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## AMERICAN WOODS FOR PAPER MAKING

From the standpoint of value of products, the paper industry in 1939, according to Bureau of Census data, ranked sixth among the prime manufacturing industries, with a total of over 2 billion dollars. In the same group it ranked fifth in 1940, with more than 328,000 employees, and second only to sawmills and planing mills in the forest products industries which employed more than 938,000 persons. More than nine-tenths of our paper comes from wood pulp. Paper, as one of our indispensable commodities, has created a new dependence on our forests, and increased their importance.

In 1944, 83 percent of the wood used by the pulp and paper industry consisted of spruce, hemlock, and pine; the remainder included about 18 species of softwoods and hardwoods. Experiments at the Forest Products Laboratory indicate that, with slight modifications in the standard pulping processes, many other woods can be used. Reports of results of experiments on a number of these woods can be obtained from the Forest Products Laboratory.

The principal woods used in the United States for paper may be broadly classified as to pulping qualities and botanical characteristics 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 more power than spruce to produce pulp of the same quality. Eastern hemlock is not so suitable as Western hemlock for groundwood. Chemical pulps made from it are darker, require more bleach, and are weaker than spruce pulps.

All pines are readily reduced with the alkaline processes and the pulps can be bleached satisfactorily under proper conditions. The young, fast-growth Southern yellow pines and lodgepole, ponderosa, sugar, limber, pinon, Eastern white, and jack pine are suitable for groundwood pulps. However, the groundwood pulps obtained from pines cause more or less trouble in paper making because their pitch content limits the proportion in which some of them can be used. For making light-colored unbleached groundwood pulp the pine must be relatively free of heartwood.

With slight modifications of the standard sulfite process shortleaf, longleaf, loblolly, slash, jack, lodgepole, red, pond, sand, and Virginia pines can be made into fair pulps with a reasonable bleach consumption, provided young growth or material containing a comparatively small amount of heartwood is used; heartwood is difficult to pulp.

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, and the red-cedars 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 more difficult to pulp by the sulfite process, but with modifications the process may be used with some of the species to produce commercial pulps. All

may be reduced by alkaline processes. The strength characteristics of the pulps vary considerably with the species. 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 somewhat lower density yields are lower on a cord basis.

### Hardwoods (Broadleaf Trees)

Because of 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; yellow-poplar, which is not a true poplar. Together, these species constitute the largest group of hardwoods used for pulp and paper manufacture. They can be pulped by chemical processes or by the groundwood process. They yield short-fibered pulps relatively low in strength. The bleached chemical pulps are used in printing papers of higher grades, the unbleached pulps in the cheaper printing and wrapping papers. Groundwood pulps are used in book, tissues, and heavy structural boards, such as insulation. Experiments have demonstrated that appreciable proportions of true poplar neutral sulfite semichemical and groundwood pulps may be utilized in the manufacture of newsprint and other printing grades.

Beech, birch, maple, sweetgum, and the tupelos, including the several varieties of these species, constitute ~~from a quality standpoint~~, the second largest group of hardwoods used for pulp. Like the "poplars," they can be pulped by the chemical processes, producing pulps somewhat similar in quality; their use is

limited by their low strength. The groundwood pulps, though short-fibered and low in strength, have value as filler stocks. Recent experimental work shows that most of the woods are adapted to the manufacture of newsprint, book, toweling, and specialty papers.

Miscellaneous hardwoods used for paper making include principally ash, chestnut (after tannin extraction), elm, oak, willow, and such lesser-used species as alder, basswood, buckeye, butternut, catalpa, sugarberry, magnolia, mangrove, hickory, locust, sassafras, and sycamore. All of these species may be pulped by the soda and sulfate processes, most of them quite readily. Most of these woods can also be pulped by the sulfite and neutral sulfite semichemical processes. 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.