr>
<td>Slash Pine</td>
<td>48</td>
</tr>
<tr>
<td>Red, White, Gym</td>
<td>17</td>
</tr>
<tr>
<td>Cypress</td>
<td>12</td>
</tr>
<tr>
<td>All Others</td>
<td>2.1M</td>
</tr>
</tbody>
</table>

**Source:** Same as Figure 4, p. 7.
occupies nearly 35 million acres, two thirds of which are in Florida and South Georgia. Loblolly pine is the leading species on the coastal plain of the Carolinas and Virginia, with shortleaf pine the dominant tree farther inland on the Piedmont. Virginia pine mingles with hardwoods in the eastern foothills of the Appalachians and forms a belt across Virginia and the Carolinas which extends on into North Georgia and Alabama. The rolling hills of Georgia, Alabama, Mississippi, Louisiana and Texas are clothed with a mixed loblolly—shortleaf—hardwood forest. Loblolly pine in mixture with hardwoods is prevalent in Southwest Arkansas, but in the mountainous part of the state it is replaced by shortleaf.

The average stand per acre of all sound trees 5.0 inches d.b.h. (diameter breast high) and larger is about 4.5 standard cords of pine and 6.0 cords of hardwood. Florida, with its large area of poorly stocked timberlands, has an average of only 2.7 cords of pine per average acre. East Texas leads with an average of slightly over eight cords per acre.\(^9\)

Of course, if the pulp and paper industry is to be permanent the mills must depend on the annual growth of wood. At the present time southern production is about 50 million cords of softwoods and 44 million cords of hardwoods. In the South as a whole, the forests are growing about one-half cord per average acre per year, but only one-quarter of a cord of the desired softwoods. In some parts of Florida the annual cut of pine pulpwood is one-tenth cord per acre per year.\(^{10}\)

\(^9\) *Ibid.*, p. 6

Forest lands comprise more than one-half the total land area of the six southern states in the sixth Federal Reserve District. As shown in Table XV, 56 per cent of Louisiana's land area is composed of forests. Tennessee (44 per cent) is the only state in the District with less than half of its area in forests.

**TABLE XV**

Forest Land Area of States in Sixth Federal Reserve District, 1947

<table>
<thead>
<tr>
<th>State</th>
<th>Total Land Area (Millions of Acres)</th>
<th>Area in Forests (Millions of Acres)</th>
<th>Per cent of Total Land Area in Forests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>32.7</td>
<td>18.8</td>
<td>58</td>
</tr>
<tr>
<td>Florida</td>
<td>34.7</td>
<td>21.8</td>
<td>63</td>
</tr>
<tr>
<td>Georgia</td>
<td>37.5</td>
<td>21.1</td>
<td>56</td>
</tr>
<tr>
<td>Louisiana</td>
<td>28.9</td>
<td>16.2</td>
<td>56</td>
</tr>
<tr>
<td>Mississippi</td>
<td>30.4</td>
<td>15.9</td>
<td>52</td>
</tr>
<tr>
<td>Tennessee</td>
<td>26.9</td>
<td>11.8</td>
<td>44</td>
</tr>
<tr>
<td>Six States</td>
<td>191.0</td>
<td>105.6</td>
<td>55</td>
</tr>
</tbody>
</table>


**Forest areas of Louisiana.** The most complete and accurate report on the forest resources of Louisiana is the *Forest Resources Appraisal State of Louisiana*. This report, completed in 1945, was a cooperative project of the American Forestry Association and the Louisiana Forestry Commission. Much of the statistical data used in writing this section is taken from that report.
The total area of Louisiana is 31,054,720 acres. Approximately 16,183,171 acres or 52 per cent is forest land. Table XVI shows these forest areas by types.

Nearly 10 per cent of the area classified as forest land is practically devoid of forest cover. In this respect, no state of the lower South except Florida has a worse situation. Equally significant is the fact that, judged by the number of trees that the soil could profitably support under reasonably good forest management and with proper fire protection, most of the forest stands in virtually all forest types and conditions throughout the State are understocked. Largely because of repeated fires and past cutting practices nearly all stands include numerous cull and defective trees and many trees of inferior species that are not readily marketable.

TABLE XVI

<table>
<thead>
<tr>
<th>Types</th>
<th>Millions of Acres</th>
<th>Percent of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine</td>
<td>5.62</td>
<td>35</td>
</tr>
<tr>
<td>Pine and hardwoods</td>
<td>2.49</td>
<td>15</td>
</tr>
<tr>
<td>Hardwoods (cypress)</td>
<td>8.07</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


11 *Forest Resources of Louisiana* (Baton Rouge: Louisiana Forestry Commission in cooperation with American Forestry Association, August 15, 1947), p. 3.

The 16,183,171 acres of forest land in the State can best be classified as second-growth or cut-over woodland, although there are a few small residual stands of old growth left in widely scattered areas. Most of the virgin and over-mature timber is the inaccessible bottom-land hardwood type.\textsuperscript{13}

Much of Louisiana's forest land is still in the hands of large owners who hold title in many cases principally to retain the oil and mineral rights. Forest product income from this portion of the land is low or non-existent. Sheep and cattle, generally owned by someone other than the landowner, graze the land. Most of these stockmen believe that burning helps the grazing of these lands and thus selfishly set fire to the land.\textsuperscript{14}

**TABLE XVII**

**Condition of Forest Areas in Louisiana**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Millions of Acres</th>
<th>Per cent of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operable timber</td>
<td>8.94</td>
<td>55.22</td>
</tr>
<tr>
<td>Poles and scattering</td>
<td>5.02</td>
<td>31.04</td>
</tr>
<tr>
<td>Reproduction</td>
<td>.67</td>
<td>4.11</td>
</tr>
<tr>
<td>Clearcut</td>
<td>1.56</td>
<td>9.63</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>16.18</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>


\textsuperscript{13} Louisiana Forestry Commission, *First Progress Report, 1944-1945*, p. 31

\textsuperscript{14} *Forest Resources of Louisiana*, op. cit., p. 6.
As shown in Table XVII, there is operable timber\textsuperscript{15} on 8.94 million acres, and poles and scattering sawlog and cordwood trees upon 5.02 million acres. Clearcut areas totalling 1,556,325 acres have not yet been restocked, and much of this must be replanted. There is satisfactory reproduction on 667,203 acres that have been cut over in past years. Upon the 16.18 million acres of forest land in Louisiana, it is estimated that there are 16,856 board feet of pine timber and 25,869 million board feet of hardwoods (International Log Rule).\textsuperscript{16}

The predominant portion of the remaining pine saw timber is loblolly,\textsuperscript{17} but the State also has small volumes of shortleaf and of both old and young growth longleaf. The principal species of hardwoods expressed in per cent of the total volume of hardwoods are: red and sweet gum, 11 per cent; tupelo and blackgum, 9 per cent; oaks (red, white and post), 20 per cent; miscellaneous other hardwoods, 16 per cent; cypress, 3 per cent.\textsuperscript{18}

\textsuperscript{15} Timber is classed as operable when stands contain 1,500 board feet or more per acre. Most sawtimber falls in this category.

\textsuperscript{16} Ed. R. Linn, "Louisiana—Southern Forestry's Proving Ground" (Reprint from American Forests, October, 1945).

\textsuperscript{17} Loblolly pine is a large tree with leaves in clusters of three, 6 to 9 inches long, as distinguished from shortleaf pine which has leaves in clusters of two, 3 to 5 inches long. Loblolly rapidly invades idle and abandoned fields wherever seeds can get to bare soil and is frequently referred to as old field pine. It is found in abundance in northwestern Louisiana and is used for both saw timber and pulpwood.

\textsuperscript{18} Ibid.
Figure 6 shows a map of Louisiana and the types of wood grown in various regions.

In describing these areas it seems well to quote Mr. Linn:19

Along the Mississippi and the lower reaches of its principal feeders, and throughout the length of the Red River are mixed bottomland hardwoods. A small area of upland hardwoods is found in West Feliciana Parish. Loblolly pine-hardwoods type is widely scattered over the state, often in areas formerly occupied by longleaf pine. The longleaf type is confined to southwestern and central Louisiana, while the mixed type, shortleaf-loblolly hardwoods, occupies most of the northwest fourth of the state. Two eastern parishes, Washington and St. Tammany, contain slash pine as well as longleaf.

Louisiana has many natural advantages that favor timber growing and the manufacture of forest products. Adequate rainfall and long growing seasons prevail and the soil is well adapted to timber growth. The topography is characterized by level expanses and gentle slopes. Logging can be carried on throughout the year except in the delta and creek bottoms where high water may impede operations for a few weeks in the winter and spring.20

Favorable transportation facilities include an excellent system of hard-surfaced roads which reduce the cost of truck logging. Several thousand miles of waterways are navigable during at least a part of each year, for barging and rafting forest products.21

19 Ibid.
20 Louisiana Forest Resources and Industries, op. cit., p. 2.
21 Ibid., p. 2.
Figure 6

Some Problems of Pulpwood Procurement

Rising cost of wood. Paper manufacturers show a growing concern over the increased cost of pulpwood. In 1936 yellow pine stumpage sold for 75 cents a cord, and pulpwood delivered to the mill at a price of $4. Just ten years later (1946) stumpage averaged $2.25 and the OPA pulpwood price ceiling applicable to most parts of the South was $9.22

The rising cost of wood, no doubt, is a major problem which must be met, and one which has made paper executives increasingly cost conscious. One procurement man from International Paper Company stated the problem as follows:23

In the last ten years in the South the price of wood has increased 306 per cent which, when we analyze it, is quite an astounding fact. This, in my opinion, is our major problem. Sometime in the not too distant future, we must discontinue raising the price of wood and start to figure out some means of reducing it. I think we shall give this some very serious thought. . .

We have, incidentally, just raised the price again to the tune of $1.00 per cord which will cost the industry in the South another $8,000,000; this following two 10 per cent raises in freight rates.

Table XVIII shows the average cost of pulpwood delivered to mills throughout the United States. It will be noted that


the f.o.b. mill price per cord increased from $7.82 in 1939 to $17.83 in 1947, an increase of 128 per cent. This increase is not so phenomenal as the 306 per cent increase in the cost of southern woods as indicated by Mr. McCaffrey.

The average delivered cost of various types of pulpwood in 1947 is shown in Table XIX. It can be seen here that, in spite of increases in the cost of pulpwood throughout the country, southern pines and hardwoods still deliver at the mill at a lower cost than other woods. This, at present, gives southern mills a competitive advantage in the cost of pulpwood.

**TABLE XVIII**

Pulpwood Average Values Per Cord
Delivered to United States Mills, 1899 to 1947

<table>
<thead>
<tr>
<th>Year</th>
<th>Value Per Cord</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>$17.83</td>
</tr>
<tr>
<td>1939</td>
<td>7.83</td>
</tr>
<tr>
<td>1938</td>
<td>8.10</td>
</tr>
<tr>
<td>1937</td>
<td>7.97</td>
</tr>
<tr>
<td>1936</td>
<td>7.71</td>
</tr>
<tr>
<td>1935</td>
<td>7.64</td>
</tr>
<tr>
<td>1934</td>
<td>7.73</td>
</tr>
<tr>
<td>1933</td>
<td>7.37</td>
</tr>
<tr>
<td>1931</td>
<td>10.94</td>
</tr>
<tr>
<td>1929</td>
<td>13.09</td>
</tr>
<tr>
<td>1919</td>
<td>15.95</td>
</tr>
<tr>
<td>1909</td>
<td>8.63</td>
</tr>
<tr>
<td>1899</td>
<td>4.95</td>
</tr>
</tbody>
</table>

TABLE XIX

Pulpwood Average Values Per Cord by Kinds, 1947

<table>
<thead>
<tr>
<th>Kind of Pulpwood</th>
<th>Price f.o.b. Mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Pulpwood</td>
<td>$ 17.83</td>
</tr>
<tr>
<td>Spruce and True Fir</td>
<td>25.77</td>
</tr>
<tr>
<td>Hemlock</td>
<td>18.47</td>
</tr>
<tr>
<td>Jack Pine</td>
<td>19.49</td>
</tr>
<tr>
<td>Southern Pine</td>
<td>14.44</td>
</tr>
<tr>
<td>Poplar (Aspen and Popple)</td>
<td>18.75</td>
</tr>
<tr>
<td>Northern Mixed Hardwoods</td>
<td>20.49</td>
</tr>
<tr>
<td>Southern Mixed Hardwoods</td>
<td>14.68</td>
</tr>
<tr>
<td>Other (including slabs and mill waste)</td>
<td>12.02</td>
</tr>
</tbody>
</table>


Part of the rise in the cost of pulpwood is the result of a general rise in the price level. As shown in Table XVIII there was also a tremendous increase in the cost of pulpwood following the first World War. In 1919 the price of pulpwood rose to $15.95 per cord, or 89 per cent of the 1947 price of $17.83 per cord. During the years 1933 to 1939 pulpwood ranged in price from $7.37 to $8.10 per cord which was below the 1909 price of $8.62 per cord.

Will the cost of pulpwood decline in the same manner as it did in the years 1933 to 1939? No one can safely predict what will happen. Future price depends on the general price level, the supply and demand for wood, freight rates, and efficiency of labor and mechanical equipment. Most of these factors which affect the price of pulpwood cannot be controlled by the paper industry itself. Paper mills can and do work in cooperation with government foresters and conservation associations in protecting present
forests and in seeing that a new crop of timber is provided for the future. In this manner, the mills can, to some extent, control the total supply of wood available for all forest products industries, but they cannot control the supply which will be available for their particular paper mill, or for the paper industry as a whole.

The only way in which a particular paper mill can control the demand for any segment of the supply of wood is to purchase or lease the timberland. This is now being done by the larger paper mills in Louisiana and throughout the South. Although land holdings of many southern paper companies are quite large, these holdings provide only a small portion of the vast quantities of pulpwood consumed.

Since the bulk of pulpwood consumed comes from private land holdings, this wood must be purchased in competition with other pulp and paper mills, as well as with hundreds of sawmills and other wood products industries.

**Competition for pulpwood.** In 1936 there were 30 pulp mills in the South and wood fiber production totaled 1.5 million tons. Between the years 1936 and 1947, 21 new plants were added. Also, the older mills greatly expanded

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24 The Springhill mill of the International Paper Company consumes 700,000 cords of wood per year. With an average annual production of one cord per acre per year, it would take 700,000 acres of timberland to supply this one mill alone.

25 One large southern paper company purchases 90 per cent of its wood supply.
their output, and production rose to around 4.75 million tons in 1946. Thus, the southern paper industry increased its output and, presumably its wood requirements by 320 per cent in 10 years. 26

As shown on the map (Figure 7) paper mills are heavily concentrated in certain areas of the South. 27 For instance, there are seven paper mills in Northern Louisiana and Southern Arkansas. In these areas where the mills are concentrated the demand for pulpwood is intense. In some cases there is serious over-cutting with consequent reductIon in timber stock. 28

The competition provided by other forest products industries is of even greater importance. The lumber industry is the most important of the other wood-using industries. Lumber comprises 50 per cent of the drain on the forest resource. Theoretically, pulp and lumber should complement each other, since the pulp mills prefer trees eight to twelve inches in diameter, 29 which is below desirable sawlog size. Since sawlog timber of large diameter has become increasingly scarce, portable sawmills are moving from one locality to the other and are cutting into

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26 Cruikshank, op. cit., p. 57.
27 A list of southern paper mills is given in Appendix A.
28 Cruikshank, op. cit., p. 58.
29 Most mills take pulpwood as small as 4 inches in diameter.
the supply of smaller trees. As the average tree size is reduced, the distinction between saw timber and pulpwood is gradually losing significance. Since the War, the boom market for construction lumber (including low-grade 2 x 4's), is causing some lumbermen to contract for yellow pine timber to a six-inch minimum diameter. This furnishes price competition which is difficult to meet.

Statistics on Pulpwood Consumption

Regional comparison of consumption. In 1948, the United States paper and pulp industry consumed 21,189,000 cords of wood. This was distributed as follows: South, 45 per cent; Northeast and Appalachian Regions, 26 per cent; Pacific Coast, 16 per cent; and Lake States 13 per cent. The consumption of pulpwood in the various regions for the year 1941 through 1948 is shown in Table XX. It will be noted that Southern consumption is not only the largest for each year, but has also steadily increased year by year while consumption in other regions has remained relatively static.

Pulp Mills Drawing Wood from the South, 1949

Source: James W. Cruikshank, 1949 Pulpwood Production in the South (Asheville: Southeastern Forest Experiment Station, October, 1950), ii. ii.
TABLE XX

Consumption of Pulpwood by Regions 1941-1946
(In 1000 standard cords of 120 cubic feet)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total United States</th>
<th>Northeast</th>
<th>Appalachian</th>
<th>South</th>
<th>Lake States</th>
<th>Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941</td>
<td>16,579</td>
<td>3,515</td>
<td>1,420</td>
<td>6,227</td>
<td>2,398</td>
<td>3,019</td>
</tr>
<tr>
<td>1942</td>
<td>17,275</td>
<td>3,530</td>
<td>1,498</td>
<td>6,804</td>
<td>2,471</td>
<td>2,972</td>
</tr>
<tr>
<td>1943</td>
<td>15,645</td>
<td>3,265</td>
<td>1,442</td>
<td>6,342</td>
<td>2,325</td>
<td>2,271</td>
</tr>
<tr>
<td>1944</td>
<td>16,754</td>
<td>3,158</td>
<td>1,489</td>
<td>7,152</td>
<td>2,473</td>
<td>2,482</td>
</tr>
<tr>
<td>1945</td>
<td>16,912</td>
<td>3,245</td>
<td>1,444</td>
<td>7,208</td>
<td>2,544</td>
<td>2,471</td>
</tr>
<tr>
<td>1946</td>
<td>17,318</td>
<td>3,466</td>
<td>1,501</td>
<td>7,516</td>
<td>2,554</td>
<td>2,781</td>
</tr>
<tr>
<td>1947</td>
<td>19,714</td>
<td>3,790</td>
<td>1,684</td>
<td>8,395</td>
<td>2,724</td>
<td>3,171</td>
</tr>
<tr>
<td>1948</td>
<td>21,189</td>
<td>3,815</td>
<td>1,767</td>
<td>9,442</td>
<td>2,822</td>
<td>3,343</td>
</tr>
</tbody>
</table>


Consumption of pulpwood in Louisiana. Statistics for the consumption of pulpwood in Louisiana are not available prior to the year 1922. The consumption starting with 1922 is shown in Table XXI

TABLE XXI

Consumption of Pulpwood in Louisiana 1922-1947
(In cords of 128 cubic feet)

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Per cent increase over previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>74,700</td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>97,574</td>
<td>30</td>
</tr>
<tr>
<td>1924</td>
<td>106,593</td>
<td>9</td>
</tr>
<tr>
<td>1925</td>
<td>170,285</td>
<td>59</td>
</tr>
<tr>
<td>1926</td>
<td>258,439</td>
<td>52</td>
</tr>
<tr>
<td>1927</td>
<td>349,272</td>
<td>35</td>
</tr>
<tr>
<td>1928</td>
<td>413,602</td>
<td>18</td>
</tr>
<tr>
<td>1929</td>
<td>459,553</td>
<td>11</td>
</tr>
<tr>
<td>1930</td>
<td>422,710</td>
<td>-8</td>
</tr>
<tr>
<td>1931</td>
<td>431,425</td>
<td>2</td>
</tr>
<tr>
<td>1932</td>
<td>449,151</td>
<td>4</td>
</tr>
<tr>
<td>1933</td>
<td>584,217</td>
<td>30</td>
</tr>
<tr>
<td>1934</td>
<td>519,884</td>
<td>-11</td>
</tr>
<tr>
<td>1935</td>
<td>663,904</td>
<td>27</td>
</tr>
<tr>
<td>Year</td>
<td>Consumption</td>
<td>Per cent increase over previous year</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1936</td>
<td>723,062</td>
<td>9</td>
</tr>
<tr>
<td>1937</td>
<td>776,778</td>
<td>7</td>
</tr>
<tr>
<td>1938</td>
<td>722,559</td>
<td>-7</td>
</tr>
<tr>
<td>1939</td>
<td>930,071</td>
<td>28</td>
</tr>
<tr>
<td>1940</td>
<td>1,313,343</td>
<td>41</td>
</tr>
<tr>
<td>1941-1946</td>
<td>(Not Available)</td>
<td>45*</td>
</tr>
</tbody>
</table>

*Represents percentage increase from 1940 to 1947.


The years in which the more noticeable increases in consumption of pulpwood took place follow closely the historical development of the Louisiana paper industry as related in Chapter IV. In 1924 (increase of 9 per cent) the Brown Paper Mill Co., Inc., began operations in Monroe; in 1925 (increase of 59 per cent) the Louisiana Mill was started in Bastrop, and the International Paper Company purchased the Bastrop Mill; in 1927, (increase of 35 per cent) International purchased the Louisiana Mill, and the Southern Advance Bag and Paper Company opened its mill at Hodge. The first full year’s operation for International’s Springhill Mill was 1939 and consumption increased 28 per cent.

During the depression (starting with 1930 for paper) consumption declined, but the 1929 consumption of 459,553 cords was even exceeded by 1933 (584,217 cords). During the remaining years of the depression consumption took a turn downward in one year (1934) but the trend was definitely upward. The war in Europe which began in 1939 and the
preparation of the United States for war created a heavy demand for packaging materials and, thus there was a decided increase in consumption of pulpwood in 1940. This upward trend continued throughout the war and lasted into the post war years.

An interesting comparison in consumption of pulpwood can be made between the figures for Maine and Louisiana. Maine's 1922 and 1947 consumption was 1,238,910 and 1,860,525 cords, respectively, an increase of 50 per cent. During the same years, Louisiana's consumption increased from 74,700 cords to 1,907,000 cords (2,452 per cent). No state had a more noticeable increase in consumption.

There are six states with a 1947 pulpwood consumption of over 1,000,000 cords—Washington, 2,755,152; South Carolina, 2,079,439; Louisiana, 1,907,151; Maine, 1,860,525; Wisconsin, 1,604,774; and Florida, 1,326,299. The states which have a consumption of 500,001 to 1,000,000 cords are Alabama, Mississippi, Georgia, North Carolina, West Virginia, New York, Minnesota, and Oregon. Between 250,000 and 500,000 cords are consumed in the states of Texas, Arkansas, Pennsylvania, New Hampshire and Michigan. The states of Tennessee, Indiana, Ohio, Connecticut, and Vermont consume less than 250,000 cords.

31 Ibid., p. 2.
32 Ibid., pp. 1-4.
TABLE XXII

Relation of Growth to Drain of all Timber by Regions in the South, 1944
(Millions of Cords)

<table>
<thead>
<tr>
<th>Region</th>
<th>Softwoods</th>
<th></th>
<th>Hardwoods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Growth</td>
<td>Excess of</td>
<td>Growth</td>
<td>Excess of</td>
</tr>
<tr>
<td></td>
<td>Drain</td>
<td>Growth Over Drain</td>
<td>Drain</td>
<td>Growth Over Drain</td>
</tr>
<tr>
<td>Total South</td>
<td>50.3</td>
<td>-2.6</td>
<td>44.2</td>
<td>1.8</td>
</tr>
<tr>
<td>South Atlantic</td>
<td>14.4</td>
<td>-0.8</td>
<td>11.6</td>
<td>3.4</td>
</tr>
<tr>
<td>South-eastern</td>
<td>21.1</td>
<td>-4.5</td>
<td>19.0</td>
<td>0</td>
</tr>
<tr>
<td>West Gulf</td>
<td>14.8</td>
<td>2.7</td>
<td>13.6</td>
<td>-1.6</td>
</tr>
</tbody>
</table>


Relation of growth to drain. The continued successful operation of the South's huge pulp and paper industry depends upon the availability of sufficient pulpwood which can be obtained at prices which will enable the South to maintain its competitive advantage over other sections of the United States. An interpretation of the figures shown in Table XXII issues a sound warning that the industry must take positive steps to provide an increased supply of pulpwood.

In 1944, the last year for which complete records are available, the total amount of wood cut from southern forests amounted to 52.9 million cords of softwoods and 42.4 million cords of hardwoods. The total drain of 95.3 million
cords was about one million more than growth. It will be noted that while the growth of hardwoods exceeded drain by 1.8 million cords, the drain of softwoods exceeded growth by 2.6 million cords. Only one region, the West Gulf (includes Louisiana, Arkansas, and East Texas) had a favorable relationship of growth to drain of softwoods.

In addition to the unfavorable growth and drain statistics given above, there is increasing competition from other wood products industries. In 1944, the total volume of sawtimber in the South decreased by 5 million cords (2.7 million cords for hardwoods). As supplies of suitable saw timber decline, the portable sawmills intensify their competition for six and eight-inch softwood trees. The trend for the last ten years has been to build up the quantity of small hardwoods and reduce the volume of softwoods. 33

It is, of course, impossible to form an accurate opinion of the status of forest growth and drain from statistics taken from only one year. The 1945 check of timber resources by the United States Forest Service in cooperation with the American Forestry Association and State Forestry agencies also showed that growing stock is decreasing in the South. It is estimated that since the original Forest Survey (varies from 1932 in Mississippi to 1940 in Virginia) the total pine growing stock has decreased in all but three

states. The percentage decrease by states is Florida 19, Mississippi 16, Georgia 9, Louisiana 7, Oklahoma 7, Alabama 2, North Carolina 1, and South Carolina 1. The percentage increase by states is Texas 18, Virginia 6, and Arkansas 2.34

The same 1945 Forest Survey also showed a great increase in growing stocks of hardwoods and cypress. The percentage increase by states is Alabama 15, Mississippi 14, Virginia 14, North Carolina 10, Georgia 10, Louisiana 5, Texas 2. The percentage decrease by states is Oklahoma 19, South Carolina 6, Florida 5, and Arkansas 4.35

The timber situation in the South today can best be stated as a fairly consistent decline in the volume of trees of saw timber size and in pine trees of all merchantable sizes, and a marked rise in the volume of small hardwoods.36

Throughout the United States about nine-tenths of the drain on timber is from cutting. The remainder is the work of fire, insects, and other natural destructive forces. Nearly half of the total timber drain occurs in the South which has only 28 per cent of the timber in the United

34 Ibid., p. 10.
36 Ibid., p. 10.
States, while about one-fourth each occurs in the North and West, with 21 and 51 per cent of the timber, respectively. 37

Pulpwood is a rapidly increasing element in drain. In 1929 this use accounted for 4 per cent; in 1936, 6 per cent; and in 1944, 11 per cent. Pulpwood drain in the South now exceeds that of the North by nearly 40 per cent and that of the West by over 80 per cent. 38

Although pulpwood drain is increasing, such use of timber is small when compared with other uses. The Southern Pulpwood Conservation Association estimates that around 14 per cent of the total drain in the South is from destructive mortality (chiefly, fire, insects, diseases, and wind), while only 10 to 12 per cent of the drain goes for pulpwood. Table XXIII shows the drain by states in the South for 1947. It will be noted that Louisiana used 54 per cent of its cut for lumber and 17 per cent for fuelwood, while only 13 per cent was used for pulpwood.


38 Ibid., p. 30.
**TABLE XXIII**

Commodity Drain on Living Timber
By States in the South, 1947

Per cent of Total by Type of Drain*

<table>
<thead>
<tr>
<th>State</th>
<th>Lumber</th>
<th>Fuel-wood</th>
<th>Pulp wood</th>
<th>Cross ties</th>
<th>Fence posts</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>62</td>
<td>18</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Arkansas</td>
<td>54</td>
<td>17</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Florida</td>
<td>45</td>
<td>12</td>
<td>30</td>
<td>2</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Georgia</td>
<td>50</td>
<td>21</td>
<td>14</td>
<td>4</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Louisiana</td>
<td>54</td>
<td>17</td>
<td>13</td>
<td>5</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Mississippi</td>
<td>49</td>
<td>15</td>
<td>16</td>
<td>4</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Texas</td>
<td>55</td>
<td>17</td>
<td>14</td>
<td>6</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>43</td>
<td>22</td>
<td>7</td>
<td>9</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Tennessee</td>
<td>40</td>
<td>31</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Virginia</td>
<td>54</td>
<td>14</td>
<td>17</td>
<td>1</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>N. Carolina</td>
<td>49</td>
<td>32</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>S. Carolina</td>
<td>46</td>
<td>20</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

*Destructive mortality not included.


**Other Procurement Problems**

Procurement of water. It was stated in Chapter I, page 10, that the paper industry is the largest user of process water of any industry in the country, and that about 2,600,000 gallons are used every 24 hours for 100 tons daily capacity. A large paper mill producing 1,000 tons of paper per day, thus requires 28,000,000 gallons of water. According to Hall Laboratories, Inc., only one other industry requires more water to produce a ton of product. It takes 400 tons of water to produce a ton of paper pulp and 800 tons to produce a ton of rayon.39

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The paper industry constitutes the largest single user of ground water in northern Louisiana.

Water must be evaporated to generate steam with which to run the generators in the power plant, cook the wood in the digesters, and to heat the drying cylinders of the paper machine. The largest quantities, however, are used in washing the liquors from the pulp, in bleaching, and in conveying the pulp from the time it leaves the digestors until it enters the head box of the paper machine.

Well or surface water which contains minerals and impurities must be chemically treated and run through water softeners before it is suitable for use.

The following information in regard to water levels at Springhill, Bastrop, Monroe, and Bogalusa was obtained from the United States Geological Survey.40

At Springhill water levels in wells 150 to about 300 feet deep have fallen as much as 92 feet since 1938, and in wells 300 to about 450 feet deep levels have fallen as much as 130 feet. These are static water levels, and pumping levels are often 60 to 100 feet lower. Original static water levels were generally 30 to 55 feet below the land surface in all wells at Springhill.

At Bastrop, wells 100 to about 115 feet deep have shown no significant decline of water levels because the withdrawals have been limited. Static water levels 75 to 80 feet below land surface do not allow much drawdown in wells 100 feet deep. Wells 600 to about 900 feet deep have shown static water level declines of 90 feet or more, and the trend is continuing downward. Original static water levels, in 1939, were about 75 to 90 feet below the land surface in all wells.

