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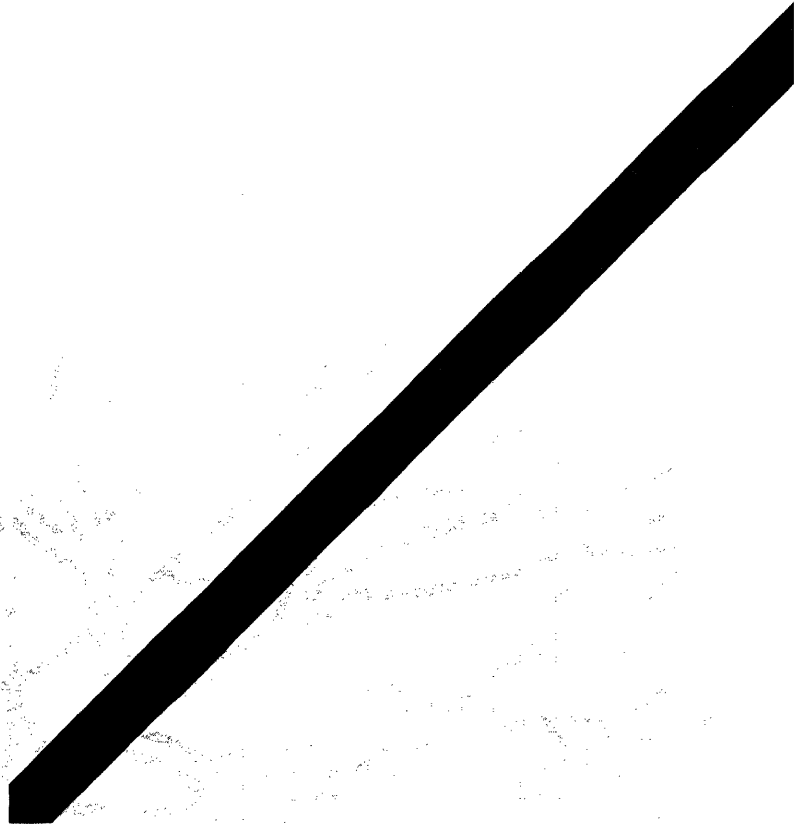
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# **Biomass Yields for Small Trees, Shrubs, and Herbs in Northern Lake States Forests**

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# BIOMASS YIELDS FOR SMALL TREES, SHRUBS, AND HERBS IN NORTHERN LAKE STATES FORESTS

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Biomass estimates for small trees, shrubs, and herbs are used in determining wildlife habitat, forest fuel conditions, and successional species occurrence. This paper presents empirical yield information for lesser vegetation in the northern Lake States (fig. 1), based on data from recent field inventories.

All data for this paper were collected by the Forest Inventory and Analysis (FIA) work unit of the North Central Forest Experiment Station. The data are from the 1980 inventory of Michigan (Raile and

Smith 1983), the 1983 inventory of Wisconsin (Raile 1985), and the 1980 inventory of the Superior and Chippewa National Forests in Minnesota<sup>1</sup>. Each forest sample plot for these inventories consisted of 10 points uniformly spaced over 1 acre (Doman *et al.* 1981). At each point, trees 5.0 inches d.b.h. and larger were selected with a 37.5 factor prism. In addition, at the first three points, tree saplings (d.b.h. 1.0 to 4.9 inches) were tallied if they occurred within

<sup>1</sup>Gerhard Raile provided data for analysis.

