County Atlas of Minnesota Mosses

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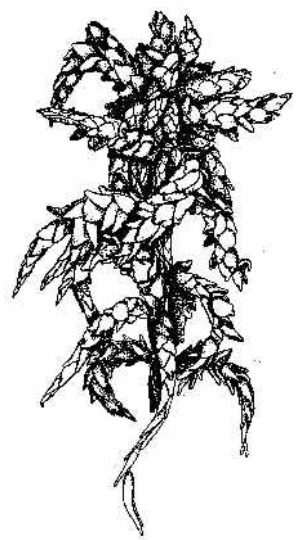

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ABSTRACT

This county atlas lists the presence or absence of 358 species and varieties of mosses within the 87 counties of the State of Minnesota. The list is based on authenticated herbarium specimens. Individual county checklists are provided. A State map shows the species tally as presently known for each county. The phytogeographic affinity and world distribution of the Minnesota moss flora is analyzed state-wide and for each one of the major biomes in the State. A dictionary with 8-letter acronyms and taxon names with authority, based on the most recent North American checklists, is provided.

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INTRODUCTION

This county atlas of Minnesota mosses shows the distribution of 343 species and 15 varieties authenticated for the State. All county records are based on specimens examined and verified by the author and deposited in either the author's personal herbarium, in the herbarium at the Science Museum of Minnesota, in MIN (The University of Minnesota Herbarium, St. Paul) or in DUL (The University of Minnesota Herbarium, Duluth). No unsubstantiated literature reports have been listed. For updates of the database, and possible future editions of the Atlas, the author would appreciate any information on additional county records based on collections that could be made available for loan and annotation.

Detailed taxonomic treatments for a Minnesota Moss Flora are being prepared, starting with *Sphagnum*, and will significantly alter the tally and composition of some families, such as the Amblystegiaceae, Brachytheciaceae, and Bryaceae, when the vouchers are more critically studied, compared with well represented material from other North American localities, and the species concepts are brought in line with the new Bryophyte Flora of North America <**http://www.nybg.org/bsci/bfna/**>.

The nomenclature used is based on that of Anderson *et al.* (1990) for the mosses, and Anderson (1990) for *Sphagnum*. The taxonomic scheme presented in the Higher Taxa List is derived from Crum & Anderson (1989) and Crosby & Magill (1981).

Seventy-one of Minnesota's 87 counties have some moss record, the northernmost counties suggesting the highest diversity or best coverage (Fig. 1). The map clearly indicates substantial under-collecting in some regions of the State, for example the counties immediately west and northwest of the Metro area, such as Todd, Wadena, Crow Wing, Morrison, Benton, Mille Lacs, Kanabec, and Wright, and also suggests poor coverage for numerous southwestern and western counties. As several cases indicate, the effect of single studies or intensive surveys of a small area, such as a State Park, can dramatically increase the number of records: Pine County from 18 to 111 species, Aitkin from 17 to 89, and Yellow Medicine from 45 to 67. For these reasons it is not yet possible to analyze the Minnesota distribution patterns for individual species, or to classify these different patterns in a meaningful way. An attempt has been made, however, to reflect at least the world-distribution affinity of Minnesota mosses so far listed.

The 358 species and varieties of mosses presently substantiated for the State of Minnesota compare as follows with the numbers listed for neighboring states and provinces: Ontario 490 species (Ireland & Ley 1992), Wisconsin 380 (Bowers & Freckmann, 1979), Iowa 272 (Conard 1956), North Dakota 106 (Ikenberry 1932), and Manitoba 267 (Bird 1973). There are 333 species tallied for the Great Plains, as defined by Churchill (1976).

The 15 varieties and 343 species of mosses recorded here for Minnesota belong to 139 genera and 45 families, compared with 109 varieties, 1329 species, 312 genera, and 72 families for the entire North American moss flora north of Mexico (Anderson *et al.* 1990). Some families are represented by a single species, such as the Andreaeaceae, Archidiaceae, Bruchiaceae, Bryoxiphiaceae, Buxbaumiaceae, Catoscopiaceae, Encalyptaceae, Ephemeraceae, Fabroniaceae, Hedwigiaceae, Schistostegaceae, Sematophyllaceae, and Tetraphidaceae, and 71 of the 139 genera include only one species for the State. Other genera have a substantial number of species, such as *Sphagnum* (33 species), *Brachythecium* (14) and *Dicranum* (11).