40 Letter from Paul H. Jones (District Geologist, Ground Water Branch, Baton Rouge, Louisiana), dated August 30, 1950.
At Monroe wells 450 feet to about 950 feet deep have shown water-level declines amounting to more than 200 feet during the past 20 years...

...declines of water levels, although excessive, do not indicate depletion of the supply except in the vicinity of Springhill, but even there it is quite possible that new water supplies can be obtained from wells located in the area within a few miles east of the mill. At Springhill and Bastrop surface-water supplies to replace ground water are not readily available, and the cost of development would probably be prohibitive. At Monroe Ouachita River water could be used at a cost of perhaps 2 to 6 times that of the ground-water supply.

At Bagalusa water levels in wells tapping the principal aquifers, between depths of 500 and 750 feet, are now only a few feet below the land surface. No serious declines have been recorded and no supply difficulties are anticipated. Water levels in wells 150 to 170 feet deep are about 25 to 30 feet below the land surface. Pearl River could, of course, be used if the ground-water supply were to fail.

No water-conservation practices are known to be in use at the paper mills. However, threatened or actual water shortage in Springhill, Bastrop, and Monroe probably has resulted in careful water use.

No further analysis of the water supply problems of Louisiana's paper mills will be attempted here. It will suffice to say that the procurement of an adequate supply of ground process water is a major problem and one which could cause serious difficulties at some future time, although such is not probable in the foreseeable future.

Procurement of chemicals. The numerous chemicals used in the manufacture of kraft paper may be classified into three groups. These chemicals used in preparation of the cooking liquor are: sulphur, salt cake, lime,
caustic soda, and soda ash. Chemicals used to add weight, substance, finish, or color to the paper are: rosin, clay, starches, alum, titanium, casein, and dyes. Still another group of chemicals are used for water purification and for bleaching. Among these are chlorine, zeolite, and salt.

The following paragraphs will give a statement on the supply situation for some of the chemicals which are vital to the continued operation of the kraft paper industry. It will be noticed that Louisiana's paper mills are favorably located for the procurement of many chemicals.

Mill purchasing agents buy most chemicals in carload lots and attempt to get a contract which will furnish the mill a supply for at least a year. Sometimes shorter contracts must be negotiated, and when the supply of certain materials becomes critically short, spot purchases must be made.

Sulphur. The kraft process requires only about six pounds of sulphur to make a ton of pulp as compared to the 260 to 280 pounds required for a ton of sulphite pulp. Because of the increased demand for the manufacture of sulphuric acid, and heavy foreign shipments, there is at present a short supply of sulphur. The great bulk of sulphur (brimstone) produced throughout the world comes from the gypsum deposits of Texas and Louisiana with the Freeport Sulphur Company and the Texas Gulf Sulphur Company as the major producers.
Late in 1950 all domestic industrial users of sulphur, including manufacturers of pulp, were notified that in 1951 there would be a cut of 15 to 20 per cent in their supply. The sulphur mining industry had expanded its production but was finding it necessary to make shipments from inventories. These inventories at the mines on December 31, 1939 amounted to 4,000,000 long tons or nearly two-year's supply. On December 31, 1950 inventories had been reduced to 2,388,113 long tons which was equal to less than one-half year's supply at the present rate of consumption. Production in 1950 from sulphur mines was 5,192,184 long tons or two and one-half times that in pre-war years.41

In 1950, 3,000,000 tons of sulphur were required for the manufacture of sulphuric acid.42 The quantity consumed in the United States for other purposes was about 1,150,000 long tons or 27 per cent of the total consumption of brimstone. The largest portion of this amount (435,000 tons) was shipped to manufacturers of wood pulp. Prior to World War II over-seas markets for brimstone were supplied by the


42 The production of sulphuric acid rose from an average of 4,700,000 net tons in 1935--1939 to 12,100,000 tons in 1950. The larger portion of the increased use of acid was for the production of fertilizer. The fertilizer industry used three and one-half times as much acid as it did in 1935--1949.
United States (40 per cent), Italy, Japan, and Norway. Since the war neither Italy nor Japan has resumed its former position in the market.

Prior to the establishment of the American sulphur industry at the turn of the century practically all sulphur used in the United States came from pyrites with Spain as the principal source of supply. Brimstone did not come into wide use until World War I, and its use has increased to the extent that it has now largely displaced pyrites.

Large quantities of pyrite are removed as flotation concentrates during the milling of copper, nickel, and zinc ores. Pyrites may also be obtained from coal washing and in the mining of gold.

The shortage of brimstone, along with allocations, may necessitate the use of more pyrite, and this will result in increased costs of production.

Salt cake. This product which is known as sodium sulphate comes from Indiana and California and the supply is short. In addition to its use in the manufacture of kraft paper, salt cake is used in making rayon and glass. When salt cake is obtained from the evaporation of mineral springs it is called crazy-water crystals. Synthetic salt cake is made by sintering soda ash and sulphur.

Upon receipt at the mill in mine-run (crystal) form each car is tested. It must test 95 per cent or better Na₂SO₄ in order to meet specification.
Lime. Large quantities are used in making the cooking liquor, but the recovery of this chemical is so complete (92 per cent) that only a small amount of new lime must be added in making a fresh batch of liquor. Lime kilns some of which are 150 feet in length with temperatures of 2,200 F are used to convert lime mud to a usable form. Lime occurs abundantly in nature chiefly in combination with carbon dioxide as calcium carbonate in limestone, marble, chalk, coral and shells. In the form of calcium phosphate it occurs in combination with other substances in bones and in some minerals. In addition to its use in mixing the kraft cooking liquor, it is used by other industries in mortars, cements, as a flux in steelmaking, and for many other manufacturing and purifying processes. There is a plentiful supply of lime. Much of the chemical used in this area is obtained from Texas and Missouri.

Sodium hydroxide. Commonly known as caustic soda, this chemical is obtained in liquid form in tank cars shipped from points in Louisiana and Texas. It is made by the causticisation of soda ash or by the electrolysis of salt. When in its solid state for household and industrial use it is known as lye. The present supply of caustic soda is short because of increased demand. It is used for etching aluminum, in quenching baths for heat treating steel, in cutting and soluble oils, and has many other commercial uses.
Soda ash. This is the common name for anhydrous sodium carbonate which is the most important industrial alkali. For household use in hydrous form it is called washing soda, soda crystals or sal soda. It is made from sodium bicarbonate which in turn is made by treating salt brine with ammonia and carbon dioxide. Soda ash is used in many manufacturing and cleansing processes. It is used as a flux in melting iron, in the manufacture of glass, in the refining of oils, in the manufacture of soap, for cleaning and water softening, and has many other applications. Although large quantities of this chemical are manufactured in Louisiana, there is not a plentiful supply because of heavy demand.

Resin. This is used in liquid form for sizing paper. There is a good supply obtainable from shipping points in Louisiana, Mississippi and Georgia. Savannah, Georgia is the principal market.

Clay. This is often known by the name of Kaolin and is used to give body, weight and color to the paper. There is a good supply to be obtained from shipping points in Georgia.

Starches. These are received by the mill in powdered form packaged in bags and are used for sizing. Most commercial starch is made from corn and large supplies are obtained from manufacturing plants in Iowa and Illinois.
**Alum.** This chemical is used for sizing paper. It is manufactured by the Consolidated Chemical Industries at Springhill and Bastrop. The Springhill paper mill receives its supply directly by a pipeline and uses the equivalent of seven or eight cars a week.

**Titanium.** This product is used to give strength and surface to the paper. It is a metallic element occurring in a great variety of minerals. The chief commercial ores containing titanium are rutile and ilmenite. Ilmenite, which is the most common ore, comes chiefly from the sea beaches of northern New York and southwestern India. Although the element is abundant, the market supply is short because of increased demand and failure to increase expensive productive facilities. Titanium is extremely hard and is used in the manufacture of steel and as an alloy to increase tensile strength, toughness, and hardness.

**Casein.** This product, manufactured from skimmed milk, is not used to any great extent in sizing kraft paper.

**Dyes.** These are used in many colors, and at present the supply is plentiful.

**Chemicals used for water treatment and bleaching.** Chlorine, which is essential for both the bleaching process and for water treatment, is made by the electrolysis of common salt. The largest use for this chemical is the bleaching of paper pulp and textiles. It is also utilized in the manufacture of war gases, carbon tetrachloride, phosgene gas, and other products.
Plentiful supplies of salt are obtained from shipping points in Louisiana, and zeolite (greensand), is produced from extensive beds in New Jersey. Both of these substances are used for water softening.
The Woods Division

Organization and duties. The organization of the woods division (or department) varies among the different companies. All companies maintain such a division and the larger companies which operate several mills have a central office to correlate this work for all of their mills. This division is responsible for furnishing the mill with a current supply of pulpwood, and also provides the management and leadership necessary to assure a permanent wood supply.

The woodlands activities of the Southern Kraft Division of the International Paper Company are divided into two principal branches. The wood procurement department is responsible for providing the mills with pulpwood and the timberlands department for the operation of company-owned lands.

Each of the mills in the Southern Kraft Division has a wood procurement manager who is responsible for meeting the mill's current pulpwood requirements and in making sure that a sufficient stockpile is maintained.
Several factors affect the flow of pulpwood from various areas. Weather conditions, labor supply, availability of transportation facilities, and competition for wood from other mills and for other uses may cause purchases to be shifted to another area or stepped up in areas where harvesting is in progress and large quantities are available.

The wood procurement department must coordinate shipments with weather conditions, storage space, production requirements, and available transportation. It also must see that wood obtained is of the proper size and quality. Under-sized wood is not only difficult and wasteful to process, but it causes a serious drain on growing stock. The department seeks to deal with suppliers whose methods of harvesting conform to sound forestry practices.

An important part of the work of the wood procurement department is that of carrying on an educational campaign and promoting conservation, reforestation, and good forestry management. In carrying on this work the procurement department not only has its own conservation engineers, but it works in cooperation with the Southern Pulpwood Conservation Association and Federal and State forestry services. Southern Kraft has one or more conservation engineers in each of the states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.
These conservation foresters in 1948 delivered messages on conservation through exhibits and meetings of various kinds to more than 700,000 people in the South. Also, 1,810 personal contacts were made during the year with landowners, pulpwood producers, woods laborers, other forest industries, and public foresters.¹

Foresters for each of the major companies will give direct service to the landowner when called upon for information on forest management. Of the total landowner contacts by Southern Kraft’s foresters in 1948, 153 visits were made with landowners having a total acreage of more than 550,000 acres of forest land. Timber on 619 forest properties involving nearly 69,500 acres of private land was marked for cutting by company foresters. This marking included more than 140,000 cords of pulpwood.² Similar activities are carried on by the other major companies.

Cooperation with other groups. Company foresters also work with school, civic, and youth groups to promote an interest in good forestry management while showing that trees should be treated as a crop. The Southern Kraft Division has made a special effort to educate the youth by publishing a sixteen-page "funny book" entitled,

¹ A Report to the People of the South for the Year 1948 (Mobile: Southern Kraft Division International Paper Company).

² Ibid.
"How Money Grows on Trees." Some companies show films and conduct forestry 4-H camps for interested boys.

The southern pulp and paper industry is aided in its activities by the Southern Pulpwood Conservation Association (SPCA). This Association, which was created in 1939, is interested solely in conservation and works with wood procurement departments, producers, dealers, and farmers in seeing that wood is grown as a crop and protected against destruction and over-cutting. Twenty-five southern pulp and paper companies with one to nine mills each are members. They are assessed a small fee on each cord of wood delivered to the mill to pay the expenses of running the Association. Many dealers and producers are also members with a fixed fee paid as dues. Any other interested parties may join the Association. The SPCA has a chief forester (Director) at the main office in Atlanta which supervises and directs the work of four areas, each of which is in charge of a forester. In 1950, area meetings open to the public were held in May at Lufkin, Texas; Mobile, Alabama; Savannah, Georgia; and Pinehurst, North Carolina.

The SPCA foresters arrange for forestry demonstrations which are attended by landowners, wood suppliers, and laborers where the latest in improved methods of fire protection, tree planting, and cutting practices are explained. The Association advocates the highest utilization of all trees in order that the timberland owners may derive the
greatest profit from growing trees. Forestry educational programs are conducted in schools, civic clubs, and other interested groups to supplement the efforts of public forestry agencies.

Ownership and Leasing of Land

The pulp and paper industry in 1944 owned about 15 million acres of land throughout the United States. Holdings in the South in 1950 totaled nine million acres, and if the need should arise could probably provide over a third of current needs without overcutting.

All of the major pulp and paper companies in Louisiana (International, Gaylord, Brown, and Southern Advance) have large holdings of land. The Southern Kraft Division of International Paper Company has over 3,000,000 acres in its timberland holdings throughout the South. Around 300,000 acres in 13 parishes in Louisiana are controlled from the company's timberlands department with headquarters in Natchitoches. Other timberland holdings by companies operating in Louisiana are: Gaylord Container Corporation, Gaylord Container Corporation, United States Department of Agriculture, Forest Service, Forests and National Prosperity A Reappraisal of the Forest Situation in the United States (Miscellaneous Publication No. 668; Washington: Government Printing Office, 1948), p. 56.


approximately 350,000 acres in Southeastern Louisiana and Western Mississippi; Southern Advance Bag and Paper Company, approximately 195,000 acres in Louisiana and Arkansas.

The recently constructed Coosa River newsprint mill in Alabama has procured 400,000 acres of standing timber to assure a perpetual supply of pulpwood sufficient to meet an annual requirement of 240,000 cords.

Company-owned timberlands are used to supplement the purchases made through contractors and for experimental work in forest management and cutting. No doubt, management in procuring this land has had in mind the provision of a future supply of pulpwood and the availability of a ready supply which could be used in an emergency. Should management attempt to acquire sufficient pulpwood lands to meet all of its requirements? James W. Cruikshank, Director of the Division of Forest Economics, thinks such a practice would be inadvisable. Mr. Cruikshank states:

... the old warning against all your eggs in one basket has no better application than to logging. The wider your cutting operations are scattered, the less chance there is of having your wood supply cut off by weather, labor troubles, and other temporary hindrances.

**Acquisition of timberland by pulp and paper companies.** Timberland is acquired by the pulp and paper companies both through purchase and lease, depending upon

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6 Cruikshank, *op. cit.*
which method is most feasible in a particular locality at
the time of acquisition. In recent years much land in
Louisiana has been acquired through a 99-year surface
lease, in order that the private landowner may hold his
mineral rights. Since Louisiana follows the servitude
theory on reservation of mineral rights it would be
impossible for a grantor to reserve his mineral rights
for more than 10 years. The 99-year lease overcomes the
objection on mineral rights, yet allows the pulp and
paper company, as lessee, sufficient time for forest
development. Some states use the title theory on mineral
rights under which the grantor may reserve indefinitely
the mineral rights when he sells his land. In these
states companies are more successful in making an outright
purchase of the timberland.

Managing company-owned timberlands. The timberlands
department is responsible for managing the company's
timberlands for maximum economic yields as a crop, acquir­
ing new lands when advisable, and in assisting with the
educational program to bring about better management of
all forest lands in the South. Altogether, the Southern
Kraft Division maintains a corps of 100 foresters.7 Pulp
and paper companies throughout the South employ approxi­
mately 180 technically trained foresters to administer the

7 International Paper Company after Fifty Years,
op. cit., p. 68.
forest work on company-owned lands and to provide free technical advice to non-company timberland owners who furnish the companies with pulpwood.

The work of the timberlands division includes harvesting supervision, fire protection, replanting newly-acquired lands where natural propagation is not feasible, and marketing sawlog and other timber production from company lands. During the 1947-1948 planting season Southern Kraft Division set out 3,612,000 seedlings on company lands. The entire southern pulp and paper industry is now planting on company lands at the rate of 45 million seedlings a year in addition to providing 12 million seedlings free of charge to private landowners.

Most southern companies, including Gaylord, International, and St. Regis, follow a multiple-use, perpetual-yield policy of forest management and marketing of the cut. This policy means that company forests are not managed for the growing of pulpwood only, but to produce a diversity of products including sawlogs, poles, piling, cross ties and stave material. During the ten years, 1938 to 1948, forest production of the Southern Kraft Division of International Paper Company has been divided 58 per cent for lumber and other uses and 42 per cent for pulpwood.

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8 Malsberger, _loc. cit._
Pulp and paper companies practice on their own lands the same forestry management which they recommend to thousands of individual landowners. During 1948 Southern Kraft Division held down its acreage burned to one per cent of company-owned land. The company has 34 heavy and 22 light tractors, 36 trucks, and 17 jeeps available for fire suppression. Gaylord Container Corporation at Bogalusa maintains an airplane for patrol to spot forest fires.

Taxation of forest land. The method used in taxing forest lands is an important factor in determining whether or not land will be reforested, and whether or not present plots will be managed for perpetual production or clear cut and put to other uses. Tree farming is a long range process. After planting, it is 15 or 16 years before the first thinning for pulpwood can be made. High current taxes with such a long time to wait for income can deter investments in forests. Many states have attempted to solve the problem by establishing a nominal annual tax on timberlands and providing for a substantial yield tax to be paid at the time of harvest.

Forest landowners in Louisiana who will obligate themselves "to grow suitable and useful timber trees under the supervision of, and according to the rules set forth in said contract by the Louisiana Forestry Commission" may contract

11 A Report to the People of the South for the Year 1948, loc. cit.
for a special valuation for tax purposes for a period not to exceed 40 years. The land is inspected by the State Forester and the Police Jury of the parish who may fix the cash value of the lands at a figure which varies from that appearing upon the current assessment rolls. "No contract shall be entered into with any landowner with a fixed cash value of less than three ($3.00) dollars per acre of the land included in said contract."\(^\text{12}\) It is also provided that no contract can be entered into where the average cash value of lands per acre included in the application is in excess of $8.00 per acre.

Prior to 1946 a severance tax of six per cent of the value, in lieu of all other taxes, was levied on forest products.\(^\text{13}\) Three-fourths of the severance tax collected from lands under contract was returned to the parish. The 1946 Legislature passed a complete new severance tax law which set the tax at 15 cents per standard cord on pulpwood, and 50 cents per thousand feet log scale for pine timber.

In 1945 there were 85 reforestation contracts on more than 700,000 acres in 16 parishes. Of these, 35 were for tracts of forest land of less than 500 acres which shows

\(^{12}\) Section 11, Act 90 of 1922, as amended by Section 1, Act 71 of 1924, and Section 1, Act 362 of 1946; Dart's Statutes, 330.

\(^{13}\) Section 1, Act 120 of 1926; Dart's Statutes, 3340.
that small owners, as well as large, were taking advantage of the opportunities provided in these contracts.\textsuperscript{14}

**Federal income tax on sale of timber.** The Internal Revenue Code, Section 117(K) provides that the profit on the sale of timber may be reported as a capital gain. Where the land has been owned by the taxpayer more than six months the provisions for long-term capital gains and losses apply, and only 50 per cent of the net income from this source is taxable.

By amendment (1943) the treatment of profit on sale of timber as a capital gain has been applicable even though the taxpayer cuts his own stumpage or sells it on a "pay-as-cut" basis. Prior to the 1943 amendment only an outright sale of stumpage was treated as a capital gain.

**Distribution of forest land ownership.** The problem of timber depletion and of future supply of pulpwood are dependent to a great extent on the ownership and control of the timberland. In the long run, the interest of the landowners in tree growing will determine to a great extent how difficult it will be to meet the timber requirements of all southern wood products industries.

Table XXIV shows the distribution of forest land ownership through the various regions of the United States. It will be noted that the South not only has the largest

\textsuperscript{14} *Forest Resources of Louisiana* (Baton Rouge: Louisiana Forestry Commission in Cooperation with American Forestry Association, 1947), p. 11.
acreage, but also has a much greater portion of its acreage in the hands of farm and other private owners.

TABLE XXIV

Forest Land Ownership in the United States, 1946
(millions of acres)

<table>
<thead>
<tr>
<th></th>
<th>South</th>
<th>North</th>
<th>West</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm</td>
<td>69</td>
<td>61</td>
<td>9</td>
<td>139</td>
</tr>
<tr>
<td>Other private</td>
<td>98</td>
<td>79</td>
<td>29</td>
<td>206</td>
</tr>
<tr>
<td>All private</td>
<td>167</td>
<td>140</td>
<td>38</td>
<td>345</td>
</tr>
<tr>
<td>National Forest</td>
<td>10</td>
<td>9</td>
<td>54</td>
<td>73</td>
</tr>
<tr>
<td>Other Federal</td>
<td>4</td>
<td>2</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>State and local</td>
<td>2</td>
<td>19</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>All public</td>
<td>16</td>
<td>30</td>
<td>69</td>
<td>116</td>
</tr>
<tr>
<td>All owners</td>
<td>183</td>
<td>170</td>
<td>107</td>
<td>461</td>
</tr>
</tbody>
</table>


According to these figures 90 per cent of southern forest acreage is privately owned.

The nine million acres of timberland holdings of the southern pulp and paper industry account for slightly more than five per cent of the privately-owned forest land of the South. The remaining 95 per cent is owned by farmers, turpentine operators, lumber companies, and a diverse group of other owners.
According to a recent study made by the Federal Reserve Bank of Atlanta on forest ownership in the Sixth Federal Reserve District (Alabama, Florida, Georgia, Louisiana, Mississippi, and Tennessee) only about a third of privately-owned commercial forest acreage is in farms.

From a profit standpoint the relative attractiveness that tree growing has for a farmer may depend upon the amount of land he has available for that purpose. The distribution of farms by size in the Sixth Federal Reserve District is shown in Table XXV. It will be noted that 85 per cent of the farms are less than 140 acres in size and that this group contains only 28 per cent of the farm woodlands. These farms average about 11 acres of woodland each, which in many cases do not furnish all the forest products needed for home use. The operators of small farms must generally concentrate on growing crops that have high labor requirements per acre such as cotton. Although the intensive crops may yield low returns per hour, they will yield the highest total income since they furnish many more hours of employment.

It will be noted in Table XXV that farms of 140 acres and larger contain 72 per cent of the total farm woodlands. These larger farms represent a good source of supply for forest products industries and much effort is being given

by conservation engineers to help them in the management of their farm woodlots.

### TABLE XXV

Farm Woodland in the Sixth Federal Reserve District
by Size of Farm 1948

<table>
<thead>
<tr>
<th>Farm-Size Group (acres)</th>
<th>Per cent of All farms</th>
<th>Total Woodland (000 acres)</th>
<th>Average Woodland Acreage per Farm</th>
<th>Per cent of Farm Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>9.6</td>
<td>28</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>10-69</td>
<td>56.8</td>
<td>3,452</td>
<td>5.3</td>
<td>8.9</td>
</tr>
<tr>
<td>70-139</td>
<td>19.8</td>
<td>7,467</td>
<td>33.2</td>
<td>19.2</td>
</tr>
<tr>
<td>140-259</td>
<td>8.8</td>
<td>7,981</td>
<td>79.5</td>
<td>20.5</td>
</tr>
<tr>
<td>260-499</td>
<td>3.1</td>
<td>5,816</td>
<td>162.5</td>
<td>14.9</td>
</tr>
<tr>
<td>500-999</td>
<td>1.2</td>
<td>4,334</td>
<td>321.9</td>
<td>11.1</td>
</tr>
<tr>
<td>1,000-4,999</td>
<td>.6</td>
<td>5,655</td>
<td>855.3</td>
<td>14.5</td>
</tr>
<tr>
<td>5,000 and more</td>
<td>.1</td>
<td>4,247</td>
<td>7,032.2</td>
<td>10.9</td>
</tr>
<tr>
<td>All Groups</td>
<td>100.0</td>
<td>38,980</td>
<td>34.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>


Most of the non-farm forest acreage (around 60 per cent of privately owned forest acreage) belongs to persons who own less than 5,000 acres each. Often these owners are residents of towns near their forest property and may be merchants, doctors, attorneys, or other persons who are holding the land as an investment. To these people the growing of trees yields returns only in the form of rent. They do not get the labor returns that an owner-operator often receives from his woods operations, nor can they combine timber growing with a processing operation as pulpmill and sawmill companies do.
Other owners of large timberland holdings include railroad companies, banks, real-estate speculators, undivided family estates, and insurance companies. Many of these do not regard the growing of timber as a profitable business since profit from forestry depends upon long-run operation, and it is often the owner's desire to sell his property. Owners of this acreage vary in their degree of control over the farm operations and in their incentives to practice forestry. About 30 per cent of this farm woodland acreage is in rented farms owned by farmers, retired farmers, farmer's widows, businessmen, professional men, and others. The other 70 per cent is owned by farmers who operate their own farms. The growing of trees is more attractive to the latter group because they can often increase their labor income by working in their own woodlots.

**Conservation and Reforestation**

**Definitions.** Conservation refers to the wise use and care of our forest resources. Good management of forest resources is conservation. This means proper cutting, protection from fire, insects, and disease, and the planting of new trees to the extent that perpetuation of the forest is assured. Reforestation, which refers to the planting of new trees, is a part of the conservation program. Forests are the one renewable natural resource.
Scope of this study. The techniques of forest management are beyond the scope of this paper. Such a study belongs in the field of forestry, and many good books have been written on forest management. This section will be given to a discussion of the unwise use of forest land in the past and to what has been done and is being done at present by government and industry to assure that Louisiana's paper industry will have a perpetual supply of wood. Such a discussion is within the realm of this study because the procedures followed are of vital importance to the pulp and paper industry.

Early history of forest usage. Frank Sweeney in his recent book *The Changing Forest Situation,* gives three phases in the history of our forest usage as follows:

1. The removal of virgin forests for settlement and the conversion of forest lands to agricultural use.

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16 Among the books in the field of forest economics, management, and finance are:


2. The use of virgin forests to furnish the timber for the expanding industrial economy during the 18th and 19th centuries.

3. The transition stage of our forest situation of today—from the old to a new forest economy in which the growing of trees can profitably furnish the forest products formerly obtained only by liquidating the old forests. In this period, while on one hand the virgin forests are waning, on the other hand new forests are coming into production.

Obviously, much of our virgin timber had to be cut, not only to provide lumber, but also to provide space. In the early history of the settlement of the United States when timber was cut to provide lumber for our expanding economy, and later to provide wood to feed the pulp and paper mills, little thought was given to conservation by either industry or government. Paper mills trailed from New England westward after the lumbermen, and new mills were erected as far west as Minnesota. When the lake forests were ravaged, lumbermen moved toward the South and the Pacific. Paper manufacturers did not immediately follow the lumbermen into the South because they had not yet learned how to satisfactorily pulp southern woods.

There was no government control or even an interest in conservation, and much of the land was clear-cut without any thought for the future. Following the Civil War, timber was one of the most easily available resources, and one that required the least capital and equipment for development. Large areas of southern timberland belonged to Federal and State governments, and liberal homestead
laws lead to abuses. Often a man cleared no more than one acre which he planted with crops or fruit trees. He lived on this land only a small portion of the required four years and still received title to his 160 acre tract. The land was then sold to timber speculators and sawmill operators. Many of these sawmills were run by "cut-out-and-get-out" operators. They helped to build the United States by cutting the fully matured virgin timber, but they did not think of leaving seed trees or providing for reforestation.

In the early history of the North American continent there are historical accounts of many great forest fires. There is so much charcoal in the soil that it is quite probable that much of the forest land was burned over at one time or another. Indians fired the forests for hunting. In 1731 North Carolina had a law which required the burning of the native grasses every March 10 to render the new grass succulent and fresh for cattle.

Some southern pioneers of the conservation movement.

A few of the early timber operators did think of the future and reforested the land. Some are still in business today with as much timber reserve on their lands as they had when they started operations. One of the early pioneers in southern reforestation was the Urania Lumber Company of Urania, Louisiana. In 1901 the management of this company began buying cut-over lands in the vicinity of the mill at a price of around $1.00 to $1.50 per acre.
This was reforested and later yielded as high as 5,000 board feet to the acre through a system of selective cutting. The late Henry Hardtner, one of the founders of the company, became known as the "father of modern forest conservation" in Louisiana and in the South. As early as 1908 he began to advocate reforestation of cut-over lands as the only possible solution to a continuation of the lumber business in Louisiana. Many who are proponents of reforestation today scoffed at Mr. Hardtner's campaign for reseeding the woods.

In 1912 the Urania Lumber Company signed a contract with the State of Louisiana by which 35,000 acres would be protected for 40 years from forest fires. This was the first organized effort for reforestation and fire protection in Louisiana.

The reforestation and conservation program of the Bogalusa Paper Company did not begin until some years later. By 1920 the large sawmill at Bogalusa which had once cut a million board feet of lumber per day was running out of timber. Enough wood of small size remained to keep the paper mill running for a few more years, but it was definitely too late to save the sawmill operation. The company started replanting on a small area, and by 1923 an area of 1,800 acres was seeded. Soon after, around 55,000 more acres were set aside for reforestation. The program started by the Bogalusa Paper Company was continued by its successor the Gaylord Container Corporation, and
today the officials of that company are among the leaders in the state-wide effort toward conservation and reforestation.

The role of the Federal and state governments in conservation. Today the Federal government, state governments, and industry, are all engaged in a program designed to see that the forests of the United States are used wisely, and to reforest new and cut-over lands. Since fire is the greatest enemy of the forest, a great deal of their attention is devoted to education in fire prevention and in establishing and maintaining the forces necessary to fight the fires when they occur.

The Federal government first began to cooperate with the states in fire prevention under the Weeks Law of 1911. Under this law the Federal government could share expenses on a fifty-fifty basis with states seeking to protect forested areas in water sheds of navigable streams. Louisiana first received this aid in 1918. The South's real effort for cooperative fire prevention began in 1924 with the passage of the Clarke-McNary Act in which Federal help was extended to states for fire prevention in all forest lands. This law authorized Congress to appropriate as much as $2,500,000 for cooperative fire protection, but this entire sum was not appropriated until 1943. In 1946 the sum appropriated was raised to $9,000,000, and in 1949 the amount was increased to a maximum of $20,000,000.
This is the sum which the Association of State Foresters and the United States Forest Service considers to be adequate for one-half the current cost of a nation-wide fire protection program.