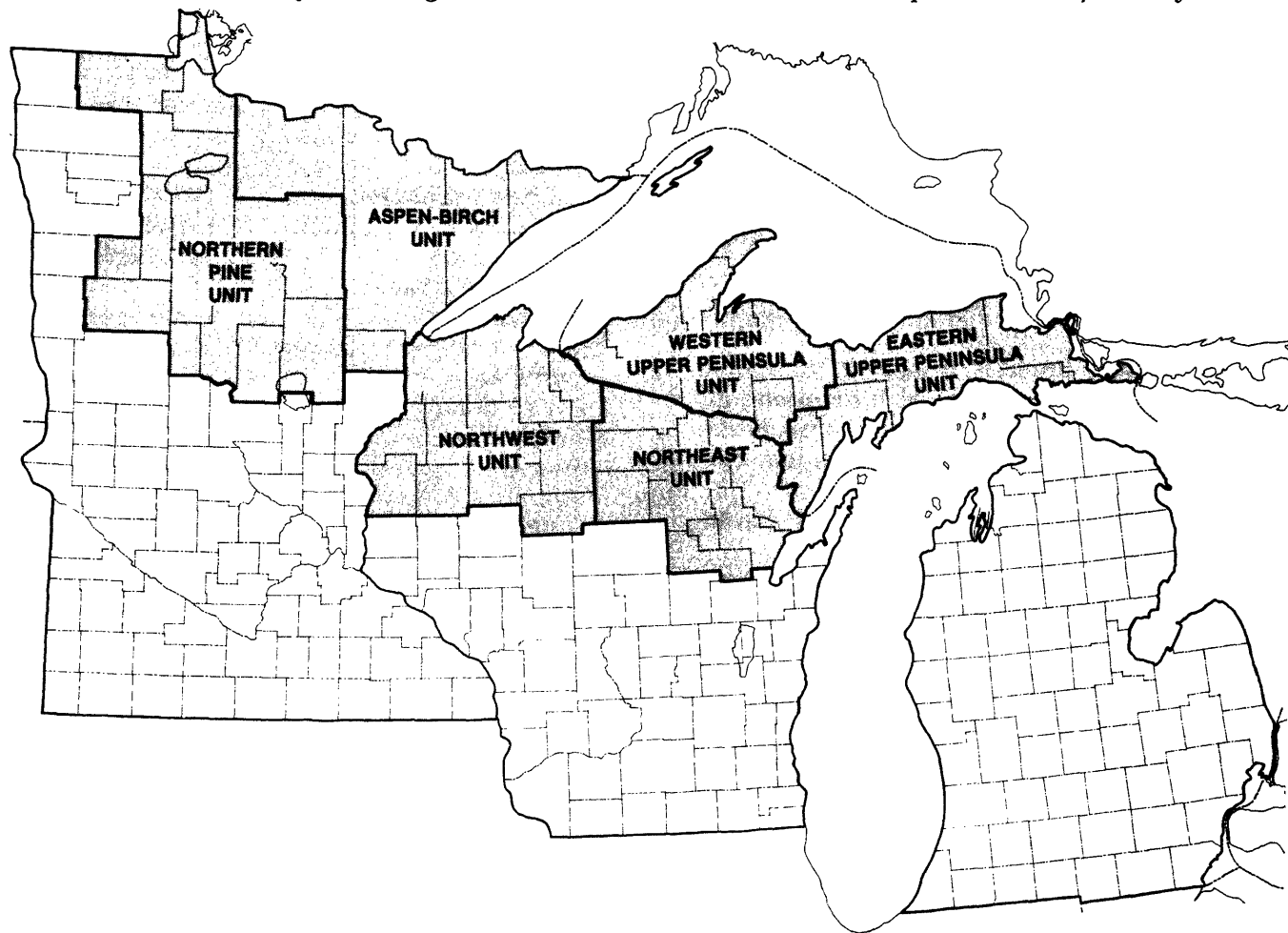


Figure 1.—Forest survey units of the northern Lake States.

6.8 feet of the point (1/300th acre plot). Small trees (less than 1.0 inches d.b.h.) and lesser vegetation were sampled on the northeast quadrant of each of these fixed radius plots.

Shrub species were placed into two categories to facilitate sampling—tall and low shrubs. Tall shrubs (including small trees) were tallied by stem diameter classes. Stem diameters were measured 6 inches above the ground level. The low shrubs (ground cover species) were sampled by visually estimating the percent cover.

Field work was conducted all year; however, consistent data were only available for May through October (Brand 1985). This provided a data base of 4,501 plots across the Lake States.

Biomass was computed using equations summarized by Smith and Brand (1983), and the results are presented in tables 1-4 as yields in green pounds per acre by forest type. Species that did not comprise at least 1 pound per acre were collected into the "other" tall and low shrub categories.

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## SPECIES AND SPECIES GROUPS IN THE LAKE STATES<sup>2</sup>

### Commercial trees

Jack pine .....	<i>Pinus banksiana</i>
Red pine .....	<i>Pinus resinosa</i>
White pine .....	<i>Pinus strobus</i>
White spruce .....	<i>Picea glauca</i>
Black spruce .....	<i>Picea mariana</i>
Balsam fir .....	<i>Abies balsamea</i>
Eastern hemlock .....	<i>Tsuga canadensis</i>
Tamarack .....	<i>Larix laricina</i>
Northern white-cedar .....	<i>Thuja occidentalis</i>
White oak	
White oak .....	<i>Quercus alba</i>
Swamp white oak .....	<i>Quercus bicolor</i>
Bur oak .....	<i>Quercus macrocarpa</i>
Select red oak	
Northern red oak .....	<i>Quercus rubra</i>
Other red oak	
Northern pin oak .....	<i>Quercus ellipsoidalis</i>
Black oak .....	<i>Quercus velutina</i>
Hickory	
Bitternut hickory .....	<i>Carya cordiformis</i>
Basswood .....	<i>Tilia americana</i>
Yellow birch .....	<i>Betula alleghaniensis</i>
Hard maple	
Sugar maple .....	<i>Acer saccharum</i>
Black maple .....	<i>Acer nigrum</i>
Soft maple	
Red maple .....	<i>Acer rubrum</i>
Silver maple .....	<i>Acer saccharinum</i>
Beech .....	<i>Fagus grandifolia</i>
Elm	
American elm .....	<i>Ulmus americana</i>
Slippery elm .....	<i>Ulmus rubra</i>
Rock elm .....	<i>Ulmus thomasii</i>
Black ash .....	<i>Fraxinus nigra</i>
White and Green ash	
White ash .....	<i>Fraxinus americana</i>
Green ash .....	<i>Fraxinus pennsylvanica</i>
Cottonwood .....	<i>Populus deltoides</i>
Willow .....	<i>Salix nigra</i>
Balsam poplar .....	<i>Populus balsamifera</i>
Bigtooth aspen .....	<i>Populus grandidentata</i>
Quaking aspen .....	<i>Populus tremuloides</i>

<sup>2</sup>The common and scientific names for tree species are based on Little (1979). The common and scientific names for shrubs are based on Gray's Manual of Botany (1950).

