



TREE AND SHRUB BIOMASS ESTIMATES FOR MICHIGAN, 1980



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Arnold J. Ostrom, *Mensurationist*

NORTH CENTRAL FOREST EXPERIMENT STATION
Forest Service - US Dept. of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

ABSTRACT.—Live tree biomass estimates in green tons and shrub biomass estimates in pounds per acre are presented for Michigan.

KEY WORDS: Tree weights, tops and limbs, tall shrubs, low shrubs.

trees less than 5 inches d.b.h. was computed from a regression equation fit to Young's tree weight table (Young *et al.* 1976). This regression equation uses d.b.h. to estimate total above-ground biomass as 80 percent of the above- and below-ground biomass.

TREE BIOMASS

In recent years, increasing removal and processing costs, new product development, increasing competition for wood, and the energy crisis have challenged the tradition of using only the merchantable tree bole.¹ Complete above-ground tree utilization requires a measure of tree volume that includes more than just merchantable volume. In Michigan, estimates of tree biomass on commercial forest land were made during the recent fourth forest inventory.

Method

Tree biomass was estimated by the following method: First, net cubic foot volumes were converted to green tons by using weight conversion factors for each species (Markwardt 1930). The weight of the bole bark was then computed using bark correction factors for individual species, the gross volume of the bole, and an average bark weight of 37 pounds per cubic foot. Tops and limbs for growing-stock and cull trees were estimated as 45 percent of the gross bole volume (Young *et al.* 1976). Finally, the biomass for

¹The above-ground volume in growing-stock trees from a 1-foot stump to a variable 4-inch top diameter outside the bark that meets pulpwood specifications.

Findings

Tree biomass, including the bark, is made up of five components (table 1). The largest portion of the

TABLE 1.—*Distribution of tree biomass on commercial forest land among tree components, Michigan, 1980*

| Tree component | Biomass | |
|---|--------------------|---------|
| | Million green tons | Percent |
| 1. 1- to 5-inch diameter breast high trees | 193.7 | 18 |
| 2. Growing stock | | |
| A. boles—from a 1-foot stump to a variable 4-inch top diameter outside the bark. | 530.9 | 51 |
| B. tree tops and limbs—the volume above the variable 4-inch top, excluding the foliage. | 247.6 | 24 |
| 3. Cull | | |
| A. boles—from a 1-foot stump to a variable 4-inch top diameter outside the back. | 44.7 | 4 |
| B. tree tops and limbs—the volume above the variable 4-inch top, excluding the foliage | 29.6 | 3 |
| All Components | 1,046.5 | |

State's tree biomass, more than 50 percent, is in growing-stock boles. This is followed by growing-stock tops and limbs that provide an additional 24 percent of the total tree biomass.

Total tree biomass in the State amounted to more than 1 billion green tons or 46 billion cubic feet (table 2). Tree biomass in growing-stock boles, the tree component used in most inventories for volume, equaled 531 million green tons (table 3).

Hardwood tree species make up 75 percent of Michigan's tree biomass. Of the 781 million green tons of hardwood biomass, 170 million tons are in hard maple species and 130 tons are in aspen. Also shown in the following tabulation is softwood tree biomass concentrated in the pines, northern white-cedar, and balsam fir:

| Species group | Tree biomass (Million green tons) |
|----------------------|--------------------------------------|
| Other hardwoods | 197.9 |
| Hard maple | 170.3 |
| Aspen | 129.6 |
| Soft maple | 124.1 |
| Oak | 117.3 |
| Pine | 87.5 |
| Other softwoods | 67.8 |
| Northern white-cedar | 58.6 |
| Balsam fir | 51.1 |
| Paper birch | 42.3 |
| All species | 1,046.5 |

SHRUB BIOMASS

The biomass of other woody perennials (all shrubs) on Michigan's commercial forest land was also estimated in conjunction with the recent forest inventory.

Table 2.--All live tree biomass on commercial forest land by species group and forest type, Michigan, 1980
(In green tons)

