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Timber Quality Evaluation—Its Complexities and Use

By E. H. CLARKE

Much has been written recently about the projected demand-supply imbalance for wood in the years ahead. Louder voices and greater pressures are being heard and felt for action to intensify timber management and harvest from a shrinking land base to meet urgent needs of a rapidly growing population. Foresters confront a monumental task in attempting to meet that demand for consumable forest products, especially in light of the intensifying competition for less tangible forest values.

Increasing pressure on the better quality timber is at the heart of the supply problem. A careful look at the quality of the existing timber resource base provides a reference point for a look ahead. Currently, our commercial forest lands are producing about 12 billion cubic feet of wood annually. By the year 2000, or sooner, the annual demand could double. A portion of our timber inventory is presently unsuitable for profitable utilization and cannot contribute to the supply perhaps for several decades. The millions of acres with large volumes of medium- and low-quality timber can better contribute if diligent attention is paid to utilizing it for its highest value use. This will require intensive study and research.

In the past, foresters too often have equated the quality of timber solely with stocking levels, species composition, and volume per acre. Timber intensively managed under these guides will not automatically yield the maximum of high-quality and high-value products. The wood may be so poor in intrinsic quality, due to low specific gravity, uneven growth or occurrence of aberrant wood, that it is unfit for any use in solid form. It will warp, shrink unevenly or excessively, machine poorly, or have low strength. It may not serve well either for use as pulp or other fiber products. Thus, the existence of trees of a given kind and size does not necessarily guarantee that an adequate base for a wood-using industry is present.

My aim here is to plead the case for recognizing and evaluating quality of standing timber as a useful tool in many forestry operations. Such evaluation provides the management link between the raw material and processing and is a basic consideration in all forestry operations concerned with timber production. In the short run, today’s forest stands have to support today’s industries and we should be greatly concerned with timber production. In the short run, today’s forest stands have to support today’s industries and we should be greatly concerned with evaluating the quality of the timber as we find it and to allocate it wisely. In the long run, it is imperative, in meeting the projected demand, that growers produce timber with characteristics commensurate with the needs of the marketplace and that processors utilize it to its highest value use.

The concept of quality has the appearance of simplicity, whereas it is extremely deceptive. “Quality” means different things to different groups, and to different individuals within groups. To the land manager, quality has usually meant thrifty growth. To the log scaler, it means volume of usable material. The pulpwood buyer may look for high density as an indication of maximum pulp yields. Even when it is further described, such as, product-quality, wood-quality, or in this case, timber-quality, it still is difficult to focus on all of its aspects. In spite of the ambiguous semantics of the word “quality,” the need for devices to recognize and evaluate the quality of standing timber is one of the more important needs of both producers and processors.

Timber quality in the broad sense is concerned simultaneously with kind, size, and physical perfection of trees and with their relative conversion value in terms of yield of end-products in demand. These two aspects—physical and economic—are inseparable.

The current approach to recognize and evaluating commercial-size timber quality is to devise rating or grading systems, for important species or species groups, based upon how well logs or trees meet the specifications of major products or use classes. In this context, grading is an attempt to classify their value for specific uses through observations of external macroscopic characteristics. It is not feasible to determine the absolute value of an individual log or tree; such a precise system would be too complex for practical application. The aim should be to devise easy-to-use grading systems that will stratify timber into relative value groups within suitable limits of accuracy for the group as a whole.

Detailed grade-yield studies are made on one or more samples of the population. These studies must be made in “above-average efficiency” producing mills. Data obtained under conditions unattainable in commercial practice may have limited utility, while data from studies made under poor or slipshod milling practices will not contribute to the objective of correlating surface characteristics to yields. The
work must be done under adequately controlled conditions, however, so that the resultant variation in product yield and quality can be identified—is it due to processing or is it biological.

After all data on the characteristics of each tree or log studied and the grade-yield recovery of products from each are available, the development of grading systems can begin. This is no easy task. Involved are several problems in estimation—and all the interrelated complexities that go with making a series of predictions, each dependent on the others. These include sources of variation, such as (1) range in kind of end-products, (2) range in volume of end-products, by product grade, and (3) range in product prices, by grade. Some, but not all, of the difficulty is due to a lack of applicable statistical theory. Much of it is lack of knowledge on the effect that the various timber characteristics have on utilization.

