generally prove considerably below the truth, but it seems desirable to have at least some estimate, however crude, of this material, especially as it is already beginning to have a market value as pulp wood. Including everything from 4 inches up there are probably about 800,000 cords. The balsam fir has no future, the ground it occupies is largely farm land, its growth is too slow, its size too small to commend it to future operations.

HARDWOOD SUPPLIES.

No sharp limits of distribution or composition of the great hardwood forest are possible, aside from the general outlines of the part which bears hemlock and birch as differentiated from the oak forest. Basswood, maple, elm, and ash, the principal hardwoods aside from oak and birch, all entered into the composition of the hardwood forest in nearly all parts of this area, though in widely varying proportions. Thus in one locality elm forms 30 per cent. and more of the woods, while in another, but few miles distant and with soil, drainage, etc., alike, the elm is nearly replaced by basswood or birch. Nor is it easy to draw lines with reference to size and quality of development. Good timber on good soils passes by easy stages into inferior timber on poorer soils, and it is but fair to say that some good timber grows in every county. In general it is an unquestionable and well recognized fact that the hardwood timber becomes smaller and scrubbier toward the north; and, when the extremes, as for instance the hardwoods of Dunn or of Shawano counties are compared with those of Iron and Douglas counties, this truth is quite apparent, but the transition is gradual and any apparent lines of demarcation are generally explained by differences in soil rather than effects of climate. In the southern portion of the area under consideration, the hardwoods attain considerable dimensions. Oak, basswood, and elm 90 to 100 feet high and over 30 inches thick are nothing unusual. In general, however, the mature timber is under 30 inches in diameter and under 75 feet in height, and on large tracts shorter than 60 feet and under 20 inches.
Generally the hardwoods are "short bodied" as compared to conifers; they furnish per tree about 2 1-2 logs and in the northern counties scant 1 1-2 logs, of which it takes 7 to 10 to the thousand feet B. M. Of the different kinds, basswood and elm are tallest and longest in body, the former quite commonly cutting 3 and even 3 1-2 logs per tree, and the latter often furnishing ship timbers 60 to 70 feet in length. Birch is generally the shortest, and large trees often furnish but a single log. As might be expected, much of the older hardwood timber is in all stages of degeneration and decay, so that much of it is defective and the cut consequently wasteful. The oak, being naturally the longest lived and having the most durable wood, is least affected, "it cuts sound;" basswood, birch, and ash are about alike and quite defective when old; while of all hardwoods the maple is the worst in this respect. With this tree especially, the fault is not entirely a matter of age but seems largely due to injury in consequence of frost; "frost cracks" with their peculiar rampart-like thickenings or ridges along their edge being very common. These cracks admit fungi and insects and thus introduce decay. This evil in maple is most strongly complained of in the central and northern parts and least in the southeast and southwest, where a great deal of fine maple occurs.

Concerning the yields in hardwoods, opinions differ widely; the estimates are generally too low and are commonly deficient. The reasons for this are several. Lack of experience both in estimating and milling of hardwoods is a chief cause, the men being used only to pine but not to hardwoods. To this must be added, lack of time, the work usually being too hurried, and also the fact that most of the work is done for certain kinds of timber only, oak, basswood, elm, etc. Such estimates usually include only choice material, the peculiarities of the hardwood market reacting even on the matter of estimates. Generally the yields are estimated at from 80 to 150 M. feet per 40 acres, or 2 to 4 M. feet per acre for fair to good lands, and from 25 to 50 M. feet per 40 acres for the poorer lands and the northern lake districts. Some townships in Wood and Marathon
counties are known to have cut over 100 million feet per town
or nearly 5 M. per acre for the total area, swamp and all.
Smaller districts, as some forests in Shawano and Langlade
counties, cut from 10 to 15 M. feet per acre, but these must be
regarded as exceptions.

The standing hardwood and hemlock was determined by as-
certaining the area of fairly stocked woodland, excluding swamp
lands, then settling on the yield per acre, or 40, and finally
estimating their relative proportions. The determination of
the area is the weakest point in the estimates. The yields for
all principal localities are based on wholesale estimates and re-
sults of actual operations. Thus the cut per township, or the
cut for a number of sections, was considered, as also the esti-
mates of lumbering and railway companies, besides the detailed
experience of several hundred men, and the results weighed by
comparing the growth in different localities.

