



# MINNESOTA FORESTRY NOTES

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## A PROVISIONAL ASSESSMENT OF SPECIES SYNECOLOGICAL REQUIREMENTS IN MINNESOTA FORESTS

Egolfs V. Bakuzis and Henry L. Hansen<sup>1/</sup>

All plant species have certain environmental requirements for moisture, nutrients, light and heat. For forestry purposes requirements of a species in terms of its essential environmental factors are of primary concern when the species is under the conditions of competition prevailing in the forest. Thus, a species having an "affinity for" moist situations is thought of as having a high "water requirement". It is also commonly believed that a species growing only in full sunlight has high light requirements. Wide use is made of the latter type of knowledge gained primarily by wide observation under forest conditions in rating trees on a scale of relative tolerance to shade. However, except in the case of shade tolerance, formalized classification of factor requirements has seldom been attempted.

Ideally, assessment of factor requirements for plants should be done on the basis of experiments designed for this purpose. However, data collected in this manner are extremely meager and on only a few species. In the absence of such experimental information, use must be made of the accumulated observations of trained biologists.

For this purpose, previously published information on 32 tree species, 55 shrubs and half shrubs, five species or species groups of vines, 18 ferns and fern allies, five species groups of lichens and mosses, and 68 herbs was compiled and converted into uniform scale of relative values from 1 to 5 in increasing order of the apparent requirements for moisture, nutrients, light, and heat. Because the original sources of information did not necessarily refer to Minnesota conditions, it was felt necessary to correct these originally assigned values on the basis of local observations. In 1957, a reconnaissance of 356 Minnesota forest communities was made systematically covering the total range of ecological conditions. This involved preparation of species lists; cover estimates of trees, shrubs, reproduction, and group cover; and brief soil descriptions. Community values were determined as averages of the synecological values assigned to the individual species. The value originally assigned an individual species was then corrected on the basis of the average of the community values of those communities in which the species occurred.

The corrected values of these species have been summarized in Table 1.

<sup>1/</sup> Research Associate and Professor, respectively, School of Forestry, University of Minnesota.



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Synecological requirements of forest species in Minnesota for moisture (M), nutrients (N), heat (H), and light (L), in relative values from 1 (least) to 5 (greatest).