It is hoped that this publication will stimulate additional surveys in neglected counties, become the basis for the development of a list of rare and threatened species, and further improve the phytogeographic analysis of the moss flora of the State of Minnesota.

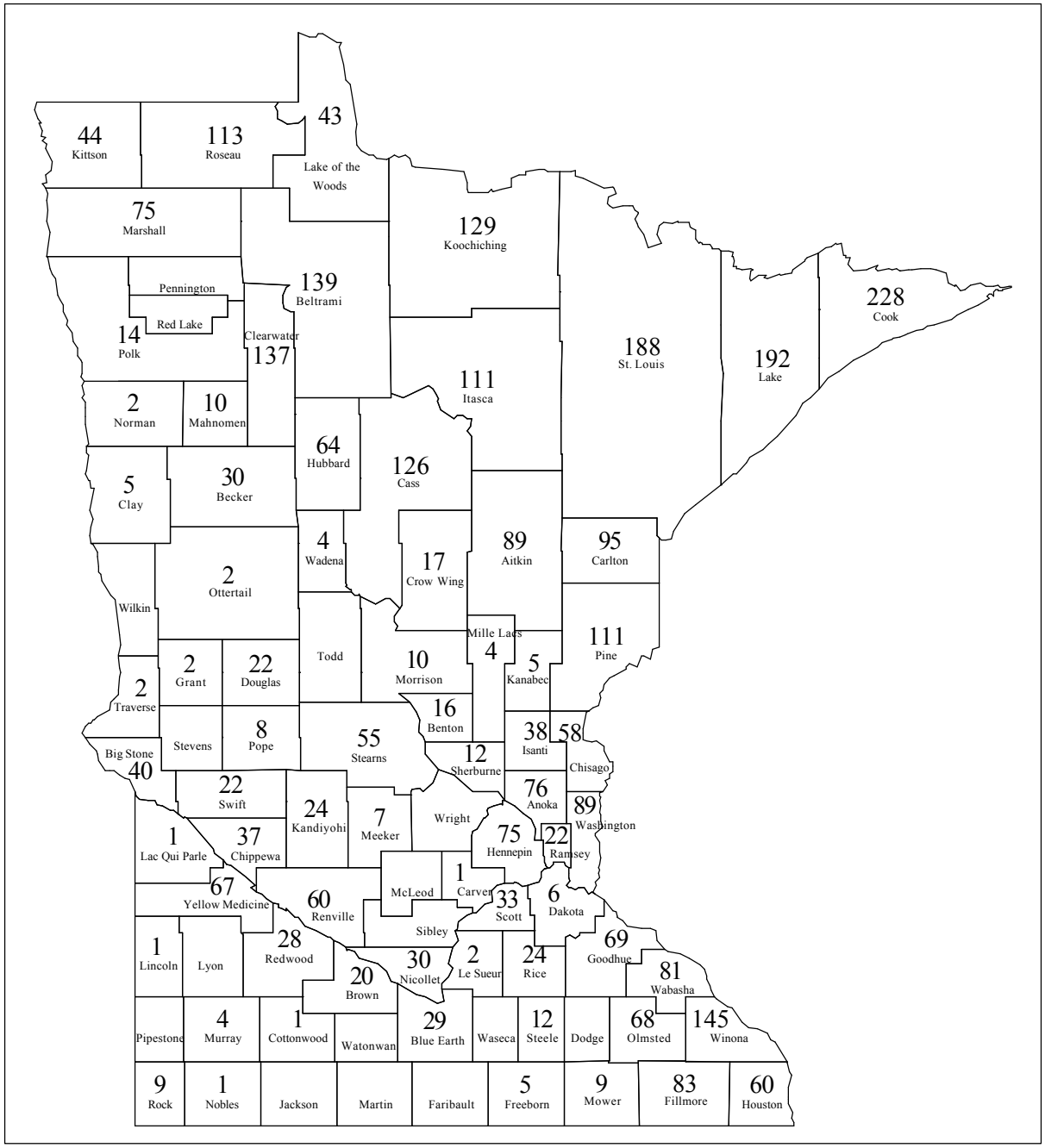

Figure 1. Number of moss species and varieties for each county of the State of Minnesota**.**

WORLD DISTRIBUTION OF MINNESOTA MOSSES

Tables 1 and 2 define the phytogeographic affinities and world-distribution types assigned to the moss species occurring in Minnesota. The classification is based on Belland (1987) and Vitt & Belland (1997), and Dr. René Belland kindly sent me a database of species assignments used by him in his papers. I added assignments for about forty additional species based on the world distribution as described in Crum & Anderson (1989). For each moss species occurring in Minnesota the world-distribution code, defined in Table 2, is listed in the Dictionary after the 8-letter species acronym.