Paper birch ..... *Betula papyrifera*  
Black cherry ..... *Prunus serotina*  
Butternut ..... *Juglans cinerea*

Noncommercial trees and tall shrubs

Striped maple ..... *Acer pensylvanicum*  
Mountain maple ..... *Acer spicatum*  
American hornbeam .... *Carpinus caroliniana*  
Eastern hophornbeam ..... *Ostrya virginiana*  
Pincherry ..... *Prunus pensylvanica*  
Chokecherry ..... *Prunus virginiana*  
Mountain-ash ..... *Sorbus* spp.  
Green alder ..... *Alnus crispa*  
Speckled alder ..... *Alnus rugosa*  
Swamp birch ..... *Betula pumila*  
Dogwood ..... *Cornus* spp.  
Black alder ..... *Ilex verticillata*  
Sweet gale ..... *Myrica gale*  
Witch hazel ..... *Hamamelis virginiana*  
Common ninebark .. *Physocarpus opulifolius*  
Juneberry ..... *Amelanchier* spp.  
Hazel ..... *Corylus* spp.  
Prickly ash ..... *Xanthoxylum americanum*  
Alder buckthorn ..... *Rhamnus* spp.  
Leatherwood ..... *Dirca palustris*  
Viburnum ..... *Viburnum* spp.  
Elder ..... *Sambucus* spp.  
Sumac ..... *Rhus* spp.  
Buffaloberry ..... *Shepherdia canadensis*  
Shrubby willows ..... *Salix* spp.

Low shrubs and herbs

Common juniper ..... *Juniperis horizontalis*  
Yew ..... *Taxus canadensis*  
Virginia creeper ..... *Parthenocissus* spp.  
Labrador tea ..... *Ledum groenlandicum*  
Leatherleaf ..... *Chamaedaphne calyculata*  
Bog laurel ..... *Kalmia polifolia*  
Sweetfern ..... *Comptonia peregrina*  
Gooseberry-currant ..... *Ribes* spp.  
Raspberry-blackberry ..... *Rubus* spp.  
Rose ..... *Rosa* spp.  
Bilberry-blueberry ..... *Vaccinium* spp.  
Bush honeysuckle ..... *Diervilla lonicera*  
Honeysuckle ..... *Lonicera* spp.  
Poison ivy ..... *Rhus radicans*  
Greenbriar ..... *Smilax* spp.  
Bearberry ..... *Arctostaphylos uva-ursi*  
Bog rosemary ..... *Andromeda glaucophylla*  
Grape ..... *Vitis* spp.  
Strawberry ..... *Fragraria* spp.

Table 1.--Average shrub<sup>1/</sup> biomass yields on commercial forest land by shrub species group and forest type, northern Lake States  
(In pounds per acre green weight)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Jack pine	346	15	--	--	--	9	--	44	45	--	--	3	--
Red pine	31	52	--	1	--	3	--	--	3	--	--	7	1
White pine	21	18	101	3	--	32	--	1	14	1	10	11	5
White spruce	10	--	4	40	269	1	24	--	6	67	9	13	34
Black spruce	22	18	4	70	--	1,311	181	999	--	5	42	14	10
Balsam fir	46	130	239	1,059	83	402	853	599	46	198	255	173	308
Hemlock	--	--	33	1	2	3	7	--	--	22	25	4	35
Tamarack	--	--	--	11	--	86	13	673	--	--	--	--	15
Northern white-cedar	--	--	--	89	1	22	613	23	--	69	12	--	9
White oak	235	66	--	--	--	--	--	--	376	1	2	9	10
Select red oak	37	23	64	--	--	--	--	--	297	3	17	21	10
Other red oak	102	51	41	--	--	7	--	--	65	--	--	9	--
Hickory	--	--	--	--	--	--	--	--	12	--	1	--	--
Basswood	--	--	--	--	15	--	2	--	12	19	33	4	23
Beech	--	--	4	--	--	--	--	--	4	4	94	--	1
Yellow birch	--	5	--	33	--	--	11	--	--	46	62	20	--
Hard maple	--	3	49	52	137	30	43	--	111	67	956	99	164
Soft maple	29	112	120	120	52	42	139	60	162	282	210	157	151
Elm	1	--	--	11	15	--	4	--	1	38	24	13	3
Black ash	--	5	5	94	--	2	194	27	8	446	30	33	25
White & green ash	--	4	1	1	7	--	11	--	8	62	46	26	44
Cottonwood	--	--	--	--	--	--	--	--	--	--	2	--	--
Willow	1	--	--	1	--	--	--	20	--	--	--	1	--
Balsam poplar	--	--	--	13	47	--	6	2	--	5	3	28	1
Bigtooth aspen	7	5	7	--	--	1	--	--	35	--	3	91	8
Quaking aspen	84	160	134	46	273	15	25	--	30	50	40	646	61
Paper birch	31	1	14	30	3	50	32	2	25	14	20	50	124
Black cherry	55	35	32	34	83	2	1	3	34	96	44	66	31
Butternut	--	--	--	--	--	--	--	--	--	--	--	1	--
Other hardwoods	2	1	--	8	--	2	2	--	19	15	1	6	49
Striped maple	--	--	--	--	--	--	1	--	5	--	21	4	26
Mountain maple	--	2	46	291	176	--	223	--	2	184	139	95	306
American hornbeam	--	4	--	--	--	--	--	--	38	108	57	15	--
Eastern hophornbeam	--	--	29	--	--	--	--	--	86	28	85	20	20
Pincherry	7	1	3	2	9	2	1	--	34	2	5	14	7
Chokecherry	14	65	19	15	90	8	11	14	54	40	20	72	39
Mountain-ash	--	--	--	5	--	8	1	--	--	2	5	42	1
Green alder	--	--	--	37	--	--	--	--	--	--	1	--	--
Speckled alder	39	402	490	5,598	705	3,315	4,056	3,988	1	4,289	241	2,531	1,488
Swamp birch	--	--	--	--	6	--	--	38	--	--	--	--	--
Dogwood	15	12	35	69	112	28	158	169	55	257	47	158	61
Black alder	--	--	--	2	--	9	62	457	1,456	494	13	50	39