| Species group | Forest type | | | | | | | |
|-----------------------|----------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|----------------------|
| | All types | Jack pine | Red pine | White pine | Balsam fir | White spruce | Black spruce | Northern white-cedar |
| SOFTWOODS | | | | | | | | |
| White pine | 20,468,311 | 566,804 | 1,245,668 | 6,238,347 | 990,056 | 238,250 | 662,120 | 1,274,799 |
| Red pine | 33,041,982 | 2,510,576 | 23,650,975 | 1,026,052 | 167,054 | 68,418 | 280,873 | 70,244 |
| Jack pine | 33,963,901 | 25,114,823 | 3,037,295 | 215,878 | 49,122 | 45,076 | 927,107 | -- |
| White spruce | 14,149,758 | 18,787 | 109,348 | 311,329 | 3,828,580 | 2,010,639 | 194,002 | 1,326,903 |
| Black spruce | 17,514,624 | 529,279 | 102,968 | 264,531 | 1,425,072 | 103,815 | 9,553,498 | 3,581,080 |
| Balsam fir | 51,103,647 | 44,687 | 213,928 | 725,983 | 13,125,533 | 611,607 | 1,651,460 | 8,917,489 |
| Hemlock | 24,730,688 | -- | 68,955 | 105,130 | 481,796 | 7,844 | 111,946 | 745,739 |
| Tamarack | 6,954,471 | 8,083 | 11,059 | 25,916 | 305,818 | 27,181 | 965,050 | 2,317,387 |
| Northern white-cedar | 58,566,961 | 3,319 | 55,447 | 111,826 | 2,555,680 | 438,206 | 1,400,752 | 40,152,115 |
| Other softwoods | 4,544,431 | -- | 177,211 | 356,765 | 3,036 | 146,032 | 2,834 | 91,066 |
| Total | 265,038,774 | 28,796,358 | 28,672,854 | 9,381,757 | 22,931,747 | 3,697,068 | 15,749,642 | 58,476,822 |
| HARDWOODS | | | | | | | | |
| Select white oaks | 34,207,991 | 170,517 | 507,217 | 241,983 | -- | -- | -- | -- |
| Select red oaks | 65,860,332 | 2,052,724 | 902,388 | 458,867 | 26,720 | -- | -- | -- |
| Other red oaks | 17,196,503 | 779,808 | 727,965 | -- | -- | -- | -- | -- |
| Hickory | 6,446,123 | 16,357 | 28,639 | -- | -- | -- | -- | -- |
| Yellow birch | 32,067,348 | -- | -- | 30,736 | 913,980 | 20,610 | 129,034 | 1,064,956 |
| Hard maple | 170,281,365 | 34,032 | 218,821 | 257,883 | 561,506 | 82,027 | 46,616 | 336,356 |
| Soft maple | 124,063,072 | 456,822 | 741,072 | 723,715 | 2,663,631 | 196,829 | 528,002 | 2,791,939 |
| Beech | 20,513,346 | -- | 26,491 | 48,023 | 13,824 | 14,389 | -- | -- |
| Ash | 41,988,244 | -- | 34,607 | 23,280 | 481,930 | 7,244 | 102,451 | 2,635,326 |
| Balsam poplar | 10,808,208 | -- | 3,690 | 15,489 | 558,276 | 104,662 | 90,339 | 1,250,182 |
| Cottonwood | 3,235,916 | -- | -- | -- | -- | -- | -- | -- |
| Bigtooth aspen | 42,644,753 | 240,833 | 646,207 | 168,764 | 114,165 | 8,158 | 74,959 | 219,519 |
| Quaking aspen | 86,950,725 | 776,862 | 1,163,902 | 744,595 | 3,055,704 | 864,176 | 1,236,931 | 1,551,461 |
| Basswood | 27,394,152 | 23,056 | 26,847 | 7,431 | 15,043 | 3,421 | -- | 83,424 |
| Yellow-poplar | 698,427 | -- | 11,603 | -- | -- | -- | -- | -- |
| Black walnut | 1,423,274 | -- | 9,766 | -- | -- | -- | -- | -- |
| Black cherry | 18,504,249 | 89,320 | 233,203 | 83,624 | 279,527 | 61,317 | 32,176 | 39,879 |
| Butternut | 288,868 | 16,485 | -- | -- | -- | -- | -- | 14,570 |
| Elm | 18,188,254 | 14,966 | -- | 14,869 | 278,377 | 19,530 | 19,582 | 163,193 |
| Paper birch | 42,268,071 | 194,107 | 264,961 | 766,856 | 2,572,795 | 162,724 | 770,213 | 5,413,820 |
| Other hardwoods | 6,560,371 | 8,010 | 23,909 | -- | 461 | 10,179 | -- | 22,341 |
| Noncommercial species | 9,860,846 | 10,859 | 33,577 | 1,206 | 42,685 | 1,047 | 67,180 | 94,855 |
| Total | 781,450,438 | 4,884,758 | 5,604,865 | 3,587,321 | 11,578,624 | 1,556,313 | 3,097,483 | 15,681,821 |
| All species | 1,046,489,212 | 33,681,116 | 34,277,719 | 12,969,078 | 34,510,371 | 5,253,381 | 18,847,125 | 74,158,643 |

(Table 2 continued on next page)