Table 1. Phytogeographic affinities defined.

affinity code	affinity name	affinity definition
ARC	Arctic	species found mainly in the arctic bioclimatic zone (Walter 1973)
BOR	Boreal	species found mainly in the boreal bioclimatic zone (Walter 1973)
TEM	Temperate	species found mainly in the temperate bioclimatic zone (Walter 1973)
MON	Montane	species generally restricted to mountains, extending into arctic regions only where mountains exists (Schofield 1969)
COS	Azonal	species that span 3 to 4 of the bioclimatic zones above (Walter 1973)

Figure 2 illustrates the world distribution of the entire moss flora of the State of Minnesota. More than half of the species have boreal affinity, the largest distribution type being the circumboreal species, then those disjunct to one or several major continental regions, and lastly, a very few restricted to eastern North America. Nearly a third of the species belong to the temperate element, with the disjunct distribution type the most common and the endemic eastern-North American type next. Very few species are circummontane (*Bryum alpinum, Hygrohypnum alpestre,* and *Pohlia drummondii)*, a single one, *Zygodon viridissimus* var. *rupestris,* is montane disjunct, and 10 species are arctic-montane (*Amblyodon dealbatus, Brachythecium turgidum, Cynodontium schisti, Cyrtomnium hymenophylloides, Hypnum hamulosum, H. vaucheri, Pseudo-calliergon turgescens, Racomitrium microcarpon, R. heterostichum,* and *Rhytidium rugosum*). Several species (9.5 %) have no zonal affinity and are classified as cosmopolitan.

Table 2. World distributions defined, by Belland (1987)

code	world distribution	world-distribution definition
1	cosmopolitan	nearly continuous world distribution without zonal affinity
2a	circumboreal	nearly continuous world distribution of boreal affinity
2b	boreal disjunct	disjunct to one or more of the following three regions in the boreal bioclimatic zone: eastern Asia, Europe, or western North America
2c	boreal endemic	endemic to eastern North America within the boreal bioclimatic zone
3a	circumtemperate	nearly continuous world distribution of temperate affinity
3b	temperate disjunct	disjunct to one or more of the following three regions in the temperate bioclimatic zone: eastern Asia, Europe, or western North America
3c	temperate endemic	endemic to eastern North America within the temperate bioclimatic zone
4a	circummontane	nearly continuous world distribution of montane affinity
4b	montane disjunct	disjunct to one or more of the following three regions in the montane bioclimatic zone: eastern Asia, Europe, or western North America
4c	montane endemic	endemic to eastern North America within the montane bioclimatic zone
5	arctic-montane	nearly continuous world distribution at high latitudes and extending southward into mountains or coastal regions