The principal macroscopic characteristics affecting the timber resource can be grouped generally as either volume-reducing or grade-reducing. These groups are interrelated and not nearly enough is known of their joint influence on utilization. The volume-reducing group is especially troublesome because some of our present units of measure and methods of determining net volume are woefully inadequate. They are outdated and badly in need of overhaul. For example, trees and logs treated by units which supposedly yield one thousand board feet of lumber, regardless of intended use. Also, the pulp industry deals with volume scales of board feet, cords and cunits even though it sells on a basis of tons. The determination of net volume involves intended use because deductions due to volume-reducing defect depend upon the conversion process and the degree to which product specifications permit the presence of the defect. Qualitative information about trees and logs ideally could be part of the measuring system. Scaling techniques that are more independent of single products and less inflexible to changing conditions are needed.

There are equally pressing problems associated with the grade-reducing group of characteristics. Presently there is no distinct line between cull timber and merchantable timber; the demarkation is arbitrary and varies between geographic regions for the same end use. In some instances, after unusable material is removed in manufacture, there may be no serious blemishes in the remaining wood; it could be high-quality. On the other hand, full-scale logs or trees may be of marginal value because the grade-reducing defects cannot be eliminated economically in manufacture.

There is a third group of characteristics that fit into neither the volume-reducing nor grade-reducing category, but yet has an important effect on utilization. Among this group are bark thickness—important to the wood treating industry; and green weights of trees—important to the efficiency of balloon logging and other aerial logging systems. There is a great need for much expanded knowledge on all the various timber characteristics and their qualitative and quantitative effect on utilization. Some of the leading species and most of the secondary species are inadequately characterized and this deficiency detracts full use.

Any grading system is actually made up of many grades—a continuum. Most users believe that a practical working system, however, should contain not more than six grades nor less than three. Further, each system should be applicable for the species over its entire range. The performance of any one grade—that is, the predicted product yield and value recovery—may differ somewhat from one location to another. Such differences may be due to both regional and local physical differences of the timber or to methods of utilization. Differences in utilization will always have to be taken into account by developing different performance tables to go with the grading system. For example, a sawmill producing only studs will have a different grade recovery mix than one that produces the full range of lengths and widths; or a processor who does not have a chipper will develop more volume of low-grade lumber than one who does. Thus, each of these processors could develop performance tables for their private use with the grading system. These would differ from the average performance used by the researcher in developing the system and would be especially valuable for use in bidding on timber sales.

Other needs and uses for grading techniques to evaluate the quality of timber are legion. There are many kinds of quality judgments that must be made during the life of the stand and during the course of manufacture. Although no one system can serve all the needs, there is strong interest in the growing list of uses of timber quality rating systems. In national planning, for determining the future outlook or timber supplies, the concern mostly is with trends in the general physical attributes of the resource rather than projected product grade-yields. An inextricable system employing quality factors can better serve in defining the direction and speed with which the quality trend is moving.

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of beauty, quiet, and space in which to remain human. We are, indeed, all in each other's service. Forest geneticists and pathologists working to grow trees resistant to minor levels of air pollutants, must collaborate closely with the engineers who are trying to reduce the amount of these pollutants. Thus, by approaching the problem from each side, we may reach a sensible standard—the right amount of air pollution for the multiple use of the air, if you like.

In the middle of the Sahara Desert hundreds of miles south of Tessalit and a thousand miles north of the southern limit of the present Sahara, there are rock drawings depicting jungle animals and indicating that the jungle was once there. This desert grew south undoubtedly with the help of man as also in India, at the rate of about a mile a year. Surely, with our present scientific and engineering prowess we can roll the carpet of jungle back.

If we get the foresters out of the forests so that they can see the trees in the cities, and bring to other cities William Penn's vision of "Greene Countrie Townes," then foresters would not have to worry if trees could vote and would win the confidence of fellow humans, not as in the old slogan, a chicken in every pot, but with a tree in every plot.

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**Timber Quality Evaluation—**

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The method of forest management prescribed and used by the operating forester, of course, has a considerable effect on the quality of the timber crops produced. To produce high-quality he must have some measure of quality. Each successive cutting operation during the rotation provides the opportunity to manipulate growing stock quality, as well as volume growth. Here too, the use of an indiscrete quality evaluation system could be most useful in determining potential.

Still another major use for quality evaluation systems is within the forest products industry where the trend is toward large vertically- or horizontally-integrated companies. They are concerned with allocation of logs to alternative plants, aiming at optimum value. Log grading systems are becoming very useful to management for this purpose. Moreover, there is the challenging opportunity of evaluating quality at each stage of the manufacturing process, where the mix of output units can be evaluated more precisely than the input unit in terms of predicting the next stage outputs. Thus, the output of one process is the input to the next and the various steps share strong inter-dependencies.

With the development of better timber quality evaluation systems, for the whole array of uses they can serve, the resource can be better managed and used to meet the growing needs of the market place. The task is large, but necessary if we are to meet the predicted demand for wood in the years ahead.