The Clarke-McNary Act provides for the Federal government to bear up to 50 per cent of the cost of a state forestry organization. By 1926 all of the Southern states were sharing Clarke-McNary funds except Arkansas and Florida. Florida joined in 1928 and Arkansas in 1933. Prior to that time, there was no state forestry organization in these states, and private industry carried the burden.18

Until 1944 the administration of state forestry in Louisiana was under the direction of the State Department of Conservation. In that year, by amendment to Section 1, Article VI of the Constitution of Louisiana, a new executive agency, the Louisiana Forestry Commission was created. The Commission is composed of seven members, two of whom are required by law to be the heads of the Louisiana State University Forestry School and of the State Department of Wild Life and Fisheries. The Governor appoints the other five members, of which two must be appointed from the timber industry (one each from the pulpwood and lumber industries). The members serve without pay. It is the

18 Frank Heyward, Jr., "History of Forest Fires in the South," The Forest Farmer, IX (June, 1950), p. 3.
duty of the Commission to appoint the State Forester, determine the forest policies and program of the State, and approve budgets and financial expenditures.

Prior to 1944 all organised forest protection on privately owned forest land was carried on through individual cooperative agreements made directly between the landowner and the Louisiana Forestry Commission. The cooperating landowner paid two cents per acre for the land which was contracted for protection. To this the Commission added two cents under the Clarke-McNary Act.

This type of program was better than nothing, but it was not at all satisfactory and was difficult to manage. The public did not understand the system of protection and did not know which was protected acreage and which was not. When an area was mapped off as a protected area, all the land in that area received protection. This caused trouble in that some farmers were receiving protection even though their neighbors paid the bill. Table XXVI shows the relation between total cooperative acres and total protected acres. The task of handling so many individual assessments was burdensome and ownership maps had to be maintained to keep an accurate picture of lands which were to be protected.

In 1944 the Legislature passed Act 179 to provide for forest fire protection on a parish wide basis. Under this plan all forest acreage or potential forest acreage in the
parish is afforded protection. The Act permits each Parish Police Jury to pass a resolution to appropriate from the General Fund or levy a tax of two cents per acre on all forest lands and cut-over potential forest lands situated in the parish. This tax includes all lands in the parish not classified as lands subdivided for town sites and not classified as land used primarily for agriculture or lands fenced and used for pasture purposes. 19

### TABLE XXVI

**Cooperative Acres and Protected Acres in Louisiana 1942-1945**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cooperative Acres</th>
<th>Total Protected Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1942</td>
<td>2,249,219</td>
<td>5,731,400</td>
</tr>
<tr>
<td>1943</td>
<td>2,264,294</td>
<td>5,926,400</td>
</tr>
<tr>
<td>1944</td>
<td>2,265,993</td>
<td>5,926,400</td>
</tr>
<tr>
<td>1945</td>
<td>3,619,984</td>
<td>6,450,000</td>
</tr>
</tbody>
</table>

*Note: The large increase in 1945 was brought about through the acceptance by nine parishes of the Forest Acreage tax. Also there was increased participation of individual landowners.*


**Act 179** also provided for the usual homestead exemption as provided in the Constitution of Louisiana. The monies from these exemptions are reimbursed to the Louisiana Forestry Commission by the State Treasurer.

19 Section 1, Act 179 of 1944, *Dart's Statutes* 3344.1.
After passage of the acreage tax, the Parish Police Jury appoints a Parish Board of Forestry to assist the Commission in carrying on its forestry program. When the State and Federal governments have added their funds to forest fire protection, there is a total of six cents per acre available for providing equipment and carrying on the work.

The increase in the funds available for forest activities of the Louisiana Forestry Commission can be seen in Table XXVII. It will be noted that the total amount of funds available has more than doubled in the last four years.

**TABLE XXVII**

<table>
<thead>
<tr>
<th>Source and Amount of Funds for Louisiana Forestry Commission 1945-1949</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Appropriation</td>
</tr>
<tr>
<td>Special Appropriation</td>
</tr>
<tr>
<td>Board of Liquidation</td>
</tr>
<tr>
<td>Federal Allotment</td>
</tr>
<tr>
<td>Private Cooperators</td>
</tr>
<tr>
<td>Parish-Wide Acreage Tax</td>
</tr>
<tr>
<td>Total Funds</td>
</tr>
</tbody>
</table>

These funds are used for personnel, travel, contractual services, supplies and materials, capital outlay, retirement, and other expenditures. The increase in funds available has enabled the Commission to spend a greater portion of its receipts for capital outlay and supplies and materials. In 1946-1949, $280,405 was used for capital outlay and $140,974 for supplies and materials. This was more than double the amount spent for the same in 1947-1948.20

Commission headquarters are located in Hammond, Oberlin, Olla, Minden, West Monroe, and Natchitoches. These offices direct fire control operations, serve as supply bases and as liaison between Central Control in Baton Rouge and parish organizations.

The activities of the Commission are directed toward meeting the following problems:

1. Adequate fire protection for all timber areas.
2. Timber services and advice for forest landowners.
3. Protection of tree seedlings to replant idle forest lands.
4. Education to assure full acceptance of this program by the public.
5. Research to devise new and better methods for growing timber.

Present status of forest fire protection. The greatest enemy of the forest is fire, and about 99.8 per cent of these are caused by man and could thus be avoided. Of the


7,725 forest fires which destroyed parts of Louisiana's great forests during the years 1948 and 1949, all except 13 of them could have been avoided. These few fires were credited to lightning.

Table XXVIII shows the number of fires by causes and the number of acres burned in the years 1948 and 1949. It will be noted that the greatest number of fires, as well as the greatest number of acres burned, was attributed to willful destruction by arson.

Acreage destroyed by fires of incendiary origin in recent years is as follows: 1946, 76 per cent; 1947, 77 per cent; 1948, 75 per cent; and 1949, 67 per cent. The heaviest loss occurred in 1948 when a total of 140,446 acres were burned. Nine fires caused by lightning in that year destroyed 71 acres. Practically all the remaining loss was caused by man—railroads, campers, debris burning, incendiary, lumbering, and smokers.

Even before a forest fire is completely out, investigators go to work to determine the cause, and many arsonists have been caught and convicted. When apprehended, these culprits give many reasons for burning the woods. These range all the way from maliciousness to the psychological joy which some mentally unbalanced individuals receive from watching the flames. Many farmers burn grass because they believe it helps the land for grazing purposes. These fires often get out of control and burn thousands of acres before they are curbed.
TABLE XXVIII
Louisiana Forest Fires by Causes
1948 and 1949

<table>
<thead>
<tr>
<th>Causes</th>
<th>1948 No. Fires</th>
<th>1948 Acres Burned</th>
<th>1949 No. Fires</th>
<th>1949 Acres Burned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightning</td>
<td>9</td>
<td>71</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Railroads</td>
<td>65</td>
<td>1,461</td>
<td>25</td>
<td>356</td>
</tr>
<tr>
<td>Campers</td>
<td>66</td>
<td>1,144</td>
<td>43</td>
<td>377</td>
</tr>
<tr>
<td>Debris Burning</td>
<td>591</td>
<td>11,236</td>
<td>510</td>
<td>7,193</td>
</tr>
<tr>
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<tr>
<td><strong>Totals</strong></td>
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<td><strong>2,751</strong></td>
<td><strong>67,377</strong></td>
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</table>


The Louisiana Forestry Commission is carrying its campaign into the school and to the public by every means available. Also, more severe penalties have been given to those who maliciously burn the woods, and to those who let fire spread to another man's property. It may take years or even generations to make the public realize the seriousness of forest fires. The Commission, however, has been able to reduce the percentage of acreage burned through the use of better equipment and by building a more efficient organization for detecting and fighting forest fires.

Most forest fires occur during the six-month period from November to May, with the greatest number occurring in January, February, and March. During these months added
precautions are taken to detect and fight fires, so that once a fire gets started, the loss can be reduced to a minimum. Without adequate control each fire has a potential of destroying thousands of acres. Forest fires have been known to destroy several million acres of land, destroy towns, and to result in loss of life. On November 30, 1950, forty-nine forest fires were burning simultaneously in different parts of Louisiana. During the first week in March, 1951, 157 forest fires were burning in Louisiana at the same time.

In the South, about one out of every nine acres of forest land burns every year. With a third of the nation's total forest acreage, the South is the scene of approximately 90 per cent of the burned over timberland. Forest fires in the South burn more timber than is used by the entire southern pulp and paper industry.

The status of forest fire protection throughout the entire South is not good. Roughly 50 per cent of the acreage burned annually on the 657,000,000 acres of forest land in the United States is burned on the 85,000,000 acres of land in the South. The low stocking and low per acre yields may be attributed to repeated fires which have prevented full and uniform regeneration. Only about

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23 Heyward, *op. cit.*, p. 3.
114,000,000 acres receive any fire protection and much of this is inadequate. This leaves over 71,000,000 acres of southern forest land without fire protection of any nature. The best data available show that only 1.23 per cent of the protected lands burn over annually, while 18.35 per cent of the unprotected lands burn each year.24

Present status of reforestation. Both industry and government have realized that protection of our present forests is not enough to assure a perpetual supply of timber. New trees must be planted. Many nurseries have been established in the South to produce seedlings for reforesting cut-over and other potential forest acreage. Appendix D shows the distribution which has been made in the South by the State and Federal governments during the last six years. In addition to distribution from government nurseries, many pulp and paper companies have made their own distribution. According to a survey made by J. C. McClellan (American Forest Products Industries, Inc.), Louisiana in 1949 produced 53,500,000 tree seedlings to rank as the top seedling producer in the United States. Federal, State, and private industry nurseries located in Louisiana produced 14 per cent of the total United

State's output of 380 million seedlings. Thirty-three million of Louisiana's seedlings were produced by state-owned nurseries and the balance by private industry and the Federal government. Other states produced seedlings in 1949 as follows: South Carolina, 32 million; Georgia, 27 million; Florida, 25 million; and Alabama, Tennessee, Wisconsin, and Michigan each produced 21 million. The total United State's output for the year 1949 was sufficient to reforest well over a third of a million acres of timberland. 25

The State of Louisiana owns two forest nurseries which are located at Oberlin and Sibley. These two nurseries alone produced over 30 million seedlings in 1950. In the latter part of 1949, the Louisiana Forestry Commission leased the large Stuart Nursery near Pollock which is owned by the United States Forest Service. The Southern Advance Bag and Paper Company and the Gaylord Container Corporation maintain their own nurseries. The other large paper companies of the State purchase trees both for planting on their own lands and for distribution to landowners.

During the 1947-1948 planting season, the Southern Kraft Division of International Paper Company purchased from nurseries and distributed free of charge 1,500,000

pine seedlings to landowners in the South. Many of these seedlings were given to 4-H Club boys and members of the Future Farmers Organization. Plans for 1948-1949 called for free distribution of 2,660,000 seedlings. During the period 1941 to 1945, southern pulp and paper companies donated 19 million seedlings to about 6,000 landowners.

The pulpwood industry in the South was responsible for having planted 56 million pine trees in 1948, of which 11½ million were contributed to small landowners. The remaining 44½ million trees were planted on lands owned by the industry. It is estimated that these seedlings which are sufficient for 60,000 acres of land, accomplished a 62 per cent replacement of the number of trees utilized the same year by the pulp and paper industry.

In nurseries, choice pine cones are dried on racks, then placed in a wire mesh tumbler which shakes out the tiny seeds. Each cone yields from 150 to 250 seeds which are planted under ideal conditions. The seedlings are carefully

26 A Report to People of the South for the Year 1948, op. cit. (Mobile: Southern Kraft Division of International Paper Company).

27 H. J. Malsberger, "Growing Trees as a Profitable Crop" (Chemurgic Papers, 1946 Series No. 5).

cultivated, and when about one year old, are distributed to industrial and private owners for transplanting. The seedlings must be planted during the cold winter. There are around 100 suitable days starting the middle of November.

Seedlings are distributed at a price below cost of production. The price as set by an Act of the 1948 Legislature to certified farmers is 50 cents per thousand for the first 5,000. All in excess of this amount are sold at $2.50 per thousand which is still less than cost.

Seedlings can be hand-planted by a two-man crew at the rate of about one acre or 1,000 trees per day. The same size crew using a tractor and mechanical planter can set out about 10 acres or 10,000 trees per day. James E. Mixon, State Forester for Louisiana, estimates that there are about 70 tree planters in the State with more being added. About one-fourth of these are owned by the Soil Conservation Service. Other agencies which provide small landowners with tree planters include banks at Leesville and DeRidder, the Illinois Central Railroad, and the International Paper Company.

There is much land in Louisiana which is not being used for any useful purpose at the present time. Some is being held in an unproductive state while the owners wait for oil developments. After a recent survey, the Soil Conservation Service revealed that about one-half of the approximately three million acres in the three soil conservation districts in North Louisiana, should never be
considered for cultivation because of the type of soil, slope, erosion, poor drainage, or other factors. These areas should be planted in permanent vegetation such as trees. Nothing has proved better than trees, especially pine, in controlling erosion of the rough, broken, severely eroded or poor soils of this area.

R. R. Reynolds of the Southern Forest Experiment Station points out that he has seen some open areas within shouting distance of some southern paper and sawmills at the same time wood is being hauled from 200 to 300 miles with a freight charge of $3 to $5 per cord.29

*Keep Louisiana Green movement.* The Keep Louisiana Green movement has been an important factor in educating the public on its responsibility to prevent fires, and to acquaint the farmers with selective cutting and reforestation. The Keep Green movement to arouse local interest in fire prevention was started in the State of Washington in 1941 and has spread to other states. The campaign in Louisiana is sponsored by the Louisiana Forestry Association with headquarters in Alexandria. The inaugural meeting which was attended by over 2,000 persons was held at Louisiana State University in January, 1949. Keep Louisiana Green Committees have been organized in several districts and meetings and demonstrations of fire fighting

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are held. Usually there is a barbecue followed by a speech by some well known forester and then demonstrations of fire fighting. Literature published by the American Forest Products Industries, Inc., is distributed. Local Committees keep in contact with the press and radio to encourage the dissemination of fire-prevention information, distribute literature, and arrange programs encouraging fire prevention locally.

Contracting for Pulpwood

In 1948 the southern pulp and paper industry consumed 9,500,000 cords of pulpwood. This wood was procured through one of three systems:

(1) Dealer-producer
(2) Mill representative-producer
(3) Company logging operations

The dealer-producer system. The most widely used method in Louisiana and throughout the South is the dealer-producer system. The dealer contracts with the mill (wood procurement department) to ship an agreed volume of wood from his specified and protected territory which may vary from one to several parishes or counties depending upon conditions. The dealer is responsible for organizing wood production in his territory and makes contacts with the various producers who cut and haul wood. Often the dealer's services include financial aid to producers in purchasing stumpage and logging equipment.

Some dealers have their own trucks and cutting and loading equipment, and also carry on to some extent, the
work of the producers. Most dealers, however, simply arrange for producers to do the field work.

It was estimated by the late James H. Allen, after making a survey of two-thirds of the productive capacity of the South, that there are 1,327 wood dealers and 61,500 independent wood producers in the South.³⁰

Paper mills purchase wood within a radius of one to 300 miles from the plant. Companies, such as International Paper Company, which operate more than one mill have a specified procurement area for each mill blocked off on the map. Such divisions of territory, however, are not used for competing companies. One company is likely to buy close to the door step of a mill operated by a competitor. That is the way the competitive system operates. It would save freight costs and be more economical from the paper company’s point of view to divide the land into areas so that each mill would purchase close to his own territory. That, however, would lead to collusion and price fixing in purchase of pulpwood, and paper companies do not want to get involved in anti-trust suits.

All mills in a locality pay about the same price for wood delivered to cars at the railroad siding, but they avoid any price-fixing agreements. Nevertheless, the f.o.b.

³⁰James H. Allen (Formerly Vice Chairman St. Regis Paper Company) "The Part The Pulp and Paper Industry has Played in Southern Forest Development" (Speech given before Southern Forestry Conference, Montgomery, Alabama, February 16, 1949).
price will not vary more than 25 cents per cord for mills in the same area.

There is a great deal of competition between the dealers buying for several mills in the same territory. These dealers, however, know how much the mill will pay for pulpwood f.o.b. shipping point, and the dealer is not likely to pay the producer a price so high that the dealer will not make his usual margin.

**Unit of measure in procuring pulpwood.** The unit of measure used in procuring wood is the standard cord (128 cubic feet). This is an orderly pile of wood 8 feet long by 4 feet wide by 4 feet high with the long dimensions of the legs parallel. The cord is an inaccurate measure, but it is so well established that it is difficult to change. Some southern mills specify 5 feet logs while others call for logs 5 feet 3 inches long. Southern pulpwood is usually cut 5 feet in length.

Most mills would prefer to buy their pulpwood by the ton (2,000 pounds) since this is the unit used for pulp, paper, chemicals, etc. Most wood weighs about 5,000 pounds per cord depending upon the kind and the water content. It is difficult to change to the ton measurement because dealers and producers have their business worked out on the basis of the standard cord. Dealers fear they would lose if they bought on a cord basis and sold to the mill on a
tonnage basis. Only one southern mill is buying by weight at the present time.

Paper mills know exactly how many cords of wood are necessary to produce a ton of paper. In 1947, 1.7 tons of pulpwood were necessary to produce a ton of sulphate pulp. On the basis of budget estimates and orders for production, manufacturers can accurately estimate the amount of wood needed for current processing and to maintain an adequate stockpile.

Order specifications to dealers. The wood procurement department provides weekly orders for a given quantity of wood to dealers in each territory. The department is guided by many variable factors in determining which dealers will get the heaviest orders, i.e., supply and demand in various areas, and total freight charges to the mill. Once a dealer has received the order it is his problem to get the wood. If his shipments exceed the order his quota may be reduced the next week.

Dealers send orders to various producers for a given number of cars loaded on railroad sidings with directions to make the bill of lading read: consigned to (Dealer) care of (Paper Mill Company). Each mill has its own


32 The dealer purchases the wood from the producer as it is loaded on car.
specifications for pulpwood and the dealer provides the producer a list of these specifications with each order.

One company lists the following specifications:

- All wood must be cut from sound, live, growing timber. All knots and limbs must be cut flush with body of stock and each length sawn.
- 4 to 10 inches must be round.
- 10 to 14 inches, inclusive, must be split in half.
- 14 inches and larger must be quartered.
- No wood will be accepted under 4 inches in diameter. All wood must be 5 feet 3 inches long, to be green, sound pine only.
- Knots and branches to be trimmed closely.
- Axe-cut wood not accepted.
- No wood accepted where fire has burned through it after being cut.
- Wood delivered under this order must be delivered within 60 days after being cut.

The cars are inspected upon their arrival at the mill, and in paying the dealer, deductions are made for any wood which does not meet specifications, and for any cars which do not meet the minimum requirements for the carload rate. The mill pays the entire freight charges upon arrival at the mill.

**Appraisal and purchase of timber by the producer.**

Pulpwood is, in many cases, produced by small operators who load one to five cars a week. These producers enter into contracts with timberland owners for purchases on one of the following bases:

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33 The average flat car holds around 15 cords, while boxcars hold less.

(1) By "lump sale" without measurement.
(2) By measurement of the standing trees.
(3) By measurement of the wood after trees are cut into piling, sawlogs, pulpwood, firewood or other products ready for market.

Timber should never be sold by the first method (without measurement). Reasonably accurate methods of estimating stumpage on marked trees are available. The Louisiana Forestry Commission points out several advantages to selling sawtimber on a stumpage basis, among which are:

1. More of the tree is likely to be used when the whole tree is sold;
2. The timber owner does not need to stay on the job as closely nor does he have to scale the logs;
3. The owner can collect the entire value at the time of sale, if the contract calls for payment in advance.

The appraisal of timber values involves a consideration of the kind of timber; volume in a given logging area; accessibility and nature of terrain; size and quality of timber; logging costs; distance to market; availability of present market; and mill price. An experienced timber buyer can give each factor its proper weight and set a price which will allow him a margin of profit. The landowner, however, is at a disadvantage in knowing whether or not he is getting a fair price. Of course several bidders can be called upon to state a price, and the owner can

35 For tables on the gross volume of trees by the Scribner and the Pope log rules and table for tabulating cords, see The Forest Farmer, IX (February, 1950), pp. 18, 19.
make comparisons with the price received for other tracts of timber. Since buyers often try to offset possible losses on tracts of marginal value by buying the better stands at prices below their actual value, an owner's evaluation by comparing tracts is not reliable.

The timber sale agreement should always be placed in writing. Standing timber is classed as an immovable and the law requires that such contracts be proved by written evidence. A sample pulpwood contract is shown in Appendix C. This is merely an example which may be modified in any manner the parties deem necessary.

Some problems of the dealer-producer system. The Forest Service of the United States Department of Agriculture is not too much in favor of the present method of marketing timber through producers and dealers.

Dependence upon contract buyers, who have little interest in either the permanence of the manufacturing plant or the continued productivity of the forest, is a disturbing element in the South and North. Possibilities exist for the creation, at strategic locations, of open pulpwood markets or timber products exchanges where producers and consumers could transact business to mutual advantage.36

There are many "fly-by-night" producers who have little regard for the permanence of either the industry or the forests. The work of the Southern Pulpwood Conservation Association, and others, however, is doing much

36 Forests and National Prosperity, op. cit., p. 56.
to improve improper cutting practices which show disregard for the future. Most dealers and many producers who have built a thriving business are interested in treating timber as a crop and in practicing good management and conservation. The fact that there are abuses of the dealer-producer system is no reason to condemn the whole system of securing pulpwood. There are many well established dealers and producers who have built a successful business with capital invested in expensive equipment. Certainly these men are as interested in the permanence of the industry and the preservation of the forests that feed the mills as the management of the mills themselves.

The Forest Service has suggested open pulpwood markets. In some localities in the South small markets have been set up along a railroad siding where farmers and others could bring a load of wood and receive the current price as it is loaded on the car. Some conservationists say that this adds to their problem in that it is more difficult for them to maintain proper control over cutting.

The greatest threat to the dealer producer system is the new Social Security Act. The new measure completely changes the definition of employee. The Social Security law previously in effect used the common law definition of employee and independent contractor. The common-law test of whether or not a person is an employee depends upon whether the person for whom the services are performed controls and directs the activities of the individual
who performs the services both as to result to be accomplished and as to the details and means by which that result is accomplished.

The proposed statutory definition of employee would enable the Social Security Administrator to classify as employees of the companies they supply, many persons who think of themselves as independent contractors.

Many pulp and paper executives and pulpwood dealers testified at a hearing before the Senate Finance Committee that the new law would force a change in the method of procuring pulpwood. One dealer who has been a pulpwood supplier for 25 years said the law would put him out of business. He stated:

Nobody can afford to do business without any idea of what his tax liabilities are, so buyers of wood just won't do business with me. In order to know where they stand and not be in a position to get stuck years later with tax, fines, and penalties for guessing wrong, they will have to produce their own wood with their own employees.

Prices paid for pulpwood. The farmer who lives in trucking distance and has equipment can greatly increase his income by taking his wood directly to the mill or to a railroad siding. The following prices for a cord of wood at various stages prevailed in one section of the South in the summer of 1949.

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1. Straight stumpage sale—by cord—$1.50 to $3.
2. Pulpwood stacked in the woods—around $5.
4. Pulpwood delivered to dealer's car on siding—$10.
5. Pulpwood delivered to mill—$11 on a short haul with a premium of $1 per cord on longer hauls.
6. Pulpwood price to dealers f.o.b. cars—about $10.75 where the freight is not in excess of $4 per cord and $11.10 where the transportation cost is less than $4 per cord.

Mill representative-producer system. The mill representative-producer system is similar to the dealer-producer system. Instead of buying through a dealer, however, the mill places its own resident supervisor in charge of an area covering several counties. It is his function to develop wood production and arrange for producers to get the wood. This system is seldom used.

Company logging operations. Few companies in the South are handling their own logging operations. This method is used extensively in the Pacific Northwest where many pulp and paper companies also own and operate sawmills. Southern paper manufacturers, in general, use the dealer-producer system even when cutting from their own timberlands.

Harvesting Pulpwood

Methods of cutting. The manner in which trees are harvested determines whether the forest will be completely destroyed or left in shape to produce another crop.
In five or ten years. The following methods of cutting are used.

**Clear cutting**—Everything that can be sold or used is cut. This should be used only when the land is being cleared for crops. It may also be used where the timber is composed of old, even-aged stands, and the land is to be reforested with seedlings.

**Seed-tree cutting**—Ten or more selected, healthy trees are left per acre, preferably in groups, to reseed the woods. It takes two or three years to restock the woods with this method. Planting seedlings gives better and much more reliable results.

**Diameter-limit method**—All trees above a certain diameter are cut. This method is simple to supervise and apply. It is not a good method, however, because diameter of a tree alone is not a good indication of whether it should be cut.

**Selective cutting**—Trees are marked for cutting by a trained forester in such a manner as to provide improvement of the stand of trees. Diseased and insect infested trees, limbly, crooked or scarred trees, old trees, and weak, slow growing trees are cut to make room for healthy trees. This is the best method, and paper companies are doing much to educate the farmer to cut his trees in this manner. Many companies are offering the services of their foresters for marking trees to be cut. It does not pay to cut young, healthy trees because the increment in size of the tree will produce a greater income. The results of a ten-year study of the Crossett Experimental Forest in Arkansas, indicate that it is possible to produce a large volume of big, high-grade logs from stands at the same time the stands are being built up to better stocking and greater production.

*Additional procedures necessary to ready logs for market.* After sufficient trails or roads are built to make the forest accessible the woods operation consists
of the following procedures which may be carried out either by hand or power equipment:

1. Felling—After clearing off a place to work the laborer severs the tree about six or eight inches from the ground.

2. Trimming—The branches are removed with an axe. One man using an axe seems to be the most satisfactory method in practice.

3. Bucking—The felled tree is sawed into proper lengths for piling, sawlogs, pulpwood, etc. The tree should be cut in such a way that it will bring the greatest possible return.

4. Skidding—The bucked logs are chained to a horse or tractor and skidden along the ground to the loading point. In some operations, the entire tree is limbed at the place where it has fallen and then skidden to the loading point where the logs are bucked.

5. Loading and hauling—Large sawlogs are leaded on trucks by "crosshauling." Pulpwood is stacked in pens and loaded on trucks by hand or with mechanical loading equipment.

Use of power equipment. The most common method of felling and bucking timber is by hand. The two man crosscut saw and the one man bow saw are still popular equipment throughout the South on small operations. During the war the shortage of labor caused an increase in the use of power saws. Many producers are now using this type of equipment, and studies have been made to compare the efficiency and costs of cutting with power saws as compared to hand saws.

The bicycle wheel type power saw is used in flatwoods areas for both felling and bucking. The chain power saw has found wide application in areas of rough terrain.
These chain saws are made of magnesium and aluminum and the small ones weigh only 38 pounds.

Power chain saws range in cost from $350 to $800 depending upon the type. With proper maintenance and care it is estimated that one should be depreciated over a three-year period. In a 1946 study\(^3\) the average annual cost for investment in a three-man chain saw was $236.67.

Any farmer or producer using power equipment must include in his fixed costs of operation, interest, taxes, insurance, depreciation, and repairs, as well as operating costs of gasoline, oil, and labor. After making a detailed study comparing the costs of cutting with the use of power saws and with hand equipment, Mr. Campbell came to the conclusion that:\(^4\)

Only a large operator can afford the investment required for a well-mechanized operation. The reason is that only in cases of large total cuts can the cost of power equipment be reasonably depreciated. Thus a farmer cutting only 100 cords of wood annually can ill afford the $350 investment in a power saw when his maximum annual savings would probably not exceed $25.00.

A higher type of labor is required for use of power equipment, and proper training of the crews is very

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Plate III

Bucking and Leading Pulpwood by Mechanical Methods
important. The work must be carefully integrated and supervised to avoid delays during any state of the woods operation. Delays are costly when labor and equipment must wait because of improper organization.

**Loading pulpwood.** In the majority of cases pulpwood is loaded by hand on trucks which have a capacity of two or three cords and hauled to the nearest railroad siding where the wood is again stacked on the cars by hand. When the distance is close the wood is hauled directly to the mill. Some of the larger dealers and producers are making wide use of mechanical loading equipment and trailer trucks which can haul as much as nine cords. One trailer can be loaded while the tractor is on its way to the mill with another. Some wood is being trucked as far as 75 miles to the mill with large diesel tractors.

Two types of machines are being used for loading wood mechanically—the chain conveyor, and the loading arch. The chain conveyor is portable and driven from a small tractor pulley. As the trees are bucked they are placed on the conveyor which lifts them to the truck. One or two men are needed at each end of the conveyor to handle the logs. The loading arch is also portable. It handles wood which has been palletized in bundles of 80 to 128 cubic feet.

When using the loading arch the wood when bucked is placed in cradles on two bands of steel strapping. After the required measurement has been stacked, the ends of
these bands are fastened to form a solid band around the bundle of wood. The loading arch which is mounted on crawlers and can keep on the job when wet ground would bog wheels down, lifts one or two bundles on the arch and conveys them to a trailer which has been placed in a clearing near a road. Wood loaded in this manner is hauled directly to the mill or to a central loading port on a railroad siding or barge line where it is unloaded with power cranes. This method cannot be used unless the wood is hauled to an unloading dock which is equipped with such cranes.

**Activities of the American Pulpwood Association toward mechanization.** The American Pulpwood Association (APA) is doing much to encourage the mechanization of cutting and handling pulpwood. This association is a National organization of both producers and consumers, with consumers of pulpwood making up about one-third of the total membership. The association holds an annual meeting in New York where papers are read and discussed. Technical Committees are appointed to work on various projects aimed at efficiency and mechanization of the woods operation. Also, the association endeavors to keep its members informed as to the status of legislation that has a bearing on the activities of its members, and it cooperates with other associations in promoting conservation.
The Technical Committees of the APA are composed of skilled technicians and representatives of management. They consider and recommend improved techniques of operation, and work on the development of new types of equipment. The minutes of these committees are distributed to the producer and consumer members of the association, thereby making the opinions and suggestions of the experts available to the pulpwood industry as a whole. The Technical Committees also serve as representatives of the pulpwood industry in direct personal contact with the equipment manufacturers and work with their engineers on development of new and better machines.