(Table 1 continued on next page)

(Table 1 continued)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Sweet gale	--	--	--	--	--	--	7	--	--	--	--	--	--
Witch hazel	--	19	1	15	4	11	--	--	61	4	8	60	1
Common ninebark	--	--	--	--	--	--	--	2	--	--	--	1	1
Juneberry	68	127	396	68	11	78	4	321	259	100	90	205	62
Hazel	669	1,026	1,230	304	593	40	99	48	997	350	255	1,079	786
Prickly ash	1	--	--	--	--	--	20	--	56	59	33	6	--
Alder buckthorn	--	--	--	2	--	--	--	--	--	--	1	1	--
Leatherwood	--	--	20	--	--	--	--	--	1	--	12	5	3
Viburnum	15	8	--	39	--	32	13	--	7	3	3	12	1
Elder	--	--	--	7	--	--	--	--	--	6	22	--	--
Sumac	9	--	--	--	--	2	--	1	14	1	--	15	2
Buffaloberry	--	--	--	1	--	--	--	--	--	--	--	1	--
Shrubby willows	116	212	5	106	281	232	317	53	71	410	43	321	201
Miscellaneous tall shrubs	27	139	1	5	3	143	211	496	12	234	8	38	11
Total tall shrubs	2,040	2,721	3,127	8,283	2,971	5,934	7,345	8,040	4,518	8,081	3,047	6,261	4,218
Low shrubs													
Common juniper	--	1	--	--	--	--	--	--	--	--	--	--	--
Yew	--	--	--	7	4	--	3	--	--	--	2	--	--
Virginia creeper	1	--	--	1	15	--	--	--	2	5	--	--	1
Labrador tea	19	--	2	43	--	291	35	150	--	7	1	3	11
Leatherleaf	20	7	3	3	--	141	3	169	--	1	--	1	--
Bog laurel	1	--	--	--	--	30	2	37	--	--	--	1	--
Sweetfern	105	26	13	--	6	2	--	1	60	--	--	11	2
Gooseberry-currant	6	4	--	11	29	4	9	13	4	26	6	16	21
Raspberrry-blackberry	49	100	58	115	139	31	50	14	94	117	57	158	114
Rose	18	13	2	3	4	2	1	--	19	1	--	6	3
Bilberry-blueberry	676	213	229	65	--	287	28	175	298	8	11	91	36
Bush honeysuckle	7	11	21	10	5	3	1	11	9	4	4	19	15
Honeysuckle	15	17	9	24	8	11	11	3	5	4	8	18	17
Poison ivy	2	1	--	--	--	--	--	--	11	2	--	1	--
Greenbriar	--	--	2	--	--	--	--	--	--	--	--	--	--
Bearberry	--	1	--	1	--	1	--	--	--	--	--	--	--
Bog rosemary	1	--	--	--	--	8	--	10	--	--	--	--	--
Grape	--	--	--	--	--	--	--	--	--	--	1	--	--
Strawberry	13	15	18	13	28	2	3	7	11	16	7	31	18
Miscellaneous low shrubs	63	37	33	12	--	16	7	29	110	5	7	31	15
Total low shrubs	996	446	390	308	238	829	153	619	623	196	104	387	253
All shrubs	3,036	3,167	3,517	8,591	3,209	6,763	7,498	8,659	5,141	8,277	3,151	6,648	4,471
Number of plots <sup>2/</sup>	163	120	391	231	30	153	234	56	180	227	1,523	1,018	175

<sup>1/</sup>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.

