

ATLAS of the WISCONSIN PRAIRIE and SAVANNA FLORA

THEODORE S. COCHRANE AND HUGH H. ILTIS



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Cover: *Tallgrass prairie cross section, showing principal grasses and forbs, and extent of root development. Original drawing by Bobbie Lively Diebold.*

ABSTRACT

This *Atlas of the Wisconsin Prairie and Savanna Flora* treats most of the native vascular plants of Wisconsin grassland and savanna communities from the standpoints of floristics and phytogeography. Included are 341 species and 73 additional subspecies, varieties, and hybrids (discussed and mapped) as well as 103 species and 50 infraspecific taxa and hybrids (discussed or casually mentioned). Part I discusses the physical geography and climate of Wisconsin; the composition of its prairie, barrens, and savanna communities; and the history of its flora. Part II consists of 354 dot maps showing the exact distributions of the taxa as based on herbarium specimens, each accompanied by a statement describing the plant's habitats, abundance, overall distribution, and geo-floristic affinities. One of the practical uses of this work is to help guide ecologists and conservationists in the planning of prairie restorations.

Key Words:

Wisconsin, prairie, savanna, grassland, plant distribution, restoration, conservation.



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PRESENTATION

It is with much pleasure that I see this prairie and savanna atlas come to fruition. This project has developed well beyond its original scope, and the result is a work that will be widely consulted by the many persons and agencies interested in prairie restoration and the Wisconsin flora in general.

This is a notable accomplishment of the University of Wisconsin–Madison Herbarium, officially designated the Wisconsin State Herbarium in 1995. We are now embarking on an era of electronic dissemination of information on the Wisconsin flora. *The Checklist of the Vascular Plants of Wisconsin* (DNR Technical Bulletin 192) was placed online in late summer, 1998 (www.ies.wisc.edu/herbarium/), and this will form the backbone of multiple additions to follow, such as detailed plant distribution maps (including the maps in this publication), photographs of Wisconsin plant species, plant description data, and access to the growing database of the more than 400,000 herbarium specimens housed in different Wisconsin herbaria. This initiative is being coordinated with other universities and museums, the Wisconsin Department of Natural Resources (DNR), and other interested parties. This kind of collaborative effort will provide much valuable information on key aspects of our state's flora.

Paul E. Berry

Director, University of Wisconsin–Madison Herbarium
(The Wisconsin State Herbarium)

FOREWORD

Since the first Midwest Prairie Conference was held in 1968 (which has since evolved into the biennial North American Prairie Conference), there has been a gradual, but steady, increase in the interest of both the general public and government agencies in tallgrass prairie ecology, conservation and restoration. In recent years, this enthusiasm for prairie has spilled over into oak savanna ecosystems as well. The development and popularity of new conferences—the biennial Midwest Oak Savanna Conference, which was first held in Chicago, IL, in 1993, and the North American Savannas and Barrens Conference held in Normal, IL, in 1994—are evidence of this, as is the significant upsurge of interest in private conservation groups and enthusiasm for gardening and landscaping with native plants. Because of the endangered status of both of these ecosystems, many local private conservation groups, as well as state and federal agencies, have made prairie and savanna communities high priority for protection and restoration.

This *Atlas of the Wisconsin Prairie and Savanna Flora* is designed to be an information resource for those planning native prairie and oak savanna restorations and plantings in Wisconsin. The dot range maps provided show the known distributions of native plants in our state and will guide you in selecting species most appropriate for given locations. For best results in matching species to a specific site's characteristics, this atlas should be used in conjunction with its companion publication, *Plant Species Composition of Wisconsin Prairies: an Aid to Selecting Species for Plantings and Restorations* (Henderson 1995a, DNR Technical Bulletin No. 188).

Restorations (simply “plantings” in most cases) of these communities have become very popular among private landowners for backyards and rural properties, and among public agencies for parks, wildlife areas, roadsides, and school grounds. Over a half-dozen private companies within or very near to Wisconsin's borders are now specializing in prairie and savanna planting, and are doing well. In addition, a state-sponsored prairie seed farm has been established in Illinois, and one is currently being developed in Wisconsin.

Unfortunately, the availability of information on prairies and savannas in Wisconsin has not kept pace with the upwelling of interest and activity in plantings and restorations. One example is the absence of an atlas of Wisconsin Flora. Without readily available distribution information, prairie and savanna species are frequently being planted outside their natural or historic ranges within Wisconsin. The primary purpose of this atlas project, therefore, is to provide the information needed to begin correcting this problem.

Some individuals planning prairie and savanna plantings may not consider the planting of native species outside their natural/historic ranges to be a problem worth worrying about, given that species ranges are not static in nature. We, however, believe it to be a very important consideration that should not be lightly dismissed.

In the absence of major climatic change or dramatic environmental changes, ranges of plant species tend to be rather stable in the context of human lifespans. (Noted exceptions are recent weedy, mostly Eurasian invaders.) Given the relatively stable climate of Wisconsin, prairie and savanna species have had 6,000 or more years following the last glaciation to recolonize and stabilize their distributions in the state. It is unlikely that any of these species would be significantly expanding their ranges in the state in the next 100 years without direct human assistance. Therefore, the distribution data represented here, which cover the past 150 years, are still very pertinent as to the "natural" ranges of these species, and they should not be ignored in planning native prairie and savanna plantings or restorations. To do otherwise will threaten the long-term integrity of the rich regional variation in prairie and savanna community composition that currently exists across Wisconsin, as well as the unique genetic composition of local populations. Ignoring these geographical ranges also increases the risk of future range distribution data becoming contaminated with artificial range expansions, which will compromise the data's usefulness to our attempts at understanding the ecology of these species and the prairie/savanna communities, and also in detecting natural range extensions that may occur with future climatic change.

These range maps were produced by the University of Wisconsin-Madison Herbarium with long-term funding from the UW-Madison Department of Botany, and since 1992 from the DNR's Bureau of Research (now Integrated Science Services), and assistance from the DNR's Bureau of Endangered Resources. They are in the public domain and may be reproduced as long as credit is given to the authors, the UW-Madison Herbarium, and the DNR.

Of course, no atlas is ever complete. Should you find what appears to be a natural population of any of the species covered in this publication that lies outside the distribution shown, please contact the UW-Madison Herbarium so that the range maps can be updated in the future.

Richard A. Henderson

Terrestrial Ecologist and Wildlife and Forestry Researcher, DNR

Prairie is composed of many different species of native American plants. It appears as an inextricable mass of endlessly variable vegetation. One glories in its beauty, its diversity, and the ever changing pattern of its floral arrangements. But he is awed by its immensity, its complexity, and the seeming impossibility of understanding and describing it. After certain principles and facts become clear, however, one comes not only to know and understand the grasslands but also to delight in them and to love them.

J. E. Weaver, 1954

North American Prairie

AUTHORS AND ACKNOWLEDGMENTS

Theodore S. Cochrane has been Herbarium Curator at the University of Wisconsin–Madison since 1970, and received his M.S. in botany there in 1983. His research has focused on the identification and distribution of the Wisconsin flora, especially Cyperaceae and Juncaceae, Neotropical Capparidaceae, and selected series of North American *Carex*. For the past 15 years he has been working with Hugh Iltis and Mexican colleagues of the University of Guadalajara on the flora of the Sierra de Manantlán Biosphere Reserve.

Hugh H. Iltis, born in Brno, Czechoslovakia, has resided in the U.S. since 1939, receiving his Ph.D. from the Missouri Botanical Garden–Washington University, St. Louis, in 1952. Botanist and environmentalist, he has devoted his life to the study of the flora of Wisconsin, the Neotropical species of Capparidaceae, and is co-describer of the fourth known species of *Zea*, namely *Z. diploperennis*, of the Sierra de Manantlán. He thus became godfather to the establishment of the Manantlán Biosphere Reserve, and has long been a strong advocate of what is now known as Biophilia, the gene-based need for contact with nature and natural patterns. A well-known fighter for nature preservation and population control, Dr. Iltis was a Professor of Botany at the University of Wisconsin–Madison and Director of the Herbarium from 1955 to 1993, where he is now emeritus.

This *Atlas of the Wisconsin Prairie and Savanna Flora* was compiled and produced at the University of Wisconsin–Madison Herbarium. It is part of a long-term project to map all the plant species of Wisconsin, a goal supported for some 75 years by the University of Wisconsin–Madison, Department of Botany. The prairie and savanna atlas, specifically, has been supported since its inception in 1992 by the University of Wisconsin–Madison Department of Botany and the Wisconsin Department of Natural Resources, Bureau of Research (now Integrated Science Services). Richard A. Henderson, terrestrial ecologist and wildlife and forestry researcher, conceived the idea of an atlas, provided the impetus by supplying the initial list of species to be included, and arranged for funding to hire mappers. We are most thankful for the assistance of the Department of Botany, its Herbarium, and its Multimedia Facility, in furnishing facilities and work time for the authors and illustrator, Kandis Elliot.

Several Wisconsin herbaria and associated botanists have provided considerable assistance over an extended period of time. We are most grateful to the directors, curators, and staff of the various herbaria for permission to survey their collections. Gary A. Fewless, Robert W. Freckmann, Susan Garity, Neil A. Harriman, the late Rudy G. Koch, Neil T. Luebke, Katherine D. Rill, Joseph R. Rohrer, and Peter J. Salamun were at all times most gracious in permitting us to invade their respective herbaria while we were working on atlas projects, as was Anita F. Cholewa of the University of Minnesota Herbarium. Some herbaria, especially those of the Milwaukee Public Museum, University of Wisconsin–Eau Claire, and University of Wisconsin–Green Bay, were most accommodating in sending large loans of specimens. Other individuals have contributed significantly to different aspects of the atlas. These include Neil Luebke and Kevin J. Lyman (Milwaukee Public Museum), Gary A. Fewless (University of Wisconsin–Green Bay), Thomas A. Meyer (Wisconsin DNR), and William J. Hess and Kim A. Allen (Morton Arboretum), all of whom cooperated by making data available in electronic form. We thank Freckmann for access to his unpublished distribution maps for *Panicum* and Kelly Kearns for furnishing the list of native plant nurseries reproduced in Appendix B. Kandis Elliot, Department of Botany Senior Artist, redrew the base map, prepared the plant drawings from color transparencies, and electronically designed this book. She and James W. Jaeger converted the original pencil working maps to electronic format.

The maps themselves represent the cumulative efforts of numerous individuals, not all of whom can be mentioned here. The earliest mapping was done by N. C. Fassett and his colleagues and students, who during the period 1929 to 1952 published 37 *Preliminary Reports* and four books on Wisconsin plant families (see Appendix C). These works may be thought of as having an atlas function, for each species within them was accompanied by a dot distribution map based on herbarium specimens, a major innovation for a state flora. Unfortunately, scarcely any of Fassett's Wisconsin manuscript maps have survived. The majority of the maps on hand were made by various undergraduate and graduate students and staff (between 1955 and 1970 under the supervision of Hugh H. Iltis), especially by Stephen Gilson in 1964 and 1965, and (since 1970 under the supervision of Theodore S. Cochrane), especially by Christine Williams, Barbara A. Warnes, and Robert H. Read during 1971 and 1972, and by Cochrane from 1970 to the present, in an attempt to map all Wisconsin specimens at the University of Wisconsin-Madison Herbarium. Intensified mapping, both updating earlier maps and completing new maps, was undertaken during the period 1992 to 1994 specifically for this project by Andrew H. Williams, Quentin J. Carpenter, Kristin E. Westad, Joseph P. LeBouton, and Nicholas I. Hill.

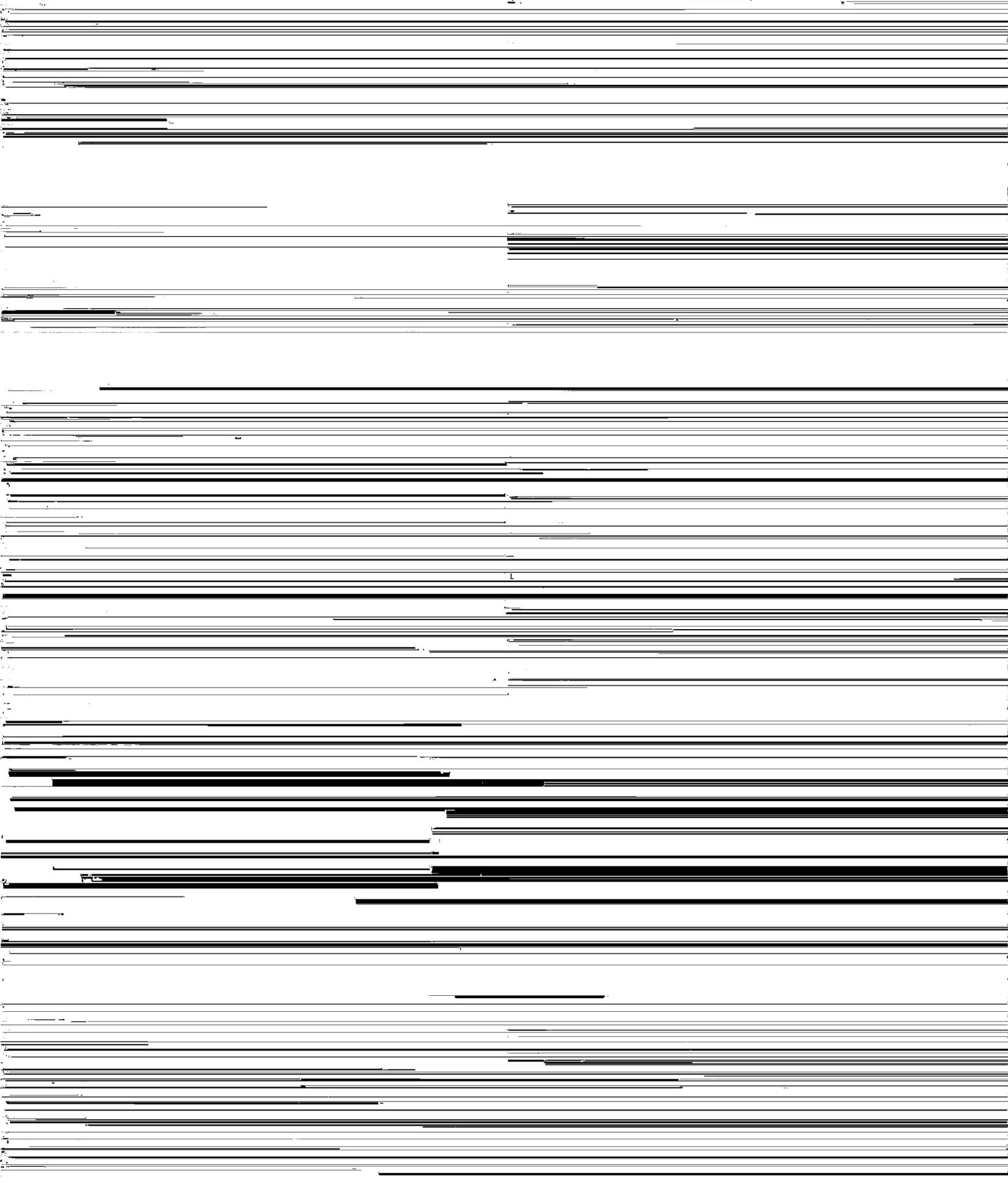
Although we have assumed authorship of this book, we are well aware of the large number of people who have contributed in one way or another to this work, especially those former graduate students and colleagues who are cited as authors in Appendix C, Reports on the Flora of Wisconsin. Their original papers have added immeasurably to the foundation upon which this work rests, as have unpublished studies on Wisconsin Heliantheae by T. Melchert, *Rosa* by W. H. Lewis, Scrophulariaceae by F. S. Crosswhite, and Apiaceae by L. Constance and M. E. Mathias. To them we are indebted, as we are to the many colleagues who have provided or verified identifications for specific families or genera. As with any floristic work, the value of the product is wholly dependent upon accurate determination of the specimens. Both authors are intimately acquainted with the flora of Wisconsin, and one of their major concerns has always been the time-consuming task of verifying the identity of each specimen. Probably the majority of the plants mapped were checked by the authors, but we were fortunate to have had the cooperation of numerous colleagues who, having identified specimens for previous studies, contributed to the accuracy of the atlas. Specialists in certain difficult groups, including G. W. Argus (*Salix*), R. J. Bayer (*Antennaria*), H. E. Ballard, Jr. (*Viola*), W. Dietrich (*Oenothera*), A. G. Jones (*Aster*), R. R. Kowal (*Senecio*), A. F. Cholewa (*Sisyrinchium*), and R. W. Freckmann (*Panicum*), have been consulted specifically for this book.

Other people who worked part-time or volunteered to assist on the project include Mark A. Wetter, who double-checked the authorities for plant names, and Merel R. Black, who helped in the search for common names and the compilation of the index. Paul E. Berry read and commented on the introductory text, and Richard A. Henderson reviewed the entire manuscript. Bobbie Lively Diebold granted permission to use the prairie cross section reproduced on the cover. Nancy R. Halliday granted permission to reproduce the prairie gradient illustration (Figure 4). All other illustrations were electronically painted by Kandis Elliot, using 35 mm slides of Wisconsin plants and habitats as reference images. Some of the slides were our own; others were loaned by Kenneth J. Sytsma and Robert R. Kowal. The Part I and Part II openers, which depict two favorite prairies, are by Thomas A. Meyer (Snapper Prairie) and Mark K. Leach (Avoca Prairie and Savanna). Finally, we wish to thank the editorial staff of the Wisconsin DNR, especially Dreux J. Watermolen, Managing Editor at the DNR Bureau of Integrated Science Services, for his assistance in guiding the book through the publication process.

This atlas is based in part upon work supported since 1992 by the Wisconsin Department of Natural Resources. The DNR provided funding for much of the final map production comprising the heart of this volume and helped fund some of the electronic formatting of this book. However, any opinions, conclusions, or recommendations are those of the authors and do not necessarily reflect the views of the Wisconsin DNR.

Snapper (Miller) Prairie State Natural Area, a high-quality lowland remnant in Jefferson County, Wisconsin, is dominated by Big Bluestem, Little Bluestem, and Northern Dropseed grasses. Subordinate to the grasses are many showy prairie forbs, including asters, blazing-stars, and the Yellow Coneflower (drooping rays) and Prairie-dock (very large basal leaves and tall naked stems) evident in this picture. Our Wisconsin deep-soil prairies consist chiefly of tall grasses and tall herbs like these, intermingled with shorter plants that bloom earlier in the season.

Photo by Thomas A. Meyer



INTRODUCTION

This *Atlas of the Wisconsin Prairie and Savanna Flora* is intended to serve anyone interested in the prairies, oak savannas, and oak woodlands of Wisconsin, whether an expert ecologist undertaking the restoration or recovery of a large-scale site, a novice prairie enthusiast contemplating a backyard garden, a professional biogeographer studying plant distributions, or a natural history amateur charmed by prairie flowers. Any one of these should expect to find help in answering two questions: where in Wisconsin does a particular species now grow (or where did it once grow, or did it occur at all?); and what kind of habitat does it prefer? Although the book may assist in the identification of plants, it is not a flora as such; and for that, the user will need to consult other works to confirm identifications (see Appendix C). Its major purpose is to provide distribution maps and habitat descriptions for grassland and savanna plants of the state. The atlas also provides an introduction to the ecology of these communities and supplementary information pertaining to the taxonomy and geography of individual species.

Richard A. Henderson, an authority in the field of prairie and savanna restoration, compiled a list of 289 species that were potential candidates for this book. His approach was entirely restoration oriented, and his choices were influenced by the lists of species presented in Curtis (1959) and plant material offered by wildflower nurseries. Catalogues of native landscapers and nurserymen in the Upper Midwest were also studied. We have excluded eight and added 60 species to make the coverage more comprehensive, and to alert a wide audience to the presence and diversity of the many species contributing to Wisconsin's

natural environment. A still larger number of infrequent species, not used by restorationists or of less ecological importance, were omitted. In the transition from savanna to forest there are numerous forest species, as for example Downy Wild-rye (*Elymus villosus*) and Zigzag Goldenrod (*Solidago flexicaulis*) that were not included because they bear little relation to either grasslands or oak openings.

Scope of the Atlas

This work covers vascular plant species that are members of the Wisconsin prairie and savanna biota, including distribution maps and notes on their habitat and frequency. From the standpoint of the Wisconsin DNR, the original purpose was to map only native plant species used by people who protect and/or design and restore prairies and savannas. It follows that the most striking and characteristic wildflowers and grasses of prairie and savanna communities are the ones covered in this book. However, because these richly integrated communities contained many subordinate grass and non-grass species, the atlas also treats some common, though less characteristic species, even if they are not usually planted or sown during a prairie restoration. Not all members of our grassland and savanna flora are covered; many others occur in prairies, savannas, barrens, glades, and other native communities (Table 1). Some of these species are listed in Table 2. Additional lists of characteristic herbaceous and shrubby species associated with prairies and savannas may be found in Curtis (1959), Curtis and Greene (1949), Green (1950),

TABLE 1. Acronyms to native plant communities

The acronyms in this table indicate native plant communities in which each species was found during Curtis's Plant Ecology Laboratory studies and are compatible with the symbols in his "Species List" (Curtis 1959) and in Table 2.

| | | | | | |
|-----|---------------------|-----|---------------------------|-----|---------------------------|
| AQE | Aquatic, Emergent | NDM | Northern Dry-mesic Forest | PW | Prairie, Wet |
| BF | Boreal Forest | NM | Northern Mesic Forest | PWM | Prairie, Wet-mesic |
| BG | Bracken Grassland | NS | Northern Sedge Meadow | SB | Sand Barrens |
| BOG | Open Bog | NWM | Northern Wet-mesic Forest | SC | Shrub Carr |
| CG | Cedar Glade | OB | Oak Barrens | SD | Southern Dry Forest |
| CLE | Cliff, Exposed | OO | Oak Opening | SDM | Southern Dry-mesic Forest |
| CLS | Cliff, Shaded | PB | Pine Barrens | SM | Southern Mesic Forest |
| DUN | Dune, Lake | PD | Prairie, Dry | SS | Southern Sedge Meadow |
| FN | Fen | PDM | Prairie, Dry-mesic | SW | Southern Wet Forest |
| ND | Northern Dry Forest | PM | Prairie, Mesic | SWM | Southern Wet-mesic Forest |

TABLE 2. Wisconsin prairie and savanna plants not mapped in this book

Each of the species has been placed in one or more native communities according to Curtis's (1959) acronyms presented in Table 1. Acronyms are in approximate order by percent of stands in which each species occurs. Sources for determining inclusion and assigning habitats were Curtis (1959), Pruka (1995), specimen labels, and field experience of the authors. This list does not include many additional species that might be encountered, nor all habitats in which they might occur. Maps for many of these species may be found in the *Preliminary Reports on Flora of Wisconsin* and the books listed in Appendix C.

| | |
|--|---|
| <i>Agastache foeniculum</i> (PB, OB, PDM) | <i>Liparis loeselii</i> (FN, BOG, PW, CLS) |
| <i>Agastache nepetoides</i> (SDM, SM, SD, OO, SWM, PWM) | <i>Lycopus americanus</i> (FN, SS, SW, PW, PWM, PM, CLS) |
| <i>Agalinis gattereri</i> (PM) | <i>Lycopus uniflorus</i> (NS, SS, FN, PW, AQE, BOG, SW, NWM) |
| <i>Anemone quinquefolia</i> (SDM, NDM, PM, PWM, PW) | <i>Mollugo verticillata</i> (SB) |
| <i>Anemone virginiana</i> (SDM, SM, CLS, PM, OO, NDM) | <i>Onoclea sensibilis</i> (AT, SS, SW, NW, BOG, NWM, NM, PW) |
| <i>Apios americana</i> (SW, PW, PWM) | <i>Ophioglossum vulgatum</i> (FN, PW, SS) |
| <i>Arenaria lateriflora</i> (SWM, SDM, SD, PM) | <i>Opuntia fragilis</i> (CLE, CG) |
| <i>Astragalus neglectus</i> (PM) | <i>Orobanche fasciculata</i> (DUN, PDM) |
| <i>Betula pumila</i> (BOG, PW) | <i>Orobanche uniflora</i> (OO, SM, SD, DUN, PD) |
| <i>Cacalia muehlenbergii</i> (SM, SW, OO, CLS) | <i>Panicum lanuginosum</i> var. <i>implicatum</i> (SB, SD, OO, CG, PD, DUN) |
| <i>Calystegia spithamea</i> (ND, PB, OO, PDM, PM) | <i>Panicum linearifolium</i> (PD, OO) |
| <i>Campanula aparinoides</i> (FN, NS, PW) | <i>Parthenocissus vitacea</i> (SD, OO, CG, PDM, PWM, PM) |
| <i>Carex brevior</i> (SB, PDM, OO) | <i>Pentaphylloides (Potentilla) floribunda</i> (FN, PW) |
| <i>Carex muhlenbergii</i> (SB) | <i>Phryma leptostachya</i> (SDM, SM, OO, NDM, NM) |
| <i>Carex siccata</i> (OB, PD) | <i>Physalis longifolia</i> var. <i>subglabrata</i> (SB, PD, PDM) |
| <i>Celastrus scandens</i> (SDM, CG, PDM, PD) | <i>Plantago patagonica</i> (SB) |
| <i>Cenchrus longispinus</i> (SB) | <i>Platanthera flava</i> (PW, PWM) |
| <i>Cirsium altissimum</i> (SDM, OO, PM, SM) | <i>Platanthera lacera</i> (BOG, PW) |
| <i>Cornus racemosa</i> (SD, OO, PWM, PM, PW, PDM) | <i>Polygonella articulata</i> (SB, OB, DUN) |
| <i>Cornus stolonifera</i> (SC, FN, AT, SS, PW) | <i>Polygonum amphibium</i> (AQE, PW, SW, BOG) |
| <i>Corylus americana</i> (SD, OB, PWM, PM, PW, PDM) | <i>Polygonum tenue</i> (PDM, PD) |
| <i>Croton glandulosus</i> var. <i>septentrionalis</i> (SB) | <i>Prunus serotina</i> (SD, SDM, NDM, OO, CG, PM, BF) |
| <i>Cypripedium candidum</i> (FN, PW) | <i>Pteridium aquilinum</i> var. <i>latiusculum</i> (BG, PB, OB, OO, PM, PWM, PDM) |
| <i>Desmodium canescens</i> (OO) | <i>Quercus bicolor</i> (SW, OO) |
| <i>Desmodium cuspidatum</i> (SD, OO, SDM) | <i>Quercus rubra</i> (SDM, SM) |
| <i>Desmodium nudiflorum</i> (SDM, OO, SM, NDM) | <i>Rhus aromatica</i> (SB) |
| <i>Draba reptans</i> (PD, PDM, CLE, SB) | <i>Rhus copallina</i> (SB) |
| <i>Elymus villosus</i> (SDM, OO) | <i>Rosa carolina</i> (OO, PDM, PM, PWM) |
| <i>Equisetum hyemale</i> (DUN, PDM, PD) | <i>Rubus allegheniensis</i> (PD) |
| <i>Eriophorum angustifolium</i> (BOG, FN, PW) | <i>Rubus flagellaris</i> (PD, OO, PM) |
| <i>Eupatorium sessilifolium</i> (SDM, OO) | <i>Rubus occidentalis</i> (OO, PDM, PD) |
| <i>Euphorbia maculata</i> (SB) | <i>Selaginella rupestris</i> (SB, PDM) |
| <i>Froelichia floridana</i> (SB) | <i>Silene antirrhina</i> (CLE, SB, PD, PDM) |
| <i>Glyceria striata</i> (FN, SWM, SW, PW) | <i>Sium suave</i> (AQE, SC, PWM) |
| <i>Helianthemum bicknellii</i> (SB, PD, PDM, OB) | <i>Solidago ulmifolia</i> (SDM, OO, SM, CLS, NDM) |
| <i>Hudsonia tomentosa</i> (SB) | <i>Stachys palustris</i> (SS, PWM, PW, SW, SC) |
| <i>Hypericum punctatum</i> (SWM, PWM) | <i>Strophostyles helvula</i> (SDM, OO, CLE, CG) |
| <i>Hypericum sphaerocarpum</i> (PWM) | <i>Symphoricarpos occidentalis</i> (OO, PD, PWM, PM) |
| <i>Isoetes brachiatus</i> (PD) | <i>Talinum rugospermum</i> (SB, CLE) |
| <i>Juncus greenei</i> (SB) | <i>Teucrium canadense</i> (SW, PWM, PM) |
| <i>Juncus interior</i> (PD, PM) | <i>Triodanis perfoliata</i> (SB, OB, PDM, CLE) |
| <i>Juncus torreyi</i> (PWM) | <i>Viola cucullata</i> (NM, NW, BF, OO, SDM, PW, PWM, PM) |
| <i>Krigia virginica</i> (SB) | <i>Vitis riparia</i> (OO, CG, OB, PDM, PWM, PM, PD) |
| <i>Lechea intermedia</i> (SB, PDM, PD, PB, OB, CLE) | |
| <i>Lechea tenuifolia</i> (SB, PDM, PD) | |
| <i>Linaria canadensis</i> (SB) | |

Table 3. Endangered, threatened, and extirpated vascular plants of Wisconsin prairies, oak barrens, and oak savannas
Modified after Bureau of Endangered Resources (1993).

| Wet prairies | Wet-mesic prairies | Mesic prairies | Dry-mesic prairies |
|--|--|---|--|
| <i>Hypericum sphaerocarpum</i> <i>Tofieldia glutinosa</i> | <i>Asclepias purpurascens</i> <i>Asclepias sullivantii</i> <i>Cacalia plantaginea</i> <i>Camassia scilloides</i> <i>Cypripedium candidum</i> ² <i>Fimbristylis puberula</i> <i>Parthenium integrifolium</i> <i>Phlox glaberrima</i> ssp. <i>interior</i> <i>Platanthera flava</i> var. <i>herbiola</i> <i>Platanthera leucophaea</i> ¹ <i>Polytaenia nuttallii</i> <i>Tomanthera auriculata</i> | <i>Agalinis skinneriana</i> ² <i>Asclepias meadii</i> ^{2,3} <i>Asclepias ovalifolia</i> <i>Asclepias sullivantii</i> <i>Astragalus neglectus</i> <i>Cacalia plantaginea</i> <i>Camassia scilloides</i> <i>Echinacea pallida</i> <i>Gentiana alba</i> <i>Lespedeza leptostachya</i> <i>Parthenium integrifolium</i> <i>Polygala incarnata</i> <i>Prenanthes aspera</i> <i>Ruellia humilis</i> | <i>Besseyia bullii</i> <i>Cirsium hillii</i> <i>Echinacea pallida</i> <i>Gentiana alba</i> <i>Lespedeza leptostachya</i> <i>Liatris punctata</i> var. <i>nebraskana</i> <i>Parthenium integrifolium</i> <i>Polygala incarnata</i> <i>Prenanthes aspera</i> <i>Ruellia humilis</i> |
| Dry prairies | Sand prairies | Oak barrens | Oak savannas |
| <i>Agalinis gattingeri</i> <i>Agalinis skinneriana</i> ² <i>Anemone caroliniana</i> <i>Anemone multifida</i> var. <i>hudsoniana</i> <i>Asclepias lanuginosa</i> <i>Astragalus crassicaerpus</i> <i>Besseyia bullii</i> <i>Cacalia plantaginea</i> <i>Cirsium hillii</i> <i>Echinacea pallida</i> <i>Lespedeza leptostachya</i> <i>Lespedeza virginica</i> <i>Lesquerella ludoviciana</i> <i>Liatris punctata</i> var. <i>nebraskana</i> <i>Orobanche fasciculata</i> <i>Prenanthes aspera</i> <i>Scutellaria parvula</i> var. <i>parvula</i> | <i>Asclepias lanuginosa</i> <i>Besseyia bullii</i> <i>Cirsium hillii</i> <i>Lespedeza leptostachya</i> ¹ <i>Opuntia fragilis</i> <i>Orobanche fasciculata</i> <i>Orobanche ludoviciana</i> <i>Prenanthes aspera</i> | <i>Asclepias lanuginosa</i> <i>Liatris punctata</i> var. <i>nebraskana</i> <i>Opuntia fragilis</i> | <i>Agastache nepetoides</i> <i>Asclepias purpurascens</i> <i>Astragalus crassicaerpus</i> <i>Besseyia bullii</i> <i>Camassia scilloides</i> <i>Gentiana alba</i> <i>Polytaenia nuttallii</i> <i>Prenanthes crepidinea</i> <i>Ruellia humilis</i> <i>Viola sagittata</i> var. <i>ovata</i> |
| Oak woodlands | Bedrock glades | | |
| <i>Agastache nepetoides</i> <i>Asclepias purpurascens</i> <i>Camassia scilloides</i> <i>Thaspium barbinode</i> | <i>Agalinis gattingeri</i> <i>Lespedeza virginica</i> <i>Opuntia fragilis</i> | | |

¹Threatened at federal level

²Concern at federal level

³Extirpated at state level

Haney and Apfelbaum (1997), Henderson (1995a), Hujik (1995), Pruka (1995), Whitford and Whitford (1971), Will-Wolf and Stearns (1998), and other references.

In ecological terms (Curtis 1959), the majority of species that appear in this book are either *prevalent* species or *modal* species. Prevalent species are those most likely to be present in any stand of a particular community type as well as being the ones with the highest densities. A species is modal in the one plant community in which it exhibits its maximum presence value. Some modal species are also prevalent ones, but many are infrequent or rare. There are 204 species of native vascular plants listed by Curtis (1959) as prevalent or modal within the prairie communities of Wisconsin. Of these, 193 are mapped in this atlas.

In recent years, especially since Earth Day 1970 and the passage of the Federal Endangered Species Act of 1973, there has been increasing concern over the identity, distribution, status, and preservation of rare species of plants and animals in Wisconsin (Bureau of Endangered Resources 1993, Read 1976). Although state or federally listed threatened or endangered species are not emphasized in this publication, many of them are indeed imperiled. Of the 1,702 species of vascular plants native to Wisconsin (Wetter et al. 1998), the DNR's Natural Heritage Inventory (1998) considers 73 endangered, 65 threatened, 4 extirpated, and 179 of significant conservation concern. Thus, 321 species, or about 19% of the native flora, have been or are in danger of local extinction or extirpation and hence candidates for listing in Wisconsin.

In this atlas in appropriate cases, following the name of the species, a status is given to indicate its listing by the Natural Heritage Inventory (1998) and Bureau of Endangered Resources (1993) as **Endangered**, **Threatened**, **Extirpated**, or of **Special Concern**, the latter term relating to those possibly in jeopardy but of uncertain status and not yet afforded legal protection. Altogether, about 28% of the endangered and threatened plant species occur primarily in prairie and oak-ecosystem habitats (Table 3). Additional species assigned to the advisory Special Concern category may, in fact, be extirpated (e.g., *Pediomelum argophyllum*) or may deserve legal status as Endangered (e.g., *Desmodium canescens*) or Threatened (e.g., *Comelina erecta* var. *deamiana*). No other natural communities in Wisconsin have been so profoundly decimated by the hand of man. Some impression of the extent of loss may be gained from Table 7 in Henderson and Sample (1995), which lists 65 extirpated, rare, and declining Wisconsin

grassland plants. (Twenty-two additional species can be considered to belong on the Henderson and Sample list, because they commonly occur in prairies as well as savannas, and because the official state lists of rare vascular plants were revised since the time of that publication.) Furthermore, many of these species are rare or infrequent throughout their range, and some are innately conservative, that is, they rarely occur anywhere except in little-disturbed vegetation remnants. As a result, prairie species like Pink Milkwort (*Polygala incarnata*), Silvery Scurf-pea (*Pediomelum argophyllum*), and the white-lettuces (*Prenanthes* spp.) are among the rarest and most elusive native plants in Wisconsin, and at least one, Mead's Milkweed (*Asclepias meadii*), is thought to have been extirpated from our flora (Table 3). Many once-common species, for example, the rosinweeds (*Silphium* spp.), of widespread but economically valuable habitats such as dry-mesic to wet-mesic prairies, may now be more in danger of extirpation than rarer species of specialized, economically unimportant habitats.

Methods and Sources of Data

A distribution map is only as good as the data and identifications of the specimens on which it is based. In general, only records vouchered by actual pressed plant specimens deposited in an herbarium are the factual basis of the dots on our maps. Thus, the distribution of our native grassland and woodland species is indicated on outline maps by dots, each representing from one to several herbarium collections. A triangle is used in rare cases where all that is known from a county are specimens without specific location. In several instances, sight records (indicated on the maps by a +) by professional botanists were utilized, those in Lincoln County by F. C. Seymour (ms. cards), in central Wisconsin by J. W. Thomson (1940) or, less often, T. G. Hartley (1962) or P. D. Sørensen (ms. cards). Those from other areas are mostly from records of the DNR's Natural Heritage Inventory.

The distribution maps were generated by manually placing symbols at exact localities cited on specimen labels or shown on manuscript maps; thus, each dot is site-specific to within a few miles and specimen-vouchered by one or more herbarium specimens. The only map records from the literature to have been incorporated are some from older *Preliminary Reports* and from Hartley's dissertation on the "Flora of the Driftless Area" (1962). Because Wis-

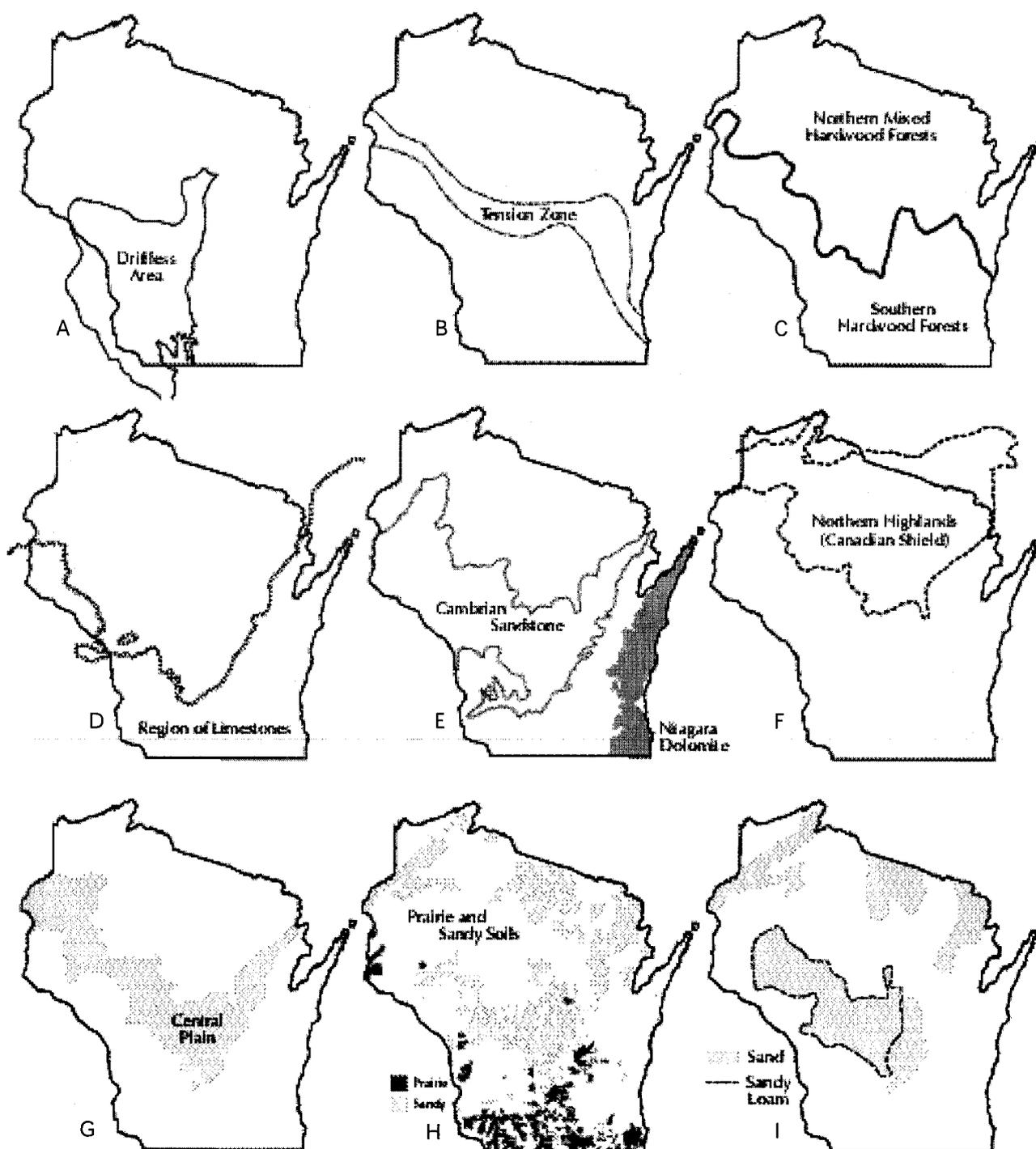


Figure 1. Base maps of Wisconsin showing the boundaries of various features of glacial (A) and bedrock geology (D, E), selected geographical provinces (F, G) and soil types (H, I), and the Tension Zone (B) and floristic provinces (C). A, redrawn after Little (1971); B and C, from Curtis (1959); D, drawn by following the line of contact between the Prairie du Chien Dolomite and the Upper Cambrian Sandstone; E (Niagara Dolomite), F, and G, from Martin (1965); E (Cambrian Sandstone) from Wisconsin Geological and Natural History Survey (1995); H, redrawn after Whitson (1927); I, redrawn after Johnson and Iltis (1964).

consin herbarium collections range from the late 1850s to the present, the maps present collection information accumulated over the course of almost 150 years. Given the destructive role of man in changing the face of the land, it hardly needs to be said that many dots represent populations that are no longer extant. By the same token, the absence of a dot in an area does not necessarily mean that the plant does not occur there.

A line enclosing the famous **Driftless Area** of Wisconsin and adjoining Minnesota, Iowa, and Illinois appears on every distribution map (Figure 1A). It indicates a hilly region never covered by ice and drift (glacial gravel), at least during the most recent glacial advances. Other features of Wisconsin physical geography such as the **Region of Limestones** (Figure 1D), the limits of the **Cambrian Sandstone** and **Niagara (Silurian) Dolomite** (Figure 1E) and the extent of **Prairie, Sandy, and Sandy Loam Soils** (Figure 1H and I) are sometimes shown, as are the boundaries of the **Northern Highlands** (Figure 1F) and **Central Plain** (Figure 1G). Running across the middle of the state from northwest to southeast is a narrow band or zone that marks major changes in the climate, and hence the vegetation, in relation to plant distribution (Figure 1B). Because the southern range limits of many northern species and the northern range limits of many southern and western species are contained within this climatic and floristic **Tension Zone** (see Curtis 1959), which also separates the **Prairie-Southern Forest** from the **Mixed Conifer-Northern Hardwoods** biogeographic provinces (Figure 1C), it also appears on many of the distribution maps.

The distribution of the species in Wisconsin, habitat information, and dates of flowering and fruiting were obtained chiefly from collections in the herbaria of the University of Wisconsin System: Madison (WIS), Milwaukee (UWM), Green Bay, Eau Claire (UWEC), La Crosse (UWL), Oshkosh (OSH), and Stevens Point (UWSP). Our maps also include records of Wisconsin material contained in such important herbaria as the Milwaukee Public Museum (MIL), the University of Minnesota (MIN), and the Morton Arboretum (MOR). In addition, records have been incorporated based on specimens in the herbaria of the University of Wisconsin—River Falls (RIVE), University of Wisconsin—Platteville, University of Iowa (IA), Beloit College (BELC), Iowa State University (ISC), Field Museum of Natural History (F), Northland College (Ashland, Wisconsin), St. Norbert College (SNC), and the private herbarium of Mrs. K. Rill

(Oshkosh, Wisconsin). We wish to express our thanks to all the curators and directors for their cooperation.

Botanical Information

The core of the atlas comprises Part II, 354 sequentially numbered maps and accompanying habitat and distributional captions. The 52 plant families represented are first divided according to the three major groupings of vascular plants to which they belong, namely the pteridophytes, representing Ferns and Fern Allies, and the monocotyledons and dicotyledons, the two subclasses of angiosperms, or flowering plants. The families are then arranged alphabetically. Under each family are the genera and species, also alphabetically. The nomenclature generally follows the second edition of Gleason and Cronquist's *Manual of Vascular Plants* (1991), occasionally Kartesz's *Synonymized Checklist* (1994), and in a few cases, different floras or monographs. Having a more intimate knowledge of the flora of Wisconsin, we have sometimes chosen to list **infra-specific taxa** not recognized by these authorities.

The habitat descriptions were derived primarily from information given on specimen labels and our own field experience. Geographical, biological, and other information is based on floras and available monographs and revisions, supplemented by herbarium label data.

The text accompanying each map includes the **scientific name** of the species, the **common name** or names, its **status** (if rare), the **total range** outside of Wisconsin with an attempt to identify or imply the floristic element to which it belongs and its post-glacial migrational origin, the **general range** within the state, a description of its **habitat**, and **flowering and/or fruiting times**. The names and/or abbreviations immediately after each Latin name are those of the botanist(s) responsible for originally describing the species. Taxonomic synonyms—scientific names once commonly used in other floras but now considered to apply to the same taxon—appear in brackets. Habitats printed in boldface indicate according to Curtis (1959, p. 633) "...the native community in which the species achieved maximum presence," that is, the community of modality. *Presence* is high for species occurring in most or nearly all sample stands of the community. The highest presence may occur in rare communities with few species, hence the oft-reported "cedar glade" in Curtis's (1959) Species List. The number in parentheses is the number of plant communities in which Curtis' Plant Ecology Laboratory (PEL) studies found the

species to occur, that is, the *fidelity* of that species. The smaller the number, the rarer the species and the more it is restricted to a particular habitat. Because not all the species listed in this atlas were quantitatively analyzed during the PEL studies, a number of them lack this information.

Common or vernacular names are listed for each mapped species even though some are not well established by usage. Regional source books were surveyed for common names, and a few were added based on our own experience. Many common names cited in popular references are included even if they appear to have been invented for the sake of giving each species a common name.

The range statement attempts to identify or imply the floristic element to which a species belongs and its post-glacial migrational origin. In all pertinent major floras covering Wisconsin (Fernald 1950, Gleason 1952, Gleason & Cronquist 1991) the plants are described as ranging from north to south, then from east to west—a biogeographically illogical sequence, because almost 100% of the species ranges developed in the recent past moved from south to north, and in Wisconsin, considering the whole flora, almost as often from west to east as vice-versa. Therefore, we have turned most of the range statements upside down to reflect the probable direction of migration.

Information on **Excluded Species** (Appendix A) and **Native Plant Nurseries** (Appendix B) follows the map section. Critical literature, mostly Wisconsin oriented, is cited under each family and sometimes also under individual species. Appendix C contains the *Preliminary Reports on the Flora of Wisconsin* (1929–1988), a series of some 70 treatments of selected Wisconsin families and genera, as well as the four book-length treatments for Wisconsin families, and other articles listed alphabetically, along with supplementary references to provide expanded coverage for our flora.

All interested parties, botanists and amateurs alike, are encouraged to correct records and report new finds to the authors for the purpose of keeping information on the Wisconsin flora current.

North American Grasslands

The vast central North American grasslands lie between the woodlands at the base of the Rocky Mountains and the western margins of the eastern deciduous forest and extends from southern Alberta and Saskatchewan to south-central

Texas (Figure 2). Going from west to east, it can be divided into three geographically parallel climax associations: the **shortgrass plains**, the **mixedgrass prairies**, and the **tallgrass prairies** (Carpenter 1940, Risser et al. 1981, Weaver 1954, Weaver & Albertson 1956). Superimposed over this pattern of continuous and interdigitating grassland types are gradients of annual precipitation and soil depth (generally declining from east to west), temperature (rising from north to south), and floristic diversity (i.e., species richness, increasing from north to south and decreasing from east to west).

Prairies vary greatly in character and composition from place to place. Generally, with enough moisture, the Tallgrass Prairie Association, also known as the true or eastern prairie, predominates in Wisconsin; although on dry, southwest-facing hillsides, shortgrass communities not unlike the mixedgrass or even shortgrass prairies from farther west are found. The tallgrass prairie receives more rainfall, is more ecologically diverse, and contains a greater number of major dominants than either the mixedgrass prairies or shortgrass plains. Originally, the tallgrass prairie stretched in an arc from south-central Manitoba to Texas and extended eastward from a transition zone with the Mixedgrass Prairie Association near the 97th Meridian to the borders of the deciduous forest biome. In the Midwest it projected eastward as the triangular-shaped "Prairie Peninsula" (Figure 2, inset), crossing southwestern Wisconsin and most of Illinois and reaching into Indiana and eastern Ohio, with scattered outliers in Kentucky, southern Michigan and southern Ontario (Gleason 1913, Langendoen & Maycock 1983, Transeau 1935). Along its eastern edge, major portions of the tallgrass prairie, including Wisconsin's grassland communities and the entire Prairie Peninsula, constitute a variant facies within the tallgrass association that has been termed subclimax prairie (McComb & Loomis 1944) or the prairie-forest ecotone (Anderson 1983, Carpenter 1940, Davis 1977). This broad ecotone comprised a mosaic of plant community types that formed a continuum from prairie to forest. The transition with the boreal forest in the far north and west was an aspen parkland, and that with the deciduous forest farther south, as in Wisconsin, was an oak savanna. Boundaries between these ecosystems varied from gradual to abrupt owing to local environmental and topographic conditions and other factors. Peninsula-like prolongations and island-like relicts of prairie and forest communities passed into one another on both uplands and lowlands, with much of the boundary

between the two formations taking on an open, park-like character now all but lost to cow and plow.

Composition

Although grasses comprise less than 10% of the plant species (in the case of Wisconsin, 17 of Curtis's 204 prevalent and modal species), in terms of individuals and plant biomass, they are the dominant plants of the prairies. Grass species, like the communities they represent (Curtis 1955, 1959), sort themselves out in a more or less definite ordination in relation to soil moisture (Figure 3). In Wisconsin, on upland sites, or steep, calcareous slopes, short (0.5 to 1.5 feet) to mid-sized (2 to 4 feet), non-rhizomatous,

bunch- or less often sod-forming grasses predominate and often present a floristic composition and visual aspect more closely resembling the shortgrass plains and mixedgrass prairies hundreds of miles to the west: Little Bluestem (*Schizachyrium scoparium*), Side-oats Grama (*Bouteloua curtipendula*), and June Grass (*Koeleria macrantha*) on the driest prairies, Prairie Dropseed (*Sporobolus heterolepis*), Indian Grass (*Sorghastrum nutans*), and Needle Grass (*Stipa spartea*) on dry-mesic or sandy prairies. Proceeding along this idealized moisture gradient to still well-drained, typical tallgrass mesic prairies, the major dominant becomes the tall (5 to 8 feet), rhizomatous, sod-forming Big Bluestem (*Andropogon gerardii*); then, on still moister, wet-mesic prairies, Big Bluestem, Switch Grass

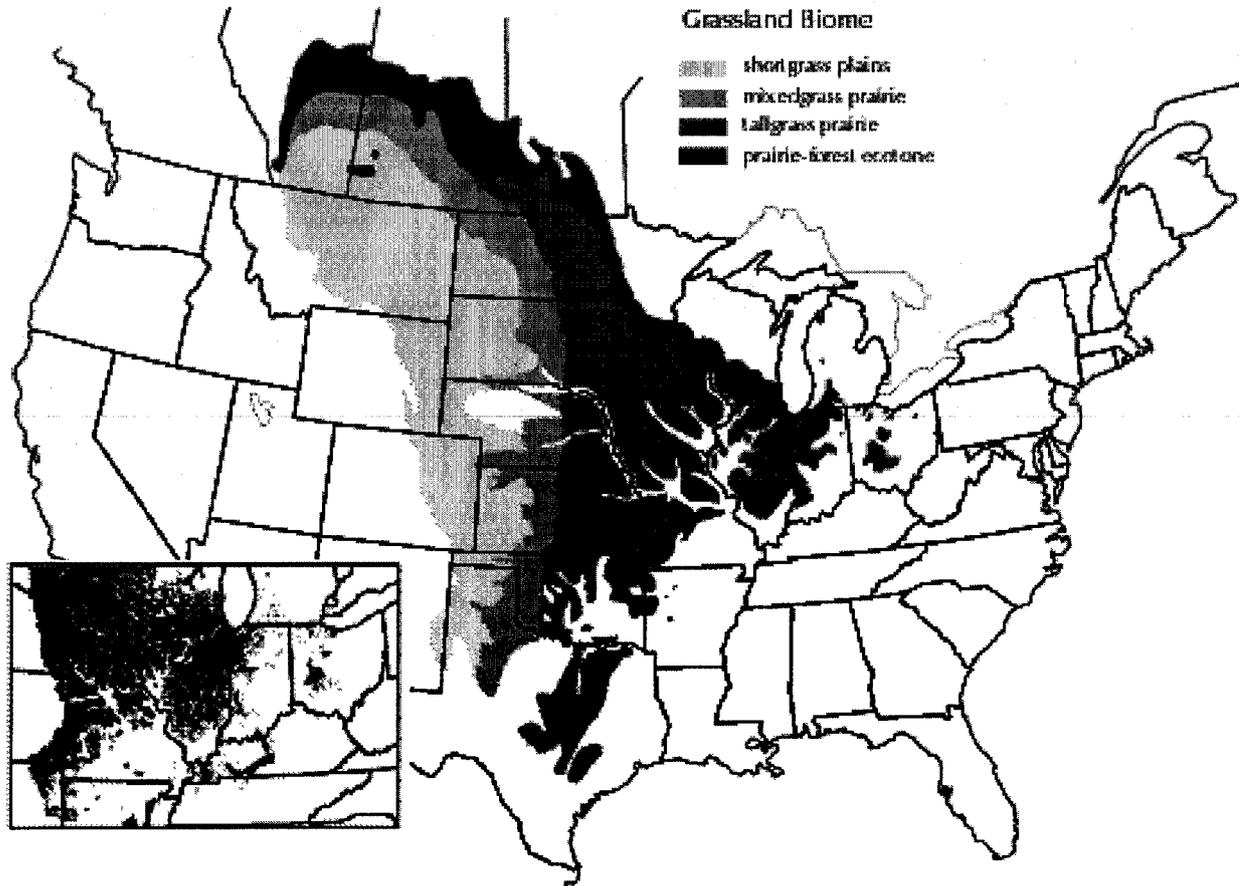


Figure 2. The grassland biome of Midwestern North America, showing the general ranges of the tallgrass and mixedgrass prairies, short-grass plains, and prairie-forest ecotone. The white oval in west-central Nebraska is the chief sandhill region. Not shown are the Atlantic and Gulf of Mexico coastal plain grasslands and pine savannas; the intermountain grasslands that extend from western Wyoming to eastern Oregon and the Palouse area; the desert grasslands that reach from Mexico into western Texas, New Mexico, and Arizona; or the central California grasslands. Depending on local conditions, topographic exposure, moisture-holding capacity of the soil, and other factors, all these Midwestern grassland ecosystems may be found in Wisconsin. Redrawn after Carpenter (1940). Inset depicts the Prairie Peninsula, an eastward extension of the tallgrass prairie, and its outliers. Reproduced from Transeau (1935).

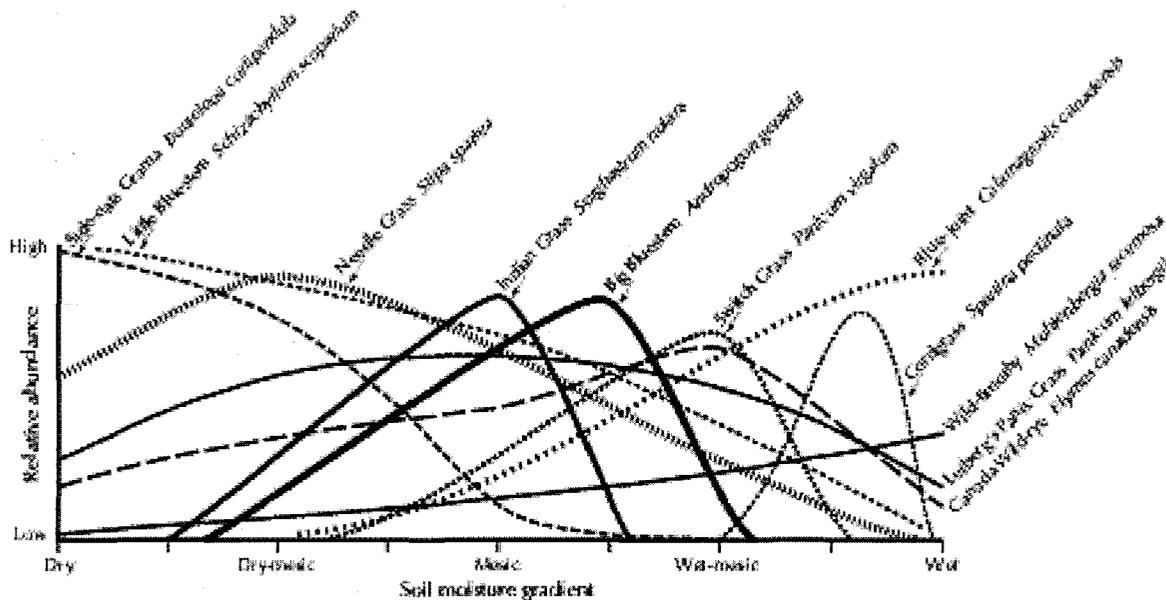


Figure 3. Generalized behavior of 11 important prairie grasses in relation to a soil moisture gradient. Each curve is unique, suggesting that the species respond in an individualistic manner to the conditions of the environment. Adapted from Bazzaz and Parrish (1982) and Curtis (1959).

(*Panicum virgatum*), and Canada Wild-rye (*Elymus canadensis*); and in wet prairies, Blue-joint (*Calamagrostis canadensis*) and Cordgrass (*Spartina pectinata*). Upland Wild-timothy (*Muhlenbergia racemosa*) and Leiber's Panic Grass (*Panicum leibergii*) occur across a wide variety of sites. Nowadays, of course, the list of dominants often includes naturalized grasses even in some well-preserved prairie remnants. Native communities utilized as pastures or otherwise artificially disturbed quickly deteriorate as the original grasses and forbs are replaced by almost wholly non-native, mostly European species. Depending on the type of habitat and degree of disturbance, the following occur in or even dominate native and surrogate grassland habitats: Canada Bluegrass (*Poa compressa*), Smooth Brome (*Bromus inermis*), Quack Grass (*Elytrigia [Agropyron] repens*), Timothy (*Phleum pratense*), and Orchard Grass (*Dactylis glomerata*) on uplands, Redtop (*Agrostis gigantea*) and Reed Canary Grass (*Phalaris arundinacea*) in lowlands, and Kentucky Bluegrass (*Poa pratensis*) everywhere across the continuum except at the wettest end. Especially difficult to eradicate are perennial Smooth Brome, which forms luxuriant sods on roadsides, pastures, and prairies; the rhizomatous perennials Canada Bluegrass and Kentucky Bluegrass,

both ubiquitous in Wisconsin's grassland and savanna communities; and the terrible Reed Canary Grass, which, deliberately planted for hay, pasturage and erosion control, has become the dominant grass cover in marshes, sedge meadows, wet prairies, low fields, and other moist habitats throughout Wisconsin.

This ordination of the major grass dominants can be replicated in the associated herbaceous species, or forbs, which, very much an integral part of the structure of prairie vegetation, contribute seasonally conspicuous color, texture, and variety (Figure 4). Except for a very few pristine, relic "virgin prairies" untouched by plowing or cattle grazing, the original character of the forb flora has changed depending on the degree of disturbance a particular remnant has suffered. Wisconsin prairies are chiefly "degraded prairies," the quality of which is often judged by the degree of replacement of the native species by introduced weedy ones. Besides floristic composition, community physiognomy and seasonal aspects like blooming and color can be used in evaluating the natural quality of a stand. Environmental attributes such as soil profile and color, microclimate, and degree and type of artificial disturbance may also serve to delineate original prairies that have been either excessively degraded or destroyed.

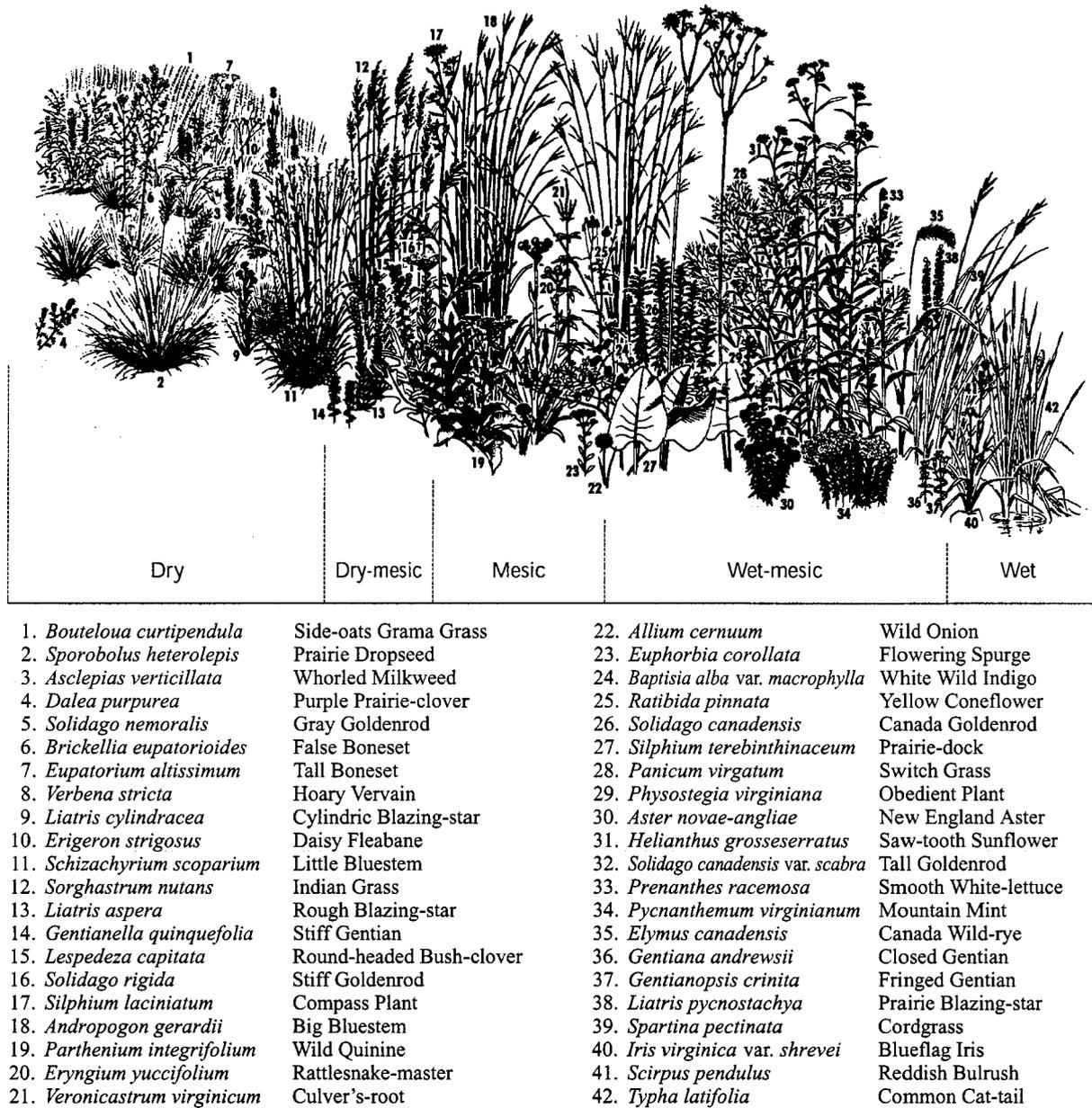


Figure 4. Generalized behavior of grass and forb species along a compositional gradient. The figure illustrates major dominants and secondary species that make up most of the vegetation in some prairies. Original drawing by Nancy R. Halliday.

Climate

Climate is generally recognized as the chief factor shaping the Great Plains environment (Borchert 1950, Weaver 1954, Weaver & Albertson 1956). The extensive plains of North America lie in the eastern rain shadow of the Rocky Mountains, which intercept humid air masses moving eastward

from the Pacific Ocean. These Pacific air masses appear to force their way like a wedge between the southward-flowing, cold Arctic and the northward-moving, warm Maritime Tropical air masses (Borchert 1950, Bryson 1966, Bryson & Hare 1974). The mean positions of these air mass boundaries or fronts are correlated with the mid-continental location of the main body of plains and prairie vegetation (Figure 5),

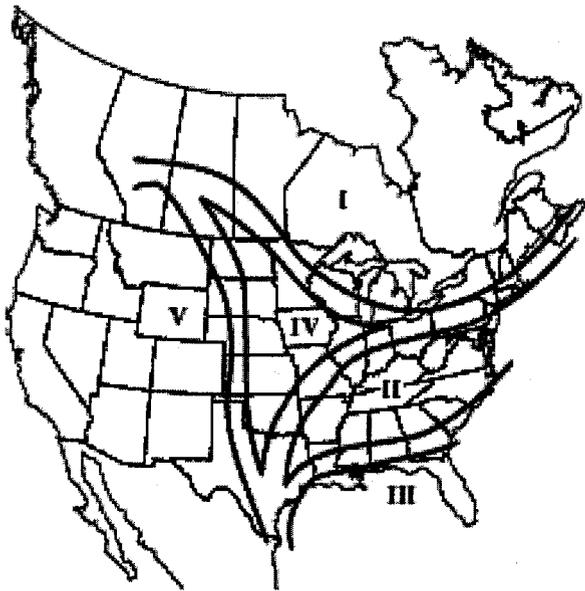


Figure 5. Climatic regions of eastern North America at the present time. Redrawn after Borchert (1950). The maps identify climatic regions dominated by the Arctic and Pacific air masses in winter and summer, respectively (I), Pacific air mass (IV, V), and Maritime Tropical air mass (II, III). The transition zone between regions I and IV corresponds with the Polar Frontal Zone. Regions are climatically the same as those shown in Figure 6.

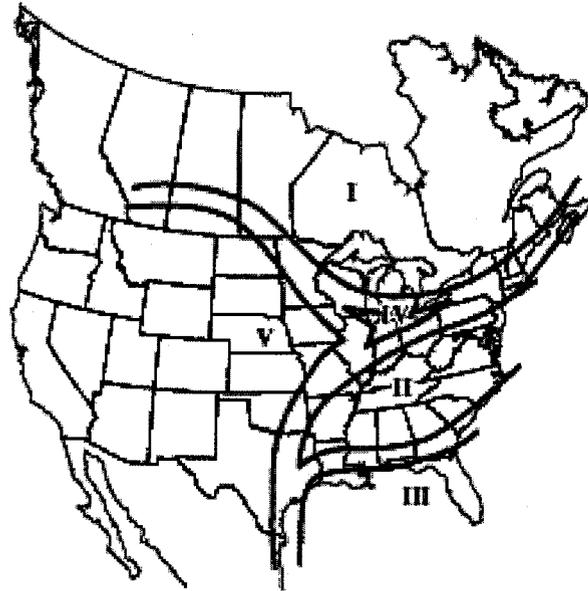


Figure 6. Paleoclimatic regions of eastern North America during a late postglacial, prehistoric period of relatively strong mean easterly circulation. During this period of relatively warm and dry summers a wedge of prairie vegetation extended eastward to Ohio or farther east as the Prairie Peninsula. Redrawn after Borchert (1950). I, the northeastern region with snowy winters; II, southeastern states and eastern seaboard with rainy winters; III, south Atlantic and Gulf Coast states with sub-tropical summers; IV, prairie region with usually dry winters and occasionally low summer rainfall; V, Great Plains with relatively dry winters and dry summers.



Figure 7. Isoclimatic lines of precipitation-evaporation ratios for the United States, which correspond closely to the distribution of the Prairie Peninsula flora. From Jenny (1941).



Figure 8. Isoclimatic lines of average relative humidity for July for the United States. The evaporating power of the air is more efficacious than precipitation amounts alone in explaining the distribution of climax communities. From USDA (1941).

which had developed by 10,000 years before present (yr B.P.) in response to late glacial climatic warming and melting of the continental ice sheet (Borchert 1950, Bryson et al. 1970, Delcourt & Delcourt 1993). During a late post-glacial, prehistoric period of shifting air mass boundaries, warming climate, and more frequent drought than at present (Figure 6), prairie vegetation spread eastward as the Prairie Peninsula, reaching its easternmost extent during the Hypsithermal Interval, generally dated between 9,000 and 4,000 yr B.P. (Delcourt & Delcourt 1993, Sears 1942, Wright 1968). Climatic conditions then changed again, with global cooling during the last 3,000 years resulting in the westward withdrawal of the Prairie Peninsula to its present-day position (Delcourt & Delcourt 1993).

The central North American grassland region experiences great and erratic variability in weather from year to year, depending on the location and duration of fronts and the frequency of their shifts (Coupland 1958, Risser 1985, Sims et al. 1978). There is less rain, higher temperatures, lower humidity, higher evapotranspiration rates, and more frequent droughts than in the mixed northern and deciduous hardwood forest regions to the east (Looman 1983, Risser et al. 1981, Transeau 1935). Other factors also correlate with the distribution of these biomes, and many of them are mutually or reciprocally related, making it difficult or impossible to rank their relative importance with respect to vegetation. The relationship between precipitation and evaporation was used by Transeau (1905, 1930, 1935) to help explain the existence of the Prairie Peninsula. More than any single meteorological variable (e.g., the total amount of precipitation), isoclimatic lines of precipitation-evaporation ratios match remarkably well on a gross scale the distribution of the Grassland Formation and other vegetation types in the eastern United States (Figure 7). Transeau (1935) also indicated that midsummer relative humidity (Figure 8) is among the more important factors in relation to the Prairie Peninsula.

The prevailing westerly winds moderate the climate of Wisconsin, the southwestern half of which lies partly within Borchert's Region IV, the prairie region, and mostly within the transitional zone between Region IV and Region I, the northeastern region (Figure 5). Many (but not all) climatic factors show good correlation with the Tension Zone (see Curtis 1959). Six of the more important factors for the vegetation are shown in Figure 9. Within the Prairie-Southern Forest Province, there are higher levels of **July evaporation** (Figure 9A), fewer **rainy days** (Figure 9B), more

days with average temperature above 68°F (Figure 9C), higher **July temperatures** (Figure 9D), less average **annual snowfall** (Figure 9E), and higher **average summer temperatures** (Figure 9F). Annual mean temperature, January mean temperature, and length of growing season also have a corresponding relation with the floristic provinces.

High temperatures and limited, more erratic precipitation are the most significant climatic factors in maintaining grassland climax against the invasion of forest. The seasonal distribution of precipitation and its range of fluctuation from year to year are probably more important than the actual total rainfall; in other words, periodic drought is critical in affecting plant growth on the prairies. With the appearance of hot dry summers and long cold winters the climate of the prairies and plains became unsuitable for the wide-ranging deciduous forests they previously supported and led to the development of the grassland ecosystem, which probably arose during the Miocene-Pliocene transition, about 7–5 million yr B.P. (Axelrod 1985), or earlier. During intervening epochs, grassland areas have been occupied alternately for varying periods of time by different vegetation types that were largely controlled by fluctuating glacial and interglacial regimes. The specific composition of the contemporary grassland biome, especially in the glaciated regions, is post-Pleistocene in age, having developed during the warmer and/or drier climates of the Holocene (Axelrod 1985, Wells 1970a, Wright 1970).

Ecology

Climate alone does not explain the distribution of prairie along the borders of the grassland ecosystem or in regions farther east that support both forests and grasslands. It is well established through historic accounts (see Curtis 1959, Pyne 1982) and research studies (e.g., Bragg & Hulbert 1976, Vogl 1964) that forest can invade prairie and prairie can invade forest. To understand the persistence of grasslands in the Prairie Peninsula, the interrelated roles of three major determinants, namely climate, fire, and grazing animals, must be taken into account (Anderson 1982, 1990; Owen & Wiegert 1981; Vinton et al. 1993). Extremes of climate such as the impact of periodic summer droughts (Anderson 1970; Stewart 1951, 1956; Tomanek & Hulett 1970; Transeau 1935; Weaver 1954; Wells 1970a, b) are probably more important to the existence of the prairies than are temperature regime and average annual precipitation. Fire frequency and intensity are related to landscape

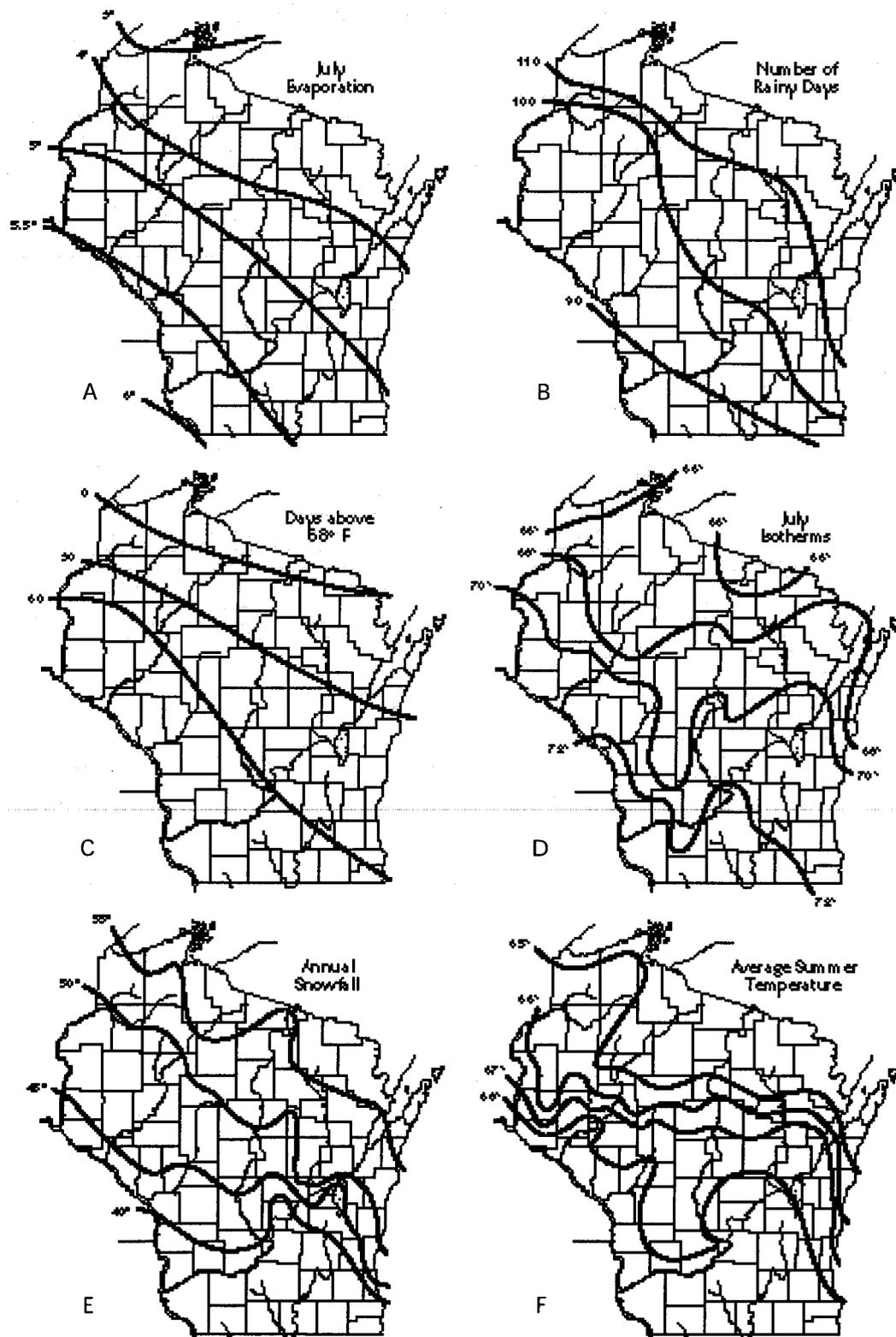


Figure 9. Climate maps, showing factors that correlate with the vegetation of Wisconsin. From Curtis (1950).