The activities of the APA in the field of labor training have been devoted to the developing of trainers in anticipation of the initiation of company-sponsored training programs for the woods operation. Training sessions have been held in various regions. It is well recognized that labor needs to be trained in the efficient use of mechanical equipment. If a paper company carried on its own logging operations, it would certainly take advantage of power equipment and labor saving devices and conduct training programs which would consist of lectures, films, and demonstrations on (1) the use and care of power equipment, and (2) safety measures and prevention of accidents.

Since the southern paper companies are not, in most cases, carrying on their own woods operations, a great
service would be rendered by sending qualified men into the field to conduct training programs for the laborers working for producers and dealers. Efficient mechanized methods in cutting and transportation would reduce costs, and the whole industry would thereby benefit.

The APA mechanization program includes:

1. The broader application of conventional cranes equipped with pulpwood grabs or slidings, particularly in the storage yard and rail head operation of consuming mills.

2. The development of a mechanical method for use in loading and unloading pulpwood in box cars, perhaps through bundling or palletizing the wood.

3. The broader application of loading attachments on trucks and tractors to eliminate man-handling of the pulpwood.

4. The development of equipment for use in areas that are inaccessible to the conventional wheel-mounted machines, particularly steep slopes and swamps.

5. The development of improved transportation equipment including trucks and rail cars.

6. The development of portable barking equipment suitable for use in removing the bark at a location as near to the stump as may be feasible.

7. The development of mechanical saws suitable for general woods use.

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42 A new all cast steel pulpwood car with a capacity of 22 cords instead of the old style 15 cords has been put into use on the GM&O Railroad.
8. The broader application and better utilization of the conventional tractor and sulky equipment, including improved methods of skidding.

9. Special methods of operation to provide for the economical harvesting of thinnings of selected cuttings on plantations.

One of the projects of the APA mentioned above deserves special comment. Portable chippers have already been developed and are used principally for disposal of brush along right of ways. Before such a chipper can be used for pulpwood on the cutting site, however, a satisfactory barking machine must be developed. Even if such a machine were developed, there would be many disadvantages to its use. In the first place, bark is burned at the paper mill as one source of fuel. In the second place, special transportation equipment would need to be developed since wood chips are bulky and take up twice as much space as pulpwood. Present studies indicate that the minimum load required for the carload rate could not be met with cars presently in use.43

One northern company (National Container Corporation of Wisconsin) is using portable chippers. The chips are blown from the chipper into large vans which haul directly to the mill. The vans are unloaded in ten minutes by using the chain conveyor which is built into the van and powered by connecting the conveyor system to a stationary

electric motor. The chips are not bark free and are used in making corrugated medium for shipping containers. This system requires good roads and a greater capital investment, but provides greater utilization of wood. The four cords out of ten which are below merchantable size, and under usual marketing methods are left in the woods, are utilized when portable chippers are used.44

Effect of tree size on costs of marketing. The Southern Pulpwood Conservation Association is urging pulpwood producers to cut the larger trees. In a release sent to pulpwood operators in the South, it was pointed out that carefully conducted experiments have shown that it costs a pulpwood operator part of his profit to cut small trees. A study on pulpwood costs was made by the Forest Products Laboratory of the United States Forest Service, in South Carolina, North Carolina, and Virginia. This study showed that the number of trees cut per acre had little influence on the working time required or cost, but that the size of the trees cut did. The relative number of man hours needed to perform the woods work for various diameters of trees is shown in Table XXIX. It will be noted in the last column that the time required to cut, load, and unload a cord of pulpwood from trees 9 to 15 inches DBH is about the same. It takes 1½ times as long to make the same amount

from 6-inch trees, 1 3/4 times as long from 5-inch trees, and 2 times as long from 4-inch trees. Although the time used on a particular woods operation might vary somewhat from that in the study, the ratio by tree sizes should be about the same.

**TABLE XXIX**

**Effect of Tree Diameter on Man Hours Needed to Cut and Haul a Cord of Wood to Cars**

(11 inches DBH = 1.00)

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<td>6</td>
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<td>1.16</td>
<td>.96</td>
<td>4.30</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Source: Southern Pulpwood Conservation Association.

**Effect of minimum wage law on costs of pulpwood.** Most of the cutting is done on a piece work basis of so much per cord with a guarantee of a minimum wage. The amendment to the Fair Labor Standards Act (Wage and Hour Law) provides for a new minimum wage. What effect this new minimum will
have on costs and the price of pulpwood has not yet been
determined, but it is generally known that the wage paid
to woods labor has been considerably below 75¢ an hour for
many of the jobs. Since pulpwood dealers are already
operating on a small margin, the increased costs will re-
sult in a higher price for pulpwood unless technological
changes and increased efficiency can be made to compensate
for the increased labor cost.

Transportation of Pulpwood

Area of wood procurement. In 1946 an analysis of
pulpwood movement to ten mill units in the South showed
that 99 per cent of the wood was produced within an airline
radius of 150 miles of the mill to which the wood was to be
delivered. The maximum airline distance of haul was 500
miles.\[45\] Table XXX shows the cumulative percent of wood
obtained within 50 to 500 miles of the mills.

Means of transportation. The greatest percentage of
pulpwood is shipped by rail. The Southern Kraft Division
of International Paper Company, which is by far the largest
consumer in the South, published the following figures on
the type of transportation used by its mills:\[46\]

\[45\] Pulpwood Production and Use in Southern Forest
Survey Territory, 1946 (New Orleans: Southern Forest
Experiment Station), p. 4.

\[46\] A Report to the People of the South for the
Year 1948, op. cit.
TABLE XXX

Area of Wood Procurement for Ten Pulp and Paper Mills
In Southern Forest Survey Territory, 1946

<table>
<thead>
<tr>
<th>Distance from mill (miles)</th>
<th>Cumulative per cent of wood obtained</th>
<th>Average</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>41</td>
<td>16 - 71</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>73</td>
<td>33 - 97</td>
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</tr>
<tr>
<td>150</td>
<td>92</td>
<td>85 - 100</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>99</td>
<td>96 - 100</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


At present there is a trend toward an increased use of trucks for short hauls of pulpwood. Less handling of wood is necessary when trucks can haul directly from the woods to the mill. One pulpwood procurement man explained that the mill received 1,100 to 1,200 cords per week by truck. This amount was sufficient to run the mill for about one-half day.

During 1947, the Wood Procurement Department of the Southern Kraft Division delivered 2,874,471 cords of pulpwood to its eight southern mills. 47 In 1948 this amount

47 The Great Southern Tree Crop—A Report to the People of the South for the Year 1947 (Mobile: Southern Kraft Division of International Paper Company), p. 19.
increased to 3,323,551 cords and the company paid over $12,300,000 to the railroads for transportation of the same. The Springhill mill alone consumes 700,000 cords of pulpwood annually which is close to 2,000 cords per day. A standard railroad car of 60,000 pounds capacity holds from 12 to 16 cords of pulpwood bolts. It can be seen from these figures that the Springhill mill would require around 140 cars of wood per day if all were shipped by rail.

Paper mills would much prefer to have their rail shipments of pulpwood made in flat cars because these can be unloaded mechanically. The shortage of such cars, however, has caused the railroads to use a large number of box cars. All of these must be unloaded by hand, and this increases costs considerably.

Two kinds of freight rates. Two kinds of freight rates are available to pulp and paper mills—cordwood rates and pulpwood rates. The pulpwood rates are much lower but are not allowed unless a certain percentage of the company's finished products are shipped over the same railroad. Paper mill traffic managers watch this matter closely and try to work out shipments of both pulpwood and finished products shipped over various lines in such a manner that the maximum of pulpwood rates can be obtained. This

48 A Report to the People of the South for the Year 1948, loc. cit.
necessitates close cooperation between the traffic and the wood procurement departments. Most mills have some cordwood rates to pay. Large companies which ship their products over many different railroads throughout the United States can come much closer to getting 100 per cent pulpwood rates than can the smaller companies.

Storage and Inventories

All pulp and paper mills keep a stock pile of wood on hand to meet any emergency which may arise because of bad weather, transportation difficulties, or lack of woods labor. This wood is stored in open piles around 60 feet high over an area of several acres. The storage yard is located adjacent to the mill's conveyors which lead to the barking drums.

Wood cannot be stored indefinitely. Pulp mill superintendents do not like to use wood which is over 90 days old because the utilization of old wood results in a greater loss of the wood in the barking drums. Also, old wood may become infested with insects, and there is danger of affecting the quality of the paper.49 In the warm summer months some superintendents want the wood used within 30 days.

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Some wood must always be used from one part of the stock pile at the same time new wood is being added to another part of the wood yard. Part of the wood which comes in cars to the mill is unloaded directly into the chain or water conveyors which lead to the barking drums, while some is conveyed by mechanical cranes to the top of the stock pile.

All pulp and paper mills maintain a supply of wood which is sufficient to last at least two weeks, and many mills maintain much larger stocks. The Springhill mill uses over 2,000 cords of wood per day. A two weeks' supply would thus require a stock pile of 28,000 cords. As many as 80,000 cords may be stock piled at Springhill, however, if conditions warrant.

Wood is piled in an orderly manner and the number of cords which are stacked on the pile is known. Every day the manager of the pulpwood procurement department receives a report of the quantity on hand, and a physical inventory is taken at two-week intervals.

Many procurement men would prefer to see the mills keep a larger stock on hand. This desire is based upon the premise that larger inventories would enable the mills to carry on full-scale operations during an emergency without resorting to a rise in the price of wood and without putting additional pressure on the procurement department. On the other hand, the mill management usually urges smaller inventories so that a minimum amount of
capital is invested in inventories. The 1946 Annual Report of the International Paper Company\(^{50}\) showed $17,083,291 invested in pulpwood at mills out of total inventories of over $68,000,000. This pulpwood was valued at cost-or-market whichever is lower.

Pulpwood gets scarce during harvest season and immediately afterward because it is hard to get labor. After harvest the workers are spending the money which they have earned and, in many cases, do not care to work. During this time the paper mills draw heavily on their stock piles and there is considerable competition for wood.

Southern pulp and paper mills are not affected in procurement by bad weather to the extent that northern mills are affected. A hard winter or a long siege of rainy weather, however, will cut down woods operations and reduce the constant flow of wood. Procurement men, thus, have a difficult job in seeing that the right kind and quantity of wood is on hand at all times. If this department should fail, operations would be slowed down or stopped completely.

\(^{50}\) Fifty-First Annual Report--1946, International Paper Company.
CHAPTER VI

CHARACTERISTICS OF PRODUCTS MANUFACTURED
IN LOUISIANA'S PAPER MILLS

An explanation of the thousands of kinds of paper produced by paper mills throughout the United States is beyond the scope of this work. An attempt will be made, however, to acquaint the reader with the major products manufactured in the pulp and paper mills located in Louisiana, with occasional reference to products of mills located in other southern states. The Paper Yearbook for 1950\(^1\) divides paper into the following two types: (1) coarse paper and paper products, and (2) fine paper and printing paper.

Practically all of the paper manufactured in Louisiana's seven pulp and paper mills falls within the first group—coarse paper and paper products. Although some printing papers are produced, the quantity is negligible when compared with coarse papers. The products of the three mills in Louisiana which make roofing and building materials will not be discussed.

General Characteristics of Louisiana Products

All of Louisiana's seven paper mills are integrated, i.e. they produce their own pulp which is manufactured into paper. All paper is made on modern high-speed Fourdrinier or cylinder machines. On October 1, 1950, there were 24 Fourdriniers ranging in width from 112 inches to 242 inches, each turning out paper at the rate of more than 1,000 lineal feet per minute. In addition, there were three cylinder board machines—one each of four, five, and six cylinders. Louisiana's pulp mills have a capacity of 8,415,000 pounds (4,208 tons) every 24 hours, and practically all of this pulp is manufactured into paper on the above machines.

There is a tendency for mills in Louisiana, as well as throughout the South, to produce the mass production grades since the South is far removed from many large markets. As machines get old in the South, management attempts to speed up and modernize these machines in order to keep on producing the mass production grades rather than resort to manufacture of the diversified grades as was done in the northeastern section of the United States when equipment became old and obsolete.

The production of diversified grades requires a flexibility which is not possible in machines which are best adapted for mass production. Diversified grades are used in small quantities by many printers and other customers and market services are tremendously important. The
paper which will please one printer or publisher may be
condemned by another. Also, the users of white paper often
do not like to secure all of their requirements from a
single mill. The nature of the customer thus makes mass
production and mass distribution of fine white printing and
writing papers almost impossible. Modification of treat­
ment and finish to meet specific requirements as well as
rapid delivery in small quantities is often required.
Meeting the demands of specific small users which order
paper made according to their specifications causes the
company manufacturing diversified grades to produce some­
times more than 500 different kinds of paper in the course
of a year. This entails complete adjustment of equipment
and consequent loss of time. The manufacturer which produ­
ces the heavy tonnage variety of papers, however, fre­
quently produces the same grade of paper in the same weights,
colors, and sizes day in and day out throughout the year. 2

Practically all of the pulp and paper mills built dur­
ing the last 20 years have been designed for manufacturing
the tonnage grades of newsprint, kraft wrapping, and kraft
boards. While the newer part of the industry is confined
to the production of tonnage grades, the older mills are
largely devoted to manufacturing the diversified grades.

2 B. C. Everest, "Marketing the Diversified Prod­
ucts of the Paper and Pulp Industry" (Speech given at Fifth
Annual Farm Chemurgic Conference, March 29-31, 1939).
It has been said that age is no criterion of the economic utility of a paper machine; it is simply an indicator of the type of production in which it may find itself.

The Census of Manufactures for 1947 shows that 21,045,629 tons of paper and board were produced throughout the United States. This tonnage was almost equally divided between paper and board with 9,395,378 tons of products classified as paper and 9,161,008 tons as paperboard.

The Census of Manufactures divides paper into the following classes: Newsprint, Groundwood, Book, Fine, Coarse, Special Industrial, Sanitary Stock, Tissue, and Absorbent. Paperboard is classified as follows: Containerboard, Binding Board, Non-binding Board, Special Paper Board Stock, Cardboard, Binder's Board, Shoe Board, other Wet-machine Board, Building Paper, and Building Board.

In the following paragraphs an attempt will be made to describe in as brief form as possible the most important products manufactured in Louisiana's pulp and paper mills.

Most of the pulp manufactured in Louisiana is made from southern pine pulpwood by the kraft (sulphate) process. About three per cent of the State's production is semi-chemical pulp, and one mill devotes its entire production (10 per cent of the state's total paper production) to the manufacture of a corrugating medium known as Chemfibre which is produced from hardwoods. The remainder of the pulp produced in Louisiana's seven mills is manufactured by the sulphate process.
Paper made from kraft pulp is light brown in its natural color but may be satisfactorily bleached. The paper has long fibres, and when manufactured on a Fourdrinier paper machine these fibres are evenly distributed in both directions of the paper. This gives the product a high bursting and tearing strength. It is thus ideally suited for many types of protective uses. It can be made in weights ranging from 18 to 250 pounds (500 sheets 24 by 36 inches) and many special qualities can be developed to make the paper suitable for wrapping, grocery sacks, butchers paper, multiwall shipping sacks, and corrugated and solid fibre shipping containers, as well as many other products.

Paper which is used for wrapping and packaging must be strong and durable. Kraft paper meets the requirements for heavy packaging better than any other. Kraft rates high on tensile strength, bursting strength, folding endurance, and resistance to tearing. Regular kraft is low on wet strength, but where this quality is desired it may be imparted through special treatment in the manufacturing process. Because of its abundance, relatively low price, versatility of form and appearance, kraft is used more in the packaging field than any other type of paper. The manufacturers of practically all products utilize kraft in some way either for packaging or shipping containers.
Kraft Wrapping Paper

Kraft wrapping paper is made in various bleached and semibleached forms, as well as in its natural color of brown. This paper dyes well and is also made in colors of red, green, orange, blue, and gray. It is produced with both machine finish (MF) and machine glazed finish (MG) with most of the paper made in the former finish. Machine glazed kraft has a glazed surface on one side and generally contains a narrow stripe within the paper. The fancier appearance of this finish makes it popular with dry goods stores, variety stores, florists, and other markets where more attractive wrapping is desired. Machine glazed kraft is usually produced in 25 pound weight (24 x 36 --500). The most widely used weights of machine finished kraft are from 25 to 80 pounds, but it may be made in weights ranging from 18 to 250 pounds. Machine finished kraft wrapping paper is manufactured in three qualities: standard, No. 1, and superstandard. The principal difference between these grades is in the Mullen or bursting strength test. The standard grade has a bursting strength of 70 to 80 per cent of its basic weight. No. 1 is warranted to test between 86 and 96 per cent, while superstandard is warranted to test more than 96 per cent. Machine glazed kraft wrapping paper is made in one quality, testing from 70 to 90 per cent on bursting strength.
Approximately 75 per cent of all kraft wrapping paper manufactured is of the standard grade while the super-standard and the machine glazed varieties each represent around 10 per cent of the total, and the No. 1 grade represents five per cent.\(^3\)

Kraft wrapping paper is suitable for all types of wrapping. The light and medium weight papers are used for carry-out packages and for packages to be mailed, the heavier weights are used for freight and express shipments. It is also utilized as a furniture wrap and for box car linings, and wooden crate and barrel linings. The automobile industry uses huge handmade bags for storing and shipping automobiles, and strips of kraft paper constitute the wrapping on every tire as it is shipped from the rubber factory.

Kraft butchers paper contains a special treatment in the manufacturing process to give it exceptional strength and imparts to the paper a high density so that blood or juice will not easily penetrate. Red dye is added to the natural brown kraft pulp to give it a pink color which blends with meat. Butchers paper may also be bleached to a lighter shade of brown, or fully bleached to white or cream color. Several grades of this paper are made for the express purpose of use in butcher shops for wrapping meats.

Bag Paper

Bag paper is manufactured on a Fourdrinier machine in weights ranging from 20 to 70 pounds (24 x 36 -- 500). The paper has a special finish and possesses additional qualities not found in wrapping paper. Unbleached kraft in its natural brown color is used in the manufacture of most grocery bags. White bags may be made by bleaching the pulp. Also, this stock is made in many colors as specified by the customer. It can be water striped, calendered, and decorated to meet special demands.

Regular bag paper should not be confused with shipping sack paper which is made with an entirely different formula designed to produce long fibres interlaced to impart additional strength and durability.

Large quantities of regular brown bag paper are used in manufacturing grocery bags of all weights, cleaner bags, and hardware bags. Bleached bags are popular for use in candy stores, bakery shops, and variety stores. Striped and colored machine glazed bags are used in large quantities by dry goods and drug stores.

Bag paper may be treated with melamine formaldehyde or plastic resins to give it wet strength. Bags made from wet strength stock are suitable for wet wash bags and garbage bags. They are also ideal for carry-home packages, for packaged ice cream, and bottles of cold beverages which have a tendency to sweat.
Paperboard

The term paperboard is used to designate all types and varieties of materials which have a thickness of 12/1000 of an inch (.012) or more and are made on Fourdrinier or cylinder board machines. It is also used to designate certain types of products which range from .006 to .012 in thickness. There are two main classes of paperboard as follows:

(1) Containerboards—This includes the liners and corrugating medium used in making corrugated shipping containers, and the board used for solid fibre shipping containers.

(2) Box boards—This material is used principally in the manufacture of folding boxes and set-up boxes. It is also used for a wide variety of other products including book covers, food trays, tablet backs, merchandising display panels, and fibre cans and drums.

Containerboards. The inner and outer facings of corrugated shipping containers are referred to in the industry as linerboard. The fluted material which is glued between these linerboards is called corrugating medium. Both are manufactured in large quantities from kraft pulp on Fourdrinier machines and sold in rolls. In 1947, 4,931,855 tons of linerboard were manufactured in the United States, and 3,286,211 tons (67 per cent) were made of kraft.\(^4\) Practically all of the kraft Fourdrinier board is made in the south from "virgin" sulphate pulp.

**Linerboard.** This product is made in various weights ranging from .009 to .030 inches. When dry finished it has a rough feel. It may, however, be water finished on one or both sides to give the paper a smooth feel and make it more suitable for printing. The water finish is produced by adding water or steam as the board passes through the calender rolls. Linerboard has a Mullen or bursting strength test of 75 to 80 per cent of thickness. This means that .030 (30 point board) will burst under a pressure of approximately 24 pounds per square inch. In addition to its use as the liner on corrugated shipping containers, this board is utilized extensively as the outer liner for fibre drums and cans.

*Fourdrinier board* is generally produced in its natural brown color when it is destined for manufacture into shipping containers, but there are increasing quantities bleached for use in manufacturing containers for food products particularly in the dairy field. Bleached kraft Fourdrinier board is used in manufacturing paper milk bottles, bottle caps, paper cups and pails, and for butter, cheese, and ice cream cartons.

**Corrugating medium.** This board is usually .009 in thickness and is dry finished. In Louisiana's pulp and paper mills it is made of kraft pulp produced from southern pine and from hardwoods pulped by the semi-chemical process. One mill manufactures corrugating medium from hardwoods under the trade-mark of Chemfibre. Although chips
containing more dirt and bark can be used in making pulp for corrugating medium than is the case for liners and finer grades of paper, a higher quality of product is obtained by keeping such foreign material to a minimum.

Corrugating medium is sold in rolls and the board is generally fluted by the converters immediately before it is glued to liners for manufacture into shipping containers. In addition to being used in making shipping containers, this corrugating medium often is combined with single sheets of linerboard to make flexible corrugated wrapping. This serves as a protective padding in shipments and is used in place of corrugated boxes in shipping a wide variety of products. It is especially advantageous for firms which need to package for shipment many products of various sizes and shapes. Flexible corrugated is made in light, medium, medium heavy, and heavy weights.

**Solid fibreboard.** This type of board is made to the desired thickness and rigidity by pasting two layers of linerboard stock on a filler of heavy chipboard. It is used to some extent by converters in making solid fibre shipping containers. There are no converters in Louisiana, however, which make this type of shipping container. In terms of thousands of square feet of container board material used, solid fibre represented only three per cent of
the total in 1949 (2,038,000 for solid fibre board and 61,129,000 for corrugated board). 5

**Boxboards.** This product is made on cylinder machines with the first and last cylinders forming the two outside layers while the remaining cylinders produce the filler for inner plies. Although most boxboard consists of a combination of different types of plies, there are some solid boards which are made with the same stock for each layer. In addition to the arrangement of plies made from different types of pulp, variations in characteristics of the finished board may be obtained by adding sizing and loading material in the beaters for greater or less stiffness, water-proofness, and moisture-proofness. Dyes may be used to give various color effects.

Cylinder box board is made in thicknesses ranging from .012 inches to .065 inches with each thousandth inch constituting a point. Cylinder board is easy to distinguish from Fourdrinier board because the great majority of fibres of cylinder board lie parallel to the direction of the machine. This gives the board a higher tensile strength parallel to the grain than across. The "shake" of the Fourdrinier wire distributes the fibres evenly in both directions, thus Fourdrinier board has almost an equal tensile strength in either direction.

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5 Figures of production are taken from *Fibre Containers*, XXXV (August, 1950), p. 149.
Cylinder board is utilized to some extent as liners for corrugated containers and for the manufacture of solid fibre shipping containers, but its principal use is for folding container stock and set-up paper box stock. Folding boxboard must bend or fold without cracking or breaking. It is made in thicknesses ranging from .013 to .052 inches with single- or multiplies. It is generally made with a finish which permits printing or lithographing.

Set-up boxboards are used in manufacturing set-up or rigid boxes and is formed in thickness ranging from .016 to .065 inches. These boards must be stiff, rigid, and capable of resisting abuse.

**Converting Papers and Paperboard Specialties**

These papers and boards include a wide range of stock which is manufactured for highly specialized uses. They are made in large quantities at the Springhill and Louisiana mills of the International Paper Company's Southern Kraft Division.

**Milk bottle hood and bottle cap board.** This board ranges in thickness from .040 to .046 inches and is hard surfaced in order that it will take color printing satisfactorily. It may be waxed or paraffined after it is printed. The product must be sanitary, chemically neutral, and capable of taking an even die cut.

**Cup stock.** This board is made according to the specifications of converters who manufacture water cups,
hot and cold drink cups, soda cups, sampling cups, and many other types of cups.

**Ice cream carton and pail stock.** This board is also made according to specifications of converters who manufacture linerless cartons and pails in all styles and shapes. Converters using this stock manufacture such products as factory-pack ice cream cartons, carry-out ice cream pails, and oyster and other types of food pails.

**File folder.** This paper is made in thicknesses ranging from .0075 to .025 inches. It is manufactured by converters into all types and sizes of filing folders. The paper must be stiff and have a uniform high finish. It must also have a high tearing and folding test as well as non-curling qualities.

**Tabulating card.** Much of the stock from which electric tabulating machine cards are made is manufactured in Louisiana. This paper must meet the exact specifications of the manufacturer. It is necessary that the cards have a close tolerance in thickness in order that the finished card will work properly when used in accounting and tabulating machines. It must be free of any carbons or other foreign material which might affect the operation of the electrical contacts. The paper possesses a smooth finish which will take a clean punch and it must be stiff so that it will not easily bend or curl. It is produced in buff and blue-white colors.
Window shade. Converters manufacture window shades from 55 pound bleached Kraft. Lacquer or paint is added by the converter, and the paper is embossed with a linen-like finish to resemble cloth window shades.

Envelope. Kraft paper is used in both its natural brown color and in bleached forms for manufacturing envelopes of all kinds and sizes. Converters manufacture envelopes on high-speed machines which die-cut, fold, seal, and gum the paper. Kraft paper is especially adaptable for making the large flat mailing envelopes, filing and expansion envelopes, and for payroll or coin envelopes.

Toweling. This paper must possess special qualities not common to ordinary kraft papers. The most important characteristic is its absorbency or ability to remove water quickly. Other desirable qualities are wet strength, softness, freedom from lint, and it should be odorless when wet. It is made in weights ranging from 23 to 38 pounds (24 x 36 -- 500) for manufacture into single- and double-ply folding towels and for roll towels for industrial, school, and household use. This stock is also manufactured into bath towels 18 by 40 inches in size for use in industrial plants and school shower rooms.

Printing and Writing Papers

Only a small percentage of the paper produced in Louisiana falls under this classification. The finest of printing and writing papers are made from rag stock or
from combinations of rag and sulphite stock in northern and eastern mills. Research, however, has developed methods of manufacturing some types of printing and writing papers from sulphate pulp or from combinations of sulphate and groundwood pulp. A very limited discussion of such papers produced in Louisiana's pulp and paper mills will be included later in this section.

**Tag stock.** This paper is made in such heavy weights that it could easily be classified as paperboard. Basis weights range from 80 to 300 pounds (24 x 36 — 500). The lighter weights are made on a Fourdrinier machine while the heavier weights are produced on a cylinder machine. The paper made in buff, white and other colors is given a smooth high water finish so that it will take printing or pen and ink writing. Some is heavily sized with rosin or coated with clay. The paper must have good folding qualities, as well as tensile and tearing strength, and moisture resistance. In addition to its use in making shipping and other tags, large quantities are used for heavy catalog and document envelopes, sales books, pamphlet and manuscript covers, menus and scorecards, and car signs.

**Index paper.** This paper which is known in the trade as Bristol is made in 90, 110, 140, 170 and 220 pound weights. It is sometimes sold in roll form, but is generally cut and sold by the ream of 500 sheets. The standard size sheets are 25½ by 30½ inches and 20½ by 24 3/4 inches. Converters cut these sheets into the usual size index
cards—3 x 5 inches, 4 x 6 inches, 5 x 8 inches, and 6 x 9 inches, and band them in packages of 100. Also, this paper is used for many printed forms such as bank and credit identification cards, instruction cards, application cards, personnel cards, library cards, and many other types of cards. The paper must be snappy and capable of withstanding a great deal of handling. Since some cards manufactured from this product will be used for machine records, the paper must be made to specific calipers. The paper is heavily sized with a hard surface and must be free from fuzz or lint so that it will be suitable for printing, pen and ink writing, and erasing. Surface-sized index paper has better writing qualities than that which is sized in the beaters.

Ledger paper. This paper is used primarily for record keeping, and is made in 24, 28, 32, and 36 pound weights (17 x 22 — 500) in blue white and buff colors. It must be extremely tough and durable, possess a good ruling, writing, and erasing surface, and have a non-glare finish. Since it is sometimes used in machines it must possess a certain degree of flexibility yet be rigid enough to stand erect when filed. The pulp is beaten in such a manner as to give the paper longer fibres than ordinary bond papers, and is tub or surface sized and calendered to meet specifications. It is necessary that the paper be adaptable to all methods of recording—manual, mechanical, and chemical;
and all processes of reproduction—letterpress, direct and offset lithography and both pen and disc ruling.

**Safety check paper.** This paper is made either by impregnating color chemicals into the paper in a distinct pattern or design of two shades of the same color or by the addition of certain chemicals in the beater or by a surface treatment. The paper is so designed that any attempt to erase with ink eradicator, eraser, or a knife will leave a white spot which is easily detected. In addition to its use for printing safety checks it is suitable for drafts; promissory notes; bonds; railroad, bus and airline tickets; hunting, fishing, and driver’s licenses; as well as birth certificates and any other papers and documents where safety from alteration is an important feature.

**Offset paper.** This paper is prepared especially for use in lithographing single and multicolored books and magazines. The off-set process of printing depends upon the fact that oil and water do not mix. The paper must be perfectly neutral. Either acidity or alkalinity can ruin the paper for use in the lithographic process. It is made clean and free from fuzz, and is processed in such a manner that it will not stretch, shrink or curl. It may be either coated or uncoated, but the former produces better color printing.

**Converted Products**

This section will be limited to a description of the converted products manufactured on property adjacent to
each of the seven pulp and paper mills located in Louisiana which are owned and operated by the same companies that own and operate the pulp and paper mill which supplies the paperboard used in the manufacturing process. The products of these converting plants are: (1) fibre shipping boxes, (2) paper bags, (3) multiwall shipping sacks, and (4) paper milk bottles.

**Fibre shipping boxes.** It is recommended by the Fibre Box Association that the term "fibre shipping boxes" be used to designate the fibreboard container which is primarily used as a shipping box. The term "container" is used as a more inclusive one to embrace all types of enclosures such as glass, tin, spiral-wound food pails, fibre drums, wire-bound boxes, etc. The term "carton" should be applied to the interior package commonly used to enclose such products as cigarettes, cereals, crackers, soap powders, etc. The nomenclature recommended by this association will be used throughout the discussion of this section. Although fibre shipping boxes are made with two broad types of construction—(1) corrugated, and (2) solid fibre, the material herein will treat only the first type since it is the only one which is manufactured in Louisiana.