<sup>2/</sup>Number of plots by forest type from which average yields were derived.

Table 2.--Shrub<sup>1/</sup> biomass yields on commercial forest land by shrub species group and forest type, Michigan Upper Peninsula  
(In pounds per acre green weight)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Jack pine	866	107	--	--	--	--	--	--	--	--	--	--	--
Red pine	--	35	--	--	--	4	--	--	--	--	--	--	--
White pine	40	9	18	6	1	--	--	--	2	3	8	5	5
White spruce	38	--	67	69	632	--	34	--	169	10	30	42	2
Black spruce	57	--	13	92	--	1,266	281	291	13	2	1	2	2
Balsam fir	26	80	396	1,210	128	561	848	1,192	240	305	321	555	555
Hemlock	--	--	--	3	1	--	1	--	57	30	13	4	4
Tamarack	--	--	--	5	--	36	18	464	--	--	2	60	60
Northern white-cedar	--	--	--	180	3	11	798	29	144	19	41	176	176
White oak	--	--	--	--	--	--	--	--	--	--	--	--	--
Select red oak	1	10	69	--	--	--	--	--	6	16	4	10	10
Basswood	--	--	--	--	--	--	3	--	46	23	3	--	--
Beech	--	--	--	--	--	--	--	--	12	134	--	--	--
Yellow birch	--	--	1	78	--	1	10	--	114	72	29	--	--
Hard maple	1	--	159	117	77	85	66	1	136	1,271	262	412	412
Soft maple	33	365	194	183	34	66	172	63	564	254	148	116	116
Elm	--	--	1	21	--	--	1	--	40	24	5	--	--
Black ash	--	--	--	67	--	5	197	--	598	22	47	13	13
White & green ash	--	--	--	2	--	--	18	--	41	30	56	118	118
Balsam poplar	--	--	--	30	116	--	9	--	2	2	73	--	--
Bigtooth aspen	--	35	--	--	2	2	--	--	--	2	5	2	2
Quaking aspen	1	60	9	18	1	5	36	1	67	29	418	116	116
Paper birch	1	--	192	21	8	74	43	20	15	20	36	36	36
Black cherry	77	--	21	20	180	4	1	--	39	52	28	60	60
Other hardwoods	--	--	--	16	1	5	1	9	--	--	5	--	--
Striped maple	--	--	--	--	--	--	2	--	1	34	19	51	51
Mountain maple	--	1	--	257	4	--	219	--	235	139	95	592	592
American hornbeam	--	--	--	--	--	--	--	--	256	--	2	--	--
Eastern hophornbeam	--	--	--	--	--	--	--	463	--	52	4	6	6
Pincherry	--	--	--	1	15	--	1	--	3	4	21	1	1
Chokecherry	--	--	--	12	--	14	18	71	69	13	105	17	17
Mountain-ash	--	--	--	1	--	12	1	--	7	8	204	1	1
Green alder	--	--	--	1	--	--	--	--	--	--	--	--	--
Speckled alder	153	383	3,368	5,482	1,758	4,090	4,221	3,037	2,584	239	1,989	552	552
Swamp birch	--	--	--	63	17	81	73	58	76	4	82	46	46
Dogwood	--	--	--	--	--	--	86	--	2	1	--	--	--
Black alder	--	1	--	--	--	--	--	--	--	--	--	--	--

(Table 2 continued on next page)



(Table 2 continued)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Sweet gale	--	--	13	--	--	9	--	11	--	--	10	--	--
Witch hazel	--	--	208	82	--	86	--	--	--	--	12	2	--
Common ninebark	10	--	220	117	61	--	114	1,431	1	184	127	389	118
Juneberry	5	--	--	4	--	1	--	119	398	209	182	376	131
Hazel	--	--	--	--	--	--	--	--	--	--	--	3	--
Alder buckthorn	--	--	--	--	--	--	--	--	--	--	8	6	1
Leatherwood	57	42	--	89	--	96	21	--	--	2	2	4	--
Viburnum	--	--	--	--	--	--	--	--	--	--	25	1	--
Elder	--	--	--	--	--	--	--	--	--	--	--	13	--
Sumac	--	--	--	--	--	--	--	--	--	--	--	--	--
Buffaloberry	--	--	--	2	--	--	--	--	--	--	--	3	--
Shrubby willows	--	223	5	54	277	11	237	15	--	439	38	114	95
Miscellaneous tall shrubs	6	--	--	--	3	7	32	--	--	1	--	--	--
Total tall shrubs	1,372	1,351	4,962	8,311	3,327	6,558	7,575	6,772	3,028	6,383	3,208	4,968	3,340
Low shrubs													
Common juniper	--	8	--	--	--	--	--	--	--	--	--	--	--
Yew	--	--	--	17	9	--	2	--	--	--	3	--	--
Virginia creeper	--	--	1	1	--	--	--	--	--	--	--	--	--
Labrador tea	45	--	8	28	--	159	23	6	5	--	--	2	5
Leatherleaf	24	4	36	2	--	91	2	226	--	--	--	--	--
Bog laurel	--	2	--	--	--	4	--	--	--	--	--	--	--
Sweetfern	168	17	7	--	14	4	--	4	--	--	--	2	--
Gooseberry-currant	--	--	--	15	3	3	7	38	9	2	2	17	5
Rasperry-blackberry	2	--	55	71	15	10	24	10	46	45	45	102	59
Rose	--	--	--	3	3	2	1	--	2	--	--	2	2
Bilberry-blueberry	1,319	956	409	52	--	346	28	253	17	7	7	70	18
Bush honeysuckle	--	12	19	6	5	--	1	16	5	1	1	5	1
Honeysuckle	--	9	3	26	3	--	14	11	7	9	9	23	12
Bearberry	--	12	--	2	--	3	--	--	--	--	--	--	--
Bog rosemary	--	--	--	--	--	6	--	--	--	--	--	--	--
Grape	--	--	--	--	--	--	--	--	--	--	1	--	--
Miscellaneous low shrubs	23	--	8	14	1	3	1	7	1	1	--	--	--
Total low shrubs	1,581	1,020	546	237	53	635	103	571	1	92	68	223	102
All shrubs	2,953	2,371	5,508	8,548	3,380	7,193	7,678	7,343	3,029	6,475	3,276	5,191	3,442
Number of plots <sup>2/</sup>	42	13	23	98	12	50	147	8	9	80	933	207	45