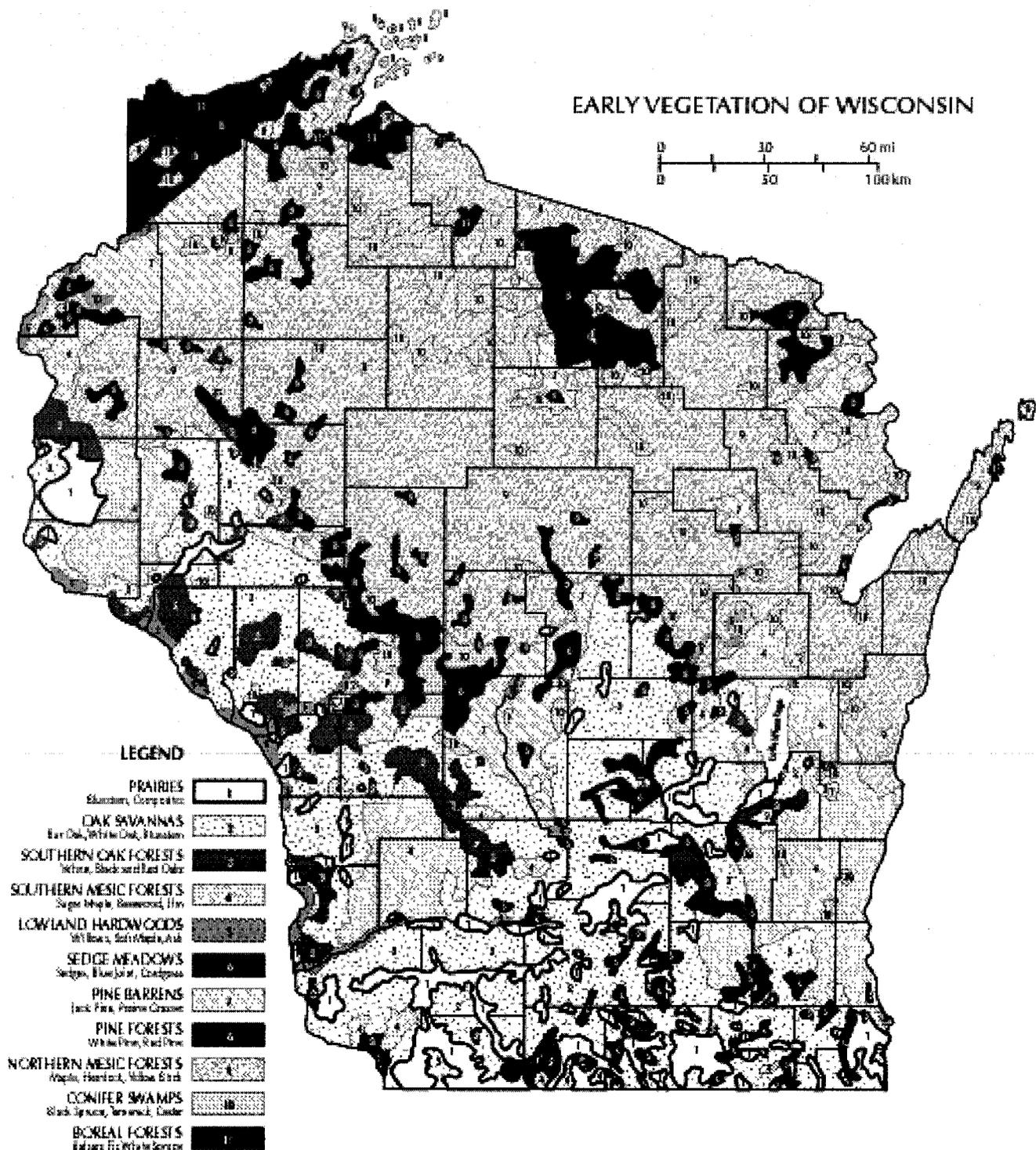


Figure 10. The presettlement distribution of plant communities based on General Land Office Survey records. Adapted from the UW-Extension Geological and Natural History Survey map (1965). Original color version available from Map Sales, GNHS, 3817 Mineral Point Road, Madison, WI, 53705-5100. Map interpretation on next page.

Figure 10. Continued.

Interpretation of the Vegetation of Wisconsin

This map is based on the original land survey conducted about the middle of the last century. Surveyors were required to place a stake each half mile, identified by notation of nearby trees, and to note briefly the general plant cover of each quarter section. These records have been used to reconstruct the presettlement distribution patterns of plant communities shown on the map.

The plant communities recognized, however, are based on systematic studies of present-day vegetation. The results of these studies are summarized in *The Vegetation of Wisconsin* (J. T. Curtis 1959), in which each community, with its history, location, and relationship to other communities and to the environment, is considered in detail. Since some of the factors determining vegetation vary gradually, the vegetation itself varies gradually, and boundaries on the map are somewhat arbitrary.

The vegetation of the state is divided into northern and southern floristic provinces by a line that runs in an S-curve northwest from Milwaukee to Hudson. North of this line the vegetation is a broadleaf forest containing conifers—pines, hemlock, spruces, and fir. Southwest of the line, conifers are much less important and are replaced by forests with several species of oaks, and by the prairies—areas dominated by grasses and tall herbs.

Fire has been important in determining almost all of the plant communities and their location. Before the coming of Europeans, the prairies (1) and the open woodlands burned almost every year. Thus most of the southern part of the state was covered with prairies or oak savannas (2), an orchard-like community with a few large bur or white oaks growing in fields of grass. Only in the more protected places did forests survive. Some of these were oak (3), but many were sugar maple-basswood-slippy elm forests (4). The lowlands were occupied by river bottom forests (5), and sedge meadows (6). With settlement, the fires were stopped, and the oak savannas grew up to the dense white oak-black oak forests found today. Most of the prairies have been cultivated, and at present, with the oak savannas, are among the rarest of our plant communities.

In the northern part of the state, a combination of fire and poor soil resulted in the development of pine barrens (7) on the sandy soils, and pine forests (8) on somewhat better soils. In the absence of fire, the white pine forests gradually changed to the northern equivalent of the sugar maple-basswood forests, a community containing sugar maple, yellow birch, and hemlock, with beech added in the eastern counties (9). Also present in the north were large tracts of lowland, with tamarack and black spruce bogs in the wetter areas, and white cedar swamps in drier, but still very moist habitats (10). In the extreme north are local occurrences of the northern conifer forests (11) dominated by fir and spruce.

A comparison of this map with maps of climate, soil, and glacial deposits shows many correspondences, indicating many relationships between vegetation and the environment. The original vegetation was thus determined by the distribution of both climatic and soil factors, modified by fire (J. T. Curtis, G. Cottam & O. L. Loucks, 1965).

features. Level to undulating topography with a thick stand of tallgrass biomass over which a hot fire could spread unchecked (Anderson 1982; Axelrod 1985; Wells 1970a, b) appears to be a determining factor affecting the distribution of grassland communities versus savannas or forests in the central Great Plains and may be especially significant in ecotonal regions (Anderson 1972, 1990, 1991; Ebinger 1991; Gleason 1913; Rodgers & Anderson 1979). The scattered bur oaks on glacial hills versus the treeless plains were proof of the killing power of hot fires. Grazing by herds of ungulates has modified grassland communities by selectively removing plant material (and perhaps destroying scattered trees and shrubs), trampling, influencing decomposition, and concentrating nutrients (Dyer et al. 1982, McNaughton et al. 1982).

Besides climate, fire, and grazing, other factors affect the vegetation. The local distribution of plant species, and as a result, plant communities, is directly related to complexities of physiography, substrate, biota, and history. In his inventory of hill prairies of Illinois, Evers (1955) concluded that on a single hillside there is much variation in plant distributions as a result of edaphic factors. It might be indicated that today, the chief factor affecting vegetation is the diverse anthropocentric uses to which the land is being put, which in prairie states primarily means conversion to agricultural fields, mowing meadows, or cattle pastures, or other purposes, especially development, that have degraded or eliminated much native habitat.

Effects of Fire

The prairie is a product of many factors, but it was the prairie fires set by lightning and, locally, the nearly annual burning by Native Americans that maintained the prairies and savannas in the face of forest succession in the Middle West (Axelrod 1985; Curtis 1959; Malin 1953; Pyne et al. 1996; Sauer 1950; Stewart 1951, 1956; Vogl 1964, 1974; and various other authors). The widespread nature of fire was emphasized in the frontier journals and diaries, its importance was well documented in the early scientific literature, and its use as a management tool has been the subject of a tremendous amount of scientific research (for reviews see Collins & Wallace 1990; Henderson & Statz 1995; Kozlowski & Ahlgren 1974; Pemble et al. 1975; Wright & Bailey 1980, 1982). Besides hindering the development of competitive grasses and invading woody species, burning reduces accumulated vegetative litter, indirectly

stimulating below-ground decomposition (Curtis & Partch 1950, Henderson 1982). The Curtis Prairie in the University of Wisconsin Arboretum in Madison presents a classic case of the importance of prescribed burning in maintaining a tallgrass prairie community (Anderson 1973, Cottam & Wilson 1966, Curtis & Partch 1948).

Prior to European settlement, fires were undoubtedly widespread and frequent and certainly played a major role in suppressing woody growth. Shrubs and trees may have been restricted by droughts, fires, and biotic factors, but they were not eliminated (Curtis 1959, Malin 1953). The tallgrass prairie zone, dominated as it is by warm-season perennial grasses, is quickly invaded by woody vegetation in the absence of fire. Tree and brush densities have increased tremendously in postsettlement time. In presettlement times, prairies occurred most commonly on level to gently sloping ground and south- and west-facing steep slopes; savannas and woodlands on slopes; and forests on the eastern side of natural firebreaks, in ravines, or on north- and east-facing slopes. Apparently, this segregation of vegetation types was determined largely by firebreaks, which controlled the frequency, and topography, the denseness of vegetation (biomass) and hence the intensity of fire (Gleason 1913, Wells 1970b, Grimm 1984, Anderson 1991). Thus, it appears probable that in the prairie-forest border region the presence or absence of tallgrass prairie on any particular site was determined by the incidence of fire (Curtis 1959, Will-Wolf & Montague 1994).

Wisconsin Grasslands and Savannas

The continental glaciers of the last ice age had for the most part melted from Wisconsin by 10,000 yr B.P., leaving behind the drift, moraines, outwash, and lake deposits that cover the Glaciated Region today. One extensive area escaped at least the later glacial advances, namely the hilly Driftless Area (King 1981, Knox 1982, Knox & Mickelson 1974), which largely occupies southwestern Wisconsin and only barely overlaps the boundaries of Minnesota, Iowa, and Illinois (Figure 1A). At the time of European settlement, about one-third of the Driftless Area was covered in prairies that were essentially treeless or were dotted with groves and oak openings and interspersed with forests. Such significant relief features as stream valleys, floodplains, terraces, and bluffs furnish much of the topography upon which the present prairie remnants survive.

The vegetation of Wisconsin developed after the demise of the last glacial ice, with prairies slowly replacing deciduous forest in response to a drying and warming trend and reaching their greatest extent during the height of the Hypsithermal Interval 8,000–6,000 yr B.P. (Axelrod 1985, Deevey & Flint 1957, Wright 1976). At its close, the climate of the Prairie Peninsula became cooler and moister, and the seasonal contrast in temperature was reduced. These changes decreased the frequency and intensity of wildfires and summer droughts and created conditions more consistent with the physiological tolerances of trees. By around 3,000 yr B.P., grasslands were being replaced by eastern forests from Minnesota to Illinois (Gleason 1923, Grimm 1983, Jacobson et al. 1987). Thus, it appears that for the past 5,000 years the Prairie Peninsula has been a shifting mosaic of prairie, savanna, and forest under climatic conditions that allowed all of these vegetation types to thrive in this region.

The presettlement distribution of the major vegetation types in Wisconsin is shown in Figure 10. The prairies (Figure 11) and savannas (Figure 12) lie within the Prairie-South-

ern Forest floristic province, which occupies the region south and west of the climatic-floristic Tension Zone. At the time of settlement, the total acreage of grasslands, that is, prairies, sand barrens, bracken grasslands, fens, and sedge meadows combined, was 3.1 million acres (Curtis 1959). The prairies themselves originally covered approximately 2.1 million acres and formed the northeastern periphery of the great mid-continental grasslands of North America. The large islands of prairie such as the mesic Arlington, Rock, Military Ridge, and Walworth prairies or the low prairies in southeastern Wisconsin that existed on surrounding glaciated lands have been almost totally obliterated. According to the State Natural Heritage Inventory, only 2,000 acres of native prairie, or 0.1% of the original acreage, remains (Henderson & Sample 1995). Northward and eastward, the prairies became smaller and more scattered until they reached the Tension Zone. Here, along both north-south and east-west transition zones, forests and grasslands merged. Savannas were present throughout this same region, and one savanna type, the pine barrens (Figure 13), reappeared north of the Tension Zone in areas of very

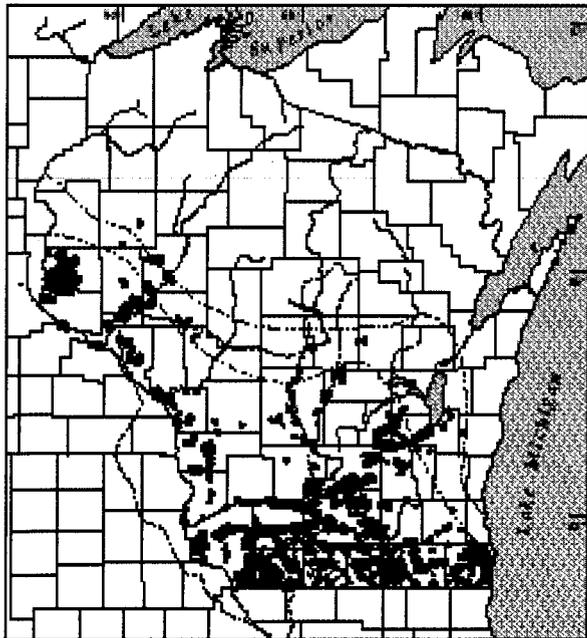


Figure 11. Original tallgrass prairies. Within Wisconsin, prairies are located southwest of the Tension Zone, occupying their greatest area in the southern third of the state. Redrawn after Curtis (1959).

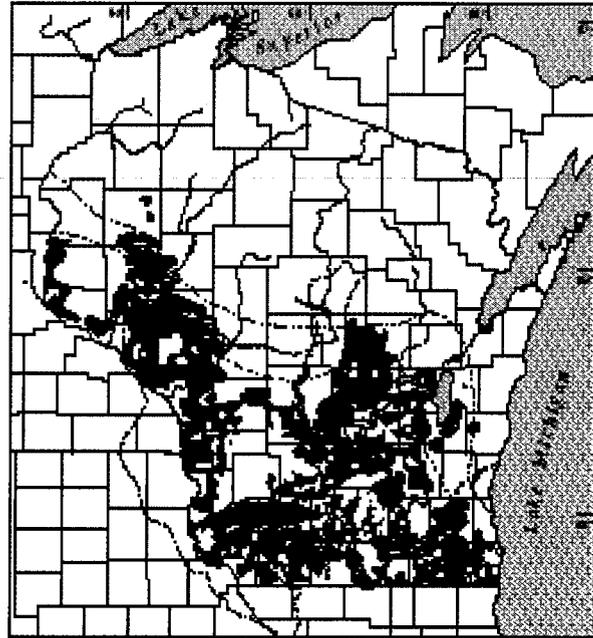


Figure 12. Original oak savannas. Oak openings were present throughout the region southwest of the Tension Zone. Oak barrens are restricted to areas of very sandy soil, especially the sand plains of central Wisconsin and terraces along major rivers. Redrawn after Curtis (1959).

sandy soil. Native prairie vegetation occurred on outwash sands at numerous smaller sites within the Tension Zone in central counties (Whitford 1972) and on nearly level heavy clays in southeastern counties (Whitford 1958). A remarkable diversity of prairie plants occurred northward well into the Mixed Conifer-Northern Hardwoods floristic province, particularly in large sandy tracts of pine barrens and bracken grasslands in northeastern Wisconsin and in areas of pine barrens and brush prairies in northwestern Wisconsin. Northern records for various prairie species may indicate 1) plants with range limits that naturally extend farther than others, 2) plants with at least some ability to spread and establish themselves beyond their native range, or 3) adventive species native farther south or west and not well established. Even in southern Wisconsin, most prairie species that are still common have become established on non-prairie soils (Gould 1941).

Prairie plants still occur in many habitats. Permanently wet communities like sedge meadows (Figure 14), shrub thickets, and fens resemble prairies in ecology and composition. Oak openings, oak and pine barrens, and related com-

munities contain large numbers of prairie plants. Dunes, old fields, roadsides, railroad corridors, and other minor or weed communities may also sustain prairie species, as do rock ledges, bluffs, and cliffs, summits of which usually support savanna, woodland, or glade vegetation with ground layers very similar to the dry prairies. Thin-soil borders adjoining outcrops support lichens, mosses, and small flowering plants such as Rock Cress (*Arabis lyrata*), Rock Spike-moss (*Selaginella rupestris*), pinweeds (*Lechea* spp.), and pussytoes (*Antennaria* spp.), while shadier borders are favorite haunts of Wild Columbine (*Aquilegia canadensis*), Alumroot (*Heuchera richardsonii*), and Harebell (*Campanula rotundifolia*).

The major plant communities of Wisconsin have been treated in detail by Curtis (1959) in his monumental synthesis, *The Vegetation of Wisconsin*, in which the vegetational continuum provides the means to arrange natural assortments of dominant species or communities according to ecological similarity along environmental gradients. The apparent differences in species composition associated with

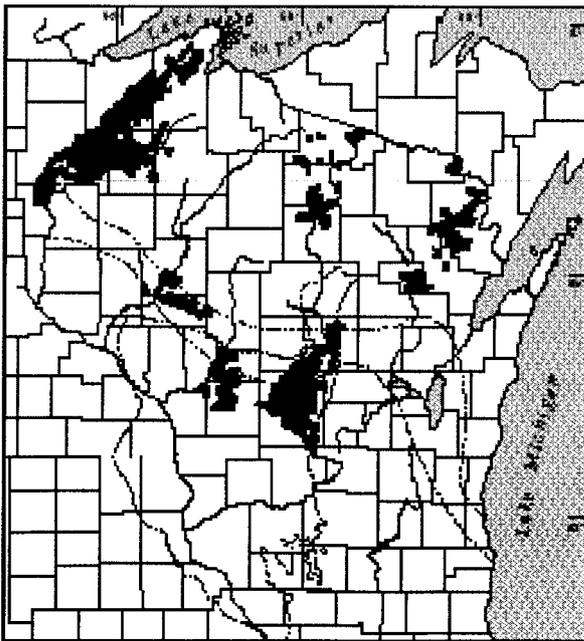


Figure 13. Original pine barrens. North of the Tension Zone, the oak barrens yield to a true savanna (locally known as barrens) in which the major dominant is usually Jack Pine and the understory often prairie-like. Most regions of former barrens are now forested, except for tracts maintained as savannas or brush prairies through prescribed burning. Redrawn after Curtis (1959).

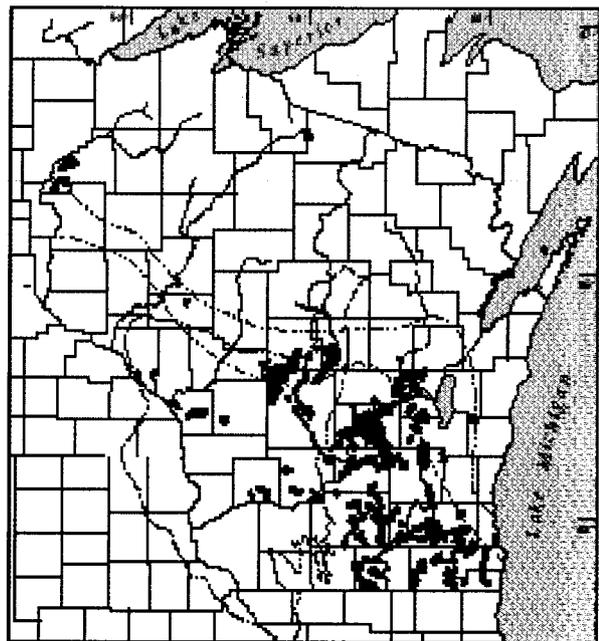


Figure 14. Original sedge meadows. Sedge meadows are present in all parts of Wisconsin, but are concentrated in areas of extinct lake beds and along shores in the south. They are closely related to fens and wet prairies, but are dominated by sedges instead of grasses. Redrawn after Curtis (1959).

Table 4. Indicator species for five segments of the prairie gradient. From Curtis (1959).

| Wet prairie species | Wet-mesic species | Mesic species | Dry-mesic species | Dry species |
|---------------------------------|----------------------------------|-------------------------------|--------------------------------|--------------------------------|
| <i>Aster novae-angliae</i> | <i>Cicuta maculata</i> | <i>Aster laevis</i> | <i>Anemone cylindrica</i> | <i>Arenaria stricta</i> |
| <i>Calamagrostis canadensis</i> | <i>Desmodium canadense</i> | <i>Ceanothus americanus</i> | <i>Asclepias verticillata</i> | <i>Artemisia caudata</i> |
| <i>Hypoxis hirsuta</i> | <i>Dodecatheon meadia</i> | <i>Cirsium discolor</i> | <i>Dalea candida</i> | <i>Aster sericeus</i> |
| <i>Oxypolis rigidior</i> | <i>Fragaria virginiana</i> | <i>Desmodium illinoense</i> | <i>Helianthus occidentalis</i> | <i>Bouteloua curtipendula</i> |
| <i>Pycnanthemum virginianum</i> | <i>Galium boreale</i> | <i>Eryngium yuccifolium</i> | <i>Linum sulcatum</i> | <i>Dalea purpurea</i> |
| <i>Solidago gigantea</i> | <i>Helianthus grosseserratus</i> | <i>Helianthus pauciflorus</i> | <i>Panicum oligosanthes</i> | <i>Panicum perlongum</i> |
| <i>Spartina pectinata</i> | <i>Heuchera richardsonii</i> | <i>Liatris aspera</i> | <i>Potentilla arguta</i> | <i>Pulsatilla patens</i> |
| <i>Thalictrum dasycarpum</i> | <i>Lathyrus venosus</i> | <i>Panicum leibergii</i> | <i>Scutellaria leonardii</i> | <i>Schizachyrium scoparium</i> |
| <i>Veronicastrum virginicum</i> | <i>Phlox pilosa</i> | <i>Ratibida pinnata</i> | <i>Sporobolus heterolepis</i> | <i>Solidago nemoralis</i> |
| <i>Zizia aurea</i> | <i>Rudbeckia hirta</i> | <i>Solidago missouriensis</i> | <i>Stipa spartea</i> | <i>Solidago ptarmicoides</i> |

topography led Curtis and Greene (1949) to select groups of indicator species that attained peaks of optimum growth for five segments of the prairie continuum (Table 4). Individual stands of prairie are placed along the gradient according to a site index calculated by means of these indicator species (Curtis 1955, 1959). The fundamental outline of the following discussion is based on the communities as designated in Curtis (1959). Henderson (1995a) has summarized available knowledge on species presence, density, and frequency for each of the five prairie types and sand barrens.

Prairie Communities

Once the European settlers arrived, the prairies of Wisconsin disappeared quickly. Prior to 1830, the prairies stretched for miles on level outwash plains, undulating glaciated terrain, and rolling surfaces or steep slopes of dolomitic bedrock. Smaller, more scattered prairies occurred on hillsides, bluff tops, and other uneven land forms, as well as on inundated lowlands, sites where extant remnants are more likely still to be found. Because most of the prairie soils of Wisconsin are predisposed to agricultural use, only a few large natural prairies remain, most notably Avoca Prairie and Savanna State Natural Area in Iowa County, which contains the largest tallgrass prairie east of the Mississippi River, and the rather unique, fen-like Chiwaukee Prairie on top of the Niagara dolomite in Kenosha County. Otherwise, what remains of the original prairies are relics on sites unsuitable

or unavailable for agricultural purposes, most often very dry prairies on steep topography, rarely mesic prairies along railroad and highway rights-of-way and in corners of neglected cemeteries, or wet prairies on lowlands subject to flooding. These remnants continue to suffer or disappear because of overgrazing, invasion by trees and shrubs due to long periods without burning, drainage changes, soil disturbances, and herbicide use. Even on protected prairies, populations have declined and species have died out entirely. (See Leach & Givnish 1996; but because most stands they studied have rarely been burned, it is unclear whether habitat fragmentation and edge effects, or lack of management, is more responsible for the gradual dilution of biodiversity.) Today, not surprisingly, considering their agricultural value, the tall-grass deep-soil prairies and the related oak savannas are the two most endangered ecosystems in the Midwest, and are, in fact, among the most decimated in the whole world (Wisconsin Department of Natural Resources 1995).

• Dry Prairies

Of all the different Wisconsin prairies, the most frequently surviving are the various dry prairies. Distinctive grassland communities have developed on deposits of sand along rivers, on glacial gravels (kames, eskers, drumlins, outwash terraces), and most commonly on dolomitic bedrock that may be exposed on bluffs and hillsides. These have become known, respectively, as sand prairies, gravel-hill prairies, and dry lime prairies (which, on steep rocky

hillsides, have been dubbed "goat prairies," because it requires the agility of a goat to scramble up them). Sand prairies are also found on inland dunes, old lake beds, and sandstone cliffs. In the presence of fire, these climax communities displace barrens (desert-like associations of *Opuntia* and *Hudsonia*—southwestern and Atlantic Coastal Plain floristic elements, respectively—with ground lichens and annuals like Coastal Joint-weed, *Polygonella articulata*). In the absence of fire these communities succumb to shading by Jack Pine (*Pinus banksiana*) and scrub oaks. According to Curtis (1959), sand prairies cannot be subdivided into different types on the basis of species composition; neither were they recognized as a distinct community by him. However, when reanalyzing Wisconsin Plant Ecology Laboratory (PEL) data augmented by information from additional stands, Umbanhowar (1992, 1993) found a compositional difference between dry prairies on sandy substrates and those on limestone substrates. In Illinois (White & Madany 1978), sand prairies have been kept apart as a separate subclass of communities on the basis of soil structure and moisture levels.

Judging from their species composition (Anderson 1954), limy prairies have affinities with the Cordilleran, Great Plains, and Ozarkian prairies to the far west, southwest, and south of Wisconsin. Little Bluestem, perhaps the most characteristic plant, is accompanied by a long list of other graminoids such as grama grasses (*Bouteloua* spp.), June Grass, drop-seed grasses (*Sporobolus* spp.), panic grasses (*Panicum* spp.), Plains "Muhly" (*Muhlenbergia cuspidata*), and sedges (*Carex* spp.); forbs, including Short Green Milkweed (*Asclepias viridiflora*), Silky Aster (*Aster sericeus*), Purple Prairie-clover (*Dalea [Petalostemon] purpurea*), False Boneset (*Brickellia [Kuhnia] eupatorioides*), etc., on the driest ridges and slopes, Heath Aster (*A. ericoides*), Rough Blazing-star (*Liatris aspera*), Old-field Goldenrod (*Solidago nemoralis*), Prairie Violet (*Viola pedatifida*), Downy Gentian (*Gentiana puberulenta*), etc., in more mesic places; and shrubs such as Lead-plant (*Amorpha canescens*), New Jersey Tea (*Ceanothus americanus*), sumacs (*Rhus* spp.), and roses (*Rosa* spp.). Prairies found on gravel hills and dolomitic bedrock resist both tree growth and grazing pressure, but like those on sand are subject to invasion by weeds and grasses and such trees as Quaking Aspen (*Populus tremuloides*), Black Cherry (*Prunus serotina*), and especially Eastern Red-cedar (*Juniperus virginiana*). However, if grazing pressure by cattle is low, the dry prairie flora for the most part is able to persist under disturbance.

• Mesic Prairies

Prairies on deep mineral soils range from dry-mesic and well drained to wet and very poorly drained, with these segments, like all others of the compositional gradient, passing imperceptibly into one another. The mesic prairies thus differ from sedge meadows and fens, which are developed on sedge peat or marl, and from cat-tail marshes, which are permanently inundated. Mesic prairies once occupied perhaps 40%, or approximately 840,500 acres (Curtis 1959), of the prairie-forest border region of Wisconsin. They evolved on flat to gently rolling topography where there had been some accumulation of well-developed soil, and their great biomass insured hot fires, eliminating shrubs and trees. Because of their deep dark soils, these prairies have been all but eliminated due to direct destruction for agricultural purposes. Plowing, over-grazing, mowing, fencerow clearing, Multiflora Rose (*Rosa multiflora*) planting during the 1950s, herbicide spraying especially since the 1960s, and pesticide application, as well as draining and irrigating, have favored exotic weeds at the expense of the natives and have made many once-common species, along with their pollinating insects and their seed-dispersing birds, locally rare or often extinct. Thus, the left-over remnants are minute, fragmented, and very scattered, pathetic monuments to human shortsightedness, greed, and need.

The mesic prairies exhibit the deepest soils, the highest plant species diversity, and the tallest grasses and forbs, Big Bluestem being the leading dominant. The other major dominants, Little Bluestem, Needle Grass, Prairie Dropseed, and Leiberg's Panic Grass, are essentially equal in importance to one another (Curtis 1959). As for the forbs, Illinois Tick-trefoil (*Desmodium illinoense*), Stiff Sunflower (*Helianthus pauciflorus*), Rough Blazing-star, Compassplant (*Silphium laciniatum*), Prairie-dock (*Silphium terebinthinaceum*), and Prairie Violet, all have ranges coinciding with that of the mesic tallgrass prairie. These, together with the more wide-ranging White Wild False-indigo (*Baptisia alba*), Pasture Thistle (*Cirsium discolor*), and Yellow Coneflower (*Ratibida pinnata*), are among the long list of most prevalent mesic prairie species.

Composition is sometimes not as uniform as might be expected, however, due to the regional geographical relations of the component species. For example, suites of often rare species to be found only in the southeastern corner of Wisconsin include the Chestnut Sedge (*Fimbristylis puberula*), Nodding Wild Onion (*Allium cernuum*), Stout Blue-eyed-grass (*Sisyrinchium angustifolium*), Marsh Gay-feather

(*Liatris spicata*), and Smooth Phlox (*Phlox glaberrima*). These are all southern or southeastern elements at the very northern or northwestern edge of their range. Conversely, in our far western counties on or near the bluffs of the Mississippi and St. Croix rivers, Ground-plum (*Astragalus crassifolius*), Downy Prairie-clover (*Dalea [Petalostemon] villosa*), Silvery Scurf-pea, Prairie Sagewort (*Artemisia frigida*), and Dotted Blazing-star (*Liatris punctata*)—all northern Great Plains elements—reach the easternmost edge of their range. All have generally similar distributions that, like the preceding group, do not correspond with the general range of the prairies in Wisconsin. Other important forbs such as Prairie-dock, which is restricted to an area south and east of Wood County, and Pale Purple Coneflower (*Echinacea pallida*), which is local in the southern two tiers of counties, also have clearly defined distribution patterns related to their southern Midwestern origins.

Several common agricultural crops and weeds are terrible pests in prairies as well: White Campion (*Silene latifolia* [*Lychnis alba*]), sweet-clovers (*Melilotus alba* and *M. officinalis*), Red Clover (*Trifolium pratense*), Leafy Spurge (*Euphorbia esula*), Wild Parsnip (*Pastinaca sativa*), and Common Dandelion (*Taraxacum officinale*) routinely invade prairies, as do the all-too-familiar forage grasses, especially the two common bluegrasses (*Poa pratensis* and *P. compressa*), Smooth Brome, Orchard Grass, and Quack Grass. In many mesic and lowland prairies, the native flora is scarcely able to compete against invasion by such ecologically aggressive exotics (Curtis 1959).

• Lowland Prairies

Lowland prairies are found in river valleys or lake basins where the soil is nearly always wet from surface water in winter and spring, or from floodwaters at any time of the year. The cold-air drainage to which some such sites are subject produces summer fogs and late spring and early autumn frosts.

The overwhelming dominants of the wettest prairies are Blue-joint and Cordgrass. The other leading dominants include Big Bluestem, Upland Wild-timothy, and many species of sedges (*Carex* spp., *Schoenoplectus* spp. [*Scirpus*, in part]). Wet prairies merge into marshes in even wetter conditions, and into the much more frequent and floristically richer wet-mesic prairies on the drier side of the continuum. The wide-ranging grasses that peak as dominants of wet-mesic prairies include Big Bluestem, Blue-joint, Cordgrass, Canada Wild-rye, and Leiberg's Panic Grass. As for

forbs, in the water and along the margins of ponds, sloughs, and swales Marsh-marigold (*Caltha palustris*), Bottle Gentian (*Gentiana andrewsii*), and Blue Flag (*Iris virginica*) lend color to the dense vegetation, as do Common Milkweed (*Asclepias syriaca*), False-toadflax (*Comandra umbellata*), Canadian Tick-trefoil (*Desmodium canadense*), Prairie Phlox (*Phlox pilosa*), and Black-eyed Susan (*Rudbeckia hirta*) on the hummocks and swells. Such characteristic sedge meadow plants as Blue-joint, Meadow Anemone (*Anemone canadensis*), water-hemlocks (*Cicuta* spp.), Field Horsetail (*Equisetum arvense*), bedstraws (*Galium* spp., including *G. obtusum*), Marsh Pea (*Lathyrus palustris*), and Purple Meadow-rue (*Thalictrum dasycarpum*) are also prevalent. Fens contain many prairie and sedge meadow species as well as some uniquely their own, especially delicate, open-habitat specialists with Atlantic Coastal Plain affinities such as One-flowered Satin Grass (*Muhlenbergia uniflora*) or Low Nut-rush (*Scleria verticillata*), a minute annual that is known from here all the way to Brazil.

Sand Barrens

The sand barrens of southern Wisconsin actually consist of a mixture of mostly naturally disturbed habitats, including active and stabilized blowouts and dunes and sand flats, and also once-plowed, now-abandoned fields too dry to support a crop. Originally, some were probably thinly vegetated with dry-mesic to dry sand prairies, but most have by now become excessively degraded, as along the lower Wisconsin River Valley, where dunes were flattened in the 1930s in preparation for turning them into pine plantations. Nonetheless, abandoned fields and roadsides in such regions still possess interesting mixtures of native pioneer species from nearby prairies, and introduced pioneers—species which in Eurasia long ago played an analogous ecological role. The latter, of course, are now our weeds, and thus mature sand-barrens vegetation reflects the development of a grassland community that is very different from, albeit closely related to, dry-mesic prairies and oak openings (Curtis 1959). Many important widespread bunch grasses of sandy habitats grow here, including June Grass and the two pink tumble grasses, Fall Witch Grass (*Digitaria [Leptoloma] cognata*) and Purple Love Grass (*Eragrostis spectabilis*), as well as the (with us, rare) pioneering Sand-reed (*Calamovilfa longifolia* var. *longifolia*) and Sand Dropseed (*Sporobolus cryptandrus*), both widespread western elements. A whole suite of species that came to Wisconsin from various directions are essen-

tially confined to this community, including Rock Spike-moss (Appalachian; see below), Sand Bracted Sedge (*Carex muhlenbergii*—eastern states), Sand Croton (*Croton glandulosus* var. *septentrionalis*—subtropical and tropical America), Rough Sand Sedge (*Cyperus schweinitzii*—Nebraska sandhills, see below), Blue Toadflax (*Linaria canadensis*—southern states), Western Ragweed (*Ambrosia psilostachya*—Great Plains), Virginia Dwarf-dandelion (*Krigia virginica*—eastern states), and, locally, the charming Fame-flower (*Talinum rugospermum*—central Great Plains sandhills). The principal species occupying blowouts include three-awn grasses (*Aristida basiramea*—Great Plains, and the beautiful *A. tuberculosa*—Atlantic Coastal Plain dunes), Large Cotton-weed (*Froelichia floridana* var. *campestris*—southeastern states), and Coastal Joint-weed (Atlantic Coastal Plain dunes). The only woody species encountered frequently is the diminutive, evergreen False Heather (*Hudsonia tomentosa*), still another element of the Atlantic Coastal Plain and an important source of ecologically specialized swale and sand prairie components.

Savanna Communities

The original vegetation pattern of the Midwestern prairie-forest border was a landscape characterized by a mosaic of prairies on hills, bluffs, and flat to gently rolling plains, oak forests in the river valleys and on their east- and north-facing slopes, and, alternating with these, savannas and woodlands (Anderson 1991, Ebinger 1991). Certainly, Wiscon-

sin's Prairie-Southern Forest Province at the time of European settlement was dominated by oak savannas and open oak woodlands (Figure 15; see also Figures 2, 10, & 12). Oak savannas had a very open canopy and were either oak openings (of pure Bur Oak, *Quercus macrocarpa*, pure White Oak, *Q. alba*, or a mixture of the two) or oak barrens (of Black Oak, *Q. velutina*, and/or Northern Pin Oak, *Q. ellipsoidalis*) (Curtis 1959). Oak woodlands and forests had a more or less closed canopy and were of several types: Bur Oak-Swamp White Oak (*Q. bicolor*), White Oak-Bur Oak-Red Oak (*Q. rubra*), Chinquapin Oak (*Q. muhlenbergii*), or Northern Pin Oak (Faber-Langendoen 1995). These oaks are both fire resistant and shade intolerant. All the oaks occurred in both savannas and forests/woodlands, together with Shagbark Hickory (*Carya ovata*), Large-toothed Aspen (*Populus grandidentata*), Black Cherry (*Prunus serotina*), Iowa Crab (*Malus ioensis*), and other tree species of lesser importance. The distributions of six major tree species of the Wisconsin savannas are shown in Figure 16.

According to Curtis (1959), the presettlement oak savannas occupied 5.5 million acres in southern Wisconsin, making them the most common community in the Prairie-Southern Forest Province. Oak and pine barrens occupied 4.1 million acres, and oak forests, many of which may have been open woodland depending on their fire history, another 1.4 million acres. Intact stands of oak savanna are now so rare that less than 500 acres, or less than 0.01 percent of the original acreage, are listed in the Natural Heritage Inventory as having a plant assemblage similar to that of the origi-

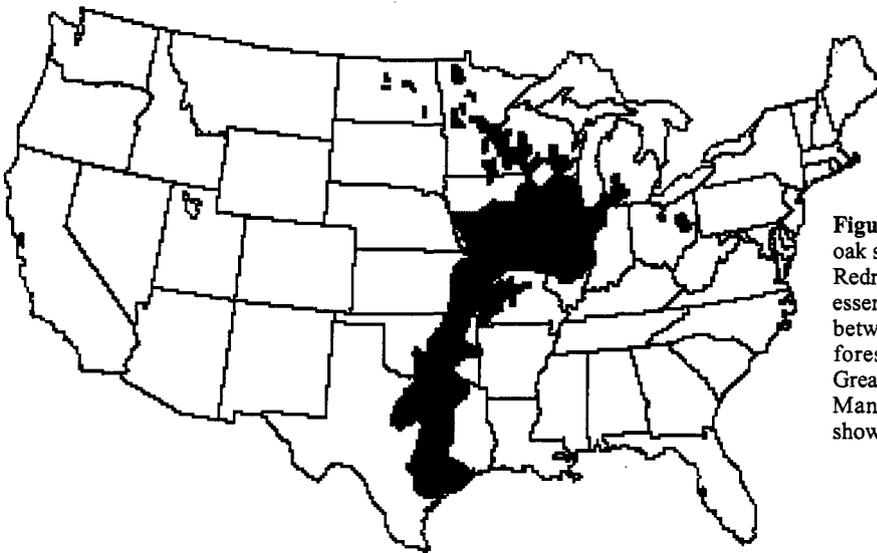


Figure 15. The presettlement distribution of oak savanna and woodlands in the Midwest. Redrawn from Nuzzo (1994). Savannas are essentially transitional communities located between and arbitrarily separated from the forests of the East and the prairies of the Great Plains (compare with Figures 2 & 12). Many outlying areas are too small to be shown on a map of this scale.

nal oak savanna (Henderson & Sample 1995). Very rarely, scattered and stately open-grown bur oaks, with an understory totally devastated by grazing, did survive to bear witness to the majestic, park-like oak opening. In the Midwest as a whole, oak savannas now occupy 0.02 percent of their estimated presettlement area (Nuzzo 1986, 1994).

Ecologists have always struggled with the definition of the term *savanna*, particularly in North America (Dyksterhius 1957, Penfound 1962). The oak savanna, a term often used interchangeably with oak opening, was defined arbitrarily by Curtis (1959) as stands of open-grown oaks with densities ranging from one tree per acre up to a maximum of 50% canopy cover, and having a predominantly herbaceous ground layer of native forbs and grasses. However, the image of a savanna being a prairie dotted with trees, or scattered trees or groves with a prairie understory, is far too narrow. Contemporary ecologists now define oak savannas as communities dominated by oaks, having an average tree

canopy of more than 10% but less than 80%, with or without a sparse shrub layer, but with a predominantly grassy ground layer rich in forbs associated with both prairie and forest communities (Haney & Apfelbaum 1990, Nuzzo 1986, White & Madany 1978). The once ubiquitous savannas of Minnesota, Iowa, and Wisconsin ranged from very open, prairie-like oak openings (grasses as an understory to trees), through close-growing or chaparral-like scrub forests, to dense shrub thickets (grasses intermixed with woody plants). These occurred on sites varying from wet to dry and flat to hilly, and developed on soils varying from thin and sandy or rocky to deep and loamy or clayey. Modern terminology for a comprehensive classification of these habitat types is still evolving (several classifications are summarized by Leach & Ross 1995). For example, Curtis (1959) recognized only four types of savanna communities in Wisconsin, namely oak barrens, oak opening, pine barrens, and cedar glade, whereas Haney and Apfelbaum

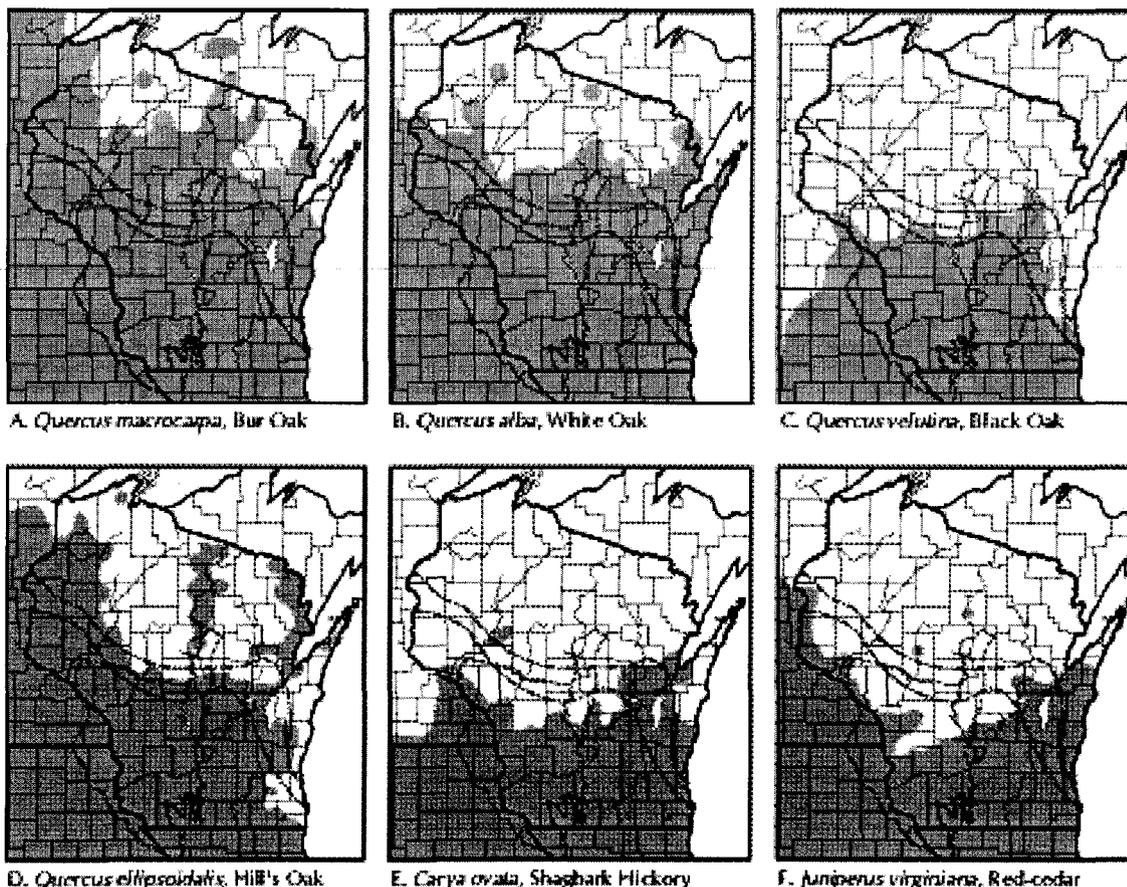


Figure 16. Distribution of major tree species in Wisconsin grassland and savanna communities. Modified after Little (1971).

(1997) recognized six oak savanna types in the Upper Midwest: eastern sand savanna, northern sand savanna (including oak and pine barrens), mesic loam savanna, floodplain savanna, clay-loam savanna, and southern oak savanna. Meanwhile, the Illinois Natural Areas Inventory (White & Madany 1978) divided the savanna community class into three subclasses separated by soil type: savanna, sand savanna, and barren; and seven natural communities based on soil moisture: dry-mesic savanna, mesic savanna, dry sand savanna, dry-mesic sand savanna, dry barren, dry-mesic barren, and mesic barren. Identical savannas probably occurred in Wisconsin, at least in terms of their canopies if not their understories. Almost unknown but deserving of attention are wet and wet-mesic savannas, rare and unusual communities that were mentioned by Bray (1955) and Curtis (1959), but which remain unrecognized in community classification systems for Wisconsin and Illinois.

Once definitions are taken into account, the next interesting problem is to construct with fair accuracy a picture of savanna understories and groundlayers in the absence of surviving savannas, quantitative data, or even any extensive list of savanna species. Little accurate information has been available to help answer the cutting-edge question of whether Midwestern savannas had a characteristic flora or even a few species restricted to them (Bray 1955; Leach 1996; Packard 1988b, 1993; Pruka 1994a, b, 1995). The species listed by early observers, and those present in relics and successful in modern restorations, reveal, not surprisingly, that savannas present differences in species composition on both regional and geographic scales comparable to the situation found in the prairies or in the deciduous forests to the east and south. Upland savannas were studied in Wisconsin in the 1950s by Curtis (1959) and his student Bray (1955, 1958, 1960), whose published species lists for the oak savannas may be misleading, because according to the observations of restoration practitioners, the flora of oak ecosystems may have been, in fact, more diverse (Delong & Hooper 1996; Leach 1994, 1996; Leach & Givnish 1999; Packard 1988a, b; Pruka 1994a, b; Henderson 1995b). Closed savannas or savanna woodlands (i.e., overgrown savannas with 50–100% canopy cover) in the recent terminology were lumped by Curtis (1959) with the southern dry and southern dry-mesic forests, despite their original distinctness from oak forest (Henderson 1995b). Recent floristic summaries of the ground layer plants of open savannas indicate that the species in the dry stands (Will-Wolf & Stearns 1998) were very different from those of either mesic

(Leach 1994, 1996; Packard 1988b, 1993) or wet stands (Hujik 1995), and presumably the floristic composition of closed savannas behaved in a similar fashion.

Oak savannas thrived on the same kind of balance between climatic regime and natural disturbance as did the prairies or the forests. Historically, these disturbances included herbivory, drought, exceptionally wet seasons, and fire. Although not every acre burned every year, the historical and scientific evidence indicates that the frequency, intensity, and extent of wildfires had an enormous impact on the ecology of oak forests and oak savannas (Abrams 1992). Just as frequent fires maintained the treeless structure and affected the species composition within the prairie biome, reduced fire frequency and intensity encouraged the abundance of oaks and the establishment of fire-tolerant tree species within the prairie-forest transition zone (Anderson 1970, 1998; Anderson & Brown 1986; Cooper 1961; Dorney 1981; Grimm 1983). Bur oaks needed only a brief period of protection from fire to flourish, their thick bark, especially evident on young trees, conferring resistance to fire and allowing them to grow to tree size. Fires resulted from both lightning strikes and human activities, and in either case spread accidentally on their own or were intentionally set for diverse purposes (Abrams 1992, Curtis 1959, Komarek 1968, Pyne 1982, Stewart 1956). Abrams (1992) estimated that fires occurred at 1- to 10-year intervals in oak savannas.

The arrival of European settlers to the Midwest in about 1830 immediately overturned the regional fire ecology. The oak woodlands, oak openings, and oak-pine forests experienced irrevocable alteration due to fire suppression, clearing of trees, removal of native animals, introduction of domestic livestock, invasion of weedy native and aggressive exotic species, and very soon, habitat fragmentation. Unfarmed savannas, except very dry or very wet ones, were changed into closed-canopy forests within two to three decades, owing to successional replacement of any one of the dominant oaks by other shade tolerant/fire intolerant trees and shrubs (Beilmann & Brenner 1951, Bray 1960, Curtis 1959, Grimm 1983, Nuzzo 1986, Stout 1944). Oak openings and oak barrens used for agricultural purposes may have retained their original tree cover, but overgrazing by domestic livestock, augmented by the rapid spread of many weedy species, eliminated the shrub and herb strata. Having been effectively exterminated, the savanna communities will continue to exist only to the extent that programs of active restoration are carried out.

• Typical Savannas

Very little concrete knowledge is available concerning the composition and dynamics of the more or less distinct subtypes of savannas that might be recognized for Wisconsin. The typical savannas occurred on soils ranging from shallow to deep and from dry to wet, but were probably most extensive on the fine-textured soils of level ground (White & Madany 1978). Typical dry to dry-mesic savannas were found on soils comparable to those of dry to dry-mesic upland forests, and their dominants were derived from the southern Ozarkian and Appalachian dry forests (Bur, Black, and White oaks in the overstory) and from the dry-mesic prairies (Big Bluestem, Little Bluestem, and Needle Grass in the ground layer; Curtis 1959, White & Madany 1978). The ground layer species were probably a mixture of prairie plants, e.g., Lead-plant, Prairie Tickseed (*Coreopsis palmata*), Purple Prairie-clover, and Flowering Spurge (*Euphorbia corollata*), forest and forest-border species such as Hog-peanut (*Amphicarpaea bracteata*), Wild Sarsaparilla (*Aralia nudicaulis*), Pennsylvania Sedge (*Carex pensylvanica*), and Pointed Tick-trefoil (*Desmodium glutinosum*), and savanna specialists that thrived in a combination of shade and sun. According to Bray's study (1960), oak savannas showed a decrease in grasses and an increase in forbs and shrubs compared to prairies, but a corresponding increase in grasses and decrease in forbs as compared with forests, with the prairie species predominant in open savannas (Curtis 1959). This conclusion simply verifies the continuum from sun-loving prairie species that can tolerate only light shade, to forest species that can tolerate but do not thrive in moderate sunlight.

Less is known about the mesic and lowland savannas of deeper mineral soils. Mesic savannas were dominated by White and Bur oaks, lowland savannas by Swamp White, Bur, or White oaks with River Birch (*Betula nigra*) and Silver Maple (*Acer saccharinum*) in spots. The canopy dominants of mesic savannas remained the same as in dry savannas, and their more favorable moisture conditions presumably resulted in ground layer vegetation that was similar to that of mesic prairies (but see Leach 1996). Tallgrass Formation species listed as probable savanna specialists (Packard 1988a, b, 1993) include some that today reach their highest levels of presence in prairies, e.g., Purple Milkweed (*Asclepias purpurascens*), Veiny Pea (*Lathyrus venosus*), Pale Indian-plantain (*Cacalia [Arnoglossum] atriplicifolia*), and Cream Gentian (*Gentiana alba*), as well as some that peak in woodlands, e.g., Woodland Brome (*Bro-*

mus pubescens), Rye grasses (*Elymus* spp.), Bottlebrush Grass (*E. hystrix*), and Elm-leaved Goldenrod. Some of these may have been characteristic savanna species that have survived successional shifts to more or less closed forests by moving into drier microsites (Pruka 1994a, b) in the same way that lowland prairie species invade drier savannas (Bray 1958, Hujik 1995). The whole argument about whether there are savanna specialists loses credibility when considering on the one hand the continuous floristic change of species replacing one another from the Atlantic shores to the foothills of the western mountains, and the probability that among the 1,000 or so species of the Midwestern tallgrass prairies (Ladd 1997), there will be some that fall in the middle of the continuum, or that grow well in semishade. In fact, but rarely, climax mesic deciduous forest species have been found occasionally in mesic prairies, for example, Nodding Trillium, Bloodroot, etc., near Juda, Green County—a nearly unbelievable situation, explained by a hot fire destroying a maple forest canopy in late fall, with the surviving herbaceous layer soon invaded by the sun-loving prairie plants.

Lowland savannas were situated at the interface of lowland forests with wet prairies or sedge meadows. The ground layers of the few remnants at Avoca Prairie and Savanna and Chiwaukee Prairie studied by Hujik (1995) were more complex than those of lowland prairies. Spatial patterning of groundlayer vegetation varied simultaneously along light and microtopographical gradients, with prairie species, e.g., Meadowsweet (*Spiraea alba*), White Wild Indigo, Common Yarrow (*Achillea millefolium*), and Common Mountain Mint (*Pycnanthemum virginianum*) being most abundant in the mostly open areas; supposed savanna specialists such as Sensitive Fern (*Onoclea sensibilis*), Meadow Anemone, and Wood Nettle (*Laportea canadensis*) in partial shade; and species characteristic of both savannas and forests such as Common Carrion-flower (*Smilax herbacea*), River-bank Grape (*Vitis riparia*), Wild Yam (*Dioscorea villosa*), and Wild Goldenglow (*Rudbeckia laciniata*) in the mostly shady areas.

• Sand Savannas

In sandy areas, the Bur oaks and White oaks of the heavy-soil savannas or oak openings are replaced by Black Oak or Northern Pin (Hill's) Oak (oak barrens) or Jack Pine (pine barrens), species that, even if burned again and again, keep coming up from underground "grubs" in the case of the oaks (Curtis 1959), or seeds in the case of Jack Pine.

These canopy dominants may occur in nearly pure stands of a single species, or in mixtures of two or all three. Systems for classifying vegetation call these communities by different names. *Oak barrens* and *pine barrens* have long been used in Wisconsin, whereas *sand savanna* is widely used in Indiana, Illinois, and Michigan. The use of terms like brush prairie, scrub oak savanna, oak barrens, oak grove, and woodland imply that sand savannas form a continuum from prairie to forest, and that savanna consisting of solitary scattered trees was not the most characteristic type (Heikens & Robertson 1994, Leach & Ross 1995, Will-Wolf & Stearns 1998). In presettlement times, the extent to which sand savannas developed in place of sand prairies depended upon topography, soil moisture, and the presence of Native Americans, and the extent to which these limited or encouraged the severity or frequency of fires.

Origin of the Prairie and Savanna Flora

Ecological plant geography, or ecology, describes the distribution of plant communities and their interactions with the environment. Historical plant geography attempts to reconstruct the history of a flora and of its species, where its elements came from, and how it was assembled, by using fossil evidence as well as characteristics of the species themselves, their ecology, morphology, physiology, genetics, and cytology.

In regions of high endemism such as California or Texas—never glaciated nor covered by ocean for tens of millions of years—this is a daunting task indeed. However, for oceanic islands like Hawaii, rising *de novo* out of the sea, or land-locked areas such as Wisconsin that until geologically recent times were largely covered by mile-thick, slowly moving ice, floristic analysis is relatively easy. Thus, reconstructing the postglacial migrational history of Wisconsin's flora, in broad strokes to be sure, is a subject that has long occupied our interest.

Glacial Setting

Glacial maps of North America all show that—except for the Driftless Area—the northern portions of the Prairie Province, including the whole of the Great Lakes region, were glaciated during the Pleistocene epoch. Earth's climate had become locally cold enough that more snow fell than melted, and huge masses of ice gradually accumulated. Complexes of massive ice sheets spread southward

many times from northern centers in North America, Greenland, and Europe, then largely melted, only to reform in response to climatic oscillations. For many tens of thousands of years the climate fluctuated markedly, so that there were alternating periods of general advance and withdrawal by the ice. Full-glacial conditions last peaked about 20,000 yr B.P., when continental ice sheets surged southward from Cordilleran and Hudson Bay centers, at which time the eastern, or Laurentide, Ice Sheet reached the Ohio River, Mississippi River Valley to central Illinois, and northern Great Plains (Figure 17). The maximum extent of ice advance during the last, or Wisconsin, glacial interval from 15,000 to 12,000 yr B.P. is shown in Figure 18.

All plant and animal life was ostensibly eliminated from ice-covered territory. Thus, the present flora of the region is quite recent, derived from, and still developing as the result of, dispersal and migration into newly exposed glaciated land during and following the northward retraction of the Wisconsin ice sheet. To understand the present-day distribution of individual species and whole floras, biogeographers must take into account where these organisms might have been living in past times. Species or plant associations do not migrate readily except into open habitats, and the last glaciation occurred very recently—about 13,000 years ago in southern Wisconsin and about 10,000 years ago in the north (Mickelson et al. 1983).

• *Survivia*

There are next to no endemics in Wisconsin, only Cliff Goldenrod (*Solidago sciaphila*), Cliff Cudweed (*Gnaphalium saxicola*), and a unique hybrid or two. Nor, except for Glade Mallow (*Napaea dioica*) and Saw-leaf Mugwort (*Artemisia serrata*), are there any to speak of in the Middle West—some barely differentiated microspecies mostly of questionable validity (see Johnson & Iltis 1964, Mickelson & Iltis 1967). With these minor exceptions, all our prairie species, as well as all others in Wisconsin's flora, have at least some populations growing south of the last (Wisconsin) maximum glacial advance. We can thus assign our plants to one or another of the various, rather arbitrarily delimited *survivia* (or refugia, as these have been called) from whence we hypothesize they migrated east, north, and west, as the case may be, after the glaciers finally melted. For wide-ranging species with relatively broad tolerances such as Tall Anemone (*Anemone virginiana*), the *survivia* may well have extended across most of the southern states; conversely, for species such as Sand Cyperus (*Cyperus*



Figure 17. Maximum extent of all glacial advances in the Pleistocene epoch. The Laurentide Ice Sheet, spreading from two centers in the vicinity of Hudson Bay, left the Driftless Area in southwestern Wisconsin and northern Illinois. The illustration is a historical composite; in reality, the Driftless Area was never completely surrounded by ice at any one time. From Farb (1963).



Figure 18. Maximum extent of glaciation in the most recent or Late Wisconsin stage (Pleistocene epoch). Modified after Farb (1963).

lupulinus ssp. *macilentus*—see below) that survived in the relatively narrow mountain chains of the southern Appalachian region with limited southern habitats, survival can be much more sharply delimited.

Because populations, now often only relictual, of almost all species did survive somewhere south of the ice, we may assume that the vegetation and climate in eastern North America, a region with pronounced topography, high moisture, and equable climate, was not too different from now. Conversely, cooling effects were more pronounced in the central United States, where the climate was much more continental. Along the Mississippi River, with its raging torrents of ice-cold melt water, and in the Midwest as a whole, climate must have been much cooler and wetter than now, and the periglacial effects, including the width of the permafrost zone, more extensive (Péwé 1983). Nonetheless, in many areas in the East, direct climatic effects of the glaciers were strongly marked for only ca. 50–125 miles to the south of the ice margin (Péwé 1983) and had little effect on the “mixed mesophytic forest” (Braun 1950, 1955). The high endemism from Maryland, Kentucky, and southern Missouri southward—sharply delimited by the margin of the Wisconsin ice advance, both of animals such as fish, salamanders, snails, and crawfish, and of many species of plants—speaks volumes about the relative mildness of the glacial climate in those areas (Braun 1950, 1955).

Such evidence suggests that the concept of survival, which often can still be identified, and of the outward migration postglacially of their floristic elements in equiformal progressive areas (see Cain 1944, Hultén 1937), especially in the case of many Appalachian elements, is a reasonable hypothesis. (It has not escaped our attention that this is a still controversial issue, for there are those who are compelled to apply the frigid European Pleistocene model to the quite different, milder situation in North America. Reports of glaciers in North Carolina, Jack Pine in Georgia, or musk ox in Texas are all based on mistakes or taxonomic misidentifications.)

• Migrations

The landscape that was left behind after deglaciation was one vast, sparsely vegetated, gravelly, sandy, or muddy seed bed—an ecologically open habitat just waiting to be invaded by a rain of seeds and propagules. From the four corners of the compass, from these floristic survivals, came our flora: the periglacial belt of tundra and conifers, the northern Great Plains and the arid southwest, the Ozarks

and the Cumberlands, the hot Mississippi Embayment and the Gulf and Atlantic dunes and coastal plains, the cool and moist Appalachian deciduous forest, and even arctic and subarctic Alaska.

Revegetation of soilless, sterile glaciated areas took time. The migration of propagules and ensuing invasion of rich flora had to necessarily follow the development of soil, mycorrhizae incursion, and shade for mesophytes. These building stages were followed by an incongruous, helter-skelter floristic mixture of periglacial conifers and tundra plants, deciduous trees and shrubs, and heliophytic prairie plants. These soon sorted themselves out under the dictates of competition and succession into plant communities reflecting the regional climate. Eventually, in the climatic wedge of the Prairie Peninsula, those species that liked a prairie climate flourished—no matter what their region of origin. Many other species became extinct, while a vast number survived elsewhere, for example in the forests to the north or in specialized habitats in the Driftless Area. It is thus not surprising that our prairie flora is now composed of a large number of broadly adapted, widespread species that had their roots in diverse habitats.

The story is, of course, much more complex. There must have been tallgrass prairie communities in favorable places south of the Prairie Peninsula during the Wisconsin Ice Age, and in the Prairie Peninsula periodically during the past million years. Natural selection for plants favoring a tallgrass climate in the same general geographic region as today must have occurred at least three separate times during the substages of the Wisconsin glaciation (and probably more frequently, in view of the evidence today of eight or so substages during the Late Wisconsin, and at least 20 glacial-interglacial cycles during the late Quaternary). During this epoch of more than a million years, the speciation that resulted in some 300 or more regional prairie endemics must have occurred, a winnowing and sifting of floristic candidates preadapted to such a climate, all contributed (then as now) by surrounding ecosystems to the ecological melting pot.

An interesting aspect of the hypothesis of glacial survival, one that indirectly supports the whole concept, is the evolutionary divergence of many phylads into species pairs, one eastern and mesophytic, one more western and either xerophytic or cordilleran (montane/subalpine meadow examples include *Dodecatheon*, *Polemonium*, and *Camassia*). The two ranges, once separated by huge distances plus climate, glaciers, dry grasslands, and other factors for tens

of millenia, reexpanded west and east, as the case may be, and in some cases overlapped in the deglaciated regions. Where sympatric in similar habitats, the species hybridized.

This east-west pairing includes forest species as well as prairie species, and is of great evolutionary interest. Among the most striking examples are our two species of fringed gentian, in the segregate genus *Gentianopsis*: the mesophytic, acidophilic, Appalachian *G. crinita*, and the relatively xerophytic, calciphilic *G. procera* of the High Plains. Although separated by different ecologies and flowering periods (*G. procera* blooms earlier, as befits a species coming from a shorter growing season), the two do hybridize in the calcareous fen-like Chiwaukee Prairie and in northern Indiana (Iltis 1965, Mason & Iltis, 1966). A similar, but even more remarkable case involves the highly distinct, sand-loving species of *Cyperus* sect. *Laxiglu-mi*, the western Schweinitz's *Cyperus* (*C. schweinitzii*), native to the Great Plains sand prairies and the Nebraska Sand Hills and beyond, with openly branched inflorescences, and the more specialized, tight-headed Sand *Cyperus* (*C. lupulinus* ssp. *macilentus*) of rocky or sandy, sunny "islands" within the Appalachian forests (Marcks & Iltis 1967, Marcks 1974). When they eventually flowed together in the Upper Middle West early on after the final glacial retreat ($\pm 6,000$ yr B.P.), they hybridized to produce a widespread introgressed population (basically *C. schweinitzii* introgressed with *C. lupulinus* ssp. *macilentus*), one that because of its morphological stability has earned recognition as a full-fledged species, Houghton's Flat Sedge, *C. houghtonii*. But within the last 150 years, with the drastic increase in disturbance due to agriculture, lumbering, and other human activities, the extensive sympatric populations of the parental species have undergone a second cycle of hybridization, producing especially on the sand terraces along the lower Wisconsin River Valley extensive hybrid swarms of enormous variability, a variability that confounds the taxonomic amateur and delights the evolutionary-oriented systematist.

Many other such east-west pairs could be mentioned (e.g., the white and red baneberries, *Actaea* spp.), all of which overlap their ranges and hybridize only in once-glaciated regions, but the two cited cases of prairie plants exemplify the dynamic interaction of biogeography, ecology, systematics, and history that make even our rather depauperate flora a fascinating subject for study.

It should be emphasized that assignment to this or that glacial survival region is not always clear or easy, certainly

not in the many widespread forest species of the southern states that may occur from North Carolina clear to Arkansas and the prairie border. But even in these cases, new molecular techniques, cytotoxic insights (polyploidy), and center(s) of a species' variability can usually identify the general area of survival (i.e., origin). Norman Fassett (1944a; see Iltis & Shaughnessy 1960), Wisconsin's great taxonomist, made an intensive study of Eastern Shooting-star, *Dodecatheon meadia*, and was able to show that its center was in the Ozarks and west-central southern states. There, the plants within any population were much alike, either all white or all pink or purple, this due presumably to inbreeding, whereas in Wisconsin such as along the railroad west of Madison or on the Chiwaukee Prairie, they were a riotous mixture of all shades of purple to white, suggesting a post-glacial mass immigration and intermingling of the various southern types.

A splendid example of tracing migration from the southern Appalachians involves the Rock Spike-moss (*Selaginella rupestris*), a species sufficiently widespread—from the eastern mountains north to Wisconsin and also in the Ozarks—that its area of survival was an open question. Tryon (1955) was able to show that the Appalachian plants regularly produced spores by sexual means, the original and therefore primitive condition. On the other hand, plants in populations to the north, then west to Wisconsin and again south to the Ozarks, were increasingly apomictic (i.e., producing spores asexually without benefit of fertilization), a highly specialized condition. Ozarkian plants were 100% apomictic, establishing the direction of migration. Other cytotoxic examples show similar patterns, with the primitive diploids restricted to the southern states and the polyploids widespread in the glaciated northern areas.

Affinities of the Flora

The contemporary flora of Wisconsin's Prairie-Southern Forest Province may be young, but it is diverse. This territory includes both the unglaciated Driftless Area, with its great variety of habitats including cool moist gorges, dry sunny hilltops, and exposed bedrock, and glaciated topography, with its monotonous cover of undulating drift left by the melting ice sheets. All this constituted available surfaces for immediate or eventual occupation by plant life. A full range of floristic elements expanded into Wisconsin's developing landscape, albeit within limits exerted by local environmental conditions. At the present time, the southern region of

Wisconsin has favorable environmental conditions for both prairies and eastern forests, because it contains practically the full complement of our Prairie and Alleghenian elements.

Existing stands of a particular community type probably do not exactly or even closely resemble those that once existed either here or elsewhere in North America prior to the Pleistocene. Each community in general, and any given stand in particular, is the result of diverse historical happenings and environmental factors that were in operation while species naturally organized themselves into different assemblages or communities. "The expansion of prairies in Wisconsin was not a single, unified movement of a homogeneous plant formation" (Curtis 1959, p. 290). Instead, species of each floristic element, whether Alleghenian and entering directly from the east, Coastal Plain from the east and south, Ozarkian and Prairie from the south and west, or Arctic and Cordilleran elements from the west and north, migrated or dispersed by various routes and at different times, in different ways, to different habitats. New England Aster (*Aster novae-angliae*), Canadian Tick-trefoil, Early Buttercup (*Ranunculus fascicularis*), and Eastern Figwort (*Scrophularia marilandica*), deciduous forest elements that spread westward to the grasslands, must have entered Wisconsin from the east; species of the interior like Heath Aster, Illinois Tick-trefoil, and Prairie Buttercup (*R. rhomboideus*) could have dispersed from the south; and western elements like American Figwort (*S. lanceolata*), directly from the west. The southwestern or Mexican element Plains Prickly-pear (*Opuntia macrorhiza*), adapted to the hot, dry climate of the arid Southwest, occurs today on open sandy bluffs in southwestern Wisconsin alongside Paper Birch (*Betula papyrifera*), a species characteristic of the Boreal Forest Region and adapted to long cold winters and cool moist summers. However, many bluffs in the area have only one species or the other, or neither, illustrating that while the flora of a particular place consists of species of diverse origins and histories, each differs from that of other places because of the way species react to local microclimates.

Basic Patterns of Distribution

The Wisconsin flora is made up of numerous temperate American species and smaller numbers of Eurasian, Mexican, and South American immigrants. Most of these species were members either of the world-wide Arcto-Tertiary and Boreo-tropical geofloras or the southwestern Madro-Ter-

tiary geoflora. There are rare cases of plants that seem clearly to have originated on other continents. Besides these elements, there are disjunct populations and endemic taxa of more limited occurrence, the distributions of which are difficult or seemingly impossible to interpret.

In general, the majority of prairie and savanna species are wide-ranging plants of north-temperate to subarctic regions, including not only those endemic to North America, but also circumboreal and Arctic-alpine species. A large number have an essentially transcontinental or least a very wide range, e.g., Nodding Wild Onion, Meadow Anemone, Smooth Aster (*Aster laevis*), Canada Wild-rye, Tall Sunflower (*Helianthus giganteus*), False Dandelion (*Krigia biflora*), Wild Lettuce (*Lactuca canadensis*), Fringed Loosestrife (*Lysimachia ciliata*), Purple Meadow-rue, Blue Vervain (*Verbena hastata*), etc. Other taxa are restricted to the eastern half of the continent, but often with sister species in the West, e.g., Marsh Fern (*Thelypteris palustris* var. *pubescens*), Wild Columbine, Calico Aster (*Aster lateriflorus*), Pasture Thistle, Bottle Gentian, Wood-betony (*Pedicularis canadensis*), Prairie Phlox, Culver's-root, (*Veronicastrum virginicum*), or the western half, e.g., White Sage (*Artemisia ludoviciana*), Wild Licorice (*Glycyrrhiza lepidota*), and American Figwort. Other temperate endemics are interior Midwest species with diverse relationships like Wild-hyacinth, *Camassia scilloides* (to the Pacific Northwest); White Prairie-clover, *Dalea candida* (to Mexico); Mullein-foxtail, *Dasistoma macrophylla* (to the eastern United States); Carolina Larkspur, *Delphinium carolinianum* (to the southwestern mountains); and Common Ironweed, *Vernonia fasciculata* (to tropical America). Finally, there is a rather heterogeneous group comprising disjunct populations and regional endemics. These taxa generally are confined to the Driftless Area or the Great Lakes.

Outline of Floristic Elements

Each floristic element is comprised of species that share the same pattern of geographical distribution and by implication a common historical background. Of the several major elements, the Alleghenian, Ozarkian, and Prairie and Great Plains are the ones contributing the greatest number of species to the prairies and savannas of Wisconsin (see Figures 19–22). Two other elements well represented in the state, the Boreal Forest and Coastal Plain, are less significant contributors. Members of the former group occur primarily in the Mixed Conifer-Northern Hardwoods Province but are

nonetheless represented in prairies (e.g., Slender Wheat Grass [*Elymus trachycaulus*]) and savannas (e.g., Starry False Solomon's-seal [*Smilacina stellata*]), whereas on the whole, those of the Coastal Plain, although substantial in number, are often of local occurrence or are associated with sandy shores, swales, and fens. However, several species of this element occur in grassland habitats, usually in oak and sand barrens: Dune Three-awn Grass (*Aristida tuberculosa*), Hoary Frostweed (*Helianthemum bicknellii*), Common Rock-rose (*H. canadense*), Greene's Rush (*Juncus greenei*), Wild Lupine (*Lupinus perennis*), Joint-weed, Steeplebush (*Spiraea tomentosa*), and Grass-leaved Goldenrod (*Euthamia graminifolia*). Comparatively few species of Mexican or South American affinity and of Cordilleran (western mountain) or Arctic-alpine relationships have reached Wisconsin.