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Shipping box specifications and uses. Corrugated boxes are made according to the specifications of the customer. Some large customers have their own packaging engineers, but many depend upon the work of experts furnished by the box manufacturers.

The design and specifications of shipping boxes must always meet the minimum requirements established by the carriers, and each box must contain an approval stamp in accordance with regulations. The requirements which are of prime importance to box manufacturers are Consolidated Freight Classification No. 15, Rules 5, 6, 21, 22, 40, 41, and 49; Railway Express Specifications and Regulations, Rule 18; and Parcel Post Regulations. Rule 41 of Railroad Freight Specifications is so important in box design and manufacture that it is often referred to as the box manufacturer's "Bible."

The specifications just mentioned name the types and qualities of materials which may be used and the tests which the finished box must meet, maximum weight of box and contents, maximum inside dimensions, methods of sealing, and special packing requirements for glassware and other fragile articles.

Shipping container regulations may be obtained from the respective carriers, and box manufacturers have available at all times a handbook containing these requirements.

It is the object of the box manufacturer to provide a container that will assure safe delivery of the customer's
product economically and with a minimum of loss. Often this involves research to obtain a knowledge of special shipping problems and past losses. Boxes are sometimes designed and manufactured to exceed the requirements of the carriers.

Each plant has a sample room in which boxes are designed and recommended to the customer for approval. For instance, the manufacturer of a chair who wishes a container made especially for this product may send the chair to the box manufacturer. Experts in the sample room will build a box by hand and package the chair therein for return to the manufacturer along with a quotation of price for a quantity of the same box.

Paperboard shipping boxes are now being used to ship many products that were formerly shipped in wooden or metal containers, and new improvements are continually being discovered. Today paperboard containers are being used to ship such articles as gas furnaces, hot water heaters, motorcycles, gasoline engines, and furniture of all kinds. Recently a special box was designed for shipping nails, staples, bolts, screws, nuts, and rivets which were formerly shipped in wooden kegs. This container was developed through the joint efforts of the Superintendent of Finishing of the American Steel and Wire Company and the Sales Promotion Manager of the Container Division of International Paper Company. This fibre box will reduce the shipping weight and costs of shipping, as well as damage claims, and
save at least 25 per cent in storage space for the manufacturer.

Since the first general approval of fibre boxes for shipment in 1906, there has been a trend toward more efficient containers of light weight and low cost. When fibre boxes were first introduced at the turn of the century, they were regarded merely as a substitute for wooden boxes, and the railroads imposed a penalty of 10 per cent on all shipments made in such boxes. The penalty on carload shipments was removed from the official classifications in 1907 and a year later it was removed for LCL shipments. Until the Prindham Decision in 1912, however, some Pacific Coast railroads who had large interests in the lumber and box fields imposed a penalty for east-bound freight shipped in fibre boxes even though no penalty was provided for west-bound freight. After extensive hearings the Interstate Commerce Commission ruled on April 6, 1914, (Docket 5273) that there should be no discrimination between the movement of suitable commodities from California dealers east bound in wood and fibre containers, and required the carriers to amend their tariffs accordingly.

The placing of fibre boxes on an equal basis with other types of shipping containers made possible the economical shipment of increased quantities of goods and opened a new era in packaging. There was almost a complete transition from bulk to package sales. The use of fibre shipping containers brought about a three-fold saving to
the manufacturer. Not only was there a saving in the initial cost of the container, but also shipping and handling charges were reduced considerably. A fibre box weighs only about one-third as much as a wooden box of the same size, which means that freight and handling charges on wooden boxes are three times that for the same size fibre box. Of course, this comparison is not completely accurate because wooden containers are generally larger and hold more merchandise. Further economies are provided the manufacturer who uses fibre shipping boxes through the saving in warehouse space and in the costs of getting the empty containers into the factory. Fibre boxes are shipped flat in bundles so that there is little waste space either in cars or in the storage room of a customer. The saving from this alone is difficult to estimate. Also, a fibre box is a better container than a wooden box since it provides a cushioning effect against shock and will not shatter when dropped as does a wooden box. Fibre boxes are safer than other types because there are no nails, wires, or rough edges to tear clothes or injure hands. They are easy to palletize and can be filled, closed, and opened without tools and without damage to the container.

It is estimated that over 90 per cent of all package shipments reach their destination in fibre containers.\(^7\)

The major uses of fibreboard shipping boxes for freight, express, parcel post, marine and air shipments of all kinds of products is approximately as follows:

1. Foods and beverages 40 per cent
2. Agricultural implements, engines, household equipment, etc. 27 per cent
3. Paper, printed material, books 10 per cent
4. Drugs, cosmetics and tobacco 8 per cent
5. Clothing, textiles, and retail store packing 8 per cent
6. Miscellaneous 7 per cent

Research and development, better sales technique, and improvements in papermaking machinery are bringing about a still greater use of packaging in fibre boxes. In addition to the advantages already mentioned fibre boxes provide a good advertising medium since an attractive display can be easily printed on the box.

Although shipping boxes should have a reasonable margin of safety, it is false economy to use a stronger or more expensive container than is needed. The strength requirements of containers are reduced or increased as the result of changes in transportation and handling methods. The advent of such facilities as motor trucks, airplanes, skid platforms, lift trucks and improvements in railroad cars and equipment have been important factors in reducing the

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transportation hazards and in making possible lower-cost shipments.

Prior to 1942 the use of fibre boxes was confined principally to domestic shipments because of the inability of such boxes to withstand damp storage conditions and the more serious handling incident to export shipments. The industry, through research, developed water resistant boxes so that the hazards of overseas shipments were not only overcome, but boxes could be dropped from airplanes into the ocean and allowed to float ashore without the contents being affected by salt water for a reasonable time. The development of fibreboard boxes suitable for export shipments opened wide new markets for this type of shipping container. There is always intensive research to improve the materials used in the manufacturing process, as well as in the design and construction of the finished box.

**Shipping box design.** Box design depends not only upon regulations of the carriers, but upon the nature of the commodity, storage conditions available, sealing methods, value of contents, packing arrangement of the manufacturer, warehousing and distribution methods, possible multiple use, and cost.

Fibre shipping boxes vary in the following characteristics: (1) the material and type of flute used in making the corrugated member, (2) the weight and characteristics of the material used for the liners, (3) the number of
sheets of corrugating medium and linerboard, (4) the design, shape, and fold of the box, (5) the method used in fastening, and (6) the design and type of partition when interior partitions are to be used with the box.

Three types of flute may be used—"A," "B," and "C," with "A" flute the highest and having the least number of ridges per foot. The size of the flute is regulated by changing the rolls on the corrugating machine. Most boxes have double-faced sheets of corrugated fibreboard. This is made by gluing firmly together a sheet of corrugating material with a sheet of linerboard on each side. When extra strength and better cushioning is desired for the package, double-wall board is used. Double-wall board consists of three flat liners and two corrugated members combined alternately so that there is a layer of board followed by a layer of corrugated material.

There are dozens of standard types of fibre shipping boxes which are illustrated and explained in the handbook9 used by box manufacturers. An explanation of these types is beyond the scope of this work. The various designs, however, make it possible to provide from one to three layers of protection on one or more of the six sides of a box.

The most popular box is the Regular Slotted Container (RSC). It is estimated that approximately 90 per cent of

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the boxes used in the United States are of this type. This box is simple and economical to manufacture and easy to assemble and seal. It may be sealed with liquid adhesive, paper sealing tape, or fastened with metal stitches. It is well adapted to the shipment of most commodities. All flaps are the same length. The outer flaps meet in the center of the box, while the inner flaps do not meet. The space between the inner flaps varies depending upon the difference between the length and width of the box. This type box is suitable for shipments which do not require two layers of protection over the entire top and bottom areas. When two layers of protection are desirable, fill in boards are often used to cover the blank space between the inner flaps.

The manufacturing process. All boxes are made in accordance with a production order which is prepared in the planning department. The production order contains the inside dimensions of the box, complete specifications for materials for each liner and corrugated member, the method of manufacture, printing, design, and shipping instructions. The sides of a shipping box are made on a modern high speed machine called a corrugator. The corrugated medium is fluted and glued to the linerboards, and the board is trimmed to the proper size and scored for folding. The board is then conveyed mechanically to a

printer-slotter machine, which in one operation automatically slots the boards and prints in one or two colors the advertising and other information on the face of the board. One company has a printer slotter that will slot an extended box 140 inches wide and print in two colors. One man is needed to load this machine while another man at the opposite end stacks the slotted and printed boards on hand trucks.

The sides of the boards are then either stapled or taped. In order that the boxes may be bundled and shipped flat, the customer himself must fasten the bottom and top to complete the finished box. A machine folds and tapes the sides of the boxes, but the larger boxes must be folded by hand. All boxes whose sides are stapled are folded and fed through a machine by hand.

Finished boxes are tied in bundles of 25 and placed on carts for delivery directly to the loading platform where they are loaded by hand into the cars.

Special machines are often developed for a customer who has given the box manufacturer a long-term contract of five to ten years. For instance, one box factory has developed a machine to make dividers for bottles at the rate of 40,000 per day. This same company has also built a special machine for making boxes in which to ship butyl synthetic rubber. The insides of these boxes are coated, after which the boards are placed on special racks for drying.
Paperboard shipping boxes are made in Louisiana at Springhill by the Container Division of the International Paper Company and at Bogalusa by the Gaylord Container Corporation. In addition to these two large shipping box plants there are eight other box plants in the state which are not owned by the paper mill companies. These box plants purchase much of their paperboard raw materials from Louisiana's paper mills.

**Paper bags.** Many types of paper bags are made in the bag plants of the Southern Advance Bag and Paper Company at Hodge, the Gaylord Container Corporation at Bogalusa, and the Calcasieu Paper Company at Elizabeth. In addition to these, five other bag plants which are not owned by the paper manufacturing companies are operated in Louisiana.

The following kinds of bags are among the most important of those produced by the paper mill companies: bakery, banana, beverage, garment, grocers, hardware (nail), handmade, liquor bottle, merchandise, millinery, notion, shopping, and specialty bags.

Grocers' bags are made in standard stock sizes ranging in capacity from 1/2 pound to 25 pounds. A large percentage of the total production of bags is devoted to these types. One company in Louisiana manufactures over 12 million bags per day.

Heavy duty grocers bags in the larger sizes are made of wet strength kraft paper so that groceries can be safely carried in damp or rainy weather. Special adhesives which
are not affected by moisture are employed in manufacturing these bags.

Printed bags are becoming more and more popular as a means of advertising. In some cases only the name of the store is printed, while in others there is some message about the store’s services and special offers of new products. Advertisements are also used to publicize community events such as the Community Chest Drives. The message can be printed in one or two colors on one or both sides of the bag.

Four basic types of bags are made on high-speed automatic machines. They are: (1) flat, (2) square, (3) satchel-bottom, and (4) automatic or self-opening. Each type of bag has characteristics which make it suitable for particular uses. The flat bag with one end of a tube of paper folded over and pasted to form the bottom allows the contents to bulge thus giving the appearance of a larger content than is actually contained therein. It is used for packaging light-weight objects in department stores, variety stores, candy and notion stores, and many other retail businesses. The square bag with the bottom folded under and pasted has a tuck at each side and is suitable for packaging articles of similar shapes. It is used in packaging food products, hardware, notions, and candy. The satchel-bottom with its diamond-shaped, pre-formed bottom contains no tucks in the side. It stands upright and is easy to fill and is used for packaging such
items as rice, sugar, and prunes. It is also used for nail bags and is the principal type utilized in manufacturing heavy shipping sacks. The automatic bag is so constructed that it opens easily by a flip of the wrist. When opened it stands upright whether empty or filled. It is used extensively for grocers sacks, candy bags, and a wide range of specialty bags.

**Multiwall shipping sacks.** These sacks consist of three to six plies of heavy kraft paper. They are utilized in shipping over 450 agricultural and industrial products. In 1949 multiwalls delivered and protected more than 65 million tons of United States products for domestic and export consumption. The total use by types of commodities was as follows:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural commodities</td>
<td>27.59%</td>
</tr>
<tr>
<td>Building materials</td>
<td>29.19%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>33.47%</td>
</tr>
<tr>
<td>Minerals</td>
<td>7.26%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2.49%</td>
</tr>
</tbody>
</table>

Multiwall shipping sacks are made in Bastrop, Louisiana, by the Bagpak Division of the International Paper Company. International also has a large multiwall plant at Camden, Arkansas. Several other companies, including the St. Regis Paper Company, manufacture this product.

Shipping sacks are all custom made, and each manufacturer of such sacks must have its own multiwall

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engineers who work closely with prospective customers in deciding the proper type of sacks and in recommending a suitable filling and packing machine. The engineer's recommendations include sack size, construction, and methods of filling, closing, and sealing. Each product packaged has different requirements so that it is not practical to produce multiwalls in stock types and sizes.

The following factors are taken into consideration in choosing the number and type of plies and the size and style of shipping sack:12

1. Composition of product
2. Flow qualities
3. Cubic foot weight (loose or settled)
4. Moisture content
5. Protection needed against loss or gain of moisture
6. Hygroscopic or deliquescent nature of product
7. Chemical action of product
8. Filling, closing, and sealing methods to be used
9. Type of shipment—air, rail, steamship, truck, carload, less than carload
10. Handling methods
11. Storage conditions

There are five types of multiwall paper shipping sacks in general use as follows: (1) the sewn valve sack, (2) the pasted valve sack, (3) the sewn bottom open mouth sack, (4) the pasted bottom open mouth sack, and (5) the open corner sack.13

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13 Ibid., p. 47.
Open mouth sacks are factory closed at the bottom, and the top must be sealed by hand or by machine in the customer's plant. On the open corner sack, the open mouth is partially closed by sewing. Generally this latter type is used for materials which are liquid when poured into the sack but harden when cooled. The internal pressure inside the sack forces a flap of the sack across the valve opening which causes the sack to close itself automatically. In some cases the open corner must be stapled after filling.

Multifaceted shipping sacks were first introduced in 1924 and soon found wide use in the cement industry. Research and sales promotion have widely expanded their use. Since 1939 the production of these bags has nearly tripled. World War II provided the opening for the use of multifacets on an extensive scale, and most wartime customers who saw the advantages of this type of packaging have continued to use them. Since 1945 the number of plants producing these bags has increased from 34 to 46.14

In addition to type of closure and size, multifaceted shipping sacks vary in the number, weight, type, and treatment of the plies. Each ply may range from 40 to 70 pound paper. Specially treated inner walls have been developed for a wide range of applications and are constantly being brought into use on new products. The treatment includes

14 Posta, op. cit., p. 80.
laminating, impregnating, or coating the kraft paper or the pulp with synthetic resins, waxes, and sizings. Bags are designed to resist moisture, oil, and penetration of hot liquids such as asphalt and wax. Also special treatments will enable the walls to resist chemical actions which would otherwise eat through the lining, and special papers have been developed to keep the contents from sticking to the inner walls.

Multiwall shipping sacks make it possible to ship refined sugar and flour without danger of infestation of bugs and vermin from without. Sacks may be designed to permit moisture to enter or to seal it out. Such hygroscopic chemicals as calcium chloride and quick lime may be shipped with a maximum of protection against moisture. Fresh shredded coconut may be shipped from the Philippines to various parts of the United States without losing its moisture or flavor. Shipping sacks are now manufactured which will stand a 24-hour submersion test and which will withstand the elements for long periods of time when stored outdoors.

**Paper milk bottles.** In 1946 International Paper Company purchased one of the four companies in the United States licensed to manufacture paper milk containers under the Pure-Pak patents of the Ex-Cell-O Corporation of Detroit and created a special division of the company (Single Service Division) to handle the manufacture and
sales. Two plants were acquired—one at Kalamazoo, Michigan, and the other at Norristown, Pennsylvania. An additional plant was constructed at Bastrop and began operations in 1947. These three plants in 1948 were producing 1,500,000 containers per day or around a billion and a half containers per year. The Bastrop plant alone now produces in excess of one million containers per day. International is in the process of building two additional milk container plants—one at Atlanta, Georgia, and the other at Kansas City, Kansas. These two plants which are scheduled to be put in operation in 1951 will increase the production by 45 million Pure-Pak milk containers per month, and there is room at each factory to triple production through the addition of more units on the same plant site.

The Single Service plants of the International Paper Company use heavy bleached Kraft board manufactured at Bastrop and Springhill. The containers are manufactured on automatic machines, printed in one or two colors according to the customer’s specifications, glued on the sides with special adhesives, packed in boxes, and shipped to the dairies. The dairies which use these containers are required to use coating and filling machines provided by the Ex-Cell-O Corporation. These machines sterilize the containers, coat them inside and out with a thin layer of wax to make them liquid resistant and sanitary, convey them to a refrigerated room to harden the wax, fill them with milk,
and seal the filled containers with wire staples ready for delivery to the customer.

Some advantages of using paper milk bottles.
These Pure-Pak milk containers are sanitary in both the manufacturing process and in use. A small tip at the top of the containers is used to open it, and the hand never comes in contact with the fluid contents.

Paper milk containers offer many advantages over the use of glass bottles from the standpoint of transportation, labor, and handling. They are lighter and more convenient than the ordinary glass bottles and do not have to be returned after use. Their use eliminates pick-up and delivery of empties, saves washing the bottles and the cost of and space needed for washing equipment, eliminates loss from bottle breakage, and saves the time and trouble of record keeping on bottle deposits. A paper container filled with milk weighs less than half as much as a glass bottle filled with the same quantity. They are an absolute necessity for use on railroad trains and in industrial plants where the return of bottles is a difficult problem. Paper milk containers also are welcomed by the storekeeper and the milk customer. In January, 1950, the chain stores in one large American city (Springfield, Massachusetts) issued orders that they would no longer handle milk enclosed in glass bottles.

Sizes. Pure-Pak milk containers are manufactured in quart, pint, and half-pint sizes. Special
containers (approximately nine-tenths of a quart) are manufactured for Mexican customers where the government requires that milk be sold in containers of that capacity. Other types of paper milk containers are manufactured by several companies throughout the United States. One is the regular cone-shaped container which is made in stock sizes and sold to the paper merchant. These bottles are ready for use on standard dairy equipment and are closed with regular milk bottle caps.

Although paper milk containers were used extensively in Los Angeles and New York as early as 1929, wide use of the product did not start until 1935. By 1940, around two million containers were used daily in the United States. Figure 8 shows the tremendous increase which paper milk containers have made over the production of glass milk bottles since 1940. The Bureau of the Census does not give manufactured milk bottles a separate classification so the comparison is made with the figures available on milk bottle stock.

Increased use of paper milk bottles. It will be noted that while the production of glass bottles has increased only 50 per cent, the production of milk bottle stock increased 700 per cent between the years 1940 and 1949. This, of course, is not an accurate comparison of the containers in which milk is marketed because old glass bottles are used again and again until broken. It does, however, show a tremendous increase in the production of
Figure 8
Production of
Paper Milk Bottle Stock
and of
Glass Milk Bottles
1940-1949

INDEX
800
700
600
500
400
300
200
100
0
1940 1941 1942 1943 1944 1945 1946 1947 1948 1949

Note: Other glass containers for dairy products included in years 1944 to date.

stock to be manufactured into paper milk containers.

The management of International Paper Company is well aware of the opportunities for development in the milk container field. In the report to stockholders on May 10, 1950, John H. Hinman, President of the company, stressed the increasing importance of container markets especially in the dairy industry.
CHAPTER VII

THE MARKET POSITION OF KRAFT PAPER AND PAPERBOARD

Trends of Consumption

One of the most important factors affecting the growth of the paper industry is the increase in the population of the United States. This growth has been relatively steady over a long period of time. Recent statistics of birth and death rates, however, have caused business men to re­vise their estimates upward on future population figures.

Between 1937 and 1947 the birth rate increased from 17.1 per thousand to over 25 per thousand. In this same period the death rate dropped from 11.3 per thousand to 10.1 per thousand. Table XXXI shows some recent population estimates for the next 25 years.

Increase in per capita consumption of all papers.
Another factor which has a tremendous influence on the total consumption of paper is the per capita consumption. As shown in Figure 9 this trend has been upward for more than 25 years, and if the extrapolation of the trend line into future years is correct, the per capita consumption of paper in 1965 will be in excess of 400 pounds or one-fifth ton per person. An estimated population of 162,633,000 as shown in Table XXXI would thus consume in
excess of 32,000,000 tons of paper per year. This is about 50 per cent more than present production with most mills now operating at nearly 100 per cent of capacity. From these figures it is obvious that new production facilities will be needed if a scarcity of paper and much higher prices is to be avoided. Present mills can expand their capacity to some extent but it is not probable that they can increase production by 50 per cent during the next 15 years.

**TABLE XXXI**

Population Estimates and Forecasts

(Continental U. S. Including Armed Forces Overseas)

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>149,242,000</td>
<td>1965</td>
<td>162,633,000</td>
</tr>
<tr>
<td>1955</td>
<td>154,306,000</td>
<td>1970</td>
<td>166,552,000</td>
</tr>
<tr>
<td>1960</td>
<td>158,563,000</td>
<td>1975</td>
<td>169,805,000</td>
</tr>
</tbody>
</table>

Forecasts are based upon figures of the Bureau of the Census and modified by the American Paper and Pulp Association.


Paper manufacturers are again beginning to realize the need for new capacity. Speaking at a meeting of the Louisiana Foresters' Association in Alexandria, Louisiana recently, Arthur G. Wakeman, executive vice-president and general manager of the Coosa River Newsprint Company,
Figure 9

Trend of Per Capita Consumption of Paper and Board
1917-1949

Note: Apparent consumption is computed by adding United States imports to domestic consumption and subtracting exports. This figure is then divided by the population to get per capita consumption.

stated that the United States would need seven additional mills within the next five years. 1

It will be noticed from Figure 9 that while the per capita consumption varies from year to year the trend is definitely upward. Growth in new uses and increased general business activity bring about a rise in per capita consumption while a decline in general business conditions results in lower consumption. Paper manufacturers must therefore be accurate in forecasting production and sales for the immediate years ahead. New uses for paperboard in the packaging field have increased the per capita consumption of paperboard tremendously. Based upon the 1929 per capita consumption of paperboard (73.1 pounds) the 1949 production would have been 5,510,000 tons. Because the per capita consumption in 1949 had increased to 144.9 pounds the actual production for that year was 9,959,100 tons. Thus in 20 years the consumption per person was almost doubled because of new uses.

The increase in per capita consumption of paperboard does not tell the whole story in regard to the amount used because the average weight of corrugated board has decreased with the greater utilization of light-weight kraft boards. Competition has forced manufacturers also to lighten the weights of other types of paperboard.

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1 Southern Pulp and Paper Manufacturer, XIII (December 15, 1950), p. 68.
Table XXXII shows the number of containers used per day in the United States in 1949. Using a population figure of 150,998,000 at mid-year 1949 the use of 250,653,000 containers per day meant that each citizen consumed 1.66 containers per day. When one realises that tremendous quantities of raw materials and semi-finished products not seen by the consumer, as well as thousands of items of food, clothing, and other consumer goods are shipped in these containers, the figure does not seem so large. Each item of goods consumed or partially consumed during the day uses part of the box in which it was packed and shipped.

Reasons for growth in paperboard consumption. Since the end of World War II paperboard production has been 49 per cent of the total production of paper and board. From 1943 to 1945, the heaviest years of war production for the industry, paperboard comprised from 50 to 55 per cent of the total.

The rate of growth for paperboard tonnage has been much greater than that for paper because of the rapid substitution of paperboard shipping boxes and cartons for wooden boxes and glass and tin containers, as well as the shift from the retail sale of goods in bulk to that of goods enclosed in packages. Over the 90-year period beginning with 1859 the rate of growth for board tonnage

has been 14 times that for paper. In 1859 board tonnage
was 6.4 per cent of the total, in 1925 it was 35.8 per cent
and by 1930 it had risen to 40 per cent. Figure 10 shows
the relation of board to paper production and the total
production of the two products for selected years from
1859 to 1949.3

### TABLE XXXII

**Daily Consumption of Paperboard Containers, 1949**

<table>
<thead>
<tr>
<th>Types of Containers</th>
<th>Daily Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folding Cartons</td>
<td>205,000,000</td>
</tr>
<tr>
<td>Set-Up Boxes</td>
<td>19,300,000</td>
</tr>
<tr>
<td>Fibre Boxes (Shipping)</td>
<td>16,200,000</td>
</tr>
<tr>
<td>Fibre Cans and Tubes</td>
<td>10,100,000</td>
</tr>
<tr>
<td>Fibre Drums</td>
<td>53,000</td>
</tr>
</tbody>
</table>


In 1949, 10,783,000 tons or 53.1 per cent of all paper
and board products was used for packaging. While only
13.9 per cent of the total paper production was used for
packaging, 39.2 per cent of the total board production was
used for this purpose. *Fibre Containers* has computed a
ratio of 2.8:1 for board and paper in packaging. That is,
for every ton of paper used in packaging, 2.8 tons of
paperboard are used for containers, fibre shipping boxes,
drums, etc.4 While it has been pointed out that the

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Figure 10

Comparison of Board and Paper Tonnage 1859-1949

consumption of both paper and board increases with population, it is evident from these figures why the growth rate for paperboard from increases in population alone has been greater than that for paper.

**Louisiana's position in paperboard capacity.** At present (1950) the state of Louisiana with a board production capacity of 2,960 tons per day is exceeded only by the state of Michigan which has a daily capacity of 3,470 tons. Ohio ranks third with a capacity of 2,743 tons and Florida ranks fourth with a capacity of 2,410 tons. As population increases, the mills in Louisiana must increase their capacity or new mills must be constructed if the state is to maintain its high rank in production capacity of board.

**The Nature of Demand for Coarse Paper and Paperboard**

It has been observed in the preceding paragraphs that the long time trend of paper and board production and consumption is upward. There is also present a seasonal variation (Figure 11) and a cyclical variation as shown in Figure 12.

In computing the seasonal variation chart, the war years from 1941 through 1946 were not considered. The chart shows that production of paperboard is heaviest during the second half of the year. The peak is reached in October, while the low production occurs in July, during

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Figure 11

Seasonal Variation of Paperboard Production
(100 per cent = Average Month)

the period of maximum vacations. Paper mills use the low production months of July and December for repairs and maintenance of machinery.

The coarse paper and board industry is a service industry in that it serves other industries in providing packaging materials for their products. When there is a great demand for manufactured goods there is also a great demand for coarse paper and board. The demand for coarse paper and board is thus jointly demanded or derived from the use of other goods. Garver and Hansen describe joint demand as

A condition in which the demands for the several agents are so connected that when one is wanted the others are likewise wanted.

This definition of joint or derived demand applies to the coarse paper and board industry.

Since the demand for paperboard is indirect and is derived from the uses of other goods, the cyclical variations in board production and consumption follow closely the business cycle. It will be seen in Figure 9 that the range above and below the trend line coincides with the high and low points of the business cycle. During the prosperity years of 1924 through 1929 the per capita consumption of paper and board was on the increase and began to fall after the stock market crash in 1929, then continued downward until 1933. It was not until 1936 that

Figure 12

Comparison of Nondurable Manufactures Index with Production of Boards and Coarse Papers:
1934-1948


per capita consumption again reached its peak of 1929. Per capita consumption continued upward with slight variations after 1936. The need for large quantities of board for shipping containers for overseas shipment during the war years brought an increase in the per capita consumption. Heavy demands for consumer goods following the war caused the per capita consumption of paper and board to continue rising until it reached its peak of 356 pounds per person in 1946. As shown in Figure 10 the production of paperboard and coarse papers increased during the war and have continued to increase in the post-war years.

It will also be noticed in Figure 12 that when the business cycle is on the rise the production of board and paper is likewise moving in that direction. There was an exception to this in 1942 when the production of board and coarse paper declined even though the index for nondurable manufactured goods showed an increase over the previous year. This was brought about through the heavy stocking of inventories in 1941 in anticipation of a paper shortage the following year. Instead of a shortage in 1942, the paper and board industries suffered a production drop which was accompanied by a weakness in prices. Production and distribution controls were instituted early in 1943 but in spite of the accumulated inventories the cut-back in consumer production in favor of war production created a shortage of coarse papers. By V-J Day inventories of paper and board were exhausted, and demand
exceeded the supply to such an extent that mills had to sell their paper and board on an allocation basis.

Since 1917, when general statistical data of production in the board industries first became available, one needs only to recite the years of peaks and troughs of the business cycle in order to see when coarse paper and board production was on the rise or decline. Peaks for both manufacturing production and paper and board production occurred in the years 1920, 1929, and 1937. The troughs were found in the years 1921, 1932, and 1938. It can be readily seen from this analysis that the probable course of general business is a matter of utmost importance to the coarse paper and board manufacturer.

Factors Influencing the Price of Coarse Paper and Paperboard

Price in a competitive market is measured by the value of that commodity in exchange. There are, however, two views of value which must be considered and analyzed together—the supply side, or the cost of producing the product, and the demand side which represents what the users of the product are willing to pay for it. Alfred Marshall brought to a climax the differences in the theories which were held by the Classical and the Austrian schools of economics by setting forth this general rule on value:

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As a general rule, the shorter the period which we are considering, the greater must be the share of our attention which is given to the influence of demand on value; and the longer the period, the more important will be the influence of cost of production on value.

In applying this rule it may be deduced that market price, or price in the short run, is determined by the value which various users are willing to place on the product to bring forth the necessary supply, and that cost of production is the principal influence on normal price, or price in the long run. The question has always been brought forth, however, as to the length of the short run.

In general it can be said that short-run price can prevail no longer than it takes for all natural economic forces to come into play. If producers of a certain grade of paper or paperboard are making excessive profits because the supply is scarce and the demand great, new producers will enter the market as quickly as possible. This will increase the supply, and assuming that the demand remains the same, prices will fall toward the cost of production.