<sup>1/</sup>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.

<sup>2/</sup>Number of plots by forest type from which average yields were derived.

Table 3.--Shrub<sup>1/</sup> biomass yields on commercial forest land by shrub species group and forest type, northern Minnesota  
(In pounds per acre green weight)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Jack pine	38	--	--	--	--	44	--	--	--	--	--	--	--
Red pine	--	94	--	5	--	--	--	--	--	--	--	49	--
White pine	--	24	361	--	--	--	--	--	--	--	--	1	--
White spruce	--	2	10	61	--	5	--	--	--	--	--	5	17
Black spruce	39	--	162	108	--	1,087	11	--	--	--	1,952	74	--
Balsam fir	168	107	108	983	91	497	1,769	46	--	63	140	101	53
Tamarack	--	--	--	25	--	31	380	--	--	--	--	--	--
Northern white-cedar	--	--	--	43	--	--	47	--	--	--	1	--	--
White oak	7	--	--	--	--	--	4	--	--	--	4	5	--
Select red oak	4	11	--	--	--	--	--	11	--	--	3	31	5
Basswood	--	--	--	--	--	--	--	--	--	--	--	4	86
Yellow birch	--	--	--	--	--	--	--	--	--	--	4	--	--
Hard maple	--	--	--	--	353	--	--	--	34	--	501	59	41
Soft maple	56	63	1,738	23	1	4	4	--	22	30	135	96	145
Elm	--	--	--	--	--	--	237	2	--	1	68	6	--
Black ash	--	--	--	--	--	--	--	--	--	633	10	58	6
White & green ash	--	25	--	1	--	--	--	--	--	1	15	20	1
Balsam poplar	--	--	--	--	1	--	--	--	--	--	--	67	4
Bigtooth aspen	--	--	--	--	--	--	--	--	--	--	--	17	--
Quaking aspen	128	300	--	197	--	32	--	240	--	--	38	881	50
Paper birch	400	9	--	109	--	42	--	3	--	--	28	13	332
Black cherry	--	--	--	--	--	--	--	--	--	--	6	8	--
Other hardwoods	--	--	--	--	--	--	--	--	--	--	--	4	--
Mountain maple	1	12	--	796	747	2	874	--	--	68	2,308	394	631
Eastern hophornbeam	--	--	--	--	--	--	--	--	--	--	63	21	55
Pincherry	--	--	--	5	13	2	3	--	--	--	--	2	37
Chokecherry	48	149	353	37	385	--	--	56	--	--	36	91	41
Mountain-ash	--	--	--	30	--	24	--	--	--	--	--	1	2
Green alder	--	--	16	--	--	--	--	--	--	--	--	--	--
Speckled alder	--	45	--	7,931	7	4,366	6,284	14,879	--	15,687	870	2,642	1,662
Swamp birch	--	--	--	--	--	--	534	--	--	--	--	--	--
Dogwood	--	23	44	68	448	5	540	919	96	92	39	249	98

(Table 3 continued on next page)