(Table 2 continued)

| Species group | Forest type | | | | | | | |
|-----------------------|-------------|-------------|--------------------|-------------|-------------|-------------|-----------|-------------|
| | Tamarack | Oak-hickory | Elm-ash-soft maple | Maple-birch | Aspen | Paper birch | Exotic | Non-stocked |
| SOFTWOODS | | | | | | | | |
| White pine | 57,392 | 1,327,649 | 631,372 | 4,621,039 | 2,241,148 | 278,665 | 57,385 | 37,617 |
| Red pine | 8,118 | 1,466,671 | 100,688 | 1,020,463 | 2,179,091 | 190,706 | 276,479 | 25,574 |
| Jack pine | 24,027 | 2,294,105 | 13,627 | 673,384 | 1,339,977 | 131,598 | 63,207 | 34,675 |
| White spruce | 2,699 | 65,857 | 485,968 | 2,828,900 | 2,494,486 | 453,627 | 17,682 | 951 |
| Black spruce | 370,831 | 16,446 | 266,979 | 459,960 | 684,670 | 122,375 | -- | 33,120 |
| Balsam fir | 211,941 | 107,725 | 2,552,836 | 10,920,373 | 9,994,960 | 2,012,649 | -- | 12,476 |
| Hemlock | -- | 52,777 | 1,086,339 | 21,232,880 | 629,940 | 206,995 | -- | 347 |
| Tamarack | 2,466,923 | 3,760 | 297,875 | 109,849 | 298,550 | 97,771 | -- | 19,249 |
| Northern white-cedar | 314,547 | 13,237 | 3,027,461 | 5,090,573 | 4,142,259 | 1,252,648 | 2,689 | 6,202 |
| Other softwoods | -- | 98,451 | 22,667 | 611,613 | 63,605 | -- | 2,968,118 | 3,033 |
| Total | 3,456,478 | 5,446,678 | 8,485,812 | 47,569,034 | 24,068,686 | 4,747,034 | 3,385,560 | 173,244 |
| HARDWOODS | | | | | | | | |
| Select white oaks | -- | 26,360,894 | 1,435,265 | 3,933,273 | 1,486,334 | 47,930 | 24,578 | -- |
| Select red oaks | -- | 41,614,049 | 708,074 | 12,290,501 | 7,326,008 | 485,426 | 87,664 | 7,911 |
| Other red oaks | -- | 14,118,068 | 204,650 | 861,195 | 479,157 | -- | 25,660 | -- |
| Hickory | -- | 3,863,219 | 188,585 | 2,313,701 | 26,820 | 8,802 | -- | -- |
| Yellow birch | -- | 72,107 | 2,046,344 | 26,936,066 | 647,613 | 199,971 | 5,931 | -- |
| Hard maple | -- | 971,796 | 1,289,447 | 160,258,290 | 4,967,813 | 1,165,616 | 60,365 | 30,797 |
| Soft maple | 48,960 | 7,594,058 | 23,830,726 | 65,824,176 | 16,215,031 | 2,404,362 | 16,524 | 27,225 |
| Beech | -- | 240,878 | 168,496 | 19,439,291 | 469,088 | 91,603 | -- | 1,263 |
| Ash | 17,611 | 1,534,198 | 14,929,497 | 18,395,634 | 3,307,367 | 480,131 | 3,817 | 35,151 |
| Balsam poplar | 36,081 | 22,590 | 730,414 | 743,506 | 6,914,212 | 270,613 | 56,773 | 11,381 |
| Cottonwood | -- | 273,204 | 1,553,423 | 942,320 | 466,969 | -- | -- | -- |
| Bigtooth aspen | -- | 5,132,973 | 356,298 | 7,275,340 | 27,781,141 | 551,806 | 57,125 | 17,465 |
| Quaking aspen | 73,809 | 1,534,782 | 2,802,951 | 15,928,075 | 55,222,380 | 1,780,801 | 166,435 | 47,861 |
| Basswood | -- | 452,735 | 1,142,238 | 24,403,823 | 991,579 | 228,835 | 15,720 | -- |
| Yellow-poplar | -- | 87,092 | 65,748 | 533,984 | -- | -- | -- | -- |
| Black walnut | -- | 980,731 | 154,067 | 278,710 | -- | -- | -- | -- |
| Black cherry | -- | 2,439,030 | 988,944 | 11,916,816 | 2,089,577 | 79,554 | 59,316 | 111,966 |
| Butternut | -- | 108,586 | 70,794 | 78,433 | -- | -- | -- | -- |
| Elm | -- | 496,708 | 3,883,951 | 11,781,002 | 1,389,893 | 73,618 | 5,341 | 47,224 |
| Paper birch | 93,647 | 758,212 | 1,967,536 | 7,825,617 | 10,871,000 | 10,584,111 | -- | 22,472 |
| Other hardwoods | -- | 1,047,225 | 2,146,275 | 3,004,686 | 254,044 | 9,779 | 33,462 | -- |
| Noncommercial species | -- | 727,334 | 734,429 | 7,043,385 | 893,034 | 144,799 | 7,245 | 59,211 |
| Total | 270,108 | 110,330,469 | 61,398,152 | 402,007,824 | 141,799,060 | 18,607,757 | 625,956 | 419,927 |
| All species | 3,726,586 | 115,777,147 | 69,883,964 | 449,576,858 | 165,867,746 | 23,354,791 | 4,011,516 | 593,171 |

