CONTRIBUTIONS OF FOREST PRODUCTS
LABORATORY RESEARCH TO SOUTHERN
PULP AND PAPER DEVELOPMENTS

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FOREST PRODUCTS LABORATORY
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The development of markets for forest products is of tremendous importance to the South because:

Almost two-thirds of the land in the southern states is more suited to the growth of forests than to any other crop.

In recent years the declining market for cotton has resulted in the abandonment of some 16,000,000 acres of cotton land -- equivalent to the loss of 138,000,000 man-days of work or 500,000 year-long jobs.

The South must look to increased industrial use and increased markets for forest products to absorb its surplus labor and to assure the prosperity of its rural communities.

The South has a tremendous advantage in producing forest materials because of rapid tree growth. It now has vast areas of forest lands which, given the proper fire protection, may be increased from 2 to 4 times its present growth. If the market for this potential growth can be developed the industrial conversion of forest products from the southern states will provide great expansion of jobs.

One of the most promising outlooks for realizing these needs of the South is the pulp and paper industry. As a matter of fact, this industry is already one of major importance in the South.

There is a somewhat general popular impression that the southern pulp and paper industry is a new development. Compared relatively with the industry in certain other parts of the country that impression is correct, but in other respects it is quite erroneous. Appreciable quantities of southern pine were being used for pulp in 1909 and by 1929 this consumption had reached over a million cords annually. In 1932, a depression year when consumption of other pulpwoods declined, southern pine was utilized for pulp to the extent of a million and a quarter cords. The tremendous growth since 1932 and particularly in the past three years is so well known as to require no comment.

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The Forest Products Laboratory was established nearly thirty years ago and research on the pulping of southern species was one of the first projects to be set up; in fact, it was under way in Forest Service laboratories prior to 1910; it has been actively in the Laboratory program since that time and is going strong today. The record shows that the Laboratory has continuously contributed factual and technical information on this subject over this period and its contributions towards the substantial development of the southern pulp and paper industry have been significant and consistently well in advance of contemporary progress. The constant aim has been soundly conservative, strictly factual (as opposed to promotional) technical information which could be utilized in most effectively developing a strong southern industry.

Certain milestones of progress may be pointed out. It was about 1911 that kraft pulp was first commercially produced at the Orange, Texas, mill of the Yellow Pine Paper Company, and I know that almost the first investigative project launched at the Forest Products Laboratory when it was established at Madison, Wis., in 1910 had to do with the production of kraft pulps from southern pines. In 1914 we issued a bulletin entitled "The Suitability of Longleaf Pine for Kraft Paper" (now out of print), in which it was pointed out that this species was entirely suitable for strong kraft, an idea which was somewhat adversely received by the pulp industry at that time. This work was rapidly followed by investigation of other southern pines, and we were able to say confidently that these woods were eminently adapted to the kraft pulping process much in advance of their extensive commercial use.

While the growth of the kraft industry in the South during the past three or four years has been phenomenal, it should be recalled that from 1910 until the depression period, kraft pulp capacity in the South doubled every five years.

In the period from 1915 to 1921 we carried on a series of preliminary pulping trials using all standard pulping processes with as many American woods as appeared to have commercial possibility. Groundwood, sulphite, soda, and sulphate pulps were made from practically all of the southern species, and the data assembled and published in bulletin form. During this period such commercial organizations as the Champion Fibre Company at Canton, North Carolina, the Carolina Fiber Company at Hartsville, South Carolina, the West Virginia Pulp and Paper Company at Covington, Virginia, and at others of their mills, experimented on a mill scale with some of these processes.

In the same period our Laboratory also investigated multiple-stage bleaching and produced on a laboratory scale satisfactory bleached book papers from a combination of sulphate pulps produced from southern yellow pine and black gum. At about the same time the Mead Fiber Corporation built a mill at Kingsport, Tennessee, where bleached pine soda pulp was produced for book purposes.
From 1921 to 1927 our research on the pulping of southern wood was accelerated. Improved methods for cooking bleachable sulphate pulps from the yellow pines were developed, and chlorination bleaching procedures tried which resulted in strong white pulps from these species. During this period also we made newsprint papers from various combinations of pine sulphite both with pine groundwood and black gum groundwood, and with black gum by means of a new process developed at the Laboratory which we called "semichemical." This process was found to be also well adapted for certain grades of pulp from southern hardwoods, the production of corrugating board from extracted chestnut chips, and for use with southern gum for butchers' wrap and lighter colored grades.

Since 1927 a great deal of effort has been directed toward the improvement of the quality of pulps and papers using the various standard pulping methods with southern pines and hardwoods, and laboratory products ranging through 9-point board from black jack oak, newsprint, and highest-quality bond papers have been successfully produced.

One interesting and very significant outgrowth of this work was the development at the Forest Products Laboratory of a southern pine newsprint in which semibleached sulphate pulp is used in place of unbleached sulphite — the commonly employed chemical part of newsprint paper. We knew that the sulphite process is very difficult to apply to pines containing heartwood, and we know also that in the ordinary run of wood coming into the mill there will be included a considerable proportion of heart-containing material. Since the production of a light-colored groundwood precludes the use of a very high percentage of dark-colored heartwood, there must be a selection of material suitable for the groundwood pulp. If the sulphite process was also to be employed a similar wood selection would be necessary. This limitation does not apply, however, if the sulphate process is employed, as wood of all sorts can be utilized by this method and the selection problem greatly minimized. It is significant that the new mill now being erected at Lufkin, Texas, will use this method rather than the sulphite-groundwood furnish which was originally advocated by some people for southern newsprint.