The Alleghenian-Ozarkian Element (that group of species centering on the southern Appalachians, ranging from Alabama to southeastern Quebec, and often throughout the Eastern Deciduous Forest Region all the way to the Ozarks) is composed of a large group of temperate forest species, many common and widely distributed. American groups with this relationship are represented in prairies by Bush-clover (*Lespedeza capitata*) (most *Lespedeza* species are southeastern, but some occur in Asia and Australia), Lance-leaved Loosestrife (*Lysimachia lanceolata*; Figure 19A) (*Lysimachia* section *Steironema* is a small group endemic to the Southeast), Clasping Milkweed (*Asclepias amplexicaulis*; Figure 19B) (many *Asclepias* species are southeastern, many also southwestern and Mexican, a few South American and African), and New England Aster (*Aster* section *Aster*, like the genus *Solidago*, the goldenrods, is a very large, actively evolving, taxonomically difficult group with its center of diversity in the East). This element is well represented in Wisconsin's woods, savannas, and barrens: Hog-peanut, Prairie Red-root (*Ceanothus herbaceus*), Upland Boneset (*Eupatorium sessilifolium*), Hairy Puccoon (*Lithospermum carolinense*), Wood-betony, Hairy Beard-tongue (*Penstemon hirsutus*), Lopseed (*Phyrra leptostachya*), Red-stalked Plantain (*Plantago rugelii*), Black Cherry, and Yellow Pimpernel (*Taenidia integerrima*). Many savanna species have as their immediate region of origin the lower Midwest and Southeast. Forest-border species having this basic pattern include Purple Milkweed (Figure 20A), Pale Indian-plantain, Bottlebrush Grass, Cream Gentian (Figure 20B), Veiny Pea, Violet Bush-clover (*Lespedeza violacea*; Figure 20C), Broad-leaved Panic Grass (*Panicum latifolium*), Starry Campion (*Silene stella* -

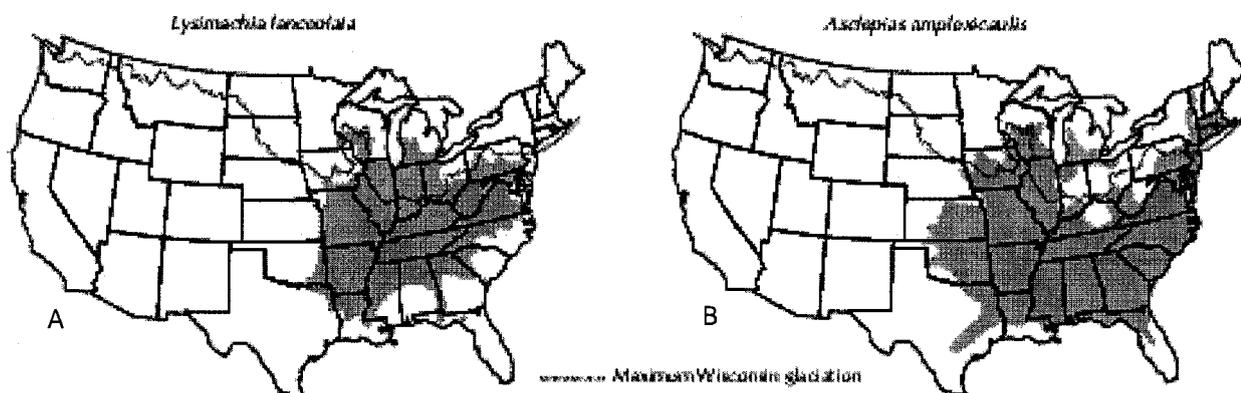


Figure 19. Distribution of Alleghenian-Ozarkian elements of the Wisconsin grasslands. A. *Lysimachia lanceolata*, Lance-leaved Loosestrife. Redrawn in part after Ray (1944). B. *Asclepias amplexicaulis*, Claspng Milkweed. Modified after Woodson (1954).

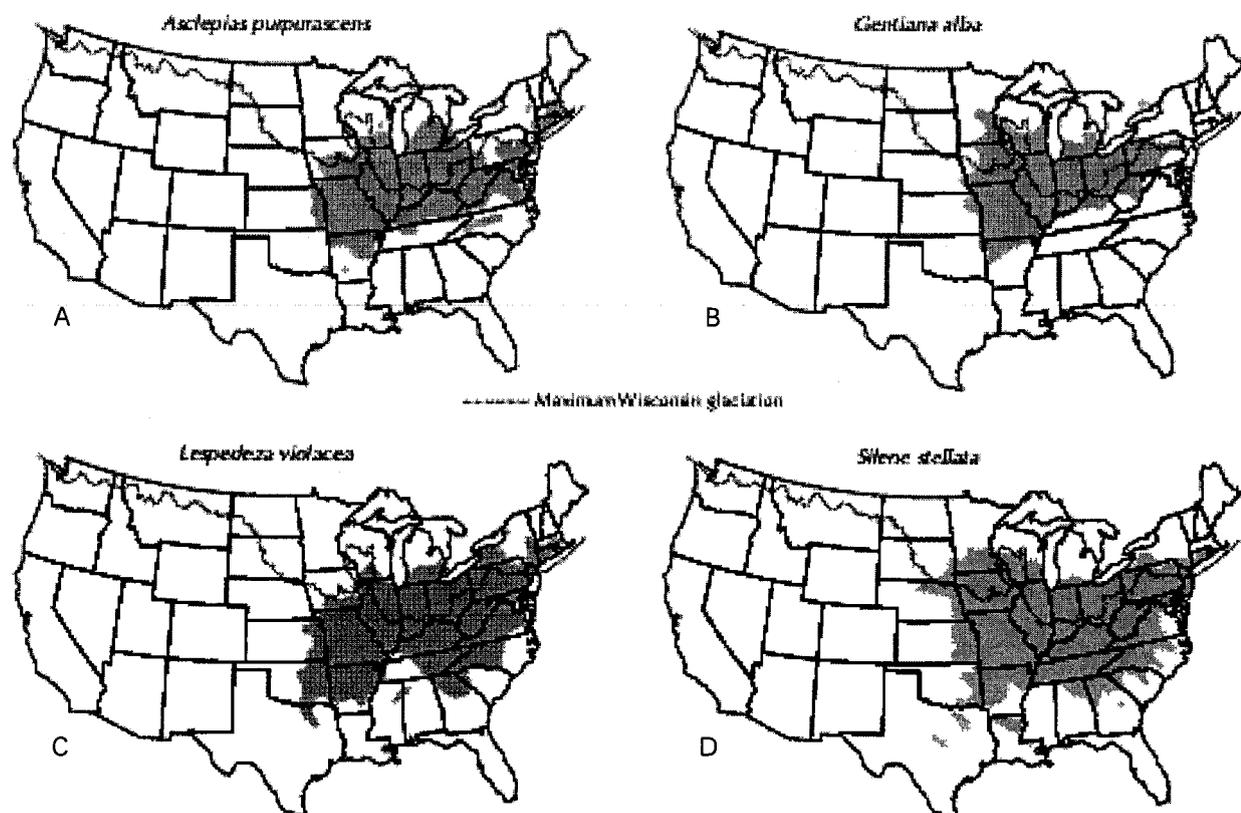


Figure 20. Distribution of Alleghenian (and/or Ozarkian) elements of Wisconsin savannas and prairies. A. *Asclepias purpurascens*, Purple Milkweed. Redrawn after class term paper by S. Kroken (1989). B. *Gentiana alba*, Cream Gentian. Modified slightly after Pringle (1967). C. *Lespedeza violacea*, Violet Bush-clover. Modified slightly after Clewell (1966). D. *Silene stellata*, Starry Campion. Compiled from various sources, including Hitchcock and Maguire (1947).

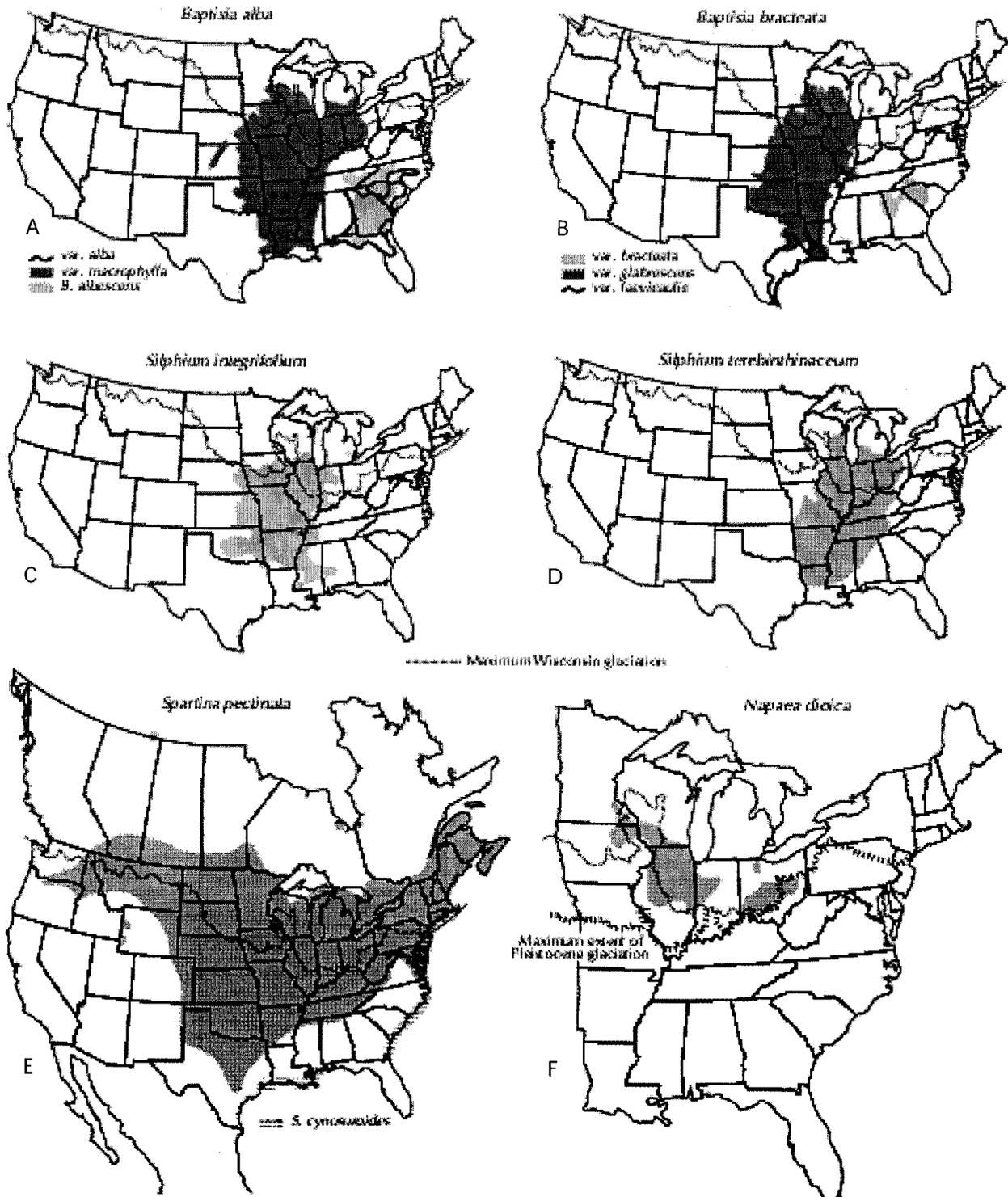


Figure 21. Distribution of Prairie elements of the Wisconsin grasslands. **A.** The two varieties of *Baptisia alba*, Milky Wild Indigo, and a related species. Compiled from various sources. **B.** The three varieties of *Baptisia bracteata*, Cream Wild Indigo. Compiled from various sources. **C.** *Silphium integrifolium*, Prairie Rosinweed. Modified after Settle and Fisher (1970). **D.** *Silphium terebinthinaceum*, Prairie-dock (generalized). Most species of *Silphium* are southeastern. **E.** *Spartina pectinata*, Prairie Cordgrass, probably derived from *S. cynosuroides*. Redrawn after Moberley (1956). **F.** *Napaea dioica*, Glade Mallow, a monotypic genus and our only Midwestern endemic genus. Redrawn after Iltis (1963).

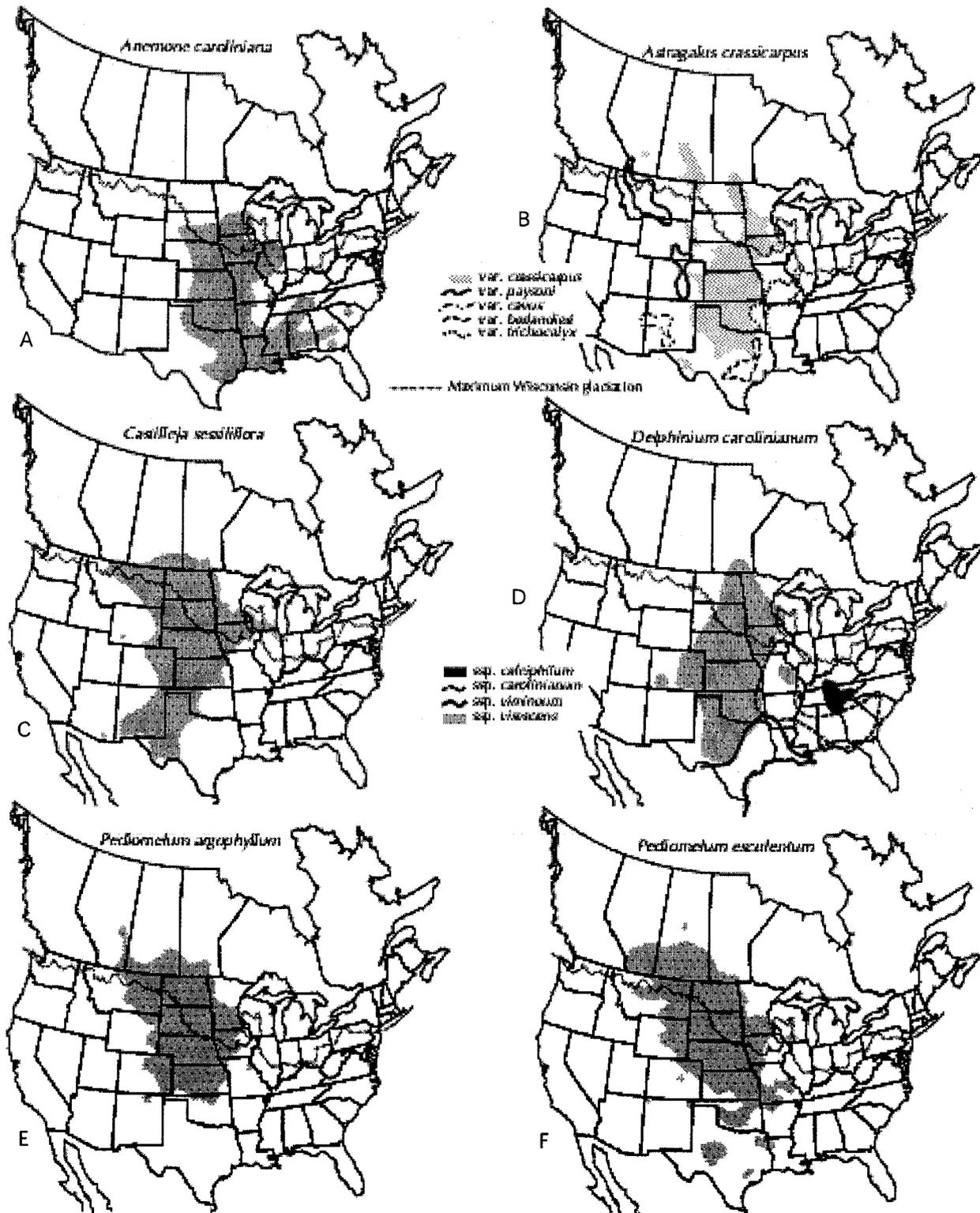


Figure 22. Distribution of Prairie-Great Plains elements reaching their eastern range limit in Wisconsin. A. *Anemone caroliniana*, Carolina Anemone. Redrawn after Dutton et al. (1997). B. The five varieties of *Astragalus crassicaepus*, Ground-plum. Redrawn after Barney (1964). C. *Castilleja sessiliflora*, Downy Painted-cup. Modified after Pennell (1935). Its closest relatives (four species) are in the western United States and Mexico. D. The four subspecies of *Delphinium carolinianum*, Plains Larkspur. Redrawn after Warnock (1997). E. *Pedicularis argophyllum*, Silvery Scurf-pea. Modified after Fassett (1939). F. *Pedicularis esculentum*, Breadroot Scurf-pea. Modified after Fassett (1939).

ta; Figure 20D), and Late Horse-gentian (*Triosteum perfoliatum*), most of which are listed by Packard (1988b, 1993) in his summaries of restoration work on savannas in Illinois.

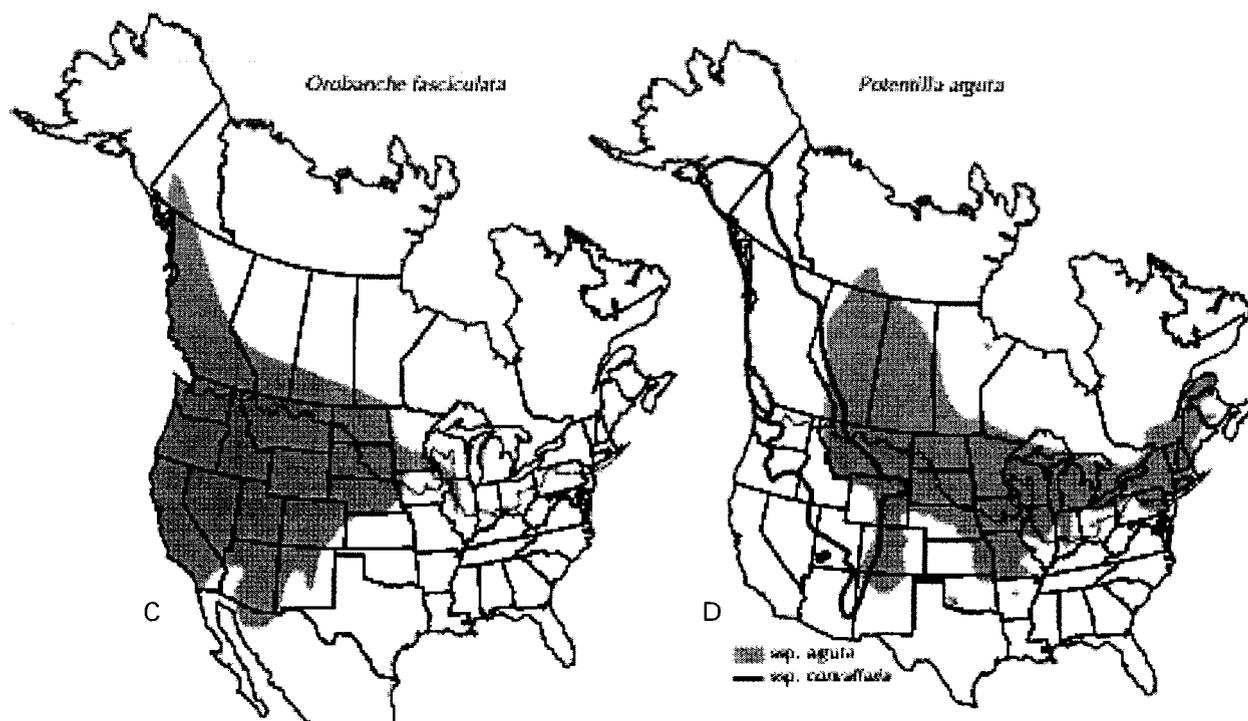
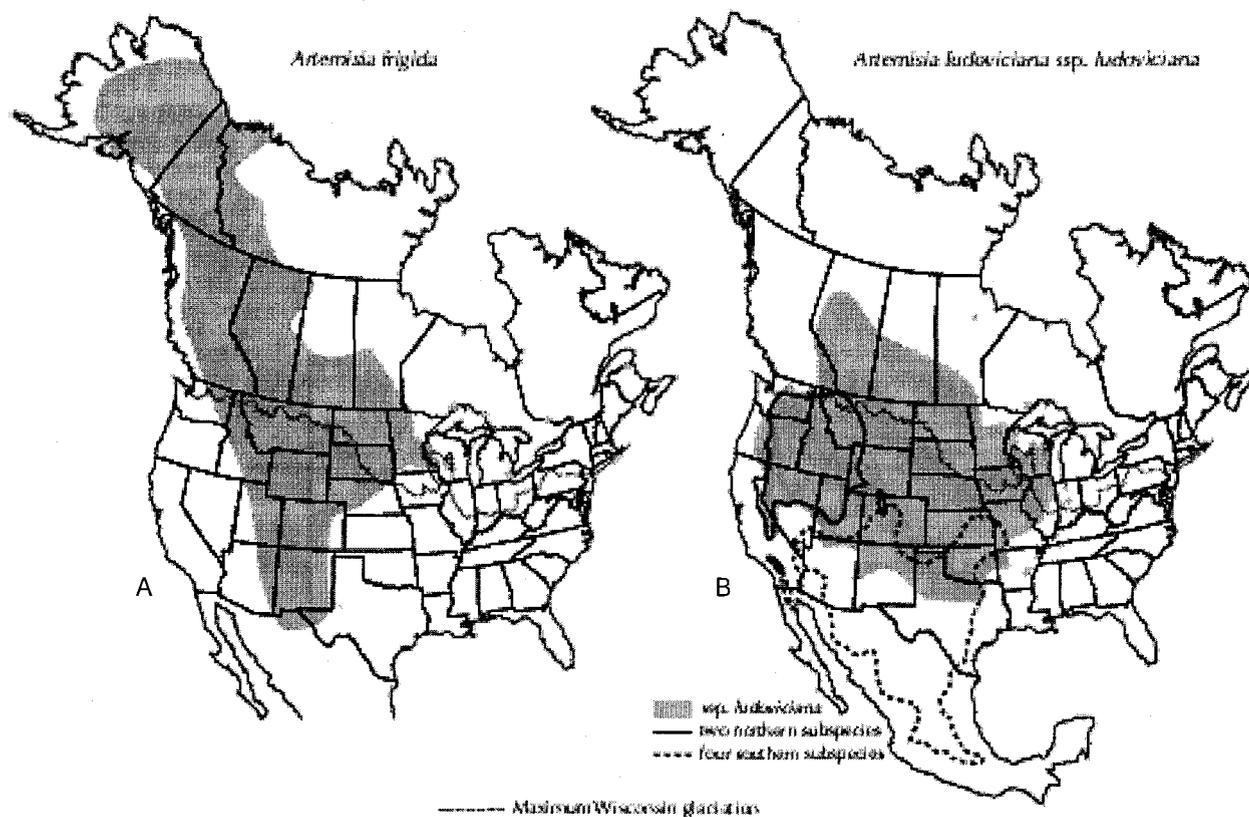
The prairie flora, that group of species having an overall range that covers part or all of the existing prairies, may be classified among several elements. One element involves plants of the true prairie, which generally range from the southern Great Plains northward toward or into the Prairie Provinces of Canada and eastward into the Prairie Peninsula. A large percentage of species belonging to the Prairie element are derived from the southeastern deciduous forest region and have geographical distributions that center on the Ozark Mountains, from which they radiate in all directions—east to the deciduous forest, west to the plains, and north into the Prairie Peninsula. Plants of the true prairie in Wisconsin include two *Baptisia* (Figures 21A & B) and four *Silphium* species (the geographical distributions of Rosinweed, *S. integrifolium*, and Prairie-dock are shown in Figures 21C & D, respectively), Prairie Indian-plantain (*Cacalia* [*Arnoglossum*] *plantaginea*), Purple Prairie-clover, Missouri Goldenrod (*Solidago missouriensis*), Stiff Goldenrod (*S. rigida*), Prairie Cordgrass (Figure 21E), and Porcupine Grass (*Stipa spartea*), as well as Glade Mallow (Figure 21F).

A second natural subdivision of the prairie flora in Wisconsin includes the Great Plains elements that reach their eastern limits in Wisconsin. Presumably, climatic conditions explain why some species of Great Plains affinity have only barely reached Wisconsin, because many others extend southward and eastward into the Prairie Peninsula or beyond. Most of these genera are Arcto-Tertiary in origin. *Anemone*, *Astragalus*, and *Stipa* are large genera of northern grasslands; *Besseyia*, *Castilleja*, and *Penstemon* are endemic, mainly Cordilleran genera with Eurasian relatives; only *Pediomelum* has Southern Hemisphere relationships. The total ranges of Carolina Anemone (*Anemone caroliniana*), Ground-plum, Downy Yellow Painted-cup (*C. sessiliflora*), Carolina Larkspur, Silvery Scurf-pea, and Prairie-turnip (*Pediomelum esculentum*), are shown in Figure 22. The following species all have the same basic distribution pattern: Autumn Onion (*Allium stellatum*), Short Green Milkweed, Prairie Sand-reed, Alum-root, Northern Plains Blazing-star (*Liatris ligulistylis*), Dotted Blazing-star, Prairie Dandelion (*Microseris cuspidata*), Slender Beard-tongue (*Penstemon gracilis*), Early Buttercup, and Prairie Dropseed. Kitten's-tail, *Besseyia bullii*, is much more restricted, being limited to seven Midwestern states.

In the third element belong those plants occurring throughout a much larger region of the West and, in the northern Great Plains, reaching their eastern and southern limits in America. These Arcto-Tertiary elements often have their generic relationships to arid, cool-temperate Eurasia and often have centers of diversity in the West. They include Prairie Sagewort (Figure 23A), Louisiana Sagewort (Figure 23B), Fleabane (*Erigeron glabellus*), June Grass, Clustered Broom-rape (*Orobanche fasciculata*, Figure 23C), Tall Cinquefoil (*Potentilla arguta*, Figure 23D), and Pasqueflower (*Pulsatilla* [*Anemone*] *patens*, Figure 23E).

The Western or Cordilleran element constitutes a large group of alpine, plateau, and foothill species that on the whole has a range centering in the western mountains of Canada and the United States, but has a surprisingly large contingent that migrated east once the ice melted. Some of these species are disjunct from the Arctic and are considered part of the Arctic or Arctic-Alpine Element. In Wisconsin, this is a significant group, members of which often reach their eastern limits in the western Great Lakes region. Typical species include Richardson's Sedge (*Carex richardsonii*), Prairie-smoke (*Geum triflorum*), Edible Valerian (*Valeriana edulis*), and White Camass (*Zigadenus elegans*), and such shrubs as Red Osier Dogwood (*Cornus stolonifera*) and Wolfberry (*Symphoricarpos occidentalis*).

The Arctic Element, sometimes called the Arctic-alpine Element, comprises a rather small group in the flora of Wisconsin; its representatives often have no close affinity to other species or groups in our flora. We even have one tundra species, the exceedingly rare Lapland Azalea (*Rhododendron lapponicum*), but a number of subarctic plants endemic to North America such as Spreading Dogbane (*Apocynum androsaemifolium*), Fringed Brome (*Bromus ciliatus*), Blue-joint, Common Water-hemlock (*Cicuta maculata*), Bog Lobelia (*Lobelia kalmii*), and Golden Ragwort (*Senecio* [*Packera*] *aureus*) are common in our prairies, fens, and sedge meadows. The group is usually defined broadly enough to contain the Arctic-circumpolar species, those occurring in Europe and/or Asia as well as North America: Common Horsetail (*Equisetum arvense*), Cut-leaved Anemone (*Anemone multifida*) (also bipolar; very rare in Wisconsin), Lyrate Rock Cress, Grove Sandwort (*Arenaria lateriflora*), Rock Sandwort (*Arenaria stricta* ssp. *dawsonensis*, a Wisconsin rarity), Harebell, Northern Bedstraw (*Galium boreale*), Sweet Grass (*Hierochloa hirta*), Marsh Pea, and Shrubby Cinquefoil (*Pentaphylloides* [*Potentilla*] *floribunda*).



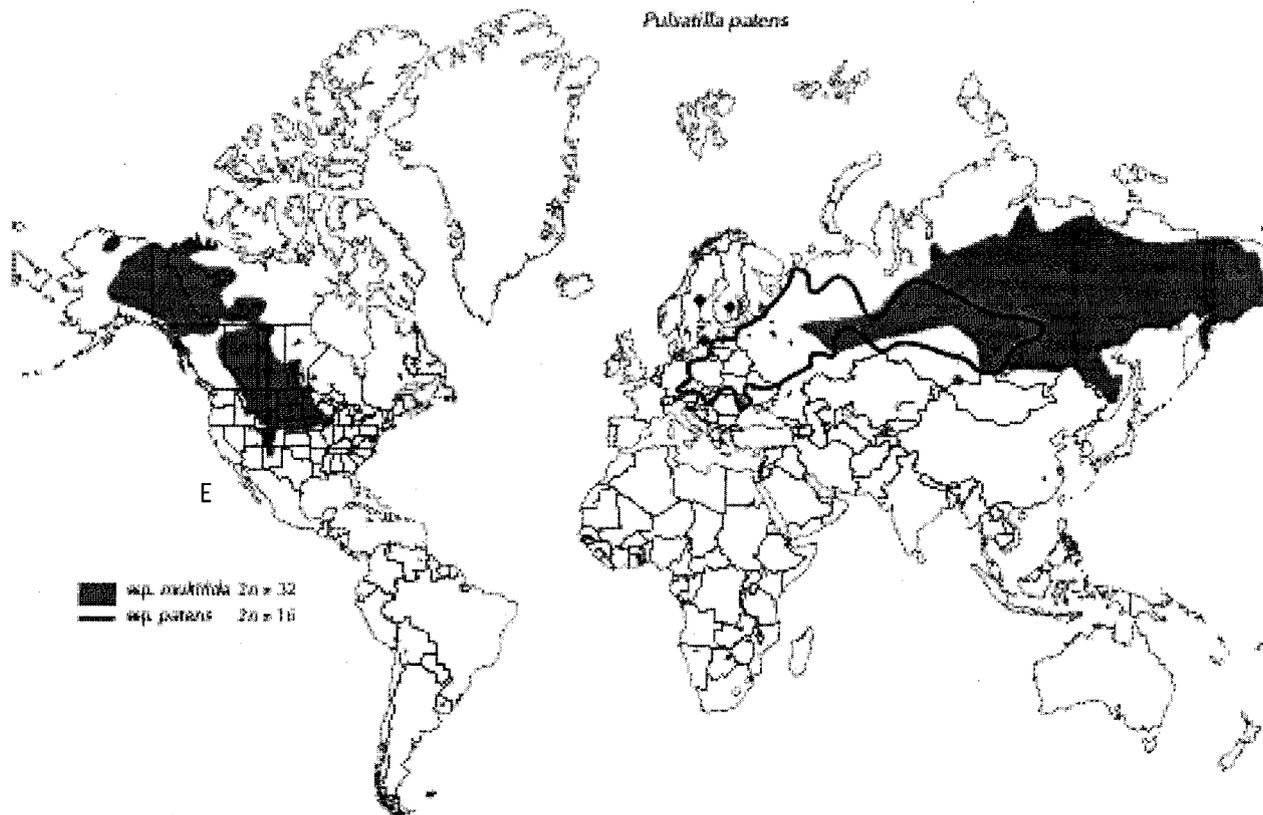


Figure 23. Facing page and above. Distribution of Arcto-Tertiary elements of the Wisconsin grasslands. **A.** *Artemisia frigida*, Prairie Sagewort. Native eastward to the Mississippi River, and occasionally adventive beyond (distribution in part generalized). **B.** *Artemisia ludoviciana* ssp. *ludoviciana*, Louisiana Sagewort, and the combined ranges of two northern and four southern subspecies. Modified after Keck (1946). Native eastward to Illinois and Wisconsin, and naturalized beyond to New England. **C.** *Orobancha fasciculata*, Clustered Broom-rape. United States range redrawn after class term paper by B. C. Reuter (1985). **D.** The two subspecies of *Potentilla arguta*, Tall Cinquefoil. Modified after class term paper by W. Shaeffer, undated. Two related species of *Potentilla* section *Drymocallis* are not shown. **E.** The two subspecies of *Pulsatilla patens*, Pasqueflower. American distribution redrawn after Dutton et al. (1997); Eurasian distribution redrawn after Hultén and Fries (1986).

Many of the heliophytic species with southern and southwestern affinities belong to genera with probable subtropical or even tropical origins. Among them are such well-known grasses as Switch Grass (Figure 24A), Little Bluestem (Figure 24B), and Big Bluestem, together with Lead-plant (*Amorpha canescens*, Figure 24C), evening-primroses, e.g., *Oenothera villosa* and *O. clelandii* (Figure 24D), tick-trefoils, e.g., *Desmodium canescens* and *D. illinoense*, Wild Licorice, and Yellow Star-grass (*Hypoxis hirsuta*), the latter of a large, basically Southern Hemisphere (Gondwanaland) genus. The 15 species of *Amorpha* are mostly eastern North American, but their relationship is to the southwestern Madro-Tertiary flora.

Species of dry or dry-mesic prairies that center in the arid Great Plains are mainly Madro-Tertiary Elements, an autochthonous (locally self-developed) flora that evolved during the last 30 million years out of partly neotropical (Andes, South American deserts) and partly northern groups. The center of origin and diversity of the genera lies in the deserts and semiarid areas of Mexico and adjoining southwestern United States (hence the name, from the Sierra Madre Mountains). There is no direct, recent relationship to the Arcto-Tertiary Flora. Madro-Tertiary groups include many species of *Asclepias* such as *A. verticillata* (Figure 25A), of *Bouteloua* such as *B. curtipendula* (Figure 25B) and *B. gracilis*, of *Dalea* such as *D. candida*, *D. purpurea*

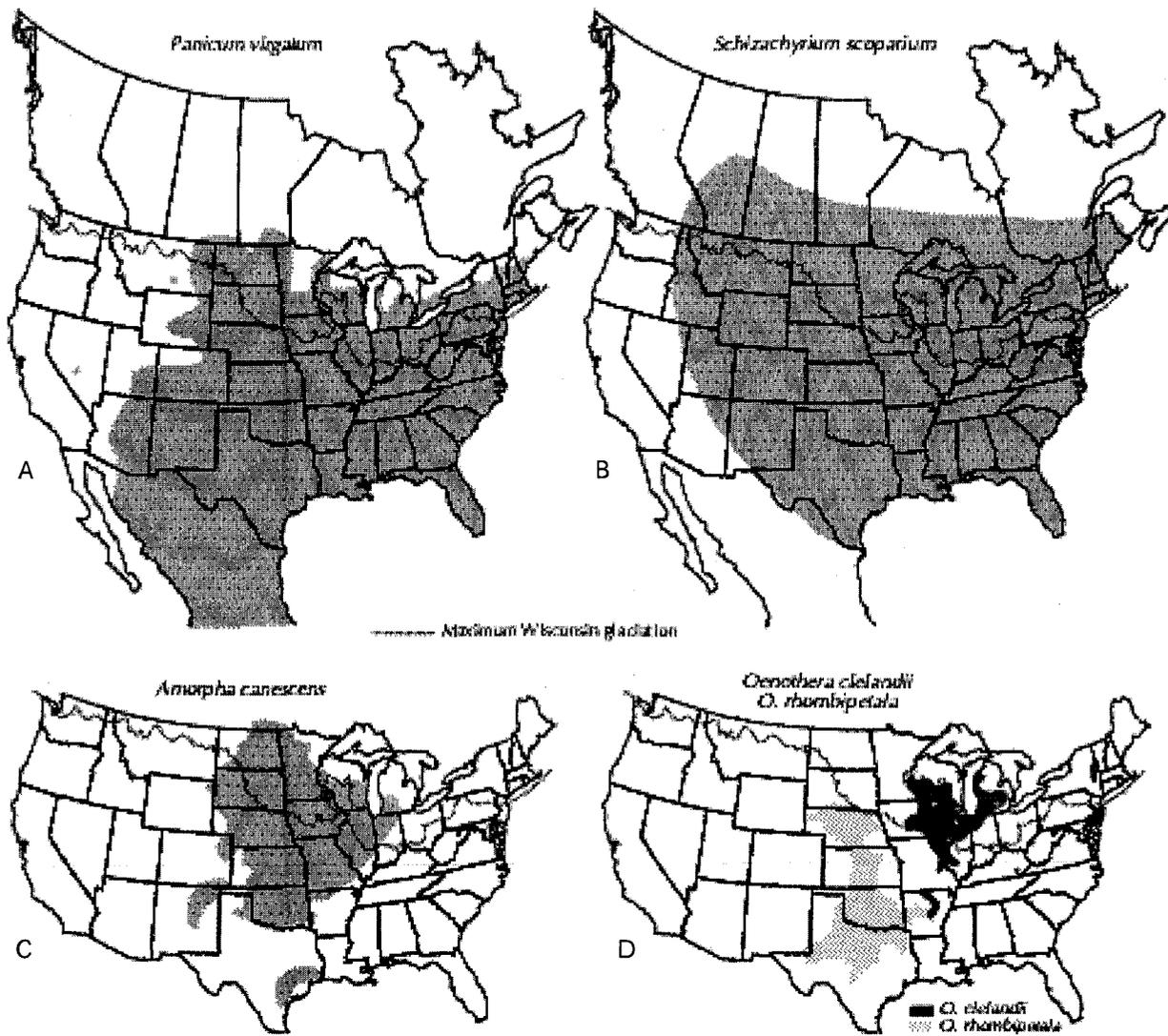


Figure 24. Distribution of Southwestern elements of the Wisconsin grasslands. A. *Panicum virgatum*, Switch Grass (generalized). B. *Schizachyrium scoparium*, Little Bluestem (generalized). C. *Amorpha canescens*, Lead-plant. Redrawn after Wilbur (1975). D. *Oenothera clelandii*, Cleland's Evening-primrose, and the closely related *O. rhombipetala*, Long-spike Evening-primrose, the latter adventive in Wisconsin. Redrawn after Dietrich and Wagner (1988).

(Figure 25C), and *D. villosa*, and as most characteristic, the 1,000 plus members of Cactaceae, with three *Opuntia* species our only representatives. Two, the locally common Plains Prickly-pear and the rare Eastern Prickly-pear (*O. humifusa*), are mapped in Figure 25D. The rare Fragile Prickly-pear (*O. fragilis*), reputedly once distributed on the fur of bison, is widely scattered as minute populations on granite or quartzite outcrops and sandstone ridges.

An additional small element not always recognized by floristic workers, the so-called Great Lakes Element, is most interesting because it contains a heterogeneous mixture of species that are more or less confined to the Great Lakes region, that is, they are endemic. Among them are certain dune and beach taxa; a few plants of fens such as Kalm's St. John's-wort (*Hypericum kalmianum*) (derived from Ozarkian relatives; for maps, see Utech & Iltis 1970) and

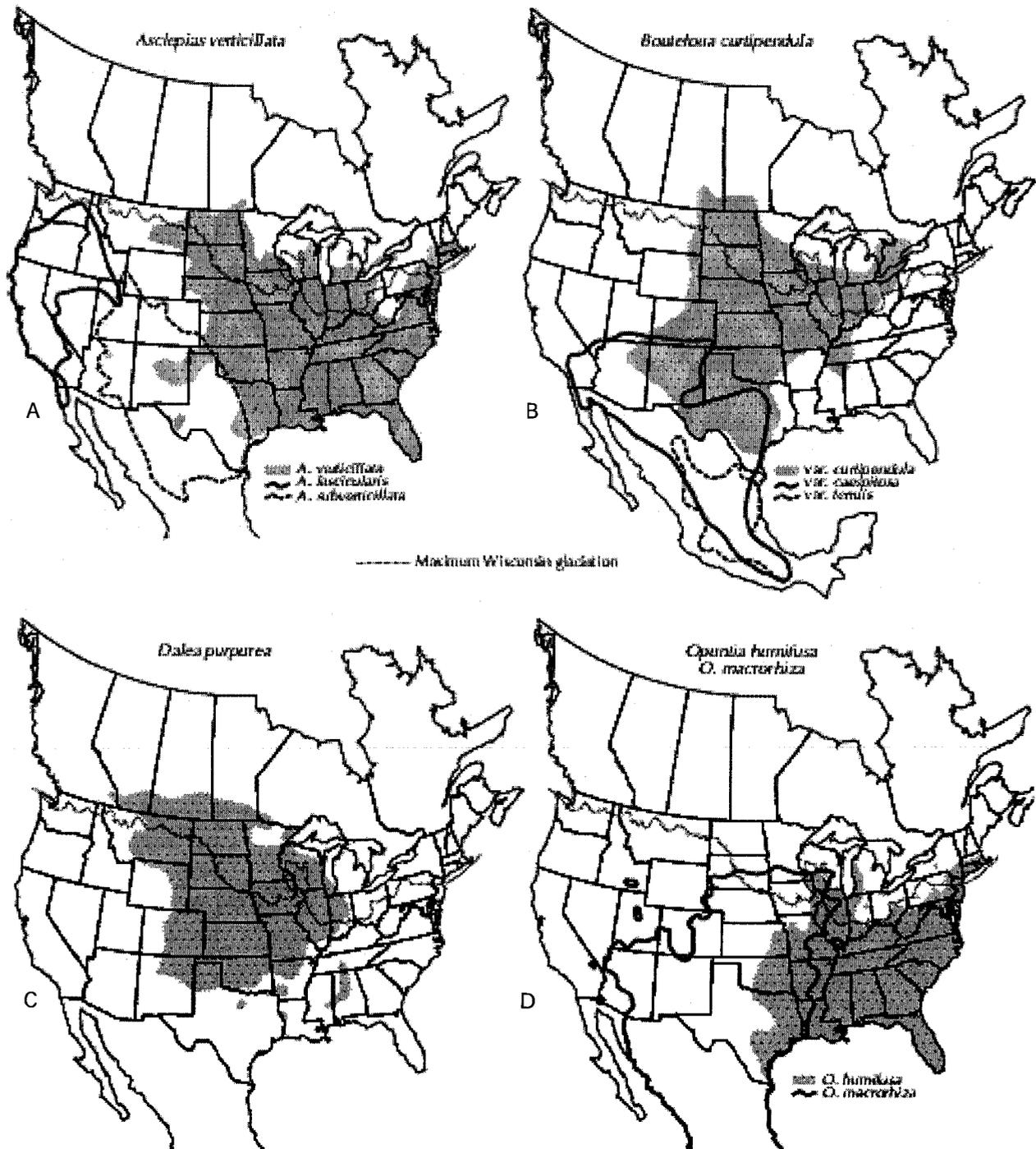


Figure 25. Distribution of Madro-Tertiary Elements of the Wisconsin grasslands. A. *Asclepias verticillata*, Whorled Milkweed, and two related species. Modified slightly after Woodson (1954). B. The three varieties of *Bouteloua curtipendula*, Side-oats Grama. Redrawn after Gould and Kapadia (1964). C. *Dalea purpurea*, Purple Prairie-clover. Redrawn after Fassett (1939). D. *Opuntia humifusa*, Eastern Prickly-pear, and *O. macrorhiza*, Plains Prickly-pear. Both modified slightly after Benson (1982).

Ohio Goldenrod (*Solidago ohioensis*) (related to southeastern taxa; for a map of its total range, see Pringle 1982); and several forbs of deep-soil prairies, e.g., Saw-leaf Mugwort, Kitten's-tail, Hill's Thistle (*Cirsium hillii*), and Prairie Bush-clover (*Lespedeza leptostachya*), an offshoot of the southern Atlantic Coastal Plain Narrow-leaved Lespedeza (*L. angustifolia*). Finally, we must mention the Glade Mallow, a tall and rank, locally occurring but not particularly rare perennial herb of wooded floodplains and moist prairies (Iltis 1963, Mickelson & Iltis 1967). The only endemic genus in the Upper Midwest, it is segregated as such because of, among other characters, its numerous, small, unisexual flowers (plants dioecious, that is, male and female flowers on different plants). It has an enigmatic history that probably involves long-distance dispersal from far-away lands, possibly California or South America (nobody knows).

The five special prairie examples are mapped in Mickelson and Iltis (1967), who hypothesize that each of them must have had either an ancient, pre-Wisconsin or even pre-glacial origin with subsequent survival either in unglaciated or in once-glaciated territory between differentially advancing glacial lobes, where they evolved into new taxa; or a recent, post-glacial origin from a more wide-spread Great Plains, western, or southern species.

In summary, the history of these special prairie and fen species, and others found entirely or mainly on the sand dunes of the Great Lakes (e.g., Sand-reed Grass, *Calamovilfa longifolia* var. *magna*, and Dune Thistle, *Cirsium pitcheri*, both derived from prairie taxa from farther west), is of particular interest, because the geographical ranges of these plants are restricted to glaciated territory. As the Midwest's only endemics, they are treasured by taxonomists and evolutionists alike.

Management of Prairies and Savannas

Southwestern Wisconsin lies within the wide ecotonal belt that separates the central North American grasslands from the eastern deciduous forests, and most any environmental change will shift the balance toward one ecosystem or the other. Because civilization has now shifted this balance more in the direction of forest, we must manage remnants of prairie or savanna if their biological diversity is to be maintained.

Today, the active management of landscapes for biodiversity, rather than for agriculture or other utilitarian rewards, has become an unwelcome responsibility for a

reluctant, often impoverished humanity the world over. Indeed, managing even perfectly preserved or carefully restored prairie remnants has become a problematic endeavor. Fragmented, isolated, highly susceptible to edge effects and the vagaries of island biogeographical principles (MacArthur & Wilson 1967)—namely the gradual, automatic, chance depletion of localized biodiversity (Leach & Givnish 1996) with little hope of renewal from now mostly distant seed sources—prairie and savanna communities, whether in public or private ownership (Houle 1996), will require the best of our knowledge and the most prudent care if their rich biodiversity is to survive.

Many complex problems need consideration. Contending with such invasive weeds as the bluegrasses (*Poa* spp.), sweet-clovers (*Melilotus* spp.), Leafy Spurge, and Wild Parsnip is bad enough. Likewise, the use of fire and grazing may at times involve difficulties—the road to mismanagement is usually paved with the best of intentions. A tallgrass prairie is, after all, an elaborate ecosystem of dynamic parts with multifactorial environmental relationships: a hundred or more species of vascular plants, myriad insects and nematodes, ground lichens and soil fungi, animal and plant parasites, all interacting with rainfall and sunlight, and above all with the rich black prairie soil. Almost any human activity could have unpredictable consequences.

Take fire, for example, a powerful management tool. Fire is essential to restore and maintain prairie and savanna vegetation within our ecotonal climate by suppressing the growth of invading trees and shrubs. But fire must be used judiciously. Some entomologists believe that it reduces long-term arthropod abundance and diversity, and that even controlled burns may damage or endanger prairie-restricted insects. Scientists who undertook experimental burning of prairies realized long ago that fire may temporarily set back insect and spider populations, and as recent research has demonstrated, at least temporarily reduce numbers of certain prairie insect "specialists" (Swengel 1996, 1997; Swengel & Swengel 1997). Of the insect species characteristically found in prairies, about 10 to 20 percent are restricted to native prairie habitat (R. Panzer, pers. comm.). Studies of the effects of fire on insects show that only a small subset of the restricted species are apt to be harmed (R. Panzer, pers. comm.). For the vast majority of insects, prescribed burning does not seem to hinder survival (Reed 1997, Siemann et al. 1997). For example, in Illinois, Dietrich et al. (1998) found "no significant differences" in diversity between burned and unburned units within enclosed and

unenclosed plots; and Panzer (1988, p. 87), noting that "Small remnant insect populations...are much more susceptible to environmental stresses such as fires than were massive unfragmented presettlement populations," nonetheless concluded that most prairie insects, even butterflies, have the ability to rebound quickly following partial burns on managed sites. These findings, however, are still preliminary. For the majority of prairie insect species, we still know little or nothing about their responses to fire or the factors that determine post-burn recovery rates. There is a great need for more detailed study with proper experimental controls of fire effects on insects.

Insects play many roles in the ecology of prairies, not the least of which is the pollination of flowers (Buchmann & Nabhan 1996, Graenicher 1900–1935, Robertson 1928). Because populations of some prairie-obligates require more than one year to recover from a fire, in particular those that overwinter in litter or exclusively inside the stems of grasses or forbs as pupae or eggs, the most prudent course would be *never to burn all of a remnant prairie at the same time*, or even in the same year. In the case of very small and isolated remnants, especially, significant parts of each should be protected from fire in any given year. Burn-sensitive species then have a better chance of survival at least somewhere on that prairie.

An alternative to fire for woody plant control is mowing, which, partially mimicking the effects of fire, may thus be an appropriate alternative for increasing survival rates of some prairie butterfly species (McCabe 1981, Swengel 1996). But whether, when, and how much mowing, like whether, when, and how much burning or grazing, are questions in need of scientific research. In any case, fire is necessary in the management of most prairies, and indispensable during the early years of a prairie or savanna restoration. Depending on the topography of the individual site, burning may have to be carried out several years in succession.

Grazing by cattle has been proposed as a panacea for prairie restoration (Williams 1996, 1997, 1999a, 1999b; but see Harrington et al. 1998). Although it is true that survival of certain otherwise uncommon species is favored by cattle grazing, sometimes dramatically so (e.g., Marbleseed, *Onosmodium bejariense*), many other native species, especially forbs in mesic and wet-mesic habitats, are selectively eliminated (Dix 1959). Bison have been shown to be much more appropriate as grazers of the western prairies (Collins et al. 1998, Hartnett et al. 1997, Kaiser 1998, Steuter 1997), especially in their preference, unlike that of cattle, for the coarse,

tall grasses (Knapp et al. 1999). After all, native herbivores were once the principal biotic factor that helped shape the Great Plains grasslands (Risser 1988, Van Dyne et al. 1980).

Conversely, Bison probably were not major players in Wisconsin's tallgrass prairies. Historical and archaeological records suggest that in Wisconsin (Schorger 1937), Illinois (Griffin & Wray 1946), and probably all of the eastern extension of the tallgrass prairie (McDonald 1981, Roe 1970, Schorger 1944), Bison were absent or rare prior to 1500 AD, as they were apparently during the entire 10,000 years or more that prairies and savannas were developing in the Upper Midwest. Bison did not appear east of the Mississippi River in large numbers until the seventeenth and eighteenth centuries, to be eliminated first by Native American hunters and soon thereafter by pioneers. In Wisconsin, Bison were always rare; the last two were killed in 1832 (Jackson 1961). Although Elk and White-tailed Deer were more common, they also suffered reduction by hunting both before and after European settlement.

For us in the Midwest, any long-term vision of prairie conservation must include first increasing preservation and restoration efforts to a biologically more realistic scope; for until preserved areas are expanded to the *minimal viable size of several thousand acres or more*, "It is unlikely that we will ever again be able to accommodate mega-fauna such as bison, elk, and wolves in a naturally functioning grassland ecosystem in Wisconsin" (Henderson 1995b, p. 123). The proposal to re-create the extensive Sauk Prairie on the lands of the former Badger Army Ammunition Plant should thus include among its grazers not only Elk and White-tailed Deer, but also, in deference to the wishes of the Ho-Chunk Nation, a small herd of Bison as well. Ultimately, the public and their politicians must learn to accept the fact that for the tallgrass prairie to survive, *very large areas need to be removed from the economy of man and returned to the economy of nature*. Meanwhile, we need to preserve every surviving bit of virgin prairie, restore every as-yet-unplowed remnant, reconnect fragmented landscapes by environmental corridors, and thus rescue as many endangered species as we can. For as Aldo Leopold admonished us in *Round River* (L. Leopold 1953, pp. 146–147), "The outstanding scientific discovery of the 20th century is not television or radio, but rather the complexity of the land organism," and therefore "to keep every cog and wheel is the first precaution of intelligent tinkering." A major restoration on what once was the Sauk Prairie is Wisconsin's, and the Midwest's, last best chance to pass on to our children a viable prairie and savanna landscape.

What of the Future?

Postscript by Theodore S. Cochrane

The need to conserve Wisconsin's natural beauty and diverse flora and fauna, its ecosystems and landscapes, is much more urgent than ever in view of four basic concerns:

- Man's need for nature (Iltis 1966, 1967, 1969; Iltis, Loucks & Andrews 1970), what E. O. Wilson (1984), America's foremost evolutionary biologist, has called *biophilia*, the human organism's innate affinity with wild nature and those plants and animals that, the world over, we bring into our homes and gardens, all a reflection of our humanity and the inextricable link between green plants and living animals with the evolution of our human mind;
- Our preoccupation with technological progress and economic growth (Samson & Knopf 1994), both of which are, after all, still largely dependent on continuing and unsustainable destruction of the natural environment and the correlated and ever-increasing elimination of its species, communities, and ecosystems (Myers 1993);
- Our need for wilderness and many more natural areas as benchmarks in understanding, through research, the workings of nature (Iltis 1959), an understanding we neglect at our peril;
- Lastly, of particular importance to Wisconsin, the natural landscape as an economic resource second only to agriculture, the green wild goose that lays the golden egg of tourism.

Untamed lands are desperately needed for education, research, recreation, and aesthetics; for maintaining a balanced, stable environment (that grasslands are superior carbon sinks in comparison to forests is only one specific relationship to current environmental issues); for serving as living models for ecological restoration, for only undisturbed ecosystems such as virgin prairies retain all their vast ecological complexities; for reminding us of our history and linking us to the land; and for experiencing ourselves and passing on to future generations a beautiful and healthy, livable world.

Alas, it is almost all over for Wisconsin's prairies and savannas, communities that are recognized as important reservoirs for biological diversity (Samson & Knopf 1996),

yet are very nearly absent or nonfunctionally represented on the living landscape. A number of prairie and savanna plant and animal species are rare or endangered, with their surviving numbers so small and the individual plants of these micropopulations so isolated that, from the standpoint of their genetic future, they may no longer constitute viable populations, what with inbreeding taking its toll. Many existing vegetation remnants are very small and often so degraded that they scarcely comprise recognizable communities. Unless the recognition, protection, preservation, management, and as a last resort *restoration* (returning a site to its original condition) of existing prairie and savanna remnants is stepped up, the permanent extinction of these characteristic Midwestern plant communities from Wisconsin is only a matter of time. Once destroyed, the only recourse will be *reconstruction*—reestablishing through guidelines of the newly emerging ecological science of restoration a broad range of prairie organisms on a former prairie site. Restoration is a slow process requiring one to several decades; however, reconstruction requires several centuries (Schramm 1992)—if re-creation of the prairie ecosystem in all its complexity is indeed possible at all.

Up to a point, regaining and keeping indefinitely native biodiversity is feasible for most but probably not all components of grassland and savanna ecosystems, especially at the dry and wet ends of the vegetational continuum. Mesic communities will require more work and time to restore (Henderson 1995b; Henderson & Sample 1995; Packard 1988a). Substantial opportunities also exist for the restoration of oak and pine barrens in Wisconsin (Eckstein & Moss 1995). Although it is important that landscape regions, large and small, be restored and maintained to promote the biodiversity once supported by our prairie and savanna ecosystems, it is equally important that neither small sites in relatively natural condition nor degraded larger remnants be ignored. Good-quality small sites are the last refuge for many species of plants, insects, and the million microorganisms in a handful of soil. Even degraded sites, being more common and often larger, represent opportunities for restoration of the prairie and savanna flora (Henderson & Sample 1995; see also the Wisconsin Department of Natural Resources 1995, Packard & Mutel 1997, Sample & Mossman 1997). We dare not let these accidentally preserved areas slide into oblivion, for they are the invaluable seed banks of the future. Whether of whole species or of locally adapted populations, *extinction is forever*.

Humans and Mother Nature, the Unbreakable Bond

Postscript by Hugh H. Iltis

May this study, with all its imperfections and omissions, serve as a stimulus to invigorate prairie appreciation and prairie preservation and restoration, for in these activities there is more involved than just beautiful flowers, or a lovely landscape, or even the satisfaction of "doing the right thing." It was the prairie ecosystem, after all, that over the millenia produced the prairie soils, including the dark-colored, humus-rich chernozems, the most fertile soils in the whole world. And it was these prairie soils, half of which now sit on the bottom of the Gulf of Mexico, the other half, once structured and crumbly, now more often than not compacted and eroded, that made Wisconsin rich, a fact realized by every farmer and a few politicians. To this day we barely understand how these soils were made to be so rich by the prairie ecosystems. Plant- and animal-soil relationships have been studied for decades, as have the effects of drought, grazing, and many other aspects of the prairie's enormous complexity; nonetheless, how to keep this prairie soil sustainably productive in the long, long run for our grandchildren and far beyond into the dark, ominous future, is a loaded question rarely considered, and as yet unanswered.

There is now hardly a single large piece of prairie ecosystem left to study or to experiment with, to learn how it renews its fertility. But why worry? May we not rely on science and technology to find the answers in the laboratory? May we not continue to count on economic credit, machinery, and chemicals—fertilizers, herbicides, and pesticides, massively applied—to produce bumper crops? Have there not regularly been agricultural surpluses?

But dare we neglect to appreciate the roles of animals, from protozoa to nematodes, millipedes, earthworms, insects, and ground squirrels, or of prairie vegetation, from *Andropogon* to *Tradescantia*, *Baptisia*, and *Silphium*, and the incorporation of plant materials, functions that are barely understood if they are considered at all?

Cornfields alone will not do, for monocultures, even if periodically interspersed with leguminous crops, can not, in their simplicity, give us all the answers. To truly understand prairies, be it the evolution of their flowers or the genesis of their soils, we need samples of unplowed, unsprayed, naturally functioning ecosystems, and an ecologically educated public who will support their preservation. Questions of human population growth and of our insatiable, unsus-

tainable hunger for the world's limited resources (Daily & Ehrlich 1992)—in short, of *Living Within Limits* (Hardin 1993), all come into play, even if all that we may wish for on a personal level is to preserve from cow and plow a dry hillside with a dozen pasqueflowers.

From a purely biological standpoint, it is our human fate, like that of all living things on this Earth, to do but one simple thing, and that is to *be a good ancestor*: certainly to our own children, and yes, even to the many generations yet to come. This is the biological imperative of life, which we cannot escape, except by misguided and seductive dreams of intellectual and technological superiority. This is our evolutionarily dictated responsibility, our duty—which we must assume (whether we like it or not), because we are living, reproducing beings, the result of evolution by natural selection—as it will be from now on and evermore.

Our crowning glory, the human brain, is a double-edged sword. On the one hand, it has deluded us by giving us God-like powers to destroy thoughtlessly our very own environment and that of future generations—the only species ever that deliberately has so tempted the fate of its own survival. On the other hand, it has empowered us to understand evolution and ecology, and with this the ability to direct our own destiny. And that imposes on us an everlasting new imperative, unheard of before in the history of life, and that is to consciously preserve, as all good ancestors must do, or restore if that is what is needed, the biological habitat that selected us, and to which we are bound by the dictates of evolution. Whether tropical rainforests or Wisconsin prairies, we must shield them from the instinctual fury of destruction wrought by our high but uninformed intelligence. Prairies, as much as tropical rainforests, are part of our holy Mother Nature, and we neglect her protection from humanity at our very own peril. Think globally, but act locally, if not for the sake of our prairie flowers, at least for the sake of our own children.

May this atlas, then, packed with geographical and ecological information, be a useful tool in fulfilling these noble endeavors, for nothing we do can ever be more important. If we succeed, we can have hope that children all over the world, ours and yours, today, tomorrow, and for millenia to come, will have a Mother Nature they can call their own, and that in Wisconsin they will be able to lie quietly in the grass on a sunny prairie hillside filled with flowers, watch bumblebees visit shooting-stars and pasqueflowers, hear dickcissels and meadowlarks call in the sky, and be ever enchanted and empowered by that great symphony we call life.

Avoca Prairie and Savanna State Natural Area, Iowa County, Wisconsin: a prairie-savanna landscape with Bur Oak. This extensive marsh-prairie-savanna complex, developed on a huge outwash sand terrace along the lower Wisconsin River, contains the largest tallgrass prairie—approximately 970 acres—east of the Mississippi River. It is covered very thinly with scattered groves and individual trees of Bur and White Oak, and no matter the vantage point, one sees only natural prairie-savanna landscape in all directions.

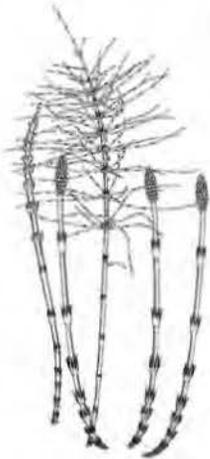
Photo by Mark K. Leach

PART II
ATLAS



PTERIDOPHYTES

The Ferns and Fern Allies



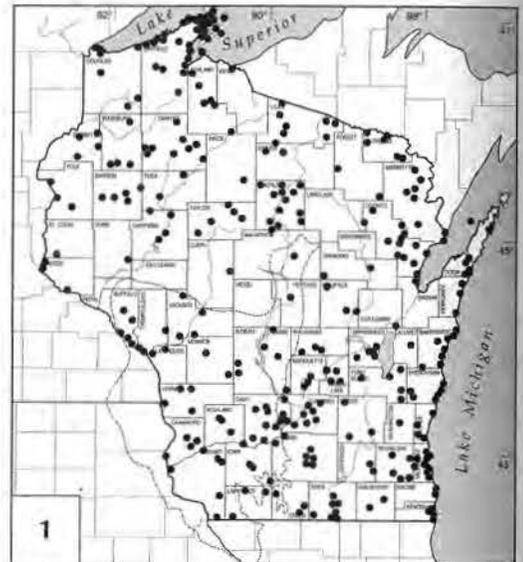
EQUISETACEAE—the Horsetail Family

Rhizomatous perennials, forming colonies, with tubular stems that are longitudinally ribbed and grooved and readily pull apart at the conspicuous solid nodes, each of which bears a whorl of small leaves and/or a whorl of branches; spore cases (sporangia) borne on specialized leaves (sporophylls) aggregated in a terminal cone (strobilus). (Hauke 1965, Peck & Taylor 1980, Tryon et al. 1953)

The only family of the order, whose single living genus, *Equisetum*, is represented in Wisconsin by 9 species plus 4 taxa of hybrid origin. Those with evergreen, unbranched stems (or at least not with regularly whorled branches) are the scouring rushes (e.g., *E. laevigatum*), and those with non-green fertile stems and regularly branched sterile stems are the horsetails (e.g., *E. arvense*). An external silicon deposit that is often minutely rough to the touch covers this most peculiar type of plant, the last remaining genus of three otherwise extinct orders of equisetopsids that were once co-dominant constituents of the swamp forests of the great coal age, the Carboniferous Period, some 300 million years ago.

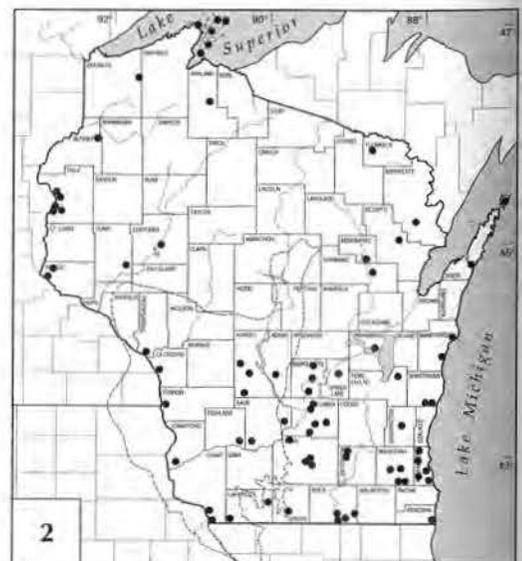
1. *Equisetum arvense* L. FIELD HORSETAIL, COMMON HORSETAIL. Circumpolar, in North America south to Georgia, Texas and California; throughout Wisconsin very common in various moist to dry habitats, especially **wet prairies** and edges of woods, often also in disturbed habitats such as fields, roadsides, railroads, sand dunes, riverbanks and lakeshores. (17)

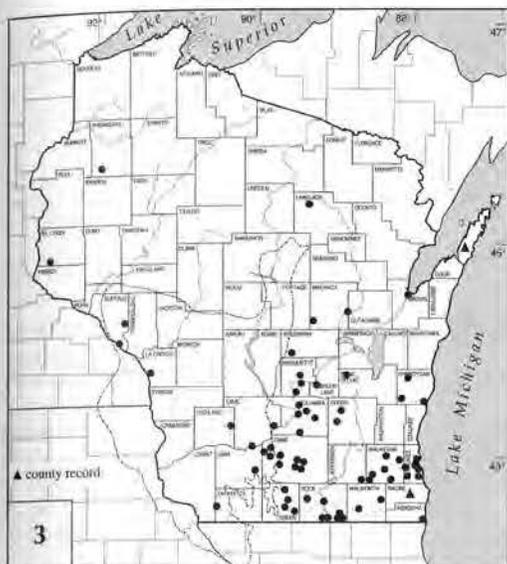
This is our most common and most variable *Equisetum*, with the light rusty-brown fertile stems emerging right after snow melt, only soon to die back just when the young vegetative shoots are beginning to develop. Both types of shoots are illustrated above.



2. *Equisetum* × *ferrissii* Clute [*E. hyemale* × *E. laevigatum*; *E. laevigatum* of Tryon et al. 1953, Curtis 1959, in part]. FERRISS'S HORSETAIL. Scattered across North America, not uncommon on the Great Plains; in Wisconsin in dry to moist, sandy, gravelly or cindery (and usually disturbed) ground: roadsides and railroads, lakeshores (including the Great Lakes) and riverbanks, sandy slopes, **wet-mesic prairies** and waste places, occasionally in oak openings and pine plantations; in southeastern Wisconsin about as frequent as the two parental species, occasional to rare in northern Wisconsin where *E. hyemale*, scouring rush, is very common, but the other parent is absent. (6)

A not uncommon sterile hybrid distributed by vegetative reproduction.





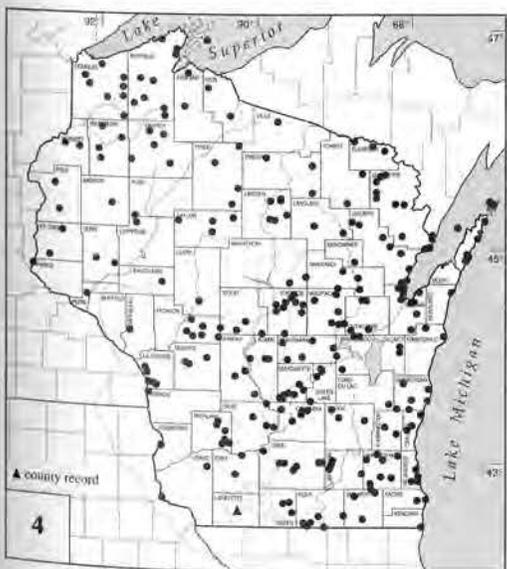
3. *Equisetum laevigatum* A. Braun [*E. kansanum* J. H. Schaffn. of Fernald 1950, Tryon et al. 1953]. SMOOTH SCOURING-RUSH. Nearly transcontinental, from western New York to southern British Columbia, south to Virginia, Texas and Baja California; in southeastern Wisconsin frequent in open habitats, especially **wet-mesic prairies** and fields, but less often along railroads, roadsides and lakeshores. (Including *E. × ferrissii*, 6)

One of the parental species of *E. × ferrissii* (2).

THELYPTERIDACEAE—the Marsh Fern Family

Small to large ferns from creeping to erect rhizomes, with deciduous, pinnate to pinnate-pinnatifid leaves (fronds) bearing needle-like hairs at least on the rachis, and sori (clusters of spore cases) that are intramarginal, with each sorus borne on a vein that continues to the margin. (Breakey & Walker 1931, Peck & Taylor 1980, Smith 1993, Tryon et al. 1953, Tryon & Tryon 1973)

Essentially worldwide, in Wisconsin represented by two genera: *Thelypteris* (blades narrowly lance-shaped and indusium present) and *Phegopteris* (blades triangular and indusium absent). Most earlier taxonomists included the majority of thelepterids in the large genus *Dryopteris*. That these ferns evidently comprise a distinct natural group was not recognized until recently, and whether they are sufficiently distinct to deserve status as a separate family is still controversial, with the more conservative recent works retaining them in the Aspleniaceae. Other treatments accept the segregate family, some recognizing as few as one (*Thelypteris*) or two (*Thelypteris* and *Phegopteris*) to as many as 32 genera. It all depends whether the taxonomist is a "lumper" or a "splitter."



4. *Thelypteris palustris* Schott var. *pubescens* (Lawson) Fernald. [*Dryopteris thelypteris*]. MARSH FERN, EASTERN MARSH FERN. Common in much of eastern North America, West Indies and (as var. *palustris*) through much of Eurasia, from Japan and northeastern Asia to Siberia; in Wisconsin locally frequent to abundant in marshy or boggy ground, especially marshes, sedge meadows, wet prairies, fens, bogs, swamp forests (deciduous or coniferous) and wet willow-dogwood-**alder thickets**, depressions in rich deciduous woods and occasionally in ditches and moist fields. (13)

No doubt our most common fern is the Bracken, *Pteridium aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) Underw., which occurs in a wide range of communities throughout Wisconsin, especially in bracken grasslands, northern forests, pine barrens and, in the Prairie-Southern Forest Province, in oak openings, oak barrens, degraded woods, dry sunny rights-of-way and even mesic to moist prairies on somewhat sandy soil.

CLASS LILIOPSIDA

The Monocotyledons



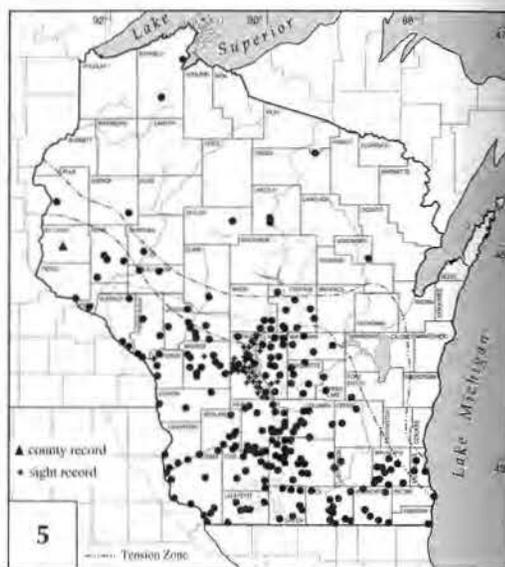
COMMELINACEAE—the Spiderwort Family

Annual or perennial herbs with mucilaginous stems with swollen nodes and sheathing leaves; helicoid inflorescences with regular to somewhat irregular flowers of 3 green sepals, 3 colorful, often blue or purple petals, 6 stamens (sometimes only 2 or 3 fertile, the others sterile or lacking), their filaments often fringed with long, brightly colored hairs; and a 3-valved, thin-walled capsule with a few, relatively large seeds. (Fassett 1932a)

Mainly tropical to warm temperate, with only two genera (*Commelina* and *Tradescantia*) and their 5 species extending northward into Wisconsin. *Commelina*, Dayflower, *Tradescantia* sensu stricto, Spiderwort, an endemic American genus, and *Zebrina*, Wandering Jew, are commonly cultivated. Every school should grow *Tradescantia*, for when the moniliform hairs (i.e., made up of a row of single cells, like beads in a necklace) on the staminal filaments are placed under a microscope, within each cell one can readily see the active flowing of the cytoplasm (cyclosis), which will amaze students now as much as it did Robert Brown (of "Brownian movement" fame) when, in 1831, he first discovered it.

5. *Tradescantia ohiensis* Raf. COMMON SPIDERWORT, SMOOTH SPIDERWORT, BLUE-JACKET. Eastern United States, especially abundant in the prairie soils of the Midwest; common in all southern Wisconsin prairie and savanna types (rare—adventive?—northward), in dry, open, often sandy places such as disturbed prairies, barrens, open oak and jack pine woodlands, cedar glades, old fields, roadsides and railroad ballast, as well as on hillsides, embankments, bluffs and dunes, occasionally in moist prairies, fencerows and borders of fields. (15) Flowering from late May to early August, fruiting from the end of June through September.

Two similar spiderworts occur from the eastern tallgrass region westward: the wide-leaved, rose-flowered *T. bracteata*, to North Dakota and Kansas, and the narrow-leaved, blue-flowered *T. occidentalis*, as far as Montana and Utah (Anderson & Woodson 1935). Both are rare in upland prairies, *T. occidentalis* in far western Wisconsin, *T. bracteata* in a few widely scattered locations and occasionally in gardens.



CYPERACEAE—the Sedge Family

Grass-like or rush-like herbs with often triangular, usually solid stems and 3-ranked leaves with closed sheaths; minute flowers that are bisexual, or if unisexual, then plants usually monoecious (both sexes on the same individual), each flower subtended by a scale and arranged in spikelets; a perianth reduced to bristles, scales or hairs, or often absent (as with grasses, all of ours are wind pollinated); and an ovary with a single ovule, ripening into an achene that is either lens-shaped, 3-angled, or sometimes round in cross-section. (Greene 1953, Marcks 1974, Zimmerman 1976)

Cosmopolitan, but most abundant in temperate and cold regions, often in damp to marshy places. Interesting taxonomically and evolutionarily, the Cyperaceae are of inestimable ecological importance, covering, often jointly with grasses, vast areas, contributing to peat formation and furnishing animal food and cover. Examples of this huge family include the taxonomically difficult sedges (*Carex*, Wisconsin's largest genus, with over 150 species), the mostly tropical umbrella sedges (*Cyperus*), and the bulrushes and wool-grasses (*Scirpus*), all common in Wisconsin.

