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MODERN TRENDS IN THE UTILIZATION OF FOREST PRODUCTS

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INTRODUCTION

TIMBER was one of the earliest raw materials to be exploited by man; and the history of the utilization of wood is as old as the history of man himself. Our primitive ancestors in their struggle for existence required wood to perform for them a few but essential tasks; to-day, in our more complex world, we make use of wood in vastly greater numbers of ways, either in its natural state or by processing it to such an extent that the finished article bears little or no resemblance to the original material. This paper does no more than touch upon a few of the modern uses of wood in which we, as foresters, are interested. In particular the emphasis is on the demand for timber in Great Britain which can be met from young conifer plantations. The Census of Woodlands showed that, in 1947, the total area of Forestry Commission Woodlands amounted to over half a million acres, mainly conifers. Private woodlands amounted to $1\frac{1}{4}$ million acres, thirty per cent of the area being conifers. (The figures refer only to high forest, and exclude areas classified as e.g., scrub, coppice, felled or derelict.) It has been estimated that for purely silvicultural reasons, about nineteen million hoppus feet of soft-wood thinnings and seventeen million hoppus feet of hard-wood thinnings could be removed annually from the above areas of high forest. In State forests there has not been a great discrepancy between the theoretically desirable and actual thinning programmes; in private woodlands, however, much remains to be done, particularly in the case of hard woods.

In the case of conifers the principal species in plantations between ten and forty years of age are:

Scots and Corsican Pine	..	39 %
European and Japanese Larch	..	22 %
Norway and Sitka Spruce	..	31 %
Remainder (Douglas Fir the most important)	..	8 %

As far as the soft woods are concerned, with one major exception, the question of species has not so far played a very important part in determining the price of small conifer poles. On account of its greater strength and durability European Larch has always commanded a better price than other soft woods. During the war, when prices were controlled, higher rates were fixed for larch. Since decontrol of prices this differentiation has continued and, for example, when larch is ordered specially, 10 % is added to mixed conifer prices for pit props.

In the hardwoods category the English oak, ash, and beech occupy about 70 % of the 227,000 acres of hard-woods between ten and sixty years of age. The most important species in the remaining 30 % of the area are birch and sycamore.

Generally speaking, hard-wood poles are more difficult to market and command a lower price than the soft woods. ,Much depends on whether there is a wood turnery in the neighbourhood.

Demand for Timber in Great Britain

The consumption of timber in Great Britain in 1950 was 706 million hoppus feet over bark (" roundwood equivalent ") of which about 45 % comprised soft woods, about 15 % hard woods and 40 % derivative products—largely pulp for paper making, but including a substantial quantity of plywood and veneers. Home grown timber consumed amounted to 92 million hoppus feet over bark (" roundwood equivalent ") of which soft woods formed about one quarter. This was a year when soft wood consumer licences were required, but hard woods were freely available.

It may be of interest to examine several of the markets in greater detail.

Mines. In very round figures the mines absorb 80 million hoppus feet of timber annually. The bulk of the timber is consumed in lengths of three to six feet with a range of top diameters from three to six inches. Soft woods account for all but between six and eight million cubic feet of the total annual consumption. Hardwood mining timber is not imported and the use of hard-wood pit props has recently ceased in some pits. About 30 % of the total consumption is in the form of sawn mining timber, e.g., crown-trees, splits, pit sleepers, cover boards and chocks.

In considering soft wood round mining timber from the forester's point of view two distinct types of produce are involved. Firstly, there is the sale of partially prepared timber which may be dispatched to a specification allowing a range of lengths and top diameters. In this case the final preparation or cutting to size may be done, for example, at the colliery. Secondly, there is the sale of the prepared pit prop manufactured to a fairly rigid specification. Although the overall requirements of the mines are such that a wide variety of sizes of prop may be prepared, practical considerations have to be taken into account. The size of prop required varies from pit to pit, and

from time to time at any one pit: this one factor alone precludes the forester from merely choosing the range of prop sizes most suited to any particular parcel of thinnings and cutting accordingly. Normally, only one size of prop is loaded on to a railway wagon and, except in large-scale thinning operations, there is a danger, when cutting too many sizes, that the forester is left with part-wagon loads. By obtaining firm orders in advance and by limiting sizes to a few for each forest, the chances of preparing pitwood profitably are enhanced. Whilst these may seem to be very elementary points they are sometimes overlooked.