To facilitate sampling, shrub species were placed into two arbitrary categories, tall and low shrubs. For tall shrubs and trees less than 1.0 d.b.h., the stem diameters by species were measured. This vegetation layer is important in the production of woody winter feed (browse) for wildlife. The low shrub group or ground cover species, considered less important as browse, were sampled by making visual estimates of percent cover. Biomass estimates in weight per acre are shown in table 4.

Method

Stem diameters were measured 6 inches above ground level for all tall shrubs and for tree species less than 1.0 inch d.b.h. For low shrubs, a visual estimate of percent ground cover was made by species.

Biomass prediction equations that have been developed (Telfer 1969, Grigal and Ohmann 1977, Ohmann *et al.* 1976, Brown 1976, Roussopoulos and Loomis 1979, Ohmann *et al.* 1981) were applied to

the shrub and small tree species. From these equations, total plant biomass (green weight) was calculated by species, using either stem diameter (tall shrubs) or percent ground cover (low shrubs) as a variable.

Findings

Shrub biomass was highest in the tamarack forest type where it totaled 2.3 tons per acre. Other forest types with significant amounts of shrub volume are listed below:

| Forest type | Low and tall shrub biomass (Green tons per acre) |
|----------------------|---|
| Tamarack | 2.3 |
| Black spruce | 1.6 |
| Balsam fir | 1.4 |
| Elm-ash-soft maple | 1.1 |
| Northern white-cedar | .9 |

The tabulation below shows those shrub species that have significant above-ground biomass per acre weights within each group by forest type:

Table 3.--All live tree biomass by species group and tree biomass component, Michigan, 1980

(In green tons)