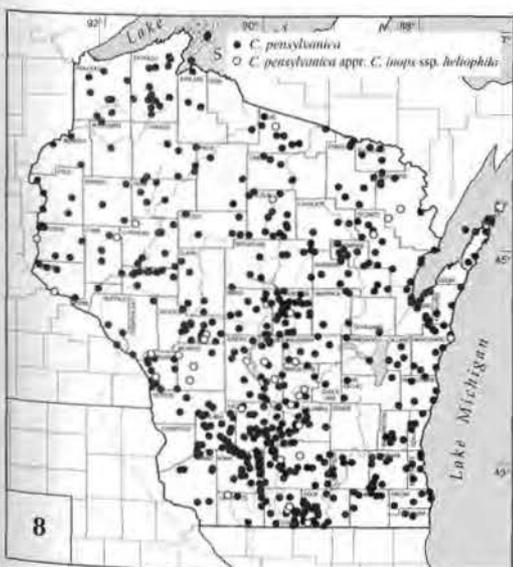


6. *Carex bicknellii* Britton. BICKNELL'S SEDGE. From the eastern Great Plains of Oklahoma and Saskatchewan across the Prairie Peninsula to southern Ontario, and near the coast from Delaware to Maine; in Wisconsin occasional or locally common within and south of the Tension Zone, very rare in the north, most abundant in lowland **wet-mesic prairies**, mesic relic railroad prairies and dry to moist sandy prairies, often on rock outcrops (rhyolite, quartzite, granite) and in prairie-like habitats such as old fields, grassy roadsides or quarries. (4) Flowering from mid May to mid June, fruiting from mid June to the end of September.

Many other carices occur in Wisconsin prairies, savannas and shrub communities such as *C. annectens*, *C. buxbaumii*, *C. conoidea*, *C. haydenii*, *C. pellita*, *C. stricta*, *C. tenera*, *C. tetanica* and *C. trichocarpa* in lowland prairies and/or sedge meadows; *C. molesta* and *C. torreyi* in mesic prairies; *C. brevior* in dry prairies; *C. eburnea* in cedar glades; *C. muhlenbergii* in sand barrens; *C. laeviconica* in lowland savannas; and *C. siccata* in oak barrens.



7. *Carex meadii* Dewey. MEAD'S SEDGE. Widespread in eastern and central North America from Texas and Virginia north to southeastern Saskatchewan, southern Michigan and New Jersey (disjunct in Arizona and Mexico); locally frequent to common in the southern two-fifths of Wisconsin (present on almost every remnant), in wet-mesic, mesic and dry-mesic prairies, but perhaps mainly in dry lime prairies on slopes of bluffs and crests of gravel hills, occasionally on dry sandy ridges, slopes and plains, rarely in sandy oak woods, bluff-top pine relics and gravelly embankments with prairie vegetation. Flowering from late April to May, fruiting from mid June to early July.



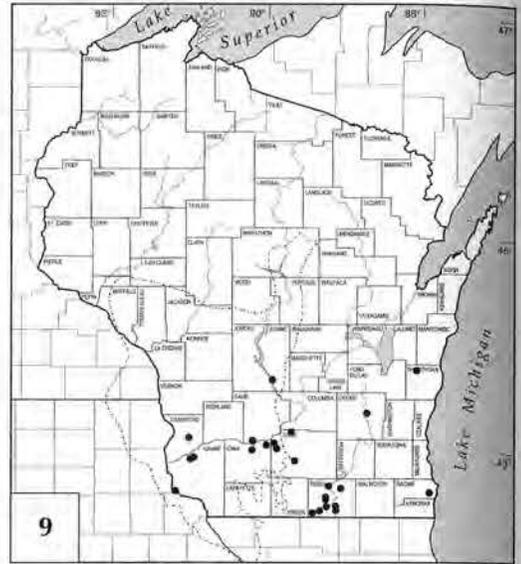
8. *Carex pensylvanica* Lam. PENNSYLVANIA SEDGE. Common from the southern Appalachians to Nova Scotia and Manitoba; in Wisconsin the most abundant and widespread sedge, ubiquitous in dry to dry-mesic habitats, particularly in woods of all types, from cool northern mixed forests to humid sugar maple forests, but mostly in **southern dry-mesic forests** and woods of oak, jack pine or aspen, in open, usually sandy or rocky ground such as sandy or limy, dry to dry-mesic prairies, barrens and dunes, there often forming extensive circular clonal colonies. (16) Flowering from mid April to late May, fruiting from mid May to early July.

Pennsylvania Sedge appears to be very tolerant of grazing, and its high relative density in some prairies may be an artifact of past grazing.

Specimens from scattered localities approach *Carex inops* L. H. Bailey ssp. *heliophila* (Mack.) Crins [*C. pensylvanica* var. *digyna*], having some but not all the characteristics of this largely prairies and plains element.

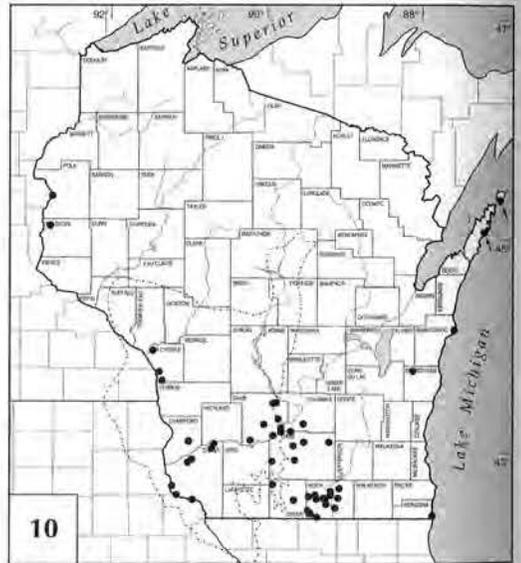
9. *Carex richardsonii* R. Br. (for Robert Brown; see note under Commelinaceae). RICHARDSON'S SEDGE (Special Concern). Interruptedly transcontinental, most common on the Canadian prairies and in montane woodlands east of the Cascades, rare eastward (Minnesota to Vermont and Maryland) on prairies, sand dunes and shorelines; present in low densities on most dry and dry-mesic prairies in the southern quarter of Wisconsin, on exposed prairie hilltops, on dolomite bedrock or morainal gravel, occasionally on open sandy plains, slopes and dunes or openings in oak woods, rarely in low fen-like prairies. Flowering from April to early May, fruiting from late May to mid June.

This species is supposedly rare but may be only under-represented in herbaria due to limited habitat, brief flowering period (when the plant resembles the ubiquitous *Carex pensylvanica*) and, finally, poor fruiting.

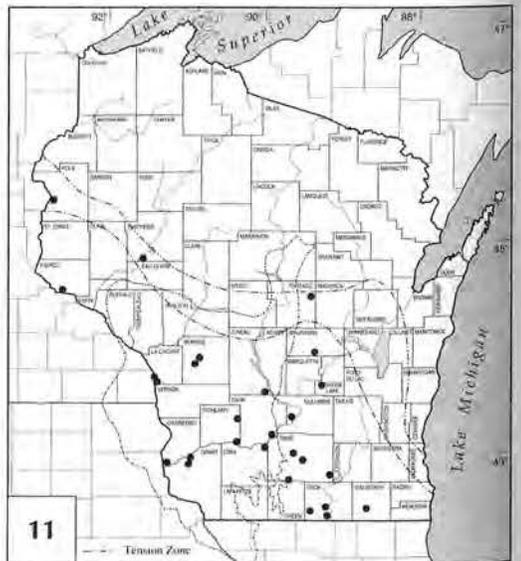


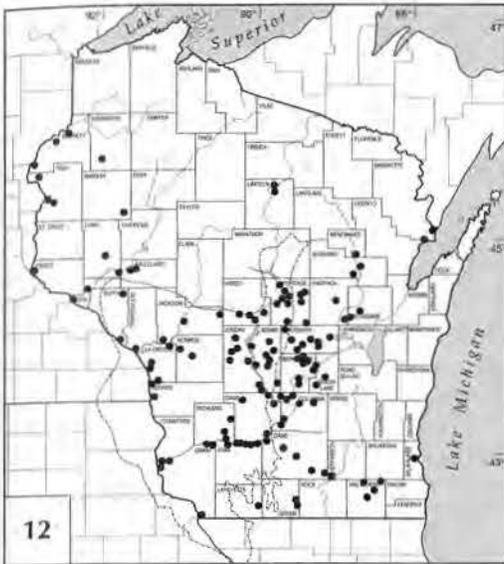
10. *Carex umbellata* Schkuhr ex Willd. [*C. abdita*]. HIDDEN SEDGE. (Greenland) Newfoundland to Saskatchewan (Vancouver Island), south to Virginia, Tennessee and Texas; in Wisconsin in dry to moist, sandy or gravelly open ground, reaching greatest abundance in steep dry limy prairies on dolomite bluffs and gravel hills, frequently on sandstone outcrops, quartzite talus, and rarely in fens and on beach ridges along Lake Michigan. Flowering from mid-April to early May, fruiting from late May through June.

This sedge resembles *Carex rugosperma*, which is a coarser, stiffer plant with larger perigynia. The two species may occur near each other (and/or with *C. pensylvanica*, which also has a coarse barrens form) along the lower Wisconsin River Valley, where *C. umbellata* characteristically grows on the steep limy bluff prairies, and *C. rugosperma* in the sandy prairies and oak barrens on the old terraces below.

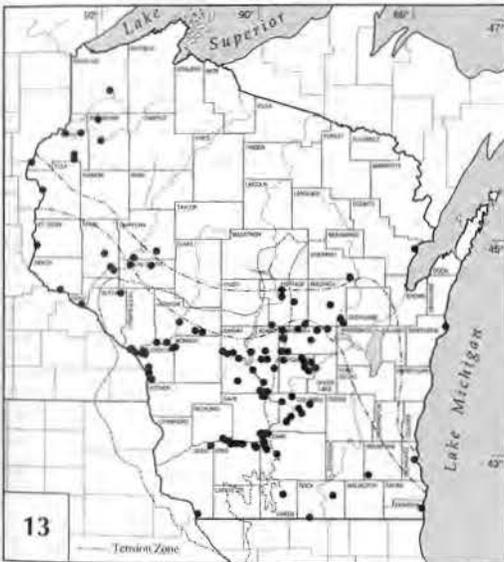


11. *Cyperus lupulinus* (Spreng.) Marcks ssp. *lupulinus* [*C. filiculmis* of Curtis 1959 and other authors, in part, misapplied]. SAND SEDGE, GREAT PLAINS FLAT SEDGE. Widespread in the eastern United States on dry exposed sands, gravels and rocky prairies and oak openings, with geographical dispersal centers in the southern Great Plains and Ozarks, as well as the Appalachians; in Wisconsin rather rare south of the Tension Zone, on sandstone and granite outcrops, gravelly areas, old fields, sand barrens and prairies, but sometimes weedy in disturbed sandy, gravelly or cindery soil such as roadcuts, eroded pastures and along railroads. (4) Flowering from mid June to late August, fruiting from July through October.



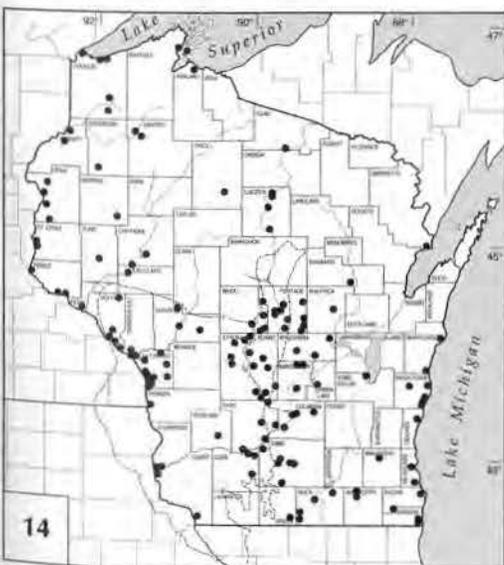


12. *Cyperus lupulinus* (Spreng.) Marcks ssp. *macilentus* (Fernald) Marcks [*C. macilentus*; *C. filiculmis* var. *macilentus*; *C. filiculmis* of Curtis 1959, in part]. SLENDER SAND SEDGE. Dry exposed sands, from the southern Appalachians to the Atlantic Coastal Plain of the Carolinas, northwestward in glaciated territory to Iowa and southeastern Minnesota; in Wisconsin in sandy soil of rock outcrops, **sand barrens**, roadcuts, abandoned fields, young pine plantations and in glacial lake beds and outwash plains. (4) Flowering from late June to early September, fruiting from July to October.



13. *Cyperus* × *mesochorus* Geise [*C. lupulinus* × *C. schweinitzii*]. MIDLAND SAND SEDGE. Three distinct but closely related taxa, *Cyperus lupulinus* ssp. *lupulinus*, *C. lupulinus* ssp. *macilentus* and *C. schweinitzii*, all members of the taxonomically difficult section *Laxiglumi*, are often sympatric in dry, open and sunny sands of prairie blowouts, roadcuts and railroads, abandoned fields, young pine plantations, sandstone outcrops and lake dunes in glaciated eastern North America. Wherever they occur together they hybridize extensively, producing highly variable hybrid swarms (Marcks 1967, 1972, 1974; Marcks & Iltis 1967). Flowering from June to September, fruiting from late June to October.

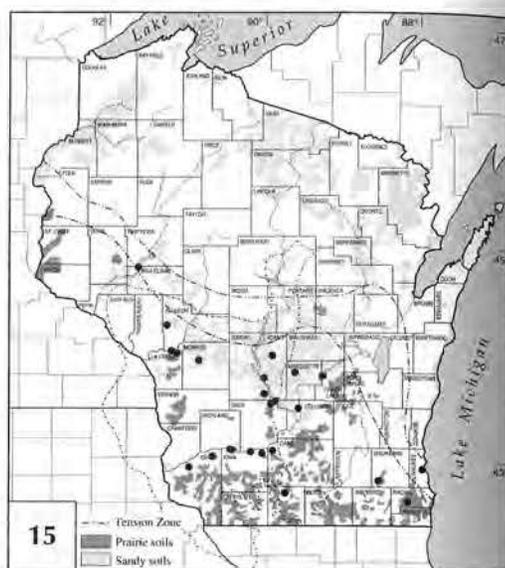
Similar, but less variable, more stabilized hybrid populations, also of sandy, grassy habitats, especially jack pine barrens, from northern Minnesota and Wisconsin to southern Ontario and New England, which appear to date back to earlier, post-Pleistocene hybridization events, have been classified as *Cyperus houghtonii* Torr.



14. *Cyperus schweinitzii* Torr. PLAINS SAND SEDGE, SCHWEINITZ'S FLAT SEDGE. A southern Great Plains element from the Staked Plain (Llano Estacado) of west Texas and the sand hills of Nebraska to the sandy soils of eastern Canada and New York; in Wisconsin rather common on dry exposed sands of glacial outwash plains, river floodplains, dunes of Lake Michigan, sandstone outcrops, **sand barrens**, and disturbed sands of roadcuts, sandblows and pine plantations. (2) Flowering from mid June to September, fruiting from July to the end of September.

15. *Scleria triglomerata* Michx. NUT-RUSH, STONE-RUSH, WHIP-GRASS, WHIP NUT-RUSH (Special Concern). A member of a large neotropical or neosubtropical genus; rare in Wisconsin, but especially characteristic of moist to **wet prairies** on sandy loam or silt loam, where it may be locally common (e.g., Avoca Prairie, Iowa County and the railroad prairies to the west of it), but also in seasonally moist sandy meadows and swales, marsh margins and oak opening borders. (3) Flowering in June, fruiting from June to late September.

The rare, diminutive *Scleria verticillata* Muhl. ex Willd., Low Nut-rush (Special Concern), its thread-like stems just 4 to 12 inches tall, hides in tall grass at Muir Lake, Marquette County, Chiwaukee Prairie, Kenosha County, and a few other calcareous prairies and fens in between. It ranges south to Texas and Florida and beyond to the savannas of the Guianas of northern South America, truly a tropical floristic element in the Wisconsin flora, here at the very northern edge of its range.



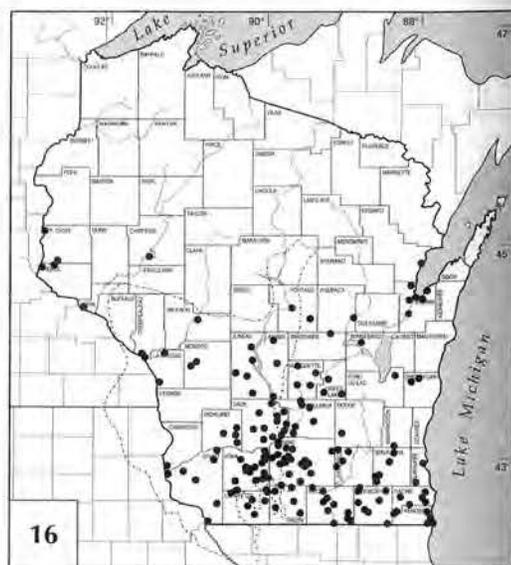
HYPOXIDACEAE—the Star-grass Family

These miniature amaryllids have grass-like, usually hairy, basal sheathing leaves, 1- or few-flowered inflorescences terminating a leafless peduncle, regular flowers with 3 pilose sepals, 3 petals, 6 (rarely 3) stamens, and an inferior ovary that ripens into a capsule or berry with many small seeds. (McIntosh 1950)

Hypoxis, by far the largest genus (100 species), is represented in North America by 15 or more species, with only *H. hirsuta* reaching Wisconsin. Most American authors place *Hypoxis* into either the Amaryllidaceae or Liliaceae, but modern taxonomists are inclined to combine it with a number of small genera into the mostly southern hemispheric, paleotropical Hypoxidaceae. Our sole species is thus an interesting reminder that floras are pieced together from floristic elements that have their roots in the four corners of the Earth, each species with its own biogeographic and evolutionary history, the genus *Hypoxis* being a Gondwanaland taxon with a modern center of distribution on the Gulf and Atlantic coastal plains.

16. *Hypoxis hirsuta* (L.) Coville. YELLOW STAR-GRASS, COMMON STAR-GRASS. Eastern North America, from Maine to Manitoba, south to Georgia and Texas; common across the southern half of Wisconsin in dry, mesic or **wet prairies**, sandy, gravelly or rocky hillsides, outcrops and bluff tops (especially edges, paths, glade-like openings) and pine relics, occasionally in pastured sedge meadows and swamp borders. (11) Flowering from mid May to late June, fruiting from late June to July.

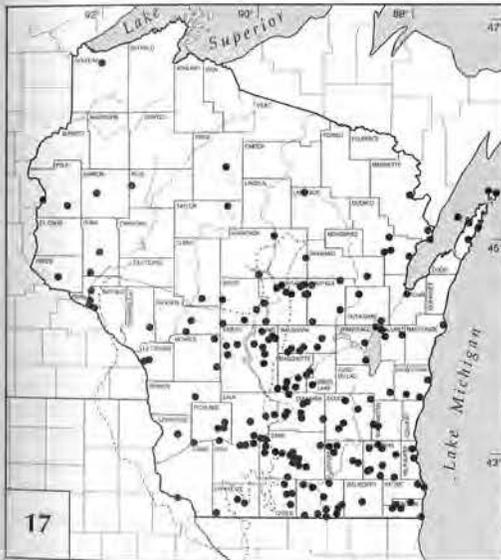
Like Blue-eyed-grass, this small herb is well identified by its common name. Hiding among grasses in sunlit prairies, old pastures and open woods, its presence is revealed in early summer by the bright yellow, star-shaped flowers.



IRIDACEAE—the Iris Family

Mostly perennial herbs from rhizomes, corms or bulbs, with basal 2-ranked leaves that are equitant [that is, folded lengthwise and astride the stem, like a rider on a horse (= *Equus*, in Latin)], flowers that may be radially or bilaterally symmetrical, with generally all 6 perianth members and often also the style petaloid, and a 3-celled inferior ovary and capsular fruit (i.e., with the perianth and stamens attached at the top of the ovary rather than beneath it). (McIntosh 1950)

In temperate and warm-temperate regions, with centers of diversity in the eastern Mediterranean region and other regions with a similar highly seasonal climate such as South Africa, this popular family of ornamental plants includes *Iris*, *Gladiolus*, *Moraea*, *Sisyrinchium*, *Crocus* and some 40 other cultivated genera. In Wisconsin, we have only *Sisyrinchium*, low, tufted, grass-like herbs with small delicate flowers, and *Iris*, perennial herbs from stout horizontal rhizomes with large, more complex flowers, which, in both genera, are pollinated by bees, flies or other nectar-seeking insects.



17. *Iris virginica* L. var. *shrevei* (Small) E. S. Anderson. SOUTHERN BLUE FLAG, SHREVE'S IRIS. Widespread in the southeastern United States; in Wisconsin often forming extensive clones in wet places or shallow water, but rarer north of the Tension Zone, in marshes, sedge meadows, low prairies, fens, swamps and low bottomland forests, alder-willow-dogwood thickets, stream margins, lakeshores, riverbanks, ponds and ditches. (13) Flowering from late May to late July, fruiting from (mid July) early August through October.

Very similar to the common, more northeastern *Iris versicolor* L., from which it is difficult or impossible to distinguish if herbarium specimens lack flowers or ripe fruit. *Iris versicolor* is an ancient 108-chromosome hexaploid hybrid of the arctic 36-chromosome diploid *I. setosa* Pall. with the 72-chromosome tetraploid *I. virginica* var. *shrevei*, hence their great similarity (Anderson 1928, 1936b). In addition, natural pentaploid hybrids (*I.* × *robusta*) have been reported from Ontario and Michigan.



18. *Sisyrinchium albidum* Raf. PALE BLUE-EYED-GRASS. Prairies and dry sandy woodlands from New York and southern Wisconsin to Virginia, western Florida and Louisiana; occasional in southwestern Wisconsin on dry sunny hillsides, brushy slopes and sandy fields, in sandy oak or jack pine woods, edges of sand blows, prairie relics, and spreading to roadsides and railroads. Flowering from mid May to mid June, fruiting in June and July.

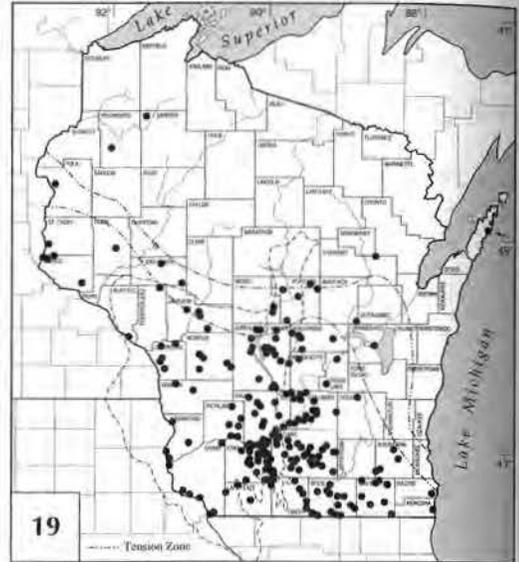
Sisyrinchium angustifolium Mill. NARROW-LEAVED BLUE-EYED-GRASS (Special Concern). Chiefly a forest and riparian species, from New England to Wisconsin and Texas, reaching its northwestern limit in southeastern Wisconsin, where it is very rare in woods, thickets and fields. Flowering from May through July.

Although a distinctive member of a taxonomically difficult genus, its epithet *angustifolium* has nevertheless been misapplied by Fernald (1950) to *S. graminoides*, by Alexander in Gleason (1952) to *S. montanum*, and by local collectors to *S. strictum* or *S. farwellii*.

19. *Sisyrinchium campestre* E. P. Bicknell. PRAIRIE BLUE-EYED-GRASS.

Widespread in prairies, from Wisconsin and southeastern Manitoba to northeastern Texas; this lovely species is common to abundant in Wisconsin on dry prairies mostly south of the Tension Zone such as sandy and gravelly hill prairies, **dry-mesic prairies**, less frequent on mesic and wet-mesic prairies, on sandstone and limestone bluffs, sand plains and open or wooded hillsides with oak, jack pine or white pine; occasionally somewhat weedy, invading sandy fields, roadsides, railroad rights-of-way and quarries. (9) Flowering from early May through June, fruiting from late May to mid July.

The many species of *Sisyrinchium*—about three dozen in North America—look so much alike that even botanists have trouble distinguishing them. Although grass-like in appearance, their two-edged stems and equitant leaves, to say nothing of the presence of a true perianth of six sepals and a capsule rather than a grain or achene, will easily distinguish them from any grass or sedge.



LILIACEAE—the Lily Family

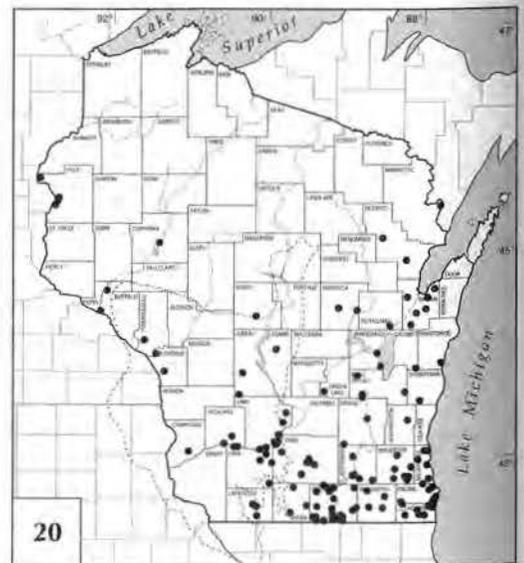
Plants of diverse habit and structure (mostly perennial herbs, sometimes woody if the family is broadly circumscribed), from rhizomes, bulbs or fleshy roots, with flowers that are radially symmetrical and often showy, with 6 tepals, commonly 6 stamens, 1 superior ovary (or if several familiar segregate families are included, also inferior), and a fruit that is a capsule or berry. (McIntosh 1950)

There are nearly 4,000 species in the traditional Liliaceae, distinguished arbitrarily from the Amaryllidaceae solely by a superior, rather than inferior, ovary. Recent and current work has shown that to reflect evolutionary relationships, a radical realignment of both families was in order, resulting in the recognition by taxonomic splitters of some two dozen natural groupings, all small except for the nearly 500 species of Liliaceae. Until the taxonomic dust has settled, we include here the Alliaceae, Amaryllidaceae, Calochortaceae, Convallariaceae, Dracaenaceae and Trilliaceae of various authors, but segregate *Hypoxis* and *Smilax* into their own families. Among the wide range of ornamental, medicinal and poisonous plants are *Allium*, *Calochortus*, *Camassia*, *Narcissus*, *Tulipa* and *Zigadenus*. Except for *Allium* and *Trillium*, all genera, whether native (e.g., *Erythronium*, *Streptopus*, *Uvularia*) or escaped garden plants (e.g., *Asparagus*, *Hemerocallis*), are represented in Wisconsin by only one or a few species each.

20. *Allium canadense* L. WILD GARLIC, WILD ONION, MEADOW GARLIC.

Widely distributed, most common in the eastern and central United States, from southern Canada to Florida and the eastern Great Plains, from southern Minnesota and the eastern Dakotas to Texas; in Wisconsin infrequent, largely confined to glacial drift in the southeastern half of the state, in moist to dry, wooded or open habitats, **wet-mesic prairies**, locally common or abundant in low to rich or even dry deciduous woods and various floodplain habitats, including stream banks, sandy or rocky shores of rivers, often weedy in grazed woods, railroad embankments, damp grassy roadsides, and other disturbed places such as edges of paths, overgrown quarries, man-made pond banks, even unkempt yards in cities. (9) Flowering from the beginning of June to early July.

Our plant belongs to a variable series of almost exclusively asexual populations reproducing by inflorescence bulbils, derived from hybrids involving several sexual species of the Deep South (Ownbey & Aase 1955).





21. *Allium cernuum* Roth. NODDING WILD ONION. Very widespread, with three variants centered in the Cascade and Rocky mountains from British Columbia to northern Mexico, and one reappearing in the East from New York to North Carolina, west to Missouri, northeastern Illinois and South Dakota (only one Minnesota station); rare but locally abundant in southeastern Wisconsin, either in calcareous wet to **mesic prairies** and savannas about Lake Michigan, especially on sands or marly clays associated with the old, now-elevated bed of Glacial Lake Chicago, or there and in northeast Wisconsin, in habitats where dolomite is near the surface, or westward, occasionally on grassy wooded banks and in oak openings (usually on sandy loam), and in Dane and Grant counties in maple-basswood forests (sometimes on moist cliffs or talus), but also spreading along railroad embankments and roadside ditches. (1) Flowering from mid July to early September, fruiting from the end of August to mid October.



22. *Allium stellatum* Ker Gawl. WILD ONION, PRAIRIE ONION, AUTUMN ONION. Prairies, barrens and rocky hills of west-central North America, from Saskatchewan and western Ontario south to Wyoming, Oklahoma and Illinois; in Wisconsin rare but locally common in the northwest, mainly in dry sand prairies (e.g., Crex Meadows) and sand barrens (Namekagon River Valley), in very rocky prairies on the high bluffs along the St. Croix River at Interstate Park (**exposed cliffs**, fide Curtis 1959), in central Wisconsin sporadic in open or disturbed, sandy or gravelly places such as ditches and lakeshores; rarely adventive farther south, as in Sauk and Rock counties. (1) Flowering from late July to early September, fruiting from late August to September.



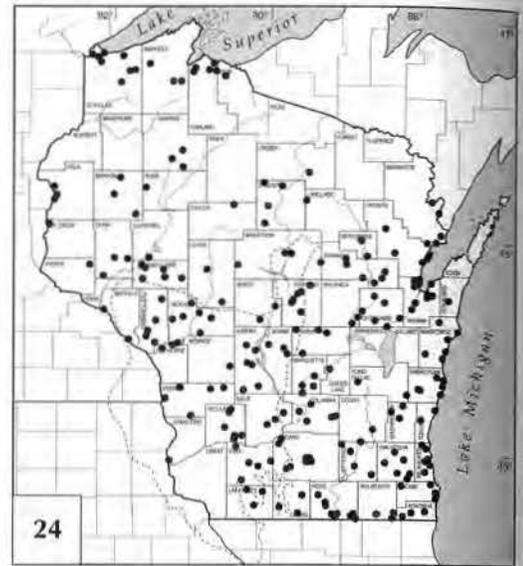
23. *Camassia scilloides* (Raf.) Cory. WILD-HYACINTH, EASTERN CAMASS (Endangered). The only eastern species of a small western genus, widespread on prairies, savannas and open woods, from southern Ontario and western Pennsylvania to Georgia, west to Texas, eastern Kansas and Iowa; in Wisconsin restricted to relictual **mesic** and **wet-mesic prairies**, barely surviving along railroads and roadsides. (1) Flowering from mid May to mid June, fruiting from late June to mid July.

This lovely plant has, in the last 150 years, lost most of its mesic prairie habitat to agriculture, and its continued existence in Wisconsin will depend on the deliberate protection and management of its few surviving stations. More of a savanna than a prairie species, it may have attained its pre-settlement optimum in rich open oak woodlands and savannas.

Camassia, though hardy and easy to grow, is still uncommon in cultivation. Our Eastern Camass can be propagated by seed and could be effectively used in the wildflower border.

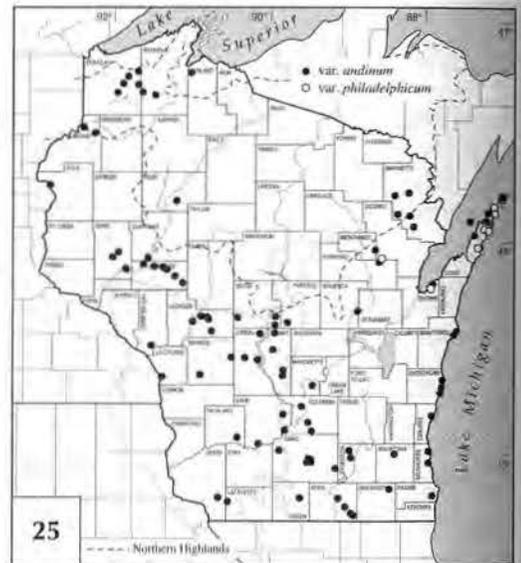
24. *Lilium michiganense* Farw. [*L. canadense* L. ssp. *michiganense* (Farw.) B. Boivin & Cody]. MICHIGAN LILY, TURK'S-CAP LILY. A mostly midwestern, barely distinct variant of the north-eastern and Appalachian *L. canadense*; occasional to locally common throughout Wisconsin in moist, mucky, peaty or sandy soils of rich, mesic to **wet prairies**, sedge meadows, fens, moist borders of mesic hardwoods, grassy openings to deep shade of swamp forests, tamarack-poison sumac bogs, thickets with willows on prairies, among alders along streams, rights-of-way with mixtures of prairie and marsh plants, and grassy, marshy places such as streambanks, ditches, fields and pastures. (19) Flowering from (mid) late June to early (late) August, fruiting from mid August through September.

Both this species and the next (25) are becoming rare (at least in the south) due to habitat loss, digging of bulbs by gardeners, and picking of the gorgeous flowers by pulling the whole stem from the bulb, thus killing it. The common name Turk's-cap Lily is best reserved for the eastern *Lilium superbum* L.



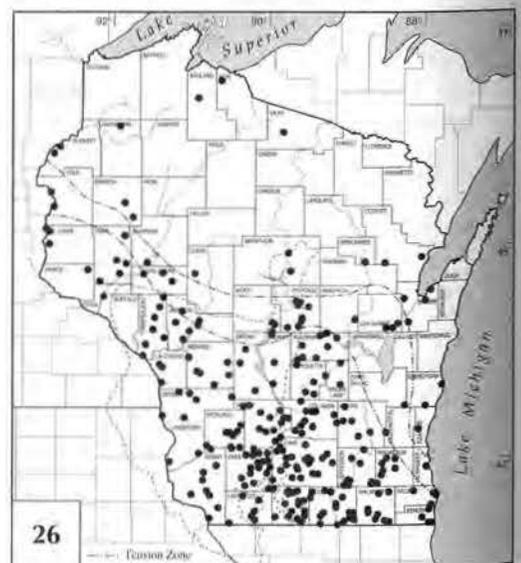
25. *Lilium philadelphicum* L. WOOD LILY, PRAIRIE LILY. Transcontinental, divisible into var. *philadelphicum*, Wood Lily (southeastern Quebec to North Carolina, Kentucky and Wisconsin) and var. *andinum* (Nutt.) Ker Gawl., Wood or Prairie Lily (southwest Quebec to the northern Great Plains, south to Ohio, Texas and Arizona); in Wisconsin both conspicuously absent from the granitic Northern Highlands, infrequent elsewhere in open, often dry, sandy or rocky woods or thickets, associated with jack pine, pin cherry, oaks and aspen, less often on edges of mesic coniferous woods, dry to moist, but mostly **mesic prairies** and swales, and on wooded bluffs and dunes along Lake Michigan; usually rare or scattered but sometimes locally common on grassy rights-of-way and clearings in cut- and burned-over areas. (9) Flowering from late June to early August, fruiting from September to October.

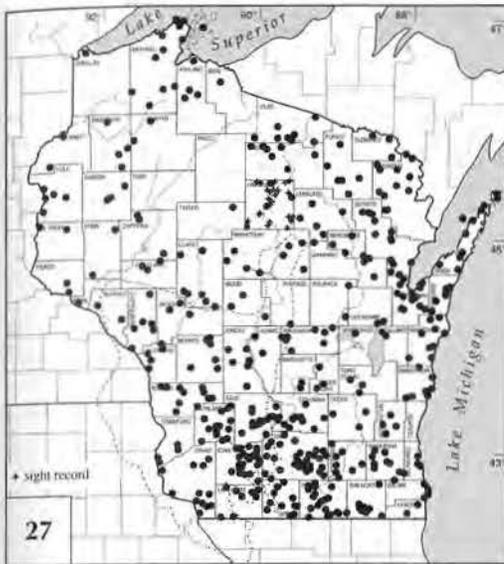
Var. *philadelphicum* (whorled leaves) is known from a few counties in northeastern Wisconsin, where it intergrades with the more western var. *andinum* (mostly alternate leaves).



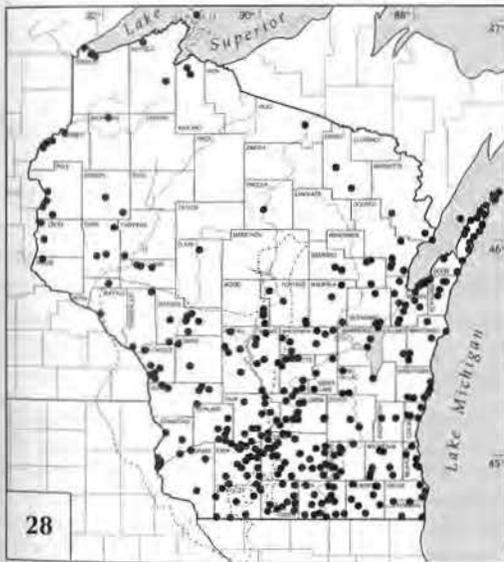
26. *Polygonatum biflorum* (Walter) Elliott var. *commutatum* (Schult. f.) Morong [*P. canaliculatum*, misapplied]. SOLOMON'S-SEAL, SMOOTH SOLOMON'S-SEAL. Temperate North America, New England to southern Saskatchewan, south to Georgia and northeast Texas (northeast Mexico); very common in Wisconsin mostly south of the Tension Zone, in a variety of open deciduous woods such as dry oak, oak-hickory, oak-pine or white birch woods and rich mesic elm, cherry, basswood and maple woods, in floodplain forests, oak openings, **oak barrens**, thickets, especially along roadsides, railroads, fencerows, on borders of bogs and marshes, and occasionally surviving as a relict in fire-devastated forest later invaded by prairie (Bray 1957). (17) Flowering from late May through June, fruiting from early July to mid October.

This is typically a variety of forests and oak openings throughout the prairies and plains, whereas the more southerly var. *biflorum* occurs from the Gulf Coast north to Indiana and New York in the deciduous forest.

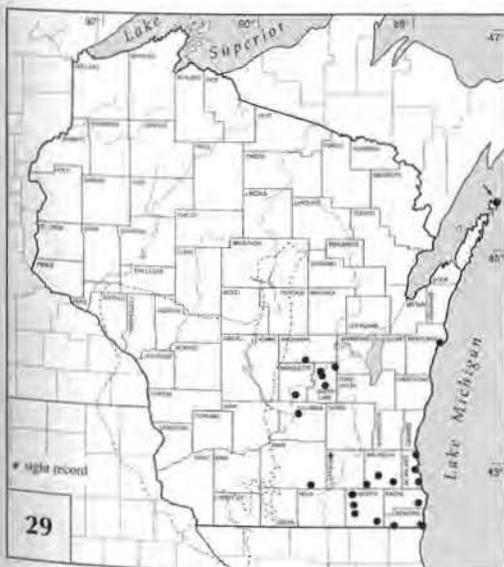




27. *Smilacina racemosa* (L.) Desf. ssp. *racemosa* [*Maianthemum r.*]. FALSE SPIKENARD, FALSE SOLOMON'S-SEAL. Widespread in eastern North America to the eastern Great Plains (Canada to Texas) and the Rocky Mountains, and with a regional variant in the West; very common throughout Wisconsin in dry, mesic or moist woods of oak, pine-oak, oak-maple and sugar maple, south of the Tension Zone in **southern dry forests**, mesic to damp maple, basswood and elm woods, and bottomland hardwoods; north of the Tension Zone in pine, pine-oak, aspen-birch and moist fir-hemlock-white cedar stands, also in semishade along grassy rights-of-way, roadsides, fencerows, slopes and banks, rarely in mesic deep-soil prairies or lowland oak savannas. (19) Flowering from mid May through June, fruiting from late July to early October. Ssp. *amplexicaule* (Nutt.) LaFrankie is the western race of the species.



28. *Smilacina stellata* (L.) Desf. [*Maianthemum s.*]. STARRY FALSE SOLOMON'S-SEAL. A transcontinental species of sandy, gravelly or alluvial shores, woods, thickets, prairies and meadows, from Canada to Colorado, Kansas and northern Missouri, and west to California; common in the southern half of Wisconsin, especially in **southern dry forests**, infrequent in the northern half, in dry to moist woods such as rich deciduous hardwoods, floodplain forests, conifer swamps and associated thickets (e.g., oak, aspen, pine, pine-oak, oak-elm, edges of white cedar woods), oak openings, prairie patches and pine relics on sandstone hills, ridges, bluffs and outcrops, shaded sandy embankments along rivers, sand barrens and occasionally in hillside prairies; particularly characteristic of stabilized inner beach ridges and dunes along Lake Michigan. (21) Flowering from early May to mid June, fruiting from late July through September.

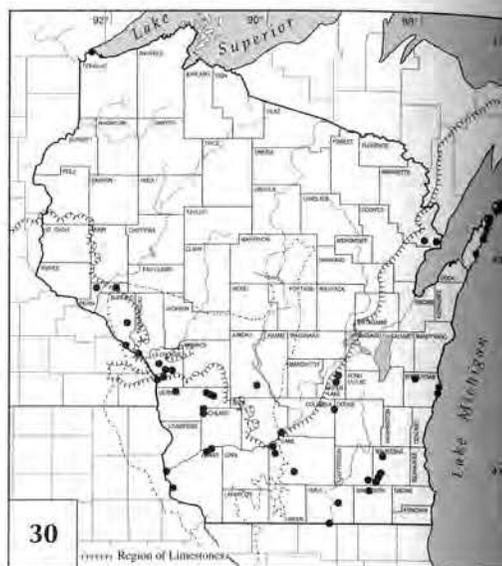


29. *Tofieldia glutinosa* (Michx.) Pers. FALSE ASPHODEL, STICKY FALSE ASPHODEL (Threatened). Eastern United States from Newfoundland and Maine to Minnesota and Alaska, south in mountain bogs to Georgia; rare but locally common in a dozen counties of eastern Wisconsin, in Door County on wet sandy or marly shores and interdunal flats and pools along Lake Michigan, in the southeast in calcareous **wet prairies**, fens, and as a pioneer in moist sandy excavations such as ditches and interdunal swales. (2) Flowering from June to July, fruits persisting through the winter.

Our specimens represent var. *glutinosa*, one of five well-defined geographical varieties, the others all occurring in western North America. Other *Tofieldia* species occur in Eurasia and the Andes of South America.

30. *Zigadenus elegans* Pursh ssp. *glaucus* (Nutt.) Hultén [*Z. e.* var. *g.*]. WHITE OF DEATH CAMAS. Widespread from Alaska to northern Mexico (ssp. *elegans*), east through Minnesota to Quebec and New York, and disjunct to the Ozarks and southern Appalachians; occasional in Wisconsin in the region of limestones (dolomites) in a variety of usually sunny habitats such as **oak openings** and dry to dry-mesic, gravelly calcareous prairies, limestone-capped sandstone bluffs, cliffs and outcrops, stabilized sand dunes along Lake Michigan and, rarely, damp, shaded calcareous sandstone ledges on the Kickapoo River; on north-facing slopes in the open prairie habitats. (5) Flowering from late May through July, fruiting from mid August to early September.

Wisconsin plants are usually treated as *Zigadenus glaucus* or *Z. elegans* var. (or ssp.) *glaucus*, an Ozarkian-Appalachian element, which is, however, scarcely or not at all separable in the Great Lakes region from the cordilleran *Z. elegans*, if the latter occurs here at all.



ORCHIDACEAE—the Orchid Family

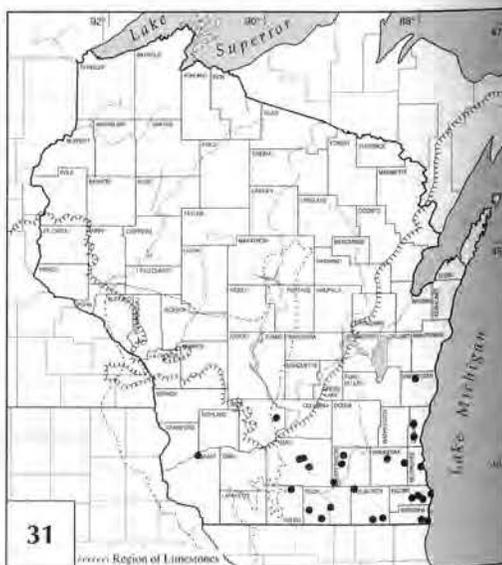
Perennial herbs, the majority tropical and epiphytic, but all of ours terrestrial, often saprophytic (without chlorophyll, nutritionally dependent on fungal mycelia), exceedingly diverse in floral morphology, their strikingly beautiful, bilaterally symmetrical flowers of 6 tepals in 2 whorls of 3 each, the uppermost petal differentiated into a lip that (except in *Calopogon*) points downward because of a 180° twist (resupination) of the inferior ovary, and 1 or 2 stamens fused with style and stigma to form the column. Except for the mealy pollen of the lady's-slippers, pollen grains are agglutinated into 2 (4 or 8) waxy pollinia, delivered by pollinators to the stigma. The capsule produces many thousands of minute, wind-borne seeds. (Case 1987, Correll 1950, Fuller 1933, Luer 1975, Smith 1993)

This, perhaps the largest of all plant families (15,000+ species), has highly specialized flowers adapted to pollination by bees, moths, butterflies, flies, mosquitoes and hummingbirds. The 200 horticultural genera include *Cattleya*, *Dendrobium*, *Epidendrum*, *Paphiopedilum*, *Vanda* and *Vanilla planifolia*, Vanilla Orchid, the pods of which yield the extract of natural vanilla. Native orchids should never be picked or dug, for this will kill them or set them back, nor should they be transplanted except in exceptional circumstances. For a voucher specimen, a portion of the inflorescence and a sketch of the habit and leaf are often sufficient for later identification.

31. *Platanthera leucophaea* (Nutt.) Lindl. [*Habenaria l.*]. EASTERN PRAIRIE FRINGED ORCHID, PRAIRIE WHITE FRINGED ORCHID (U.S. Threatened, WI Endangered). A midwestern species of the Prairie Peninsula, extending eastward to New York and Nova Scotia; rare in Wisconsin, characteristically in rich mesic or **wet-mesic prairies**, as in Jefferson County (Leopold 1940), but sometimes on edges of tamarack fens. (3) Flowering from late June through July, fruiting in September.

This tall orchid presents a striking display because of its large, white inflorescence, pollinated in the early evening by Sphinx moths (Bowles 1983, Sheviak & Bowles 1986).

The lady's-slippers, *Cypripedium candidum* (Threatened), *C. parviflorum* (Special Concern), *C. pubescens* and their even rarer hybrids (Curtis 1932, 1946, 1959) may be found in moist prairies. *Cypripedium candidum*, once shipped by the wagonload from southeastern Wisconsin to Chicago flower markets, is now all but extinct here.





32. *Spiranthes cernua* (L.) Rich. NODDING LADY'S-TRESSES. A widespread North American "compilosppecies" from the Atlantic to the Great Plains; in Wisconsin occasional throughout in moist, open, acidic to calcareous habitats such as sandy lakeshores, swales and ditches, also in peaty, mucky or marly substrates, including **fens**, low prairies, borders of marshes, sedge meadows, bogs and damp thickets, rarely on sandstone ledges in the North; usually among grasses and sedges or in sparse, ecologically open vegetation. (Including the next, 4) Flowering from August through September.

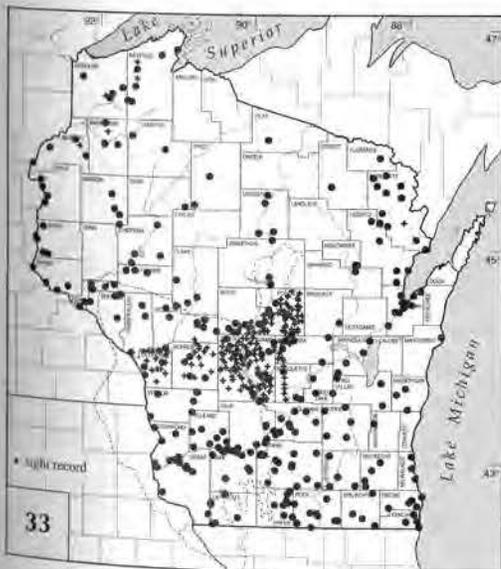
Spiranthes magnicamporum Sheviak. GREAT PLAINS LADY'S-TRESSES. Mostly an eastern Great Plains species; in Wisconsin local on dry to moist calcareous prairies, typically on open gravelly ridges and bluffs of exposed dolomite along the Mississippi River and in rich mesic to moist prairies, wet clay bluffs and swales among sand dunes along Lake Michigan in the southeast. Flowering from late August to mid October.

This stable diploid species, closely related to the above, was recognized as distinct only recently (Sheviak 1973).

POACEAE [GRAMINEAE]—the Grass Family

Annual or perennial herbs (or shrubs to "trees," in bamboos) with cylindrical, jointed stems and 2-ranked leaves, each consisting of sheath, ligule and blade; inconspicuous flowers, consisting of 2–6 stamens, 1 pistil and 1–3 minute scale-like tepals (lodicules), each enclosed by two bracts (lemma and palea), the whole forming a floret; one to several florets, attached to an axis and subtended by 2 empty bracts (glumes), forming a spikelet; and the spikelets in turn variously arranged into inflorescences. Each fertile floret produces a 1-seeded fruit, the grain, or caryopsis. (Fassett 1951, Hitchcock 1951, Pohl 1966)

A vast, worldwide family of over 10,000 species, the Poaceae constitute not only the climax vegetation of seasonally dry regions such as prairies, plains and steppes, but also humanity's most important food crops such as wheat, rice, corn, oats, barley, sorghum and rye, not to mention animal forage and fodder, ornamentals and turf, and raw materials for paper, construction, glue, oils and perfume (the uses of bamboo are legion). The grasses challenge the taxonomist, amateur and professional alike; nonetheless, every wildlife manager, forester or agronomist should know the most significant Wisconsin genera and species on sight.



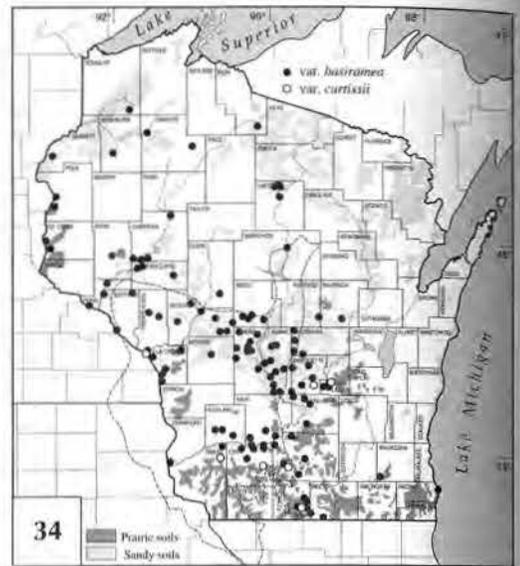
33. *Andropogon gerardii* Vitman. BIG BLUESTEM, TURKEYFOOT. A southern element, widespread from Florida to Mexico, north to Quebec and Saskatchewan; in Wisconsin formerly abundant and still locally common in moist to dry, but especially **mesic prairies**, in dry open woods (often associated with jack pine or scrub oak), and co-dominant with little bluestem on calcareous hill prairies, sandy plains and old fields, but absent from the Precambrian Shield except on roadsides and railroads. (19) Flowering and fruiting in late summer.

The dominant constituent of tallgrass prairies, Big Bluestem, with its 3' to 6' or even up to 9' tall stems, still presides over scenes of unequalled splendor on some of our few remaining unplowed deep-soil prairies.

34. *Aristida basiramea* Engelm. ex Vasey. FORK-TIP THREE-AWN. Interior United States, from Texas to Minnesota and Kentucky, adventive to Maine and Florida; frequent in central and southwestern Wisconsin in dry, sandy, cindery or gravelly soil, most common on **sand barrens**, sandy prairies and abandoned sandy fields, becoming less common in scrubby open black oak woods and on bluffs, slopes below cliffs, and outcrops (sandstone and granite), and weedy on roadsides, railroad tracks, sand and gravel pits, limestone quarries and waste ground. (3)

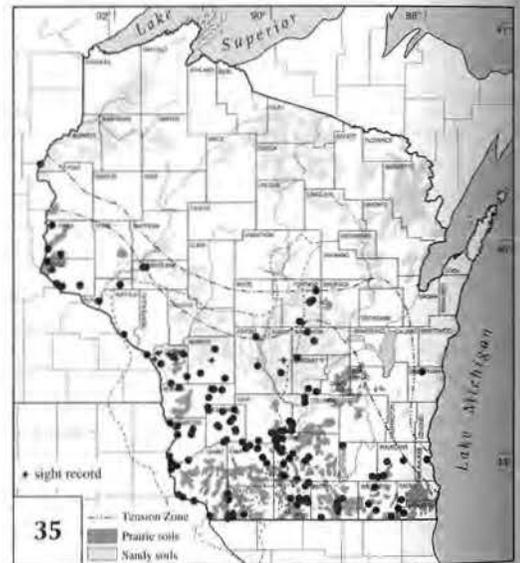
Aristida b. var. *curtissii* (A. Gray ex S. Watson & J. M. Coult.) Shinnery [A. *dichotoma* var. *c.*], CURTISS'S THREE-AWN, of similar habitats but mostly on dry rocks, is more local and sometimes grows with the typical variety.

The lovely *Aristida tuberculosa* Nutt., Beach Three-awn, of the dry sands of the Atlantic coastal states from Massachusetts to Mississippi and again from Lake Michigan to Minnesota, occurs in Wisconsin in sand prairies and barrens, especially in the Wisconsin and Mississippi river valleys.



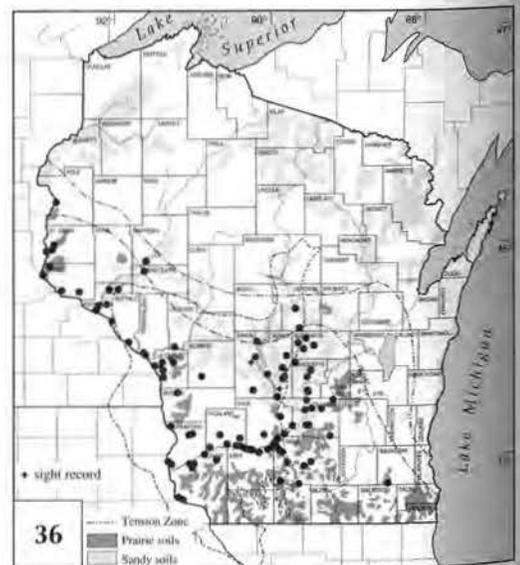
35. *Bouteloua curtipendula* (Michx.) Torr. SIDE-OATS GRAMA. A Madro-Tertiary element, and the most widespread member of a genus found throughout grasslands of the Americas, from Mexico to Canada and also in South America from Colombia to Argentina; in Wisconsin rather common south of the Tension Zone, where it is characteristic of dry-mesic to **dry prairies**, oak openings and cedar glades, usually on sandy plains, gravelly or rocky hills, bluff prairies such as along the Mississippi River, often on calcareous soils, but rarely on roadsides or mine tailings. (5) Flowering and fruiting in late summer.

Side-oats Grama is one of several *Bouteloua* species that are prominent members of the shortgrass flora of the Great Plains region. Like Big Bluestem, Little Bluestem, Indian Grass, Switchgrass and Prairie Dropseed, Side-oats is being more widely planted all the time in landscaping because of its attractive appearance and excellent growth in dry soils. The common name refers to the graceful raceme of small, drooping, oatlike spikes suspended on one side of the common axis (rachis).



36. *Bouteloua hirsuta* Lag. HAIRY GRAMA. Dry prairies, plains and hills, from Wisconsin and North Dakota to Florida, Louisiana, Texas, California and Mexico; not infrequent in the central sands and outwash-filled valleys of the Wisconsin and Mississippi rivers, in dry sandy prairies, **cedar glades**, oak openings and often on dry sandstone or limestone bluff prairies, where it usually grows with *B. curtipendula*. (6) Flowering throughout August and September.

Hairy Grama is easily confused with the almost glabrous Blue Grama, *Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths, a widespread and dominant shortgrass prairie and steppe species of the Great Plains, which barely reaches Wisconsin on the St. Croix and Mississippi river bluffs in St. Croix and Pierce counties, and is rarely adventive along railroads elsewhere in the southern part of the state.

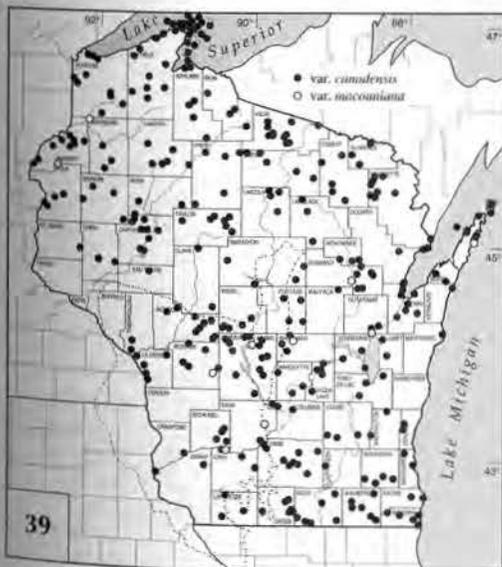




37. *Bromus ciliatus* L. [including var. *intonsus* Fernald]. FRINGED BROME. Transcontinental in temperate North America, south to Maryland, Tennessee, Colorado and California (Mexico); scattered throughout Wisconsin except in the southwest, in open low damp woods, swamps, sedge meadows, prairies, fens, bogs, **alder thickets**, stream banks and shores, northward often in drier, sandy upland oak or aspen woodlands, bracken grasslands, pine plantations and roadside ditches. (11) Flowering from July to early August, fruiting from early July to early October.



38. *Bromus kalmii* A. Gray. KALM'S OF PRAIRIE BROME. Northeastern North America, from New England and southern Ontario south to Maryland and west to Iowa, Minnesota and the Black Hills; throughout Wisconsin our most common native brome, in dry to moist open ground or thickets, chiefly associated with **bracken grasslands** and pine or oak woodlands, especially along borders and clearings, frequently in dry (especially on north-facing slopes) to wet-mesic, calcareous prairies, occasionally along roadsides and in fields. (10) Flowering in July, fruiting from early July to early October.

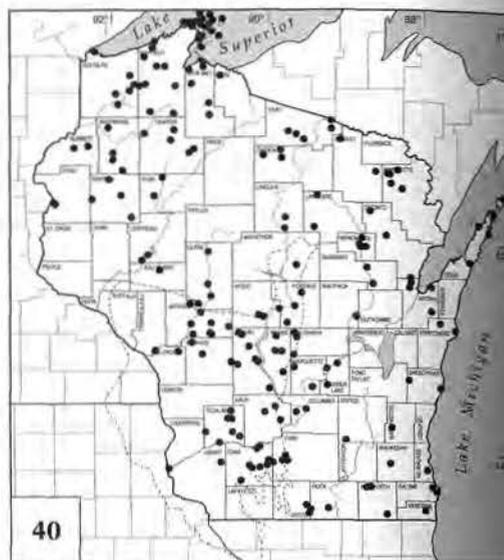


39. *Calamagrostis canadensis* (Michx.) P. Beauv. BLUE-JOINT, REEDGRASS. An aggregate circumboreal species, in North America transcontinental from Greenland to Alaska, south to Arizona and in the mountains to North Carolina; one of Wisconsin's most common wetland grasses, occurring often as a dominant in nearly pure stands, in sedge meadows, marshes, wet prairies, **fens**, swales, bogs, openings in wet thickets, depressions in woodlands, along sloughs, streams, shores and rock pavements along the Great Lakes, only rarely in drier ground. (20) Flowering throughout June.

This highly variable species is represented here mostly by var. *canadensis* [including var. *robusta*], BIG REEDGRASS, and rarely by the small-flowered var. *macouniana* (Vasey) Stebbins, MACOUN'S BLUE-JOINT, MACOUN'S REEDGRASS.

40. *Danthonia spicata* (L.) P. Beauv. ex Roem. & Schult. POVERTY GRASS, POVERTY OAT GRASS. A transcontinental, low-arctic to temperate zone species, from Canada to Florida and New Mexico; in Wisconsin in mesic or more generally dry places, usually in sandy or rocky, poor and thin, occasionally peaty, acidic soil, in **bracken grasslands**, openings in aspen, oak and/or pine woods, barrens or glades, particularly on plains, dunes, ridge tops, bluffs and outcrops, and often weedy in abandoned fields, roadsides, gravel pits and earthen dams. (5) Flowering from late June into early July, fruiting throughout July and August.

A variable species, and, like many others in this genus, often apomictic with abortive anthers.



41. *Digitaria cognata* (Schult.) Pilg. [*Leptoloma cognatum* (Schult.) Chase]. FALL WITCH GRASS. Southeastern North America, west to Minnesota, the southern Great Plains and into northern Mexico; in Wisconsin mostly in the Driftless Area and the central lowlands, where locally abundant, most often on dry to mesic sandy prairies, **sand barrens**, lakeshores and riverbanks, dunes and blowouts, and weedy on roadsides, railroads and sandy abandoned fields. (5) Fruiting from early July into November.

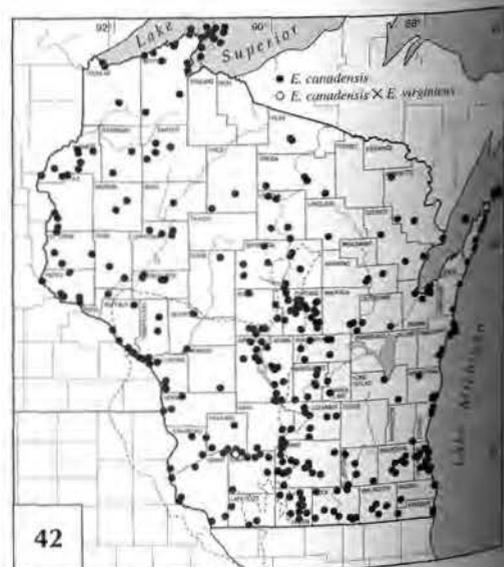
In its delicately branched architecture, Fall Witch Grass superficially resembles *Panicum capillare* L., Common Witch Grass, and *Eragrostis spectabilis*, Tumble Grass (46), two other very common weedy natives that, occupying many of the same disturbed ecological niches, line our highways in the fall with a pale pink haze.



42. *Elymus canadensis* L. CANADA WILD-RYE. Throughout most of the United States and southern Canada to Alaska in one or the other of its varied forms; in Wisconsin common, usually in sandy or gravelly sunny ground, including dry to **wet-mesic prairies**, sandy woods, oak openings and thickets, particularly common on lakeshores, sand dunes and riverbanks, and sometimes weedy along roadsides, railroads and in abandoned fields. (10) Flowering from mid July to mid August, fruiting from early August through October.

Our plants are mostly var. *canadensis* (northern range of the species, south as far as Oklahoma) and var. *robustus* (Scribn. & J. G. Sm.) Mack. & Bush (east-central range of the species). The less well-defined f. *glaucofolius* (Muhl. ex Willd.) Fernald and var. *villosus* Bates are, for the present, included by us in var. *canadensis*. Hybridization with *E. virginicus*, *E. hystrix* and other species may help explain its great variability (Church 1954, 1958, 1967).

Coarse but attractive, this cool-season perennial is easily established in prairie landscape plantings.

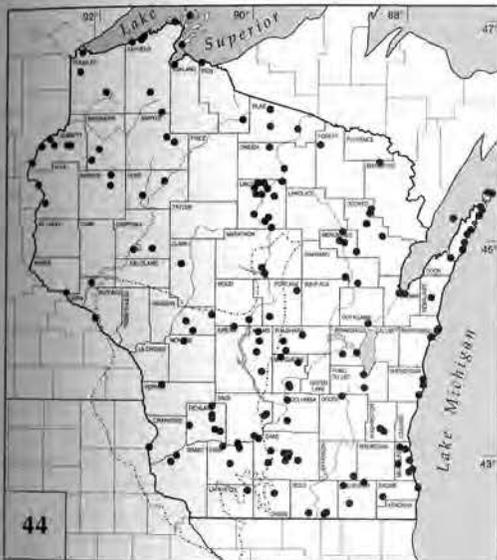




43. *Elymus hystrix* L. [*Hystrix patula* Moench]. BOTTLEBRUSH GRASS.

Widespread in the deciduous forests and northern hardwoods of eastern North America and the eastern Great Plains; in Wisconsin fairly common, especially southward, in rich deciduous or mixed woods such as **southern dry-mesic forests**, less often in dry oak or oak-hickory woods, swamps and thickets, and often on riverbanks and open floodplain forests. (9) Flowering from mid June to mid July.

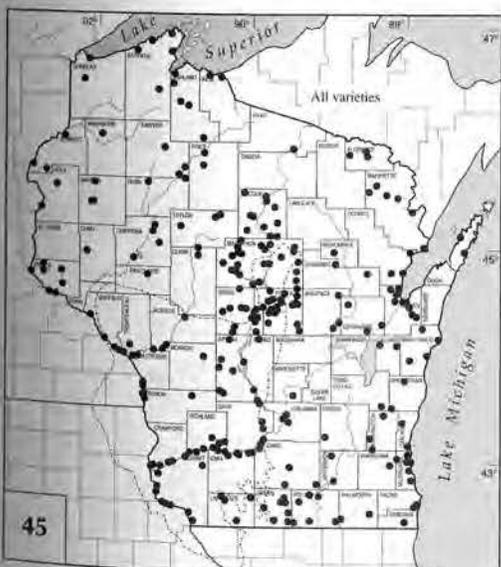
Although very different in appearance owing to its open spikes and obsolete glumes, this charming grass is known to form fertile hybrids with other *Elymus* species such as *E. virginicus*, hence its assignment in recent years to that genus. A variable species, with the typical variety having glabrous to scabrous lemmas, and the var. *bigeloviana* (Fernald) Bowden, BIGELOW'S BOTTLEBRUSH GRASS, pubescent lemmas.



44. *Elymus trachycaulus* (Link) Gould ex Shinnery [*Agropyron caninum* (L.) P. Beauv., misapplied; *A. subsecundum* (Link) Hitchc., in part; *A. trachycaulum* (Link) Malte ex H. F. Lewis].

SLENDER WHEAT GRASS. A transcontinental species with a Canadian, northern Great Plains and far western center of distribution, reaching eastward only into glaciated areas; in Wisconsin common in dry prairies, open woods, **bracken grasslands**, sand barrens, on cliffs, lakeshores and dunes, and sometimes as a weed on roadsides, railroads and other waste places. (9) Flowering from late June to mid July, fruiting from mid July to late September.

Despite much study, there remains a lack of understanding of the variability and proper infraspecific classification of this polymorphic species. Of the five variants that have been recognized for Wisconsin, ssp. *trachycaulus*, the characteristic Slender Wheat Grass of the prairie states, is the most common.



45. *Elymus virginicus* L. VIRGINIA WILD-RYE. A widespread, highly

variable temperate zone forest species of eastern North America, from Newfoundland to Florida, extending west across the Great Plains as far as Alberta, Washington and Arizona; frequent throughout Wisconsin in **southern wet forests** and other low deciduous woods and thickets, especially along stream banks and flood plains, marshy, often sandy or swampy shores, damp meadows and prairies. (5) Flowering from the end of June through July.

Our specimens fall into four intergrading varieties (or forms or species), namely, var. *intermedius* (Vasey) Bush, var. *jejunus* (Ramaley) Bush, var. *submuticus* Hook. and var. *virginicus*. Hybrids with *Elymus hystrix* and *E. canadensis* rarely occur. On-going work by Julian J. N. Campbell should soon help clear up this difficult taxonomy.

46. *Eragrostis spectabilis* (Pursh) Steud. [including var. *sparsihirsuta* Farw.]. TUMBLE GRASS, PURPLE LOVE GRASS. A perennial, very widely distributed, from Maine to Minnesota, south to Florida, Texas, Mexico and Belize; locally common in western, central and southern Wisconsin in dry, open, sandy or gravelly ground, in **sand barrens**, dry sandy prairies, oak openings and dry sandy shores, conspicuous (even in northern Wisconsin) as a weed on roadsides, railroads and old sandy fields, spreading into waste places, there resembling *Digitaria* [*Leptoloma*] *cognata* and *Panicum capillare*, two other pink tumbleweeds of similar ecology. (2) Flowering from mid June into early October.

Eragrostis pectinacea (Michx.) Nees ex Steud., Low Love Grass, frequents sand prairies, sandy shores, and cultivated and waste ground.

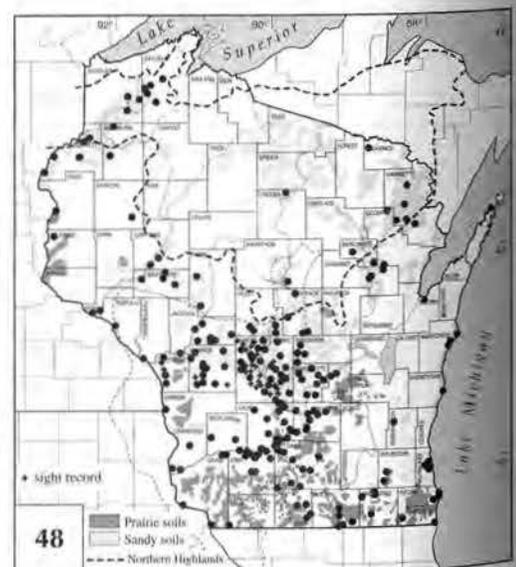
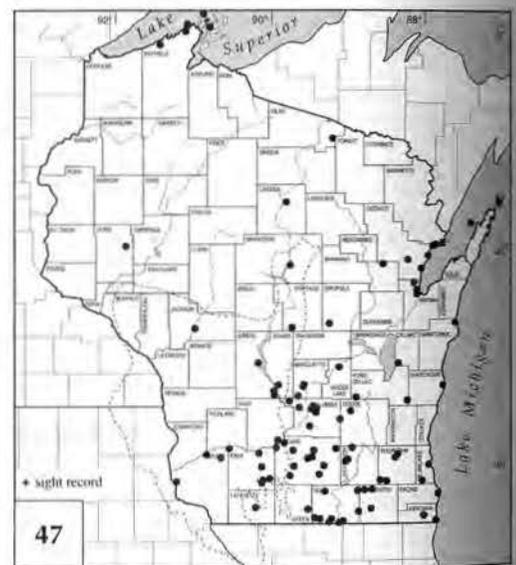
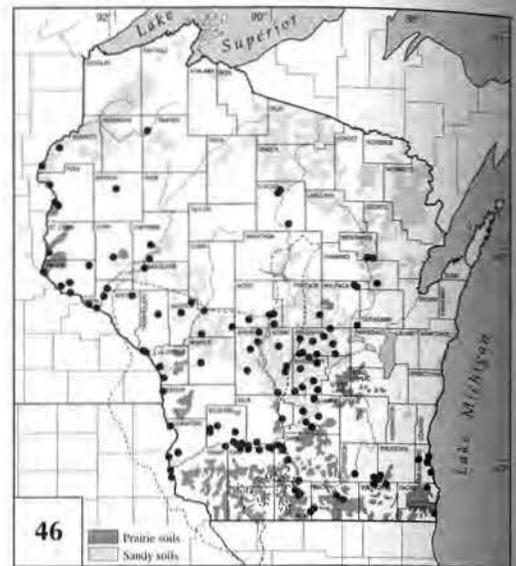
47. *Hierochloa hirta* (Schrank) Borbas ssp. *arctica* (J. Presl) G. Weim. [long called *H. odorata* (L.) P. Beauv.]. SWEET GRASS, VANILLA GRASS. Circumboreal, from North America to Eurasia in low-arctic to cool-temperate zones, south to New Jersey, Ohio and Arizona; scattered in the southeastern half of Wisconsin, rare in the north, usually in **wet prairies**, swales, shores and edges of woods and bogs, and occasionally in wet sandy fields and roadsides. (4) Reflecting its arctic and boreal biogeography, it is the earliest of our grasses, blooming from March to mid June.

Like many northern species, Vanilla Grass has reduced sexual reproduction due to polyploidy leading to apomixis (asexual seed formation). The sweet vanilla-like fragrance is due to coumarin, the same substance that in wet alfalfa is often lethal to cows. Investigation of this problem at the University of Wisconsin in the 1930s led to the discovery of the rat poison Warfarin and the anticoagulant Coumadin.

Native Americans used the long shiny leaves produced during the summer to make fragrant baskets.

48. *Koeleria macrantha* (Ledeb.) Schult. [*K. cristata* Pers.; *K. pyramidata*]. JUNE GRASS, PRAIRIE JUNE GRASS. Circumboreal and throughout most of Canada and the United States, common in the western states and on the prairies and plains; in Wisconsin lacking from the Northern Highlands and eastern deciduous forests, but regionally common in sandy jack pine, black oak or Hill's oak woodlands, **sand barrens**, dry or dry-mesic prairies, occasionally wet-mesic prairies (e.g., Young and Avoca prairies), sandy abandoned fields, sand dunes and other disturbed sandy places. (13) Flowering in early summer (throughout June and July).

Although for many years known as *Koeleria cristata*, and more recently treated as conspecific with the strictly European *K. pyramidata* (Lam.) P. Beauv. by several North American authors, according to Arnow (1994), these are two distinct species, with the correct name for all North American material being *K. macrantha*.





49. *Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb. PRAIRIE OR PLAINS MUHLY. Typical of the northern Great Plains short-grass prairies and steppes, from Alberta to New Mexico, east to the Ozarks, Illinois and Michigan, rarely beyond; in Wisconsin locally common on the very steep, very dry, southwest-facing Mississippi River bluffs, which for all practical purposes have shortgrass or steppe vegetation, otherwise rare and scattered in southern Wisconsin just beyond the Wisconsin terminal moraine in Dane and Green counties (Curtis 1959), in sandy, gravelly or rocky, dry or **dry-mesic prairies**, rarely in abandoned limestone quarries. (4) Flowering throughout September, fruiting in October.