Species	Number Observ.	Relative Values				Species	Number Observ.	Relative Values			
		M	N	H	L			M	N	H	L
<b>TREES</b>											
Abies balsamea	163	3.6	2.0	1.4	2.0	Athyrium filix-femina	73	3.5	3.3	2.2	1.1
Acer negundo	36	3.3	5.0	5.0	3.4	Botrychium virginianum	9	3.9	4.5	2.8	1.0
Acer rubrum	70	1.9	2.3	2.6	3.4	Dryopteris cristata	28	4.4	1.8	1.3	3.5
Acer saccharum	46	3.2	5.0	3.5	1.0	Dryopteris disjuncta	19	4.3	2.8	1.3	1.0
Acer saccharinum	5	3.2	5.0	5.0	4.5	Dryopteris phegopteris	10	4.2	2.6	1.3	1.0
Betula alleghaniensis	13	3.7	5.0	2.4	1.7	Dryopteris spinulosa	57	3.9	2.3	1.4	1.1
Betula papyrifera	149	2.9	2.1	1.7	5.0	Dryopteris thelypteris	5	4.6	1.8	1.1	1.4
Carya cordiformis	9	2.7	5.0	4.8	1.0	Equisetum arvense	7	4.1	2.4	1.8	1.0
Celtis occidentalis	20	3.3	5.0	5.0	1.6	Equisetum sylvaticum	18	3.3	2.3	1.4	3.2
Fraxinus nigra	43	3.9	3.5	2.6	1.8	Lycopodium annotinum	17	4.4	1.8	1.2	1.1
Fraxinus pennsylvanica	62	3.0	5.0	4.4	3.6	Lycopodium clavatum	25	2.9	1.3	2.5	1.1
Juglans nigra	6	1.6	5.0	5.0	2.0	Lycopodium obscurum	58	2.5	3.1	1.4	1.9
Juniperus virginiana	11	1.0	2.6	5.0	3.0	Matteuccia nodulosa	6	3.5	5.0	4.2	1.0
Larix laricina	33	5.0	1.0	1.0	5.0	Onoclea sensibilis	11	3.6	4.4	3.3	2.6
Ostrya virginiana	39	2.4	5.0	4.3	1.1	Osmunda cinnamomea	15	3.8	1.9	1.5	1.1
Picea glauca	85	2.8	2.2	1.5	2.3	Osmunda claytoniana	17	2.1	4.9	5.0	2.1
Picea mariana	86	4.5	1.2	1.0	3.5	Polypodium virginianum	10	1.8	1.3	1.1	3.4
Pinus banksiana	55	1.0	1.1	1.9	5.0	Pteridium aquilinum	68	1.2	1.8	2.4	4.1
Pinus resinosa	70	1.1	1.6	2.1	4.5	<b>MOSESSES AND LICHENS</b>					
Pinus strobus	106	1.7	2.1	2.0	2.8	Lichens	27	1.6	1.0	1.0	5.0
Populus balsamifera	17	3.7	2.7	2.1	3.5	Leaf mosses	25	3.1	2.6	1.1	1.3
Populus deltoides	10	2.9	5.0	5.0	3.9	Feather mosses	47	3.4	1.8	1.0	1.7
Populus grandidentata	15	1.3	3.0	3.1	3.4	Brown mosses	43	4.0	1.1	1.0	1.1
Populus tremuloides	129	2.0	2.3	2.1	4.2	Sphagnum spp.	47	4.9	1.0	1.0	5.0
Quercus alba	8	2.1	5.0	4.6	1.3	<b>HERBS</b>					
Quercus ellipsoidalis	22	1.0	1.8	3.0	5.0	Actaea spp.	48	3.5	3.0	2.3	1.1
Quercus macrocarpa	106	1.5	3.2	3.8	3.5	Antennaria canadensis	25	1.0	1.2	2.1	5.0
Quercus rubra	70	1.5	4.2	3.5	2.8	Apocynum androsaemifolium	54	1.1	1.6	2.8	5.0
Thuja occidentalis	56	4.2	2.3	1.3	1.2	Aquilegia canadensis	40	1.5	2.8	3.5	4.1
Tilia americana	93	2.5	5.0	3.8	1.5	Aralia nudicaulis	142	2.5	2.3	2.0	2.7
Ulmus americana	79	3.5	5.0	3.9	2.0	Aralia racemosa	17	2.7	5.0	3.7	1.0