| Species group | Biomass component | | | | | |
|-----------------------|----------------------|--------------------|--------------------|--------------------|-------------------|-------------------|
| | All components | 1- to 5-inch trees | Growing stock | | Cull | |
| | | | Boles | Tops and limbs | Boles | Tops and limbs |
| SOFTWOODS | | | | | | |
| White pine | 20,468,311 | 2,040,428 | 12,189,288 | 5,517,596 | 429,076 | 291,923 |
| Red pine | 33,041,982 | 6,003,291 | 18,273,921 | 8,463,173 | 185,544 | 116,053 |
| Jack pine | 33,963,901 | 6,053,240 | 18,447,271 | 8,324,038 | 691,748 | 447,604 |
| White spruce | 14,149,758 | 2,226,721 | 7,919,098 | 3,747,674 | 156,194 | 100,071 |
| Black spruce | 17,514,624 | 8,013,947 | 6,387,658 | 3,002,748 | 61,356 | 48,915 |
| Balsam fir | 51,103,647 | 21,193,910 | 19,971,004 | 9,250,908 | 393,271 | 294,554 |
| Hemlock | 24,730,688 | 1,754,291 | 14,401,939 | 6,585,497 | 1,218,319 | 770,642 |
| Tamarack | 6,954,471 | 2,557,909 | 2,772,757 | 1,362,239 | 132,205 | 129,361 |
| Northern white-cedar | 58,566,961 | 21,278,584 | 21,530,000 | 10,454,389 | 2,924,482 | 2,379,506 |
| Other softwoods | 4,544,431 | 2,103,424 | 1,449,494 | 648,356 | 214,297 | 128,860 |
| Total | 265,038,774 | 73,225,745 | 123,342,430 | 57,356,618 | 6,406,492 | 4,707,489 |
| HARDWOODS | | | | | | |
| Select white oaks | 34,207,991 | 2,583,066 | 20,270,584 | 9,434,816 | 1,215,413 | 704,112 |
| Select red oaks | 65,860,332 | 2,836,535 | 41,209,572 | 18,693,029 | 1,946,629 | 1,174,567 |
| Other red oaks | 17,196,503 | 771,423 | 10,465,449 | 4,716,395 | 782,621 | 460,615 |
| Hickory | 6,446,123 | 583,336 | 3,852,494 | 1,831,545 | 114,735 | 64,013 |
| Yellow birch | 32,067,348 | 3,087,632 | 15,100,270 | 7,258,876 | 3,749,416 | 2,871,154 |
| Hard maple | 170,281,365 | 30,609,600 | 87,477,220 | 40,693,732 | 7,030,385 | 4,470,428 |
| Soft maple | 124,063,072 | 23,312,870 | 62,142,272 | 29,705,963 | 5,358,206 | 3,543,761 |
| Beech | 20,513,346 | 1,720,044 | 10,288,958 | 4,990,610 | 2,115,726 | 1,398,008 |
| Ash | 41,988,244 | 11,176,241 | 19,857,082 | 9,047,810 | 1,169,084 | 738,027 |
| Balsam poplar | 10,808,208 | 1,493,468 | 5,947,443 | 2,809,185 | 325,097 | 233,015 |
| Cottonwood | 3,235,916 | 168,491 | 2,001,614 | 981,077 | 40,055 | 44,679 |
| Bigtooth aspen | 42,644,753 | 5,267,931 | 23,766,408 | 11,033,490 | 1,525,170 | 1,051,754 |
| Quaking aspen | 86,950,725 | 13,950,017 | 43,874,360 | 20,772,083 | 4,876,787 | 3,477,478 |
| Basswood | 27,394,152 | 1,729,817 | 16,888,735 | 7,432,664 | 826,876 | 516,060 |
| Yellow-poplar | 698,427 | 34,677 | 456,065 | 207,685 | -- | -- |
| Black walnut | 1,423,274 | 42,261 | 905,291 | 421,608 | 35,979 | 18,135 |
| Black cherry | 18,504,249 | 3,337,485 | 8,736,663 | 3,937,813 | 1,576,911 | 915,377 |
| Butternut | 288,868 | 83,219 | 102,681 | 48,257 | 34,490 | 20,221 |
| Elm | 18,188,254 | 4,186,989 | 8,691,081 | 4,084,645 | 781,728 | 443,811 |
| Paper birch | 42,268,071 | 5,612,788 | 22,909,959 | 10,888,803 | 1,752,869 | 1,103,652 |
| Other hardwoods | 6,560,371 | 1,797,298 | 2,604,921 | 1,259,784 | 540,835 | 357,533 |
| Noncommercial species | 9,860,846 | 6,100,943 | -- | -- | 2,458,082 | 1,301,821 |
| Total | 781,450,438 | 120,486,131 | 407,549,122 | 190,249,870 | 38,257,094 | 24,908,221 |
| All species | 1,046,489,212 | 193,711,876 | 530,891,552 | 247,606,488 | 44,663,586 | 29,615,710 |

| Tall shrub species and trees less than 1.0 inch d.b.h. | Forest type | Shrub biomass |
|--|--------------------|-------------------------|
| | | (Green pounds per acre) |
| Speckled alder | Tamarack | 2,607 |
| Speckled alder | Black spruce | 1,703 |
| Speckled alder | Balsam fir | 644 |
| Speckled alder | Elm-ash-soft maple | 607 |
| Balsam fir | Balsam fir | 587 |
| Low shrub species | | |
| Blueberry | Jack pine | 459 |
| Leatherleaf | Tamarack | 321 |
| Labrador tea | Black spruce | 218 |
| Leatherleaf | Black spruce | 158 |
| Blueberry | Red pine | 157 |

white-cedar, paper birch, and white pine forest types. The following tabulation shows both tree and shrub biomass estimates in pounds per acre by forest type:

| Forest type | Tall shrubs | Low shrubs | Trees |
|----------------------|-------------------------|------------|---------|
| | (Green pounds per acre) | | |
| Jack pine | 620 | 591 | 80,509 |
| Red pine | 474 | 213 | 104,521 |
| White pine | 887 | 284 | 121,150 |
| Balsam fir | 2,534 | 196 | 108,626 |
| White spruce | 1,302 | 51 | 104,963 |
| Black spruce | 2,717 | 533 | 72,405 |
| Northern white-cedar | 1,827 | 44 | 126,378 |
| Tamarack | 4,109 | 424 | 64,923 |
| Oak-hickory | 1,117 | 198 | 130,556 |
| Elm-ash-soft maple | 2,124 | 120 | 105,374 |
| Maple-birch | 1,266 | 51 | 147,440 |
| Aspen | 1,559 | 112 | 97,380 |
| Paper birch | 1,624 | 131 | 124,625 |
| Exotic | 277 | 107 | 92,967 |
| Nonstocked | 508 | 139 | 6,889 |