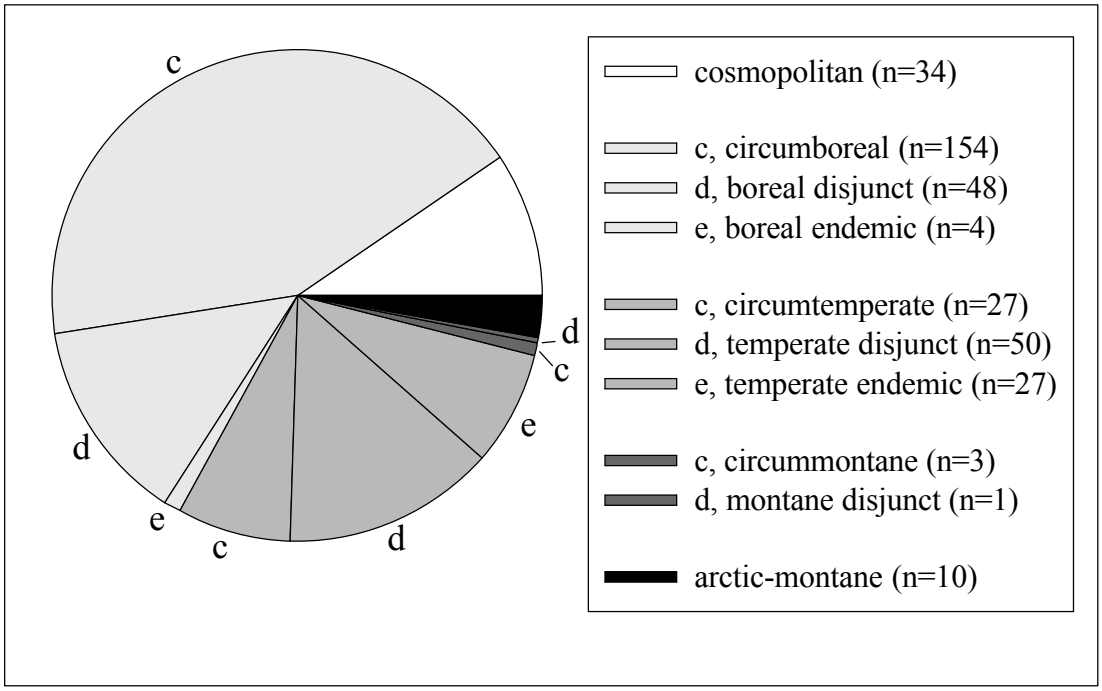

Figure 2. The world distribution of the mosses of Minnesota.

Figure 3 illustrates the differentiation of the world-distribution pattern among the three major biomes of Minnesota. The Laurentian Mixed Forest area of Minnesota has a total of 316 of the 358 Minnesota species, the Eastern Broadleaf Forest 249 species, and the Prairie Parkland 118 species. In addition, the proportion of species with boreal affinity, in particular those with a disjunct distribution, decreases when moving from the mixed northern forest through the broadleaf forest to the prairie. The temperate and cosmopolitan elements increase proportionally. The montane species are absent in the broadleaf forest and prairie, and only a single arctic-montane species (*Pseudo-calliergon turgescens*) is found in the extreme-rich fens in the northern part of the prairie biome. These calcareous fens are very similar in habitat as some of the open coastal peatlands in which the species occurs in the rest of the continent (Miller 1980).