Prices cannot for any long period of time remain below the cost of production. If the supply of a given grade of paper should become too great in relation to the demand, price would fall to the cost of production or lower. When profits were reduced, the marginal producer would be forced out of the market, and with the decrease in supply, prices would rise.
**Inelastic supply.** In the paper industry it is difficult to either decrease or increase the supply in a period of weeks or months. It has been pointed out in previous sections of this work that there is some grade shifting as favorable market prices become available for specific kinds of paper. To the extent that present mills can shift to a profitable grade, the supply of paper can be increased to meet an increased demand. The amount of kraft paper and board which could be produced through grade shifting is negligible; however, since mills which have the raw materials and facilities are already producing this type of paper.

Future expansion of the supply can come from increasing the present production of existing mills. If a mill is operating at only a fraction of capacity, production can be stepped up to close to 100 per cent for a limited period of time by putting into use idle machines or by speeding up of present machines. Such seems unlikely at present with kraft mills now operating at between 90 and 100 per cent of capacity. The increased demand and shortage of supply of kraft papers since World War II has already caused many kraft manufacturers to increase production through modernizing and speeding up present equipment. If the production equipment is in proper balance between the barkers and the finishing rooms, paper machines can be speeded up only within certain bounds without having to
add new barkers, digesters, washers, refiners, and other production machinery all along the line.

Increased capacity of a paper mill cannot be brought about by adding a single machine or group of machines in small doses. The addition of a single Fourdrinier machine involves an investment of over a million dollars, and when all of the equipment is installed to feed a new machine the pulp it requires, an expansion through the addition of a new Fourdrinier is a multi-million-dollar project.

New mills can be built and such mills will be constructed, whenever there is good promise of a steady market at profitable prices. It takes around three years, however, from the time a decision is made to construct a new mill until plans can be drawn and the mill constructed and put into operation. Much can change in three years, and the heavy investment necessary causes paper company executives to look at prospects for the future rather than present market prices. Previous experiences resulting in loss from over-expansion have caused paper manufacturers to be wary of too rapid an increase in productive capacity.

All of the analysis thus far has been on the supposition that there would be an increase in the demand for kraft paper and board. Suppose the demand for this paper and board should decrease. What would be the effect on the supply? Could paper manufacturers cut their production and reduce the supply, or would there be a glutted market with still lower prices?
Because of the high fixed capital investment it is necessary that a paper mill operate at a high percentage of its capacity if the production is to be profitable. Although variable costs can be reduced by cutting back board production, fixed costs remain relatively the same. As production is decreased fixed costs make up a greater proportion of the total costs and thus unit cost of production increases at the same time that market price is decreasing. A single mill might even operate at a loss for a given period of time as long as it could pay its variable expenses but it could not do so for a great length of time. Marginal, high-cost producers would have to go out of business. These firms would, however, be sold at bankrupt prices and although the previous owner would lose heavily, the new owners with good management could enter into production as low cost producers because of their relatively small fixed capital investment. Paper mills are scrapped, if at all, only when the equipment becomes obsolete. Once a paper mill is put into operation it continues to produce some kind of paper. Ownership may change but the mill continues to produce.

From the above analysis it can be seen why paper executives are so careful in their planning before undertaking expansion. It may be concluded that the supply of coarse paper and board is relatively static, and that any changes in the supply must come about gradually and over a
period of years rather than months. Elasticity of supply
of kraft paper and board is less than unity, i.e., any
change in price will result in a less than proportionate
change in the quantity offered by suppliers.

Since the Korean war the demand for coarse papers
and substitutes has increased because of the packaging
needs of the armed services and because of inventory build­
ing. The increased demand and development of serious
shortages, without a corresponding increase in the supply,
has caused the price of nearly all kinds of paper to rise.

Manufacturers who had faced increased material and labor
costs previously and who had tried to hold prices steady
no longer hesitated to raise prices as demand increased.

Since kraft manufacturers are already operating at close
to 100 per cent of their capacity any large increase in
supply from present producers is unlikely. Unless the
government allocates steel for construction of new kraft
paper and board mills any increase in the supply of wrap­
ing paper and board must come from sub-marginal producers
entering the field of coarse paper production through
grade shifting as the price becomes high enough to pay
their relatively high cost of producing these papers. If
price control is invoked on coarse papers and boards these

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6 Since the Korean war began on June 26, 1950,
several increases in price have taken place. In October
and November prices for all paperboards and kraft liners
advanced $7.50 to $10 per ton. Newsprint advanced $6 to
$10 per ton.
Submarginal firms cannot enter into production of coarse papers, and even greater shortages of packaging papers will prevail. Submarginal firms would not produce the best kraft paper because they are not equipped for such a process, but they would produce inferior bogus wrappings and jute boards which could serve in an emergency for home consumption as the armed services call for greater quantities of board for packaging overseas shipments. As kraft mills switch to the production of a higher percentage of board, kraft paper production will fall with resulting shortages in wrapping and bag papers.

Even as price controls are invoked, the costs of producing paper seem destined to rise, and if the present margin between selling price and total costs of production and selling draw closer together the present marginal producer can no longer pay his total costs. As more and more men are called into the armed services and as woods workers migrate to the more profitable war-plant work, higher wages must be offered to woods workers to keep men on the job. This would be true even if wages as well as prices were frozen because labor will tend to seek the higher paid jobs, and woods workers leaving for the armed services and for war jobs could not be replaced except at higher wages.

Paper manufacturers also face the problem of scarcity of metals for machinery maintenance and higher costs of
chemicals. Price increases have already taken place for sulphur, salt cake, resins, casein, and other raw materials used in the manufacture of paper. Paper manufacturers use large quantities of copper, aluminum, and other metals which are in short supply.

Inelastic demand. The demand for coarse paper and paperboard is relatively inelastic, i.e., any change in price will result in a less than proportionate change in the quantity taken. Albert Meyers in speaking of inelastic demand says:

As the total amount spent decreases with a decline in price (or increases with a rise in price) the elasticity of demand is less than unity; the demand is inelastic.

Garver and Hansen cite the following conditions which affect elasticity:

1. Individual demand is usually elastic for luxuries and inelastic for necessities.

2. The individual demand for a good is likely to be elastic if other goods can be substituted for it or if it can be substituted for other goods.

3. The demand for a good tends to be more elastic if it has a variety of uses than if it can serve us in only one capacity.

4. The demand for any commodity is likely to be inelastic at very high and at very low prices.

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5. Demand is likely to be inelastic when consumption is clearly affected by habit and custom.

Out of the five conditions stated above which tend to make demand for a good inelastic, paper meets four of them. It is impossible for most durable and non-durable goods to safely reach the consumer without proper packaging. Paper and paperboard have proved to be not only the cheapest type of packaging, but also the best. Thus, paper and board are a necessity and cannot be easily substituted. The cost of paper and paperboard packaging is relatively low when compared with the value of most of the products they contain.

The price of wood and metal shipping containers is so much higher than that of paperboard containers that paper and board could increase a great amount in price before other containers would be used. Kraft wrapping paper, bag paper, and corrugated shipping containers have proved their worth so well, that their use is now influenced to a great extent by habit and custom. Of course, high prices and scarcity will make it difficult to open markets for new uses and new products. Just as the war causes the prices of paper and board to rise, however, it has the same effect on the metal, wood, and plastic industries, and the scarcity of steel may make it impossible to buy steel containers.
Rival supply. When considering a shift from one type of coarse paper to another and from one type of paperboard to another it would seem that demand would be relatively elastic. Both kraft and jute liners (made from waste papers) are used in the manufacture of fibre shipping boxes. An examination of the price and consumption of these two products since 1946, however, shows that there has been no relation between price and the quantity of each which is consumed. Between 1946 and 1949 the average annual price delivered in Chicago of kraft Fourdrinier liners rose from $73.60 to $102.02 per ton, an increase of 38 per cent. The total consumption per year of these liners rose from 1,385,000 tons to 2,006,600 tons, an increase of 45 per cent. During the same period the price of jute liners rose from $71.50 to $77.13, an increase of only 8 per cent, while consumption fell from 1,375,600 tons to 867,000 tons, a decrease of 38 per cent.

If both kraft and jute liners will accomplish the same purpose and one can be made to serve just as easily as the other, it would seem that the price for each would have to maintain a close relationship. Otherwise, there would be a shift in the relative consumption of the two types. Kraft is still preferred, however, for strength and for printing qualities, and thus kraft will continue to be used even though its price is higher than that for jute.
Figure 13 shows the comparative prices for kraft Fourdrinier linerboard and jute linerboard between the years 1939 and 1949, and Figure 14 shows the comparative consumption of the two products. Because of the superior quality and light weight of kraft liners, jute consumption had been declining prior to 1938. From 1939 to 1946 as the United States approached and fought World War II, jute liner consumption fluctuated widely up and down according to the demand for container boards and the relative availability of kraft liners. During the years when the demand for liners was great and the capacity of kraft mills was not sufficient, jute filled the gap. During the war the Office of Price Administration raised jute price ceilings to relatively high levels to encourage production in marginal mills that otherwise might not have produced linerboard.

After the war, both kraft and jute continued to rise in price, but when new Fourdrinier kraft capacity became available in 1947, 1948, and 1949, both the price and consumption of jute declined while both the price and production of kraft continued to rise. This would seem to indicate a preference for kraft even though the price difference became greater.

The principal variable in the manufacturing cost of jute liners is the price of waste paper. When the price of jute declined during the years 1947-1949 the price of
Figure 13

Comparison of Average Annual Containerboard Prices 1939-1949

**Figure 14**

**Comparison of Consumption of Jute and Kraft Liners: 1939-1949**

old corrugated waste dropped from $37 to $12 per ton. If jute board is to be produced, the price of waste must be high enough to make collecting and packing a profitable operation. The price of jute will also have to be sufficient to enable jute manufacturers to pay this higher price for waste, otherwise jute liners will not be manufactured.

Kraft and jute linerboard are in rival supply. Likewise, this same condition exists for the various kinds of corrugated board—kraft, semi-chemical, and straw. Rival supply occurs where two or more goods are competing for the same use or demand. Garver and Hansen say: 11

When two or more producers goods compete among themselves to supply the same consumers goods that still can be regarded as substantially the equivalent of each other, they are said to constitute rival supplies for the finished good or goods in question.

Rival supply is a condition in which the supplies of several goods are so connected that when one is wanted (for this particular use) the others are not wanted.

As pointed out by Garver and Hansen the conditions that determine whether goods will compete against each other and whether its rival will be used are: 12

1. Technical requirements
2. Tastes and whims of the consumer
3. The price at which goods can be obtained in the market.

12 Ibid., p. 170.
The potential substitution of another good affects price in three ways:\textsuperscript{13}

1. When the demand for a good increases, the existence of a rival supply may prevent its price from rising as high as it would have risen had not the substitute been available.

2. Technique may bring in a competitive good.

3. The demand for a good may be increased by the discovery of a new use for it.

Summary of supply-demand factors influencing price.

In summarizing the nature of supply, demand, and price of coarse paper and paperboard, it may be seen that many factors are involved. It has been pointed out that both the supply and demand of coarse papers is relatively inelastic. This condition would seem to lend itself to monopoly and high prices because any change in price would result in a less than proportionate change in the quantity taken and in the quantity that would be placed on the market. On the other hand, rival supplies of competing paper products tend to hold the price of any one coarse paper product in check, because if the price of any one coarse paper product which had a rival should become too high, demand would be shifted to the other product.

Technical requirements and the tastes and whims of the consumer seem to favor kraft liner, but if the price of the product should get too far out of line, demand might shift to jute.

\textsuperscript{13} Ibid., p. 172.
It will be noticed in Table XXXIII that while the index on the price for paper exclusive of newsprint and for paper including newsprint is below the BLS wholesale commodity price index, the index for paperboard is above for every month except July. This indicates that in 1950 the price of paperboard is higher in proportion to the 1939 price level than is the price of other types of paper.

TABLE XXXIII

Comparison of Wholesale Commodity Price Index With Index of Average Value Per Ton of Paper (Average for 1939 = 100)

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<tr>
<td>APPA Ave. Value</td>
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<td>Per Tons:</td>
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<tr>
<td>Paper exclusive of Newsprint</td>
<td>196.4</td>
<td>197.1</td>
<td>197.6</td>
<td>197.2</td>
<td>198.7</td>
<td>197.9</td>
<td>198.1</td>
<td>206.1</td>
</tr>
<tr>
<td>Paper including Newsprint</td>
<td>197.6</td>
<td>198.1</td>
<td>198.7</td>
<td>195.8</td>
<td>195.8</td>
<td>197.6</td>
<td>193.2</td>
<td>205.3</td>
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<tr>
<td>Paperboard</td>
<td>211.2</td>
<td>209.1</td>
<td>209.4</td>
<td>208.7</td>
<td>208.1</td>
<td>208.0</td>
<td>207.0</td>
<td>218.6</td>
</tr>
<tr>
<td>Paper including Newsprint and Paperboard</td>
<td>200.8</td>
<td>200.4</td>
<td>201.4</td>
<td>199.5</td>
<td>199.0</td>
<td>200.2</td>
<td>202.1</td>
<td>206.4</td>
</tr>
<tr>
<td>BLS Wholesale Commodity Price Index</td>
<td>196.5</td>
<td>198.1</td>
<td>198.1</td>
<td>198.3</td>
<td>202.2</td>
<td>204.0</td>
<td>211.3</td>
<td>215.7</td>
</tr>
</tbody>
</table>

Source: *Monthly Statistical Summary, American Paper and Pulp Association (September, 1950), p. 7*
The Nature of Competition in the Kraft Industry

Earlier in this chapter it was stated that in a competitive market the value in exchange is determined by the demand and supply. It is known, however, that a condition of pure competition is present for only a relatively few commodities.

Classification of the market situation. John Ise in classifying market situations with respect to the relative amounts and character of the monopolistic elements involved lists the following groups:

I. Competitive
   A. Pure
   B. Perfect
   C. Monopolistic Competition

II. Monopolistic
   A. Monopolistic Elements on the selling side
      1. Monopoly, where there is only one seller
      2. Duopoly, where there are two sellers
         a. Selling identical products
         b. Selling differentiated products
      3. Oligopoly, where there are several sellers
      4. Monopolistic competition (appears also in competitive situations)
   B. Monopolistic elements on the buying side
      1. Monopsony, where there is only one buyer
      2. Duopsony, where there are two buyers
      3. Oligopsony, where there are several buyers

Professor Ise further states that "Oligopoly prevails in industries in which only a few producers are credited

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Each of these manufacturers claims some advantage for his product over that of other manufacturers, but when an impartial comparison is made of the papers and boards of the same type and weight manufactured by the various companies, it is found that the products are relatively homogeneous. There is only a small degree of product differentiation, if any. All papers and boards must conform to weight and test specification provided by the trade and by the carriers.

15 Ibid., p. 142.
When products are homogeneous, any change in price by a leading manufacturer is bound to affect the price of competitors to a greater extent than would be the case if there were a great degree of product differentiation. John F. Due says:

"If products are homogeneous, or nearly so... price changes by firms are more certain to produce substantial effects upon sales of competitors than if differentiation is strong; thus immediate reactions by the competitors are very likely to occur."

International Paper Company serves as a price leader on most lines of kraft paper and board. A price change by International is almost certain to be followed by other producers. Whether this comes about through spontaneous coordination or through outright price agreements has never been determined.

Professor Due distinguishes between complete and limited oligopoly:

"If the feeling of mutual interdependence among oligopolists is sufficiently strong, maximum profits for the group will be realized; to such a situation the term complete oligopoly may be given..."

"More frequently, however, oligopoly takes a limited form; firms are conscious of the effects of their policies upon those of other firms but the feeling of mutual independence is not sufficiently strong to allow action which will maximize profits of the firms of a group. When agreements are made,..."

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they may involve methods which will lessen the
degree of price competition; if prices are actually
agreed upon, the divergent interest of the various
firms may prevent the acceptance of the group
profit maximization figure.

There has been no attempt on the part of the manu-
facturers of kraft paper to hold up prices by limiting
production of existing mills. Such has not been necessary
because there is not sufficient productive capacity to fill
the demand for kraft. Many mills have expanded their
capacities, and two new kraft mills in Florida and a new
Chemfibre mill in Alabama are now in process of
construction.

Paper executives could be considered by some as over
cautious in building new mills, but it cannot be said that
this is because of a desire to hold down the supply. Mak-
ing proper analysis of the market situation and using good
judgment before investing millions of dollars certainly
cannot be condemned in light of the unhappy situations
which have previously taken place from over-expansion in
the paper industry.

Some reasons for hesitancy in expanding production.
Prior to World War II the paper industry in the South
underwent a tremendous expansion. Within 18 months dur-
ing 1938 and 1939 a million and a quarter tons of new
production were added to the kraft industry. Some 900,000
tons of this increase in annual capacity was for the
manufacture of containerboard alone.
According to Alan G. Goldsmith, three major factors govern volume expansion:

1. Normal increase in consumption based upon increase in population, increase in literacy and the standard of living and more economical movement of commodities.

2. The ability of the industry to produce more efficiently in better qualities and at lower costs, articles which have been manufactured by another industry.

3. Entirely new uses developed by the industry as a result of the progressive growth of civilization.

During the late 1930's all of these conditions were present. The paper industry is not dominated by patent controls which would curtail production. Expansion, therefore, depends solely upon the judgment of businessmen who have or who control capital sufficient to establish a paper mill. Many companies moved almost simultaneously to meet this situation. Expansion had to be in terms of units that would be competitive, and each new paper machine increased capacity by 300 to 400 tons per day. Prior to the time Germany attacked Poland in 1939 stock on hand exceeded unshipped orders as shown by Figure 15. Prices were weak, and paper manufacturers began to talk of over-expansion. It was thought that several years of growth would be necessary before a balance of supply and demand would be reached.

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18 Speech given at Fifth National Farm Chemurgic Conference, March 30, 1939.
Figure 15

Unshipped Orders and Stock on Hand at Mills
Expressed as Per Cent
Of Average Monthly Capacity

Source: Monthly Statistical Summary,
Over-expansion in Canada several years earlier had resulted in low profits and finally bankruptcy for many Canadian firms. This, along with the fact that in 1932 the paper industry in the United States had operated at 58 per cent of capacity, was well remembered. Net profits after taxes averaged only 2 per cent as compared with 4 per cent for all manufacturers. Marginal paper mills went into the hands of the receiver.

A paper mill must obtain enough business to keep it operating somewhere near its practical capacity. The combination of high fixed charges and a comparatively low-cost product necessitates high volume.

The paper industry is vigorously opposed to the policy which our government has been following as its foreign policy has changed from one of tariffs and protected industries to a policy which leans in the direction of free trade. In many cases the paper industry feels that it has been a victim of reciprocity.

Under the Smoot-Hawley Tariff Act of 1930 the rate on plain paperboard was 10 per cent with a proviso which imposed on any imported board a rate of duty equivalent to that levied by the country of origin. The Canadian rate on paperboard was 25 per cent and duty was collected on Canadian imports at this rate. In the Reciprocal Trade Agreement Act in 1934 this countervailing duty rate was canceled. The tariff was further reduced to 7½ per cent during the Reciprocal Trade Agreements negotiations at
Annecy, France in 1949. The conference at Torquay, England, which is now in progress has under consideration a plan to lower this tariff to 5 per cent.

The tariff of 30 per cent on wrapping paper set by the Act of 1930 was reduced to 25 per cent in the Trade Agreement with Sweden in 1935. The trade agreement with Finland in 1936 established two classifications on wrapping paper. The duty of 25 per cent ad valorem on sulphate wrapping paper was reduced to 20 per cent. Other types of wrapping paper fell under the classification "other wrapping paper" with a duty of 25 per cent. In an agreement with the Netherlands effective February 1, 1936, a separate classification was set up for "straw wrappings" and the duty reduced to 15 per cent.

Newsprint has been on the free list since 1913.

The tariff rates on paperboard given above are in actual practice misleading. Containerboard in competitive weights is .009 inches in thickness. To be classified as paperboard for tariff purposes, the product must be .012 inches in thickness. If less than .012 it falls under the heading of "paper not specifically provided for" and is dutiable at 30 per cent. Pending negotiations at Torquay, England, may reduce this rate to 15 per cent.

Canadian paper mills since 1947 have developed a new type of corrugating material with a kraft base which has a thickness of .012 and is thus dutiable at 7½ per cent.
This material is easily compressed to the standard thickness of .009 after it is exported into the United States.

The new Canadian corrugating material is made from wood not suitable for manufacturing newsprint. Canada has enormous quantities of jack-pine, aspen, and other hardwoods which paper mills are required by law to use in conjunction with spruce. Because of the cheaper material used in its production and other cost factors, Canada has been able to sell this product at approximately $76.50 per ton f.o.b. mill. With a duty rate of 7½ per cent and production costs at least 10 per cent below those in the United States, Canada is able to compete with Southern mills in the sale of such board in the Northern half of the United States, even without taking into consideration the 10 per cent depreciation in the value of the Canadian dollar.

The success of the Canadian product in the United States market and the reduced tariff have already brought about plans for the expansion of the kraft industry in Canada.

George B. Gibson, Managing Director of the Fourdrinier Kraft Board Institute,19 testified before the Committee for Reciprocity Information when it was taking testimony prior to the Torquay Conference:20

19 The Institute represents mills in ten southern states which produce 90 per cent of the Fourdrinier Kraft Board manufactured in the United States.

We state here today that with the existing differentials on freight rates investors can justify the building of Canadian mills for the production of this product that can take away or seriously undermine market operations of our own industry north of the Mason-Dixon Line, where most of the consumption takes place.

At the same hearing George Olmstead, Jr., who appeared in behalf of the American Paper and Pulp Association, asked for the following: 21

1. No reduction in United States rates at this time.
2. A raise in some rates.
3. Some lowering of foreign duties on American paper products under the reciprocal trade agreements.

He stressed the point that foreign producers have lower costs from the wood stands to the final product chiefly because of lower wage costs.

Another fear of the paper industry is that it may become more profitable for the Scandinavian countries as well as Canada to make into containerboard and corrugating board the pulp they are presently shipping the United States for use in non-integrated mills. There is already a shortage of market pulp for these mills, and any further reduction in the supply might result in many of these mills shutting down. In 1947 and 1948 the United States imported 2,322,460 and 2,176,111 tons of wood pulp respectively.

It is not the purpose of this paper to discuss the advantages and disadvantages of free trade from an economic

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standpoint, but the statement that tariff reduction could have a serious effect on the paperboard industry does seem to have some merit. The pulp and paper mills require machinery, equipment, and supplies from many other industries—from forests, mines, steel mills, chemical manufacturers and many others, all of which pay good wages. Our whole economy has been geared to a protective tariff and to a higher wage scale than that paid in other countries. To reduce or possibly eliminate the tariff entirely for certain specified products manufactured in large quantities by other countries could have a serious effect upon certain segments of our economy.

Paper executives know only too well the history of the United States newsprint industry since the tariff was removed in 1913. Paper men say we exported our newsprint industry to Canada and production and import figures for the United States show their statement to be correct.

Table XXXIV gives a comparison of production and imports for all kinds of paper and for newsprint and paperboard for selected years running from 1909 to 1948.

After newsprint was put on the free list in 1913, the United States production increased from 1,313,284 tons in 1914 to a peak of 1,563,318 tons in 1925, an increase of only 19 per cent. During this same period imports of newsprint climbed from 278,406 tons to 1,448,425 tons, an increase of 421 per cent.
The above figures do not tell the whole story. After 1935 production of newsprint in the United States declined still further, while imports continued to rise. In 1948 the United States produced only 875,760 tons of newsprint while it imported 4,395,572 tons, and exported 27,661 tons. In other words, in 1948 the United States imported 83 per cent of its newsprint supply. Most of these imports came from Canada. In 1948, 4,125 thousand tons or 73 per cent of the total consumption of newsprint in the United States was imported from Canada.

Of course, it must not be assumed that the tariff was the only cause for moving the newsprint industry to Canada, but the removal of the duty, along with other factors, did create a situation which fostered the construction of new mills in Canada. There were many excellent sites for paper mills in Canada which included vast government-controlled forests and large water power sites which were in close proximity to the large New England markets. Cheap waterborne transportation made the principal markets of the United States easily accessible.

At the time International Paper Company built its newsprint mill at Three Rivers, Quebec, in 1920 technology had not developed a method of producing newsprint from resinous southern pine.

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TABLE XXXIV

Comparison of United States Production and Imports of Paper:
All Kinds, Newsprint, and Boards Selected Years 1909-1948
(In Tons of 2000 pounds)

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<thead>
<tr>
<th>Year</th>
<th>All Kinds Production</th>
<th>Imports</th>
<th>Newsprint Production</th>
<th>Imports</th>
<th>Boards Production</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>4,121,495</td>
<td>35,051</td>
<td>1,168,098</td>
<td>18,528</td>
<td>883,088</td>
<td>A</td>
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<td>5,152,705</td>
<td>316,219</td>
<td>1,313,284</td>
<td>278,406</td>
<td>1,291,805</td>
<td>A</td>
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<td>1920</td>
<td>7,185,122</td>
<td>787,421</td>
<td>1,511,968</td>
<td>729,869</td>
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<td>43,222</td>
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<td>9,001,742</td>
<td>1,541,680</td>
<td>1,563,318</td>
<td>1,448,425</td>
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<td>1,226,086</td>
<td>2,297,552</td>
<td>3,978,577</td>
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<td>2,815,555</td>
<td>2,343,315</td>
<td>2,383,315</td>
<td>4,623,633</td>
<td>24,643</td>
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<tr>
<td>1940</td>
<td>14,483,709</td>
<td>3,625,982</td>
<td>1,056,304</td>
<td>2,762,537</td>
<td>6,379,074</td>
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<tr>
<td>1945</td>
<td>17,370,965</td>
<td>2,753,211</td>
<td>725,475</td>
<td>2,668,799</td>
<td>8,913,736</td>
<td>50,866</td>
</tr>
<tr>
<td>1946</td>
<td>19,277,667</td>
<td>3,625,982</td>
<td>772,797</td>
<td>3,491,769</td>
<td>9,504,235</td>
<td>41,867</td>
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<tr>
<td>1947</td>
<td>21,114,000</td>
<td>4,121,400</td>
<td>633,038</td>
<td>3,957,333</td>
<td>10,408,982</td>
<td>58,858</td>
</tr>
<tr>
<td>1948</td>
<td>21,921,757</td>
<td>4,581,811</td>
<td>875,760</td>
<td>4,395,572</td>
<td>10,773,407</td>
<td>75,412</td>
</tr>
</tbody>
</table>

(A) Not shown separately.

Although the northern part of the United States did have available a sufficient quantity of spruce for current operations, it was thought by industry that the vast quantities available in Canada made a better location for new sites from a long-range point of view.

International Paper Company concentrated its development in the United States on the purchase and construction of new kraft paper and board mills. These products rode to market behind a tariff wall, and new uses were continually being developed. The tariff, of course, was not the only reason for the rapid development of southern kraft. Many other reasons were explained in Chapters II and III. The tariff, however, was a contributing factor.

Imports of paperboard have been small compared with total imports of paper, and particularly newsprint, as shown in Table XXXIV. Imports of kraft board have been increasing, however, since the tariff on board was lowered and since Canada developed the new corrugating material which is dutiable as paperboard (0.012). Around 30,000 tons per year of this board alone are being imported into the United States.

The contrast between the decrease in the production of United States newsprint and the great increase in the production of paperboard will be noted in Table XXXIV. While production of newsprint in the United States decreased 33 per cent between the years 1914 and 1948, (from 1,313,284 tons to 875,760 tons) and imports increased 1,480 per cent
(from 278,406 tons to 4,395,572 tons) board production increased 834 per cent (from 1,291,805 tons to 10,773,407 tons).

Technology now permits the pulping of southern pine for making newsprint. Why hasn’t there been construction of newsprint mills in the South by established companies rather than the construction of projects which are publisher-owned and controlled? Alban R. Casper testified before the House Judiciary Subcommittee studying the newsprint industry, that low profits and uncertainty on the part of manufacturers as to the extent and duration of the newsprint shortage are the factors which held back expansion. He declared:

The profit margin in the newsprint industry in the United States has not been attractive... In the last 20 years United States mills have been liquidated or have turned to making more profitable grades of paper. This can be attributed to the small return offered to equity capital. Any substantial increase in the production of newsprint will depend on the earnings of the industry.

It was explained in Chapter III that two southern newsprint mills had been constructed. These two mills—one at Lufkin, Texas, and the other at Childersburg, Alabama, manufacture around 250,000 tons of newsprint per year. A third mill is under construction at Naheola, Alabama, to manufacture 200,000 tons of newsprint and linerboard.

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Like the Childersburg project, the mill at Naheola is a publishers' cooperative venture with the publisher stockholders taking most of the newsprint tonnage.

To date (1951) the major paper companies of the United States have not constructed a newsprint mill in the South, even during the time when the United States is "begging" for increased capacity. There must be good reasons for this, and some of them have been explained in this section.

There has been no attempt here to show whether the protective tariff on certain types of paper has been good or bad from an economic point of view. Rather, there has been an attempt to show the effect which government policy and the tariff have had on certain segments of the paper industry. The fear that a further reduction in the present duty rate on paperboard will serve to expedite the migration of at least a part of the kraft paper industry to Canada does cause business executives to hesitate on the construction of new mills at a time when other factors would seem to call for a great increase in productive capacity.

The market situation following World War II. During the 1930's there was great competition among producers of paper and paperboard with increased research and sales effort to develop new products and find new uses. After war began in Europe in 1939 mills found themselves "swamped" with orders as a result of scare buying and building up inventories. After Pearl Harbor, (December 7, 1941) orders slackened during the period of transition from Peace to War.
Beginning late in 1942 there was renewed demand for consumer goods, and this, along with large orders for the Armed Services, kept mills running close to capacity. Paper and paperboard was loaded into cars for shipment as it came off the machines. Some mills were over a month behind on orders until 1946, and there was a scarcity of wrapping and bag papers for civilian use.