50. *Muhlenbergia glomerata* (Willd.) Trin. MARSH WILD-TIMOTHY, MARSH MUHLY. Eastern North America, from North Carolina to southern Canada and west to Nebraska, the Dakotas (rare) and rarely beyond; in Wisconsin widespread except for the southwest, mostly in moist or wet open ground, locally frequent in sedge meadows, fens, prairies, shrub carrs, bog mats, openings in tamarack swamps, and occasionally in moist woods. Flowering from mid July to mid September, fruiting from mid September to early October.

This species and the next (51) are somewhat allopatric in Wisconsin, but largely sympatric in the upper Midwest and not always readily separable. Nonetheless, they may be distinguished cytologically, geographically and ecologically. *Muhlenbergia glomerata*, a diploid, is basically a north-eastern (Appalachian) hydrophilic element, whereas the tetraploid *M. racemosa* is a mesic tallgrass prairie element (Pohl 1969). Curtis (1959) evidently scored both species as *M. racemosa* and listed bracken grasslands as the community of maximum presence.



51. *Muhlenbergia racemosa* (Michx.) Britton, Sterns & Poggenb. UPLAND WILD-TIMOTHY. Western and central North America, from Alberta to Michigan and Illinois, in the Great Plains south to northern Texas and Arizona, also eastern Washington and Oregon; in Wisconsin infrequent, but most common southwestward, in moist, mesic or dry prairies, on sandstone or limestone rock outcrops and bluffs, and occasionally along roadsides, railroads and in disturbed places. (Including *M. glomerata*, 11) Flowering from early July to early September, fruiting from late September through October or later.

Similar to *Muhlenbergia mexicana* (L.) Trin. (with which it crosses), *M. sobolifera* (Muhl. ex Willd.) Trin. and especially *M. glomerata* (50), its eastern counterpart, all of which sometimes occur in Wisconsin prairies.

52. *Panicum leibergii* (Vasey) Scribn. [*Dichanthelium leibergii* (Vasey) Freckmann]. LEIBERG'S OR PRAIRIE PANIC GRASS. Prairies and open woods, from the northern Great Plains of Alberta to Oklahoma, and in the Prairie Peninsula to Illinois and Michigan (New York); in Wisconsin infrequent to locally common south of the Tension Zone, in dry, wet-mesic or **mesic prairies**, in dry, bluff-top and sandy or gravelly hillside prairies, oak savannas and railroad right-of-way prairies. (10) Flowering from late May to late June (main sexual culms), mid June to early August (axillary, apomictic, autumnal shoots).

This lovely grass, a conservative prairie species, is now rarely seen; it survives only in our few mesic prairie relics.

At least eight other taxa of panic grass (*Panicum*) occur in Wisconsin grassland and savanna communities, notably *P. capillare*, *P. flexile*, *P. implicatum*, *P. praecocius* (prairies; 55), *P. columbianum*, *P. depauperatum*, *P. linearifolium* (sand barrens) and *P. meridionale* (juniper glades), all except the first two often assigned to the segregate genus *Dichanthelium*.



53. *Panicum oligosanthos* Schult. var. *scribnerianum* (Nash) Fernald [*Dichanthelium oligosanthos* (Schult.) Gould var. *scribnerianum* (Nash) Gould]. FEW-FLOWERED OR SCRIBNER'S PANIC GRASS. Widespread from the eastern Great Plains and southern Canada to northern Mexico; in Wisconsin frequent south of the Tension Zone in dry, open, sandy or gravelly ground, including dry or **dry-mesic prairies**, steep high lime or sandy prairies, sandstone ledges, open oak woods, often in mesic to moist prairie relics along railroad rights-of-way, and sometimes weedy, spreading to fields and roadsides. (10) Flowering from late May to mid July (main sexual culms), late June to October (axillary, apomictic, autumnal shoots).

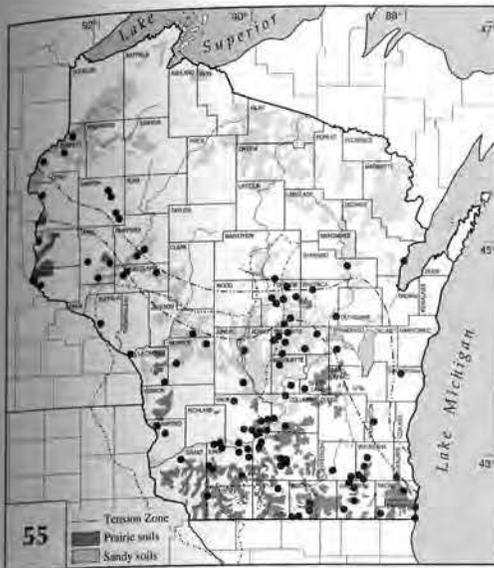
Wisconsin plants belong to the common phase of the species and may readily be distinguished from the southern var. *oligosanthos*.



54. *Panicum perlongum* Nash [*Dichanthelium perlongum* (Nash) Freckmann]. LONG-STALKED PANIC GRASS. A prairie and plains species (southern Manitoba to Texas, east to Indiana); frequent in central and south-central Wisconsin, rare and scattered elsewhere, particularly on dry-mesic to **dry prairies**, oak savannas, often on prairie hillsides, sand prairies, sandstone or limestone outcrops, ancient lavas at the Dells of the St. Croix and sometimes spreading to old fields and roadcuts. (7) Flowering from late May to mid June (main sexual culms), mid June to late July (axillary or basal, apomictic, autumnal shoots).

Morphologically intermediate between *P. linearifolium* Scribn., with which it is united by some authors (? Curtis 1959, Gleason & Cronquist 1991), and *P. depauperatum* Muhl., this perhaps a hint as to its origin.





55. *Panicum praecocius* Hitchc. & Chase [*Dichantherium acuminatum* var. *villosum*; *D. villosissimum* (Nash) Freckmann var. *praecocius* (Hitchc. & Chase) Freckmann; *P. lanuginosum* var. *p.*]. EARLY OF PRAIRIE PANIC GRASS. Sand hills and dry prairies, from North Dakota south to Texas, east to Michigan; in our region basically a prairie species, frequent in central and southern Wisconsin on loam or sandy soils, most often in **oak barrens**, mesic to dry prairies, open oak woods, clearings, edges, fields and roadsides. (5) Flowering from mid June to early July (main sexual culms), late June to early September (axillary, apomictic, autumnal shoots).

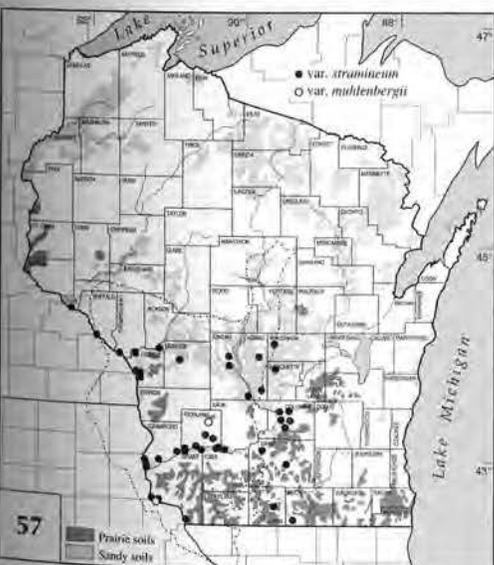
A member of the *Panicum lanuginosum* Elliott complex, and seemingly a link between it and the likewise variable *P. villosissimum* Nash.



56. *Panicum virgatum* L. SWITCH GRASS. One of the main tallgrass prairie and Great Plains species, common throughout much of the United States, northern Mexico and Cuba; common throughout much of Wisconsin except for the Northern Highlands (Precambrian shield) and the wooded northeast, in sunny, dry to moist sandy soils or less often seasonally marshy ground, in mesic to low prairies, swales, dunes, **sand barrens** and blowouts, riverbanks and sand bars, spreading into fields, roadsides, railroads and adjoining waste ground. (10) Flowering from July to early October.

Like Big Bluestem and Indian Grass, Switch Grass is late-blooming, thus betraying its southern origins. It is enormously variable due to various levels of polyploidy, with aneuploidy also reported (see work on Wisconsin populations by UW Dept. of Agronomy professor E. Nielsen 1944, 1947).

Switch Grass is easily established and therefore very suitable for prairie restorations. Although a major dominant farther west, Switch Grass was not as important in Wisconsin prairies.

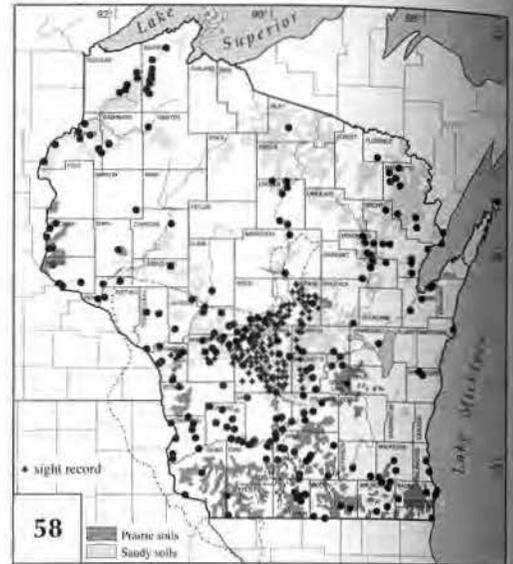


57. *Paspalum setaceum* Michx. [*P. ciliatifolium*]. HAIRY BEAD GRASS. Our only member of an enormous tropical and subtropical genus, *P. setaceum* ranges throughout the eastern half of the United States, from New Hampshire and southeastern Minnesota to Panama; occasional in southwestern Wisconsin, in dry or mesic, usually very sandy soil, in black oak woodlands, stabilized sand dunes and xeric sand prairies on the Mississippi and Wisconsin river terraces, and often spreading to fields, roadsides, railroads and waste places. Fruiting from early July through September or into October.

Our two intergrading varieties are the common var. *stramineum* (Nash) D. Banks, STRAW-COLORED HAIRY BEAD GRASS, and var. *muhlenbergii* (Nash) D. J. Banks, MUHLENBERG'S HAIRY BEAD GRASS, collected only twice. Seven other varieties have been recognized in the *Paspalum setaceum* complex (Banks 1966).

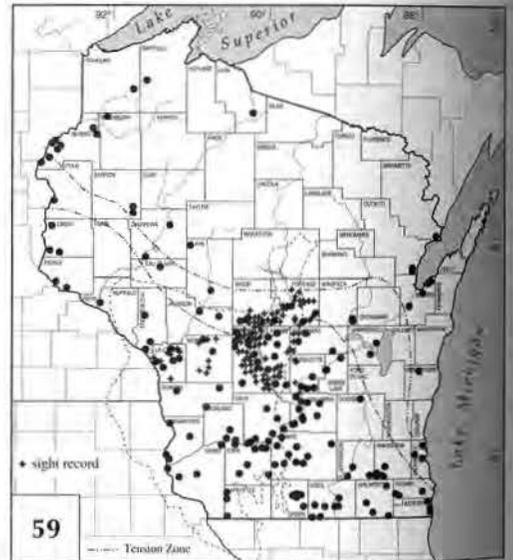
58. *Schizachyrium scoparium* (Michx.) Nash [*Andropogon scoparius* Michx.]. LITTLE BLUESTEM, PRAIRIE or BROOM BEARDGRASS. Abundant, enormously polymorphic and wide-ranging, from southern Canada and across most of the United States to Mexico, an abundant important constituent of tall- and mixed-grass prairies, on dry, rocky or sandy soil generally; in Wisconsin widespread and locally common in **dry prairies**, especially steep south-facing "goat prairies," but also open oak woods, pine barrens, cedar glades, dunes, sand plains and shores, and spreading along roadsides, railroads and into old fields. (15) Flowering from mid July through September (mid October), fruiting from late August through October.

Although highly variable, all of our material belongs to ssp. *scoparium*. Only occasional specimens of ssp. *divergens* (Hack.) Gandhi & Smeins, not easily distinguished from ssp. *scoparium*, have been seen from the state. The genus *Schizachyrium* includes all *Andropogon* species with only one raceme (rame) at the end of each culm or culm branchlet.



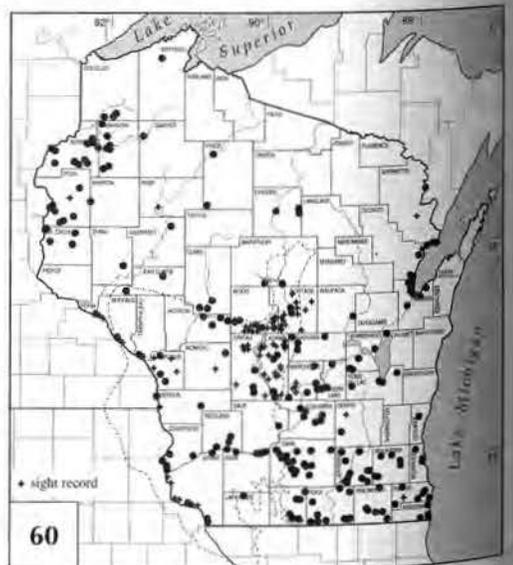
59. *Sorghastrum nutans* (L.) Nash. INDIAN GRASS. Prairies, open woods and fields throughout eastern and central United States, from southern Canada into central Mexico, often dominant or subdominant with *Andropogon gerardii* and *Schizachyrium scoparium* (on uplands), *Koeleria macrantha* (on slopes), or *Spartina pectinata* (in lowlands) in the tallgrass prairie; in southern and western Wisconsin mostly south of the Tension Zone, in **dry-mesic prairies**, open pine, oak or red cedar woods, spreading somewhat onto disturbed sandy fields, roadsides and railroads, especially in north-eastern and northwestern parts of the state. (10)

Another coarse, rhizomatous perennial and midsummer bloomer, characteristic of tallgrass prairie, the culms reaching up to 7' tall and growing either in dense stands or as single stems. Indian Grass produces a much thinner sod than Big Bluestem (33). Floristically, *Sorghastrum* is a small genus with South American (Argentinian) relationships.



60. *Spartina pectinata* Link. CORDGRASS, PRAIRIE CORDGRASS, SLOUGH-GRASS. From Newfoundland to Washington and Texas, a widespread prairie and plains species of an otherwise cosmopolitan coastal, mostly halophytic genus; locally frequent in Wisconsin in **wet prairies**, fens, sedge meadows, sandy shores, and dry to damp grassy to wet marly spots along roadsides and railroads, sometimes in dry sand. (9) Flowering in early fall.

The leaves are drawn out into a very long, threadlike tip and are sharply roughened on the margins. Seeds are rarely produced in most species of *Spartina*; reproduction and perennation are carried out almost entirely by rhizomes.

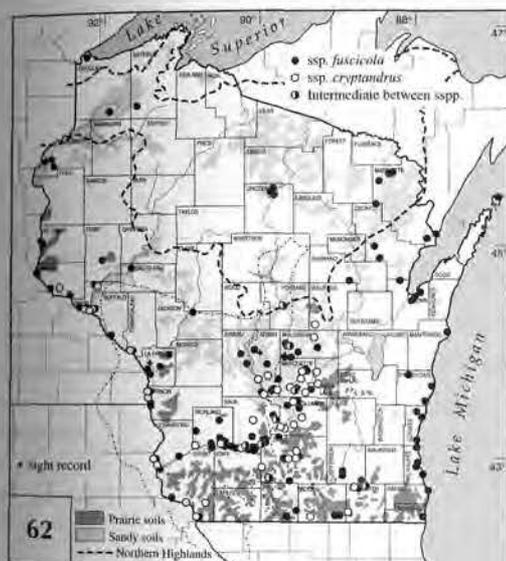




61. *Sporobolus compositus* (Poir.) Merr. [*Sporobolus asper*]. ROUGH or TALL DROPSEED. A near-transcontinental species of dry, often sandy soil, especially on prairies, plains and sometimes beaches, from Texas and New Mexico to Canada; rather rare in the southern third of Wisconsin, where thought by Fassett (1951) to be "probably adventive," possibly not present in undisturbed prairie, but now known to occur in the southwest on most **dry prairies** and a few mesic prairies as well, occasionally spreading to railroads, roadsides, gravel pits and other waste places. (3) Flowering and fruiting in late summer and early fall.

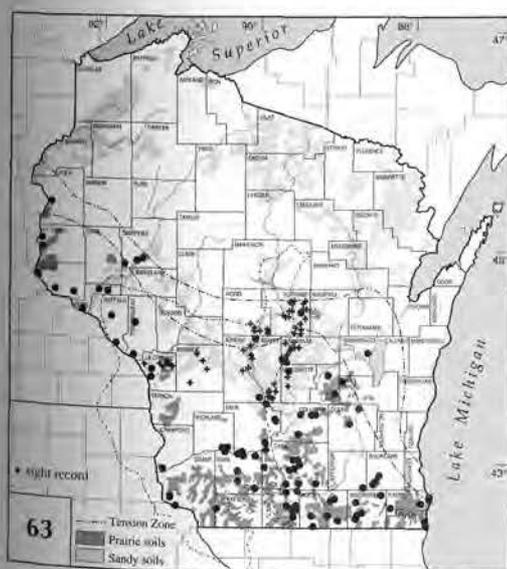
Plants of our range represent var. *compositus*.

- Sporobolus clandestinus* (Biehler) Hitchc. [*S. asper* var. *clandestinus*; *S. canovirens*]. Rough Dropseed, Rough Rush Grass. Our only and isolated record for this southern grass (Texas to southeast Iowa and Illinois, east to Florida and Connecticut) is from a sand prairie south of Bell Center in Crawford County.



62. *Sporobolus cryptandrus* (Torr.) A. Gray. SAND DROPSEED. Widespread in temperate North America, common from the northern Great Plains into Mexico and from the Atlantic coast to the Rocky Mountains and beyond; in Wisconsin mostly south of the Tension Zone, essentially absent from the Cambrian Shield, in dry, sandy soil, occasionally in relatively undisturbed, open to lightly wooded barrens, **cedar glades**, dunes and shores, but locally abundant and weedy in fields and along roadsides and railroads. (7) Flowering from mid June to mid September, fruiting from mid July to mid October.

Divisible on minor characters into ssp. *cryptandrus*, mostly along the Mississippi, Wisconsin and Black rivers and the beds of glacial lakes Wisconsin and Oshkosh, and ssp. *fuscicola* (Hook.) E. K. Jones & Fassett, ranging farther north and east, but like the former, lacking from the area of Precambrian rocks of the Northern Highlands.



63. *Sporobolus heterolepis* (A. Gray) A. Gray. PRAIRIE or NORTHERN DROPSEED. A tussock grass *par excellence*, of Madro-Tertiary (southwestern and Mexican) floristic affinities, widespread on prairies from Quebec and Ohio to the mixed prairies of the northern and eastern Great Plains (Saskatchewan to Texas and northern New Mexico); in Wisconsin more or less infrequent south of the Tension Zone, where it is an indicator of unplowed and relictual **dry prairies**, often toward the bottoms of steep hill prairies and on river terraces where conditions are more mesic. (9) Like all Madro-Tertiary elements, flowering (August to early September) and fruiting (late August to early October, rarely November) in late summer and fall.

A major dominant of undisturbed dry-mesic and mesic prairies and a prevalent species of dry and wet-mesic prairies (Curtis 1959). A handsome grass, Prairie Dropseed is being planted more and more often not only in wildflower meadows and prairie restorations, but also in more formal gardens.

64. *Sporobolus vaginiflorus* (Torr. ex A. Gray) A. W. Wood. POVERTY GRASS, POVERTY DROPSEED. Throughout eastern North America, from (Nova Scotia) Michigan to South Dakota, south to Georgia, Nebraska, Arizona and Mexico; frequent in much of Wisconsin in dry sandy or gravelly open habitats, often on prairie hillsides, dry bluffs and **cedar glades**, most commonly as a weed along sandy or gravelly roadsides, railroads and even city sidewalks. (3) Flowering from mid August to early September or later, fruiting from late August into October.

Divisible into var. *vaginiflorus*, rare on dry bluffs and hillsides in southwestern Wisconsin, and the far more widespread and weedier var. *inaequalis* Fernald.

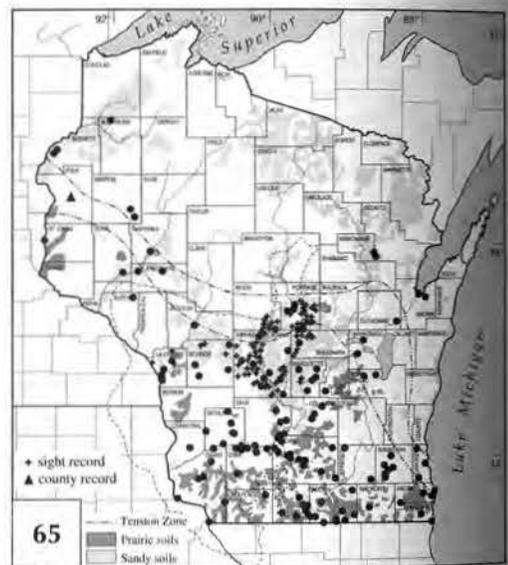
Sporobolus neglectus Nash, Small Dropseed, another delicate annual found in southeastern Wisconsin, is extremely similar except in spikelet size.



65. *Stipa spartea* Trin. [*Hesperostipa spartea* (Trin.) Barkworth]. NEEDLE OF PORCUPINE GRASS. Dry prairies and plains, extending from (Yukon) Alberta to northern New Mexico, eastward through the Great Plains to eastern Kansas and Indiana (Pennsylvania); in Wisconsin locally frequent south of the Tension Zone in open, sandy or gravelly soil, particularly in dry to **dry-mesic prairies**, sand prairies, open oak woods and dunes, sometimes spreading to roadsides and railroads. (9) A northern grass, it flowers in early summer.

The enormous and persistent twisted awn responds to changes in atmospheric moisture and, by coiling and uncoiling, ratchets and drills the sharp-pointed callus at the base of the fruit into the ground, thus helping to plant it.

The more slender *Stipa comata* Trin. & Rupr., Needle-and-thread, characteristic of Great Plains mixed prairies, reaches eastern Minnesota, but has been found in Wisconsin only along railroads as an introduction, though in some sand prairie relicts in Portage, Iowa and Rock counties it may well be native.



Chiwaukee Prairie Scientific Area
Kenosha County, Wisconsin

SMILACACEAE—the Catbrier Family

Herbaceous to partly woody vines or perennial herbs, from thick rhizomes or tubers, with prickly stems in some species; simple leaves, these usually with paired tendrils from near the petiole base, and blades commonly with 3 to 7 “parallel” main veins; small, radially symmetrical flowers borne in umbels (sometimes racemes or spikes), usually unisexual (the sexes on separate individuals), and with 6 greenish, whitish, yellowish or brownish tepals, 6 stamens and 1 superior pistil; and a fruit that matures into a small blue or red berry with (mostly) 1 to 6 seeds. (Mangaly 1968, McIntosh 1950)

A small but cosmopolitan, mostly tropical family that includes the large genus *Smilax*, Catbrier or Greenbrier, to which all five Wisconsin representatives belong. *Smilax* has broad, net-veined leaves and axillary inflorescences that arise in the angle where a leaf joins the stem. The small, inconspicuous, fetid-smelling flowers are pollinated by small insects, mostly flies in our species.



66. *Smilax herbacea* L. [*S. h.* var. *h.*]. SMOOTH CARRION-FLOWER.

Mostly southern (Appalachian), from Quebec to Alabama, in the upper Midwest very rare (Wisconsin, Michigan, Illinois) or infrequent (Minnesota), including only strictly glabrous plants, these very rare in southern Wisconsin, where known only from cutover woods, grassy weedy banks and thickets in Dane, Grant and Iowa counties. Flowering in July, fruiting in September.

All pubescent specimens from Wisconsin previously identified as *Smilax herbacea* are now assigned to *S. lasioneura*, which may represent only a pubescent western variant, or occasionally to *S. illinoensis* Mangaly, which might have resulted from past hybridization of *S. lasioneura* with *S. ecirrhata* (Mangaly 1968).



67. *Smilax lasioneura* Hook. [*S. herbacea* L. var. *lasioneuron* (Hook.) A. DC.]. HAIRY or COMMON CARRION-FLOWER.

From mainly west of the Appalachian Mountains to Montana, south to western Florida and Oklahoma; in Wisconsin frequent (sporadic northward) in all kinds of open deciduous woods and thickets, from oak-pine woodland and **southern dry forests**, oak openings and edges of prairies, through rich maple-basswood to flood plain forests, especially along borders and clearings, stream banks, marsh margins and old pastures, overgrown relictual cemetery prairies, fencerows, roadsides and railroads (often with other climbing or sprawling vines). (15, as *S. herbacea*) Flowering from late May to mid July, fruiting from August to Thanksgiving, the dark, almost-black fruiting umbels favorite objects for dried flower arrangements.

CLASS MAGNOLIOPSIDA

The Dicotyledons



ACANTHACEAE—the Acanthus Family

These herbs, vines or small shrubs have distinctive vegetative characters: namely stems that shrink or collapse beneath each node when dry, notable development of bracts and bracteoles, and simple, opposite leaves. Flowers bisexual, from essentially regular to bilaterally symmetrical, the corolla generally tubular with a 5-lobed limb (as in *Ruellia*) or more often bilabiate. Stamens usually 4 or 2 (and 1 or 2 staminodes frequently present). Ovary superior, with 2 to 10 ovules in each of the 2 chambers. Fruit usually an elastically dehiscent capsule, in which the outer halves or “valves” spring apart at maturity, flinging out the seeds by pegs called “ejaculators” and leaving a persistent central column. (Long 1970)

Pantropical, in the New World abundant from Brazil to Mexico, but only marginally represented in the United States (7 indigenous species in the Northeast, 1 of these barely entering Wisconsin). The Acanthaceae are of slight economic importance. A number of species are cultivated for ornament, including Shrimp Plant, Clock Vine and Bear’s-Breech, and a few are dye plants.

- 68. *Ruellia humilis* Nutt. HAIRY RUELLIA (Endangered).** A widespread species polymorphic in the southern states, from Pennsylvania to southern Michigan and eastern Iowa, south to Florida and Texas; very rare in southern Wisconsin, in dry open ground, dry or dry-mesic prairies, but more often in disturbed prairie-like areas, including railroads, river terraces and bluffs; rarely established as an escape from cultivation along weedy roadsides (as at Middleton, Dane County, where collected in 1995). Possibly introduced from farther south, but found locally in prairie remnants, albeit naturally open habitats, and collected very early (the earliest Wisconsin specimens are without date but were collected ca. 1849 to 1862). Flowering from the end of June to mid-September, fruiting from the end of July to September.

Ruellia humilis increases through self-seeding in gardens and may eventually become more noticeable as an adventive. The only Minnesota collection, just across the Wisconsin state line, was apparently introduced (Ownbey & Morley 1991).



ANACARDIACEAE—the Cashew or Sumac Family

Shrubs or small trees with resinous tissues, sometimes poisonous, and simple or pinnately compound leaves. Flowers in branching inflorescences, mostly small and numerous, bisexual or unisexual (including North American species), 3- or 5-merous. Stamens (in ours) usually 5, arising from or under the edge of a nectariferous disk. Pistil 1, the developed ovary 1-chambered, 1-seeded. Fruit usually a drupe. (Barkley 1937, Brizicky 1962, Fassett 1940)

Predominantly tropical, but extending into temperate Europe, Asia and America, where its principal representatives are sumacs, poison-oak, poison sumac and poison-ivy, the latter three well known for causing contact dermatitis in people allergic to them. The family is a source of edible seeds (cashew and pistachio “nuts”) and fruits (mango), some ornamental plants (notably the Smoke-tree), and various products, including tannic acid, resin, oils and lacquers.





69. *Rhus glabra* L. SMOOTH SUMAC. Temperate North America, from New England and southwest Quebec to southern British Columbia, south to northern Florida, Texas, Nevada and Mexico; in Wisconsin abundant in dry, more or less open ground (plains, slopes, banks, bluffs), roadsides, railroads, fencerows, dry or **dry-mesic prairies** and prairie-like habitats, sandy barrens, abandoned fields, borders of woods and clearings, including oak openings (often with pines, oaks, hickories). (12) Flowering from mid June to mid July, fruiting from late July into October (fruits persisting until the following June).

Smooth Sumac forms uniform, often large clones that suppress other plants and contribute to the patchwork appearance of prairies. It can become a problem weed in disturbed prairies.

Rhus copallina L. [including var. *latifolia*], Shining or Winged Sumac, is local in central Wisconsin and along the west side of Green Bay in old sandy fields, prairie openings on bluffs, and open, sandy or rocky woods of oak and/or pine.



70. *Rhus* × *pulvinata* Greene [*R. glabra* var. *borealis* Britton, not *R. borealis* Greene]. HYBRID SUMAC. Generally local in north-eastern United States and southern Canada, but rather frequent to common in the Appalachians and Upper Midwest; in Wisconsin frequent in habitats similar to those of its parents: edges of dry, sandy, rocky or loamy woods (oak, pine-oak, aspen), thickets, roadsides, fields, banks, fencerows, prairies and prairie-like areas, often on formerly pastured or cultivated hillsides reverting to forest.

This polymorphic series of presumed hybrids and hybrid segregates is derived from crosses between *R. glabra* and *R. hirta*. Judging from herbarium records, these hybrids are about half as frequent in Wisconsin as *R. glabra* itself, but given the difficulty in identifying specimens without fruit, are probably more common. According to Voss (1985), these are more common in Michigan than pure *R. glabra*.

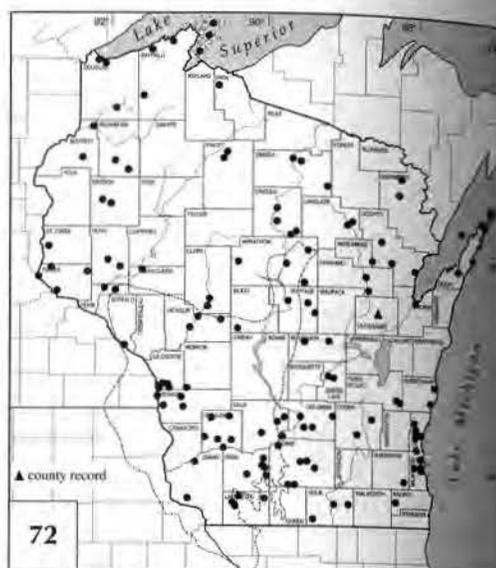


71. *Rhus hirta* (L.) Sudw. [*R. typhina* L.]. STAGHORN SUMAC. Nova Scotia to Minnesota, southward to Iowa and at upper elevations to northern Georgia and northern Alabama; common almost anywhere in Wisconsin in sandy, gravelly or rocky, open or partly shaded habitats: thin, deciduous, mixed or coniferous woods, **oak barrens**, clearings, borders and thickets, wooded or brushy slopes, bluffs and cliffs, roadsides, fields, banks, sand and gravel pits, sometimes moist shores, very rarely in prairies. (10) Flowering from early June to mid July, fruiting from early August through November (fruits persisting through the following June).

Staghorn Sumac is frequently cultivated for its fine autumn color, and some of our collections, especially those with lacinate leaflets, represent garden escapes.

72. *Toxicodendron rydbergii* (Small ex Rydb.) Greene [*Rhus radicans* var. *r.*; *T. radicans* var. *r.*]. RYDBERG'S or WESTERN POISON-IVY. A cordilleran and Great Plains element, from British Columbia to Arizona and Texas, east in glaciated territory through Minnesota and Iowa to Quebec and New England (on a few Virginia mountaintops); in Wisconsin common to abundant, chiefly associated with woods (**southern wet forests**, rich deciduous to dry oak-pine or aspen woods), also on sandy shores and cobblestone beaches, dry prairies, old fields and fencerows, frequently invading cut-over woodland, railroads and waste ground; preferring sandy, gravelly or rocky soil, but also in black organic or clayey soil. (25) Flowering from early June to early August, fruiting from early July through the winter, its white drupes persisting to the following June.

This is the common northern non-climbing poison-ivy often included in a collective *Rhus radicans* L. The climbing southern *Toxicodendron radicans* ssp. *negundo* (Greene) Gillis, Common Poison-Ivy, extends into Wisconsin river valleys.



APIACEAE [UMBELLIFERAE]—the Parsley or Carrot Family

Easily recognized, the umbellifers are typically herbs with alternate or basal, usually compound leaves, sheathing petioles, and small flowers in compound umbels, or in a few genera (e.g., *Eryngium*), dense heads. The very characteristic flowers have 5 minute or obsolete sepals, 5 incurved, soon-deciduous petals, and 5 stamens inserted on the margin of a flat disk on top of the inferior ovary, with the 2 styles and their swollen bases (stylopodium) arising from the disk's center. The fruit is a dry schizocarp separating at maturity into 2 mericarps, these remaining suspended by a slender wiry filament, each mericarp 1-seeded, commonly ribbed and usually with oil tubes between or under the ribs. (Crawford 1970, Fassett 1941, Mathias & Constance 1944–45)

Particularly diverse in north-temperate regions, this nearly cosmopolitan, very natural family of some 3,000 species is closely related to the less highly evolved, more tropical, mostly woody Araliaceae. It includes a large number of food plants (celery, parsnips, carrots), condiments (dill, caraway, fennel and others) and ornamentals (Gout-weed, Masterwort), as well as several deadly poisonous plants (Water-hemlock, Fool's-parsley and Poison-hemlock).



73. *Angelica atropurpurea* L. var. *atropurpurea*. COMMON GREAT ANGELICA, with leaves glabrous beneath, is widespread in northeastern North America, from Labrador to Minnesota, and Illinois to West Virginia and Delaware; local in southeast Wisconsin in marshes, shores, **southern sedge meadows**, swales, fens, stream and lake banks, borders of mixed woods, particularly characteristic of springy habitats such as shaded seepage slopes. (9) Flowering from late May through July, fruiting from late June to early October.

Angelica atropurpurea var. *occidentalis* Fassett. WESTERN GREAT ANGELICA, with leaflets minutely pubescent beneath, is, except in the northeast, frequent in Wisconsin, adjoining eastern Minnesota, eastern Iowa (and northwestern Illinois?) in similar habitats and with the same phenology as the typical variety, but also often in northern sedge-meadows and tamarack swamps. Authors unfamiliar with Wisconsin's flora do not give Western Great Angelica taxonomic recognition despite its obvious geographical-morphological reality.





74. *Cicutu maculata* L. COMMON WATER-HEMLOCK. Wet places throughout much of temperate eastern and central North America; common throughout Wisconsin in moist to wet, deciduous, mixed or coniferous woods and thickets, marshes, shores, sedge meadows, **wet-mesic prairies**, shrub carrs, stream banks, swales, sloughs and ditches. (14) Flowering from late June to early September, fruiting from late July to mid October.

This harmless-looking, white-flowered herb has "tuber-like roots, resembling small sweet potatoes and with the fragrance of parsnips, [that] are deadly poisonous" (Fernald 1950, p. 1095). A European relative, Poison-hemlock, was given to Socrates so as to cause his death.

Daucus carota L., Wild Carrot, Queen-Anne's-lace, is a smaller plant also with white petals but more finely divided leaves. This pernicious, if lovely, Eurasian weed is not only thoroughly naturalized in such Wisconsin communities as roadsides, old fields and waste places but also invades disturbed woods, prairies and other habitats.



75. *Eryngium yuccifolium* Michx. RATTLESNAKE-MASTER. Mostly a grassland, coastal savanna or open woodland perennial herb, widespread from Florida and Texas to New Jersey and southeastern Minnesota; in Wisconsin locally common only in dry-mesic to **wet-mesic prairie** remnants in the southern tiers of counties (at the two northern stations, with their dates of collection, undoubtedly adventive). (6) Flowering from early July to late August, fruiting from late July well into October or later.

This remarkable species is unlike any other native plant in our area in its strap-shaped, yucca-like leaves with parallel venation (really an expanded midrib) and remotely spiny margins, and in its densely flowered, spherical heads (really contracted umbels). It has many relatives in South America, Mexico, the southeastern and western United States, and even several in the Mediterranean region and Near East.



76. *Heracleum lanatum* Michx. [*H. maximum* W. Bartram; *H. sphondylium* L. ssp. *montanum* (Schleich. ex Gaudin) Briq.]. COW-PARSNIP. Widespread in North America, from Alaska and Labrador south to Georgia, Kansas and California (also disjunct, to Siberia); locally frequent throughout Wisconsin in rich, damp, open to shady bottomlands, streamsides, borders of mesic to moist hardwood forests of black ash, elm or silver maple, peaking in **southern dry-mesic forests** (according to Curtis 1959, but most often seen in damp soil of disturbed floodplains, borders of woods and along roadsides), as well as in white cedar swamps, wet thickets, sedge meadows and low prairies, and often weedy on roadsides, pastures and ditches. (4) Flowering from late May to early August, flowering from the end of May through September (fruits may persist until the following spring).

This giant among our umbellifers, to 9' tall and with large, compound leaves and broad, flat umbels, is aptly named after Hercules, a Greek hero of great strength.

77. *Oxypolis rigidior* (L.) Raf. COWBANE, WATER DROPWORT. Eastern North America, from Florida and coastal Texas north to New York and Minnesota; infrequent in the southern half of Wisconsin, in moist habitats, especially marshes, fens and black-soil mesic, wet-mesic and **wet prairies**, often near springs, borders of lowland deciduous woods, swamps of tamarack (with poison sumac) or white cedar, boggy streambanks, swampy thickets, and moist ditches and swales. (8) Flowering from late July through September, fruiting from mid August to mid October.

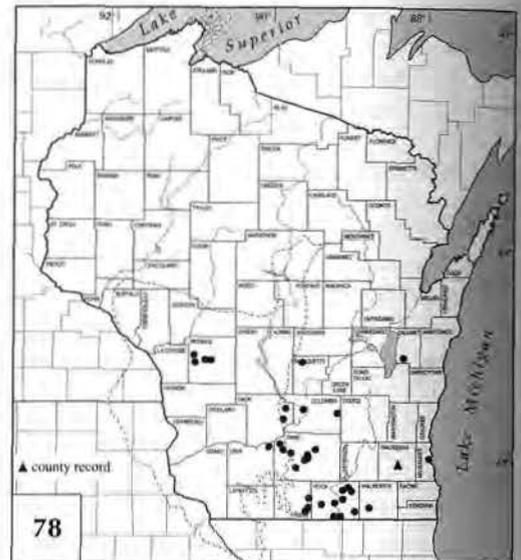
Cowbane bears a superficial resemblance to the less frequent Water-parsnip, *Sium suave* Walter, from which it differs in its entire or irregularly toothed leaflets (versus finely and uniformly toothed in *O. rigidior*) and larger fruits. *Sium* is a less frequent plant of similar habitats, including swales in wet prairies, but occurs more often in marshes, swamps and shores.



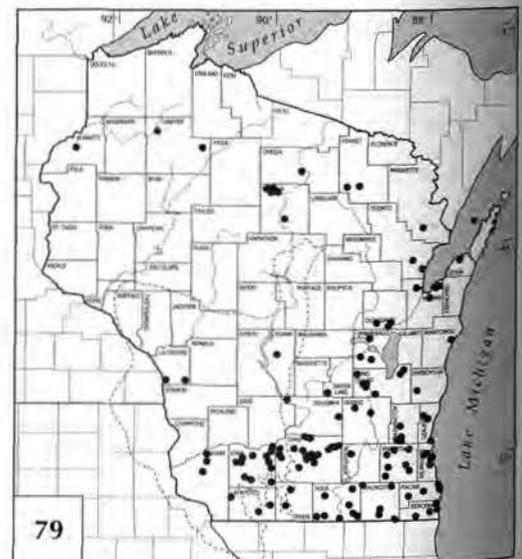
78. *Polytaenia nuttallii* DC. PRAIRIE-PARSLEY (Threatened). A prairies and plains herb, widespread from Kansas, Mississippi and Texas, north to southeastern-most Minnesota and Indiana; in Wisconsin now local in dry to **wet-mesic prairies** along railroads, in oak barrens and cut-over white oak, poplar or oak-hickory forests, and on quartzite outcrops and cliffs in the Baraboo Hills; formerly probably not as rare, but its numbers now drastically reduced due to agricultural destruction or degradation of its habitats. (3) Flowering from late May through June, fruiting from mid July to early November.

Named for its discoverer, Thomas Nuttall (1786–1859), who accompanied the Astoria Party in its 1811 exploration of the upper Missouri River, and who was thus able to describe for the first time many, even the most common, of our prairie species.

Pastinaca sativa L., Wild Parsnip, a ubiquitous Old World weed especially in southern Wisconsin, is a most pestiferous invader of prairies, virgin or restored.



79. *Taenidia integerrima* (L.) Drude. YELLOW PIMPERNEL. An easily recognized, elegant (even delicate) species of mostly open, dry to mesic, rarely moist, eastern deciduous forests, from Georgia and Texas north to Quebec and southeastern-most Minnesota; in Wisconsin in sunny woods and thickets, mainly in the southeast, locally abundant in sandy, gravelly or rocky oak openings, open oak woodlands, and **southern dry forests** of oak-hickory or red oak, and, northward, sporadically in jack pine, aspen and maple-basswood, less often in streambank thickets or swampy deciduous woods, only rarely in prairies, and also as a weed along fencerows, roadsides and railroads. (6) Flowering from early May to early July, fruiting from late June through August.





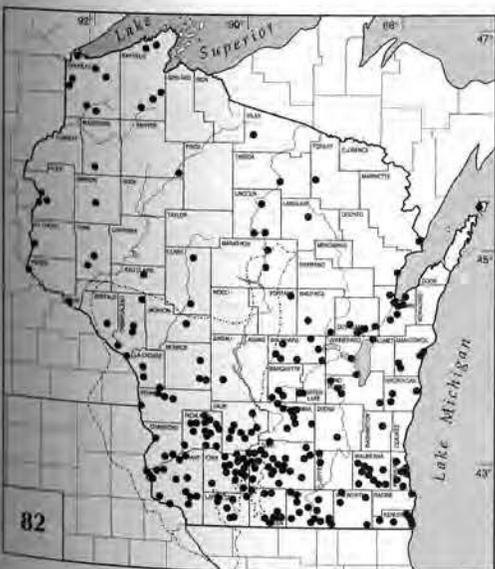
80. *Thaspium trifoliatum* (L.) A. Gray var. *flavum* S. F. Blake. MEADOW-PARSNIP (Special Concern). Prairies, woods and thickets in the eastern and central United States, chiefly in the southern reaches of the Prairie Peninsula from eastern Kansas and Nebraska to southern Michigan and Ohio, eastward to New York and south to Alabama; local in south-central Wisconsin, most frequent on moist to **mesic prairies**, marshy ground near rivers, and rocky oak or oak-hickory woods and thickets, rarely along fencerows, roadsides and railroads. (6) Flowering from early May to early July, fruiting from early August through September.

Frequently confused with the much more common species of *Zizia* (both *Z. aurea* and *Z. aptera*, although more closely resembling the latter), but with all flowers pedicellate (in *Zizia* the central flower in at least some umbellets is sessile) and with fruits prominently winged on all sides (rather than merely ribbed).



81. *Zizia aptera* (A. Gray) Fernald. HEART-LEAVED GOLDEN ALEXANDERS. Spanning the North American continent, from New England and Georgia to Colorado and British Columbia; in Wisconsin occasional in the southeastern and rare in the northwestern quarters, in the former locally common in moist to **mesic prairies**, drained or burned marshland, prairie relics on roadsides or railroads, and bur oak groves, but rarely in dry limy prairies and (in the northwestern part of the state) sandy pine barrens. (5) Flowering from early May to late June, fruiting from late June to late August.

Strongly resembling *Zizia aurea* (82) and nearly identical to *Thaspium trifoliatum* (80), but unlike the former, with most or all of its basal leaves undivided and heart-shaped at the base. All three species are common throughout the tallgrass prairie region, with Common Golden Alexanders preferring moist prairies and lowland thickets, and Heart-leaved Golden Alexanders and Meadow-parsnip reaching greater prevalence in more mesic, upland prairies and savannas.



82. *Zizia aurea* (L.) Koch. COMMON GOLDEN ALEXANDERS. Widespread, from Georgia and Texas north to Quebec and Saskatchewan; very common in southern Wisconsin, less frequent northward, in open, mesic to wet habitats, especially abundant in mesic to **wet prairies** (with *Gentiana*, *Liatris*, *Valeriana*), fens, grassy meadows, old fields, roadsides, openings and thickets on streambanks, rights-of-way and fencerows, less often in dry prairies and in deciduous woods of all kinds, but there especially in open mesic spots. (11) Flowering from mid May through July, fruiting from mid June to early September.

See comments under the previous two species (80, 81).



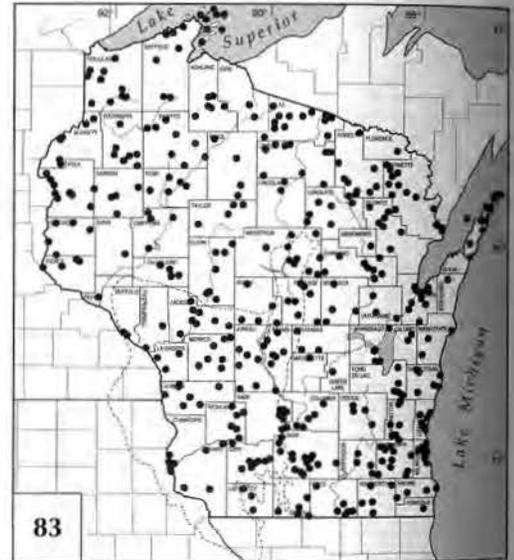
APOCYNACEAE—the Dogbane Family

Chiefly tropical and subtropical, often twining herbs, lianas, shrubs or trees, with mostly opposite, simple leaves, milky juice, and radially symmetrical 5-merous flowers with a pistil of 2 carpels united either by a common style (ours) or for their whole length. The corolla, unlike that of the closely related but more specialized milkweeds, is often funnellform or slenderly tubular with expanded lobes twisted in bud, bearing stamens that often come together around, and sometimes adhere to, the single, thickened, stigmatic cap, their pollen not in pollinia, but in tetrads. The fruits in our species are paired elongate follicles that open along the seed-bearing suture to release many silky-comose seeds, but in the tropics they may be dry capsules or fleshy berries or drupes. (Rosatti 1989, Woodson 1938)

Its many ornamental plants include Oleander, Frangipani and Periwinkle (*Vinca minor*), and tropical species yield many toxic alkaloids and glucosides such as the antileukemic drugs vincristine and vinblastine, derived from the commonly cultivated Rosy Periwinkle (*Catharanthus rosea*) of Madagascar, tranquilizing drugs derived from *Rauwolfia*, and many other pharmaceuticals.

- 83. *Apocynum androsaemifolium* L. SPREADING DOGBANE.** Throughout temperate North America to Alaska, south in the mountains to Georgia and Arizona (lacking south of South Dakota); common throughout Wisconsin, in upland dry oak, pine and/or aspen to mesic forests, especially **northern dry forests**, with *Gaultheria*, *Pteridium* and *Vaccinium*, in jack pine, black oak or bur oak savannas, thickets, clearings and forest margins, sometimes in prairies but more often along roadsides, railroads, fencerows, open or sparsely wooded hillsides, sandy old fields, occasionally borders of sedge meadows and other damp sites; usually associated with woody plants in diverse sunny and grassy or partly shady and brushy habitats. (18) Flowering from mid June through August, fruiting from the end of August into October.

This species is known to hybridize and backcross with our other taxa.



- 84. *Apocynum cannabinum* L. INDIAN-HEMP, HEMP DOGBANE.** Throughout temperate North America, abundant from New York to Alberta and all of the Great Plains, south to the Gulf and west to the Pacific; infrequent across the southern two-thirds of Wisconsin in open habitats such as edges of sedge meadows, wet prairies, cattail marshes, shores of rivers, and dry, wet or **mesic prairies**, often in sandy, gravelly or rocky places with mixtures of weeds and flood plain or prairie species (on Mississippi River bluffs from open woods above through talus-slope thickets to weedy communities at the base), forming colonies along roadsides, railroads, banks, even on mine tailings, but not collected from fields or pastures; in habitats similar to those of *A. sibiricum*, with which it is often confused. (10) Flowering from mid June to early August, fruiting from mid August through September.

Highly variable in pubescence, leaf shape and petiole length due to hybridization with 83 and 86.





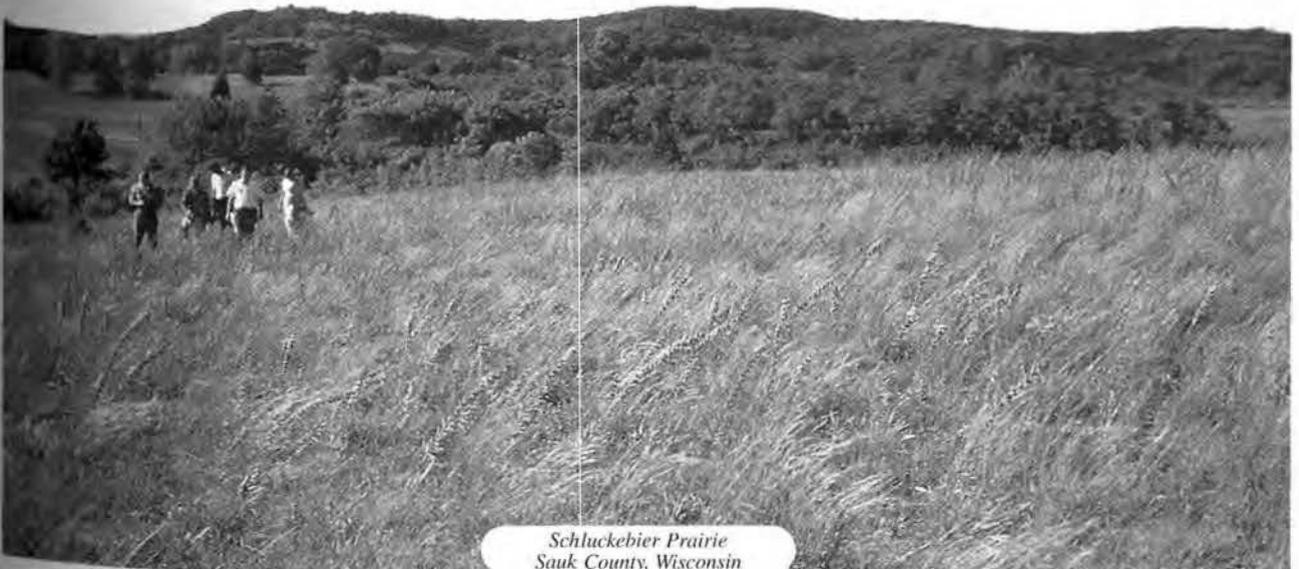
85. *Apocynum* \times *floribundum* Greene [*A.* \times *medium*]. HYBRID DOGBANE. Newfoundland to British Columbia, south to Virginia, Tennessee, Texas and New Mexico (essentially the same range as *A. androsaemifolium*); occasional throughout Wisconsin in open woods and borders, prairies (often rocky), old fields, railroads and waste ground generally, seldom on lakeshores. Flowering from (late May) June, fruiting from late August into September.

Comprised of a polymorphic series of putative hybrids and backcrosses combining the characters of *A. androsaemifolium* and either *A. cannabinum* or *A. sibiricum*, or both (see Anderson 1936a, Johnson et al. 1998, Woodson 1938).



86. *Apocynum sibiricum* Jacq. CLASPING INDIAN-HEMP, DOGBANE. Throughout much of southern Canada and the cool-temperate United States (Newfoundland south in the mountains to West Virginia, on all of the Great Plains, and west to British Columbia); in Wisconsin frequent in dry to moist, usually open habitats, especially prairies, **fens** and similar grassy areas (formerly pastured openings, field edges, cemeteries, churchyards), also riverbanks, marsh edges, abandoned fields and fencerows, readily colonizing disturbed gravelly sites such as railroads, roadsides and weedy waste places. (2) Flowering from June to mid August, fruiting in September.

There is some doubt as to whether this taxon is sufficiently distinct from *A. cannabinum* to warrant recognition as a separate species. The chief differences are in its \pm cordate, subsessile lower stem leaves. More common and slightly weedier than *A. cannabinum*, it has been treated as *A. cannabinum* var. *hypericifolium* (Aiton) A. Gray.



Schluckebier Prairie
Sauk County, Wisconsin

ARALIACEAE—the Ginseng Family

Trees, shrubs or woody vines (sometimes herbs), often with prickly stems, commonly with either palmately or pinnately compound or lobed leaves. Flowers small, bisexual or unisexual, in simple umbels that are usually arranged in racemes or branched inflorescences.

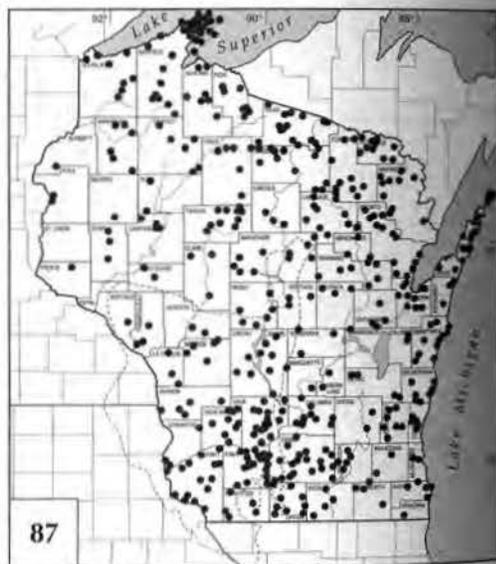
Calyx cup-shaped or inconspicuous, usually represented by 5 minute teeth or reduced to a rim around the top of the ovary (or absent). Petals falling early. Style base or bases generally swollen and usually confluent with the nectariferous disk capping the ovary. Fruit a berry or a drupe (rarely splitting into separate carpels as in the Apiaceae). (Fassett 1937, Fassett & Elser 1950, Graham 1966)

Much like the Apiaceae, but mostly tropical to subtropical and woody, with the styles usually more than 2, the fruit mostly fleshy or pulpy and oil tubes usually absent. Several species are grown indoors or outdoors as ornamentals, including the southern Devil's Walking-stick, False-aralia and English Ivy. A few are used in herbal preparations, notably the famed Ginseng, a name derived from the Chinese name for a close eastern Asiatic relative of our American *Panax quinquefolius*. Having become quite rare in the wild due to over collecting, this species is grown commercially in Wisconsin, especially in Marathon County, for export to China.



87. *Aralia nudicaulis* L. WILD SARSAPARILLA. A transcontinental subarctic and north-temperate species (south in the mountains to Georgia, Indiana, Missouri, Colorado and Washington); very common in dry to moist woods throughout Wisconsin, whether deciduous (oak-hickory, maple-basswood, etc.), coniferous (pine, spruce-fir) or mixed (northern hemlock hardwoods), upland or swampy, common in white pine-red maple and aspen-birch **northern dry mesic forests**; very rarely collected in open deciduous woods with prairie species nearby. (17) Flowering from mid May to late June, fruiting from the end of May through August. Fruits form about three weeks after anthesis and persist through the summer.

Ubiquitous in woodlots, including those known to have been savannas in historic time. It is fire resistant at restoration sites (R. A. Henderson, pers. comm.) and is suspected of having been a component of forest-derived, but not prairie-derived savannas (Bray 1957).



ASCLEPIADACEAE—the Milkweed Family

Of this highly specialized family, our species are erect herbs or rarely perennial vines, yet in the tropics most are lianas and some even trees. Milkweeds have opposite or whorled, less commonly alternate, leaves, milky juice, 5-merous flowers, and paired follicles containing numerous silky-tufted seeds. The 5 stamens are fused to the corolla tube (forming a column, from which arise 5 hoods, each usually with a horn) and to the style (forming a 5-angled gynostegium, with elongate grooves between the anthers). The pollen of each anther sac is agglutinated into a pollinium, with the pollinia of adjacent sacs of neighboring anthers joined by translator arms attached to a central black "gland." When the leg of a visiting insect such as a wasp slips into a groove, it becomes caught, and can only free itself by extracting the pollinium-pair, which is soon transported to another flower, inserted into another groove, and so delivered to the stigmatic surface. (Noamesi & Iltis 1958, Rosatti 1989, Woodson 1954)

Primarily tropical and subtropical, only a few genera (when broadly defined) ranging into temperate zones, the prominent North American genus being *Asclepias* (150 spp., 14 in Wisconsin).





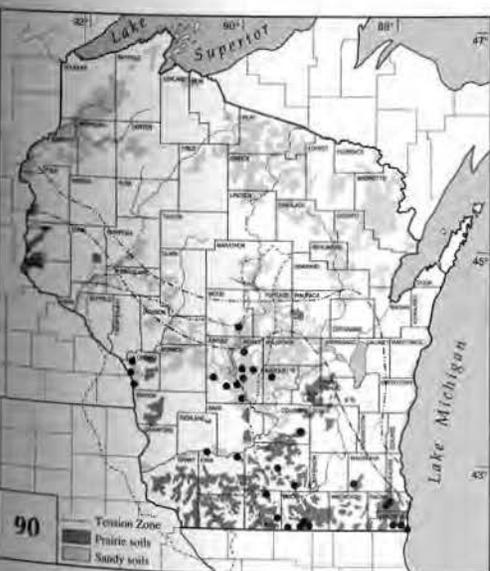
88. *Asclepias amplexicaulis* Sm. CLASPING MILKWEED. From the Atlantic Coastal Plain (New England to Florida) to the eastern Great Plains (Texas, Nebraska and southeastern Minnesota); mostly in southern Wisconsin south of the Tension Zone, in dry, usually sandy, sunny **oak barrens**, sand prairies and savannas, sandstone ridges and often sandy roadsides, abandoned fields, and other open, somewhat disturbed, sandy habitats with sparse vegetation. (6) Flowering from mid June to mid July.

Clasping Milkweed is a distinctive species with solitary terminal umbels, two to five pairs of clasping leaves with \pm crisped margins and greenish-purple (not red or purple) flowers.



89. *Asclepias exaltata* L. TALL OR POKE MILKWEED. A typical mesophytic to moist deciduous forest Appalachian element with a "white pine-hemlock-northern hardwoods" range, from the mountains of northern Georgia and eastern Tennessee to Delaware and beyond to New England and Ontario, west to southern Illinois and eastern Minnesota; in Wisconsin rather uncommon in densely shaded to open, moist to dry woods and savannas, from **southern dry-mesic forests**, edges of woods, and under trees in savannas to rich maple-beech or even swampy woods, now and then surviving in roadside thickets and fields. (6) Flowering from mid June to mid July.

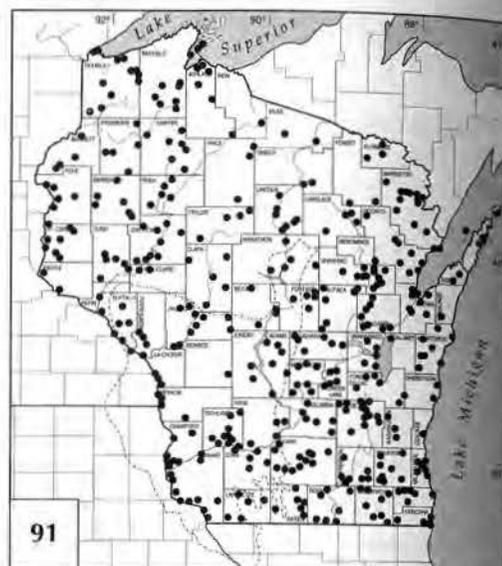
Poke Milkweed is seldom abundant at any one location, but "In some woodlands, where this species is known to grow, years may go by without it[s] being evident, only to show up irregularly in massive numbers" (Swink & Wilhelm 1994, p. 129).



90. *Asclepias hirtella* (Pennell) Woodson [*Acerates h.*]. TALL GREEN OR PRAIRIE MILKWEED. A distinctive Ozarkian tallgrass prairie and savanna element, from eastern Oklahoma to (barely) southern Minnesota and Michigan, more local eastward through Ohio to southeastern Ontario and West Virginia (central Tennessee and southwestern Kentucky); rare in Wisconsin, mainly in mesic to **wet-mesic prairies** in central and south-central parts of the state, and sometimes surviving on roadsides and other dry to moist, sandy, open places. (5) Flowering from July to August.

91. *Asclepias incarnata* L. SWAMP MILKWEED. From Kansas and the Carolinas north to the Canadian border, and scattered elsewhere (Florida to New Mexico); in Wisconsin ubiquitous in wet, acidic to calcareous, open habitats such as shores of lakes and rivers, edges of swamps, bogs, woods and thickets, **fens**, wet to wet-mesic prairies, swales and ditches; often in alluvial soils. (8) Flowering from mid June to mid August.

This is one of our taller, showier milkweeds, and the only one growing in saturated soils. Its branched stems have one or more umbels of numerous flowers, richly colored purplish-pink and often whitish in the center. It is a favorite of Monarch butterflies.



92. *Asclepias lanuginosa* Nutt. [*Acerates* L.; *Asclepias nuttalliana* Torr. sensu Woodson] WOOLY MILKWEED (Threatened). A rather rare central and northern Great Plains element, from Kansas and Iowa to southern Saskatchewan, east to northern Illinois; in Wisconsin rare in gravelly and sandy **dry prairies**, hill prairies, along railroads (especially on cuts through crumbling sandstone), and on sand flats near the Wisconsin River. (3) Flowering from late May to July.

"A very odd and infrequently collected species having essentially the same distribution as *A. ovalifolia* and occasionally associated with it" (Woodson 1954, p. 176).



93. *Asclepias ovalifolia* Decne. DWARF or OVAL-LEAVED MILKWEED (Threatened). A northern Great Plains element, from South Dakota (Black Hills) to southern Saskatchewan, Iowa, northern Illinois and northern Michigan; in Wisconsin occasional in sandy to black-soil, dry to mesic prairies, savannas and woodlands (oak, jack pine and/or aspen), **southern dry forests**, and occasionally on sandy roadsides. (3) Flowering from early June to mid July.

Young sterile plants of *Asclepias syriaca* (96) can be easily confused with this species.





94. *Asclepias purpurascens* L. PURPLE MILKWEED (Endangered). Once undoubtedly a frequent component of the mesic savannas, open oak woodlands and deep-soil prairies of the tallgrass climax, from the edge of the Great Plains (Arkansas, Iowa, Wisconsin) across the Prairie Peninsula to Ohio and southern Ontario, eastward mostly on the Coastal Plain from North Carolina to Massachusetts, today a rare species northward and eastward; in southern and eastern Wisconsin on rocky wooded slopes, edges of open or disturbed oak woods, **wet-mesic prairies** and prairie relics along railroads, and rarely along roads in ditches and hedges. (2) Flowering from mid June to mid July.

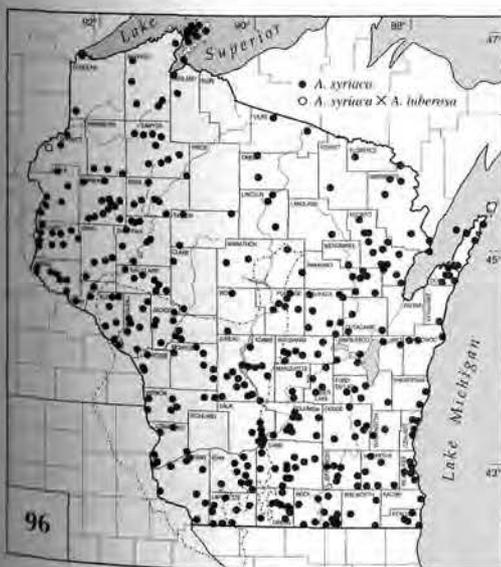
Easily mistaken for *Asclepias syriaca*, Common Milkweed (96), but with a terminal umbel and glabrous corolla lobes, and also *A. sullivantii*, Sullivan's Milkweed (95), but the leaves with evident petioles and wedge shaped at the base.

Purple Milkweed favors mesic prairies and edges of open woodlands and brushy roadbanks that simulate original savanna borders and prairie thickets.



95. *Asclepias sullivantii* Engelm. ex A. Gray. SMOOTH OR SULLIVANT'S MILKWEED (Threatened). East-central Great Plains from Oklahoma and eastern Nebraska to southern Minnesota, east in the Prairie Peninsula to Ohio and southern Ontario, very much in the western range of *Asclepias purpurascens* (which it resembles); rare in eight southern Wisconsin counties, in **fens** and low to mesic prairies, surviving in prairie remnants along railroads and (rarely) as isolated plants along roadsides after the native vegetation has been destroyed. (4) Flowering in July.

***Asclepias meadii* Torr. ex A. Gray. MEAD'S MILKWEED (Extirpated).** An Ozarkian element endemic to midwestern mesic prairies, now rare and local throughout its range, extremely rare in Iowa and Illinois, formerly in Indiana and Wisconsin, where it had been collected once from near Lancaster, Grant County. Not having been found since 1879, it is presumed to have been extirpated in Wisconsin. Many seedlings have been transplanted into protected prairies in Illinois, Iowa and Wisconsin, representing a minor prairie restoration success.



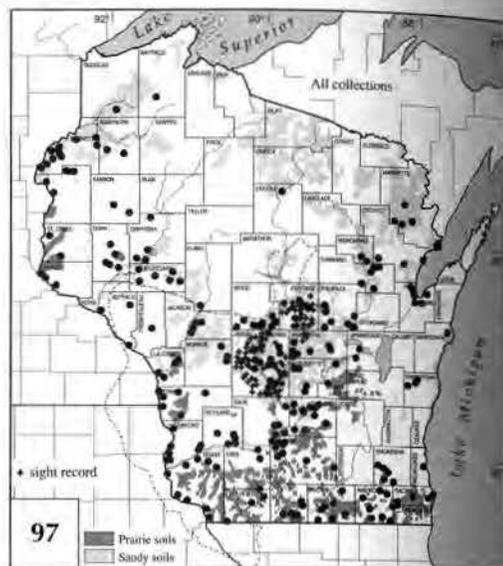
96. *Asclepias syriaca* L. COMMON MILKWEED. Unlike its rare mimics (94 and 95) very common and aggressively widespread in northeastern and central North America, from the Great Plains of Kansas to southeastern Manitoba, east to North Carolina and New Brunswick; extremely common throughout Wisconsin, and one of our commonest native plants, in prairies (**wet-mesic prairies**), fields, pastures, roadsides and railroad embankments, also dunes near Lake Michigan; generally weedy in disturbed sunny habitats, forming nearly pure stands in recently bulldozed city lots. (15) Flowering from early June to early August.

The favorite food of Monarch Butterfly caterpillars, which are now declining due to indiscriminant pesticide spraying in Wisconsin, destruction of the overwintering grounds in mountain forests in Michoacan, Mexico, and possibly other factors not yet understood.

97. *Asclepias tuberosa* L. ssp. *interior* Woodson [including ssp. *terminalis* Woodson]. BUTTERFLY-WEED, ORANGE MILKWEED. From northern Mexico and the southern Rocky Mountains to Minnesota, east to the Atlantic from the Gulf and Florida to New England; in Wisconsin in **dry-mesic prairies**, steep calcareous “goat prairies,” fields and roadsides; particularly common in the sandy areas of the central part of the state. (11) Flowering from mid June to August.

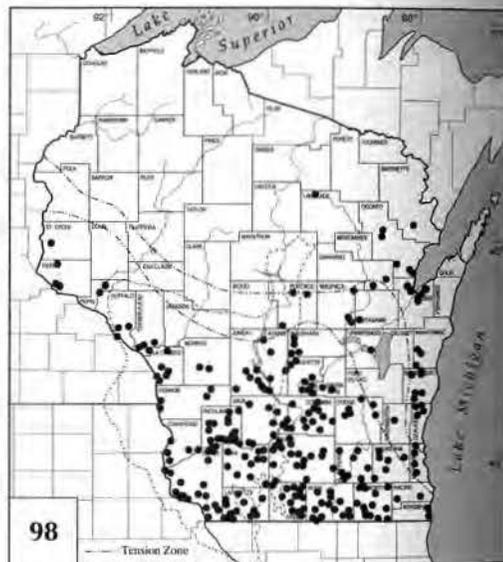
This is a variable species, divisible on leaf shape (Woodson 1947, 1954) into a Floridan, eastern, central and western subspecies, the latter two in Wisconsin, but of questionable reality and here united.

Unique in its color, and “as our only milkless milkweed—with alternate leaves besides” (Voss 1996, p. 92), this is a spectacular plant in the wildflower garden and prairies, where it should not be picked, increasingly rare as it has become in many areas.



98. *Asclepias verticillata* L. WHORLED MILKWEED. FOR us, a most distinctive species, but with many southwestern and Mexican relatives, from the Great Plains to the Atlantic (Texas to Manitoba, Florida to Massachusetts); in Wisconsin very common south of the Tension Zone in dry sandy soils, especially mesic to **dry prairies** and open woodlands with prairie flora, commonly weedy on roadsides, pastures and abandoned fields. (9) Flowering from July to early September.

Of the 150 or so species of *Asclepias*, all (with rare exceptions) have the same distinctive flower, pod (follicle) and seed structure, exude a sticky, milky sap wherever the plant has been cut or broken, and disperse their seeds via the autumn winds with the aid of a tuft of long, silky hairs (coma) attached to them. *Asclepias verticillata* itself is a distinctive, slender plant with numerous, narrowly linear, whorled or opposite leaves and white or greenish flowers in several small umbels from the upper nodes.



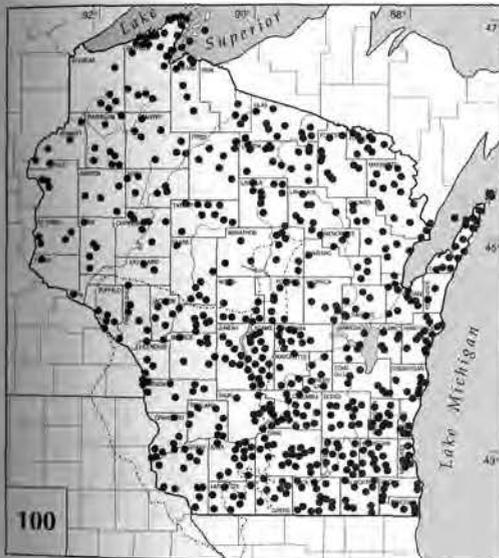
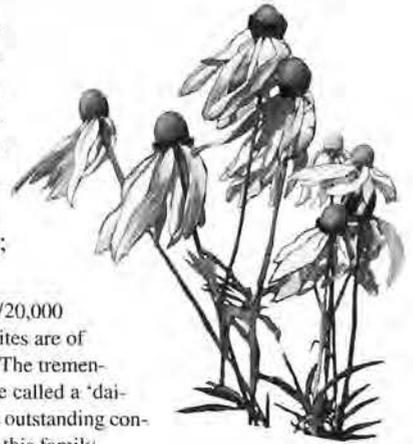
99. *Asclepias viridiflora* Raf. [*Acerates* v.]. SHORT GREEN MILKWEED. Truly widespread, throughout the Great Plains, prairies and coastal savannas from northeastern Mexico to Manitoba, Georgia and Long Island; in Wisconsin occasional south of the Tension Zone in sandy, mesic or **dry-prairie** relics, on “goat prairies” and dry hillsides, sometimes with limestone outcroppings, and along railroads, rarely spreading to old sandy fields and pastures. (5) Flowering from early June to late August.



ASTERACEAE [COMPOSITAE]—the Sunflower Family

Mainly herbs, sometimes with milky juice, with individual flowers densely aggregated into heads, the common receptacle of each head with an encircling involucre of bracts, each head simulating a single “flower.” Flowers either all tubular and regular, or the central disk flowers tubular and regular and the marginal ray flowers strap-shaped and irregular, or all the flowers strap-shaped. Anthers united into a tube. Pistil of 2 united inferior carpels, but the fruit a 1-seeded achene, commonly crowned by a pappus (the modified calyx) consisting of hairs, bristles, awns or scales. (Barkley 1964, 1978; Beals & Peters 1967; Johnson & Iltis 1964; Melchert 1960; Mickelson & Iltis 1967; Salamun 1964; Shinnors 1941)

Evolutionarily the most advanced family of dicots and the largest family of vascular plants (1,100 genera/20,000 species), cosmopolitan but especially abundant in temperate to subtropical, semiarid regions. Composites are of considerable economic importance, more than 200 genera contributing food plants and ornamentals. “The tremendous numbers of Composites in [xeric] and all other prairies would suggest that...the prairie should be called a ‘daisyland’ instead of a ‘grassland’” (Curtis 1959, p. 269). Asters, goldenrods, sunflowers and silphiums are outstanding contributors to the brilliant late summer floral displays in Wisconsin, where there are some 265 species in this family.



- 100. *Achillea millefolium* L. ssp. *lanulosa* (Nutt.) Piper** [*A. m.* var. *occidentalis*], YARROW, MILFOIL. Subarctic American; ubiquitous throughout Wisconsin in a variety of sunny habitats, from disturbed areas such as sand bars of lakes or rivers, railroad yards, abandoned fields, roadsides and pastures, to prairies, open woods and juniper glades, an indicator of **mesic prairies**. (17) Flowering from June through mid October, the peak from mid June through July, fruiting from July to mid October.

The *Achillea millefolium* polyploid complex consists of a circumboreal series of morphologically barely discernible subspecies, varieties and ecotypes. Our evidently native plants are mostly tetraploid ($2n = 36$ chromosomes), less often pentaploid ($2n = 45$) or hexaploid ($2n = 54$), the Eurasian ssp. *millefolium*, cultivated here in gardens and rarely escaped, hexaploid (see Warwick & Black 1982). Wild plants with light to deep pink rays, once referred to ssp. *millefolium*, are now known to represent both the native subspecies and Eurasian cultivated forms (Gervais 1977).