TOTAL ABOVE-GROUND BIOMASS

The highest estimates of total biomass per acre are found in the maple-birch, oak-hickory, northern

Table 4.--All live shrub^{1/} biomass yields on commercial forest land by shrub species group and forest type, Michigan, 1980

(In pounds per acre)

| Shrub species group | Forest type | | | | | | | | | | | | Non-stocked | | | |
|----------------------|-------------|----------|------------|------------|--------------|--------------|----------------------|----------|-------------|--------------------|-------------|-------|-------------|-------------|--------|--|
| | Jack pine | Red pine | White pine | Balsam fir | White spruce | Black spruce | Northern white-cedar | Tamarack | Oak-hickory | Elm-ash-soft maple | Maple-birch | Aspen | | Paper birch | Exotic | |
| TALL SHRUBS | | | | | | | | | | | | | | | | |
| Balsam fir | 4 | 27 | 125 | 587 | 66 | 181 | 317 | 145 | 10 | 72 | 71 | 125 | 285 | -- | -- | |
| Tamarack | -- | -- | -- | 14 | 13 | 10 | 8 | 81 | -- | 2 | -- | 1 | 15 | -- | -- | |
| White spruce | 17 | 7 | 3 | 48 | 43 | -- | 13 | -- | 2 | 4 | 4 | 5 | 35 | -- | -- | |
| Black spruce | 199 | 6 | -- | 71 | -- | 476 | 46 | 167 | 26 | -- | -- | 2 | 1 | -- | -- | |
| Jack pine | 8 | 27 | -- | -- | -- | -- | -- | -- | 3 | -- | 1 | 3 | -- | -- | 4 | |
| Red pine | 13 | 22 | 122 | 7 | -- | -- | -- | 6 | 34 | -- | 2 | 6 | 14 | -- | -- | |
| White pine | -- | -- | -- | 306 | 7 | 9 | 315 | 22 | -- | 15 | 16 | 15 | 27 | 94 | -- | |
| Scotch pine | -- | -- | -- | 8 | -- | -- | -- | -- | -- | 5 | 11 | -- | 1 | -- | -- | |
| Northern white-cedar | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | |
| Hemlock | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Boxelder | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Striped maple | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5 | 1 | 3 | -- | -- | |
| Red maple | 11 | 48 | 55 | 37 | 153 | 29 | 56 | 29 | 85 | 109 | 102 | 143 | 53 | 3 | -- | |
| Silver maple | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 10 | -- | 3 | -- | -- | -- | |
| Sugar maple | -- | 15 | 68 | 29 | 55 | 52 | 9 | -- | 8 | 25 | 480 | 39 | 22 | -- | -- | |
| Mountain maple | -- | -- | -- | 103 | 86 | -- | 32 | 2 | 76 | -- | 32 | 21 | 145 | -- | -- | |
| Red alder | 34 | -- | 7 | -- | -- | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | |
| Green alder | 71 | 24 | 118 | 644 | 260 | 1,703 | 433 | 2,607 | 13 | 607 | 35 | 134 | 283 | 16 | 369 | |
