

# TECHNICAL NOTE NUMBER 212

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

FOREST PRODUCTS LABORATORY

MADISON 5, WISCONSIN

REVISED December 1953

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## AMERICAN WOODS FOR PAPERMAKING

The paper industry ranks sixth among prime manufacturing industries from the standpoint of value of products and employs more than 420,000 production workers. More than nine-tenths of the paper is made from wood pulp. About 14 percent of the total volume of wood harvested currently from American forests is used for the production of wood pulp. Paper, as one of the indispensable commodities, has created a new dependence on the forests and has increased their importance.

The consumption of pulpwood in the United States in 1952 was nearly 26.5 million cords. Spruce, balsam fir, pine, and hemlock have long been the principal pulping woods. They and 1 or 2 other less-used softwoods now comprise about 86 percent of the pulpwood used. More than half of the softwoods used are the southern pines. The remaining 14 percent are hardwood species. About 20 species are included in the hardwoods and miscellaneous softwoods. Experiments at the Forest Products Laboratory indicate that many other woods can be used. Reports of results of experiments on a number of them can be obtained from the Laboratory.

As indicated above, the principal woods used in the United States for paper may be broadly classified as to botanical characteristics and pulping qualities as either softwoods or hardwoods.

### Softwoods (Conifers)

All spruces are suitable for pulping by any of the processes, and all make high-quality pulp except Sitka spruce, which yields a rather coarse-fibered pulp.

Western hemlock is similar to the spruces in pulping quality, although in the groundwood process it requires a little more power than spruce

to produce pulp of the same quality. Eastern hemlock is not so suitable as western hemlock for groundwood. Though chemical pulps made from eastern hemlock are darker, require more bleach, and are weaker than spruce pulps, this wood is used in fairly large amounts.

All pines are readily reduced with the alkaline processes (sulfate and soda), and the pulps can be bleached satisfactorily under proper conditions. The young, fast-growth southern yellow pines and lodgepole, ponderosa, sugar, eastern white, and jack pines are suitable for groundwood pulps. However, the groundwood pulps obtained from pines cause more or less trouble in papermaking because of their pitch content. For making light-colored, unbleached groundwood pulp, the pine must be relatively free of heartwood.

The heartwood of pine is difficult to pulp by the sulfite process. With modifications of the standard sulfite process, shortleaf, longleaf, loblolly, slash, jack, lodgepole, red, pond, sand, and Virginia pines can be made into fair-quality pulps for papermaking. However, the present production of pine sulfite pulp is mostly used for making rayon.

All true firs are as readily pulped as spruce by any process and, with the exception of red fir, are comparable in quality. Red fir yields a rather dark mechanical pulp, and the sulfite and sulfate pulps made from it are more difficult to bleach than those of spruce.

Baldcypress, Douglas-fir, the larches (tamarack), and the redcedars are not suitable for the generally acceptable grades of groundwood pulp. Douglas-fir, pretreated with steam or hot dilute alkali, can be ground for pulp suitable for shipping container boards. These woods are relatively difficult to pulp by the sulfite process, but with modifications the process may be used with some of the species to produce pulps of acceptable quality. All may be reduced by alkaline processes. A considerable amount of Douglas-fir sawmill waste is pulped by the sulfate process. The strength characteristics of the pulps vary widely with the species. For example, Douglas-fir pulp excels in certain properties while western redcedar pulp is superior in others. The yield of pulp from redcedar is relatively low.

The white-cedars are readily and fairly acceptably pulped by all processes. The yields, in comparison with other woods, are normal on a weight basis, but because of relatively lower density, they are lower on a cord basis.

## Hardwoods (Broadleaf Trees)

Because of their similar pulping characteristics the pulp industry has classified as "poplars" a number of hardwood species, including some that botanically do not belong to the poplar family. Included in the group are such true poplars as aspen, cottonwood, and balsam poplar, as well as yellow-poplar, which is not a true poplar. Together, these species constitute an important group of hardwoods used for pulp and paper manufacture. They are among the softer and lower density woods of the hardwood species. They can be pulped by chemical, semichemical, and groundwood processes by which they yield short-fibered pulps relatively low in strength but suitable for many uses. The bleached chemical pulps, which possess certain quality advantages, are used in printing and wrapping papers of higher grades and in specialty boards; and the unbleached pulps are used in the cheaper printing and wrapping papers. The unbleached semichemical pulps can be used in wrapping and newsprint paper, container boards, and insulating board. The groundwood pulps are used in book and other printing papers and in insulating board.

A common regional grouping classes sweetgum, the tupelos, red maple, and elm as "soft" hardwoods for pulping purposes, although actually they are harder than most of the woods in the "poplar" group. These woods, plus beech, the birches and other varieties of maple, constitute another large group of hardwoods yielding pulp with similar qualities. All can be pulped by the chemical and semichemical processes, and the pulps can be used for about the same purposes as those described above for the "poplars." The groundwood pulps, though short-fibered and low in strength, have value as filler stocks. The quality of the hardwood groundwood can often be improved by chemically treating the sticks of wood before grinding (chemigroundwood). Experimental work shows that most of the woods in this group are adapted to the manufacture of newsprint, book, toweling, and specialty papers, structural corrugating board, hardboard, and purified cellulose for rayon manufacture.

In recent years, oak, once regarded as one of the poorest of pulping woods, has been increasing in use and it now can be considered as an important pulpwood. It is pulped by the soda, sulfate, and semichemical processes. The pulps find use in corrugating board and, after bleaching, in printing papers.

Miscellaneous hardwoods used for papermaking include principally ash, chestnut (after tannin extraction), willow, and such less-used species as alder, basswood, buckeye, butternut, catalpa, sugarberry, hickory, locust, sassafras, and sycamore. All may be pulped by the soda, sulfate, and semichemical processes, most of them quite readily. The lighter colored species are, in general, suitable for pulping by the groundwood process. Their principal use is in book, magazine, and cheap printing papers, and in corrugating board.