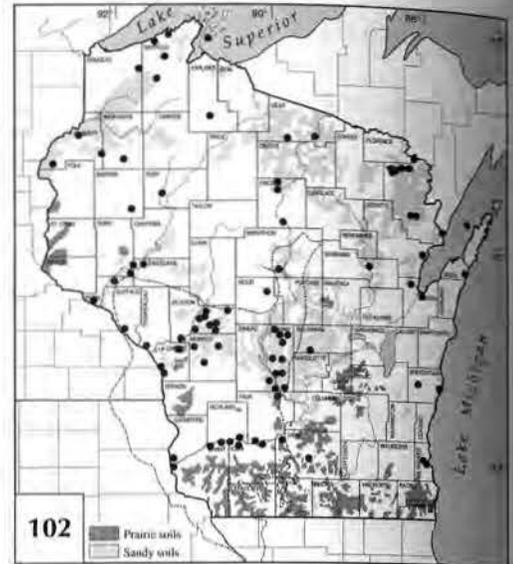


- 101. *Ambrosia artemisiifolia* L. COMMON OF SHORT RAGWEED.** Quebec and Florida to Texas, Kansas and the Pacific Northwest; throughout Wisconsin, but approaching the northern limits of its range in the northwest and west-central counties, in **dry prairies** and woodlands, but above all a serious weed of ruderal habitats, in cities, on roadsides, railroad embankments and cultivated cereal fields, becoming abundant in any disturbed, overgrazed and often sterile soils. (12) Flowering from late July to late September, fruiting from early September to late October.

Now in North America a weedy pioneer (Payne 1970, for map), but perhaps in pre-Columbian times a rather uncommon native of eastern North America in such ecologically open habitats as rocky bluffs, dry prairies or gravelly beaches.

- 102. *Ambrosia psilostachya* DC. [*A. coronopifolia*].** PERENNIAL OF WESTERN RAGWEED. Native from northern Mexico and California to southern Canada and the Great Plains, east to Michigan and Illinois (and beyond as an occasional weed); throughout Wisconsin, infrequent but locally abundant in sandy soils, commonly found on **sand barrens**, sandy prairies, sandy glacial outwashes, sandy beaches, sandblows, and dry open upland woods. (6) Flowering from mid July to mid August, fruiting from early September to mid October.

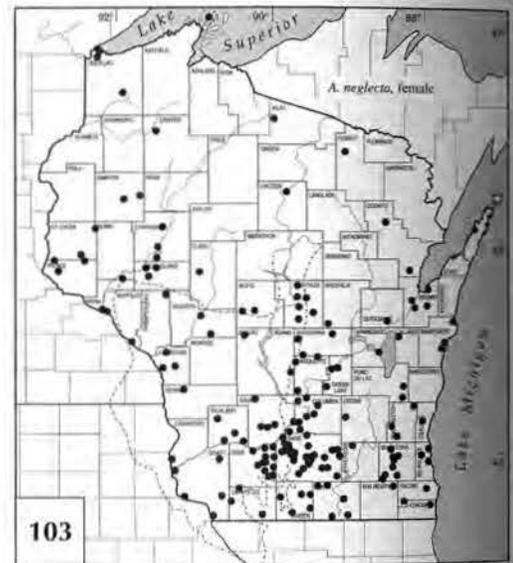
This, the least abundant and only perennial of our ragweeds, is a minor contributor to the ragweed pollen loads. It may form hybrid colonies with common ragweed where both occur together, which they often do (Payne 1970, Wagner & Beals 1958). The hybrid, also perennial, is called *Ambrosia* × *intergradiens* W. H. Wagner. Rare hybrids with Giant Ragweed (*A. trifida* L.) have been reported, but not yet from Wisconsin.



- 103. *Antennaria neglecta* Greene, female plants.** FIELD PUSSY-TOES. Widespread from New England to the southern Northwest Territories, south to Virginia, Oklahoma and eastern Colorado; more common in southern than in northern Wisconsin, in sandy pastures, oak openings, **oak barrens**, cedar glades, pine barrens, dry pine woods, dry oak woods, and according to Curtis (1959) in all but the wet prairies. (17) Flowering from mid April to early (late) June, fruiting from late May through July.

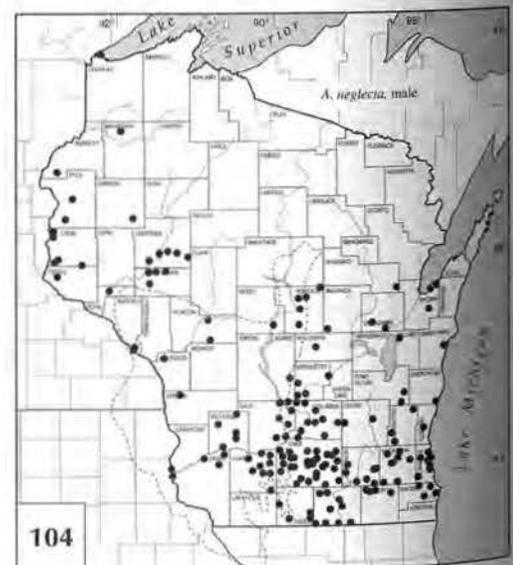
One of two sexual diploid species in Wisconsin (the other being *Antennaria plantaginifolia*, 105, 106). Although easily distinguished from each other, both intergrade with various polyploid taxa (Beals 1968, Beals & Peters 1967), from which they are difficult to tell apart (all of our collections here mapped were named by *Antennaria* specialists E. W. Beals and/or R. J. Bayer).

The large number (17) of habitats indicated by Curtis (1959) undoubtedly rests on a certain amount of taxonomic confusion.



- 104. *Antennaria neglecta*, male plants.** FIELD PUSSY-TOES. In the same sorts of woodlands and prairies as female plants (103), but absent from large portions of northern Wisconsin, raising interesting questions about reproduction in this species. Flowering from mid April to early (late) June.

Both sexes are apparently widespread and very common in the Great Plains.





- 105. *Antennaria plantaginifolia* (L.) Richardson, female plants.** PLANTAIN PUSSY-TOES. Eastern United States, mostly from the Atlantic Coast, the Piedmont and Appalachians, but disjunct to Wisconsin and Minnesota, where, according to Bayer and Stebbins (1982, 1987, 1994), the species is limited to the Driftless Area; most common in southern Wisconsin, following the Mississippi and St. Croix rivers into the northwestern part of the state, occurring in dry places such as oak openings, **sand barrens**, dry prairies, bedrock glades and pastures. (5) Flowering from early May to mid July, fruiting from early June to mid July.

A good many herbarium specimens are on the borderline between this species and *Antennaria parlinii* Fernald sensu lato (including *A. fallax* Greene and *A. munda* Fernald), another common, large-leaved but polyploid taxon not mapped here.



- 106. *Antennaria plantaginifolia*, male plants.** PLANTAIN PUSSY-TOES. In the same habitats as female plants (105). This species is predominantly diploid and sexual, with male and female plants occurring in about equal numbers. Flowering from early May through June (or later).



- 107. *Artemisia campestris* L. ssp. *caudata* (Michx.) H. M. Hall & Clem. [*A. caudata*; *A. c.* var. *calvens*].** WORMWOOD. A variable North American native of wide distribution, part of a circumboreal complex with many races, most common in the eastern and central United States, from Canada south to Florida, Texas and Arizona; in Wisconsin very common in ecologically open habitats such as dry, often steep high lime prairies, sandy **dry prairies**, sandstone and limestone cliffs and their talus slopes, sunny black oak-jack pine barrens, inner beaches and dunes on Lake Michigan, sandbars in rivers, and often weedy on disturbed sandy roadsides, overgrazed or abandoned sandy fields, and even waste places in cities. (12) Flowering from late July to mid September, fruiting from mid September through October (or later).

Although a number of segregates have been named, particularly in arctic, subarctic and alpine regions, our specimens are all referable to ssp. *caudata* (including both glabrescent and grayish-pubescent plants).

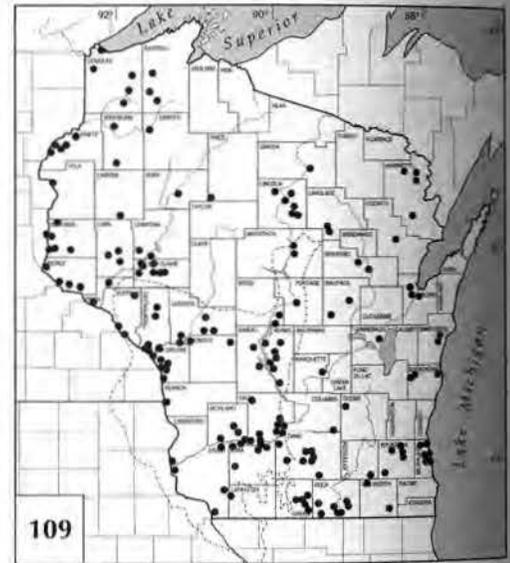
- 108. *Artemisia frigida* Willd. PRAIRIE SAGEWORT (Special Concern).** A subarctic to boreal steppe plant, widespread from Eurasia and Alaska to the Rocky Mountains of New Mexico, east on the northern and western Great Plains, in short and mixed grasslands to Nebraska, Minnesota and barely into Wisconsin; here on **dry-mesic prairies**, exposed limestone bluffs, talus slopes, and Mississippi River sand terraces in Pierce, Pepin, Buffalo and Trempealeau counties, rarely adventive elsewhere in disturbed areas such as on railroad and road cuts. (1) Flowering in August and September, fruiting in October.

The dates on the map indicate years of collection for adventive specimens.



- 109. *Artemisia ludoviciana* Nutt. ssp. *ludoviciana*. WHITE SAGE, LOUISIANA SAGEWORT.** A widespread, highly complex species of western North America and the Great Plains, from Texas deep into Canada, with seven (according to Keck 1946) allopatric geographic subspecies, this one native as far east as Manitoba and Illinois (but mostly adventive northward and eastward); characteristic of Wisconsin **dry-mesic prairies**, dry sandy prairies, as well as deep-soil mesic and even moist prairies, but often somewhat weedy on railroads and roadsides. (4) Flowering and fruiting from (late July) mid August through mid October.

Native Americans burned this plant to repel insects, as did the early European settlers as an incense.



- 110. *Artemisia serrata* Nutt. TOOTHED SAGE, SAW-LEAF MUGWORT.** A localized prairie species endemic to the upper Mississippi River Valley, extending from central Illinois to Wisconsin, eastern Minnesota and northwestern Iowa; in the western half of Wisconsin in rich, moist, sandy soils along rivers and streams, in wet to **wet-mesic prairies**, low wet meadows, marshy roadsides, floodplain pastures and ditches. (4) Flowering and fruiting in August and September.

This is one of our very few regional endemic species, "one of a select group of prairie plants which originated in the area of Illinoian glaciation and which increased their ranges into the area of Wisconsin glaciation sometime between the retreat of that ice and the present" (Mickelson & Iltis 1967, p. 218). Toothed Sage is a tetraploid ($2n = 36$ chromosomes) evidently derived from the western diploid *Artemisia longifolia* Nutt. ($2n = 18$) of western Ontario and the northern Great Plains.





111. *Aster ericoides* L. [including var. *prostratus* and f. *caeruleus*]. HEATH OR WHITE PRAIRIE ASTER. Almost transcontinental, Maine to southern Saskatchewan, south to Virginia, Texas, northern Mexico and southeastern Arizona; in Wisconsin most abundant in open, sandy and sunny places, including woodlands, but chiefly on sandy, gravelly or rocky, dry to **dry-mesic prairies**, less commonly in mesic to wet-mesic prairies, open black oak or jack pine woods, surviving in such grassy areas as old cemeteries, orchards and fencerows, frequently weedy in disturbed areas, especially along roadsides, railroads, sandy fields, gravel pits and quarries, sometimes on sandy riverbanks, lakeshores and pine plantations. (9) Flowering in late August to late October, fruiting early September to October.

Aster × *amethystinus* Nutt. [*A. ericoides* × *A. novae-angliae*]. Occasional in Wisconsin, occurring both as apparently fertile F_1 individuals as well as hybrid swarms. The parents are evidently not genetically, but rather ecologically isolated.



112. *Aster firmus* Nees [*A. lucidulus* (A. Gray) Wiegand; *A. puniceus* var. *f.*]. SHINY-LEAVED ASTER. Northeastern North America, from West Virginia to the Ozarks, north to New York and South Dakota; abundant in southeastern and eastern Wisconsin, very spotty westward, in marshes, sedge meadows, wet to wet-mesic prairies, **fens**, tamarack bogs, swampy deciduous or mixed ash-alder-cedar woods and wet thickets (especially along rivers and near lakes), occasionally in moist depressions in upland woods, ditches, wet fields and low pastures. (6) Flowering from the end of August to early October, fruiting from late September into October.

Subglabrous and with pale, sky-blue flowers, the more southerly *Aster firmus* is close to the hispidulous, deep-blue flowered *A. puniceus* (127) and often combined with it. Specimens difficult to place most likely involve hybridization with *A. hesperius* A. Gray, *A. lanceolatus* (especially) or *A. praealtus* Poir., rather than with *A. puniceus*.



113. *Aster laevis* L. SMOOTH OR SMOOTH BLUE ASTER. A highly variable species, transcontinental, from Georgia and Arkansas to British Columbia; common and widespread in Wisconsin except in the Northern Highlands, mostly in dry to mesic open woods of oak, pine, aspen or red cedar, barrens and edges of lowland forests, dry to **mesic prairies**, sometimes weedy in fields, commonly on shaded or partly open banks, clay bluffs along Lake Michigan, roadsides, railroads and fencerows, occasionally on lakeshores and various disturbed habitats such as quarries, gravel pits, pastures, and even fallow vegetable gardens. (13) Flowering from (mid) late July to early October, fruiting from late September to mid November.

One of the more attractive asters, Smooth Aster succeeds as a wildflower in dry sunny sites.

See 114 for putative hybrid derivatives.

114. *Aster laevis* hybrid derivatives. Some of our specimens evidently contain genes of other *Aster* species, these hybrids sometimes identifiable as being derived from crosses between *A. laevis* and *A. lanceolatus*, *A. oolentangiensis*, *A. lateriflorus*, or even *A. pilosus* or *A. puniceus*; however, as often as not, atypical herbarium specimens can only be assigned to “near *A. laevis*.”

According to Shinnars, in “The genus *Aster* in Wisconsin” (1941, p. 398), “Hybrids are challenging, and the attention which they have attracted tends to give an exaggerated idea of their frequency or importance.” Nevertheless, for the botanist who knows the asters and thinks he has found a hybrid, it is always important to carefully document all other *Aster* species growing nearby as possible parents.



115. *Aster lanceolatus* Willd. var. *interior* (Wiegand) A. G. Jones. [*A. tradescantii* of authors, not L.; *A. simplex* var. *i.* and *A. l.* ssp. *i.*]. INLAND PANICLED ASTER. A Midwest taxon, from the eastern edges of the central Great Plains, Nebraska to the Ozarks, east to New York and southern Ontario; generally distributed in Wisconsin in rich, moist, sandy, clayey or mucky soils, such as marshy pastures, moist prairies and rights-of-way (with mixtures of prairie and marsh plants and weeds), along old channels and sandbars of rivers, sometimes at the edges of deciduous woods and bogs, lowland savannas and shrub carrs, and as a weed in moist fallow fields. (14) Flowering from mid August through September.



116. *Aster lanceolatus* var. *lanceolatus* [*A. simplex* var. *ramosissimus*]. WHITE PANICLED or MARSH ASTER. From the base of the Rocky Mountains, ubiquitous over most of the Great Plains, and the dominant phase eastward in the Prairie Peninsula to Nova Scotia and New Jersey; in Wisconsin common in marshy ground or sometimes more mesic places, on stream banks and lakeshores, sloughs and swales, marshes, low prairies, sedge meadows, shrub carrs and low open woods, sometimes on rights-of-way and in wet ditches. (14) Flowering from mid August to mid October.

An abundant, weedy and highly variable species, superficially similar to *A. lateriflorus* and *A. pilosus*. It was treated by Shinnars (1941) as a variable species with two varieties, but three varieties are recognized for Wisconsin (and for *A. lanceolatus* as a whole) by Jones (1980, 1989), Gleason and Cronquist (1991) and others, although there is much intergradation and in Wisconsin no local geographic differentiation.





117. *Aster lanceolatus* var. *simplex* (Willd.) A. G. Jones [*A. paniculatus* var. *simplex*; *A. simplex* Willd.]. BRANCHED PANICLED ASTER. Newfoundland and Nova Scotia to North Carolina, west to the eastern Great Plains, from central Saskatchewan to Oklahoma; common throughout Wisconsin in low, damp to marshy ground, along the shores of lakes, rivers and streams, lowland thickets, mesic to wet prairies, **fens**, edges of marshes, swamps, bogs and low woods (and, rarely, spruce-fir or hemlock-hardwoods), often locally common in old fields, pastures, ditches, fencerows and rights-of-way. (14) Flowering from early August to mid October.

Semple and Chmielewski (1987), who treated this species in a very broad sense, considered var. *simplex* to be synonymous with var. *lanceolatus*. However, at the same time they described two additional infraspecific taxa under *A. lanceolatus*, namely var. *hirsuticaulis* Semple & Chmiel. and var. *latifolius* Semple & Chmiel., and attributed both to Wisconsin.



118. *Aster lanceolatus* hybrid derivatives. There seem to be a large number of natural hybrids involving *A. lanceolatus*, which occasionally crosses, and thus intergrades, with species of chromosome base number $x = 8$. For Wisconsin these include *A. borealis* (Torr & A. Gray) Prov., *A. firmus*, *A. laevis*, *A. lateriflorus*, *A. ontarionis* Wiegand and *A. puniceus*; and perhaps also *A. hesperius* A. Gray and apparently even members of section *Cordifolii*, such as *A. drummondii* Lindl.

The taxonomy of *Aster lanceolatus* is complicated by several levels of polyploidy ($2n = 32, 48, 64$), Pleistocene survival in several "survivia," both east and west, and the ability of the species to be a promiscuous hybridizer.

See note and map under 114.



119. *Aster lateriflorus* (L.) Britton var. *lateriflorus*. CALICO ASTER, SIDE-FLOWERING ASTER. Eastern North America from Nova Scotia south to Florida, west to the very eastern edge of the Great Plains, from Manitoba south to east Texas; abundant throughout Wisconsin in dry to moist forests, woodlands and thickets, especially along borders, trails and clearings, on floodplains and in fens, most common in the southern hardwood forests (**southern wet forests**), from black, white and red oak to mesic maple-basswood and maple-beech woods, northern hemlock-hardwoods and second-growth white pine, red maple and birch woods; also on clay bluffs along Lake Michigan and Lake Superior. (11) Flowering from late July to early October.

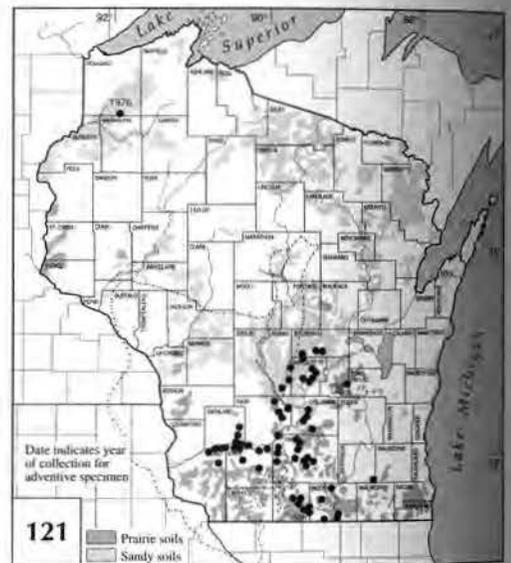
Another very common, highly variable species (see 120), often weedy in grazed woods and semi-shady gardens, where it is the last autumn flower to bloom. Calico Aster occasionally forms putative hybrids with, among others, *A. cordifolius* L., *A. laevis*, *A. ontarionis*, *A. puniceus* and possibly also other species (*A. borealis*?).

120. *Aster lateriflorus* varieties. Although the vast majority of our plants can be referred to var. *lateriflorus* (119), some are probable hybrids involving any number of other species, and a few others are referable to the weakly distinguished var. *hirsuticaulis* (Lindl. ex DC.) Porter [including var. *tenuipes*; *A. tradescantii* of authors] or the more definite var. *horizontalis* (Desf.) Farw. [*A. l.* var. *pendulus*], both of which appear to be highly local in Wisconsin. These (as well as other varieties whose ranges do not extend to Wisconsin) are poorly defined and of doubtful taxonomic validity.



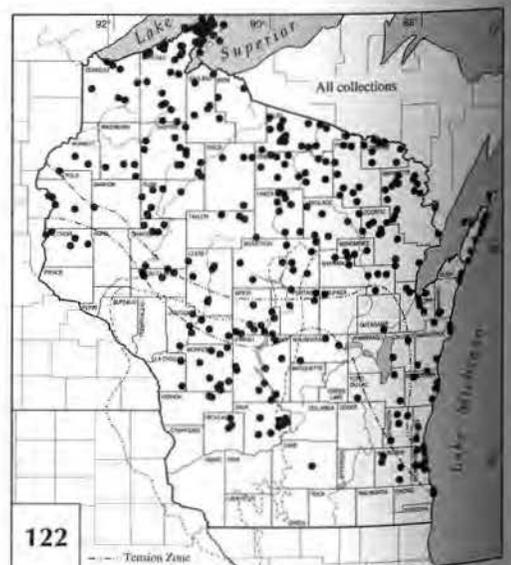
121. *Aster linariifolius* L. [*Ionactis* L.] FLAX-LEAVED ASTER. A most distinctive eastern North American endemic, from New Brunswick to Wisconsin, south especially on the Atlantic Coastal Plain to northwestern Florida, the Arkansas Ozarks and east Texas; confined in south-central Wisconsin to dry, open, sandy or rocky places such as bluff tops, outcrops (e.g., Monticello Rock Outcrop, Green County), sandy and gravelly prairies and black oak barrens associated with them, occasionally on dry lakeshores, roadside banks and abandoned fields, and, at the old site of Utley, Marquette County, on quarry walls (rhyolite); preferring acidic soils. (6) Flowering from late August to mid October, fruiting from mid October into November.

Flax-leaved Aster is still locally common, but the number of extant sites for it has been declining rapidly over recent decades. The Douglas County specimen, suspiciously disjunct, may represent a one-time waif or inaccurate herbarium label.



122. *Aster macrophyllus* L. BIG-LEAVED ASTER. Northeastern North America, with the "white pine-hemlock-northern hardwoods" range, from the Appalachians of Georgia, the Carolinas, and Tennessee to Quebec, west to Minnesota; ubiquitous throughout northern and eastern Wisconsin in almost all woods except the wettest, from dry Hill's oak-aspen-white oak through maple-basswood, hemlock-hardwoods and intermediate types, to wet-mesic white cedar-balsam fir and boreal forests, rarely on edges of swamps or bogs, also in pine barrens, oak-hickory woods, closed savannas and thickets, including wooded dunes, moraines, rocky bluffs at Devil's Lake State Park, and relic pine and/or hemlock stands on cliffs in the Driftless Area; thriving in cut- or burned-over tracts and roadsides at forest edges. (14) Flowering from late July through September, fruiting from late September through October.

Several varieties and forms, at least four of those recognized by Fernald (1950), occur in Wisconsin. In agreement with most authors we consider them not worthy of taxonomic recognition.

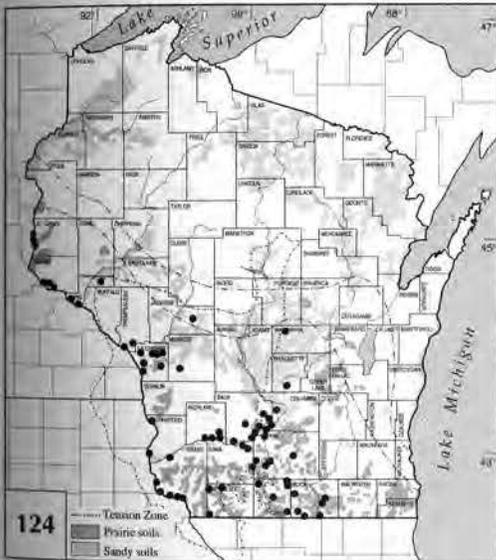




123. *Aster novae-angliae* L. NEW ENGLAND ASTER. Rich damp ground, in the highest Appalachians from the Carolinas and Alabama north to Nova Scotia, west into the eastern Great Plains from southern Manitoba to eastern Kansas, occasionally beyond; abundant in Wisconsin mostly south of the Tension Zone in diverse, usually mesic to wet, open habitats, especially in mesic to **wet-mesic prairies**, marshes, sedge meadows, fens and swales, also in moist woods and thickets, stream banks and lake shores, often in disturbed, sometimes dry ground such as fields, pastures, ditches and railroad ballast, and somewhat weedy on roadsides, fencerows and quarries. (9) Flowering from late August to early October.

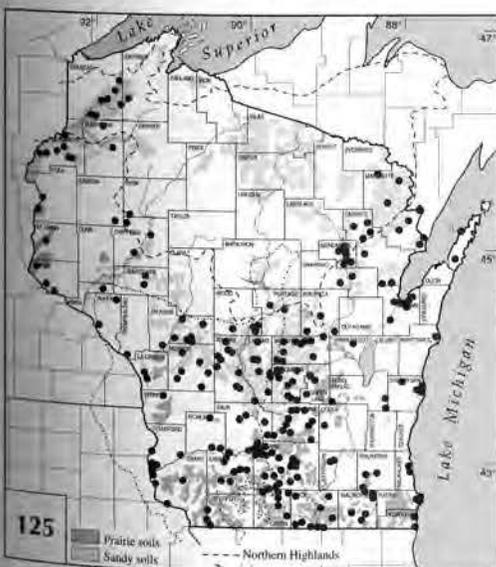
New England Aster, the showiest of our native species, is the most important *Aster* from a horticultural standpoint. Some of our herbarium records may therefore represent escapes from cultivation.

New England Aster forms hybrids with *Aster ericoides* (111).



124. *Aster oblongifolius* Nutt. [including vars. *angustatus* and *rigidulus*]. **AROMATIC ASTER.** A xerophyte of dry prairies, bluffs, sand blows and cliffs, throughout the Great Plains from Saskatchewan to Texas (New Mexico), east to Arkansas (Alabama) and Indiana, very rarely to Pennsylvania and the North Carolina mountains; in Wisconsin south of the Tension Zone, in very dry, rocky or sandy prairies on terrain ranging from undulating to precipitous, most often on bluffs of calcareous sandstone (i.e., sandstones overlain by dolomites) or limestone, sandstone or quartzite, as well as on outcrops, boulders and talus, gravelly hillsides, high lime prairies (e.g., Thousands Rock Point, Iowa County), **dry prairies**, (e.g., Schluckebier Sand Prairie and Spring Green Preserve, Sauk County); rarely in open scrub oak-jack pine woods or grassy brushy roadcuts or banks undergoing succession from prairie (5). Flowering from early September to early October.

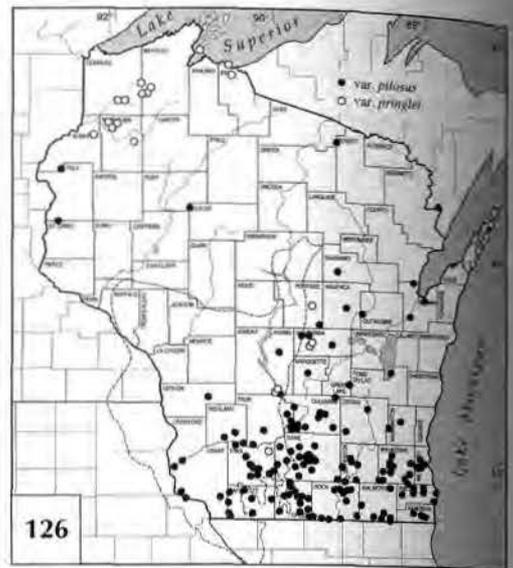
Like so many prairie species, Aromatic Aster is now fairly rare in Wisconsin, less frequent than the map may suggest.



125. *Aster oolentangiensis* Riddell [*A. azureus* Lindl.]. **SKY-BLUE ASTER, PRAIRIE HEART-LEAVED ASTER.** Prairies and dry open woods from western New York and southern Ontario to Minnesota (South Dakota) and eastern Kansas, south to western Tennessee, northwestern Mississippi and eastern Texas; locally common throughout much of Wisconsin but absent on the acidic archean bedrock of the Northern Highlands, mostly in dry sandy, gravelly or rocky soil, especially in dry to **dry-mesic prairies** or occasionally in mesic or wet-mesic prairies, in open upland northern pine woods, oak woods and oak openings, black oak and/or jack pine savannas, red pine and/or white pine woods, aspen stands, lakeshores, calcareous bluffs, cliffs, ledges, limestone flats (Brown County) and Lake Michigan dunes (Manitowoc County), and along roadsides, railroad rights-of-way and similar dry sites (14). Flowering from mid August to early October, fruiting from late September through October.

126. *Aster pilosus* Willd. HAIRY OR FROST ASTER. Widespread in eastern North America, from Nova Scotia and Maine to northwestern Florida, west to southeastern Minnesota, eastern Nebraska and Louisiana; in southern Wisconsin very common in **dry-mesic prairies** and borders of woods, more rarely on sandy shores, edges of marshes and low prairies, but now, with almost all mesic prairies destroyed, in dry to mesic, disturbed grassy hill-sides, fields, fencerows, pastures, railroads, roadsides and waste ground, especially vacant lots, city streets and mine tailings. (4) Flowering from late August to mid October.

Several named varieties occur in Wisconsin, but only var. *pilosus* and the glabrous, chiefly northeastern var. *pringlei* (A. Gray) S. F. Blake deserve recognition, the latter on sandy or stony shores, including lakes Michigan (Door County) and Superior (Ashland and Iron counties), glacial lake barrens, and occasionally in dry open oak woodlands elsewhere. Considered native but quite weedy, *A. pilosus* nonetheless makes a lovely garden plant in October, being the last aster to bloom.



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127. *Aster puniceus* L. SWAMP ASTER. Quite variable and widely distributed, the aggregate species from Newfoundland to central Saskatchewan, south in the mountains to Georgia and Alabama, west to the edge of the northern Great Plains; frequent throughout Wisconsin on peaty, mucky or sandy soils, in bogs and swamps of cedar, tamarack, spruce and fir, in boggy depressions in mixed or deciduous woods, lowland hardwoods, thickets and marshes, **northern sedge meadows**, fens and seepage slopes; generally in marshy or swampy, open or shaded ground (streamsides, lakeshores, ditches and pastures, rarely on sandy hillsides or cliffs that are moist from runoff water or seepage). (9) Flowering from early August to mid October, fruiting from mid September into October.

Similar morphologically and ecologically to the chiefly mid-western *Aster firmus*, which is more frequent and more likely to grow in wet prairies. Our plants are quite uniform, but rare specimens show good evidence of hybridization involving *A. lanceolatus* and *A. praealtus* Poir.

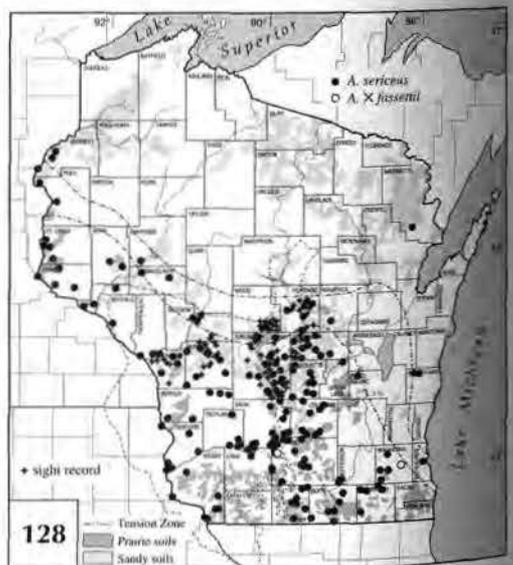


127

128. *Aster sericeus* Vent. SILKY ASTER. Dry open woods, bluffs, prairies and barrens, on the eastern Great Plains from eastern Texas to Manitoba, east to western Ontario and Tennessee; locally abundant in southern and western Wisconsin in and south of the Tension Zone, in open, sandy, gravelly or rocky **dry prairies** on level to rolling sands, sandy and gravelly hillsides, sandstone outcrops and limestone bluffs, sometimes under oaks, jack pine or red cedar but usually in the open; also in sandy old fields and roadsides. (7) Flowering from mid August to early October, fruiting from late September to late October.

Like many of its prairie associates, Silky Aster is now much rarer than the map would suggest, surviving mostly on very steep, rocky "goat prairies" unlikely to be plowed or overgrazed.

Aster × *fassettii* Ilitis, unpublished [*A. ericoides* × *A. sericeus*]. **FASSETT'S ASTER.** This rare sterile hybrid, exactly intermediate, has been collected only twice.



128



129. *Aster shortii* Lindl. SHORT'S ASTER. A Midwest speciality, from the Appalachian Plateau (Alabama and Georgia to southwest Pennsylvania) to Missouri, southern Michigan and southeastern Minnesota; locally frequent in southern Wisconsin in **southern dry-mesic forests** (oak with basswood, maple, elm, ash, ironwood, walnut), oak-hickory and maple-beech woods and rarely cedar glades; often on thinly wooded, rocky banks and calcareous slopes with prairie vegetation and brush encroachment, often in cut-over woods, shrubby clearings, thickets, limestone quarry edges, partly shaded roadsides and fencerows. (10) Flowering from the end of August to mid October, fruiting from mid October into winter.

This aster is not listed by Curtis (1959) as prevalent in the ground layer of the oak opening, nor do any herbarium specimens give savanna or oak opening as the habitat. Nonetheless, *Aster shortii* has morphological, physiological, ecological and biogeographical characteristics of classic savanna species.



130. *Aster umbellatus* Mill. var. *pubens* A. Gray [*A. pubentior*]. HAIRY FLAT-TOP ASTER. A northwestern, puberulent phase of the species, mostly from Michigan to North Dakota and Alberta, south to Nebraska (see 131).

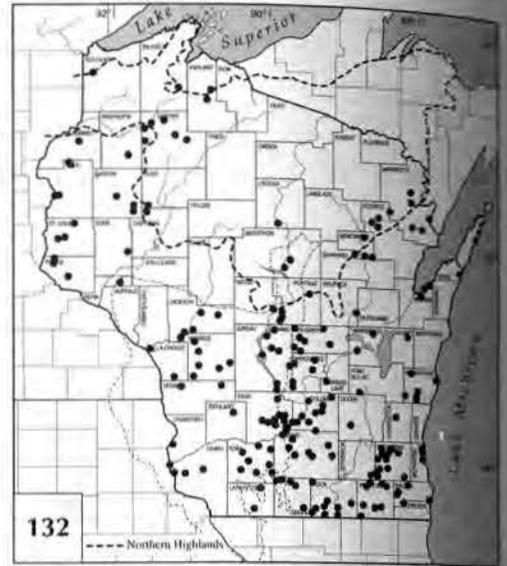
The var. *pubens* is sometimes considered a species, in which case the correct name is *A. pubentior* Cronquist, but other authorities make it a variety of *A. umbellatus* (Shinners 1941) or reduce it to a synonym of the latter (Jones 1989). The two taxa intergrade considerably in the Great Lakes region, including in Wisconsin, where both types are about equally common and sometimes grow together.



131. *Aster umbellatus* var. *umbellatus*. FLAT-TOP ASTER. Eastern North America, the collective species from Newfoundland to the northern Great Plains in Alberta (see 130), the typical variety to Minnesota, south to northern Illinois, Kentucky, and in the mountains to Georgia and Alabama, and west through southern Arkansas to Texas, apparently lacking in the Ozarks and much of the Prairie Peninsula; throughout Wisconsin in diverse habitats, mostly in marshy, swampy or peaty ground, also in sandy or rocky uplands (such as **bracken grasslands**), north of the Tension Zone in spruce-cedar-ash swamps, moist fir-yellow birch-hemlock woods, and second-growth aspen, white birch, pine or red maple stands, edges of tamarack or sphagnum bogs; more ecologically restricted in the south, there in fens, low prairies, sedge meadows, shrub carrs, openings in low sandy woods, drained, burned or cut-over lowlands, margins of tamarack bogs and cranberry marshes, weedy in drainage ditches, roadsides and old grassy fields. (16) Flowering from late July to late August, fruiting from mid August to mid October.

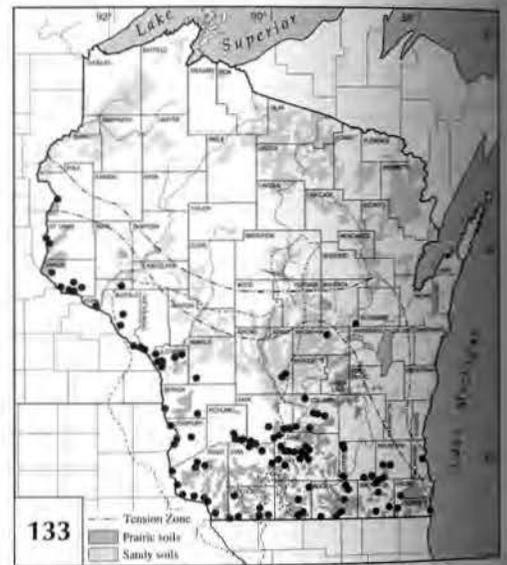
132. *Aster urophyllus* Lindl. [*A. sagittifolius* Willd.]. ARROW-LEAVED ASTER. Widespread in the eastern and central United States; in Wisconsin very common except in the Northern Highlands, from dry oak, poplar, or occasionally pine woods to mesic maple-beech forests, especially along woodland borders and openings, peaking in **southern dry-mesic forests**, moist bottomland forests, thickets, roadsides, fencerows, pastures, fields and old cemeteries, occasionally in marshy or low places. (12) Flowering from mid August to late October, fruiting from late September into October.

Arrow-leaved Aster is most commonly found in open woods and woodland borders with other asters, goldenrods and grasses. It scarcely occurs in prairies except those that were formerly grazed and now suffer from much brush encroachment, implying that oak openings were probably its original habitat. Drummond's Aster, *Aster drummondii* Lindl., is locally common in habitats similar to those of the closely related *A. urophyllus*, and the two tend to hybridize freely.



133. *Brickellia eupatorioides* (L.) Shinnery var. *corymbulosa* (Torr. & A. Gray) Shinnery [*Kuhnia e.* var. *c.*]. FALSE BONESET. Widespread from New Jersey and Florida westward, this variety is a widespread Great Plains grassland element, from Ohio to Montana and Arizona; in Wisconsin south of the Tension Zone, most common in dry-mesic to **dry prairies**, rocky or sandy prairie relics on steep calcareous bluffs, rarely on sand dunes, including sand terraces of the Mississippi River, but absent from the sandy level prairies of the Central Plain, occasionally along roadsides or railroads. (8) Flowering from (July) August into October, fruiting from late August through October.

Superficially similar to Tall Boneset, *Eupatorium altissimum* (145), which has opposite, triple-veined (instead of mostly alternate, one-veined) leaves. False Boneset is a member of a large southwestern and Mexican genus, a so-called Madro-Tertiary element.



134. *Cacalia atriplicifolia* L. [*Arnoglossum atriplicifolium* (L.) H. Rob.]. PALE INDIAN-PLANTAIN. In open forests of the eastern United States, from eastern Oklahoma, Alabama and western Florida, north to New York and Wisconsin; like all Wisconsin cacalias, conspicuous but rare, in dry to dry-mesic (often oak-elm) or even swampy open woods, thickets, oak openings and borders, dry to **wet prairies** and railroad embankments, rarely weedy in fields and roadsides. (2) Flowering from mid June to mid September, fruiting from mid August to mid October or later.

Like many species characteristic of open forests, Pale Indian-plantain grows well in moist to mesic prairies.





135. *Cacalia plantaginea* (Raf.) Shinnery [*Arnoglossum plantagineum* Raf.; including *C. tuberosa* Nutt.]. PRAIRIE INDIAN-PLANTAIN (Threatened). Centered in the central United States from Ohio and southern Ontario to southeastern Minnesota (northeastern South Dakota), south on the eastern Great Plains to Alabama and Texas; a localized species of Wisconsin prairies, most commonly in rich, moist, sandy, alluvial soils along rivers and streams, or on springy, peaty ground, especially in **wet-mesic prairies**, less frequently, and in small populations of up to 12 plants, on dry high lime prairies (sometimes with *Cirsium hillii*) and the dry-mesic lower slopes of prairie bluffs. (6) Flowering from mid July through August, fruiting from late August (through October?).

A conspicuous plant, formerly abundant, now rare due to the near elimination of the deep-soil prairies by agriculture. Its leaves resemble *Plantago major* L. in their parallel venation, in both cases (also in *Eryngium yuccifolium*) an evolutionary reduction of the leaf to a midrib, followed by an expansion.



136. *Cacalia suaveolens* L. [*Hasteola suaveolens* (L.) Pojark., *Synosma suaveolens* (L.) Britton & A. Br.]. SWEET INDIAN-PLANTAIN. A species of open, moist, low woodlands of the north-central United States, from the Appalachians in Georgia to southern New England, west to southeastern Missouri and southeastern Minnesota; in southern Wisconsin in damp, rich to wet, peaty soil, usually in marshes, sedge meadows, **wet prairies** and marshy places along creeks and rivers, often in transition zones between lowland woods or thickets and marshes, also ditches. (3) Flowering from late July to late September, fruiting from late September through October.



137. *Cirsium discolor* (Muhl. ex Willd.) Spreng. FIELD OF PASTURE THISTLE. Southeast Canada to Minnesota, south in the mountains to the Carolinas, northern Louisiana and eastern Kansas; not uncommon in southern and southwestern Wisconsin in sunny open woods, wet to dry-mesic prairies, an indicator of **mesic prairies**, often on prairie relics along railroads, less commonly on lakeshores and in sedge meadows, and occasionally weedy in roadside ditches and well-drained, waste places. (10) Flowering from mid July to early September, fruiting from early August through September.

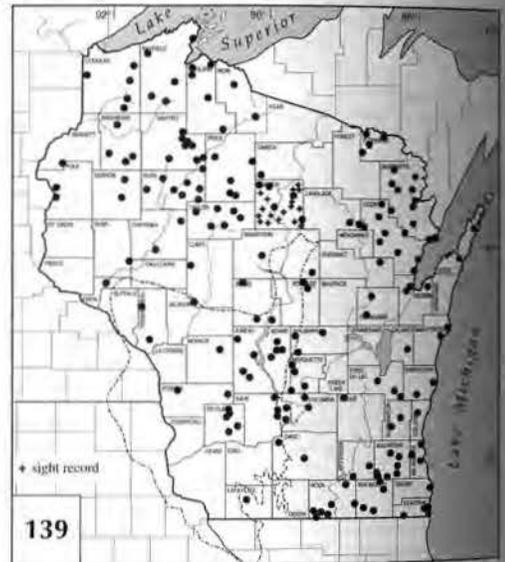
The thistles—there are 12 species of *Carduus* and *Cirsium* in Wisconsin—are truly beautiful plants. They include everything from locally occurring native species needing protection to rare adventives and abundant introduced weeds.

138. *Cirsium hillii* (Canby) Fernald [*C. pumilum* ssp. *h.*]. PRAIRIE OF HILL'S THISTLE (Threatened). North-central United States, from central Minnesota to South Dakota, Iowa, central Illinois and western New York and the Lake Huron-Georgian Bay Islands in Ontario; in southern and western Wisconsin now rare and local on **dry-mesic prairies** and steep, calcareous hill prairies, as well as in deep-soil or sandy prairie relics along railroads; apparently introduced in Douglas and Marinette counties. (2) Flowering from mid June through July (August), fruiting from late July to mid August (mid September).

Hill's Thistle, a Midwest prairie endemic, is a perennial closely related to the eastern *Cirsium pumilum* (Nutt.) Spreng. sensu stricto, which ranges from Maine to North Carolina and is a biennial.

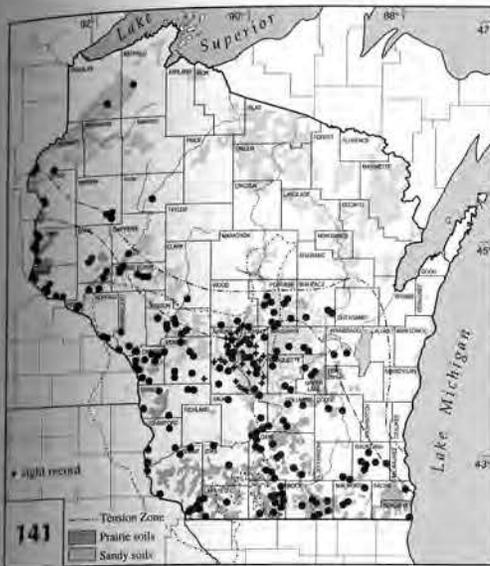


139. *Cirsium muticum* Michx. SWAMP THISTLE. From Newfoundland, Hudson Bay and Saskatchewan to North Carolina and Texas; throughout Wisconsin in open moist habitats, most prevalent, especially in the south, in **wet prairies**, rather rare in wet-mesic and mesic prairies, common in poorly drained, highly organic, mucky soil at edges of bogs, in wet sedge meadows, around springs and in tamarack swamps; in northern Wisconsin often in moist spruce-fir-white cedar or aspen-paper birch woods, rarely as a roadside weed in burned, second-growth, sandy woods. (12) Flowering from mid July to mid September, fruiting from mid August to early October.



140. *Coreopsis lanceolata* L. SAND COREOPSIS (Special Concern). Dry, sandy, gravelly or rocky places, the overall range from the north shore of Lake Superior to New England and Florida, west to Wisconsin, Oklahoma and Texas (cultivated and escaped elsewhere). In Wisconsin var. *lanceolata* is locally common along Lake Michigan, on the edges of older sand dunes and in sandy open woods near the lake (one station each in Sheboygan and Oconto counties in similiar sandy sites slightly inland). The majority of our material belongs to var. *villosa* Michx., with pubescent stems and leaves, but current authorities do not consider it worthy of recognition. It is sporadic along roadsides and other waste places, apparently as an escape from cultivation. It is native to the south and east of Wisconsin. (2) Flowering from early June to late August, fruiting from early July to late September.





141. *Coreopsis palmata* Nutt. PRAIRIE COREOPSIS. Widespread in the tallgrass prairie, from the eastern Dakotas to the Ozarks and Texas, east in the Prairie Peninsula; in Wisconsin very common within and south of the Tension Zone, especially abundant in mesic to **dry prairies**, xeric “goat prairies,” and—before ill-advised herbicide spraying for “weeds” in the 1960s wiped out much biodiversity—along railroads and roadsides; also in various other dry open habitats, including open, sandy jack pine, scrub oak, or bur oak stands and savannas. (13) Flowering from mid June to October, fruiting from August to November.



142. *Echinacea pallida* (Nutt.) Nutt. PALE PURPLE CONEFLOWER (Threatened). A widespread prairies and plains species once common from eastern Montana to Iowa, eastern Kansas, Arkansas, Illinois and Kentucky, south to Texas, and irregularly introduced eastward; in Wisconsin now rather rare in Dane, Grant, Green, Racine and Rock counties in **mesic prairies**, railroad rights-of-way and roadsides, less frequent in dry open habitats such as gravelly slopes and gravel pits. (3) Flowering from late June to August, fruiting from August onward (the plants stay upright and dry slowly, and the fruits persist into winter).

Echinacea purpurea (L.) Moench, Purple Coneflower, a widespread, more southerly species common in the Ozarks and Midwest but not native to Wisconsin, was planted in the Curtis Prairie restoration of the University of Wisconsin-Madison Arboretum, where it has become well-established and periodically even dominant.



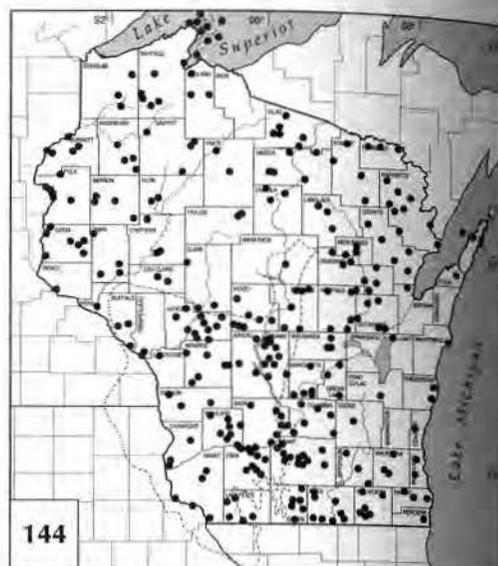
143. *Erigeron pulchellus* Michx. var. *pulchellus*. ROBIN'S-PLANTAIN. Most of eastern North America, from Georgia and eastern Texas north to Maine and Minnesota; in Wisconsin in **southern dry-mesic forests** of oak or oak-hickory, mesic maple-basswood or maple-birch, especially in grassy openings and cedar glades, locally abundant on grassy or brushy hillsides, partly shaded ravines and banks, cleared woodland, prairie pastures and dry prairies on bluffs and ridges, occasionally in sandy fields and old quarries. (11) Flowering from mid May to mid June, fruiting from mid June into July.

Two other varieties are local beyond our borders.

Today, this spring ephemeral occurs with such dry prairie indicators as Lead-plant, Little Bluestem, Shooting-star and Prairie-smoke, as well as those more tolerant of disturbance such as Pussy-toes, Sand Cress and Puccoon. However, Robin's-plantain is probably one of the species that reached high presence values in oak savannas during prehistoric times.

144. *Erigeron strigosus* Muhl. ex. Willd. DAISY FLEABANE Ubiquitous on the Great Plains from the Rocky Mountains eastward and weedy throughout much of the United States and southern Canada; very common throughout Wisconsin, especially in mesic to **dry prairies**, sand plains and blowouts, barrens, lakeshores and river terraces, oak openings, disturbed woods and borders, and open brushy or wooded hillsides and bluffs; very weedy (but innocuous) along roadsides, railroads, abandoned fields, pastures, fencerows, quarries and gravel pits; sometimes in low ground but usually in dry places with sandy or gravelly, poor or worn soils. (15) Flowering from early June to early October; fruiting from late July to late October.

Infrequent plants, morphologically intermediate between *Erigeron strigosus* and *E. annuus* (L.) Pers. have been called var. *septentrionalis* (Fernald & Wiegand) Fernald, but it is not clear whether these are hybrids or variant types of *E. strigosus*.

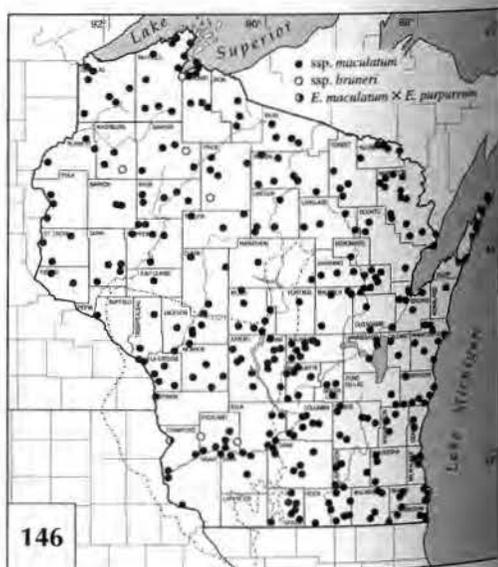


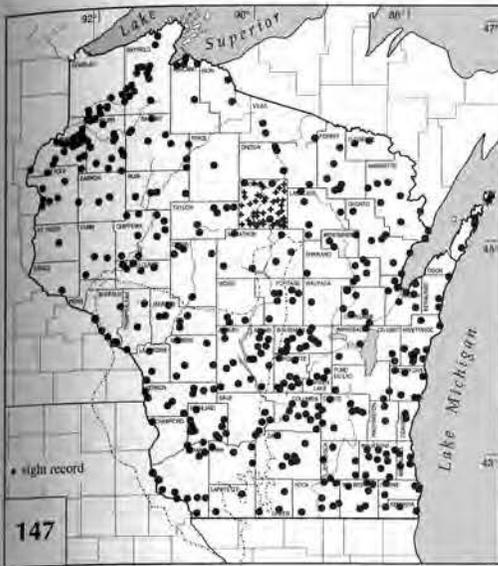
145. *Eupatorium altissimum* L. TALL BONESET. Widespread in the eastern United States from New Jersey to Minnesota, eastern Nebraska and Texas, rather infrequent and sporadic in southwestern Wisconsin on dry rocky limestone (dolomite) prairies, less often on **mesic prairies** and wooded bluffs, and rarely locally abundant on bare sterile mine tailings (in Benton, Lafayette Co.). (1) Flowering from late July into early September, fruiting from mid-August to October.



146. *Eupatorium maculatum* L. SPOTTED JOE-PYE-WEED. Widespread in northern North America from ocean to ocean, south in the mountains to Tennessee, to Illinois and New Mexico; throughout Wisconsin, characteristic of wet prairies and especially northern sedge meadows, in marshes, **alder thickets**, wet woods, lowlands, and along streams and lakes, less common in bogs or drier habitats. (11) Flowering from early July through September, fruiting from late July into October.

Most of our plants are the typical eastern ssp. *maculatum*, but the western ssp. *bruneri* (A. Gray) G. W. Douglas of the northern Great Plains (Nebraska to Manitoba) is occasionally encountered as well.





147. *Eupatorium perfoliatum* L. var. *perfoliatum*. BONESET, COMMON BONESET. Nearly ubiquitous from Nova Scotia and Florida west to the Dakotas and northeastern Texas; throughout Wisconsin, common in open moist habitats such as sandy lakeshores, sand bars, beaches, sedge meadows, wet prairies, **fens**, southern lowland forests, northern damp cedar-hemlock or tamarack-spruce-popular woods, shrub carrs, swamps, marshes, streamsides and wet cliffs, rarer in drier habitats, though often very weedy in heavily grazed pastures or gravelly dry hillsides. (12) Flowering from late June through September, fruiting from late July to early October.

Local varieties occur beyond our range.

Surprisingly, Boneset and several other sedge-meadow species have been turning up, albeit in low densities, in upland oak woodlands in which controlled fires are being used as a management tool (R. A. Henderson, pers. comm.).



148. *Eupatorium purpureum* L. [including var. *holzingeri*]. PURPLE JOE-PYE-WEED. In the eastern deciduous forest and Prairie Peninsula from New England and the Appalachians to Minnesota and eastern Oklahoma; in Wisconsin infrequent in the southern half, nearly lacking from the region of the Central Plain, mainly in the dry and **southern dry-mesic forests** dominated by oaks, and in mesic to damp maple, basswood and elm woods south of the Tension Zone, less common on thinly wooded bluffs, rarely in mesic prairies, lakeshores and marshes, and (in the Wisconsin River bottoms) in dense underbrush of moist sloughs subject to seasonal inundation. (5) Flowering from (mid) late July to mid August, fruiting from August through September.

Very similar to the more common *Eupatorium maculatum* (146), Spotted Joe-pye-weed, but in drier habitats and with only 4–8 very pale pinkish to purplish flowers per head.

Like *Solidago ulmifolia* and other oak woodland species, Purple Joe-pye-weed proliferates during savanna and woodland restoration.

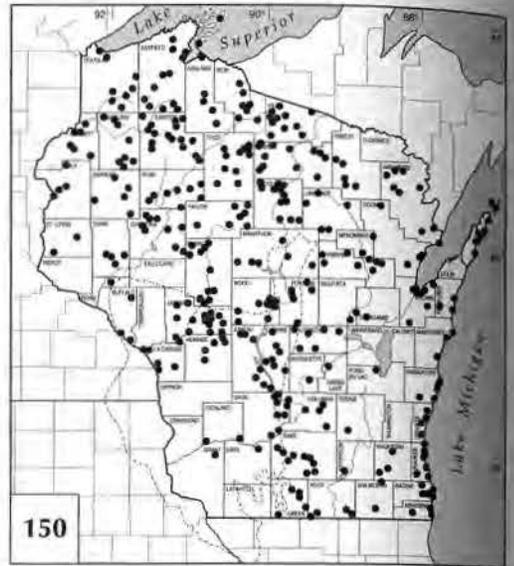


149. *Eupatorium rugosum* Houtt. var. *rugosum* [including var. *tomentellum*]. WHITE SNAKEROOT. Widespread, abundant and variable (but hardly subdividable except for one variety of the southern Appalachians), from northern Florida north to Nova Scotia and west to the eastern Great Plains; in Wisconsin abundant except in the extreme northwest in dry, mesic or moist woods, most prevalent in **southern dry-mesic forests**, woodlands and savannas, wet woods and thickets, shady ravines, riverbanks and floodplains, less frequently on lakeshores, bluffs and cliffs, abundant in disturbed woods, along trails and openings, and weedy in urban areas; flourishing in light shade and deep soil generally. (10) Flowering from late July through September, fruiting from (late July) August to early October.

The leaves and stems of White Snakeroot contain tremetol, a toxin that causes "trembles," a fatal disease of cattle. Tremetol is soluble in milkfat and, when transmitted to other animals or humans, causes the notorious "milk sickness," common in some parts of the Midwest during the early days of settlement.

150. *Euthamia graminifolia* (L.) Nutt. var. *graminifolia* [*Solidago graminifolia* (L.) Salisb. var. *g.*]. GRASS-LEAVED GOLDENROD. Transcontinental, the collective species from Newfoundland to British Columbia, south to Virginia, Missouri and New Mexico; the glabrous typical variety common throughout most of Wisconsin in mesic to moist prairie remnants, moist to dry fallow fields and **northern sedge meadows**, also on edges of marshes, bogs, and moist maple-basswood and hemlock-yellow birch-maple woods, rarely in open deciduous woods, somewhat weedy along fencerows, open sandy or clayey roadsides and railroad rights-of-way. (14) Flowering (late July) early August into October, fruiting from late August into October.

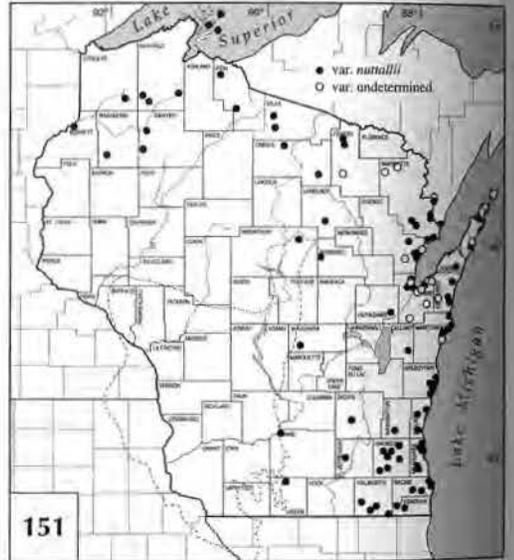
A polymorphic species with several varieties, ecogeographically distinctive or not, of which this is the most common.



151. *Euthamia graminifolia* (L.) Nutt. var. *nuttallii* (Greene) W. Stone [*Solidago g.* var. *nuttallii* (Greene) Fernald]. NUTTALL'S GRASS-LEAVED GOLDENROD. A minor phase with very short, spreading pubescence, sympatric with var. *graminifolia*, but extending westward only as far as Minnesota; generally distributed in eastern and northern Wisconsin. (14) Flowering and fruiting as in var. *graminifolia*.

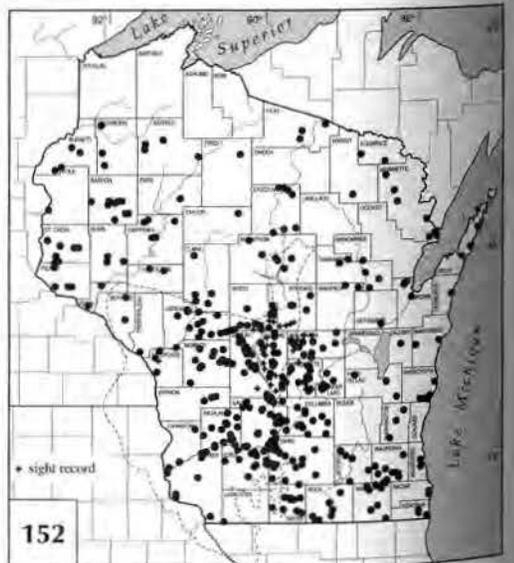
About one-fifth of our material is referable to var. *nuttallii*, which appears to be only slightly discrete geographically and not at all discrete ecologically within our range.

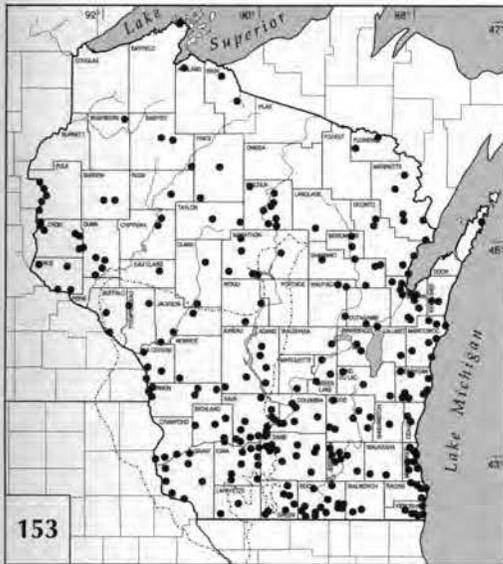
Less common than the variable and widespread *Euthamia graminifolia* is *E. gymnospermoides* Greene (*Solidago g.*), Viscid Grass-leaved Goldenrod, a western species reaching its eastern range limit south of the Tension Zone in dry sandy fields, sandy prairies, and at the edges of jack pine and/or black oak woods.



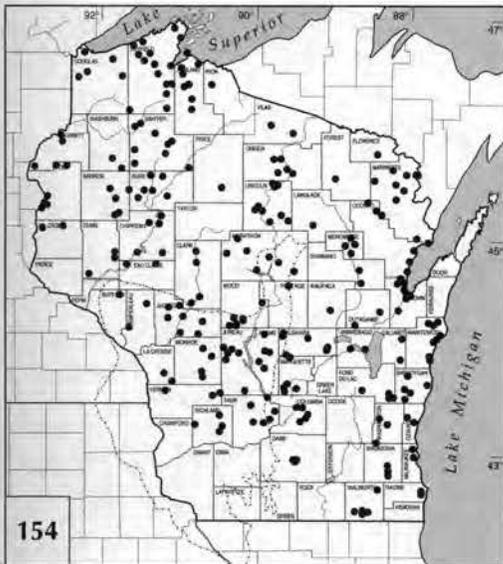
152. *Gnaphalium obtusifolium* L. sensu stricto. FRAGRANT OR OLD-FIELD CUDWEED, CATFOOT, RABBIT'S-TOBACCO. Widespread in eastern North America from Florida and Texas north to Nova Scotia and Manitoba; throughout Wisconsin very common in sandy fields, roadsides, prairies, **sand barrens** and occasionally in open dry woods. (11) Flowering from August to early October, fruiting in September and October.

Unlike most sand prairie annuals, which are only ephemerally or peripherally present, *Gnaphalium obtusifolium* belongs to a guild of persistent species that includes Geyer's Spurge (*Chamaesyce geyeri*), Common Cotton-weed (*Froelichia floridana*), Slender Knotweed (*Polygonum tenue*) and Coastal Joint-weed (*Polygonella articulata*) (Plumb 1979).

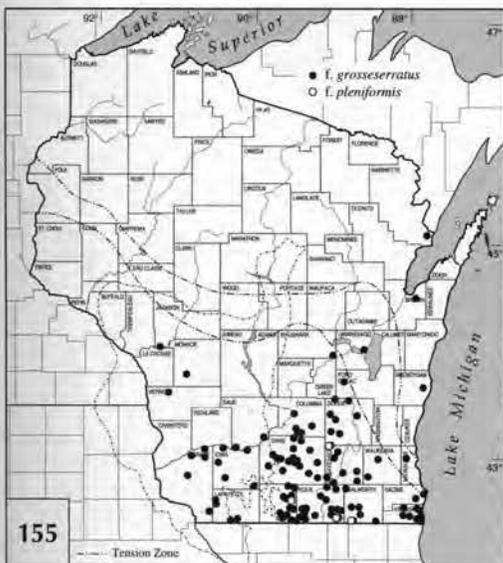




153. *Helenium autumnale* L. var. *autumnale* [including var. *canaliculatum*]. COMMON SNEEZEWEED. A polytypic species, throughout much of temperate North America; abundant in all but northernmost Wisconsin, in sunny or shady moist areas such as river bottom floodplain forests, low open woods with alder, willow, elm, ash, red-osier dogwood, silver maple and yellow birch, on sand and gravel bars of rivers and lakeshores, meadows of *Carex*, in low swales or marshes, and peaking in **wet prairies**. (7) Flowering from mid July to mid October, fruiting from August through October.



154. *Helianthus giganteus* L. TALL or SWAMP SUNFLOWER. An eastern taxon, from the Appalachians of Georgia and the North Carolina Piedmont to Maine, west to southern Manitoba; very common throughout most of Wisconsin but lacking in six southern or southwestern counties, although most abundant in the north in a wide variety of habitats: sedge meadows, riverbanks, lake margins, **alder thickets**, mesic to dry poplar woods, and clearings in northern hardwoods; especially common along wooded roadsides, abandoned fields and other disturbed woodlands; in southern Wisconsin in moist to mesic prairies, marshes, thickets, open woods, and along railroads and roadsides. (4) Flowering from July to mid September, fruiting from late July to October.



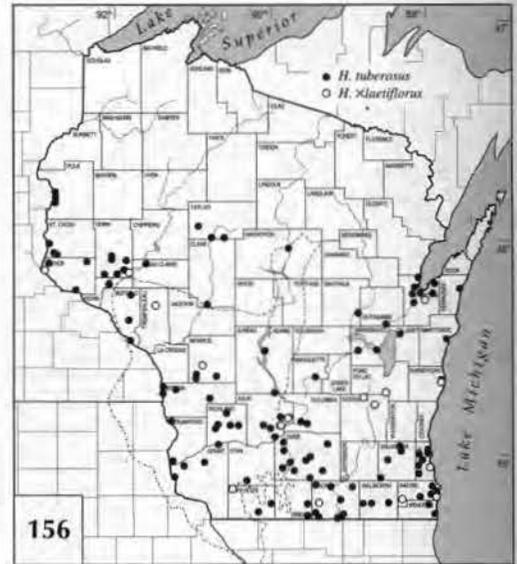
155. *Helianthus grosseserratus* M. Martens. SAW-TOOTH SUNFLOWER. A western element of the southern Great Plains, from Louisiana and Texas to Minnesota, east in the Prairie Peninsula (as a striking component of the tallgrass prairie) to Ohio and (introduced?) beyond to New England; in southern Wisconsin common in **wet-mesic prairies**, less frequent in mesic to dry-mesic prairies (absent from dry and sandy prairies), in moist thickets, marshes, ditches, along streams, lakes, railroads, roadsides and fencerows. (11) Flowering from July to early October, fruiting from late August to October.

It can be difficult or impossible to try to sort out specimens of our various native and introduced sunflowers. However, the majority of common prairie species, including Sawtooth Sunflower and Swamp Sunflower (154) of wet meadows and moist ground generally, and Naked-stemmed (157) and Stiff Sunflower (158) of dry to mesic prairies, are readily identifiable.

156. *Helianthus* × *laetiflorus* Pers. [*H. pauciflorus* × *H. tuberosus*].

HYBRID PRAIRIE SUNFLOWER. Widely scattered in the eastern and midwestern United States and adjacent Canada; in southern Wisconsin sporadic in dry to moist soil along roadsides, railroads, fields, waste ground and other disturbed sites, rarely in native prairie. Flowering from August to early October.

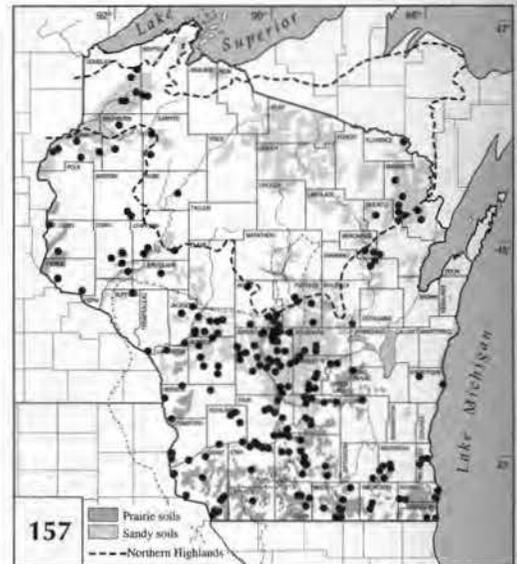
Supposedly a series of hybrids resembling *H. pauciflorus*, but occasionally tuber-bearing and with yellow disk florets as in *H. tuberosus*, in other characters intermediate between those of the postulated parents (Clevenger & Heiser 1963).



Helianthus tuberosus L. JERUSALEM ARTICHOKE. Nearly throughout the eastern United States and southern Canada and across the Great Plains; common in the southern half of Wisconsin in rich or moist soils along streams and rivers, shrub carrs, open woods, prairies, fencerows, roadsides and railroads, often on sandy beaches and in waste places; frequently in low open areas with native weedy species of prairies and marshes. (1) Flowering from late July to early October.

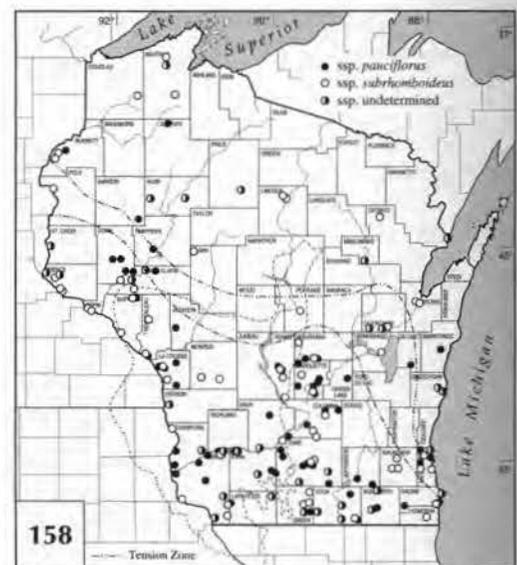
157. *Helianthus occidentalis* Riddell ssp. *occidentalis*. NAKED-STEMMED SUNFLOWER. A very distinctive, basally leaved subspecies of a mostly Midwest prairie species ranging from eastern Minnesota south through the Ozarks into eastern Texas, east to northern Ohio and scattered in the East and South; widespread throughout Wisconsin but lacking from the Northern Highlands, especially common in very sandy, dry to mesic prairies, sandy oak and jack pine barrens, calcareous "goat prairies," and on sandy roadsides, fields and railroads. (13) Flowering from mid July to mid September (early October), fruiting from August to October.

The epithet *occidentalis*, meaning western, is a nineteenth century misnomer; the species' range extends only to eastern Minnesota.



158. *Helianthus pauciflorus* Nutt. ssp. *pauciflorus* [*H. rigidus* (Cass.) Desf.; *H. laetiflorus* var. *rigidus*]. STIFF OR PRAIRIE SUNFLOWER. A Midwest subspecies (Indiana to southern Manitoba and eastern Texas, occasional eastward (introduced?); in Wisconsin mainly south of the Tension Zone in wet to dry prairies, most common in dry-mesic and mesic prairies, sand prairies, sand barrens and terraces, dry, steep, calcareous "goat prairies," and roadsides and railroads. (8) Flowering from late July through September.

A very distinctive but complex species represented in our region by two intergrading subspecies (or varieties) and a named putative hybrid (156) (Clevenger & Heiser 1963, Heiser et al. 1969). Most Wisconsin specimens are ssp. *pauciflorus*, although ssp. *subrhomboideus* (Rydb.) O. Spring & E. E. Schill. [*H. laetiflorus* var. *subrhomboideus*; *H. rigidus* var. *subrhomboideus*], of the northern Great Plains, from southern Alberta to western Texas and Wisconsin (eastward as a weed), is almost as frequent.





159. *Helianthus strumosus* L. ROUGH-LEAVED SUNFLOWER. Throughout the eastern United States to the edge of the Great Plains from Texas to Minnesota; very common throughout Wisconsin, especially in the southern half, abundant in oak woods (**southern dry forest**), oak openings, edges of woods and thickets, in mesic to moist prairies, sand prairies, limestone or sandstone bluffs and ledges, lakeshores, roadsides, railroads and fencerows; uncommon in very wet or very dry areas. (15) Flowering from late July through September, fruiting from August through October.

Similar to and often confused with *Helianthus tuberosus* (156) and *H. decapetalus* L., the latter occasional throughout Wisconsin in closed to open oak woods and thickets, less often in open or moist areas along roadsides, railroads and lakeshores (but not in prairies).



160. *Helianthus strumosus* approaching *H. hirsutus* Raf. HAIRY or ROUGH SUNFLOWER. Frequent nearly throughout Wisconsin, chiefly associated with open woodlands, especially oak but also jack pine, as well as dry to mesic prairies, sandy or gravelly banks, roadsides, old fields and fencerows; usually on uplands and slopes. Flowering in August and September, fruiting from August to October.

Helianthus hirsutus, "itself a borderline species" (Heiser et al. 1969), is very closely related to *H. strumosus*, each consisting of a complex of poorly defined morphological races. In eastern and southern states the two may deserve taxonomic recognition, but in the northern part of their range, including Wisconsin, the distinctions ascribed to them (stem pubescence and petiole length) seem particularly inconsistent. Intermediates occur so frequently that we have been discouraged from attempting to maintain them as specifically distinct. Herbarium specimens with hirsute or scabrous stems have been mapped as "approaching *H. hirsutus*."