| Speckled alder | -- | -- | -- | 5 | -- | -- | -- | -- | -- | 5 | 15 | 3 | -- | -- | -- | |
| Yellow birch | 1 | -- | 1 | 10 | 31 | 11 | 6 | -- | -- | 8 | 6 | 7 | 12 | -- | -- | |
| Paper birch | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Swamp birch | -- | 30 | -- | -- | -- | -- | -- | -- | 5 | 11 | -- | 1 | 1 | -- | -- | |
| American hornbeam | 1 | 1 | 93 | 68 | 15 | 49 | 110 | 38 | 45 | 219 | 27 | 126 | 200 | 1 | 36 | |
| Dogwood | -- | -- | -- | -- | -- | 3 | -- | -- | 4 | -- | 1 | -- | -- | -- | -- | |
| Flowering dogwood | 6 | 21 | -- | -- | -- | -- | -- | -- | 8 | 3 | 2 | 3 | -- | -- | 46 | |
| Hawthorn | -- | 6 | -- | -- | -- | -- | -- | -- | 1 | 2 | 24 | 2 | -- | -- | -- | |
| Beech | -- | 2 | -- | -- | 1 | -- | -- | -- | 22 | 21 | 20 | 25 | 16 | 1 | -- | |
| White ash | -- | -- | -- | 28 | 1 | -- | 96 | 1 | 1 | 155 | 9 | 21 | 7 | -- | -- | |
| Black ash | -- | -- | -- | -- | 1 | -- | 10 | -- | 1 | 45 | 4 | 11 | 2 | -- | -- | |
| Green ash | -- | -- | -- | -- | -- | -- | 53 | 8 | -- | 32 | 3 | 1 | -- | -- | -- | |
| Black alder | -- | -- | -- | -- | -- | 4 | -- | -- | -- | 16 | -- | -- | -- | -- | -- | |
| Mountain holly | -- | -- | -- | -- | -- | -- | -- | -- | -- | 26 | 8 | -- | 1 | -- | -- | |
| Spice bush | -- | -- | -- | -- | -- | -- | -- | -- | 3 | -- | 1 | -- | -- | -- | -- | |
| Apple | -- | -- | -- | -- | -- | -- | -- | -- | 14 | -- | 45 | 21 | 1 | 21 | -- | |
| Eastern hophornbeam | -- | -- | 8 | -- | -- | -- | -- | -- | 6 | -- | 1 | 18 | 10 | -- | -- | |
| Balsam poplar | 1 | 10 | -- | 31 | 18 | -- | 20 | -- | 7 | 6 | 2 | 62 | 53 | 17 | -- | |
| Bigtooth aspen | 4 | 27 | 1 | 3 | -- | 4 | 7 | 5 | 7 | 21 | 27 | 213 | 53 | 20 | -- | |
| Quaking aspen | 12 | -- | -- | -- | 8 | -- | -- | -- | 5 | 1 | 1 | 3 | -- | -- | 1 | |
| Pincherry | 27 | 36 | 30 | 21 | 16 | 8 | 2 | -- | 149 | 66 | 51 | 68 | 18 | 40 | 1 | |
| Chokecherry | 6 | 2 | 5 | 5 | 83 | 6 | 4 | 17 | 13 | 17 | 9 | 32 | 7 | 4 | 1 | |
| Sandcherry | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 16 | |
| Pawpaw | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | |
| White oak | 6 | 1 | 13 | -- | -- | -- | -- | -- | 67 | 1 | 4 | 5 | -- | 1 | -- | |
| Northern pin oak | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Northern red oak | 62 | 35 | 4 | -- | -- | -- | -- | -- | 164 | 4 | 13 | 32 | 13 | 12 | 2 | |
| Black oak | 8 | -- | -- | -- | -- | -- | -- | -- | 25 | -- | -- | 2 | -- | -- | -- | |
| Sweet gale | -- | -- | -- | 34 | -- | -- | 4 | -- | -- | 22 | -- | -- | -- | -- | -- | |