(Table 3 continued)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Witch hazel	--	2	--	23	--	28	--	--	--	--	--	--	--
Common ninebark	--	--	--	--	--	--	25	--	--	--	--	--	--
Juneberry	28	58	544	145	47	12	--	4	88	38	101	72	72
Hazel	1,949	2,164	299	475	2,384	56	--	2,865	157	1,063	1,981	2,436	2,436
Prickly ash	--	--	--	--	--	--	--	--	--	--	39	--	--
Leatherwood	--	--	--	--	--	1	--	--	--	82	5	--	--
Viburnum	--	23	--	--	--	--	--	--	1	1	45	2	2
Elder	--	--	--	44	--	10	--	--	45	--	--	--	--
Sumac	--	--	--	--	--	918	--	--	--	--	4	--	--
Shrubby willows	179	634	480	--	--	--	48	--	4,301	52	50	517	517
Miscellaneous tall shrubs	--	--	--	--	--	19	--	--	--	4	1	--	--
Total tall shrubs	3,045	3,745	4,115	11,109	4,477	7,185	16,889	3,275	21,167	7,461	7,125	6,293	6,293
Low shrubs													
Yew	--	--	--	1	--	--	11	--	--	2	--	--	--
Virginia creeper	--	--	--	1	--	--	--	--	--	--	--	--	--
Labrador tea	--	--	--	131	--	238	84	200	23	1	14	2	2
Leatherleaf	--	--	--	12	--	182	1	528	--	6	3	--	--
Sweetfern	--	2	--	--	--	--	--	--	--	2	--	13	13
Gooseberry-currant	4	9	--	13	113	10	28	44	7	235	16	70	70
Raspberrry-blackberry	99	57	13	145	305	66	125	5	11	179	26	144	93
Rose	20	45	47	7	3	9	4	--	20	--	3	26	6
Bilberry-blueberry	373	109	968	72	--	175	49	12	45	28	112	11	50
Bush honeysuckle	17	9	49	21	--	3	1	--	80	2	7	5	5
Honeysuckle	177	80	--	29	27	46	11	--	15	9	40	59	59
Bearberry	--	--	--	--	--	--	--	--	--	--	--	--	--
Bog rosemary	--	--	--	--	--	--	31	--	--	--	--	--	--
Grape	--	--	--	1	--	--	--	--	--	--	--	--	--
Miscellaneous low shrubs	--	1	--	--	--	1	--	8	--	8	--	--	--
Total low shrubs	690	312	1,077	433	448	730	314	828	178	473	199	261	298
All shrubs	3,735	4,057	5,192	11,542	4,925	7,915	10,504	17,717	3,453	21,640	7,660	7,386	6,591
Number of plots <sup>2/</sup>	12	19	4	36	7	28	15	4	2	10	25	124	30

<sup>1/</sup>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.

<sup>2/</sup>Number of plots by forest type from which average yields were derived.

Table 4.--Shrub<sup>1/</sup> biomass yields on commercial forest land by shrub species group and forest type, northern Wisconsin

(In pounds per acre green weight)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
Tall shrubs													
Jack pine	180	5	--	--	--	1	--	56	48	--	--	4	--
Red pine	47	45	--	--	--	6	--	--	3	--	--	2	1
White pine	16	18	103	--	--	62	--	1	15	--	22	14	7
White spruce	--	--	--	3	43	--	9	--	3	13	8	10	35
Black spruce	6	25	2	34	--	1,424	11	1,218	--	--	23	7	16
Balsam fir	40	143	230	934	30	261	671	541	18	183	178	141	274
Hemlock	--	--	35	--	3	6	20	--	--	3	17	2	59
Tamarack	--	--	--	13	--	140	7	737	--	--	--	--	--
Northern white-cedar	--	--	--	13	--	38	353	24	--	30	2	1	8
White oak	350	90	--	--	--	--	--	--	401	2	4	12	17
Select red oak	55	28	64	--	--	--	--	--	312	1	20	25	11
Other red oak	152	70	44	--	--	15	--	--	69	--	1	14	--
Hickory	--	--	--	--	--	--	--	--	13	--	2	--	--
Basswood	--	--	--	--	42	--	--	--	13	5	50	5	15
Beech	--	--	4	--	--	--	--	--	--	--	32	--	1
Yellow birch	--	7	--	--	--	--	15	--	--	10	47	21	--
Hard maple	--	4	43	6	64	5	4	--	90	32	457	57	90
Soft maple	24	85	98	93	103	41	101	65	130	135	140	171	168
Elm	1	--	--	5	42	--	10	--	1	40	23	16	6
Black ash	--	7	5	155	--	--	180	34	8	343	43	24	36
White & green ash	--	--	1	--	20	--	--	--	8	78	75	18	24
Cottonwood	--	--	--	--	--	--	--	--	--	--	--	3	--
Willow	1	--	--	2	--	--	--	26	--	--	--	2	--
Balsam poplar	--	--	--	1	--	--	--	2	--	7	4	8	1
Bigtooth aspen	11	1	7	1	--	--	--	37	37	6	6	130	13
Quaking aspen	111	145	143	19	744	16	8	--	29	44	58	672	40
Paper birch	2	--	3	9	--	36	16	3	25	14	19	61	102
Black cherry	52	48	33	61	30	1	--	4	36	136	33	88	28
Butternut	--	--	--	--	--	--	--	--	--	--	--	1	--
Other hardwoods	3	2	--	3	--	--	6	--	20	25	4	6	86
Striped maple	--	--	--	--	--	--	--	--	--	--	--	--	22
Mountain maple	--	--	49	137	--	--	96	--	2	163	42	41	80
American hornbeam	--	6	--	--	--	--	--	--	41	29	154	22	15
Eastern hophornbeam	10	2	31	--	--	--	--	--	67	47	141	25	15
Pincherry	15	57	16	9	1	4	--	--	36	1	8	14	1
Chokecherry	--	--	--	86	1	6	--	--	58	26	31	59	48
Green alder	--	--	--	--	--	--	--	--	--	--	2	--	--
Speckled alder	--	482	313	4,850	--	2,406	3,256	3,171	1	4,453	216	2,674	1,857
Dogwood	22	12	37	76	3	1	251	121	57	375	119	165	56
Black alder	--	--	--	5	--	19	27	582	1,551	818	34	74	69

