UTILIZATION PRACTICES AND TRENDS — HARDWOODS FOR PULP¹

By D. V. LOVE²

Basic to any discussion of the past, present or future use of hardwoods for pulp is some background regarding:

- (a) the pulping qualities of hardwoods compared to softwoods, and
- (b) the pulping processes suitable to the hardwoods.

In this paper no distinction will be made between poplar and the heavy hardwoods although there are some rather fundamental differences between the two groups. The poplar has a longer fibre length than the heavy hardwoods and is less dense. As a group, however, the hardwoods, including poplar, have a much shorter fibre length than the softwoods and the heavy hardwoods are much denser than the softwoods yielding a greater weight of pulp per unit volume of wood. The pulp produced from hardwoods is much weaker than that produced from softwood.

So much for the characteristics of the pulp of hardwoods.

The processes by which wood fibres are separated to produce pulp are of significance also in this discussion. The first commercially important pulping processes—soda and sulphite were not well adapted to the use of hardwood (except poplar) which were difficult to cook by these methods. The sulphate process, using a strong base instead of acid, developed commercially about 1912, was well suited to the use of the heavy hardwoods as they would pulp easily by this process. In more recent times two other processes suitable only for hardwoods have been developed. The first is the semi-chemical process by which the chipped wood is first softened by a short cooking in neutral sulphite at high temperature and then mechanically separated to produce a somewhat crude pulp. By modifications in cooking and refining the grade of the pulp can be raised to a very high standard. The second important development—very recent—is the chemi-groundwood, by which process the wood is chemically treated in the bolt and subsequently ground to produce the pulp mechanically.

These two technical factors, the quality of the hardwood pulps and the processes by which they are produced, are two of the four factors which must be understood before the story with respect to hardwood pulp can be properly related. The two remaining factors—economic rather than technical—are:

- (a) the trends of demand and use for wood pulp in general, and
- (b) the economic position of the hardwood pulpwood compared to softwood pulpwood.

The trends of demand and use for woodpulp can be traced but briefly in the time available. To cite U.S. statistics the woodpulp consumption plotted over time from 1900 to 1955 has the appearance of a parabola. Actual

¹ A paper presented at the 48th Annual Meeting of the Canadian Institute of Forestry, held at Chicoutimi, Quebec, October 2 - 5, 1956.

² Professor, Faculty of Forestry, University of Toronto, Toronto, Ontario.

production in 1900 was 1½ million tons, in 1925 was 5½ million tons, in 1945 was 12 million tons, in 1955 was 20 million tons. The rate of growth from 1900 has been a fairly steady 4.8 per cent per year. This has been maintained by: (a) increasing population and (b) increasing per capita consumption.

The per capita consumption has been increased by expanding the markets for pulp and using it in places where it was never used before—to a large extent as a substitute for wood for boxes, crates and lathes, and in a new market, food packaging.

The final factor—the economic position of hardwood pulpwood compared to softwood pulpwood—can be disposed of in a sentence by quoting a mill manager in one of Michigan's pulp mills. "With imported spruce pulpwood costing \$54.00 per cord landed in our yard how can we afford not to use the poplar and other hardwoods which we can purchase locally for \$12.50 per cord." The spread between the cost of softwood pulp and the cost of hardwood pulp is not always so great, but there is usually a sizeable difference representing pressure for the increased use of hardwood as a substitute for softwood.

With this background the position of the hardwoods in the woodpulp field—past, present and probable future—is easily appreciated.

1. The Distant Past

In the distant past the situation could be summed up as follows:

- (a) early processes better suited to the use of softwood;
- (b) softwood plentiful, cheap and easily handled;
- (c) pulp of superior quality;
- (d) limited uses and limited market for woodpulp in general. Under such conditions no industrialist in his right mind would even consider using hardwood except under unusual local circumstances.

2. The Not-So-Distant Past

By 1940 under the stimulus of war production the situation had altered as follows:

- (a) pulping processes were originated, designed to produce high yield hardwood pulp;
- (b) softwood pulpwood costs were soaring due to local shortages and increasing transportation;
- (c) markets were developing for the grades of pulp for which the hardwoods are best suited;
- (d) hardwoods were locally available in large quantities at relatively low cost. The obvious result was increased hardwood utilization.

3. The Present

Those of us who have used wood for carpentry work soon come to recognize the working qualities of one species over another and we favor one species over another for a particular piece of work. If the work calls for pine, we do not want to have to use hemlock. The hemlock does not have the qualities we require so it must be replaced by pine. If we had a piece of hemlock with

the qualities of pine which we require (assuming that we had no prejudices) we would be satisfied with hemlock. However in natural wood, unfortunately, the only wood with the qualities of pine is pine itself.

In pulp the situation is quite different—true softwood pulp has certain desirable characteristics which are not available in hardwood pulp and vice versa. However, by judicious mixing of the softwood with the hardwood the best qualities of both can be emphasized. The strength of the softwood can be imparted to the inexpensive hardwood and we have satisfactory pulp which may be not only cheaper, but physically better, for our purposes by virtue of the presence of the hardwood pulp.

Thus we see at the present time a tendency to analyze the requirements of the specific product to be made from the pulp and then to mix a pulp which meets the specifications using as much hardwood pulp in the furnish as the requirements of the product will permit. In some products 100% hardwood is quite satisfactory, in others the hardwood may have to be reduced to almost nil. Between these limits there is a tremendous use for hardwood which the manufacturers now fully appreciate. This is the present situation—a certain amount of hardwood pulp can be used in almost every piece of paper or paper board.

4. The Future

Where is this trend of increased utilization of hardwood likely to lead us? It should lead us:

- (a) to closer definition of the qualities we require in our paper, and
- (b) to the more rigid adherence to the specifications utilizing hardwood to the fullest extent that those specifications will permit. This will produce the product that will do the job and produce it at the lowest possible price. This is what the future demands. As long as hardwood enjoys an economic advantage over softwood, there will be efforts made to design processes and equipment to enable the greater use of hardwood. Considering the annual surplus of hardwoods in the United States of 49.2 million cords compared to a softwood deficit of 4.5 million cords, it appears that the economic advantage may be fairly long-lived, at least in the United States.

Of what interest is all this to the forester who is not directly concerned with pulpwood production? First, any changes in the pattern of utilization of species in an industry as important to the forests as the pulp and paper industry must be of concern to foresters generally. Second, this tendency of the pulp and paper industry to look with favor on the hardwoods opens a great door which foresters have been trying to get through for years. Here is the solution to a multitude of our forest management problems—utilization of the low-grade species and poor quality individuals. Some of you might be inclined to throw up your hands and say, if wood pulp can be produced from all of this silvan junk, why should we bother with silvicultural practices designed to favor superior species. The answer is this, not all wood is used to produce woodpulp, and woodpulp made from what we consider superior species has inherent qualities superior to the hardwoods in many respects. No amount of technical know-how is going to eliminate this difference. There will always be a recognition of quality which will be economically rewarding.