(Table 4 continued on next page)

(Table 4 continued)

| Shrub species group | Forest type | | | | | | | | | | | | | Non-stocked | |
|-------------------------------------|--------------|------------|--------------|--------------|--------------|--------------|----------------------|--------------|--------------|--------------------|--------------|--------------|--------------|-------------|------------|
| | Jack pine | Red pine | White pine | Balsam fir | White spruce | Black spruce | Northern white-cedar | Tamarack | Oak-hickory | Elm-ash-soft maple | Maple-birch | Aspen | Paper birch | | Exotic |
| Mountain ash | -- | -- | -- | -- | 6 | 9 | -- | -- | 2 | 2 | 2 | 2 | 2 | -- | -- |
| Witch hazel | -- | -- | 18 | 10 | 7 | 11 | -- | -- | 38 | 11 | 11 | 45 | 12 | -- | -- |
| Juneberry | 25 | 11 | 109 | 25 | 82 | 12 | 18 | 391 | 18 | 18 | 16 | 49 | 38 | 1 | 7 |
| Hazel | -- | 20 | 106 | 88 | 111 | -- | 162 | 45 | 21 | 86 | 113 | 115 | 48 | -- | -- |
| Prickly ash | -- | -- | -- | -- | -- | -- | 4 | -- | 64 | 12 | 3 | -- | -- | -- | -- |
| Alder buckthorn | -- | -- | -- | -- | -- | -- | 4 | -- | -- | 3 | -- | -- | -- | -- | -- |
| Leatherwood | -- | -- | -- | -- | -- | -- | 47 | 137 | 189 | 192 | 2 | 1 | 56 | -- | -- |
| Viburnum | 34 | 27 | -- | 239 | -- | 98 | 2 | -- | 2 | 18 | 11 | 2 | -- | -- | 1 |
| Elder | -- | 6 | -- | -- | -- | -- | 1 | -- | 10 | 7 | 7 | 18 | -- | 4 | 4 |
| Sumac | -- | 38 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- |
| Buffaloberry | -- | -- | -- | 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Buttonbush | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Willow | 57 | 23 | 1 | 105 | 246 | 4 | 43 | 408 | 1 | 89 | 9 | 61 | 69 | 41 | 20 |
| Sassafras | -- | 2 | -- | -- | -- | -- | -- | -- | 32 | 1 | 6 | 2 | -- | -- | -- |
| American basswood | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 4 | 10 | 2 | 1 | -- | -- |
| American elm | 12 | -- | -- | 2 | -- | -- | -- | -- | 4 | 56 | 15 | 4 | 78 | 1 | -- |
| Slippery elm | -- | -- | -- | -- | -- | -- | -- | -- | 6 | 2 | 1 | -- | -- | -- | -- |
| Rock elm | -- | -- | -- | -- | -- | -- | -- | -- | 6 | 11 | -- | -- | -- | -- | -- |
| Total | 620 | 474 | 887 | 2,534 | 1,302 | 2,717 | 1,827 | 4,109 | 1,117 | 2,124 | 1,266 | 1,559 | 1,624 | 277 | 508 |
| LOW SHRUBS | | | | | | | | | | | | | | | |
| Common juniper | -- | -- | 10 | -- | 1 | 1 | 2 | 2 | -- | -- | 3 | -- | -- | -- | -- |
| Yew | -- | -- | -- | 4 | -- | -- | 2 | -- | -- | 1 | -- | -- | -- | -- | -- |
| Holly | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | 1 | -- | -- |
| Virginia creeper | -- | -- | -- | -- | -- | -- | -- | 2 | -- | 7 | -- | -- | 1 | -- | 1 |
| Spirea | 13 | -- | 23 | 41 | 12 | 218 | 9 | 15 | -- | 41 | -- | -- | 1 | -- | -- |
| Labrador tea | 50 | -- | 151 | 67 | -- | 158 | 1 | 321 | 9 | 19 | -- | 17 | 66 | -- | -- |
| Leatherleaf | 2 | -- | -- | -- | -- | 6 | 1 | 1 | -- | 1 | -- | -- | -- | -- | -- |
| Bog laurel | 48 | 13 | 1 | -- | 5 | 1 | -- | 1 | 18 | -- | 2 | 6 | -- | 5 | 7 |
| Sweetfern | -- | -- | -- | 4 | -- | -- | 2 | 3 | 1 | 8 | -- | 2 | 1 | -- | 26 |
| Gooseberry-currant | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- |
| Chokeberry | -- | 31 | 38 | 26 | 5 | 9 | 9 | 29 | 25 | 22 | 29 | 39 | 42 | 102 | 69 |
| Rasperry-blackberry | 8 | -- | -- | 2 | -- | 1 | -- | -- | 2 | 2 | 1 | -- | -- | -- | -- |
| Rose | 4 | -- | -- | 2 | -- | -- | -- | -- | 2 | 2 | -- | -- | -- | -- | -- |
| Black huckleberry | 459 | 157 | 56 | 32 | 13 | 130 | 11 | 41 | 133 | 10 | 11 | 38 | 12 | -- | 35 |
| Bilberry-blueberry | -- | 4 | 4 | 3 | 6 | -- | -- | 3 | 1 | 1 | -- | 2 | 2 | -- | -- |
| Bush honeysuckle | -- | 7 | 1 | 15 | 8 | 3 | 5 | 4 | 3 | 3 | 5 | 7 | 4 | -- | -- |
| Honeysuckle | -- | -- | -- | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Snowberry | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Shrubby cinquefoil | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| St. John's wort | 7 | 1 | -- | -- | -- | 2 | 1 | -- | -- | 1 | -- | -- | -- | -- | -- |
| Bearberry | -- | -- | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- | -- | -- |
| Greenbriar | -- | -- | -- | -- | -- | 4 | -- | 2 | -- | -- | -- | 1 | -- | -- | -- |
| Bog rosemary | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- |
| Grape | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3 | -- | -- | 1 | -- | -- |
| Total | 591 | 213 | 284 | 196 | 51 | 533 | 44 | 424 | 198 | 120 | 51 | 112 | 131 | 107 | 139 |
| All shrubs | 1,211 | 687 | 1,171 | 2,730 | 1,353 | 3,250 | 1,871 | 4,533 | 1,315 | 2,244 | 1,317 | 1,671 | 1,755 | 384 | 647 |
| Number of plots^{2/} | 188 | 107 | 62 | 90 | 101 | 115 | 246 | 28 | 435 | 325 | 1,883 | 916 | 108 | 30 | 37 |

^{1/}Trees under 1.0-inch d.b.h. are also included. Low shrub species that averaged less than 1.0 pound per acre are not included.

^{2/}Number of plots by forest type from which average yields were derived.

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