During the years 1946, 1947, and 1948, mills produced at a record pace, but still were not able to catch up with the volume of orders. The year 1947 was one of record production. The monthly production record exceeded that for 1946 six times during the year and total production exceeded by nine per cent that for 1946. Productivity rose from 114 pounds per man in 1946 to 117 pounds in 1947.24

During these years of peak demand with a sellers' market following the war, orders simply flowed into the mills and production had to be allocated to customers. Some mills were not bothered about improving their merchandising policies until it was seen that a buyers' market was returning. A buyers' market began to return during 1948 and by April 1949, many mills had to increase their selling effort and begin to think more about serving the interests of their customers. Beginning in April 1949, and for about six months thereafter some mills in Louisiana had to slow

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down on production to keep goods from piling up in limited warehouse space.

The first noticeable change in the market to meet increased competition was an improvement in the quality. In 1949, it was possible to secure improved qualities of paper, paperboard, and shipping containers without delay. There was a sharp decrease in the prices of inferior grades (Figure 13) while the better grades remained relatively steady. Management began to give more attention to tightening up on hidden costs like indirect labor. Also, more efficient operation was sought through installation of more mechanical handling equipment, through reduction of waste, and through improved supervision and training of production workers and salesmen. Beginning in the latter months of 1948 and the early part of 1949, there was a drop in the price of all wholesale commodities. As shown in Figure 16, paper prices also declined. During this period of recession, as has been true in the past, customers tended to live on inventories and reduce orders to the mills in the hope of still lower prices.

A few high-cost small mills, some of which were brought into production during the war, closed operations. These were largely non-integrated mills which had relied upon purchases of European pulps which were too high for them to meet the competition of integrated mills.  

Figure 16

Comparison of Wholesale Commodity Price Index with Index of Average Value per Ton of Paper (Average for 1939 = 100)

Effect of the Korean War on Demand

Following the outbreak of the Korean war on June 26, 1950, fear of shortages and higher prices caused consumers to accumulate inventories. This placed additional pressure on production and caused prices to rise more rapidly than would have been the case had it not been for scare buying. By November 1950, kraft wrapping paper was moving in the gray market at premium prices as some large manufacturers deferred a larger proportion of their production to bag and shipping sack paper. Although representative tonnages of wrapping paper were still being made, established coarse paper merchants in some parts of the United States were almost completely cut off from supplies. There was a shortage of wrapping paper for Christmas shopping in New York. Some coarse paper merchants who formerly had received large tonnages, now received only a token shipment of the quantity ordered.

The Role of the Paperboard Industry in National Defense

At the beginning of World War II the United States government did not realize the importance of paperboard in prosecuting to completion a modern war. After the war had been fought, however, it was recognized as one of the most vital elements in a war economy.

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The paperboard industry provided the armed services, as well as most civilian needs, in spite of great handicaps which were imposed upon production in the early years of the war. Since pulp supplies were cut off from Europe, mills in the United States had to rely on domestic pulp production and imports from Canada. Paperboard was not recognized as essential and the government considered a plan of curtailing production. A few selected mills were to be operated; the rest were to be closed.

Some mills actually were closed for a portion of the war. While the government was following this policy, woodworkers, paper mill workers, and box plant workers took jobs in recognized war plants and many were drafted into the armed services.

Need for and development of special packaging for military use. It soon became evident to the armed forces fighting overseas that a new type of packaging was necessary. Peace-time containers which were at first used, were not meant for the rigors of war. Complaints about the performance of domestic type paper boxes which the army had obtained in large quantities came from the South Pacific in 1943. Such boxes were not made of materials and design which permitted them to be floated ashore or left for weeks on open beaches.

A container had to be designed which could withstand temperatures of 120 to 140 degrees F. in the holds of ships, stand rough handling and high humidity conditions, as well
as to be suitable for submersion in salt water without falling apart.

The paperboard industry which had been conducting continuous research for more durable containers and new uses developed a new kraft board (V-Board) which was far stronger and more water resistant than any board previously used. This board was made by introducing a layer of asphalt between layers of kraft board which had been given unusual wet strength properties. Research engineers developed new adhesives and the methods to seal these adhesives so that V-Board could be manufactured into a high water resistant container for shipments of supplies to the Armed Services fighting overseas. More than a billion V-Boxes were produced by the paperboard and fibre box industries during World War II, and without these, transportation of supplies to the troops on the fighting fronts throughout the world could not have been accomplished without much greater losses of supplies.

Tremendous losses occurred from inadequate packaging during the years of the War. Fibre Containers\textsuperscript{27} gives some calculations which show clearly the seriousness of these losses:

\begin{quote}
The economics here are simple. If $10\text{ billion}$ of war and lend-lease goods went overseas in one year, with a $20\%$ loss factor due to inadequate packaging, the loss obviously would be $\$2\text{ billion}$.
\end{quote}

\textsuperscript{27} August, 1950, \textit{op. cit.}, p. 85.
If through proper paperboard supplies that loss factor could have been cut to 10% or $1 billion, the saving would have been more than the value of the yearly output of paperboard mills during the war—nearly double in fact.

In addition to these special V-Boxes for overseas shipments huge quantities of fibre boxes were needed for shipments of raw materials and parts for industrial use. For instance, empty shell cases were packed into paperboard boxes with dividers to protect them from nicks and dents. These shell cases were shipped from the factory to all parts of the country for loading. The loaded shell ready for firing was then placed in a fibre tube, capped at each end, and shipped to the fighting front.

The manufacture of V-Board required from 30 per cent to 100 per cent more materials per box than did comparable packaging for civilian consumption. This made the paperboard industry a vital chain in the industrial production necessary for national defense. Such needs were not recognized early enough and much damage had been done before the government realized the importance of the paperboard industry. To supplement the depleted labor force in the woods, prisoners of war were used wherever possible, and more efficient mechanical methods of cutting wood were developed. The public was urged to save waste paper. Scarce pulp and paperboard were allocated, board was diverted to the manufacture of V-Boxes, and uses of some paperboard products were sharply curtailed.
Table XXXV shows the end uses of paperboard during the first half of 1944 as determined from a study made by the War Production Board. Near the end of the war, 55 per cent of the authorized total production of paper and board was devoted to paperboard. Out of this total production of board 41.4 per cent was given to containerboards and 23.6 per cent to folding box boards. 28

It will be noticed in Table XXXV that 79.6 per cent of the total containerboard and 78.2 per cent of the folding box board production during the first half of 1944 was utilized for war.

Other contributions during World War II. The kraft paper industry served the national defense in other capacities besides the manufacture of V-Board and V-Boxes. Research engineers of International Paper Company developed the first nitrating pulp to be made successfully on a commercial scale from kraft pulp, and during the war this pulp was manufactured at the Louisiana Mill in Bastrop.

When plans were being laid for the invasion of the European continent, General Dwight D. Eisenhower requested a superior map paper which would not be easily torn after creasing. Ordinary map papers pulped in water became ink-smeared from body moisture and heat. A high quality map paper was developed and manufactured in large quantities at

28 Fibre Containers, XXXV (August, 1950), op. cit., p. 85.
the Springhill mill of the International Paper Company. Maps made from this paper could be immersed in water, creased, and subjected to treatment which other papers could not endure.

**TABLE XXXV**

End Uses of Paperboard During First Half of 1944

<table>
<thead>
<tr>
<th>Board and Paper Classes</th>
<th>Class I War</th>
<th>Class II Indirect War</th>
<th>Class III Civilian Maintenance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containerboards</td>
<td>69.3%</td>
<td>10.5%</td>
<td>20.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Folding Boxboards</td>
<td>19.9%</td>
<td>58.3%</td>
<td>21.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Set-up Boxboards</td>
<td>18.4%</td>
<td>27.4%</td>
<td>54.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Cardboard</td>
<td>30.4%</td>
<td>26.9%</td>
<td>42.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Building Board</td>
<td>52.4%</td>
<td>43.1%</td>
<td>4.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Other Board</td>
<td>54.8%</td>
<td>10.9%</td>
<td>34.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Notes:

Class I includes uses by Government Agencies, Foreign Economic Administration, and War Plants.

Class II includes uses for Communication, Transportation, Public Service, Agricultural Products, Drugs, and Construction.

Class III includes uses for Manufactured Civilian Products, Retail and Household, and Miscellaneous.


Modern Government-industry cooperation. The importance of the paperboard industry was proved during World War II and steps have been taken since by both government and industry to assure that war-time needs will be met.

The National Securities Resources Board, a permanent civilian organization composed of the Secretaries of Agriculture, Commerce, Defense, Interior, Labor, and Treasury, came to the conclusion in 1949 that paperboard production in any future war should be maintained at a maximum level.
The Munitions Board, Production Allocation Manual, No. 90-1, published in March, 1950 and designed to facilitate production planning for emergency procurement, classifies pulp, paper, and paperboard materials in Category II, i.e., production that is basic in nature or is a potential bottleneck to wartime output of material.

Industry is working with the Munitions Board on packaging requirements through the Munitions Board Packaging Industry Advisory Committee which held its first meeting on June 7, 1950. This committee is an outgrowth of the former Packaging, Storage, and Materials Handling Industry Advisory Committee.

One of the aims of the Munitions Board and the Military Departments is to standardize materials and methods used in packaging. This will cut down inventories and allow for economy in production, save training time, and permit exchange of personnel and supplies between the Services.

The military has many problems in packaging which can be worked out with industry's cooperation. Some of the specific projects on which the committee will be of assistance are: making recommendations with regard to simplification of specifications, development of solutions to problems encountered in packaging specific commodities, preservation of various materials and containers, container handling, and work with industry and the Department of Defense in development of new materials to meet strategic requirements.
Another advisory committee representing the pulp, paper and paperboard industry was appointed under the **Defense Act** of 1950. This committee which is composed of executives from most of the leading paper companies of the United States has advisory powers in connection with priorities and allocations, and to develop programs for production and distribution.

Soon after the Korean war began producers of corrugated and solid fibre containers formed an organization known as the **Weatherproof Fiber Box Group** for the purpose of expediting the production and delivery of these types of boxes in the large quantities needed by the Armed Forces and other departments of the government.

Military Aid packages shipped to Western Europe now contain a shield of the United States in red, white, and blue and bear the legend "Supplied by the United States." The purpose is to impress on Europeans the American support of the Atlantic Defense Pact. Whenever these emblems are to be used in connection with shipments under contracts executed by the Armed Forces, these instructions appear in invitations for bids, contracts, and shipping instructions.

With millions of men being called into the Armed Services for overseas service, paperboard is again playing an important part in the national economy and in the defense of the western world.
CHAPTER VIII

CHANNELS OF DISTRIBUTION

Introduction

Mass production industries cannot exist on a local market. The successful operation of such industries, therefore, depends upon mass distribution. As shown in Table XXXVI practically every southern state except Texas has an excess of paper production over the amount consumed in the state.

The following states produce less paper of all kinds than they consume: Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Indiana, Illinois, Iowa, Missouri, Kansas, Colorado, Delaware, Maryland, District of Columbia, West Virginia, North Carolina, Tennessee, Texas, and California.

The large deficits in paper production occur in the states of New York (819,433 tons), Illinois (651,799 tons), Missouri (439,231 tons), Texas (550,567 tons), and California (1,251,756 tons).\(^1\)

The figures given here do not by any means give a complete picture. Although a state may have an excess production as shown by Table XXXVI this excess is of

\(^1\) 1946 data as shown in Table XXXVI.
<table>
<thead>
<tr>
<th>States</th>
<th>Production***</th>
<th>Estimated Consumption****</th>
<th>Excess Production</th>
<th>Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continental United States:</strong></td>
<td>19,277,667</td>
<td>19,027,134</td>
<td>250,533</td>
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</tr>
<tr>
<td>Maine</td>
<td>1,194,918</td>
<td>102,433</td>
<td>1,092,475</td>
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</tr>
<tr>
<td>New Hampshire</td>
<td>216,115</td>
<td>61,189</td>
<td>154,926</td>
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</tr>
<tr>
<td>Vermont</td>
<td>98,707</td>
<td>43,138</td>
<td>55,569</td>
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</tr>
<tr>
<td>Massachusetts</td>
<td>691,337</td>
<td>703,525</td>
<td>--</td>
<td>12,188</td>
</tr>
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<td>Rhode Island</td>
<td>45,000</td>
<td>113,521</td>
<td>--</td>
<td>68,521</td>
</tr>
<tr>
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<td>2,557,946</td>
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<td>819,433</td>
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<td>New Jersey</td>
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<td>729,233</td>
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<td>1,423,179</td>
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<td>Maryland</td>
<td>244,000</td>
<td>320,042</td>
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<td>76,042</td>
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<td><strong>District of Columbia</strong></td>
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<td>Ohio</td>
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<td>1,101,577</td>
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<td>693,401</td>
<td>1,345,200</td>
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<td>651,799</td>
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<td>Minnesota</td>
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<td>349,364</td>
<td>210,646</td>
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</tbody>
</table>

(Data in Tons of 2000 Pounds)
<table>
<thead>
<tr>
<th>State</th>
<th>Production***</th>
<th>Estimated Consumption****</th>
<th>Excess Production</th>
<th>Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>78,500</td>
<td>330,284</td>
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<td>251,742</td>
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<tr>
<td>Missouri</td>
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<td>486,412</td>
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<td>439,231</td>
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<td>283,550</td>
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<td>132,450</td>
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<td>Production***</td>
<td>Estimated Consumption***</td>
<td>Excess Production</td>
<td>Deficit</td>
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<td><strong>TOTAL</strong></td>
<td></td>
<td>6,647,274</td>
<td>6,396,741</td>
<td></td>
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</table>

**Estimates based on overall consumption modified by per capita income variations.

***Source: Bureau of the Census.

****Excluding Imports of Newsprint.

particular types of paper and there may be a deficit of other types. For instance, the state of Massachusetts is nearly in balance between production and consumption of all types of paper. The state, however, is highly specialised in the production of the finer grades of writing and book papers which it sells in all states while it must "import" the coarse grades of paper from other states. Louisiana produces heavy tonnages of kraft wrapping, bag, and other coarse papers, but produces no newsprint and only a small quantity of writing and book papers.

It is impossible from data available to make an accurate statement of the volume of interstate shipments of paper. It is, however, estimated by the American Paper and Pulp Association that at least 65 per cent of all paper and board production is shipped outside the state of origin.\(^2\)

It is evident that although a small portion of the production of Louisiana and other southern mills is consumed in the South, the great bulk of the market lies in the northern, northeastern, east coast, and western states. This means that each company must either have its own marketing organization to sell in these sections of the United States or sell through middlemen who are prepared to distribute on a national scale.

Chapter VI described the various paper and paperboard products produced in Louisiana mills. Each of these is a mass production item and is distributed in large lots. It will be the purpose of this section to explain the channels through which these products are sold by the manufacturer. Any explanation of the channels used by the wholesaler or other middleman in getting the product directly to the consumer in small lots is beyond the scope of this study.

**Classification of Paper and Paper Products**

Most paper and paperboard products manufactured in Louisiana may be classified as fabricating materials, i.e., those materials which are incorporated into the final product with or without further processing. This certainly applies to bag paper, paperboard, printing papers, and all converting papers. Kraft wrapping paper when used in final form by the consumer is classified as operating supplies, i.e., "those materials which are used up in the operation of business enterprises and institutions but which do not enter into or form a part of the final product."³ When cut into rolls of the size ready for distribution to hardware, drug, dry goods, variety and other stores, this is the proper classification for kraft wrapping paper. This

paper, however, is generally sold by the manufacturer in large rolls and is re-wound into small rolls by converters. When sold by manufacturers in a form not ready for distribution, such paper is properly classified as a fabricating material.

Paperboard shipping boxes, paper bags, multiwall shipping sacks, and paper milk cartons, fall in the category of operating supplies since they are sold by the manufacturer in completed form and when used do not become a part of the finished product.

It has been explained in previous chapters that many companies operating in Louisiana have their own converting plants in which they manufacture paper bags, fibre shipping boxes, multiwall shipping sacks and paper milk cartons. A sizeable proportion of the production in Louisiana mills is thus consumed by the companies themselves in their own converting plants. Where this is the case the channels used for distributing these finished products will be discussed.

Classification of Channels

The channels utilized by paper manufacturers in distributing their products may be divided as follows:

(1) Direct sale, (2) Sale through merchant middlemen, and (3) Sale through agent middlemen. In some cases a single company may utilize more than one of these channels for the same product.
Direct sales. Direct sales are generally made to converters for further processing or fabricating into the finished product. They are also made to the government under a system of competitive bidding. Paperboard shipping cartons are nearly always sold directly to the user.

Merchant middlemen. The merchant middleman in the paper trade is called a paper merchant or a paper jobber. There are around 3,000 of these businesses located in principal cities throughout the United States. The paper merchant is essentially a wholesaler and carries a warehouse stock covering a wide variety of paper items purchased from various manufacturers. Some merchants (white paper merchants) handle only printing and writing papers, while others (coarse paper merchants) specialize on coarse paper items. Some of the large merchants handle both types.

The paper merchant sells to the local converters, printers, or retailers. He performs the same functions as that of the wholesale grocer, or wholesale druggist, i.e., buying, selling, storing, dividing, financing, risking, and transportation. The paper merchant also renders a technical service, therefore, his employees are required to have a highly specialized knowledge of the printing and converting industries. Sales of wrapping papers require a thorough knowledge of shipping and packaging methods, while sales of printing papers require a specialized knowledge of printing and reproduction methods.
In all cases, the paper merchant must know the type of paper which is best for the purpose and should be able to make constructive suggestions for its use.

**Agent middleman.** Agent middlemen sell the mill’s products without taking title. They are of two types: (1) The mill agent or commission house, and (2) Brokers.

The *mill agent* represents several paper mills and sells in a restricted territory under contract with his principal. The prices of the product and selling terms are fixed by the manufacturer.

The *broker* is an independent agent middleman whose function is to bring buyers and sellers together. The completion of the actual transaction is left to the principals and the broker never sees the goods he sells. He receives a fee for his services.

**Channels Utilized In Selling Various Paper, Paperboard, and Converted Products**

Unbleached and bleached pulp when sold by the mills is marketed either directly to industrial users or sold through a commission house. Generally the latter method is used because the mills are not able to furnish a steady supply of market pulp. One manufacturer explained that it was a big problem for his mill to make enough pulp to feed the paper machines in his own mill. Some mills are integrated to use all of the pulp they produce. Others sell a quantity of market pulp each day.
The great bulk of kraft wrapping paper is sold in earload lots through paper merchants and jobbers. In remote territories not covered by the company's own salesmen, brokers and mill agents are also utilized.

Over half of the corrugating medium and linerboard produced in Louisiana is converted into shipping boxes in container plants owned by the same company. The rest is sold directly to box plants of other companies.

Most kraft converting papers are sold directly to converters. One company sells some of this paper through brokers, and mill agents.

Fibre shipping boxes are, in practically all cases, sold directly to industrial users. Paper milk cartons are sold only to dairies. Multiwall bags are in most cases marketed directly to industrial users. Some, however, are sold through paper jobbers.

One company sells its entire output of grocery bags to jobbers. The other companies sell most of theirs through this channel, but also market some directly to chain stores and utilize all types of agent middlemen. Cleaner bags are sold through jobbers and agent middlemen. Some, however, are sold directly to large cleaning establishments.

One company sells all of its tall oil directly to industrial users, while other companies sell a portion of their production direct but also make use of the commission house.
Exclusive agencies are not generally granted in the marketing of kraft paper and paperboard. Two companies said they never give an exclusive agency. International Paper Company markets some of its grades which are sold under a trade name, such as Springhill White Tag, Springhill Manila Tag, and Index Bristol, through appointed agents in various cities.

**Selling to the Government of the United States**

The largest single purchaser of paper in the United States is the Government itself. Government procurement of paper is centered in four different agencies: (1) Government Printing Office, (2) Bureau of Printing and Engraving (3) General Services Administration and (4) Army Quartermaster Corps.

The Government Printing Office purchases more than 3,000 carloads per year of all types of paper and envelopes for printing and mailing numerous government documents including the Congressional Record, the Census, and bulletins and reports of the various government agencies. In addition to these items the GPO purchases all blank paper and plain envelopes for the use of government departments in the District of Columbia. Most of these purchases are on a quarterly basis, but the GPO early in 1950 announced that it would purchase newsprint on a yearly basis, and asked for bids on five and one-half million pounds to be opened June 12.
The **Bureau of Engraving and Printing** handles all the functions in connection with the procurement and handling of distinctive papers required for the printing of United States' currency, stamps, and public debt securities.

The purchases of paper for all other departments of the Federal Government except the Military are centered in the **General Services Administration**. Stocks of all types of papers purchased by this agency are stored in various supply depots throughout the United States where they can be requisitioned by all government offices. Among the items purchased by this administration are paper bags and sacks, packing paper, wrapping paper, kraft folders, and paper towels, as well as all kinds of typewriting, mimeograph papers, and envelopes.

Beginning March 15, 1950, purchase responsibility for all the armed forces paper supplies was given to the **Army Quartermaster Corps** with headquarters in New York City. This centralizes all of the purchases for the Army, Navy, (including the Marine Corps), Air Force, and foreign aid program. A great variety of paper products serving a multitude of purposes are utilized by the Armed Services. The use of paper for administrative functions comprises only a small proportion of the total requirements. The large shipments of military supplies by train, ships, trucks and planes, both domestic and overseas, require many types of packaging materials. Items shipped range from the most delicate types of instruments to less
fragile supplies, as well as perishable foods. In order to reach their destination in perfect condition, such items as paper bags, wrapping paper, corrugated paper, barrier materials, paper shipping sacks, and fibre shipping boxes are needed. The Quartermaster Corps also consumes large quantities of map paper and chart paper, as well as the hundreds of items normally used by civilian agencies.

Sales to the Army Quartermaster Corps, as well as to the other government procurement agencies, are made on the basis of competitive bids. To further stimulate interest in selling to the QMC a policy has been adopted to allow ninety days between the making of an award and the first delivery date.

Active participation of the paper industry in QMC planning activities is being sought through the establishment of a Quartermaster Association Industry Paper Group. Paper manufacturers and suppliers are working through this association with the QMC to develop and evaluate plans for defense to meet the national emergency.

The packaging requirements and specifications for the Armed Services are in charge of the Munitions Board Packaging Committee in Washington, D. C. This committee coordinates the activities of the three packaging boards for the various service branches and also has the advice of the Industry Advisory Committee described in Chapter VII.
The three service branch boards are: **Air Force Packaging Board**, Wright-Patterson Air Force Base, Dayton, Ohio; **Army Packaging Board**, Pentagon Building, Washington, D.C.; and the **Navy Packaging Board**, Munitions Building, Washington, D.C. These boards and the **Industry Advisory Committee** control the establishment of specifications for containers for military shipments.

The research and development branch for the armed forces in connection with food and containers is the **Armed Forces Food and Container Institute** in Chicago. The institute maintains complete laboratory facilities for extensive testing and development and is aided in its work by the **Food and Container Institute**, an Industry Advisory Group.

Any purchases of containers for the Armed Services itself are centered in the **Army Quartermaster Corps** as explained previously. Of course, most of the procurement of containers is through government contractors and actual specifications for containers are contained in the specifications for the item to be packed.

General specifications for containers of goods procured by the Armed Forces and under the supervision of the Munitions Board Packaging Committee are titled **National Military Establishment Specifications**. Among these are specifications covering V-type fibre boxes for overseas shipment, folding cartons for overseas shipment, set-up boxes for overseas shipment, wood-cleated solid fibre boxes for overseas shipment, fibreboard drums (overseas
type), and general specifications for packaging and packing for overseas shipment.

Regular federal specifications governing ordinary procurement by the branches of the Federal Government such as Treasury, Agriculture, etc., are contained in the Federal Standard Stock Catalog. These are governed by the Technical Committee on Packaging, Federal Specifications Board, Washington, D. C.
CHAPTER IX

COMPANY ORGANIZATION AND FINANCE

International Paper Company

Investment in plants and properties. Three of Louisiana's pulp and paper mills are part of a vast organization which is the largest paper company in the world. The International Paper Company, a New York Corporation organized in 1898, has numerous mills and converting plants in various parts of the United States and Canada. The company on December 31, 1950 had assets totaling $408,540,630. Of this amount a net of $252,707,682 was invested in plants and properties including intangibles in the United States and Canada. Its paper and pulp mills in the United States had a net value of $112,291,542 while those in Canada were valued at $31,960,203. The net value of converting plants was: United States, $13,066,346 and Canada, $4,048,216.

Location of plants. International Paper Company's plants are located as follows: 1

Southern Kraft Division. Nine pulp and paper mills are located at Springhill, Louisiana; Bastrop, Louisiana (2); Georgetown, South Carolina; Panama City, Florida; Mobile, Alabama; Camden, Arkansas; Moss Point, Mississippi; and Natchez, Mississippi.

Groundwood Specialty Papers. Two plants are located at Chisholm, Maine, and Palmer, New York.

Book and Bond Papers. Three mills are located at Niagara Falls, Tonawanda, and Ticonderoga, New York.

Newsprint Mills. Two mills owned by Canadian International Paper Company are located at Three Rivers and Gatineau, Quebec, and one mill owned by New Brunswick International Paper Company is located at Dalhousie, New Brunswick.

Dissolving Pulp Mills. Three mills owned by Canadian International Paper Company are located at Temiskaming and Gatineau, Quebec, and Hawkesbury, Ontario.2

Jute Board Mills. The company now owns one mill at Hartford City, Indiana.3

Container Plants. Nine plants to manufacture fibre shipping boxes are located at Whippany, New Jersey; Somerville, Massachusetts; Chicago, Illinois; Kansas City, Kansas; St. Louis, Missouri; Georgetown, South Carolina; Los Angeles, California; Springhill, Louisiana; and Wooster, Ohio.

Bag Plants. A plant at Mobile, Alabama, produces grocery and specialty bags. Two others at Camden, Arkansas, and Bastrop, Louisiana, manufacture heavy duty, multiwall paper shipping sacks. A plant at Ottawa, Canada, owned by a subsidiary converts paper purchased from other Canadian producers into specialty bags, paper cups, and other paper products. This subsidiary also operates bag plants at East Angus and Cap de la Madeleine, Quebec.

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2 A new $20,000,000 mill with a capacity of 300 tons per day to manufacture dissolving pulp was put into operation at Natchez, Mississippi, in January, 1951.

3 The jute board mills were originally acquired as standby mills to meet the peak demands for container boards. The mills at Three Rivers, Michigan and Cincinnati, Ohio, were sold during 1950.
Milk Container Plants. The company owns and operates three plants at Bastrop, Louisiana, Norristown, Pennsylvania; and Kalamazoo, Michigan.  

Miscellaneous Properties. A plant at Dayton, Ohio manufactures stamped envelopes for the United States Post Office Department; a fibreboard mill at Gatineau, Quebec, makes insulating board. The company also owns a plywood plant at Gatineau.

It owns or partially owns other manufacturing operations too numerous to mention here. In the United States and Canada International owns or leases 17,000,000 acres of timberlands which contain more than 58,000,000 cords of wood.

Means of financing. In 1930 International's funded debt and bank loans were in excess of $100,000,000. This was reduced to $60,000,000 by 1941. In 1945 this amount stood close to $50,000,000 and in the next two years the funded debt was completely paid. International Paper Company is now financed entirely by stocks which are composed of cumulative $4 preferred stock, no par value, ($23,000,000), and common stock with $7.50 par value, ($66,750,000). At the end of 1950 there were 27,479 shareholders and unappropriated earned surplus was $136,465,658.

Sales organization. The sales organization of International Paper Company is headed by the Vice-President in Charge of Sales who is one of eighteen men on the Board of Directors. Since the numerous mills operated by

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4 New plants are under construction at Atlanta, Georgia and Kansas City, Kansas.

5 This stock was changed from $15 par value on December 20, 1949 with two $7.50 shares issued for each $15 share.

International manufacture a wide variety of products, this organization is divided into divisions according to product lines, with each of these divisions in charge of a sales manager. A General Sales Manager coordinates the work and serves as a liaison between the Vice-President in Charge of Sales and the sales managers for the various divisions. The divisions which are headed by a sales manager are:

Book and Bond Division, which sells bleached papers (white) made in both northern and southern mills; Groundwood Division, which sells papers with a large content of groundwood, all made in the North; and the Southern Kraft Division which sells brown paper, all made in the South. Southern Kraft has two subdivisions— one selling paper including grocery and variety bags, and the other linerboard and corrugating material.

Each of the converting lines is sold by separate sales divisions, each with its own sales manager. They are:

Container Division, Multiwall Shipping Sack Division, and Single Service Division. The latter sells paper milk containers.

The Canadian sales of newsprint, pulp, and building boards including plywood, are directed from Canada.

International Paper Company needs a sales force with varying experience and ability. It requires men who are able to sell large accounts where the contract may be for a term of years. In many cases salesmen must have a knowledge of the publishing and printing business, and in
other cases they must be familiar with the problems connected with conversion.

The main sales offices of International Paper Company are located in New York and Chicago. Branch offices are located at Boston, Massachusetts; Cleveland, Ohio; Atlanta, Georgia; Baltimore, Maryland; Charlotte, North Carolina; Cincinnati, Ohio; Dallas, Texas; Kansas City, Missouri; New Orleans, Louisiana; Milwaukee, Wisconsin; Philadelphia, Pennsylvania; and Syracuse, New York.

Processing of orders. Orders for paper and board are processed in either the New York or the Chicago office and sent to the various mills. In some cases the production required for a single order may be divided among several mills. The order when received by the mill contains specifications of production, quantity, and directions for shipment. There is no statement as to the price received from the customer to whom shipment will be made. Each mill prepares its own production orders, and the management knows a month or more in advance what each machine will be producing.

Production statistics. Within the United States International produced 2,506,311 tons of board, paper, and pulp in 1950. Of this amount 2,152,743 tons (86 per cent) was kraft. Of the 1,018,574 tons of Canadian production in 1950, 774,484 tons (75 per cent) was newsprint.
In 1950 International produced and sold 557,643 tons of converted products. These were divided as follows:

- Shipping containers: 251,042
- Grocery, multiwall, and miscellaneous bags: 155,543
- Insulating board—Canada: 36,961
- Plywood—Canada: 13,313
- Milk containers and miscellaneous converted paper products: 100,784

Sales and income. In 1950 International's sales and other income amounted to $509,110,329 as compared with $420,396,343 in 1949 and $462,026,760 in 1948. After making provision for taxes the company in 1950 had a net profit of $66,647,151. Net profit in 1949 was $51,646,739 which was a decline from the $60,489,266 shown in 1948. In 1950 International paid a cash dividend to common stockholders amounting to $22,250,000 ($1.25 per share on 7,120,000 shares and $1.50 per share on 8,900,000 shares), and a stock dividend of 25 per cent on 1,760,000 shares of common stock. International paid cash dividends for prior years as follows: 1949, $17,800,000; 1948, $17,800,000; 1947, $14,240,000; and 1946, $9,062,594.