Ulmus thomasi	24	2.9	5.0	5.0	2.6	Arisaema atrorubens	22	3.5	5.0	4.2	1.3
<b>SHRUBS</b>											
Acer spicatum	110	3.5	2.4	1.7	1.4	Asarum canadense	33	3.6	4.8	2.9	1.0
Alnus crispa	23	1.6	1.3	1.2	3.9	Aster macrophyllus	159	2.5	2.1	2.0	3.2
Alnus rugosa	58	4.6	1.6	1.0	3.6	Caulophyllum thalictroides	18	3.0	5.0	4.5	1.0
Amelanchier spp.	14	2.8	2.3	1.9	4.7	Circaea alpina	14	4.1	3.1	1.8	1.0
Betula pumila	12	5.0	1.1	1.0	5.0	Circaea quadrisulcata	5	3.8	5.0	3.8	1.0
Cornus alternifolia	18	2.2	4.7	3.9	1.2	Clintonia borealis	120	3.4	2.1	1.4	2.3
Cornus racemosa	20	1.1	4.4	4.2	2.9	Coptis groenlandica	40	4.1	1.9	1.1	1.0
Cornus rugosa	31	2.1	3.2	2.8	2.4	Cornus canadensis	120	3.5	1.7	1.2	2.1
Cornus stolonifera	82	3.9	2.1	1.7	3.4	Cryptotaenia canadensis	12	3.3	5.0	4.6	2.5
Corylus americana	63	1.3	2.5	3.1	5.0	Desmodium glutinosum	16	2.5	4.9	4.4	1.0
Corylus cornuta	121	1.9	1.4	1.9	3.1	Epigaea repens	10	1.1	1.4	1.7	5.0
Crataegus spp.	8	2.6	5.0	4.4	4.5	Fragaria spp.	140	1.7	2.1	2.1	3.6
Diervilla lonicera	119	1.5	1.8	1.7	3.4	Galium asprellum	15	4.7	3.5	2.2	1.4
Dirca palustris	11	2.7	5.0	3.6	1.0	Galium boreale	52	1.2	1.7	2.5	5.0
Juniperus communis var. depressa	10	1.0	1.0	2.0	5.0	Galium triflorum	74	3.5	2.3	1.6	1.5
Lonicera canadensis	61	3.3	2.5	1.7	1.4	Habenaria obtusata	8	4.7	1.0	1.0	1.0
Lonicera dioica	8	1.2	2.1	2.7	5.0	Hepatica acutiloba	6	3.1	5.0	3.8	1.1
Lonicera hirsuta	21	2.7	1.9	1.6	3.2	Hepatica americana	26	1.4	2.9	2.9	2.4
Lonicera oblongifolia	16	4.1	1.9	1.6	3.2	Heracleum maximum	9	3.5	4.4	3.7	2.2
Prunus pennsylvanica	23	1.2	1.8	2.9	5.0	Hydrophyllum virginianum	15	3.6	5.0	5.0	2.5
Prunus pumila	10	1.2	1.8	1.5	5.0	Impatiens capensis	23	3.7	5.0	4.2	1.4
Prunus virginiana	96	1.1	3.4	3.1	3.6	Impatiens pallida	7	4.2	5.0	4.4	2.3
Rhamnus alnifolia	13	4.6	1.2	2.0	4.5	Laportea canadensis	33	3.6	4.9	5.0	1.0
Rhus glabra	10	1.2	2.9	4.3	5.0	Lathyrus ochroleucus	22	1.2	2.3	2.6	4.6
Ribes americanum	31	3.4	5.0	3.1	2.4	Lathyrus venosus	52	5.1	1.9	2.5	5.0
Ribes cynosbati	63	2.8	4.5	3.6	2.0	Linnaea borealis	75	3.0	1.8	1.0	2.8
Ribes hirtellum	10	3.9	2.3	1.8	2.7	Lysimachia ciliata	9	3.4	2.7	1.9	3.8
Ribes lacustre	13	4.0	2.5	1.7	1.2	Maianthemum canadense	112	1.4	1.8	2.1	4.1
Ribes triste	18	4.0	2.9	1.4	2.0	Melampyrum lineare	9	1.0	1.0	2.9	5.0
Ribes spp. (cumulated)	120	3.7	3.6	2.0	2.1	Mitella nuda	68	4.0	2.5	1.4	1.0
Rosa acicularis	39	1.4	1.8	2.6	5.0	Moneses uniflora	6	3.8	1.8	1.6	5.0