Cutting pit-props to exact sizes rather than to general specifications may necessitate peeling and seasoning, and in fact the use of peeled seasoned pitwood is tending to increase. If peeling and seasoning are undertaken, the forester's supervisory duties are increased and the money spent on preparing the peeled props must be idle until seasoning is completed and the props sold. On the other hand, peeling enhances the appearance of pit-props; seasoning, which is accelerated by peeling, reduces their weight and increases their strength. These two factors may be very important in helping timber to maintain its place *vis-a-vis* other materials in the propping and shoring of mines.

Pulpwood and Boardmill Material

In relation to the utilization of thinnings it may be convenient to consider what is generally termed pulpwood under three main heads, viz., wood used for the manufacture of (i) textiles, (ii) paper, and (iii) fibre boards. There are, at present, no pulp mills in Britain producing pulp for the manufacture of textiles; none of the paper pulp mills using wood are dependent to any extent on home-grown timber for their supplies, but the fibre-board mills rely to an increasing extent on home-grown timber. However, the possibilities of setting up new plants based entirely on home-grown timber have often been discussed and this provides the excuse for mentioning the subject of " pulp " very briefly to-night.

(*i*) *Textiles.* The use of wood for the manufacture of textiles is comparatively new, even though rayon was the first textile fibre to be made by man. In 1920 the production of rayon in Europe was just over 10,000 tons per annum, compared with about 800,000 tons to-day, made mainly from dissolving wood pulp. The latter figure represents a considerable consumption of timber with spruces as the most important group of species—when it is realized that it takes very nearly 200 hoppus feet of roundwood to make one ton of rayon.

(*ii*) *Paper.* Pulp for paper making can be produced from a wide range of vegetable fibres, but for one reason or another the extent to which is it possible to produce paper-pulp on a commercial scale has so far been rather more limited in practice than the theoretical studies of the problems have indicated. Fortunately wood is par-

ticularly suitable for the manufacture of paper pulp on a commercial scale. A number of processes may be used dependent on the species available or the end use of the pulp or a combination of both. Briefly these processes are:

(*a*) *Mechanical* (*Groundwood*) *Pulp*

Roundwood is ground by means of large stones into fibres. Yields are high (69 hoppus feet pulpwood per ton of pulp). As can well be imagined, soft woods that can be used in this process are limited to those with a comparatively low resin content. Hitherto, spruce has been the only soft wood used on any scale in Europe and Scandinavia; of the hard woods aspen and poplar have been used on a limited scale on the continent.

(*b*) *Chemical Processes*

Mechanical pulps have a somewhat limited range of uses, mainly for newsprint and paperboard. Pulps produced by the action of chemicals on wood chips have a wider range of uses, although approximately twice as much timber may be required to produce one ton of pulp.

The *sulphite* process, like the mechanical process, has hitherto been capable of using only conifers with a small resin content and has therefore been in competition for the not unlimited supplies of spruce in Europe. Broad-leaved species free from tannins and other heartwood substances are suitable, e.g., birch, beech, poplar and willow.

Very recently it has been announced that, in Sweden, Stora Kopperbergs Berlag have been able to produce sulphite pulp of good quality from Scots pine by using a two-stage sodium bisulphite cooking process, thus enabling them to utilize large quantities of small-sized pine for which there has been a somewhat limited market in the region of one of the main spruce-sulphite-pulp producing centres.

The *sulphate* process can make use of most conifers and a number of temperate hard woods. This advantage in the way of raw materials has to some extent been offset in the past by the limited range of papers that could be made from sulphate pulp. In the last twenty years modern methods of manufacture have overcome this disadvantage and it is now possible to produce a high quality pulp by the sulphate process.

Semi-chemical. Mention must also be made of the possibility that in the future more wood may be pulped, partly by chemical and partly by mechanical means. This so-called semi-chemical process gives the high yields of mechanical pulp from a much wider range of species than are acceptable in the conventional mechanical pulp-mill. As in the early days of the sulphate process the use to which the pulp can be put is—at the present time—somewhat limited. There is

hope, however, that in time improvements in the manufacturing techniques can be expected to remedy this situation.

All the above processes require bark-free timber of four inches diameter and up, and to be economic the weekly intake must be reckoned in hundreds of tons of timber.

Fibreboards

From the forester's point of view the manufacture of fibreboards from wood is a somewhat less exacting operation than the manufacture of paper pulps. Unbarked timber is acceptable, and in diameters below those normally acceptable in paper pulp mills. Virtually all the common conifers can be used, although the larches are not looked on with great favour. Poplar and willow, and to a lesser extent chestnut, birch, alder and beech, may be used in mixture with conifers.