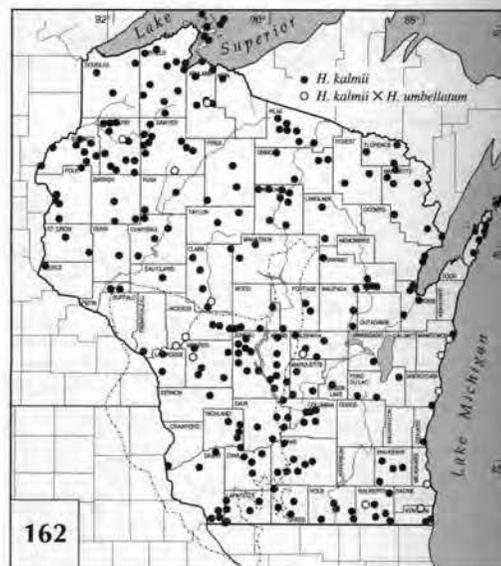
161. *Heliopsis helianthoides* (L.) Sweet. FALSE SUNFLOWER. Common throughout Wisconsin, in the south and west in wet to dry-mesic prairies, although most common in **mesic prairies**, often in and on the edges of open, cut-over woods, in thickets, on floodplains, lakeshores, low or abandoned fields, and along roadsides and railroads; in the north along wooded roadsides and lakes and streams. (12) Flowering from June to early October, fruiting from July to October.

Two slightly differentiated forms occur in our region: the smooth-stemmed, Appalachian-centered var. or ssp. *helianthoides*, infrequent in the southwestern Wisconsin, and the rough-stemmed, Great Plains and prairie-centered var. or ssp. *scabra* (Dunal) Fernald [ssp. *occidentalis* T. R. Fisher], to which most Wisconsin specimens can be referred.

Being very shade tolerant, False Sunflower is likely more of a savanna than a prairie species.

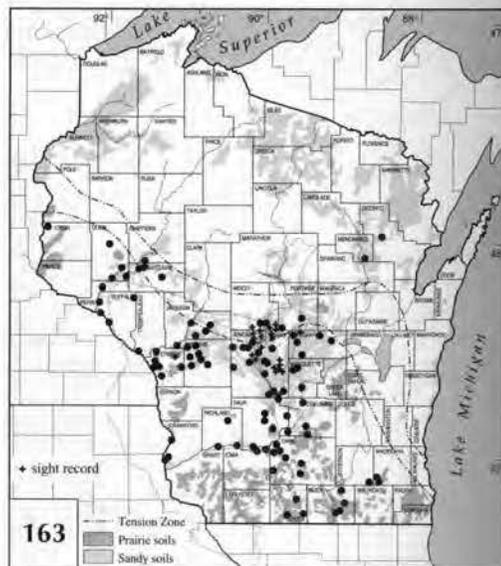
162. *Hieracium kalmii* L. [including var. *fasciculatum*; *H. canadense* Michx.]. CANADA HAWKWEED. Cool temperate North America from Canada's maritimes and northeastern states to British Columbia, evading the Great Plains; common throughout Wisconsin, especially in the **bracken grasslands** north of the Tension Zone, mostly on sandy, slightly acid soil with jack pine, aspen, oaks and pines; on sandy lakeshores and rivers, weedy on sandy roadsides, railroad tracks, in pastures, gravel pits, quarries and sandy fields. (14) Flowering from mid July to mid October, fruiting from late July through October.

Most of our plants can be referred to the slender var. *kalmii*, with thinner leaves and more open inflorescences and a few to the robust extremes called var. *fasciculatum* (Pursh) Lepage, with thicker leaves and shorter, stiffer peduncles, with all possible intermediates bridging the gap. Hybrids with *H. umbellatum* L. sensu lato [*H. scabriusculum* Schwein.] and *H. scabrum* [*H. × fassettii* Lepage] are occasionally found.



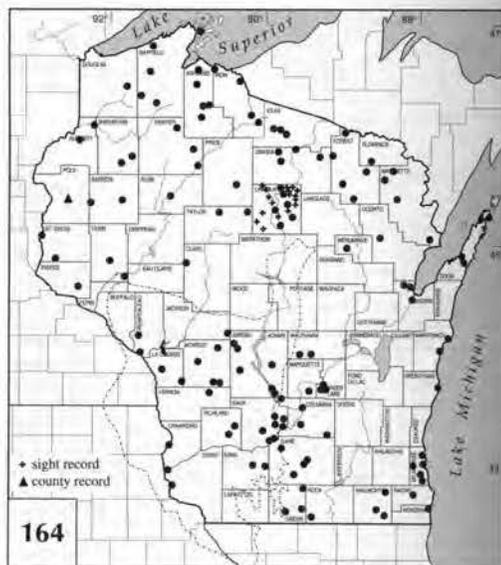
163. *Hieracium longipilum* Torr. ex Hook. LONG-HAIRED HAWKWEED.

A beautiful and characteristic sand prairie dweller from Indiana and Michigan to (mostly) eastern Minnesota and Oklahoma (Louisiana); in southwestern Wisconsin most prevalent in and characteristic of dry sandy prairies, especially along the Chippewa, Wisconsin and Trempealeau rivers and on railroad rights-of-way, the **sand barrens** of central and southwestern Wisconsin, occasionally on steep dry prairies, and in jack pine woods, and rarely weedy in abandoned fields and roadsides; equally frequent on disturbed and undisturbed soils. (9) Flowering from early July through mid August, fruiting from late July through late September.



164. *Hieracium scabrum* Michx. var. *scabrum*. ROUGH HAWKWEED.

A species of dry open woods, from the Appalachians of northern Georgia to Nova Scotia, west to Missouri, Minnesota and southwestern Ontario; relatively common throughout Wisconsin, especially in **southern dry-mesic forests** and in the northern hardwoods region, in jack pine or red pine woods, oak woods and oak openings, rarely in more mesic woods, lakeshores, streambanks, sandy prairies and sunny hillsides, pastures, fields and railroads; on both sandstone and limestone, but mostly in dry sandy soil. (5) Flowering from late July to late September, fruiting from September into early October.





165. *Hieracium scabrum* var. *tonsum* Fernald & H. St. John.

SMOOTH-STEMMED HAWKWEED. Maine and southern Quebec to northern Michigan and adjoining Ontario, overlapping the previous; in Wisconsin scattered in habitats similar to those of var. *scabrum* (164), but more abundant in the northern hardwood region, in black oak, sugar maple, *Acer-Populus* and spruce-fir-hemlock-*Thuja* woods, sandy plains, lakeshores and pastures. Flowering from late July to early September, fruiting from late August to late September.

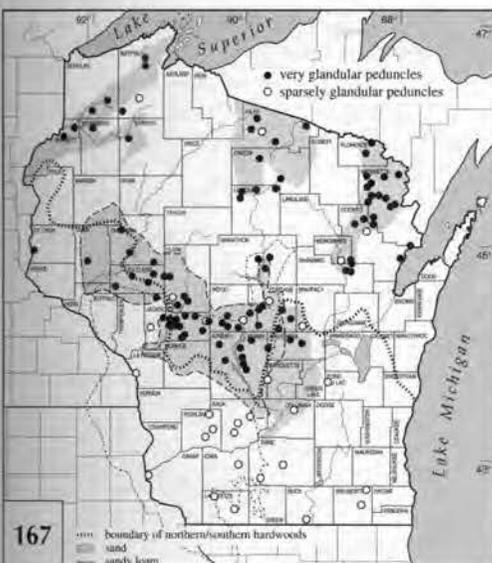
The two varieties may occur together in Iron, Vilas and Washburn counties, and in the latter a rare specimen intermediate between them. The common name of var. *tonsum* is a misnomer, because the stem may be minutely bristly.



166. *Krigia biflora* (Walter) S. F. Blake ssp. *biflora*. FALSE-DANDELION.

Widespread in eastern North America from New England to the eastern edge of the Great Plains, south to Georgia (?) and in the southern Rocky Mountains; in Wisconsin common in the Southern Forest-Prairie Province in rocky woods and sandy areas south of the floristic Tension Zone, mostly in open oak-hickory, maple-basswood and jack pine-scrub oak woods, **wet prairies**, and weedy on roadsides, railroads and open thickets. (13) Flowering from late May to mid July (August), fruiting from June through July (October).

Nearly identical to the next (167), but consistently lacking glandular pubescence.



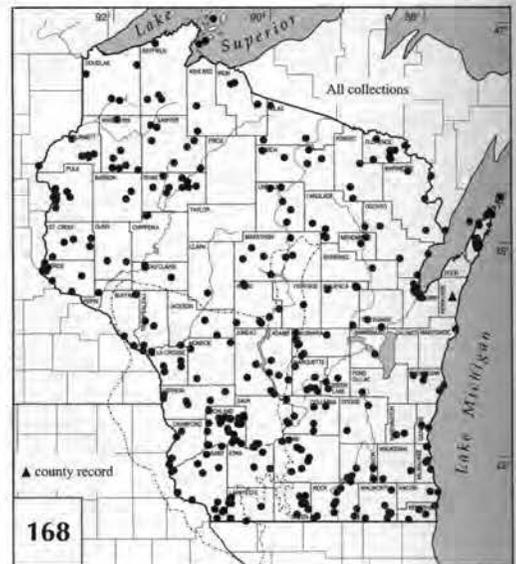
167. *Krigia biflora* ssp. *glandulifera* (Fernald) H. H. Iltis. FALSE-DANDELION.

Mostly in the region of northern hardwoods, from the southern Appalachians to New England, Iowa, Minnesota and Colorado and New Mexico; in Wisconsin relatively common in sandy areas within and north of the Tension Zone, on roadsides, lakeshores, or in oak or jack pine woods, on sandy hillsides and open fields, less common in aspen woods, sedge meadows and alder-white cedar swamps. Flowering from (late May) early June to mid July (September), peaking ca. 10 days later than in ssp. *biflora*, this perhaps related to its more northerly range; fruiting from June sporadically through August (October).

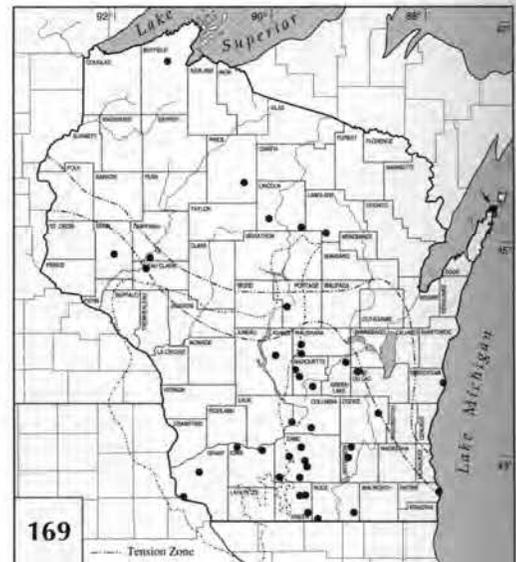
Krigia virginica (L.) Willd., Virginia Dwarf-dandelion, is locally abundant in dry open sandy habitats, especially sand barrens and jack pine woodlands, but also along roadsides and railroads near the Wisconsin River in Dane, Sauk, Iowa and Richland counties.

168. *Lactuca canadensis* L. TALL WILD LETTUCE. Subcontinental, from Florida to Nova Scotia and Saskatchewan to Texas; in Wisconsin all over in a great variety of habitats, prevalent in wet to **mesic prairies**, on roadsides, sandy fields, limestone bluffs, and in disturbed maple-hemlock, aspen and river bottom woods, shaded ravines and marshes. (14) Flowering from late June into September, fruiting from July through September.

A weedy species, *Lactuca canadensis* is very variable, with four varieties based on leaf shape: var. *canadensis*, infrequent across the southern two-thirds of Wisconsin, and the more common var. *latifolia* Kuntze and var. *longifolia* (Michx.) Farw., both throughout the state. (Variety *obovata* Wiegand, to be expected in Wisconsin, is not reported by Johnson & Iltis 1964.) What with these “varieties” more often than not occurring in the same population, our map does not differentiate between them.



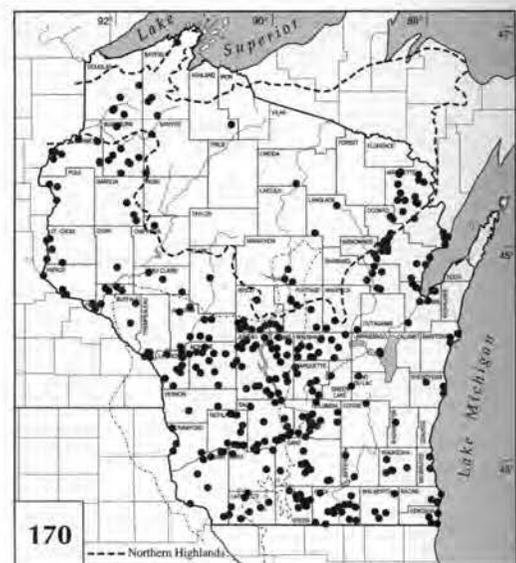
169. *Lactuca ludoviciana* (Nutt.) Riddell. PRAIRIE WILD LETTUCE. Widespread from the Pacific Coast across the Great Plains to Mississippi and Saskatchewan, east to northern Illinois (Indiana?); scattered or rarely locally common throughout southern and central Wisconsin, but mostly lacking in the Driftless Area except near the Wisconsin River, most abundant in upland **dry-mesic prairies**, in deep-soil and sandy prairies, often on roadsides or railroads; in northern Wisconsin introduced on roadsides, railroads, coal yards and sandy fields. (6) Flowering from July through mid September, fruiting from late July to October.

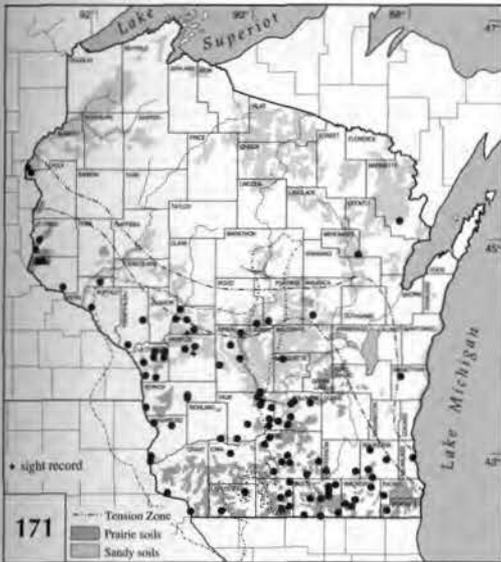


170. *Liatris aspera* Michx. [including var. *intermedia*]. ROUGH BLAZING-STAR. Eastern and central United States (and occasionally Ontario), from northern Florida and the Carolinas to Ohio and North Dakota, in the eastern Great Plains south to Texas; throughout Wisconsin, but rare in the central Northern Highlands, most common on **mesic prairies** such as are found along railroads, on dry, especially sandy prairie relics, becoming less common in open woods, on bluffs and river banks, and in willow thickets, often associated with jack pine and scrub oak. (13) Flowering from mid July to mid September (October), fruiting from (late July) August through September (October).

Many of our specimens can be referred to the mainly eastern var. *intermedia* (Lunell) Gaiser, but in Wisconsin the two have nearly identical ranges and intergrade freely.

Hybrids or introgressants between this species and *Liatris ligulistylis* are known to occur in Wisconsin, as are the more easily identified hybrids between it and *L. cylindracea*.





171. *Liatris cylindracea* Michx. FEW-HEADED BLAZING-STAR. A species of dry sandy or rocky soils from southern Ontario and western New York (Niagara) westward to eastern Minnesota and Missouri; in Wisconsin reaching greatest prevalence in **dry prairies** south of the Tension Zone, also on dry limestone (dolomite) bluffs, sandy river banks, and rarely on roadsides or railroads. (7). Flowering from mid July to early September, fruiting from August into October.

A hybrid between this species and *Liatris aspera* [*L.* × *gladewitzii* (Farw.) Shinnery] is known from Crawford and Rock counties.



172. *Liatris ligulistylis* (A. Nelson) K. Schum. NORTHERN PLAINS BLAZING-STAR. The upper Great Plains counterpart to the eastern *L. aspera*, from southern Alberta south to New Mexico and east to South Dakota, Minnesota, Arkansas and Illinois; in Wisconsin rather sporadic (as it is throughout its range), most abundant in **mesic prairies**, especially deep-soil railroad prairies, on roadsides, less common on shores of lakes and edges of swamps, low prairies and in dry sandy places; in northern Wisconsin adventive on sandy roadsides and railroad embankments. (2) Flowering in July and August, fruiting from August to early September.

This species often grows near or with *Liatris aspera*, and hybrids, especially introgressants between the two, appear to be relatively frequent. These are mapped with the parental species they most resemble (see Johnson & Iltis 1964).

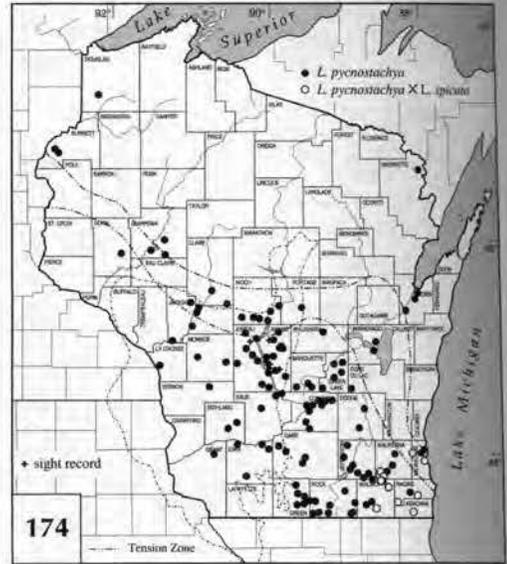


173. *Liatris punctata* Hook. var. *nebraskana* Gaiser. DOTTED BLAZING-STAR (Endangered). A highly variable xerophyte of the mixed grasslands, from southern Saskatchewan to southwestern Michigan, southward to northern Mexico, Texas and northwestern Arkansas; rare in Wisconsin, in sand prairie relics and **dry-mesic prairies** on sandstone bluffs and terraces along the Chippewa, St. Croix and Mississippi rivers in the far western part of the state. (1) Flowering in August, fruiting into September.

Our plants are part of the common phase of the species, var. *nebraskana*, weakly segregated from the more western var. *punctata* and chiefly Mexican var. *mexicana* Gaiser.

174. *Liatris pycnostachya* Michx. THICK-SPIKE BLAZING-STAR. A western Great Plains species, from the Dakotas south to Louisiana and Texas and east to Indiana; in Wisconsin typical of wet and **wet-mesic prairies**, locally common on mesic prairies, in wet, sometimes rather calcareous sedge-grass meadows (fens), peat marshes, bogs, wet roadsides and wet prairie relics along railroads south of the Tension Zone. (9) Flowering from July to early September, fruiting from (mid July) August through September.

Liatris pycnostachya co-occurs with *L. aspera*, *L. ligulistylis* and *L. spicata* (commonly hybridizing with the latter wherever they overlap), but is mostly lacking in the five south-eastern counties where *L. spicata* is relatively common.



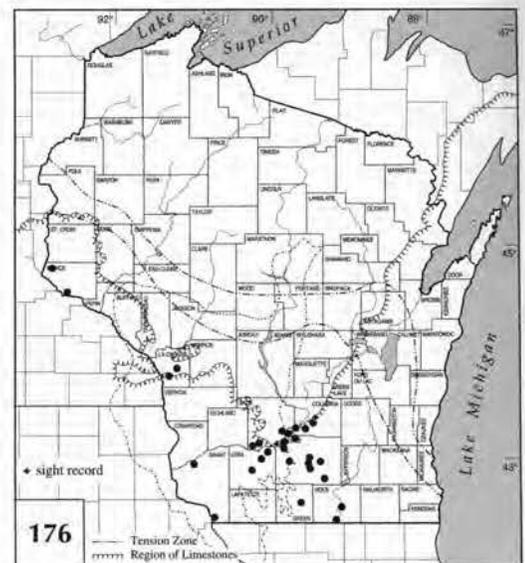
175. *Liatris spicata* (L.) Willd. SESSILE-HEADED OR MARSH BLAZING-STAR, GAY-FEATHER (Special Concern). Eastern United States, from Long Island to Florida, west to Wisconsin, Illinois and Mississippi (Louisiana); in Wisconsin occurring only in the extreme southeast (at the Bayfield County station, surely adventive), in sandy, rather calcareous, moist to **mesic prairies** and sandflats along the Lake Michigan shore. (4) Flowering in late July and early August, fruiting in August and early September.

A rare and beautiful species, here at the very edge of its range. Although once locally abundant, it is now probably threatened, because its habitat is all but swallowed up by agriculture and development. Hybrids with the closely related, but less catholic, *Liatris pycnostachya* are further mentioned above (174).

This Gay-feather, which thrives in full sun and ordinary soil, is much in demand by gardeners and florists, who use it in bouquets. Farmers in southwestern Wisconsin are now growing it to supply commercial markets.

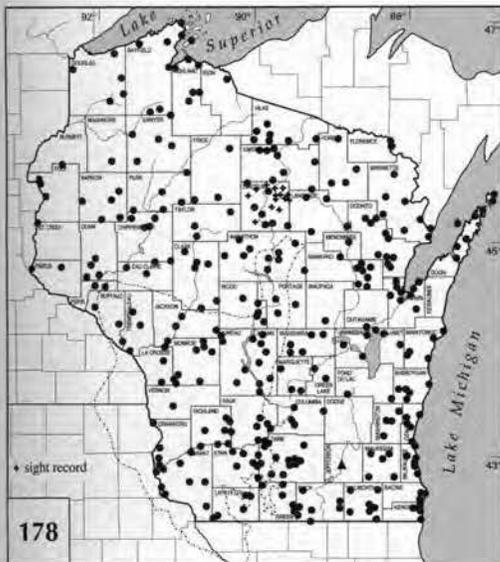


176. *Microseris cuspidata* (Pursh) Sch. Bip. [*Agroseris c.*; *Nothocalais c.*]. PRAIRIE DANDELION (Special Concern). A western Great Plains species, from Montana to Oklahoma, east to Wisconsin and Illinois; in southern Wisconsin rare and sporadic, mainly on sandy or rocky, steep, calcareous prairies and bluffs, **dry-mesic prairies**, gravelly hillsides and along railroads; in Pierce County on sand terraces of the Mississippi River. (2) Flowering throughout May and into June, fruiting from mid May through June.





177. *Parthenium integrifolium* L. WILD QUININE, EASTERN FEVERFEW (Threatened). Eastern United States, from Georgia to northeastern Texas, north to New York, Ohio and the eastern edge of the Great Plains; in Wisconsin once probably a common and typical species of mesic and **wet-mesic prairies**, now rare, and restricted to prairie relics, open bur oak woods, railroads and roadsides in the southern two tiers of counties. (3) Flowering from late June to early September, fruiting from mid August to October (a species that is, however, notorious for poor fruit set).



178. *Prenanthes alba* L. RATTLESNAKE-ROOT, LION'S-FOOT. Eastern North America, widespread from western Quebec to Saskatchewan, south through New England to Georgia, Tennessee, eastern Missouri and northwestern Arkansas; in Wisconsin very common throughout in many habitats, most abundant and prevalent in the **southern dry-mesic forests**, but also mesic to dry forests as well as low woods, and common in lowland prairies, limestone bluffs and sandy shores, less common in northern coniferous forests and deer yards, jack pine woods, alder thickets and white cedar-hardwoods, often weedy on roadsides. (18) Flowering from early August to early October, fruiting from mid August through October.

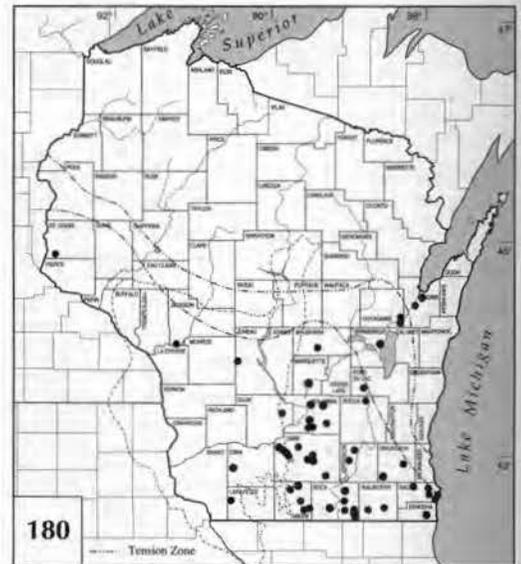


179. *Prenanthes aspera* Michx. ROUGH WHITE-LETTUCE (Endangered). Central United States, from the eastern Great Plains of Nebraska south to Arkansas and east to Ohio; in Wisconsin a very rare species of both sand prairies and steep, rocky, calcareous, dry prairies (**wet-mesic prairies** [?] fide Curtis 1959). (2) Flowering from early August to September, fruiting in October.

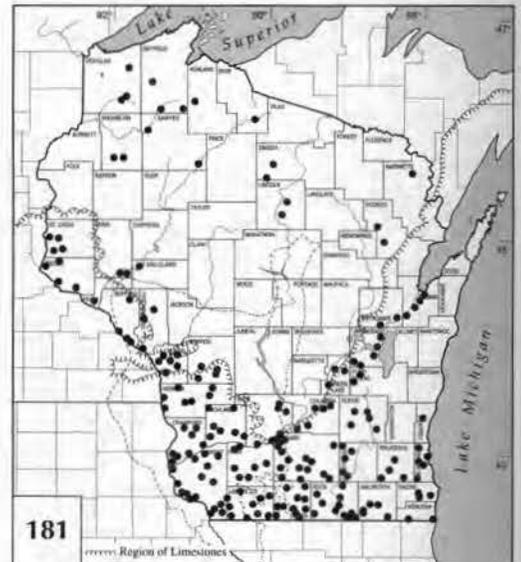
Prenanthes crepidinea Michx. GREAT OR MIDWESTERN WHITE-LETTUCE (Endangered). A tall forest herb of the eastern United States deciduous forest region, from western New York to southeasternmost Minnesota, south to West Virginia and Kentucky (Arkansas); in Wisconsin (as in Pennsylvania, Minnesota, Arkansas and Missouri) a very rare species, collected only once each from **wet-mesic prairies** in Crawford and Green counties and recently from a seepage area in an oak-maple forest in the Baraboo Hills. (1) Flowering in September.

180. *Prenanthes racemosa* Michx. GLAUCCIOUS WHITE-LETTUCE. Northeastern Great Plains, from Alberta and North Dakota to Missouri, east to Quebec and New Jersey, also in the Rocky Mountains to Colorado; in Wisconsin at one time a prevalent species of deep-soil, dry to **wet-mesic prairies** except in the Driftless Area, now relatively rare, restricted to relic prairies mostly on railroad rights-of-way and rocky or gravelly hill prairies south of the Tension Zone. (7) Flowering from (the end of August) early September to October, fruiting from mid September to mid October.

Doubtfully divisible into subspecies. The typical (and according to Gleason & Cronquist 1991, eastern) subspecies has relatively small heads with fewer involucre bracts and flowers. In the western part of the range, but extending east to Maine, is the common phase, ssp. *multiflora* Cronquist. Both variants are present in Wisconsin; but because they seem to lack ecological or distributional distinctness in the local flora, we are not convinced that taxonomic recognition is meaningful.



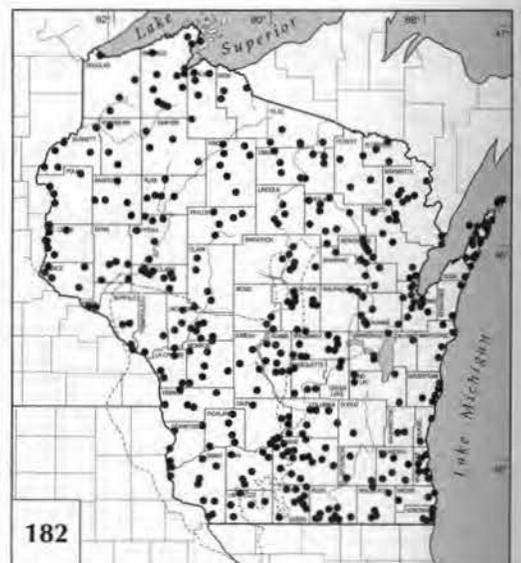
181. *Ratibida pinnata* (Vent.) Barnhart. YELLOW CONEFLOWER. A typical tallgrass prairie species, from eastern South Dakota and southern Minnesota south to northeastern Texas, east in the Prairie Peninsula and beyond to Tennessee, Florida and Ontario; very common in southern and southwestern Wisconsin, occasional elsewhere, a characteristic species of mesic to wet prairies, most prevalent in **wet-mesic prairies**, less frequent in xeric "goat prairies," often in degraded dry prairies and along railroads and roadsides; in the north in isolated (adventive?) colonies along forest edges. (11) Flowering from July to early October, fruiting from late September through October.

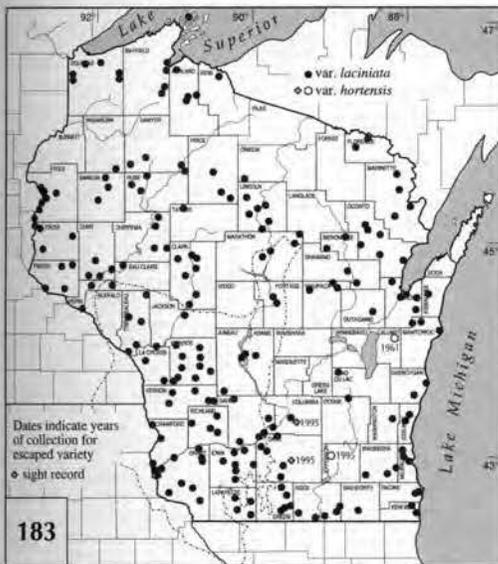


182. *Rudbeckia hirta* L. var. *pulcherrima* Farw. [*R. serotina*]. BLACK-EYED SUSAN. Transcontinental but with the regional variability divisible into the mostly Appalachian var. *hirta*, the southern var. *angustifolia* (T. V. Moore) Perdue, and the Prairie Peninsula and eastern Great Plains var. *pulcherrima*; in Wisconsin very common throughout in wet to dry-mesic prairies, peaking in **wet-mesic prairies**, savannas, fields, along roadsides and railroads, fencerows and other open habitats. (13) Flowering from mid June through September (October), fruiting from late July to October.

Our plants are chiefly or wholly referable to var. *pulcherrima*, an aggressive weed with a center of distribution to the west and southwest of us, but which has spread east to the Atlantic Coast, west to British Columbia and south into Mexico.

The coneflowers and black-eyed susans are sturdy and beautiful, qualities that impress gardeners. *Rudbeckia hirta*, the most abundant and best-known coneflower, is planted as a component in mixtures of wildflower seed.





183. *Rudbeckia laciniata* L. CUT-LEAF CONEFLOWER. Nova Scotia to southern Manitoba and the eastern Great Plains, south to Florida and along the Rocky Mountains to Arizona; common throughout Wisconsin, characteristic of shaded or partly shaded floodplains and streambanks, in open **southern wet forests**, thickets and clearings, including moist slopes, ravines and streambanks in mesic woods, wet prairies, sloughs, open meadows near lakes and streams, less often along roadsides and railroads; in the north chiefly along roads at the edges of lowland forests and wet thickets. (13) Flowering July to early October, fruiting from August to October.

The “double-flowered” var. *hortensis* L. H. Bailey, rarely collected, is a garden escape.



184. *Rudbeckia subtomentosa* Pursh. SWEET CONEFLOWER. Regionally endemic to the central United States and the southeastern edge of the Great Plains (Michigan to Iowa, south to Louisiana and eastern Oklahoma); occasional to rare across southernmost Wisconsin, in prairies, marshes, river bottoms, or low habitats along railroads and roadsides; most common in the large complex of relatively undisturbed bottomland habitats (edges of woods, lowland savannas, thickets, marshes, mesic or **wet-mesic prairies**) along the lower Wisconsin and Sugar rivers. (3) Flowering from late July to early September.

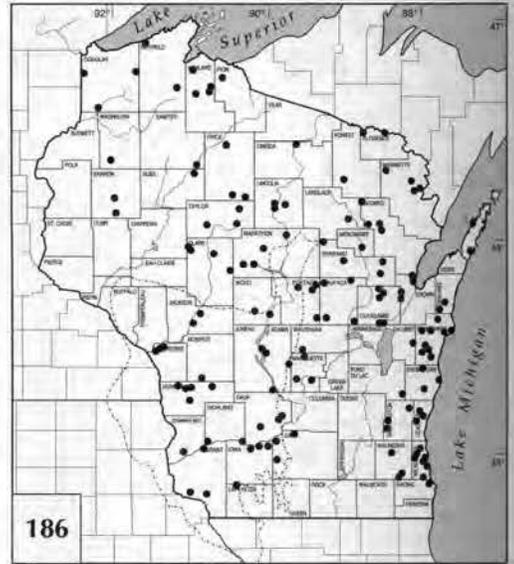


185. *Rudbeckia triloba* L. THREE-LOBED CONEFLOWER. Widespread in the eastern United States (New York to Minnesota and eastern Kansas, south to western Florida and eastern Oklahoma) and with regional varieties in the East and far South; in southern Wisconsin locally frequent in second-growth woods and thickets along river bottoms, weedy prairies, old fields, and borders of marshes and fens; often cultivated and escaping along roadsides, fencerows, railroads and waste places near areas of human activity, including dumps, vacant lots, alleys and unkempt yards. Flowering from August to mid October, fruiting over winter (achenes present from October until the following April).

Considered to be native in our region, although often inhabiting severely disturbed communities. “Its ecology is difficult to assess...” (Swink & Wilhelm 1994, p. 654).

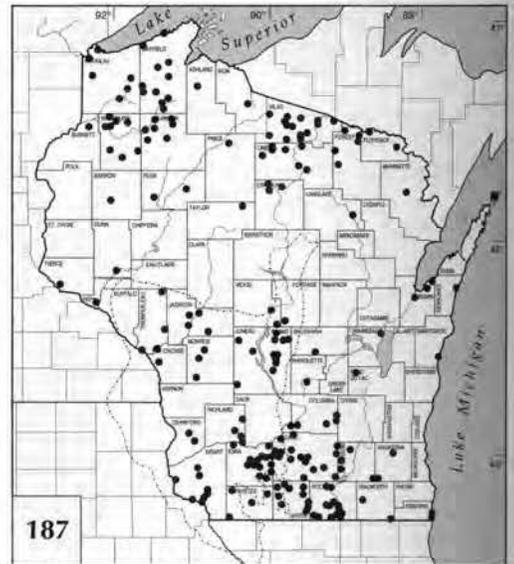
186. *Senecio aureus* L. [*S. a.* var. *gracilis*; *Packera aurea* (L.) A. Löve & D. Löve]. GOLDEN RAGWORT, HEART-LEAVED GROUNDSEL. The most widespread species of subg. *Packera* in eastern North America, in wet, often shady habitats throughout the eastern deciduous forest and boreal forest from northern Florida and Texas to Newfoundland and Hudson Bay; frequent throughout Wisconsin, typically in wet, shady habitats, but also in **wet-mesic prairies**, rich to lowland woods and thickets, including swamp forests, streambanks and seepage slopes, pastures, tamarack bogs, alder swamps and other damp or wet areas. (11) Flowering from mid May in the southern part of the state to mid July in the north, fruiting from mid June to mid July.

Similar to *Senecio pseud aureus* (188) except the latter lacks rhizomes and has basal leaves that are only slightly cordate or rather abruptly contracted to the petiole (instead of \pm strongly cordate) at the base.



187. *Senecio pauperculus* Michx. [*Packera paupercula* (Michx.) A. Löve & D. Löve]. NORTHERN MEADOW GROUNDSEL, NORTHERN MEADOW RAGWORT. Widespread in meadows, streambanks, open woods and moist calcareous cliffs across northern North America from Newfoundland to Georgia, westward south of Hudson Bay to Alaska and Oregon and along the Rocky Mountains to Colorado; common throughout much of Wisconsin in mesic prairies, **bracken grasslands**, meadows, savannas, open woods, bogs and streambanks. (6) Flowering from mid May through July, fruiting in June and July (to mid September in the far north).

Encompassing many morphological and cytological races (four in Wisconsin), hybridizing and sometimes intergrading with other “packeras” where their ranges overlap. Northern Meadow Ragwort is very similar to *Senecio plattensis* (188), but grows in moister sites and has a less persistent tomentum, narrower, unlobed basal leaves, and less deeply cut stem leaves.



188. *Senecio plattensis* Nutt. [*Packera plattensis* (Nutt.) W. A. Weber & A. Löve]. PRAIRIE RAGWORT (Special Concern). Common throughout the prairies and plains of central North America, from Canada south to Texas (irregularly eastward); infrequent in western and south-central Wisconsin in dry prairies and prairie-like habitats, mostly on bluffs and gravel terraces of the Mississippi floodplain. Flowering from May to late June, fruiting in June.

Senecio pseud aureus Rydb. var. *semicordatus* Mack. & Bush [*Packera pseud aurea* (Rydb.) W. A. Weber & A. Löve var. *semicordata* (Mack. & Bush) T. M. Barkley]. WESTERN HEART-LEAVED GROUNDSEL. A wet-prairie herb in the drainages of the Mississippi and Missouri rivers (disjunct in the Black Hills), reaching its eastern range limit in moist prairies, fens and sunny, springy sites in the southeastern quarter of Wisconsin. Flowering from (mid) late May through June.

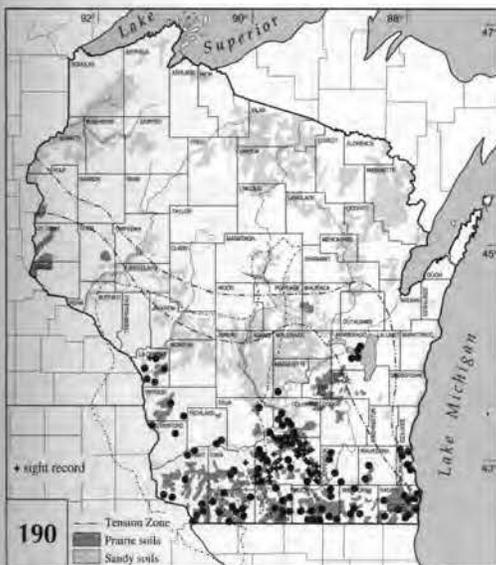




189. *Silphium integrifolium* Michx. var. *deamii* L. M. Perry. PRAIRIE ROSINWEED. From Alabama to Texas and on the eastern Great Plains north to Nebraska, Wisconsin and southern Michigan; in the southern quarter of Wisconsin once common in tall-grass, **wet-mesic prairies**, but also in wet to dry prairies, railroad rights-of-way and along roadsides; rarely adventive (or escaped) farther north. (8) Flowering from late June to early September, fruiting from September to mid October.

Essentially all ours are the glandular var. *deamii*, but var. *integrifolium*, adventive from south and east of Wisconsin, is represented by one collection from Milwaukee County plus a second one mapped by Settle and Fisher (1970). A third variant, var. *neglectum* Settle & T. R. Fisher, has been attributed to our region as well.

Hybrids between *Silphium integrifolium* and *S. perfoliatum* are variously intermediate, and have been collected on Curtis Prairie, UW-Madison Arboretum and on a railroad prairie relic west of Brodhead, Green County.



190. *Silphium laciniatum* L. COMPASS PLANT. A most distinctive tall-grass prairie indicator, from the eastern Great Plains (South Dakota to northeastern Texas) eastward to Alabama and in the Prairie Peninsula to Ohio; locally once common in southern Wisconsin, now between plow and cow (see Curtis 1959, p. 426) rather rare, especially in **mesic prairies**, but also in wet or dry, rocky *Bouteloua-Schizachyrium* prairies, occasionally persisting because of deep roots as a relic along roadsides. (7) Flowering in July and August, fruiting from late July to early October.

Reports of hybrids between *Silphium laciniatum* and *S. terebinthinaceum*, such as from Benedict Prairie, Kenosha County, may be based on juvenile, relatively unlobed leaves of *S. laciniatum* or doubtfully on plants of the southern *S. terebinthinaceum* var. *pinnatifidum* (Elliott) A. Gray (but see Fisher 1959). In Wisconsin, *S. laciniatum* grows in generally drier sites, and where the two species grow together (e.g., Faville Prairie), blooms earlier (pers. obs.), so that here, unlike farther south, hybrids are less expected.



191. *Silphium perfoliatum* L. CUP PLANT. Eastern deciduous forest from southern Ontario to Georgia, west to the edges of the Great Plains (North Dakota to northeast Oklahoma); in Wisconsin chiefly in the southwest half on the edges of low woods, low wet prairies, and river and stream banks of **southern wet forests**, common along open or shaded roadsides, fields and other rich and moist habitats; in the north adventive (?), usually along wooded roadsides. (9) Flowering from July through September, fruiting from September to October.

A Native American medicinal species, Cup Plant is persisting and spreading slightly from long-ago introductions in the Bad River, Lac du Flambeau and Menominee reservations.

192. *Silphium terebinthinaceum* Jacq. PRAIRIE-DOCK. Characteristic of tallgrass prairies, from northern Arkansas to southeastern Wisconsin, eastward in the Prairie Peninsula to Ohio and southern Ontario, and scattered beyond (Mississippi to North Carolina); in Wisconsin sharply limited to the last (Wisconsin) glaciation (mostly absent from the Driftless Area, this perhaps simply a climatic coincidence), typically in deep-soil prairies, occurring in all but the driest prairies, but especially in **wet-mesic prairies**, and, unable to withstand grazing (Curtis 1959), now found only in prairie relics, railroad rights-of-way and roadside openings, and occasionally persisting along barbed wire fences as the last survivor of the prairie flora. (7) Flowering from July to early September, fruiting from late August to September.

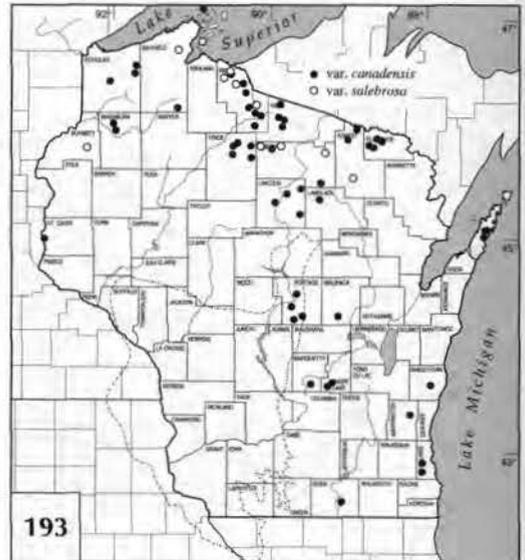
Conspicuous even when not in flower owing to its very large basal leaves, which, like those of *Silphium laciniatum* (190), align their edges in a north-south direction (blades facing east-west), hence the common name of the latter.



193. *Solidago canadensis* L. var. *canadensis*. COMMON OF CANADA GOLDENROD. Northeastern North America (Newfoundland and Massachusetts, west in the coniferous forest to Hudson Bay, the northeastern Great Plains of Minnesota and beyond); chiefly in northern and eastern Wisconsin, occasional along roadsides, fields, slopes, fencerows and edges of marshes, swamps, **alder thickets** and open woods. (20) Flowering from (late July) early August to early September, fruiting from August to October.

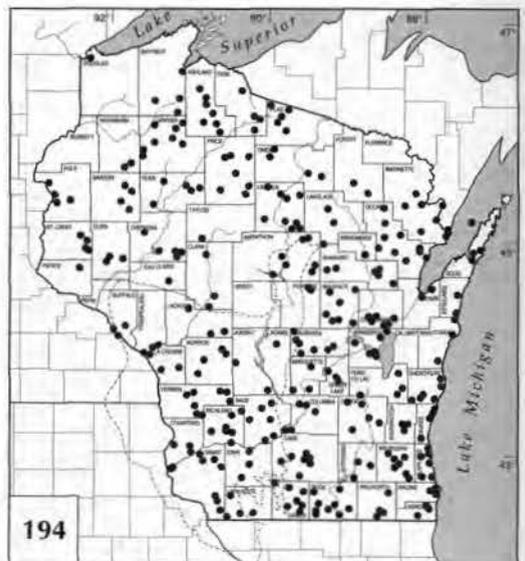
Solidago canadensis is a polyploid complex (see Croat 1972, Gleason & Cronquist 1991) plagued by hybridization, east-west clinal variation and much weediness, with at least four of the five or more varieties represented in Wisconsin. Though Curtis (1959) lumps all varieties together (hence his fidelity value of 20), they do have different ecological amplitudes and therefore deserve recognition.

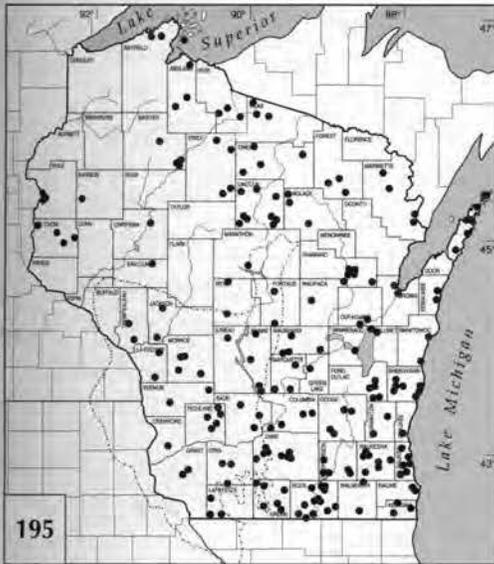
Rare plants from far northern Wisconsin appear to be var. *salebrosa* (Piper) M. E. Jones (*S. elongata*, *S. lepida*), a boreal and cordilleran element with northeastern extensions.



194. *Solidago canadensis* L. var. *hargerii* Fernald [Salamun's (1964) *S. c.* var. *gilvocanescens*, a name properly belonging to a western variety]. COMMON OF CANADA GOLDENROD. Eastern and central United States, from Connecticut south to Virginia and west into the Great Plains and, irregularly, New Mexico; abundant in Wisconsin in open to partly shaded, often degraded habitats, in fields, prairies, edges of bogs, **alder thickets**, marshes, woods, sandy beaches, dry to moist ditches, roadsides and railroads, occasionally in open deciduous woods and jack pine-black oak barrens. (20) Flowering from (mid) late July to (mid) late September, fruiting from late August to October.

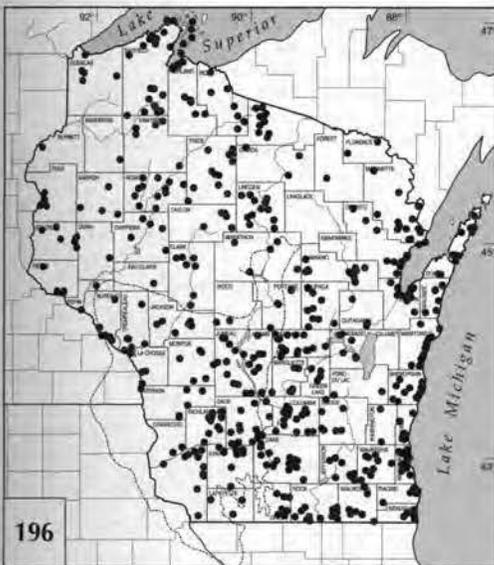
This diploid variety (Semple & Ringius 1983) is similar to, and even more common than, the hexaploid var. *scabra* (195), but some authors do not distinguish between them.





195. *Solidago canadensis* L. var. *scabra* Torr. & A. Gray [*S. altissima* L. of Fernald 1950, Salamun 1964 and Semple & Ringius 1983]. COMMON, CANADA OR TALL GOLDENROD. Eastern North America, from Quebec to northern Florida, west to the Great Plains; widespread throughout Wisconsin but more common in the south, most frequently in open moist to dry fallow fields, disturbed prairies, old pastures, dry open roadsides, steep sloping banks, railroad embankments, brushy roadsides, fencerows, open sandy areas, and along edges of, or rarely in, open deciduous woods and jack pine-black oak barrens. (20) Flowering from (early) mid August to September (early October), fruiting from late August to early November.

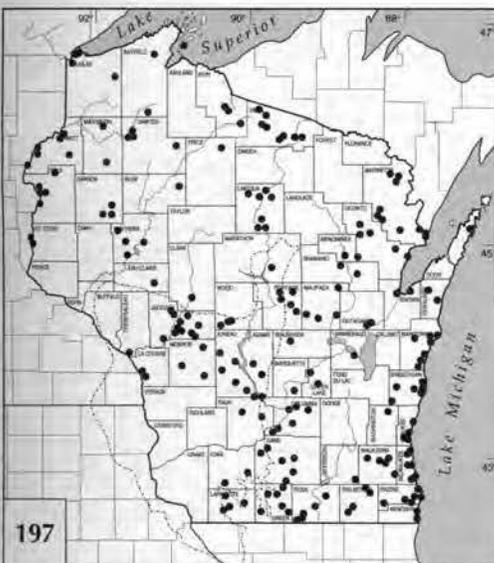
A hexaploid similar to the diploid var. *hargeri* (194), from which extremes are often difficult to distinguish, with var. *hargeri* typically flowering two to four weeks later.



196. *Solidago gigantea* Aiton [including vars. *pitcheri* and *serotina*]. LATE OR GIANT GOLDENROD. Widespread (except the Southwest) over most of the United States and southern Canada; abundant throughout Wisconsin in moist rich soils, in shade or sun, marshes, fens, roadside ditches, banks of lakes and streams, edges of bogs and moist sandy beaches, less common in dry to **wet prairies**, fallow fields, along railroad embankments and brushy roadsides, in the latter habitats often associated with *S. canadensis*. (16) Flowering from late July to September, fruiting from August to October.

Strongly resembling *Solidago canadensis* (193-195), with which it may hybridize, except for its very smooth stem (glabrous up to the inflorescence) and earlier blooming date (by two to three weeks).

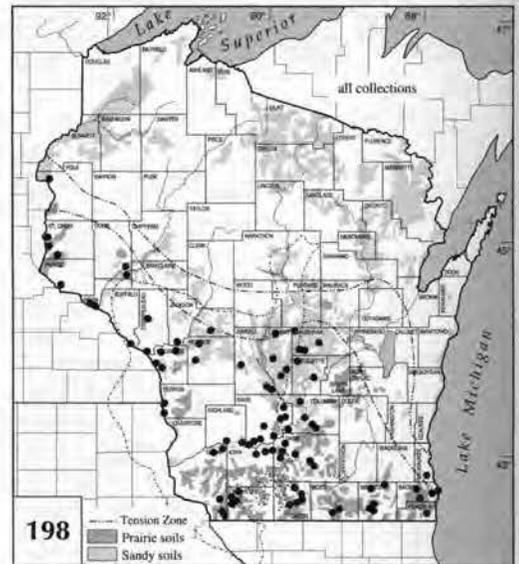
For the record, goldenrods are no more guilty of causing hay fever than any other species producing insect-transported pollen. The real cause is mainly ragweed pollen, especially that of *Ambrosia trifida* L.



197. *Solidago juncea* Aiton. EARLY GOLDENROD. Eastern North America, from southern Canada south in the mountains to northern Georgia and Alabama, and west to northeastern Minnesota and Missouri; common throughout Wisconsin, especially abundant in sandy or loamy open fields, along railroad embankments and weedy fencerows, less common in wet-mesic to **mesic prairies** and fields, along brushy roadsides, on steep roadbanks, and rarely at the edges of open deciduous woods. (12) Flowering from late June to mid September, fruiting from late July to October.

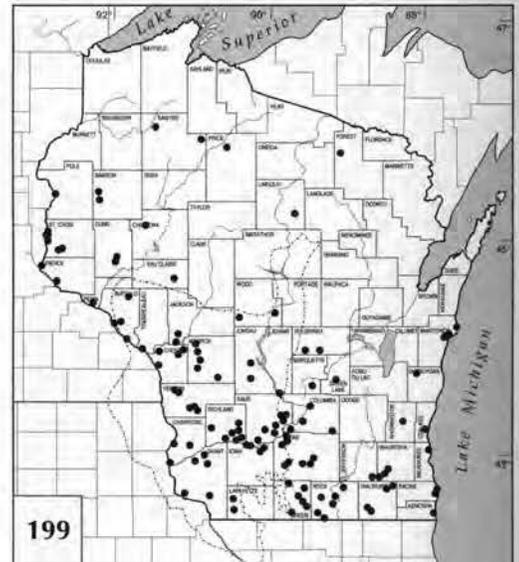
Early Goldenrod intergrades with *Solidago missouriensis* (198) (Semple & Ringius 1983), of which it seems to be an eastern North American sister species.

- 198. *Solidago missouriensis* Nutt.** [including var. *fasciculata*]. MISSOURI GOLDENROD. Ubiquitous in the prairies and Great Plains from Texas to Canada, barely reaching Ontario, in the East intergrading with *S. juncea* (197) of moister habitats; in Wisconsin frequent in prairie areas south of the Tension Zone, in dry to mesic prairies on gentle sunny slopes, river terraces, along roadsides and railroad rights-of-way, sometimes in sandy prairies, on or adjacent to blowout dunes, and on steep hillsides. (9) Flowering from (late July) early August to September, fruiting from mid August to October. Several of our specimens from south-central and southwestern counties have been assigned to var. *missouriensis* by Salamun (1964), one of several weakly defined western phases of this species. These plants are very close to var. *fasciculata*, and at least in Wisconsin appear to be inseparable from var. *missouriensis*. As with many widely distributed taxa, here is an example of a morphological cline reflecting the East-West climatic continuum.



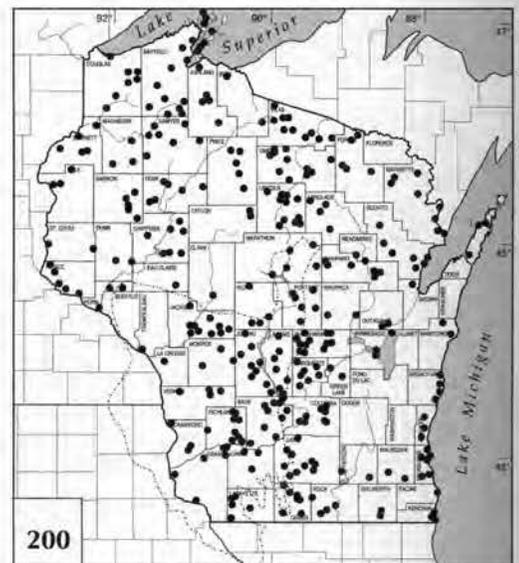
- 199. *Solidago nemoralis* Aiton ssp. *decemflora* (DC.) Brammall** [*S. n.* var. *d.*; *S. n.* var. *longipetiolata*]. FIELD OR OLD-FIELD GOLDENROD. On the Great Plains and Prairie Peninsula; in Wisconsin in habitats similar to those of ssp. *nemoralis* (200), though more common in southwestern Wisconsin. Flowering and fruiting as for ssp. *nemoralis*.

According to Brammall and Semple (1990), this subspecies is tetraploid and basically occupies the Great Plains region, reaching eastward into adjacent portions of the eastern deciduous forest and westward to the foothills of the Rocky Mountains. It is very similar to the typical subspecies, but the two can be separated by a suite of quantitative characters, recently amplified through studies conducted by Semple et al. (1990). Unlike *Solidago missouriensis*, these taxa reflect cytological differences as well.



- 200. *Solidago nemoralis* Aiton ssp. *nemoralis*.** FIELD OR OLD-FIELD GOLDENROD. A variable species of open, sunny prairies, plains and woodlands, widespread from Texas to Canada and east to the Atlantic; very common throughout Wisconsin on dry, sandy, clayey and sterile soils in abandoned fields, pastures, along roadbanks, on mesic to dry prairies, railroad embankments, edges of oak woods, and in jack pine and black oak barrens and blowout dunes. (14) Flowering from mid August to September (October), fruiting from early September to October.

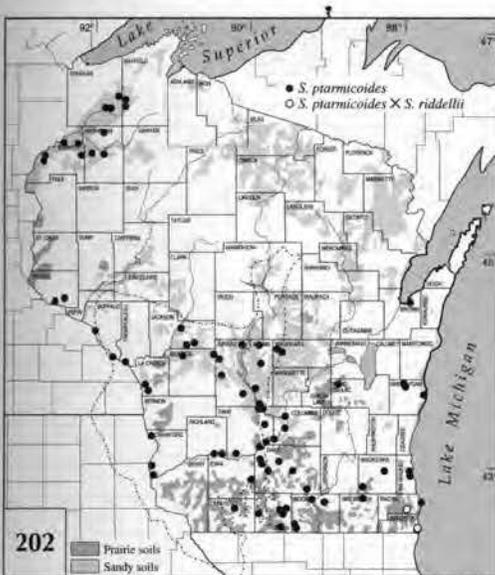
This subspecies consists of both diploids and tetraploids, and occupies the portion of the overall species range that coincides with the deciduous forest of eastern North America (Brammell & Semple 1990).





- 201. *Solidago ohioensis* Riddell. OHIO GOLDENROD (Special Concern).** A Midwest neoendemic restricted totally to glaciated territory, from northern Illinois to Minnesota and, in the Prairie Peninsula, to Ohio and southwest Ontario; in Wisconsin a rare indicator of wet alkaline meadows, **wet prairies**, especially those underlain by calcareous substrate, and fens in southeastern Wisconsin, often with *Gentianopsis procera*, also in moist to dry depressions between old beach ridges in Door County. (5) Flowering from mid August to late September, fruiting from late August to October.

Similar to *Solidago riddellii* (203) and, in the branching pattern of the open, flat-topped inflorescence, *S. ptarmicoides* (202), the latter rarely forming hybrids with both these species. Those with *S. ohioensis* are called *S. × krotkovii* B. Boivin, which has been reported, but not collected, from Kenosha County. See notes under 202, 203.



- 202. *Solidago ptarmicoides* (Nees) B. Boivin [*Aster p.* (Nees) Torr. & A. Gray; *Unamia p.*]. UPLAND WHITE GOLDENROD.** A calciphilic prairie element, widespread from the Upper Great Plains (South Dakota to Saskatchewan) to James Bay and western Quebec, south to Colorado, Arkansas, Great Lakes dunes, and, scattered, down the Appalachians to Georgia; across southern Wisconsin and reappearing in sand barrens in the northwest, locally common in sandy, gravelly or rocky, often calcareous **dry prairies**, especially steep “goat” or gravel hill prairies, occasionally in rich, dense, moist prairies and interdunal swales near Lake Michigan; more or less local and limited in its ecology. (4) Flowering from late July to late September, fruiting from late August to mid October.

Easily recognized by its narrow leaves, flat-topped inflorescences, and especially the white flowers, this peculiar goldenrod masquerades as an aster. It never hybridizes with asters, but occasionally with the other species of *Solidago* in the *Oligoneuron* group [*S. ohioensis* (201), *S. riddellii* (203), *S. rigida* (204)] and *S. canadensis* (193–195).

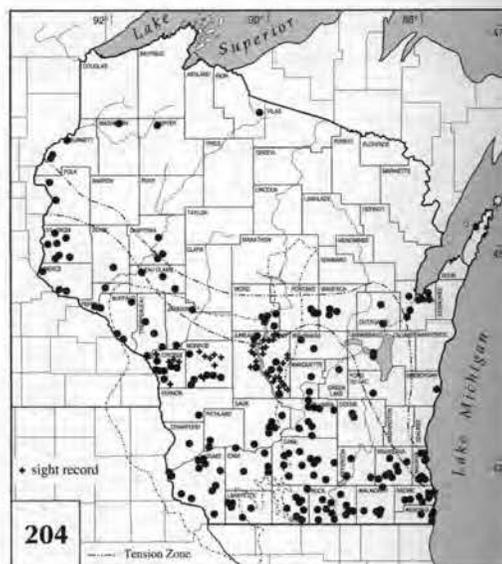


- 203. *Solidago riddellii* Frank. ex Riddell. RIDDELL'S GOLDENROD.** An ecologically specialized meadow and fen species, with scattered disjunct populations in central North America, from Missouri and Minnesota to Manitoba, east through the southern Great Lakes states to Ohio and southwest Ontario; in Wisconsin restricted to the southeastern alkaline sedge meadows, **fens**, wet prairies, edges of marshes, and rarely in moist roadside ditches. (5) Flowering from early August to late September, fruiting from September to October.

Hybrids are known of *Solidago riddellii* with *S. ohioensis* (201) and with *S. ptarmicoides* (202) [*S. × bernardii*]. J. P. Bernard (in a personal communication to Salamun, see 1964, pp. 378–379) reported seeing both of these on a Kenosha County prairie (undoubtedly the wet calcareous Chiwaukee Prairie), but so far only a few collections of *S. × bernardii* (mapped with *S. ptarmicoides*, 202) have been made.

204. *Solidago rigida* L. STIFF GOLDENROD. Abundant throughout the Great Plains (New Mexico to Alberta), east in the prairie “wedge” to Ohio and southwest Ontario, and scattered beyond, both in dry prairie-like habitats and as a weed in the eastern United States; in Wisconsin widespread in dry to mesic or **wet-mesic prairies**, sometimes a common weed in overgrazed pastures, spreading beyond the limits of the prairie areas into northern and eastern Wisconsin on sandy soils along roadsides, railroad rights-of-way and occasionally on sandy lakeshores. (10) Flowering from early August to late September, fruiting from early September into October.

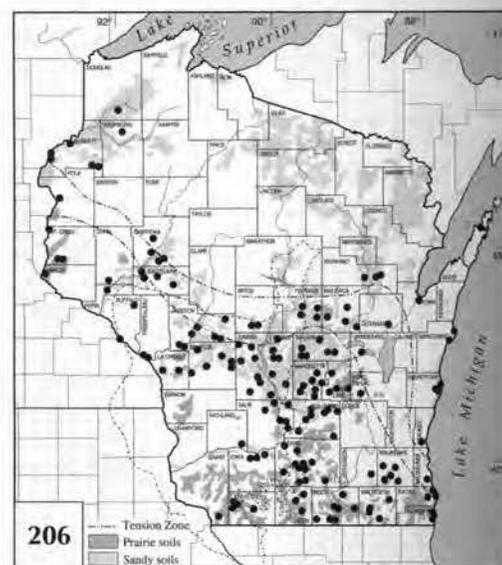
Divisible into three infraspecific taxa, justified by the recent study of Heard and Semple (1988). Equally common in Wisconsin are ssp. (or var.) *rigida*, a midwestern-northeastern tetraploid race ($2n = 36$), and ssp. *humilis* (Porter) Heard & Semple [*S. r.* var. *h.*], a partly sympatric, diploid ($2n = 18$) prairies-and-plains race.



205. *Solidago speciosa* Nutt. var. *jejunifolia* (E. S. Steele) Cronquist. SHOWY GOLDENROD. A polymorphic species, widespread in open habitats of the eastern United States from the southern Atlantic Coastal Plain to the eastern Great Plains (Texas to the Dakotas), the Black Hills and New Mexico; var. *jejunifolia* a local Midwest variant (Indiana to Illinois and Minnesota); in northwestern and central Wisconsin, following the area of outcropping Cambrian sandstone, in sandy soils along roadsides, river terraces, in bur oak and black oak openings and in open jack pine stands. (9) Flowering from (mid) late July to late August (early September), fruiting from late August to October.

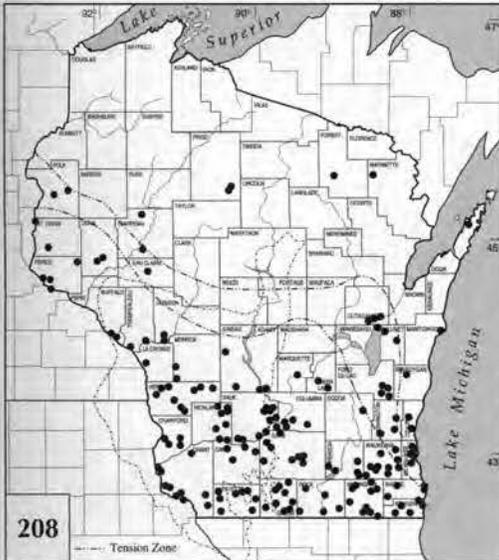


206. *Solidago speciosa* var. *rigidiuscula* Torr. & A. Gray. SHOWY GOLDENROD. The generally smaller, stiffer, more scabrous variety of the North American prairies and plains floristic province (Texas to Minnesota), occurring sporadically westward to Wyoming and New Mexico and occasionally east in the Prairie Peninsula as far as Ohio and central Tennessee; in Wisconsin locally common south of the Tension Zone in **mesic prairie** remnants and on sandy soils along roadsides, in open fields, ridges, outcrops, river terraces and open black oak and jack pine woods, eastward chiefly along sandy roadsides, railroad rights-of-way, and on sandy beaches and dunes along the shores of Lake Michigan. (9) Flowering from (late July) early August to early October, fruiting from mid August to late October.



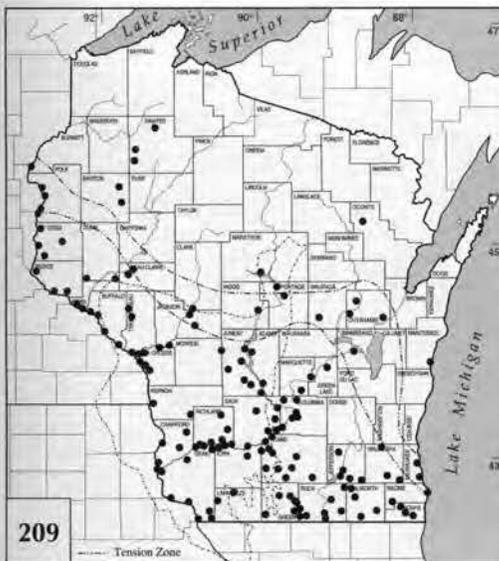


207. *Solidago speciosa* var. *speciosa*. SHOWY GOLDENROD. The more robust variety, scattered in open habitats through much of the eastern deciduous forest region, especially in the Midwest prairie transition, and to the southern coastal plain of the Carolinas; chiefly in western and southwestern Wisconsin south of the Tension Zone, in remnant, often sandy, **mesic prairies**, abandoned fields, roadsides, open sandstone bluffs, steep roadbanks, neglected cemeteries and sometimes in black oak savannas or open jack pine woods; spreading northward and eastward along sandy roadsides and railroad rights-of-way. (9) Flowering from mid August to September, fruiting from early September to mid October.



208. *Solidago ulmifolia* Muhl. ex Willd. ELM-LEAVED GOLDENROD. Throughout the eastern deciduous forest, from the southern Great Plains (east Texas to southeast Minnesota) east in the Midwest prairie transition to Ohio, and scattered from Nova Scotia to Florida; in Wisconsin associated chiefly with the deciduous **southern dry-mesic forests**, most common at the edges of sugar maple-basswood woods, oak woods, and sometimes birch-aspen woods, frequently along bushy roadsides, wooded gravelly hills and sandy outcroppings, and occasionally on steep, dripping wet sandstone cliffs and brushy rock outcrops in the Driftless Area. (12) Flowering from late July to early October, fruiting from late August to October.

Our plants represent var. *ulmifolia*.



209. *Vernonia fasciculata* Michx. ssp. *fasciculata*. COMMON OR SMOOTH IRONWEED. A widespread polymorphic complex, in the Midwest (ssp. *fasciculata*) from the southern Great Plains (eastern Oklahoma to Minnesota) and across the Prairie Peninsula to Ohio and Kentucky; in Wisconsin locally abundant south of the Tension Zone, occasional in the north, especially in **wet-mesic prairies**, tall forb communities along railroads, open lakeshores and riverbanks, open river-bottom forests, swamps and marshes, and often a prominent weed in low overgrazed pastures. (5) Flowering from mid July into September (peaking in early August), fruiting from late July through September (peaking in late August).

A member of a large pantropic genus with many species in the Southeast.



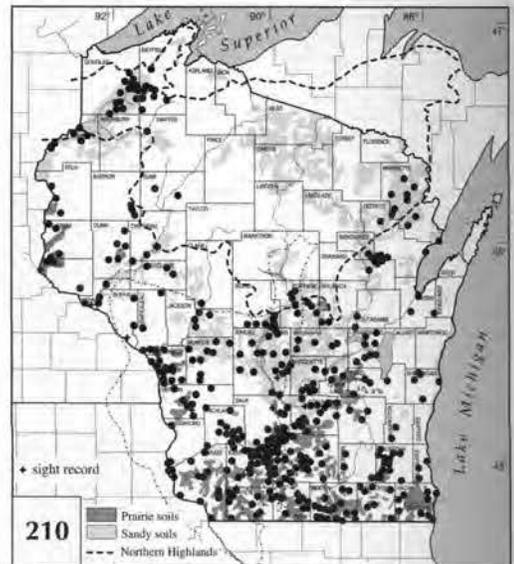
BORAGINACEAE—the Borage Family

Ours are herbs (sometimes shrubs or trees in the tropics), often rough-hairy, the flowers commonly in helicoid cymes (coiled inflorescences that, blooming sequentially, elongate and straighten with maturity), 5-merous, the united petals variously shaped, mostly with a slender tube and spreading lobes, the throat often partly closed by "scales." Much like the mints, the 2-carpellate pistil is deeply divided into 4 lobes that surround the central gynobasic style and then, in fruit, split into (1–) 4 single-seeded nutlets, these sometimes bearing barbed prickles. (Al-Shehbaz 1991; Johnston 1924, 1952; Kruschke 1946)

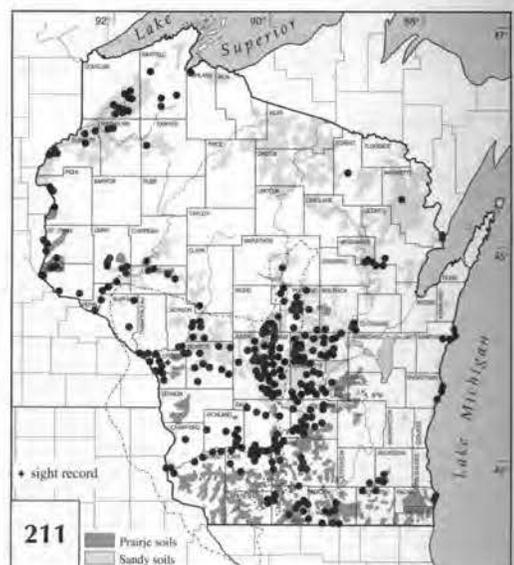
Mostly in temperate and subtropical, seasonally dry regions, well represented in the Mediterranean basin and western United States. Here belong an appreciable number of cultivated ornamentals, from Borage to Lungwort, Heliotrope and Forget-me-not. The puccoons, which have stout taproots containing an intense purple dye, were used as contraceptives by certain Native American tribes and inspired biochemists in the development of oral contraceptives.

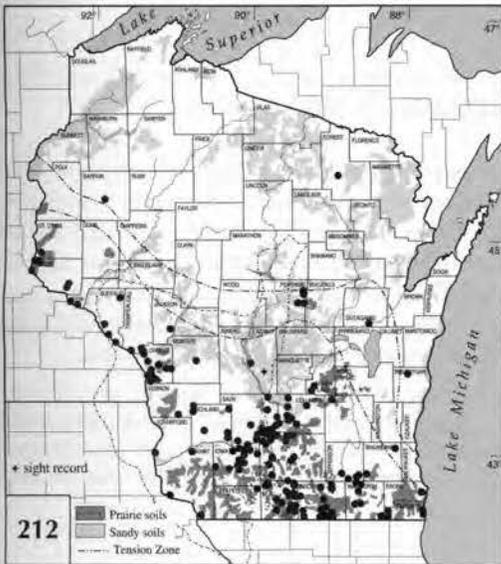
- 210. *Lithospermum canescens* (Michx.) Lehm. HOARY PUCCOON.** Calciphilic heliophile centering on the Ozarks and Cumberlands, from the eastern edge of the Great Plains (northeastern Oklahoma to Saskatchewan) to the Appalachians (Pennsylvania to Georgia); in Wisconsin common in well-drained, calcareous or sandy, dry to mesic prairies (or even in seasonally moist prairies along Lake Michigan), open woods such as jack pine and **oak barrens**, on bluffs, and sometimes on roadsides and railroads; uncommon east of the Niagara escarpment and lacking from the South Superior Uplands. (15) Flowering from late April to late June, fruiting from early June to late July.

Together with Bird's-foot Violet, Shooting-star and Blue-eyed-grass, the puccoons are early prairie bloomers, flowering long before the taller midsummer species reach the peak of their development and hide the characteristic showy spring flowers in their shade.



- 211. *Lithospermum carolinense* (Walter ex J. F. Gmel.) MacMill. ssp. *croceum* (Fernald) Cusick [*L. c.* var. *croceum*]. HAIRY or PLAINS PUCCOON.** An arenophile (Lat. *arena*, sand, + Gk. *philos*, loving) centering on the southern Great Plains from the east Texas prairies to the Nebraska sandhills, eastern Minnesota to Michigan and very scattered beyond to southern Ontario, and on the Coastal Plain from Texas to Virginia; in Wisconsin characteristic of dry, especially sandy soil, in **sand barrens** and oak and pine woodland (especially black oak savannas), in sandy prairies and old sandy fields, on bluffs and ridges, and along roadsides and railroad rights-of-way in southern and western parts of the state, local eastward to the dunes along Lake Michigan. (9) Flowering from early May through July (August), fruiting from late June to mid September (the white shiny nutlets may persist on the dead stems until the following spring). "Puccoon" is the Native American name for the dye derived from the sap, especially in the roots, of this and other Boraginaceae.