Organization of Southern Kraft Division. The main offices of the Southern Kraft Division are located in Mobile, Alabama where two vice presidents of the International Paper Company have their offices. One of these vice presidents is General Manager of the Southern Kraft

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7 Fifty-Third Annual Report, op. cit., p. 11.
Division, while the other is Assistant General Manager in charge of all production, research development and construction for the nine mills of the Division.

The organization of each mill may be broken down into three departments as follows: (1) Manufacturing, (2) Wood Procurement, and (3) Administration. A mill manager is in charge of all production. The wood procurement department has the responsibility of securing a current wood supply and maintaining the stock pile. The wood procurement manager has his office at the mill but is working under the direct supervision of the Timberlands Division which has headquarters in Mobile.

The administrative work of each mill is placed in charge of an agent. In addition to serving as the company's legal representative, this agent also is in charge of all administrative and office personnel. The personnel, purchasing, stores, and accounting departments are under his supervision.

**Gaylord Container Corporation**

The Gaylord Container Corporation, chartered in Maryland in 1937, has one of the most completely integrated operations of any paper manufacturing company in Louisiana. Practically all of the paper and board production at the Bogalusa mill is converted in the company's own plants at various points in the United States.
Investment in plants and properties. On December 31, 1950 total assets of the Gaylord Container Corporation amounted to $46,750,326. This amount included property, plant, and equipment with a net value of $22,611,142.

Location of plants and properties. All paper and board roll stock is produced in the pulp and paper mill at Bogalusa, Louisiana. Adjacent to this plant which has a daily capacity of 700 tons of sulphate pulp and 70 tons of semi-chemical pulp, are located several converting plants. These plants manufacture corrugated shipping boxes and other packing materials, and kraft grocery bags and sacks.

In addition to the two converting plants in Bogalusa the company also operates several other converting plants which are either owned or leased. These plants manufacture corrugated and solid fibre boxes, dry and paraffine folding cartons, packing materials, beverage carriers, and display stands. Two corrugated and solid fibre shipping box factories and one folding carton plant are located in St. Louis. Other converting plants are situated at Dallas, Houston, and Weslaco, Texas; Atlanta, Georgia; Tampa, Florida; Greenville, North Carolina; Jersey City, New Jersey; and Milwaukee, Wisconsin.

Gaylord also owns townsite properties, a hospital, and over 700 houses in Bogalusa. It owns the entire capital stock of the Bogalusa Stores Co., and 50 per cent of the

voting power of the Bexar Realty Co. Gaylord owns in fee about 350,000 acres of reforested and cutover lands in Louisiana and Mississippi. It owns outright or retains mineral interests in over 450,000 acres checkerboarded over an area of some 6,000 square miles in southeastern Louisiana and extending into south central Mississippi. One oil well is producing, and exploration and drilling is in process. For the purpose of strengthening the fuel position of the paper mill the company's Minerals Division in 1950 completed a 26 mile pipe-line to supply fuel to the Bogalusa mill from gas reserves contracted for by the company.

Means of financing. Until recently Gaylord Container Corporation was financed by sales of common stock and through plowing back earnings. The company has over 6,300 shareholders owning stock with a par value of $1.66 2/3 a share. On December 31, 1950 $2,338,317 of the 2,925,000 authorized shares were outstanding. Capital stock was shown on the books at $3,897,195 with an additional amount of $4,716,570 as capital paid in for common stock in excess of par value. The company has 40,000 shares of 51/2 per cent cumulative convertible preferred stock with a par value of $50 a share which is authorized and unissued.


10 On May 8, 1946 par value was changed from $5 a share with three $1.66 2/3 shares issued for each $5 share.
On April 1, 1949 Gaylord borrowed $7,500,000 to be used for expansion of its pulp and paper mill and converting plants. This loan was evidenced by unsecured 3 per cent promissory notes privately held. On April 1, 1950, $187,500 of this loan was paid. The balance is to be paid in annual installments of $375,000 with a final payment of $2,437,500 on April 1, 1964.

Under the terms of the loan agreement Gaylord may not pay a cash dividend unless at the date of declaration the following conditions have been fulfilled: 11

1. The net working capital of the Corporation shall be at least $7,500,000;

2. The current assets shall be at least 200% of the current liabilities; and

3. The sum of $3,500,000 plus net income computed for the period commencing January 1, 1949, to and including the date of declaration shall be greater than the aggregate amount of all dividends declared since January 1, 1949.

**Sales organization.** Gaylord Container Corporation manufactures a wide line of goods consisting of corrugated shipping boxes, solid fibre boxes, beverage carriers, display stands, packing materials, folding cartons, kraft grocery bags and sacks, kraft wrapping paper, butchers paper, kraft paper specialties, linerboard, laminated paper, sulphate pulp, tall oil, turpentine, and tung oil. Like International Paper Company, the sales organization to market these products is organized along product lines.

The main offices are located in St. Louis, and 40 sales branch offices are scattered throughout the United States all the way from New York to San Francisco and from Minneapolis to New Orleans.

All sales are in charge of a Vice-President and Director of Sales who is one of the 16 members of the Board of Directors. He is assisted by two general sales managers who also have their offices in St. Louis. One is a sales manager for corrugated and solid fibre boxes, and the other is sales manager for bags and wrapping paper. In addition there is a sales manager for folding cartons. Another man handles the sales management for mill products but works directly under the sales manager who handles the bag and wrapping paper division. Each plant has its own sales manager and these managers in turn report to the respective general sales manager mentioned above.

Gaylord has six divisional Vice-Presidents with each in charge of a geographical division. These Vice-Presidents and the location of their offices are as follows:

- Central Division. . . . St. Louis, Missouri
- Southern Division . . . New Orleans, Louisiana
- Texas Division. . . . Houston, Texas
- Southeastern Division . Atlanta, Georgia
- Florida, Division . . . Tampa, Florida
- Eastern Division. . . . New York, New York

These divisional Vice-Presidents have as many as three or four plants under their control. Each plant has its own superintendent who is in charge of manufacturing.
All general policies of the company are made in St. Louis and passed on to the divisional Vice-Presidents who in turn pass them on to the proper men in their organization.

Since many of Gaylord's product lines are sold to different types of trade, salesmen are not permitted to sell all lines. Boxes are sold directly to manufacturers, while bags and wrapping papers are sold to jobbers for resale. These are entirely different lines as far as selling is concerned. Folding cartons are in a few instances sold by the same men who sell corrugated and solid fibre boxes.

Since paper bags are sold to jobbers, fewer salesmen are needed to cover a given territory than is necessary for the sale of corrugated boxes which are sold directly to the customer. The average city has only four or five prospects for sales of paper bags and some have only one. Although the larger cities have a great many paper jobbers, it is not necessary in any case to keep a salesman in one city alone to handle the bag business. Salesmen who live in cities such as New York, Chicago, Philadelphia, and St. Louis, also cover the surrounding territory.

The corrugated box business takes continuous calling and in many cases several men must work in one city alone. A city the size of New Orleans, for instance, requires four salesmen, St. Louis requires eight and New York seventeen.

Sales and income. Gaylord Container Corporation's net sales to customers in 1950 amounted to $63,849,000 as compared with $52,820,000 for 1949, and $61,131,000 for
1946. After making allowance for taxes net earnings were $6,682,000 in 1950, $4,129,000 in 1949, and $8,015,000 in 1948. For each of the last three years (1950, 1949, and 1948) the company has paid dividends of $1.50 per share ($3,507,493) on its common stock. The rest of the earnings have been invested in the business. Since 1946, Gaylord has expended more than $20,000,000 for new facilities.

Southern Advance Bag & Paper Co., Inc.

Investment in plants and properties. Southern Advance Bag & Paper Co. was incorporated in Maine in 1927. In 1939 it merged its parent company, Advance Bag & Paper Co., Inc., which was liquidated. On December 31, 1949 the company had assets totaling $12,453,254. The net value of its plant and equipment, all of which is located at Hodge, Louisiana, was $6,427,466. In addition to this plant the company also owns practically all of the real estate, business buildings, and dwellings in the town of Hodge. It owns in fee or leases approximately 195,000 acres of timberland. Some of this land contains mineral resources and the company is presently earning some royalties from natural gas.


13 This does not include a net amount after depletion of $1,605,612 invested in timberlands.

14 In 1945 Southern Advance Bag & Paper Co., Inc., organized a wholly owned subsidiary—Advance Land & Timber Co. to acquire and operate timberlands.
wells. Southern Advance owns 95 per cent of the North Louisiana and Gulf Railroad which runs through the company's pulpwood tracts and connects with the Chicago, Rock Island & Pacific Railway and with the Illinois Central Railroad.

Means of financing. Until recently Southern Advance Bag & Paper Co., Inc., was financed with 4 1/2 per cent preferred stock with par value of $100 and common stock with a par value of $1. One million common shares are authorized and on December 31, 1949, 887,576 shares were issued and outstanding. This stock is owned by around 2,200 stockholders.

The 4 1/2 per cent preferred stock was callable as a whole or in part, and the company has been gradually calling this stock. On December 31, 1949, 2,523 shares of the 25,000 shares authorized were in the treasury. In August, 1950, the company retired the 4,144 shares which were still outstanding.

Organization. The main offices of the Southern Advance Bag & Paper Co., Inc., are located in Boston, Massachusetts. Sales are directed from this office by the Vice-President in Charge of Sales.

Seven sales branch offices are located as follows: New York, New York; Chicago, Illinois; Philadelphia,

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15 This stock was changed from no par to $1 par value in December, 1945 on a share to share basis. The number of common shares were doubled in 1948 through the means of a 100 per cent stock dividend.
Pennsylvania; Washington, D. C.; Southern Pine, North Carolina; Dallas, Texas; and Detroit, Michigan.

All orders are cleared through the Boston office and sent to the pulp and paper mill at Hodge, Louisiana. The Resident Manager at Hodge is in charge of converting operations, town properties, and administrative personnel. The Plant Manager is in charge of all manufacturing in the pulp and paper mill.

This company does not manufacture such a varied line of products as the other two companies discussed previously. Salesmen have an exclusive territory in which they sell all products of the company including unbleached pulp, kraft wrapping paper, kraft converting papers, grocery bags, cleaner bags, and tall oil.\footnote{All of these products are manufactured at Hodge, Louisiana. The company has a large bag plant which produces in excess of 12,000,000 bags per day.}

Sales and income. In 1949 Southern Advance had net sales of $13,999,816 and in 1948 this amount was $17,885,403. The company's net income for 1949 and 1948, after allowance for taxes was $1,731,926 and $3,920,765 respectively. On December 31, 1949 the company had earned surplus of $8,612,411. In 1949 and 1948 Southern Advance paid cash dividends of $996,523 and $1,331,364 respectively.

Brown Paper Mill Co., Inc.

The Brown Paper Mill Co., Inc., located in West Monroe, Louisiana, is the largest family-owned sulphate pulp and paper mill in the world. Since the company is a
closed corporation and no published reports are issued, little information can be given here in regard to the total investment of plant and equipment and the means of financing.

The Brown Paper Mill was founded in 1924 by E. W. Brown, Jr., and his brother Luther Brown, both from Orange, Texas. The mill began operations with one paper machine. In 1927 another machine was added, and in 1929 two additional machines were put into operation. With four machines the company has a production of around 550 tons of kraft bag, wrapping, and converting papers, corrugating material, and containerboard every 24 hours.

Until after World War II the company sold its roll stock in a trade territory which covered that part of the United States which lies east of the Rocky Mountains.

Since World War II, four large converting plants, owned and operated by sons and sons-in-law of the founders of the paper mill, have been put into operation. A large percentage of the production of the paper mill is now sold to these converting plants. All of these converting plants are located within a radius of one-half mile from the paper mill, and a private railroad owned by the Browns delivers the paper directly to their doors. Each plant gives its orders for paper with complete specifications to the mill and each pays the same price that any other converter would pay.

Two companies, Kraftco, and Brown Container Company, Inc., manufacture corrugated shipping boxes. These are
both large businesses. Yearly gross sales of Brown Container Company are in excess of $10 million with products being shipped throughout Louisiana, Texas, Mississippi, Alabama, Florida, Kentucky, Pennsylvania, Massachusetts, Tennessee, Missouri, Iowa, Ohio, Arkansas, Kansas, Oklahoma, Indiana, Georgia, South Carolina, and North Carolina. Sales offices are located in Chicago, Illinois; New Orleans and Alexandria, Louisiana; Indianapolis, Indiana; Little Rock, Arkansas; Dallas, Harlingen, and Houston, Texas; Memphis, Tennessee; Louisville, Kentucky; and Tampa, Florida. Thirteen salesmen are continually on the road and the company operates seven vans which deliver daily to Memphis, Dallas, Houston, Little Rock, New Orleans, and Jackson.

Brown Container Corporation has expanded rapidly since it started in 1948 with 78 employees. By the end of 1949 the number of employees rose to about 175, and at the present time (1951) the plant employs over 260 men and women.

Two companies, Negley Bag & Paper Co., and Brown Paper Industries, Inc., were founded in 1948. Both companies manufacture paper bags. In 1949 Negley added a multiwall shipping sack plant.

Negley Bag & Paper Co. has sales offices in New York, New York; Cincinnati, Ohio; St. Paul, Minnesota; St. Louis, Missouri; Atlanta, Georgia; New Orleans, Louisiana; Dallas and Houston, Texas; and Los Angeles, California. The
company's sales amount to more than $10 million per year. Fourteen bag machines operating three shifts per day manufacture in excess of 3,000,000 grocery and cleaner bags every 24 hours. The company's multiwall plant produces around 300,000 shipping sacks per day and is now undergoing an expansion which will increase its capacity.

The Brown Paper Mill Co., Inc., and the four converting plants are supposedly operated independently of each other. The two bag plants, as well as the two shipping box factories, appear to be in competition. Each has its own general manager, production superintendent, and sales force. There is, however, an interlocking of the directors of the Brown Paper Mill Co., Inc., Brown Paper Industries, Inc., and Brown Container Company, Inc. For instance, John S. Brown, who is President of Brown Container Company, is Vice-President of Brown Paper Industries. E. W. Brown III served as President of Brown Container Company, Inc., during the years 1948 and 1949. He is at present (1951) Vice-President and Treasurer of Brown Paper Industries, and is a director of the Brown Paper Mill Co., Inc. Slade Brown, who is Vice-President and Secretary of Brown Container Company, is also a director of the Brown Paper Mill Co., Inc. Charles E. Brown is at the present time (1951) President of Brown Paper Industries.
APPENDICES
# APPENDIX A

## LOCATION AND PRODUCTION OF SOUTHERN PULP AND PAPER MILLS, 1950*

<table>
<thead>
<tr>
<th>Location of Mill</th>
<th>Type of Pulp</th>
<th>Tons of Pulp Every 24 Hours</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Alabama</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Coosa River Newsprint Co., Coosa Pines</td>
<td>Groundwood</td>
<td>294</td>
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<tr>
<td>2. Gulf States Paper Corp., Tuscaloosa</td>
<td>Sulphate</td>
<td>220</td>
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<tr>
<td>3. Hollingsworth &amp; Whitney Co., Mobile</td>
<td>Sulphate</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>4. I. P. Co., (So. Kraft Div.), Mobile</td>
<td>Sulphate</td>
<td>225</td>
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</tr>
<tr>
<td>5. Mobile Paper Co., Crichton</td>
<td>Groundwood</td>
<td>535</td>
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</tr>
<tr>
<td><strong>B. Arkansas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Crossett Paper Mills, Crossett</td>
<td>Sulphate</td>
<td>150</td>
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<tr>
<td>2. I. P. Co., (So. Kraft Div.), Camden</td>
<td>Sulphate</td>
<td>1,874</td>
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</tr>
<tr>
<td><strong>C. Florida</strong></td>
<td></td>
<td></td>
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<tr>
<td>1. Container Corp. of America, Fernandina</td>
<td>Sulphate</td>
<td>310</td>
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<tr>
<td>2. Hudson Pulp &amp; Paper Corp., Palatka</td>
<td>Sulphate</td>
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</tr>
<tr>
<td>3. I. P. Co., (So. Kraft Div.), Panama City</td>
<td>Sulphate</td>
<td>810</td>
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<tr>
<td>5. Rayonier, Inc., Fernandina</td>
<td>Sulphate</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>7. St. Regis Paper Co., Pensacola</td>
<td>Sulphate</td>
<td>375</td>
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* Figures rounded to nearest whole number.
<table>
<thead>
<tr>
<th>Location of Mill</th>
<th>Type of Pulp</th>
<th>Tons of Pulp Every 24 Hours</th>
<th>Each Mill State</th>
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<tr>
<td>D. Georgia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Brunswick Pulp and Paper Co., Brunswick</td>
<td>Sulphate</td>
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<td></td>
</tr>
<tr>
<td>2. Macon Kraft Co., Macon</td>
<td>Sulphate</td>
<td>600</td>
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<tr>
<td>3. St. Mary's Kraft Corp., St. Marys</td>
<td>Sulphate</td>
<td>500</td>
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<tr>
<td>4. Union Bag &amp; Paper Corp., Savannah</td>
<td>Sulphate</td>
<td>1,160</td>
<td>2,560</td>
</tr>
<tr>
<td>E. Louisiana</td>
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<tr>
<td>2. Calcasieu Paper Co., Elizabeth</td>
<td>Sulphate</td>
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<tr>
<td>3. Gaylord Container Corp., Bogalusa</td>
<td>Sulphate</td>
<td>777</td>
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</tr>
<tr>
<td>4. I. P. Co., (So. Kraft Div.), Bastrop Mill</td>
<td>Sulfate</td>
<td>985</td>
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<tr>
<td>5. I. P. Co., (So. Kraft Div.), Louisiana Mill, Bastrop</td>
<td>Groundwood</td>
<td>60</td>
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<tr>
<td>6. I. P. Co., (So. Kraft Div.), Springhill</td>
<td>Sulphate</td>
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<td>7. Southern Advance Bag &amp; Paper Co., Hodge</td>
<td>Sulphate</td>
<td>300</td>
<td>4,695</td>
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<td>F. Maryland</td>
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<td>G. Mississippi</td>
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<tr>
<td>1. I. P. Co., (So. Kraft Div.), Moss Point</td>
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<tr>
<td>2. I. P. Co., (So. Kraft Div.), Natchez</td>
<td>Sulphate</td>
<td>(Dissolving Pulp)</td>
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<tr>
<td>4. Masonite Corp., Laurel</td>
<td>Misc.</td>
<td>900</td>
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<td>5. U. S. Gypsum Co., Greenville</td>
<td>Groundwood</td>
<td>180</td>
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<tr>
<td>Location of Mill</td>
<td>Type of Pulp</td>
<td>Tons of Pulp Every 24 Hours</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>-----------------------------</td>
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</tr>
<tr>
<td><strong>H. North Carolina</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. Champion Paper &amp; Fibre Co., Canton</td>
<td>Sulphate &amp; Soda</td>
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<tr>
<td>2. Halifax Paper Co., Roanoke Rapids</td>
<td>Sulphate</td>
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<tr>
<td>3. Mead Corp., Sylva</td>
<td>Semi-Chem.</td>
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<td>4. N. C. Pulp Co., Plymouth</td>
<td>Sulphate</td>
<td>700</td>
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</tr>
<tr>
<td>5. Riegel-Carolina Corp., Acme</td>
<td>Sulphate</td>
<td>200 1,872</td>
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</tr>
<tr>
<td><strong>I. South Carolina</strong></td>
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<td></td>
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<td>1. I. P. Co., (So. Kraft Div.), Georgetown</td>
<td>Sulphate &amp; Chemfiber</td>
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<td>2. Sonoco Products Co., Hartsville</td>
<td>Semi-Chem.</td>
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<tr>
<td>3. West Va. Pulp &amp; Paper Co., Charleston</td>
<td>Sulphate</td>
<td>700 2,310</td>
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<tr>
<td><strong>J. Tennessee</strong></td>
<td>Cotton Linter</td>
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<td>1. Buckeye Cotton Oil Co., Memphis</td>
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<td>4. Southern Chemical Cotton Co., Chattanooga</td>
<td>Semi-Chem.</td>
<td>67 747</td>
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<td>5. Southern Extract Co., Knoxville</td>
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<tr>
<td><strong>K. Texas</strong></td>
<td>Groundwood</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>2. Southland Paper Mills, Lufkin</td>
<td>Groundwood</td>
<td>280</td>
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<td>3. Camp Manufacturing Co., Franklin</td>
<td>Sulphate</td>
<td>330</td>
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<tr>
<td>4. Chesapeake Corp. of Va., West Point</td>
<td>Sulphate</td>
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<tr>
<td>5. Columbian Paper Co., Bristol</td>
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<td>85</td>
<td></td>
</tr>
<tr>
<td>Location of Mill</td>
<td>Type of Pulp</td>
<td>Tons of Pulp Every 24 Hours</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
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<tr>
<td>6. Mead Corp., Lynchburg</td>
<td>Semi-Chem.</td>
<td>125</td>
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<tr>
<td>7. Nat’l. Container Corp. of Va., Big Island</td>
<td>Semi-Chem.</td>
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<tr>
<td>10. West Va. Pulp &amp; Paper Co., Covington</td>
<td>Sulphate</td>
<td>360</td>
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</tr>
<tr>
<td></td>
<td>Soda</td>
<td>100</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>2,600</td>
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</tbody>
</table>

Total for 57 mills 23,600

*Paper mills using only purchased market pulp are not included.

Source: Compiled from information contained in Southern Pulp and Paper Manufacturer, XIII (October 1, 1950), p. 89 ff.
## APPENDIX B

### PULPWOOD PRODUCTION IN LOUISIANA

**BY PARISHES, 1948* and 1949**

*(In Standard Cords)*

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<td>Acadia</td>
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<td>4,335</td>
<td>62</td>
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<td>5,956</td>
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<td>22,316</td>
<td>4,305</td>
<td>1,400</td>
<td>40,335</td>
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<td>3,712</td>
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<tr>
<td>Avoyelles</td>
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<td>--</td>
<td>102</td>
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<tr>
<td>Beauregard</td>
<td>9,318</td>
<td>9,793</td>
<td>362</td>
<td>457</td>
<td>9,680</td>
<td>10,250</td>
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<td>Bienville</td>
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<td>41,082</td>
<td>896</td>
<td>600</td>
<td>57,460</td>
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<td>17,662</td>
<td>16,490</td>
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<tr>
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<td>14,749</td>
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<td>24,578</td>
<td>14,749</td>
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<tr>
<td>Caldwell</td>
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<td>--</td>
<td>16,264</td>
<td>8,917</td>
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<td>Cameron</td>
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<tr>
<td>Catahoula</td>
<td>561</td>
<td>--</td>
<td>38</td>
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<td>Claiborne</td>
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<td>22,094</td>
<td>277</td>
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<tr>
<td>De Soto</td>
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<td>23,402</td>
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<td>17,662</td>
<td>23,402</td>
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<td>Parish</td>
<td>Pine 1940</td>
<td>Pine 1949</td>
<td>Hardwood 1948</td>
<td>Hardwood 1949</td>
<td>Total 1948</td>
<td>Total 1949</td>
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<td>Lincoln</td>
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<td>953,823</td>
<td>759,824</td>
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**Source: James W. Cruikshank, 1949 Pulpwood Production in the South (Forest Survey Release No. 35; Asheville: Southeastern Forest Experiment Station, September, 1950), pp. 13, 14.
Agreement entered into this_____, day of________, 19____, between________________________, of____________, ______________________, State of________________________, hereinafter called the seller, and________________________, of________________________, State of________________________, hereinafter called the purchaser.

WITNESSETH:

Section 1. The seller agrees to sell, and the purchaser agrees to buy, under the terms and conditions hereinafter stated, the living pulpwood timber which has been designated by the seller, or his representative, as follows:

(State kind of timber, whether marked with paint or blazed, minimum diameter outside the bark at the 10th stump height, or other specifications)
on a certain tract of land belonging to the seller situated in the Parish of _______________ State of_____________
described as follows:_________________________________________

Section 2. The purchaser agrees to pay the seller in mutually agreed upon installments in advance of cutting.

the first installment of $________________________ dollars shall be paid when the contract is signed and subsequent installments shall be paid on or before such time as the value of the pulpwood previously cut shall equal the total payments actually made.

Section 3. The purchaser agrees to pay the seller for all wood cut under this agreement at the rate of $____ per unit of___________ cubic feet which shall be a stack of wood cut into_________ foot lengths and closely piled 4 feet high and 8 feet long.
Pulpwood will be measured in solid ricks at the following places:

(Indicate whether stacked in woods, on trucks, or on cars.)

Section 4. The purchaser agrees:
  a. To work into pulpwood, merchantable tops of trees cut from saw-log, and parts of trees wasted in logging operations.
  b. To cut stumps so as to cause the least possible waste, and not higher than 10 inches above the ground except when defective or badly fire scarred.
  c. To utilize all trees cut to a 4-inch top diameter except when a piece may be unmerchantable on account of large limbs. The purchaser agrees to pay two cents ($0.02) per stick for each merchantable piece left in the tops of trees which have been cut for pulpwood by him or his agents.
  d. To protect young trees against unnecessary injury. Only dead trees, unmerchantable hardwoods, tops, or other trees designated by the seller shall be used for building roads necessary to remove the wood, and roads shall be so located as to avoid stands of young timber so far as practicable.
  e. To exercise care at all times against the starting and spread of fire. Any fires caused by the purchaser or his agents shall be suppressed by the purchaser at his own expense, and the purchaser agrees to pay for all damages caused by any such fires.
  f. To repair at his own expense damages caused by him or his agents to the roads, gates, fences, bridges, and other improvements.
  g. Purchaser agrees to furnish the seller with itemized copies of all mill invoices covering timber cut under this contract.
  h. To pay double the rate stipulated under Section 3 for all marked or designated trees left uncut and all trees cut which are not designated or marked, except when necessary to release lodged trees or to salvage badly damaged trees.

Section 5. It is further understood and agreed by and between the parties hereto that:
  a. All timber included in this agreement shall remain the property of the seller until paid for. Wood left un-hauled shall be paid for by the purchaser at the regular rate.
  b. The seller guarantees that he has full right and title to the timber included in this sale.
c. All pulpwood shall be cut, paid for, and removed on or before __________, 19____, unless extension of time is requested and granted in writing.

d. In case of dispute under this contract, final decision shall rest with arbitration board of three persons, one to be selected by each party to the contract, and the third to be selected by the other two.

e. This agreement shall not be assigned in whole or in part by either of the parties hereto without the written consent of the other party.

f. The seller may stop all operations for violation of this contract by the purchaser and for cause may retain all monies deposited to the sale.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals this __________ day of ________, 195____.

Witnesses:

______________________ (Purchaser) __________________ (SEAL)

______________________ (Seller) __________________ (SEAL)

(An acknowledgement by either single or married persons or by a corporation should be attached to the bottom of the contract and when notarised will make the contract legal and binding.)

## APPENDIX D

### NURSERY STOCK DISTRIBUTION BY YEARS

**M Seedlings - All Classes**

<table>
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<tr>
<th>Fiscal Years</th>
<th>1944</th>
<th>1945</th>
<th>1946</th>
<th>1947</th>
<th>1948</th>
<th>1949</th>
<th>Total</th>
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<td>Alabama</td>
<td>1,276</td>
<td>1,789</td>
<td>1,255</td>
<td>1,463</td>
<td>5,798</td>
<td>19,569</td>
<td>31,150</td>
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<td>667</td>
<td>878</td>
<td>409</td>
<td>4,043</td>
<td>6,671</td>
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<td>2,214</td>
<td>2,609</td>
<td>1,754</td>
<td>481</td>
<td>10,680</td>
<td>19,383</td>
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<td>3,407</td>
<td>8,614</td>
<td>4,519</td>
<td>19,593</td>
<td>27,362</td>
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<td>Louisiana</td>
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<td>654</td>
<td>228</td>
<td>808</td>
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<td>17,232</td>
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<td>Stuart &amp; Ashe</td>
<td>-</td>
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<td>22,240</td>
<td>30,545</td>
<td>22,115</td>
<td>97,313</td>
<td>155,238</td>
<td>342,696</td>
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*Source: United States Department of Agriculture, Forest Service, Southern Region, Atlanta, Georgia, April 27, 1950.*
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VITA

Glenn Lundin Hodge, son of Claude LeRoy and Helen Anna Hodge, was born in Columbus, Kansas, November 27, 1912. He was graduated from Cherokee County Community High School in 1931. He attended Kansas State Teachers College, Pittsburg, from 1931 to 1935 and received the Bachelor of Science degree with a major in Commerce and minors in Social Science and in Psychology. While attending college he played the trumpet in the college band, orchestra, and in the State Festival Symphony Orchestra.

He taught commercial subjects in the high schools at LaCygne, Kansas; Osawatomie, Kansas; and Bisbee, Arizona, from 1935 to 1941.

On June 6, 1938, he was married to Mildred Lucille Knox and that summer began graduate work at the University of Denver School of Commerce, Accounts and Finance. He was graduated with the Master of Science degree in 1941, with a major in Accounting and a minor in Finance.

He was employed as instructor in Business Administration and Accounting at Louisiana State University from 1941 to 1947, during which time he served five years as Assistant to the Dean of the College of Commerce. He began work toward the Doctor of Philosophy degree in 1942.

In 1947, he accepted a position as Associate Professor of Business Administration at Louisiana Polytechnic Institute and is at present employed in that institution as Professor of Business Administration and Assistant Head of the Department.

During the summer of 1946, he began work on this dissertation and is now a candidate for the degree of Doctor of Philosophy at the August, 1951 Commencement.
EXAMINATION AND THESIS REPORT

Candidate: Glenn Hodge

Major Field: Business Administration

Title of Thesis: The Paper Industry with Special Reference to Louisiana

Approved:

[Signature]
Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: 23 July 1951