Fibreboards, whether they be hard boards or insulating boards, have two outstanding advantages over natural timber—they can be made to given—and rather precise—specifications, and they can be made in large sizes. In addition they are frequently made from a proportion of small diameter timber which it would be difficult to dispose of in any other way.

Sawmill waste and roundwood waste from the cross-cutting of round timber to lengths can also be used in boardmills, although special machinery is generally required to chip slabwood effectively.

Chipboards

Although, strictly speaking, not within the " pulping " field, mention must be made of chipboard manufacture. Chipboards are made by bonding together of " chips "—produced from shavings and offcuts from woodworking factories—by synthetic resin glues. A strong board of rather large dimensions can thus be made from material which has hitherto been classed as " waste." Recently much thought has been given to the advantages that would accrue if the solid wood were cut into shavings specifically for chipboard manufacture. This may be an important development from the forester's point of view, in that forest thinnings, and perhaps sawmill slabwood of reasonable size, will probably play a greater part in the chipboard factory of the future than they have in the past.

Agricultural, Horticultural and Estate Timbers

In considering the enormous consumption of timber by the mines and the wood-hungry pulp and board mills, one must not lose sight of the humbler local markets for thinnings. In fact, at present, in Britain, the next most important group of industries after the mines, from the point of view of the utilization of small thinnings, are those using fencing stakes and stakes for agricultural and horticultural work. These markets absorb approximately 20 % of

the thinnings from State forests and use both conifers and hard woods. The quality required is inferior to that required by the mines and the range of sizes is greater. Poles are sold in the length for the manufacture of rails for fencing and pergola work for public parks and private gardens. The demand near big towns is heavy and there has been a good demand for round stakes for use on the new housing estates developed since the war.

Sawn Softwood Timber

So far we have mentioned two extremes in utilization, the use of timber mainly in the round, and the demand or potential demand, for round timber which undergoes a complete transformation before it reaches the final consumer. What of sawn timber—the " partially processed " wood ?

The main end uses to which sawn softwoods were put in 1949 are given below. The figures are no more than an estimate based on the issue of consumer licences for soft woods. Unfortunately there are no comparable figures for pre-war years and figures for 1950-52 have not been issued.

1949	*Thousand Standards*	*Million Cubic Feet*	%
General Industry ..	150	25	13
Export Packing ..	240	40	21
Food Packing ..	35	6	3
Shipbuilding and Repairing ..	45	7	4
Transport ..	115	19	10
Housing	340	56	29
Other Building ..	130	21	11
Miscellaneous ..	110	18	9
Total	1,165	192	100 %

It is at once obvious that housing and building are together the main consumers of sawn soft woods (40 %); what is even more interesting, and perhaps less often appreciated, is that packing (24 %) is the next largest market for sawn soft woods (and this too in a year when hard woods were free from consumer licence restrictions). The demand for the smaller sizes of boxboard is one that often can be met from thinnings, particularly from butt-cuts which are too stout or short for mining timber or pulpwood, yet too short for conversion to sawn lumber.

It is not always so easy to meet the demand for building timbers from thinnings, since building timber is frequently required to be either in long lengths or of high quality, or both. This is not to say that good structural timbers cannot be obtained from thinnings; they can, but the material will require to be selected.

SAWN HARDWOOD TIMBER

In the years 1946 to 1948 when hard woods were still subject to consumer licensing, out of a total annual consumption of about sixty million cubic feet, about one-sixth went into domestic furniture; this was the largest single user of hard woods except for the rather omnibus head " general industry," which accounted for about one-third of the total.

HARD WOOD (Million Cubic Feet)

Consumer	1946	1947	1948	1948 %
General Industry ..	30·0	27·0	30·0	33
(of which Domestic Furniture) ..	(14)	(10)	(10)	17
Export Packing	1·0	1·0	1·5	2
Food Packing	3·5	4·0	4·0	7
Shipbuilding and Repairing	2·5	2·5	2·5	4
Transport	7·5	9·0	9·0	15
Housing Other Buildings ..	3·0	2·5	5·0	8
Miscellaneous Home and Overseas Requirements	13·5	10·5	8·5	14
TOTAL	61·0	56·5	60·5	100 %

Apart from charcoal manufacture, fencing, sawn mining timber and certain types of turnery, the big demands for hard woods are for timbers which require considerable care in selection and grading.