Since 1930 the Laboratory has devoted a great deal of attention to improvement of processes and to a study of growth conditions which affect the quality of wood for pulping purposes. In the first category we have intensively studied the use of soda-base sulphite cooking liquors and find promising possibilities in this connection. For example, if neutral sodium sulphite solutions are employed, properly buffered so that acid conditions are not developed, very strong light-colored and easy-bleaching pulps can be made from both pines and hardwoods. We have, furthermore, developed methods for the recovery of the soda from the waste liquors incident to these procedures which, we believe, bring them well into the range of practical operation.

Another significant field of work in the past few years has been the determination of the important influence of forest growth conditions upon the suitability of southern pines for varied grades of pulp and
paper. Growth factors determine the relative proportions of springwood and summerwood present in the tree, the amounts of heartwood and sapwood, of abnormal compression wood, of pitch or resin. As a matter of fact, these results of growth circumstances often play a much more significant role in the pulping of southern pines than the species themselves.

For example, a slash pine containing heartwood is extremely difficult to pulp by the sulphite process, whereas the same species fast-grown and without heartwood is readily reduced. Or a fast-grown loblolly pine of high springwood content differs diametrically from a loblolly pine wherein the proportion of springwood is low and the summerwood content high, because the two types of fibers are entirely different -- in the case of the summerwood thick-walled and stiff, in the case of the springwood thin-walled and pliable. Papers made from wood in which one or the other of these fiber types predominate are widely different in quality.

The above brief historical resume has been made for two reasons: First, to emphasize that the problem of pulping southern pines and other southern species is by no means a new one. Both the industry and the Government, as well as numerous private individuals, have been highly interested in this subject for many years and have been working strenuously to improve its status. Second, to emphasize the lag which occurs between technical research and commercial exploitation. While a few brave and hardy pioneers often immediately rush forward to try our technological developments, there is almost always a period in which the results are discouraging and seemingly of little significance. Our early work with kraft pulp, for example, was challenged and many doubting Thomases arose to assert that the South would never be able to compete with other parts of the country in production of this product. How wrong they were is evidenced by the tremendous growth during the past twenty years. The production of bleachable pulps from southern woods has only recently assumed what might be considered significant proportions; a lag of ten years or more intervened between the publication of reliable technical data on this development and its initiation in a really large way commercially.

The ideas of Dr. Herty and ourselves on newsprint are now in this lag period. Contrary to a widespread belief, no newsprint paper is yet being produced in the South. A mill is being built, as you know, for this purpose, and there is little reason to doubt that many thousands of tons of newsprint will eventually be made from southern pine. Just how rapidly this development will come depends upon many factors besides the technical ones.

The work which we are now doing on the relation of forest growth conditions to pulpwood suitability is very likely considered by many as visionary and impractical at the present time. However, there are many evidences that it is being quietly utilized by various individual mills, and I have no doubt but that in years to come, as the paper base broadens in the South and new grades are manufactured, that wood selection based on growth condition data will become a common practice.
On the basis of what we know today, there is every reason to believe that there will be a continued growth and development of pulp and paper products from the great forest resources of the South. However, it should be remembered that the South has no monopoly on forest resources. Wood also grows rapidly in the Northwest, and there are reforestation possibilities in the Lake States and in the Northeastern part of the country which may sooner or later bring tremendous quantities of wood into the market for pulp and other purposes. Hence, we seem bound to have a continuous state of competition existing between various forested sections of the country as well as competition with other forest-producing countries. Many factors, such as labor, other raw materials, freight rates and markets, and power and water resources, will need to be adjusted in the inter-regional competition which must, of necessity, result.

There is one other factor which might be mentioned. That is the possibility of fiber sources other than wood. At the present time some bagasse, a considerable quantity of straw, and a very small amount of cotton are utilized in this country for pulp products. The possibilities of flax, hemp, cornstalks, ramie, and other fibers are continually suggested. We see for all of these fibers a certain possible limited outlet in special grades of papers and pulps, but thus far we have yet to find one of these crop plant sources which seems in a position to compete successfully with wood in the large tonnage fields. Various factors enter in, but the outstanding fact is that wood is one of the most compact and most cheaply produced sources of cellulose for pulp fiber available. Thus far no crop plant has been able to compete with it in any tonnage grade save insulation. It seems destined for a long time to continue to be the dominant raw material of the paper and pulp industry.

While on this subject, let me offer a friendly and I hope constructive criticism to the Farm Chemurgic movement: That is the relative neglect of wood as a farm product and as the source of many useful chemical compounds. To be sure, the Council has emphasized pulp and paper from southern pine and has liberally encouraged Dr. Herty's activities in this field. But paper is only one product from wood and, as already indicated, that outlet for southern pines is really not new, but has been under development actively for more than thirty years.

Other wood outlets are for such products as industrial alcohol, plastics, naval stores, tannins, and hydrogenated lignin compounds to say nothing of specially refined cellulose for rayon textiles, cellulose films, etc. As a matter of fact, it appears that wood in many instances has a better chance of success in many of these fields than any of the other crop plants. For after all wood is a crop! It is a crop that farmers all over the country, with the possible exception of the great plains, grow continuously. It is a crop which is produced with less effort than nearly any other. It is a crop which can be harvested at convenience, rather than being held to a seasonal basis. It is a crop which requires less investment in capital or labor than almost any other, which does not impoverish the land, and which effectively eliminates erosion and decadence of land values.
I hope, therefore, that we may see a more active consideration of the virtues of forest farming, and a more virile interest in forest products and forest products research as one of the most promising fields of Farm Chemurgic endeavor.