The proportions of hemlock and hardwood and the different
kinds of hardwoods among themselves, is also ascertained in
the same manner. There exist for all principal localities, ex-
tensive detailed estimates; those of the Chicago & Northwestern
Railway, and also those made for several years by Mr.
Ben. Hall of Marinette, are models of this kind. Of these,
a number were examined, and in addition the views of different
operators compared. To most men the figures of yield will
probably seem high, and in truth 6 M. feet per acre, or 240 M.
per 40, does appear like a large amount even for the best
counties. But it must not be forgotten that here all kinds
of timber, birch, maple, elm, etc., are considered merchantable,
and also that all sizes above 12 inches diameter, and for oak
and hemlock even tie sizes are included. Waste and swamp
areas are excluded and thus only the acres of well stocked land
enter into consideration. Those who consider the yield as
taken too low (and there will be many of these) will bear in mind
that merchantable saw timber in hardwoods and hemlock, is at
present quite a different thing from pine, and also that both
hardwoods and hemlocks are short-bodied, have been injured by
fire, and involve in all old stands a heavy per cent. of defective material.

Present stand of hardwood saw timber.

<table>
<thead>
<tr>
<th>Kind of wood</th>
<th>Million ft. B. M.</th>
<th>Per cent of all hardwoods</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak</td>
<td>1,400</td>
<td>8.6</td>
<td>75 per cent red oak</td>
</tr>
<tr>
<td>Basswood</td>
<td>4,600</td>
<td>29.0</td>
<td>Yellow or red birch.</td>
</tr>
<tr>
<td>Birch</td>
<td>4,150</td>
<td>26.0</td>
<td>30 per cent. rock elm.</td>
</tr>
<tr>
<td>Elm</td>
<td>2,650</td>
<td>16.5</td>
<td>Mostly black ash.</td>
</tr>
<tr>
<td>Ash</td>
<td>900</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Maple</td>
<td>2,300</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The hardwoods are cut in all parts of this territory, they are generally logged in a small way and most of the lumber is cut in small mills, with a yearly output of 1-2 to 5 million feet. According to a masterly canvass conducted by the *Northwestern Lumberman* of Chicago, the results of which are published in its issue of January 22, 1898, the total output of hardwood lumber amounts to about 275 million feet B. M. To this must be added large quantities of mining timber used in the mines of Florence, Iron, and Ashland counties, railway ties, piling and construction, and ship timbers; and also considerable quantities of cooperage material and wagon stock, which in the aggregate probably bring up the total cut of hardwoods to about 500 million feet.

The most valued and therefore the most culled of the hardwoods is the oak, particularly white oak, the exploitation of which was begun in Wood and Clark counties more than 25 years ago. Of the other hardwoods, the basswood is most extensively cut and finds the most ready market, followed in this respect by elm, particularly the fine rock elm. Birch, though the prettiest wood of the region, is much underrated, owing to fashions which prejudice the market. Nevertheless, large quantities are cut every year and the same is true of maple, which is
generally the least estimated of the hardwoods. Owing to its irregular distribution, ash is of local importance only, though in some places it is claimed that ash logs are as easily procured as almost any other. (Oconto county.)

Among trees of secondary importance aspen (poplar), white birch, butternut and beech may be mentioned in order of their economic value. The aspen (poplar), both the common aspen and large-toothed aspen are found in all parts of the area, but are conspicuous as timber trees only in the northern forests, especially of Douglas, Bayfield, and Ashland counties. These aspens (poplars) take possession of all burned slashings, but aside from their value as nurse trees to pine and better woods the aspens on the slashings of North Wisconsin have generally been of no value so far, and it appears doubtful if they ever will be except in a few localities, chiefly in the better sandy loam districts.