If one can risk a few sweeping generalizations one might comment on the demand for thinnings by saying that hardwood thinnings have at present no " national " markets of the magnitude of those open to soft-wood thinnings. That there are four major outlets for softwood thinnings—to some extent complementary to each other, to some extent in competition with each other; viz., (i) the mines, (ii) pulp and board mills, (iii) farms, forests and market gardens, and (iv) the box and packing crate trades. That the mines require the bulk of their supplies of timber in lengths and top diameters similar to those most readily acceptable in pulp mills, fibreboard mills frequently accepting whole poles or parts of poles too small in diameter for either of these two markets. That fencing

posts—whether they be round, split, or square-sawn—may be obtained from thinnings which would also make mining timber or pulpwood; and that the lighter horticultural stakes may come from boardmill material. That logs capable of producing the larger sizes of pit-prop and pulpwood may often equally well be sawn into boxwood or packing crate material, and in this sense there is competition between three consumers for the same material. That on the other hand, the boxwood and packing crate markets can make use of those butt-cuts which, although of too large a diameter to make pit-props or pulpwood, are too short for conversion into the general run of sawn lumber.

DISCUSSION

From the foregoing even the most pessimistic of us could feel fairly confident that the demand for timber and timber products is there. Can one be confident that, as production increases, home-grown timber can be sold in a market dominated—except during the war years—by imported timber. So far as hardwoods are concerned home timber of *high* quality has not only held its own with imported, but has often been preferred. Home-grown Scots Pine and European Larch of good quality have always found a market where the timber has been properly prepared, selected and presented. In Scotland, particularly, the greater part of the long-established home timber trade grew and prospered on Scots Pine and European Larch.

It is common knowledge, however, that on much of the land which is available for forestry, Scots Pine and European Larch would not thrive, and other conifers have been, and must in the future, be planted. Sitka Spruce is the most important of these, followed by Norway Spruce, Japanese Larch, Douglas Fir, and Corsican Pine.

At the Forest Products Research Laboratory at Princes Risborough the properties of all these newer species have been investigated, catalogued and compared with the properties of imported timber of the same species and with, for example, home-grown Scots Pine and European Larch. The data have been made available in the *Handbook of Home-grown Timbers*, but it should be pointed out that as more and more of these species are becoming available in larger sizes, the work of testing goes on; and more reports of performance in practice are coming forward. There is no time to-night to enter into a detailed discussion of the results obtained. One can sum up the position fairly and concisely by saying that the evidence to date shows that home-grown timber can fulfil many of the demands for timber in Great Britain, provided that it is properly prepared and carefully selected for the end use in view. It is particularly important—and this is a personal view—to realize that home-grown thinnings are not by any means always suitable for the same end use as the mature imported timber of the same species. There is no doubt that in the past quite understandable prejudices against home-grown timber may have arisen in the minds of certain consumers

through the failure of themselves or their suppliers to appreciate this point.

The title of this talk was given as " Modern Trends in the Utilization of Forest Products." We have been discussing the present demand for timber and for its products such as paper and building boards. What of the future trends in utilization ? It may be significant that in the last twenty years or so the production of sawn timber in Sweden, one of the world's leading forest countries, has fallen by over 1,000,000 cubic metres (6·7 million in 1930, 5·5 million in 1950) whereas manufacture of soft and hard fibreboards has increased from under ten thousand metric tons in 1930 to over 270 thousand metric tons in 1950. Plywood and blockboard manufactures have more than doubled in the same period; and mechanical and chemical pulp production has increased from 2·4 million metric tons to 3·2 million metric tons. Thus, over the last twenty years in Sweden, there has been a tendency to use an increasing proportion of the annual cut of timber as a raw material to be broken down and reconstituted rather than to shape it and use it in its " natural " state. There are many reasons for this change, the most obvious being that the demand for products made from timber has grown rapidly, whilst the use of timber as timber has tended to remain static or to diminish. Less obvious perhaps, but equally important, is the fact that many products of timber such a fibre building boards can be made partially or wholly of timber of too small dimensions for use in the round or of too small dimensions to saw economically. The " waste " that arises in conversion—whether in cross-cutting round timber to lengths or in sawing into squared timber—is also being utilized to an ever-increasing extent in board manufacture. Whilst it is true that the use of timber as such has continued through the Stone Age, the Bronze Age, the Iron Age, and we have no reason to suppose that it will not continue through the Atomic Age, complacency would be a dangerous thing. Constant vigilance and research will be needed to ensure that if traditional markets do diminish and new unfamiliar demands are made upon timber the grower and processor alike are able to meet them. Should those new demands fail to materialize in " ready-made " fashion, there seems to be no good reason why they should not be created—in line with the modern trend in so many industries unconnected with forestry.