Rosa blanda	44	1.5	1.8	2.2	5.0	Osmorhiza claytoni	38	3.5	5.0	3.5	1.0
Sorbus spp.	42	3.9	2.0	1.0	1.2	Osmorhiza longistylis	5	3.4	4.9	4.2	1.4
Symphoricarpos albus	24	1.2	1.0	2.6	5.0	Pedicularis canadensis	6	1.0	1.0	3.5	2.0
Symphoricarpos occidentalis	24	1.8	3.6	4.8	4.8	Petasites palmatus	33	3.6	2.5	1.5	2.6
Viburnum lentago	5	2.8	4.6	5.0	2.1	Phryma leptostachya	9	3.1	5.0	4.8	2.7
Viburnum rafinesquianum	40	1.6	2.2	2.9	3.0	Polygonatum pubescens	40	2.6	4.9	4.0	2.5
Viburnum trilobum	16	3.4	3.1	2.8	3.4	Polygonatum canaliculatum	9	1.7	5.0	4.8	5.0
Xanthoxylum americanum	18	2.0	5.0	5.0	1.0	Potentilla palustris	5	4.9	1.2	1.0	5.0
<b>HALFSHRUBS</b>											
Andromeda glaucophylla	9	5.0	1.0	1.0	5.0	Prenanthes alba	22	2.0	2.7	1.4	2.6
Arctostaphylos uva-ursi	26	1.0	1.0	1.6	5.0	Pyrola rotundifolia	32	1.7	1.8	1.7	2.8
Chamaedaphne calyculata	19	5.0	1.0	1.0	5.0	Pyrola secunda	42	1.6	1.8	1.6	2.6
Chimaphila umbellata	31	1.1	1.4	1.6	4.0	Rudbeckia laciniata	12	3.8	5.0	4.3	3.1
Chiogenes h'ispidula	23	4.6	1.1	1.0	3.3	Sanguinaria canadensis	18	2.1	3.0	4.4	1.0
Comptonia peregrina	9	1.0	1.0	1.8	5.0	Sanicula marilandica	61	2.1	3.0	2.9	2.7
Gaultheria procumbens	32	1.0	1.1	1.8	5.0	Smilacina racemosa	20	3.3	5.0	4.5	1.2
Kalmia polifolia	12	5.0	1.0	1.0	5.0	Smilacina stellata	20	2.5	4.9	3.9	3.4
Ledum groenlandicum	54	4.9	1.0	1.0	5.0	Smilax herbacea	34	2.3	5.0	3.8	2.5
Rhus radicans	72	1.0	3.0	3.2	3.8	Solidago canadensis	12	1.7	2.1	2.5	5.0
Rubus allegheniensis	16	3.1	1.6	2.0	5.0	Solidago flexicaulis	16	2.8	4.7	2.8	1.0
Rubus idaeus var. strigosus	69	3.6	1.9	1.5	3.6	Solidago gigantea	14	4.1	2.7	2.6	4.5
Rubus parviflorus	22	3.2	2.2	1.7	2.6	Streptopus roseus	51	2.5	3.5	2.6	1.4
Rubus pubescens	37	3.8	2.1	1.4	1.0	Thalictrum dasycarpum	25	3.6	3.4	3.0	3.6
Vaccinium angustifolium	73	1.5	1.1	1.5	5.0	Thalictrum dioicum	83	2.1	3.3	3.0	2.6
Vaccinium myrtilloides	40	2.1	1.2	1.2	4.0	Trientalis borealis	53	4.0	1.6	1.2	1.2
Vaccinium oxycoccos	16	5.0	1.0	1.0	5.0	Trillium spp.	13	3.0	5.0	3.4	1.0
<b>VINES</b>											
Celastrus scandens	6	1.1	2.9	3.0	4.5	Urtica spp.	16	3.6	5.0	4.9	1.1
Menispermum canadense	10	3.3	5.0	4.9	2.8	Uvularia grandiflora	48	2.5	5.0	3.8	1.1
Parthenocissus quinquefolia	50	3.1	2.6	4.5	3.2	Uvularia sessilifolia	11	1.7	4.2	3.1	1.0
Polygonum cilinode	17	2.1	3.0	2.7	2.9	Viola pubescens	8	2.5	2.4	1.8	2.6
Vitis spp.	34	2.5	4.9	5.0	4.7	Viola rugulosa	34	4.1	2.4	1.5	1.4