(Table 4 continued on next page)

(Table 4 continued)

Shrub species group	Forest type												
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-maple	Maple-birch	Aspen	Paper birch
<b>Tall shrubs</b>													
Witch hazel	--	26	--	19	--	--	--	--	65	--	1	88	2
Common ninebark	--	--	--	--	--	--	--	--	--	--	--	1	--
Juneberry	95	161	406	25	--	98	9	148	276	52	32	168	34
Hazel	784	932	1,304	429	34	61	66	40	1,007	447	341	1,128	585
Prickly ash	1	--	--	--	--	--	65	--	60	97	89	2	--
Alder buckthorn	--	--	--	--	--	--	--	--	--	--	1	--	--
Leatherwood	--	--	21	1	--	--	--	--	1	--	16	5	4
Viburnum	--	--	--	2	--	2	--	--	7	3	5	8	2
Elder	--	--	--	--	--	--	--	--	6	6	18	--	--
Sumac	14	--	--	--	--	--	--	1	15	1	1	18	3
Shrubby willows	154	119	--	199	464	124	482	60	76	109	52	432	154
Miscellaneous tall shrubs	38	190	1	13	6	279	621	631	13	387	22	56	19
<b>Total tall shrubs</b>	<b>2,184</b>	<b>2,710</b>	<b>2,996</b>	<b>7,204</b>	<b>1,629</b>	<b>5,052</b>	<b>6,284</b>	<b>7,465</b>	<b>4,612</b>	<b>8,115</b>	<b>2,593</b>	<b>6,495</b>	<b>3,989</b>
<b>Low shrubs</b>													
Common juniper	--	--	--	--	--	--	--	--	--	--	--	--	--
Yew	--	--	--	--	41	--	2	--	--	--	--	--	--
Virginia creeper	1	--	--	--	--	399	49	172	2	9	1	--	1
Labrador tea	11	--	2	26	--	159	7	126	--	7	2	1	16
Leatherleaf	20	9	1	1	--	59	8	47	--	--	--	1	--
Bog laurel	1	--	--	--	--	1	--	--	64	--	--	16	--
Sweetfern	92	32	14	--	--	3	--	5	4	21	12	15	13
Gooseberry-currant	9	4	--	6	4	32	88	15	100	154	78	178	145
Raspberry-blackberry	62	124	59	149	168	289	22	175	20	1	--	4	2
Rose	24	8	2	1	6	6	--	--	317	2	12	112	40
Bilberry-blueberry	461	126	210	76	--	289	22	11	9	4	10	26	25
Bush honeysuckle	8	11	21	11	7	2	5	2	5	3	7	13	7
Honeysuckle	3	4	9	20	--	--	--	--	12	3	--	1	--
Poison ivy	3	1	--	--	--	--	--	--	--	--	--	--	--
Greenbriar	--	--	2	--	--	--	--	--	--	--	--	--	--
Bog rosemary	1	--	--	--	--	12	1	10	--	--	--	--	--
Strawberry	19	20	19	31	75	5	10	9	12	27	18	46	31
Miscellaneous low shrubs	86	50	35	14	--	32	20	35	117	7	19	46	27
<b>Total low shrubs</b>	<b>801</b>	<b>389</b>	<b>374</b>	<b>335</b>	<b>301</b>	<b>999</b>	<b>223</b>	<b>607</b>	<b>662</b>	<b>239</b>	<b>159</b>	<b>460</b>	<b>307</b>
<b>All shrubs</b>	<b>2,985</b>	<b>3,099</b>	<b>3,370</b>	<b>7,539</b>	<b>1,930</b>	<b>6,051</b>	<b>6,507</b>	<b>8,072</b>	<b>5,274</b>	<b>8,354</b>	<b>2,752</b>	<b>6,955</b>	<b>4,296</b>
<b>Number of plots<sup>2/</sup></b>	<b>109</b>	<b>88</b>	<b>364</b>	<b>97</b>	<b>11</b>	<b>75</b>	<b>72</b>	<b>44</b>	<b>169</b>	<b>137</b>	<b>565</b>	<b>687</b>	<b>100</b>

<sup>1/</sup>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.

<sup>2/</sup>Number of plots by forest type from which average yields were derived.

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Biomass yields for small trees, shrubs, and herbs in northern Lake States forests. Res. Pap. NC-277. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1986. 11 p.

Biomass yield information by forest type is presented for lesser vegetation in northern Michigan, Wisconsin, and Minnesota based on data from recent field inventories.

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**KEY WORDS:** Green weight, lesser vegetation, forest inventory.