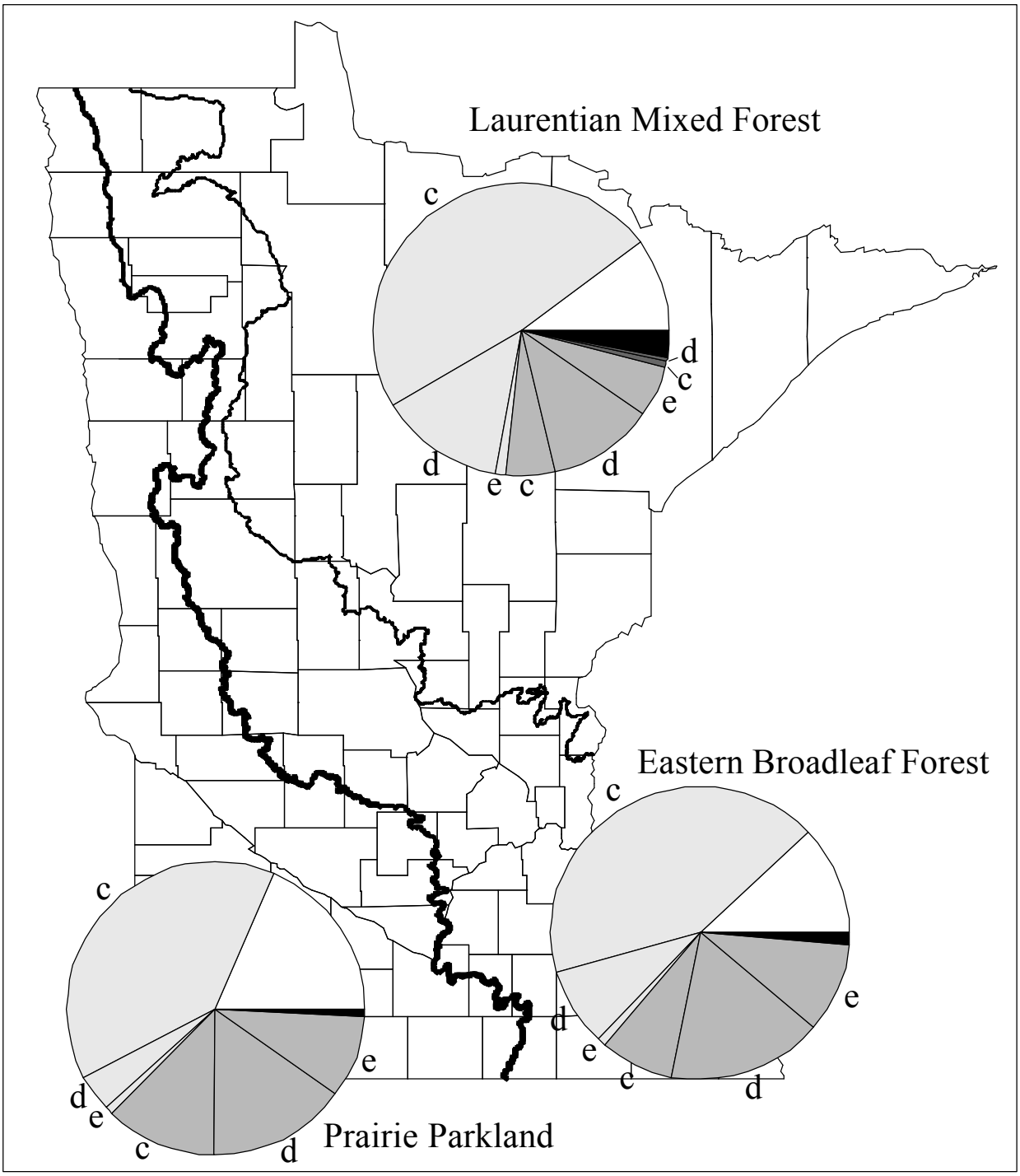

Figure 3. The world distribution of the mosses of Minnesota's biomes. See Figure 2 for the pie legends. The boundaries of the provinces of Minnesota's Ecological Classification System are plotted on the background map.

REFERENCES

Anderson, L.E. 1990. A checklist of *Sphagnum* in North America north of Mexico. The Bryologist 93: 500-501.

Anderson, L.E., H.A. Crum, and W.R. Buck. 1990. List of the mosses of North America north of Mexico. The Bryologist 93: 448-499.

Belland, R.J. 1987. The moss flora of the Gulf of St. Lawrence region: ecology and phytogeography. Journal of the Hattori Botanical Laboratory 62: 205-267.

Bird, C.D. 1973. A new catalogue of the bryophytes from Alberta, Saskatchewan, and Manitoba. 63 pages, duplicated. University of Calgary, Alberta, Canada.

Bowers, F.D. and S.K. Freckmann. 1979. Atlas of Wisconsin Bryophytes. The Museum of Natural History, Stevens Point, Wisconsin. Reports on the Fauna and Flora of Wisconsin 16. Part II.

Churchill, S.P. 1976. Mosses of the Great Plains: introduction and catalogue. The Prairie Naturalist 8: 44-57.

Conard, H.S. 1956. Mosses and liverworts of Iowa. Proceedings of the Iowa Academy of Sciences 63: 345-354.

Crosby, M.R. and R.E. Magill. 1981. A dictionary of mosses. Missouri Botanical Garden. Third printing, with corrections and additions.

Crum, H.A. and L.E. Anderson. 1981. Mosses of Eastern North America. Columbia University Press, New York. 1328 pp.

Ikenberry, G.L. 1932. The mosses of North Dakota. The Bryologist 35: 74-82.

Ireland, R.R. and L.M. Ley. 1992. Atlas of Ontario Mosses. Syllogeus 70, Canadian Museum of Nature. 138 pp.

Miller, N.G. 1980. Mosses as paleoecological indicators of lateglacial terrestrial environments: some North American studies. Torrey Botanical Club, Bulletin 107: 373-391.

Schofield, W.B. 1969. Phytogeography of northwestern North America: bryophytes and vascular plants. Madroño 20: 155-207.

Vitt, D.H. and R.J. Belland. 1997. Attributes of rarity among Alberta mosses: patterns and prediction of species diversity. The Bryologist 100: 1-12.

Walter, H. 1973. Vegetation of the earth on relation to climate and eco-physiological conditions. Heidelberg Science Library, Vol. 15. English Universities Press Ltd., London.