The white birch is best developed near Lake Superior, but never grows large, generally remaining a mere sapling, commonly less than 12 inches in diameter and 50 feet in height. In this territory it is almost always a member of mixed woods, often joining the white pine, and rarely forms thickets by itself (on some burned areas in Forest county.) It is cut for chair stock, etc., but 90 per cent. of all white birch is too small for present markets.

The butternut is sparingly scattered over the better loam lands as far north as the Iron Range. It occurs isolated, rarely in small groups, and though it grows to good size its distribution here seems uncertain and accidental.

The beech is restricted to the sandy loam lands of the Green Bay region, and invades only the edges of the real loam or clay lands of northern Oconto and Shawano counties. Wherever seen, it appears to thrive, is abundant in all sizes and evidently reproduces well.

Throughout the hardwood forests all stages from the seedling to the old and decaying timber trees are represented. In some cases the stand of old, mature timber is quite heavy, and
undergrowth and sapling timber are restricted; but more generally the mature trees are in the minority, and are scattered about, standing 10 to 20 per acre, and the greater part of the ground is occupied by young trees, small saplings, and bushy or withy beginners. The undergrowth is generally composed of the young forest trees, and distinct kinds or species performing this function are few, often wanting. All kinds of hardwoods reproduce actively as is well illustrated in numerous windfalls and abandoned clearings, where dense thickets of mixed hardwoods occupy every foot of the ground. Abundance of seed and ability to stand shade enable the maple to predominate among the young growth even where it holds but third rank and less as a timber tree. Conspicuous among the young growth, without ever attaining the size of log timber, are the blue beech, bush or striped maple, and, somewhat less abundant, the hop hornbeam. As a common underbrush proper, on both loam and sandy soils, can be mentioned only the hazel. The dogwood (cornel) and wild red (pin) cherry are much less abundant; the latter becoming really conspicuous only on the burned lands. The willows are quite abundant as scattering brushwood in open places, and occur on the dry sandy soils as well as on clay lands. Alder replaces the large willows along many of the streams and in some swamps. It is never more than a bush, but as such forms characteristic alder brakes.

The scrubby hardwoods of the openings consist almost exclusively of oaks. A variety of both white and red oaks (particularly bur, white, and red oaks) grow here into bushy dwarfs, 15 to 25 feet high, 4 to 12 inches in diameter and branching out almost from their very base. These scrub oaks occasionally form thickets but generally stand too far apart to prevent a ground-cover of grass and weeds.

Since the hardwood forest occupies the better soils, its area will necessarily continue to be diminished as the country is settled, and the present supply of timber will be reduced at a rate quite independent of hardwood lumbering. Nevertheless, the
SUPPLY OF TIMBER.

difficulty of clearing the land, the comparative safety from fires, and the abundance of young, well growing stock all combine to prolong the supplies. The outlook for the hardwoods is far brighter than for the much more valuable pine.

TOTAL SUPPLY OF TIMBER.

In the following table the entire supply of timber is arranged according to the uses that might be made of the same:

*Classification of wood supplies.*

<table>
<thead>
<tr>
<th></th>
<th>Conifers.</th>
<th>As per cent. of</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million feet B. M.</td>
<td>Conifers.</td>
<td>Total saw timber.</td>
<td></td>
</tr>
<tr>
<td>White Pine</td>
<td>15,000</td>
<td>52</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Norway pine</td>
<td>2,300</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Hemlock</td>
<td>11,700</td>
<td>40</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>29,000</td>
<td>100</td>
<td>64.3</td>
<td></td>
</tr>
</tbody>
</table>

**HARDWOODS.**

<table>
<thead>
<tr>
<th></th>
<th>Million feet B. M.</th>
<th>As per cent. of</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All hardwoods.</td>
<td>Total saw timber.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oak</td>
<td>1,400</td>
<td>8.6</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Basswood</td>
<td>4,600</td>
<td>29.0</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>Birch</td>
<td>4,150</td>
<td>26.0</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>Elm</td>
<td>2,560</td>
<td>16.5</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>900</td>
<td>5.6</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Maple</td>
<td>2,300</td>
<td>14.3</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>16,000</td>
<td>100</td>
<td>35.7</td>
<td></td>
</tr>
</tbody>
</table>

Total of saw timber, 4,500 million feet.