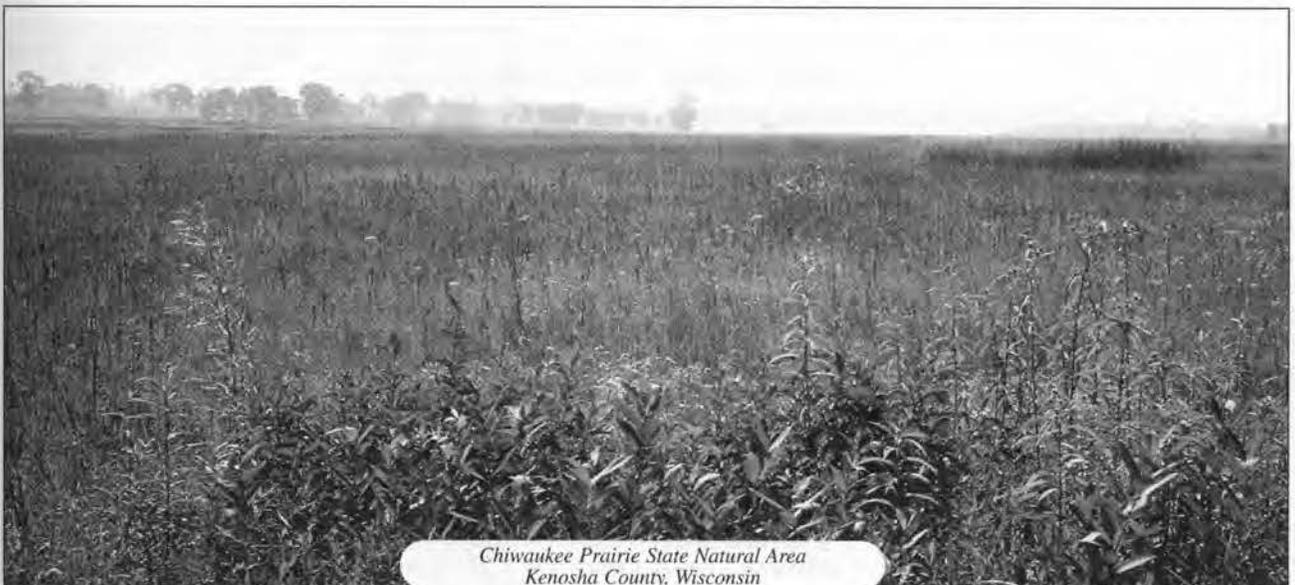
- 212. *Lithospermum incisum* Lehm.** FRINGED OR NARROW-LEAVED PUC-
COON. Widespread throughout the dry far-western prairies
and desert grasslands of the Great Plains from northern
Mexico to southern Canada, and from the Great Basin to
southern Ontario; in Wisconsin locally common in the south
in dry disturbed open ground and sandy or gravelly calcare-
ous soil of hillsides, bluffs, **dry prairies**, old fields and
rarely along railroads; collected twice in the north, presum-
ably as introductions. (6) Flowering from early May to mid
June, fruiting from mid June to late September.

The early chasmogamous flowers are showy, with lemon
yellow corollas with irregular, almost fringed lobes, unlike
the later cleistogamous ones (not present in the previous two
species), which are small and sometimes apetalous but pro-
duce abundant shiny white nutlets.



- 213. *Onosmodium bejariense* A. DC.** [*O. molle*, in greater part]. MARBLE-
SEED, FALSE-GROMWELL (Special Concern). Divisible into four
morpho-geographic taxa (Turner 1995) of central and eastern
North America, from Texas north to Saskatchewan, east to the
Carolinas and southern Ontario; in Wisconsin represented by
two varieties restricted to the region of limestones, both rare
to locally common: var. *hispidissimum* (Mack.) B. L. Turner
in the north and east in dry calcareous blufftop prairies, brushy
and/or weedy openings on rocky wooded slopes, and sandy
soils along rivers and floodplains; and var. *occidentale*
(Mack.) B. L. Turner in the Driftless Area, on dry, rocky or
gravelly, usually disturbed (grazed) prairies on limestone
bluffs, ridges and hillsides, from the most xeric *Schizachyri-
um-Bouteloua* to rich dry-mesic prairies, prairie pastures,
roadsides and utility rights-of-way. Flowering from early June
to mid July (sporadically to mid September), fruiting from
mid July to mid October.

Some of our specimens appear to be intermediate between
the varieties (Cochrane 1976).



Chiwaukee Prairie State Natural Area
Kenosha County, Wisconsin

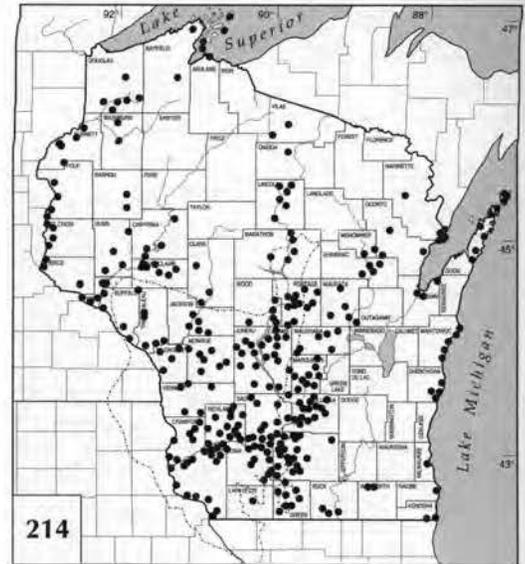


BRASSICACEAE [CRUCIFERAE]—the Mustard Family

Herbs with acrid watery juice and alternate leaves. Flowers 4-merous, regular, without a floral cup or tube, typically in racemes. Petals arranged in the form of a cross, hence the name Cruciferae, usually narrowed into a slender base (claw). Stamens 6, the outer pair alternating with and almost always shorter than the 4 inner ones. Ovary superior, 2-celled by development of a thin vertical partition (septum) connecting the 2 parietal placentae. Fruit a capsule, either a (elongate) silique or (short) silicle, the 2 valves falling away from the hoop-shaped, persistent placentae (replum) and the membranous septum (or rarely indehiscent). (Patman & Iltis 1962, Rollins 1993)

A very large family, chiefly in temperate to cold, and also alpine regions, uniform in its flower structure, very diverse in its fruits, and difficult taxonomically. It includes many well-known garden vegetables (cabbage, Brussels sprouts, cauliflower, kohlrabi, turnip, kale, etc.), some ornamentals (Honesty, Wallflower, Candytuft) and numerous weeds (Peppergrass, Yellow Rocket, Tumble Mustard), among them the recently introduced and extremely aggressive Garlic Mustard, *Alliaria petiolata*.

214. *Arabis lyrata* L. SAND CRESS, LYRATE ROCK CRESS. Transcontinental, from (Siberia) Alaska to Vermont and south to Missouri and (in the mountains) to Georgia; in Wisconsin very common, particularly in the Driftless Area, in a large number of "open" habitat communities, most abundant in very sandy or rocky, sunny places such as beaches and dunes, sand flats, sandy, gravelly or rocky dry prairies, in open, dry woods and cedar glades, on sandstone cliffs and rocky slopes, less commonly on limestone cliffs and quartzite outcrops; frequently weedy in sandy pastures, gravel pits, railroad embankments and roadsides. (11) Flowering from April to September, fruiting from mid May through September.



CACTACEAE—the Cactus Family

Highly specialized stem-succulent subshrubs, shrubs or trees, mostly of semi-deserts and deserts, arid grasslands, and tropical America, often in montane regions with a highly seasonal climate. Mature stems generally without true leaves, often globose, cylindrical or flattened, provided with cushion-like areoles from which emerge hair, spines, bristles, and the solitary, mostly regular and perfect flowers. Sepals and petals generally numerous, not clearly differentiated, all basally united and \pm fused to the inferior ovary. Stamens numerous, arising from the well-developed floral cup. Pistil of 3 to 10 carpels, the 1-celled ovary with as many placentae along the walls as there are carpels and stigmas. Fruit a many-seeded, dry to fleshy berry. (Benson 1982, Ugent 1963)

A large family of over 1,000 species that are entirely American, with the possible exception of a mistletoe-like, sticky-fruited epiphyte, reaching Patagonia and British Columbia (with a few genera—as introductions—having found their way to other areas of the world). Members of many genera are grown as ornamentals, but our three native prickly-pears are largely of interest as morphologically odd representatives of the Madro-Tertiary geoflora.



215. *Opuntia humifusa* (Raf.) Raf. [*O. compressa* J. F. Macbr.; *O. rafinesqueii*]. EASTERN PRICKLY-PEAR. Widespread, from Florida (Mexico) to the Atlantic coastal sands of Massachusetts, west to Kansas and Oklahoma, doubtfully separable in our region from the next; very rare in southern Wisconsin in dry sand prairies and on sandstone ledges. Flowering in early July.

Opuntia macrorhiza Engelm. PLAINS PRICKLY-PEAR. A widespread Madro-Tertiary element of sandy habitats from Mexico north to Idaho and Michigan; in southwestern and central Wisconsin in sands and on and at the base of sandstone bluffs, mainly along the Wisconsin and Black rivers, in dry sand prairies, **cedar glades**, open jack pine-oak woods and sand barrens. (5) Flowering from mid June to July, fruiting from mid July to October.

Opuntia fragilis (Nutt.) Haw., Little Prickly-pear, diminutive and inconspicuous, with obovoid segments, characteristic of dry rocky or sandy Great Plains mid-grasslands, is rare in Wisconsin, mostly on very dry quartzite outcrops and cedar glades.

CAESALPINIACEAE—the Caesalpinia or Senna Family

One of the three classical subfamilies of the old Leguminosae, this largely paleotropical group of mostly trees, shrubs and lianas is distinguished from the Mimosaceae and Fabaceae by technical characters of the “caesalpinaceous” corolla (which, also mostly 5-merous, is only somewhat irregular compared to the more advanced peas and beans) and androecium (consisting of 1 to 20, but mostly 10, distinct or variously fused stamens that do not ensheath the pistil nor project far beyond the free petals). The leaves, like those of its close relatives, are pinnate or bipinnate, the fruit is a leguminous pod, and the seeds have a large basal embryo. (Fassett 1939, Isely 1975)

A large family (2,000 species) only marginally represented in our temperate flora, with four genera (five, if *Cercis*, Redbud, is indeed native, which is very doubtful) reaching the southern and warmest parts of Wisconsin. They are *Gleditsia* (Honey Locust), *Gymnocladus* (Kentucky Coffee-tree), and two genera formerly placed into an all-inclusive *Cassia*, namely *Senna* and *Chamaecrista*.



216. *Chamaecrista fasciculata* (Michx.) Greene [*Cassia chamaecrista*, *Cassia* f.]. PARTRIDGE-PEA, LOCUST-WEED. An annual heliophyte throughout the South, and west to the Great Plains from Texas to Nebraska and southern Minnesota; in Wisconsin locally abundant on sunny alluvial sands of the Mississippi, St. Croix and Wisconsin River bottoms, on sandy banks, eroding slopes and bases of sandstone bluffs, occasionally on summits of limestone bluffs in **dry-mesic prairies** or prairie openings in oak-poplar-paper birch woods; like many plants of sandy disturbed soil, spreading to old fields, grassy or sandy roadsides, railroads and quarries. (2) Flowering from early July to early October, fruiting from late August through early October.

217. *Senna hebecarpa* (Fernald) H. S. Irwin & Barneby [*Cassia h.*; *C. marilandica* sensu Fassett 1939]. WILD SENNA. North-eastern United States, from western North Carolina, Tennessee and Illinois to Massachusetts and southern Wisconsin; local in Wisconsin, confined to floodplains of the lower Wisconsin River and its tributaries (e.g., Blue River, Black Earth and Mill creeks) and the Rock and Sugar rivers near the Illinois border, in moist to mesic borders of **southern wet-mesic forests**, stream banks, sandy, moist or mesic roadsides and cleared wet alluvial pastures. (1) Flowering from early July to mid August, fruiting from the end of August to early October.

The very similar, more southerly *Senna marilandica* (L.) Link (*Cassia medsegeri* Shafer of Fassett 1939) (Special Concern) has been collected with the above at Avoca and again in Grant County, for both species their northwestern-most stations.

These handsome plants lend themselves to cultivation in gardens.



CAMPANULACEAE—the Bellflower Family

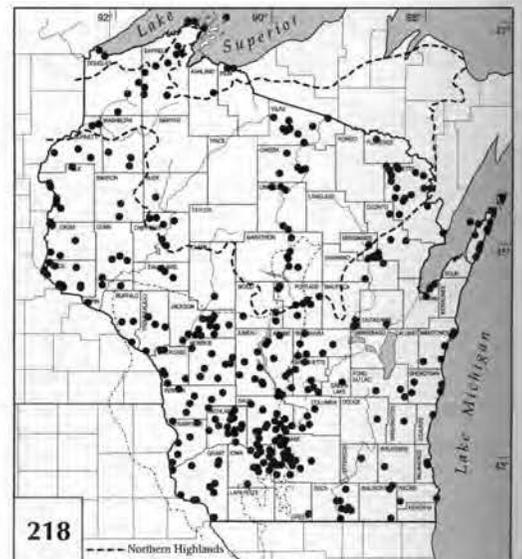
This mostly herbaceous family of over 2,000 species is sharply divided into: the temperate subfamily Campanuloideae (or Campanulaceae) with a regular, bell-shaped, 5-lobed corolla, free anthers and 3 to 5 carpels (e.g., *Campanula*, *Triodanis*); and the advanced subfamily Lobelioideae (or Lobeliaceae), marvelously diverse in tropical mountains of Hawaii, Latin America and central Africa, with a tubular, strongly bilabiate, resupinate (inverted by 180°) corolla, 5 united anthers forming a tube into which the pollen is shed, only to be pushed out, piston-like, by the brushy stigma, and an ovary with 2 semi-inferior carpels. In *Lobelia* (with 6 species in Wisconsin) the fruit is commonly a capsule, releasing its dust-like seeds by valves or pores (or in the tropics, fleshy and animal-dispersed). (Mahony 1929, McVaugh 1943, Shetler 1963)

Economically, the family is important only for the large number of ornamentals cultivated for their often quite showy flowers. One of the campanulas, *C. rapunculoides*, is a persistent, if attractive, weed in Wisconsin gardens and fields.



218. *Campanula rotundifolia* L. HAREBELL, BLUEBELL. A complex, circumpolar species, from the Arctic south to New Jersey, Ohio, the northern Great Plains, the Rocky Mountains of New Mexico and northern California (Eurasia); in Wisconsin frequent in diverse, dry to damp open habitats such as sandy woods (pine, oak, aspen), sandstone or limestone bluffs, cliffs, outcrops and ledges, dry to dry-mesic prairies and **cedar glades**, also on shores and dunes, spreading into fields and along embankments and roadsides (the straight row of dots on Map 218 through the acidic Northern Highlands follows U.S. Highway 51). (14) Flowering from June through September, fruiting from July to mid November.

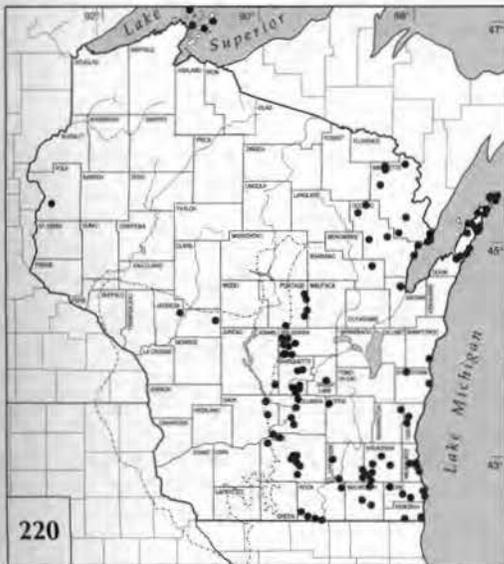
Triodanis perfoliata (L.) Nieuwl., Venus' Looking-glass, one of a group of sand barrens annuals, extends north in Wisconsin to Jackson and Waushara counties, where locally common in sandy barrens, open oak or pine woodlands, and fields and roadsides.





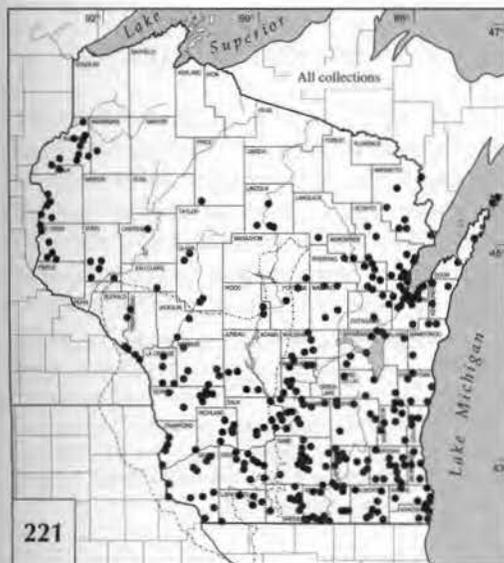
219. *Lobelia cardinalis* L. CARDINAL-FLOWER. Widespread in the eastern North American deciduous forest biome (New Brunswick to the Mississippi in southeastern Minnesota, south to Florida and Texas); in Wisconsin infrequent, more local than but growing with *L. siphilitica* (221), in wet, shaded or sunny, neutral soil of floodplains (**southern wet forest**), wooded riverbanks, swampy thickets, sloughs, ponds and seepage areas in deciduous woods, less often in marshes, wet meadows and ditches. (4) Flowering from the second week of July to the beginning of October, fruiting from the third week of August through November.

This native perennial, with its stunning brilliant red flowers, is one of the few plants in our flora to be pollinated by our Ruby-throated Hummingbird. For naturalizing in moist sunny areas, gardeners use both Cardinal-flower and Great Blue Lobelia (221), the shorter blue flowers of which are pollinated by bees.



220. *Lobelia kalmii* L. KALM'S OR FEN LOBELIA. A transcontinental, subarctic to temperate North American calciphile (Newfoundland and Hudson Bay to northern British Columbia, south to New Jersey, Ohio, Iowa and Washington), all stations except for a few in Colorado in glaciated territory; in Wisconsin on damp or wet, often calcareous shores, meadows and ledges, locally frequent in **fens**, shrub carrs, low neutral to calcareous prairies, and sandy, gravelly or marly lakeshores and spring borders, also on interdunal flats and limestone pavements on Lake Michigan and in rock crevices along Lake Superior. (4) Flowering from July to the beginning of October, fruiting from August to mid October.

White-flowered plants (f. *leucantha* Rouleau) are occasional.

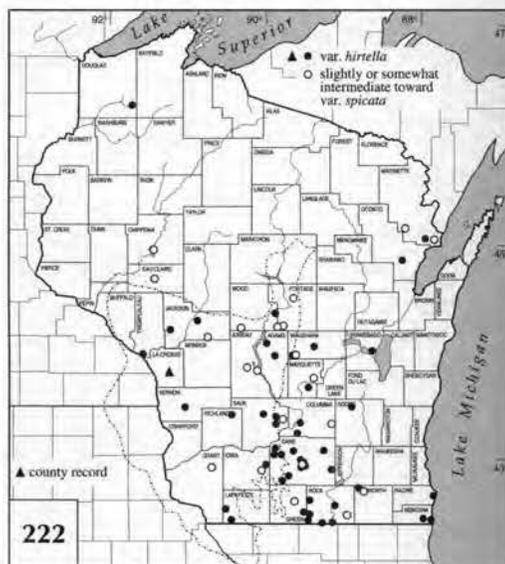


221. *Lobelia siphilitica* L. var. *siphilitica*. GREAT BLUE LOBELIA. Widespread in the eastern North American deciduous forest biome (Maine to Minnesota, south in the mountains to Alabama, the Ozarks and the edge of the Great Plains); in Wisconsin in moist to wet, neutral or somewhat calcareous ground, occasional to common in all but the northern counties in low woods, wet hollows, streamsides, deciduous forests and occasionally white cedar woods, clearings, marshes, **fens**, swales, pastures and pond edges. (7) Flowering from (end of June) late July to mid October, fruiting from September to early October.

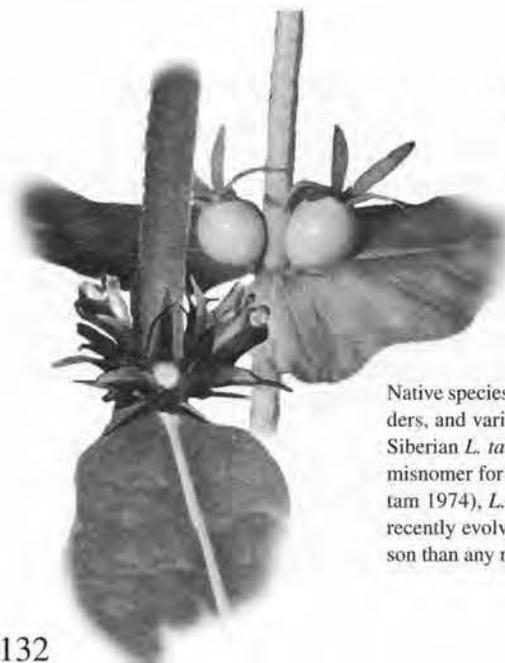
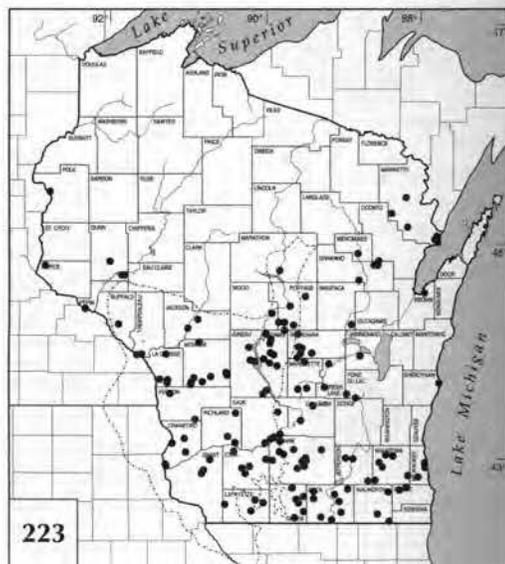
Lobelia siphilitica var. *ludoviciana* A. DC., a smaller, glabrous plant with narrow leaves, grows from Arkansas and the southern Great Plains (Texas) to Manitoba and in Wisconsin in the northwest counties, and intergrades with var. *siphilitica*, to which it is a western, ecogeographic vicariad.

222. *Lobelia spicata* Lam. var. *hirtella* A. Gray. HAIRY PALE SPIKED LOBELIA. Apparently an Ozarkian element, widespread into the northern Great Plains, eastward across the Upper Midwest to the Gaspé region of Quebec and New England; in Wisconsin frequent, growing in the same habitats and having the same distribution as var. *spicata* (223), of which it is evidently the western, more pubescent, xeromorphic vicariad, and with which in Wisconsin it freely intergrades. (15) Flowering from late May to late July, fruiting from August to mid September.

A highly variable species, composed of several more or less weakly defined varieties or “races.”



223. *Lobelia spicata* Lam. var. *spicata* [including var. *campanulata*]. PALE SPIKED LOBELIA. Widespread in temperate eastern North America, from the southern Appalachians and Interior Plateaus north to the Canadian border (Quebec to North Dakota); occasional to locally frequent in Wisconsin, not in the northern part of the state, in sandy, loamy or mucky soils of mesic to wet prairies, infrequently in “goat prairies”, thinly wooded bluffs, **cedar glades** (an odd habitat, hardly represented at all by specimens), ridges and hillsides, clearings in woods (pine, oak, aspen), grassy or wooded embankments, edges of marshes, also pastures and old fields; essentially a plant of prairies, savannas and open woods but somewhat weedy and often growing in disturbed habitats. (15) Flowering from late May to early September, fruiting from late July through September.



CAPRIFOLIACEAE—the Honeysuckle Family

A small Arcto-Tertiary family of shrubs to small trees or vines (seldom herbs), most abundant in eastern North America and eastern Asia, with opposite, usually simple leaves (compound in the elderberries) and mostly (4-) 5-merous flowers with a commonly small calyx, a bell-shaped to tubular, sometimes bilabiate corolla and a half to fully inferior, 2- to 5-locular ovary maturing into a berry or sometimes a drupe or capsule. (Ferguson 1966, Salamun 1980, Wade & Wade 1940)

Native species of either *Lonicera*, Honeysuckle, or *Viburnum* may grow in savanna thickets or prairie borders, and various Asiatic species are favorite ornamentals. Two commonly grown in Wisconsin are the Siberian *L. tatarica* and the Japanese *L. morrowii*, the parents of *L. × bella* (“beautiful honeysuckle,” a misnomer for this dreadful shrub if there ever was one). A highly variable hybrid swarm (Barnes & Cottam 1974), *L. × bella* is a terribly efficient invader of woods, thickets and prairies, probably because, recently evolved and locally selected by our human-disturbed environment, and with a longer leafy season than any native shrub, it is perfectly adapted to our disturbed habitats.

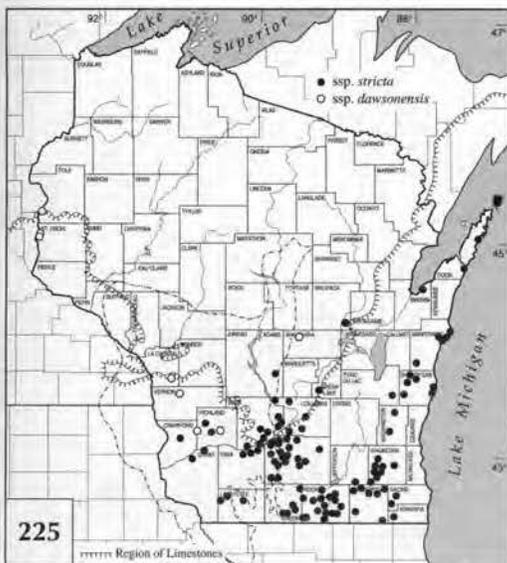


224. *Triosteum perfoliatum* L. LATE HORSE-GENTIAN, WILD-COFFEE, TINKER'S-WEED. A member of a classical Arcto-Tertiary genus (8 species eastern Asiatic, 3 eastern North American), throughout the eastern deciduous forest, from the Carolinas to Massachusetts and, through southern Michigan and eastern Minnesota, to the edge of the central Great Plains in Kansas and northeast Oklahoma; almost entirely confined to southern Wisconsin, in dry (oak-hickory), open or pastured woods, **southern dry-mesic forests**, oak savannas and open oak woodlands, thickets and brushy fields, and gravelly or rocky ridges, less often in rich woods or in the open in old fields and along railroads and fencerows; preferring heavy soils and avoiding the central sand plains. (7) Flowering from mid May to early July, fruiting from early August to October.

CARYOPHYLLACEAE—the Pink Family

This large, mostly north temperate, herbaceous family has opposite, simple, entire leaves arising from swollen nodes, regular, 4- or 5-merous flowers with separate or united sepals, free petals, 10 or fewer stamens, and a 1-chambered ovary that matures into a few- to many-seeded superior capsule opening by valves or apical teeth. (Maguire 1951, Schlising & Ilits 1962)

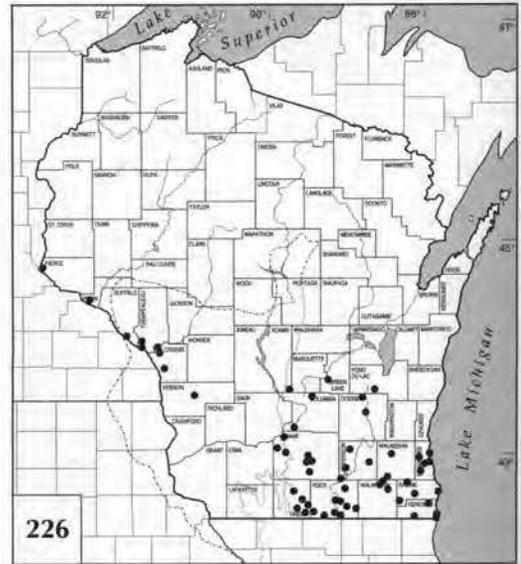
Garden plants (Carnation, Pink, Baby's-breath, Catchfly) and weeds (chickweeds, White Campion, Soapwort, Spurrey) abound, but native species of prairies and savannas are few. Caryophyllaceae (from *carya*, Greek name of the walnut, and *phylon*, leaf) refers to the aroma of crushed walnut leaves, which led to the use of the ancient name for the clove (a spice), and thence to the Clove Pink, *Dianthus caryophyllus*.



225. *Arenaria stricta* Michx. ROCK SANDWORT. Widespread in North America (Alaska to Texas), with a third subspecies, *ssp. texana* (Robins.) Maguire, occurring in the Ozarks and southern Great Plains. The southeastern *ssp. stricta* is common in dry or rocky habitats of southern and eastern Wisconsin on tops of calcareous sandstone or limestone bluffs, rock outcrops in the very steep, very **dry prairies** beneath them, sandy or gravelly hillsides, sand prairies, open woods, sand dunes along Lake Michigan, and rarely wooded rock outcrops recently converted from prairie. The northern *ssp. dawsonensis* (Britton) Maguire [var. *litorea* (Fernald) B. Boivin] (Special Concern) is rare on a few bluffs in central and western Wisconsin, adjoining Minnesota, and north to Newfoundland and Alaska. (7) Flowering and fruiting from late May through July (September).

Arenaria lateriflora L., Grove Sandwort, a circumboreal and subarctic species, is common in Wisconsin south of the Tension Zone, but then not reappearing again until Hudson Bay, in dry to moist, open deciduous woods and thickets, moist to mesic prairies, pastures and wooded riverbanks.

226. *Silene stellata* (L.) W. T. Aiton var. *scabrella* (Nieuw.) E. J. Palmer & Steyerl. STARRY CAMPION. Eastern and central United States (Georgia to Massachusetts, west to the edge of the eastern Great Plains of Texas to North Dakota), with var. *stellata* more southern and eastern and the barely different var. *scabrella* more western, extending east to Michigan and Tennessee; locally frequent in southeastern Wisconsin and occasional in western Wisconsin, but nearly lacking from the Driftless Area except in its western river valleys, in open upland oak woods, mesophytic or sandy woods, woods borders, **cedar glades**, riverbanks and sand terraces (Pepin County), sometimes in prairie borders, deep-soil prairies and grassy ditches, and occasionally along railroads, roadsides and fencerows. (6) Flowering and fruiting from early July to mid August (September).



CISTACEAE—the Rock-rose Family

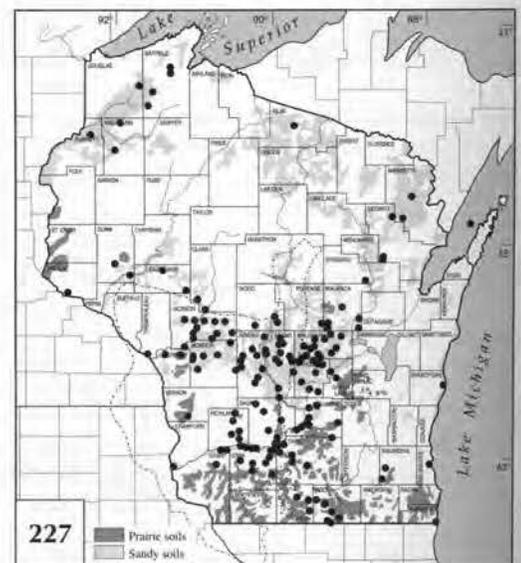


A small, north-temperate, mostly Mediterranean group represented in Wisconsin by dwarf shrubs or herbs with conspicuous but short-lived yellow flowers (*Helianthemum*, *Hudsonia*) or minute dark reddish flowers (*Lechea*) of 5 unequal sepals, 3 or 5 petals all crumpled up in bud, few to numerous stamens and 3 fused superior carpels that ripen into a leathery capsule. (Brizicky 1964a, Daoud & Wilbur 1965)

Cleistogamy, the occurrence of self-pollinating flowers that set seed without opening, is widespread in the family. Several species of Cistaceae are frequent to common in Wisconsin's dry to mesic prairies, open woodlands, barrens, sandy flats and dunes, abandoned fields, and sandy or rocky ground generally; our other *Helianthemum*, *H. bicknellii*; 3 species of *Lechea*, Pinweed, a distinctive but taxonomically difficult genus; and *Hudsonia tomentosa* Nutt., False Heather or Beach-heath, a sporadically distributed, mat-forming, evergreen shrub restricted with us to sand barrens (often in blowouts; see Curtis 1959, p. 311) and sandy shores (especially dunes along the Great Lakes and near the Wisconsin River).

227. *Helianthemum canadense* (L.) Michx. COMMON ROCK-ROSE. Eastern North America, from Georgia, Mississippi and Missouri north to Nova Scotia and Minnesota; common in southern and central Wisconsin, following the Cambrian sandstone northeastward and reappearing on outwash plains in the Northwest, in dry sandy prairies (with *Cladonia* spp., long-haired hawkweed, Virginia dwarf dandelion, horsemint and other common sand barrens associates), open jack pine woods, black **oak barrens**, bur oak openings, prairie-like habitats on sandstone slopes, bluffs and outcrops, and also on sandy lakeshores. (15) Flowering from mid May to mid July, fruiting from (early June) July to mid October.

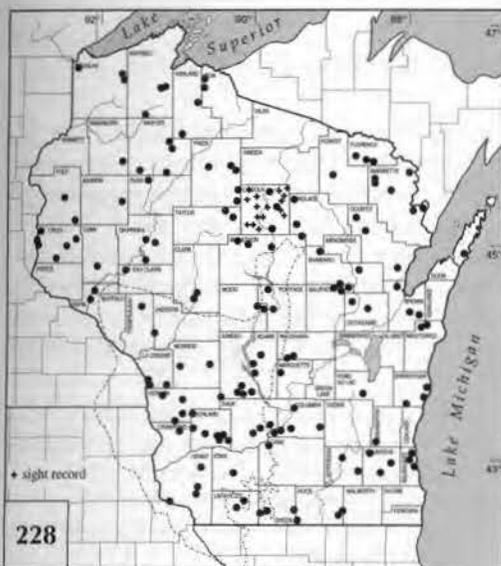
Helianthemum bicknellii Fernald, Bicknell's Rock-rose, blooms 2–3 weeks later and occurs in the same habitats. "On a frosty late November morning, if you are lucky, you may see crystals of ice protruding from cracks in the lower part of the stem, hence [for both our helianthemums] another common name, Frostweed" (Swink & Wilhelm 1994, p. 391).



CLUSIACEAE—the Mangosteen Family [including Hypericaceae, St. John's-wort Family]

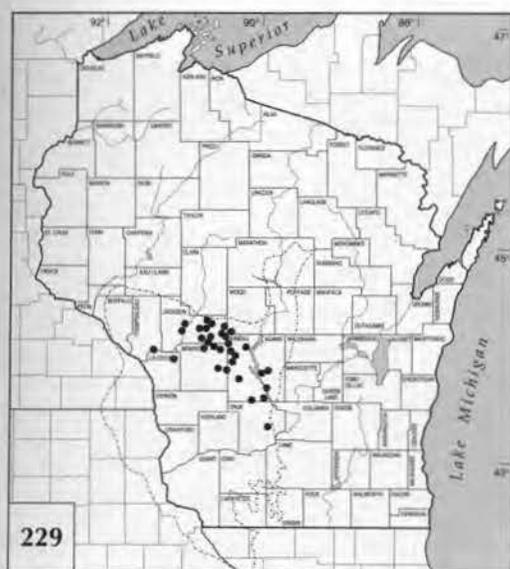
Opposite or whorled, entire leaves, 4- or 5-merous flowers with yellow, orange or pinkish petals, numerous stamens (sometimes a set number in *Hypericum*) often united by their filaments into 3 to 5 bundles, a single pistil of 3 to 5 carpels with many ovules being typical of our species. (Gillett & Robson 1981, McLaughlin 1931, Utech & Iltis 1970, Wood & Adams 1976)

A highly polymorphic, mostly tropical woody family, but with all of our species belonging to subfamily Hypericoideae (or family Hypericaceae). Some hypericums are weeds such as the European *Hypericum perforatum*, Common St. John's-wort, thoroughly naturalized in our area along roads and in fields and disturbed prairies. Our other 14 species are native, occurring in marshes, bogs, lakeshores and moist woodlands. Most have translucent-dotted (punctate) leaves, due to oil-filled cavities that are visible especially with a hand lens when leaves are held to the light. Many of our species are closely related, and readily hybridize in nature.



228. *Hypericum pyramidatum* Aiton [*H. ascyron* L., misapplied]. GREAT OR GIANT ST. JOHN'S-WORT. Maryland, Indiana, Missouri and northeastern Kansas, north to Quebec to Minnesota; in Wisconsin in wet and open habitats such as gravelly riverbanks, **alder thickets**, sphagnum sedge meadows, mesic forest edges and drainage ditches. (3) Flowering from late June to mid September, fruiting from mid July to early October.

According to some European authorities, American plants represent the same species as that in eastern Asia (e.g., Lake Baikal region). Botanists who accept this opinion use the parenthetical name above for both the Old and New World plants. This tall (up to ca. 2 m) ± shrubby herb has the largest leaves, flowers (4 to 6 cm in diameter), and capsules of our species of *Hypericum*.



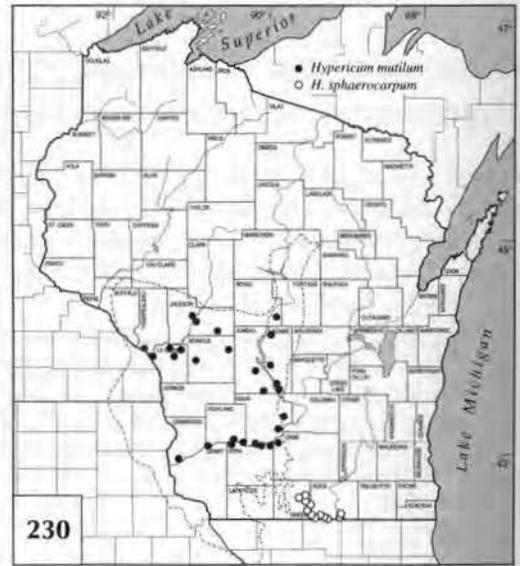
229. *Hypericum canadense* L. CANADIAN ST. JOHN'S-WORT. Eastern North America from Georgia to Alabama to Newfoundland, west to Iowa, the Black Hills and southeastern Manitoba; in Wisconsin mostly in the northern Driftless Area, in **wet-mesic prairies**, sandy-peaty roadsides, along railroads, wet sandy meadows, swales and marshes, moist sandstone ledges and heath-sedge bogs. (1) Flowering from early June to late August, fruiting from mid July through late August.

Hypericum punctatum Lam., Spotted St. John's-wort, occurs throughout Wisconsin (except the northern quarter) along weedy forest borders, open wooded slopes, floodplain thickets, dry to moist fields, and sometimes in wet prairies.

Hypericum perforatum L., Common St. John's-wort, a cool-to warm-temperate, almost cosmopolitan European weed (once terribly aggressive in western North America until finally controlled by an introduced Australian beetle), is ubiquitous in Wisconsin in almost any open, weedy, grassy habitat, including various sorts of prairies.

230. *Hypericum mutilum* L. ST. JOHN'S-WORT. Eastern North America, from Florida and Texas to Minnesota and Newfoundland; in Wisconsin, mostly in the lower Wisconsin River Valley and the Driftless Area, on sandstone cliff ledges, sandy creek margins and river flats, moist sandy or black muck lowland meadows, **mesic prairies**, swales and desiccated temporary pools, and rarely in moist woods or abandoned fields. (1) Flowering from July to September, fruiting from early August to late September.

***Hypericum sphaerocarpum* Michx.** ROUND-FRUITED ST. JOHN'S-WORT (Threatened). This subshrub is a Midwest endemic in low to mesic prairies, limestone outcrops and cedar glades, from Alabama and the Arkansas Ozarks and adjoining Oklahoma and Kansas north to Wisconsin and (barely) Michigan; in Wisconsin very local, confined to rich, moist or mesic prairies with scattered willows, dogwood and bur oak; rarely weedy along railroads. Flowering from late June to mid August, fruiting from mid July through August.



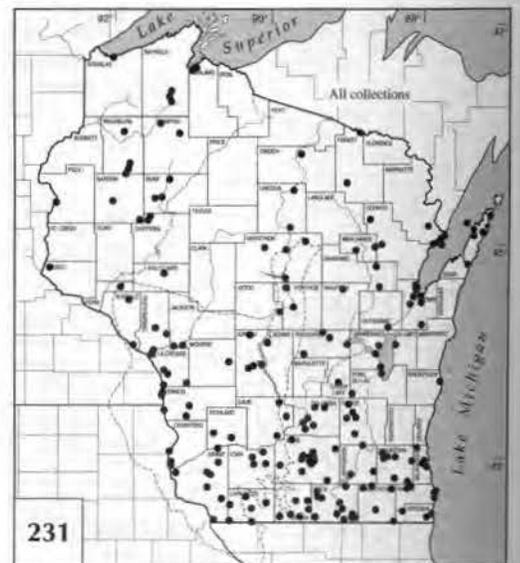
CONVOLVULACEAE—the Morning-glory Family

A widely distributed family of mostly annual or perennial herbs, many, and most of ours, vines (but often shrubby or arborescent in the tropics), with alternate leaves (or almost leafless, yellow or orange, twining parasites lacking chlorophyll in *Cuscuta*, the dodders). Flowers often showy, 5-merous except for the 2-carpellate pistil, with a funnelform or tubular corolla, the 5 stamens attached to its base and alternate with its lobes, these usually twisted in the bud, and a superior ovary with 1 to 4 ovules in each of its 1 or 2 cells. Fruit a variously dehiscent capsule. (Fogelberg 1937, Lewis & Oliver 1965, Wilson 1960b)

The family includes a few plants cultivated for their flowers (*Ipomoea*, the morning-glories) or tubers (*I. batatas*, the Sweet-potato), and a few troublesome weeds such as *Cuscuta* and *Convolvulus arvensis*, Field Bindweed, an aggressive, perennial, agricultural pest beloved by neither farmer, gardener nor prairie enthusiast. *Calystegia spithamea* (L.) Pursh (*Convolvulus* s.) Low Bindweed, often overlooked, is a plant of dry, usually sandy, gravelly or rocky open woods, clearings and prairies of mostly northern Wisconsin.

231. *Calystegia sepium* (L.) R. Br. ssp. *angulata* Brummit [*Convolvulus* s.] HEDGE BINDWEED. Extremely variable, our subspecies from North Carolina to New Mexico, north to Massachusetts, the northern Great Plains and Washington; common except in north-central Wisconsin, usually on dry to wet-mesic but especially **mesic prairies**, disturbed upland woods, old fields, pastures, fencerows, roadsides and railroads, also in lowland habitats such as edges of bottomland woods and thickets, lakeshores, streamsides, sedge meadows, shrub carrs and disturbed areas such as ditches, dikes and boat landings. (10) Flowering from June to early October, fruiting from early August to November.

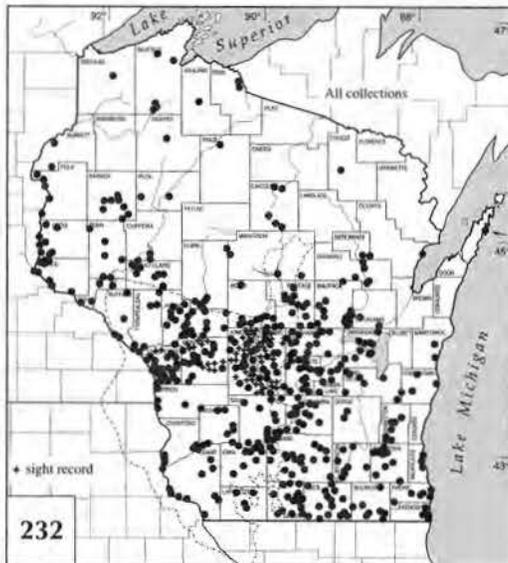
Originally described from Europe. North American forms have been divided into many poorly defined species, subspecies and varieties. Several have been attributed to Wisconsin, but because no one has done a detailed study of our plants, we assume most are native and map them here as *Calystegia sepium* ssp. *angulata* [including ssp. *americana*].



EUPHORBIACEAE—the Spurge Family

A huge (7,500 species), mostly warm-temperate to tropical family so diverse that it is virtually impossible to characterize it in any simple way. All of ours are herbs, but shrubs and trees are common in the tropics, usually with acrid milky juice, opposite, simple to compound leaves, and stipules that are sometimes glandlike. Flowers nearly always unisexual and with or without a perianth, the pistillate consisting uniformly of a single pistil of 3 carpels usually forming a capsular schizocarp, with each of the 3 segments dehiscent to release its single seed. In *Euphorbia* sensu lato (1,500 species) the compact inflorescence acts as a “false flower,” called a cyathium, which consists of several staminate flowers (that look like single stamens) surrounding a single pistillate flower inserted in a cup-like involucre usually bearing glands, the whole effectively mimicking a complete flower. (Fassett 1933, Richardson et al. 1988, Webster 1967)

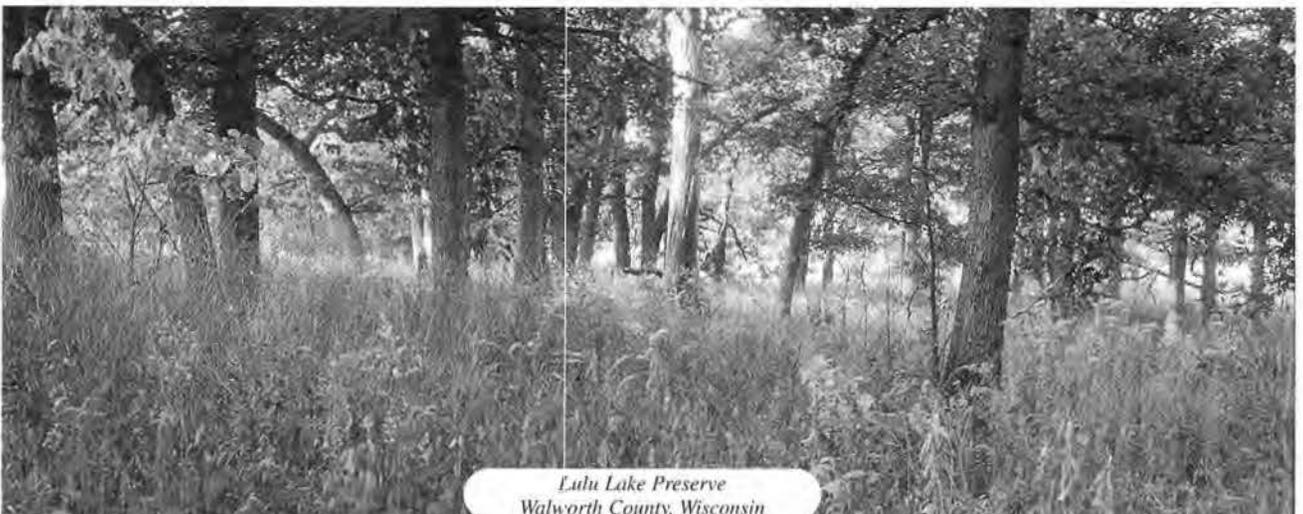
The best-known members of this interesting family are the economically important *Manihot esculenta* (cassava, tapioca), *Croton* (oils, resins), *Ricinus communis* (castor oil), *Hevea brasiliensis* (commercial rubber) and *Euphorbia* (ornamentals, including Poinsettia). Many species are poisonous, and many persistent weeds.



232. *Euphorbia corollata* L. FLOWERING SPURGE. Widespread in the eastern United States and the eastern Great Plains on dry to moist, sandy or loamy soils; primarily in the southern two-thirds of Wisconsin, prevalent in open, sandy or gravelly, sunny native communities, there, with its snow-white flowers, dominating visually many a dry to mesic prairie, in jack pine or scrub **oak barrens**, cedar glades, sandstone ridges, limestone bluffs, sand flats, blowouts and lakeshores, commonly weedy in abandoned fields, roadsides, railroads, fencerows, and occasionally quarries or city lots. (15) Flowering from late May to mid September, fruiting from early July to late September.

Most northern Wisconsin stations are believed to be recent introductions (Fassett 1933), although Flowering Spurge was known from Lincoln County as early as 1893.

Euphorbia esula L., Leafy Spurge, a most aggressive agricultural weed, often invades and becomes permanently naturalized in fields and roadsides and also dry to mesic prairies. Because of its deep root system (up to 2 m or more), it is virtually impossible to eradicate.



FABACEAE—the Pea or Bean Family

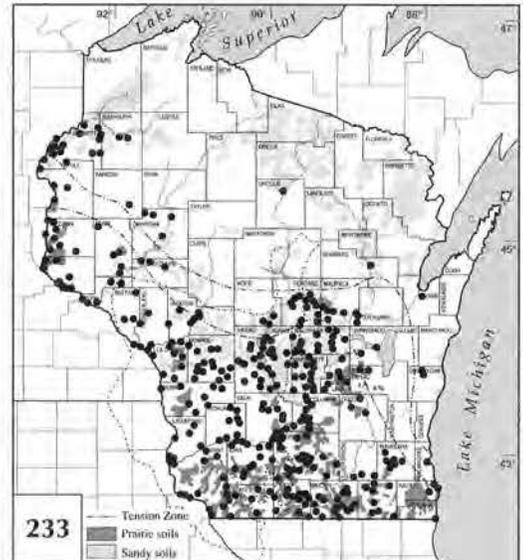


This, the most specialized subfamily (Papilionoideae) of the “old” Leguminosae, includes over 12,000 species of mostly herbs, but with trees and lianas common in the tropics. Flowers typically papilionaceous, i.e., bilaterally symmetrical with an upper larger petal (“standard”) enclosing two lateral (“wings”) and two lower petals, the latter fused into a “keel” enfolding the stamens and pistil. Stamens (5) 10, usually with 9 of the filaments connate into an open sheath around the pistil and the 10th (uppermost) free. Fruit a legume, i.e., a dry, several-seeded “pod” opening down one or both sutures, or sometimes jointed or permanently closed. (An actively evolving family, with variations in flower and fruit themes abounding.) (Fassett 1939; Isely 1975, 1981; Welsh 1960)

A family of great importance, yielding forage and food (vegetables, seeds) crops, ornamentals, timber trees and other products. After the composites and grasses, the legumes are the largest family on prairies, very important ecologically because of the ability of their symbiotic root bacteria to fix nitrogen. *Robinia pseudoacacia*, Black Locust, an introduction from the Ozarks (or southeastern mountains?), is a persistent invader of woods and sandy prairies, and it takes heroic efforts to eradicate it.

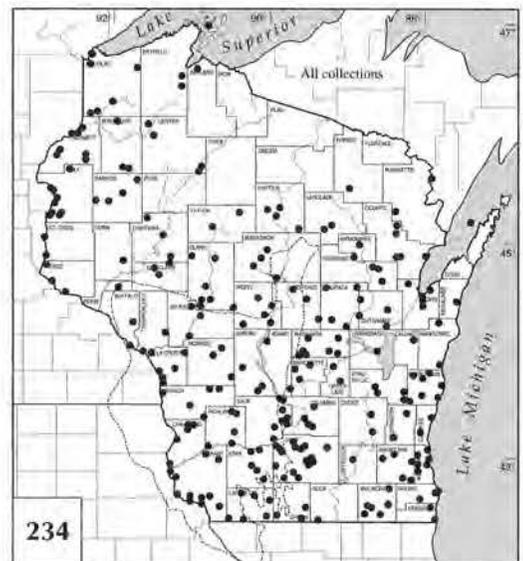
233. *Amorpha canescens* Pursh. LEAD-PLANT. The only prairie species of a small North American genus, common on the Great Plains from New Mexico to southern Saskatchewan, and east in the prairie “wedge” to northern Indiana; in Wisconsin common mostly south of the Tension Zone on mesic to **dry prairies** and open sandy woods, on dry rocky bluffs (sandstone, limestone, quartzite, basalt), xeric sand prairies and prairie patches on sandy or rocky ground, occasionally in low prairies, fields and lakeshores, more or less open oak and/or pine woods, including oak openings, jack pine barrens and cedar glades, and along sandy roadsides and railroads. (15) Flowering from the end of May to mid September, fruiting from early July to early October.

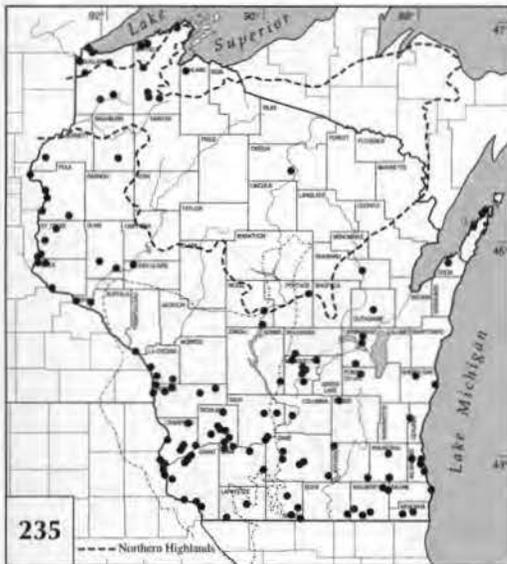
Like the doctrine of signatures of medieval medicine, the leaden-gray pubescence of the leaves suggested to early miners in southwestern Wisconsin the presence of lead. Note that the corolla is reduced to a single petal (the banner).



234. *Amphicarpaea bracteata* (L.) Fernald. [including var. *comosa* (L.) Fernald]. HOG-PEANUT. Widespread throughout the eastern United States, also southeast Canada and eastern Mexico; abundant throughout Wisconsin (except in the extreme northeast), in dry to moist, deciduous or mixed woods and thickets, oak openings (savannas), northern or **southern dry-mesic forests** and lowland forests, especially common where more or less disturbed and sunny, as along trails, banks, borders and clearings, on brushy roadsides, fencerows, overgrown fields, unmowed ditches, marshy or swampy ground, and dry to wet prairies. (19) Flowering from August to mid September, fruiting from September to early October.

Most of our specimens belong to var. *bracteata*, but frequent specimens are the poorly defined var. *comosa*. The latter, slightly more southern in Wisconsin, prefers more open habitats. Since the two forms are wholly sympatric, the recognition of these varieties as environmentally induced forms would be more appropriate.





235. *Astragalus canadensis* L. CANADA MILK-VETCH. Throughout most of southern Canada, eastern and central United States, and the Great Plains (Saskatchewan to Utah and Texas), and disjunct to Siberia, a locally variable *Astragalus* (see Barneby 1964, Fassett 1939, Isely 1984); in most of Wisconsin but avoiding the Canadian Shield (Northern Highlands), infrequent to locally common from Lake Michigan bluffs to stony shores of Lake St. Croix, mostly along borders, clearings and trails in dry upland (often cut-over) woods and on grassy and/or shrubby roadside banks, railroad cuts, bluffs, cliffs and sandstone outcrops, also on dry to **mesic prairies**, oak openings, and other sunny or partly shaded habitats such as lakeshores, stream banks, edges of quarries and sand pits. (4) Flowering from the beginning of June to late August, fruiting from late October through November (a few seeds persist on the plant into December).

Our most common species of *Astragalus*. The others—*A. alpinus* L., *A. crassicaarpus* (236) and *A. neglectus* (Torr. & A. Gray) E. Sheld.—are all among the rarest plants in our flora.



236. *Astragalus crassicaarpus* Nutt. GROUND-PLUM, PRAIRIE-PLUM (Endangered). A widespread and characteristic polymorphic species of the western prairies and Great Plains, from Alberta and the Rocky Mountain foothills to Manitoba, Wisconsin, western Missouri, Texas and New Mexico (with endemic subspecies in Texas and Tennessee), our plants belonging to the var. *crassicaarpus* (see Barneby 1964); rare to locally common only in extreme western Wisconsin on dry and **dry-mesic prairie** relics on hills, bluffs and river terraces. (1) Flowering in May.

Astragalus crassicaarpus is an indicator of undisturbed prairie soils, the larger surviving populations occurring on high lime prairies on steep south- and southwest-facing bluffs with western Great Plains species that are rare or uncommon in our state [e.g., *Artemisia frigida* (108), *Dalea villosa* (240), *Calylophus serrulatus* (Nutt.) P. H. Raven, *Pediemelum esculentum* (251)] and other prairie associates such as *Cirsium hillii* (138) and *Onosmodium bejariense* (213).

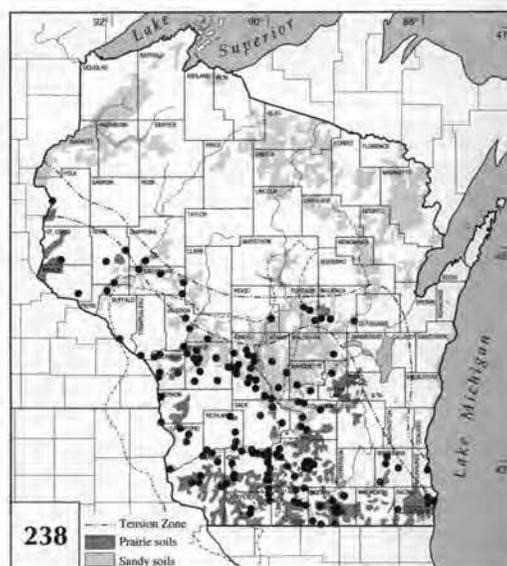


237. *Baptisia alba* (L.) Vent. var. *macrophylla* (Larisey) Isely [*B. lactea* (Raf.) Thieret var. *lactea*; *B. leucantha* Torr. & A. Gray.]. WHITE or MILKY WILD INDIGO. A widespread prairie and eastern Great Plains species, its range and habitat much the same as the next (238), restricted in Wisconsin to south of the floristic Tension Zone, generally on richer, moister soils than *B. bracteata*, predominantly on deep-soil, **wet-mesic prairies** as are still surviving mostly along railroads, moist sand prairies, rarely in dry prairies; occasionally in open, sandy or rocky woodlands, lake and river shores, and edges of bottomland fields, swales and sloughs. (9) Flowering from late May to early August, fruiting from late July to early October.

This beautiful stately plant, a "tumbleweed" when dry, is now infrequent, though long persistent in fencerows and roadsides (at least until the herbicide spraying of "weeds" during the 1950s and 1960s).

238. *Baptisia bracteata* Muhl. ex Elliott var. *glabrescens* (Larisey) Isely [*B. leucophaea* var. *g.*; *B. b.* var. *l.*]. CREAM OR PLAINS WILD INDIGO. A species of the prairies and southern Great Plains, from eastern Texas (and Mississippi) to southeastern Minnesota, then east in the Prairie Peninsula to Ohio (var. *glabrescens*), but with a disjunct population like so many others, e.g., *Lespedeza leptostachya* (248), in the Southeast, from (North) South Carolina to Alabama (var. *bracteata*); infrequent in the southwestern half of Wisconsin, its distribution characteristic of but not confined to prairie relics, mostly in sandy, dry to mesic prairies, dry high lime prairies, sandstone and limestone bluffs, sandy or gravelly hillsides and banks, and in open oak woods, oak openings and pine relics, abandoned fields, roadsides and rarely even in pastures (livestock avoid eating it because of its alkaloids). (7) Flowering from late April to late June (early July), fruiting from mid July to late October.

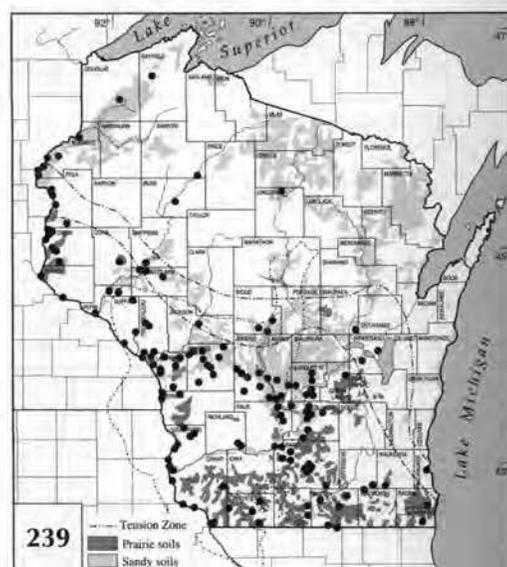
Baptisia, like *Silphium*, is basically a southeastern genus, with a few species having become adapted to the prairies and plains.



239. *Dalea candida* Michx. ex Willd. var. *candida* [*Petalostemon c.*]. WHITE PRAIRIE-CLOVER. The most widespread of the nearly 160 New World, mostly southwestern and Mexican *Dalea* spp. (Barneby 1977), from the central Great Plains (Saskatchewan to Texas) east to southern Ontario, Indiana and scattered to Tennessee and Alabama; in Wisconsin characteristic of dry to mesic prairie remnants, sand prairies (rarely on sand terraces and dunes), open, sandy or rocky woods (black and/or white oak) and cedar glades, less common along roadsides and railroads in sandy soils. (8) Flowering from late June through August (September), fruiting from mid July to early October.

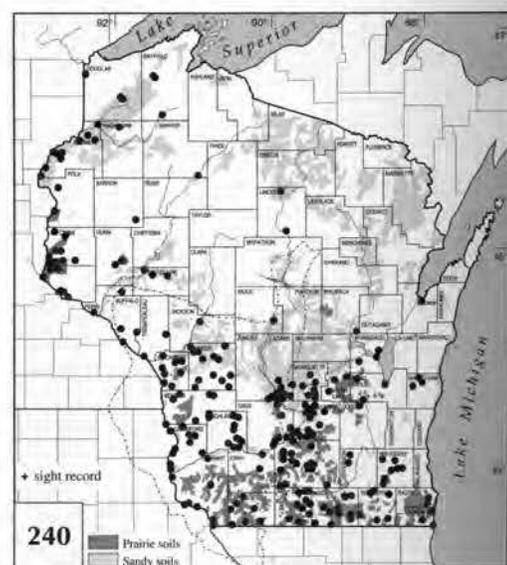
The distributions and habitats of *Dalea candida* and the far more common *D. purpurea* (240) in Wisconsin are essentially the same, and they often grow together. These species have long been known as *Petalostemon candidum* and *P. purpureum*.

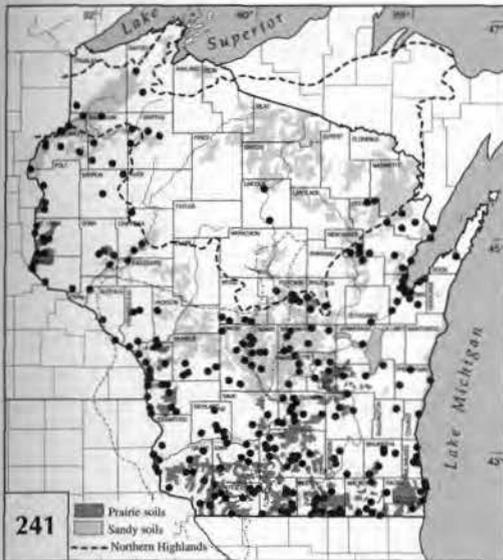
“White prairie-clover is browsed by all classes of livestock and soon disappears with overgrazing” (McGregor 1986, p. 441).



240. *Dalea purpurea* Vent. [*Petalostemon p.*]. PURPLE PRAIRIE-CLOVER. From the southern Canadian Great Plains to New Mexico, north Texas and east in the Prairie Peninsula to Indiana and beyond; locally frequent in the southwestern half of Wisconsin, characteristic of mesic to dry prairie remnants, sand prairies and oak openings, as well as moist prairies, often in open scrub oak-jack pine woodlands and dolomite or quartzite glades, rarely spreading along roadsides, railroads and old fields; at one time common on flat to gently rolling prairie, now generally seen on bluffs, ridges, cliffs and outcrops, gravelly hillsides and sand terraces. (8) Flowering from July to late September, fruiting from late July to late October.

Dalea villosa (Nutt.) Spreng. (*Petalostemon v.*), Silky or Downy Prairie-clover (Special Concern), reaches its eastern range limit in western Wisconsin in sandy prairies, barrens and juniper savannas along the St. Croix River. Populations may be relatively large and should sustain themselves as long as natural habitats remain and grazing is excluded.

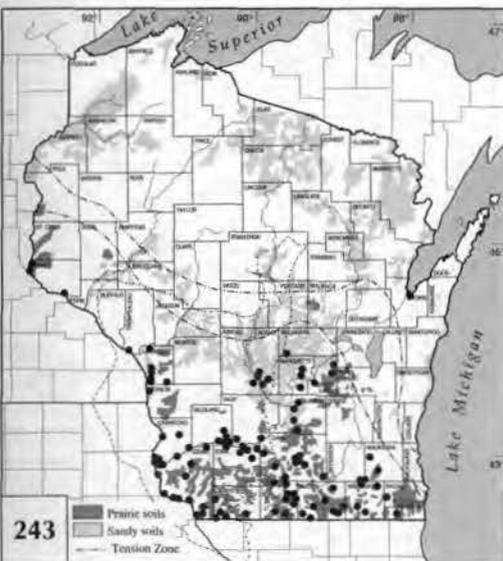




241. *Desmodium canadense* (L.) DC. CANADA TICK-TREFOIL. Characteristic and widespread in the northern Great Plains, to the Prairie Peninsula and beyond (Oklahoma and Nebraska to Manitoba, east to Maryland, New England and Quebec); in Wisconsin widespread (except in the Northern Highlands), common on dry to wet, most prevalent on **wet-mesic prairies**, low sunny meadows, dry sandy fields, open oak woodlands and savannas, borders of upland woods (jack pine, oak, aspen), thickets and fencerows, often along roadsides and railroads, sandy hillsides, gravelly calcareous ridges, and similar sites (causeways, dikes bordering cranberry marshes, lakeshores, etc.); far more shade-tolerant than *D. illinoense* (243). (9) Flowering from late June to early September, fruiting from mid July to late October.



242. *Desmodium glutinosum* (Muhl. ex Willd.) A. W. Wood [*D. acuminatum*]. CLUSTER-LEAF TICK-TREFOIL. Throughout the eastern deciduous forests from the Atlantic across to the Great Plains [Florida to Texas (northeastern Mexico), north to southern Canada]; nearly throughout Wisconsin except in the Northern Highlands, in dry to mesic, less often damp, hardwood (deciduous) forests, reaching greatest prevalence in the **southern dry-mesic forests**, in rich black oak-white oak, oak-hickory, and oak-birch or oak-white pine woods, common in oak-maple and maple-basswood communities and white oak and black oak savannas; in loamy or clayey or less often sandy or gravelly soils. (11) Flowering from July to mid August (occasionally early September), fruiting from late July to early October.



243. *Desmodium illinoense* A. Gray. PRAIRIE OR ILLINOIS TICK-TREFOIL. Characteristic of the eastern southern Great Plains, from northeast Texas to Nebraska and Minnesota, east in the tallgrass prairies to Ohio; in Wisconsin locally frequent on dry to moist, but mostly **mesic prairies** south of the Tension Zone, concentrating along the Mississippi and Wisconsin rivers and the central sand plain, in oak openings (e.g., Blue Springs, Eagle and Genesee state natural areas) and nearby open sandy or gravelly slopes, ridges and bluffs and edges of dry oak woods; surviving mowing (and even herbiciding?) and sometimes persisting along grassy, unshaded roadsides and railroads with mixtures of weeds and prairie or upland-thicket species. (8) Flowering from July to late August, fruiting from July to mid September (mid October).

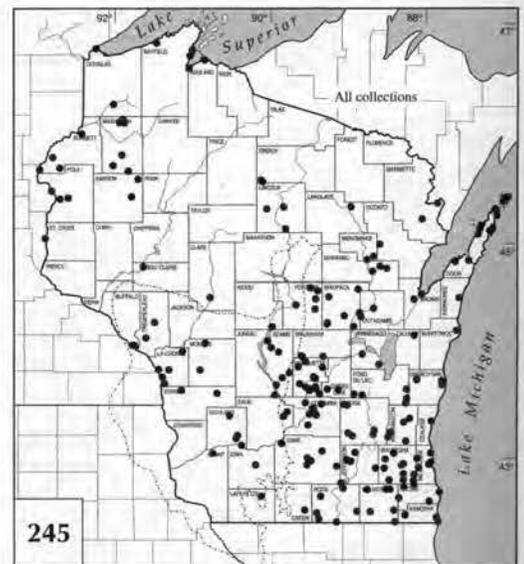
244. *Desmodium perplexum* B. G. Schub. [*D. paniculatum* (L.) DC., in part; *D. dillenii* Darl., in part; *D. glabellum* (Michx.) DC. of authors]. PANICLED TICK-TREFOIL, SMOOTH TICK-TREFOIL. A highly variable taxon throughout the deciduous forest region of the eastern and central United States; scattered in southern and eastern Wisconsin in dry to moist, usually open, upland woods (especially oak and oak-hickory), oak openings, wooded bluffs, rocky ridges and openings (including open quartzite glades, bluff tops and wooded talus slopes in the Baraboo Hills), sometimes on sandy hillsides and grassy, brushy banks with mixtures of weedy plus native species of upland thickets and prairies. Flowering in August, fruiting from mid August through September.

In recent literature the *Desmodium paniculatum* group has been treated as a single species, as one species consisting of two varieties, or as two, three or four species. Wisconsin plants all fit the textbook *D. perplexum* formula if the traditional species are maintained (see Isely 1953, 1983).



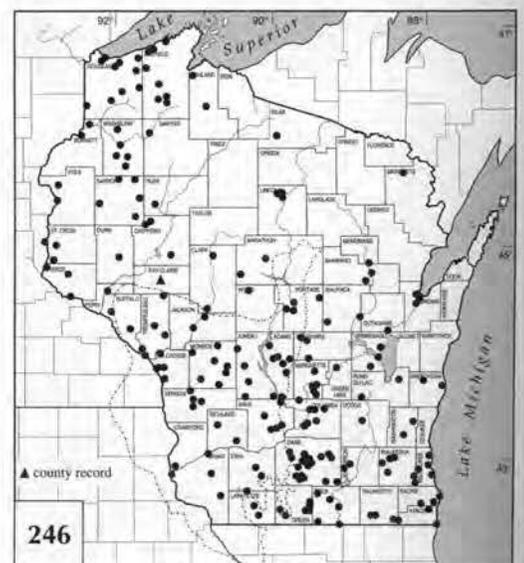
245. *Lathyrus palustris* L. MARSH PEA. Polymorphic circumboreal species, in North America south to North Carolina, Ohio, Missouri and California; occasional to locally common throughout Wisconsin (but rare in the region of Archaean rocks), in open, moist, peaty, muddy or sometimes gravelly or sandy habitats, in wet prairies, **southern sedge meadows**, fens, marshes, shrub carrs, bogs, tamarack swamps (often degraded), damp grassy edges of woods, stream and pond banks, shores and beaches, swales and ditches. (11) Flowering from (late May) June to late August, fruiting from July through September.

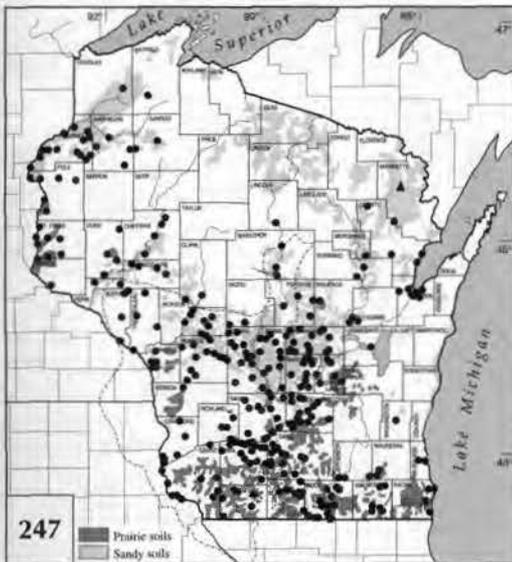
Represented in North America by several named varieties whose characters overlap and recombine so strongly as to make them of little taxonomic value. Three are conventionally recognized in our state: var. *palustris* [including var. *linearifolius*]; var. *myrtifolius* (Muhl. ex Willd.) A. Gray (the most distinctive variety); and var. *pilosus* (Cham.) Ledeb. [including var. *macranthus*].



246. *Lathyrus venosus* Muhl. ex Willd. var. *intonsus* Butters & H. St. John. VEINY PEA. A Midwest hairy phase, from Arkansas to Saskatchewan, east to southern Ontario and Indiana, overlapping or intergrading with the typical glabrous variety in the eastern mountains; frequent throughout Wisconsin (except in the northeast), in open oak-hickory, oak-pine, jack pine and aspen woods, savannas, and dry to **wet-mesic prairies**, especially when recently cut or burned, as well as in a variety of other open habitats such as sandy ridges, lightly wooded rocky slopes, talus, summit openings on wooded bluffs, roadsides and embankments, and occasionally in fields, pastures, fencerows and on shores. (13) Flowering from mid May through June, fruiting from mid July to early October.

This and other plants such as *Camassia scilloides* (23), *Heliopsis helianthoides* (161), *Astragalus canadensis* (235), *Blephilia ciliata* (261) and *Ranunculus rhomboideus* (301), said by Curtis (1959) to achieve maximum presence values in prairies, likely have more affinity with savanna than prairie habitats.





247. *Lespedeza capitata* Michx. BUSH-CLOVER. A very variable, distinctive species of midwestern and eastern North America, from eastern Texas to Minnesota, western Florida and New England (southwestern Quebec); Wisconsin's most abundant native legume, common in dry to mesic prairies and on dry, sandy, gravelly or rocky ground in general, an active invader of roadsides, railroads, old fields and shores; also on limestone and/or sandstone bluffs and cliffs, granite and quartzite glades and rhyolite mounds, as well as in open woods, especially jack pine-scrub oak barrens and juniper glades, less often in open red oak-white oak, white pine and northern hardwoods stands. (15) Flowering from (mid) late July to early October, peaking in August, fruiting from September to late October.

Even locally this is a most variable species in regard to pubescence, leaflet shape and crowding of heads. Current authors minimize the taxonomic importance of the varieties recognized by Fassett (1939) and Fernald (1950) or ignore them altogether.



248. *Lespedeza leptostachya* Engelm. PRAIRIE BUSH-CLOVER (U.S. Threatened, WI Endangered). One of our few Midwest endemics, restricted to the tallgrass prairies of northern Illinois, southern Wisconsin, northern Iowa and southern and central Minnesota; very rare in Wisconsin, in dry to mesic prairie remnants, sand prairies and oak openings, preferring gravelly hill prairies and thin-soil prairies over dolomitic bedrock. Flowering in August, fruiting from the end of August into October.

Listed as endangered or threatened in the states in which it occurs, due to the extensive loss of its prairie habitat to agriculture. "Plowing of remnant virgin [prairie] tracts... probably has contributed to the pending extinction of *L. leptostachya*" (Clewell 1966, p. 382).

Most of its flowers are cleistogamous, that is, fertilized and seed setting without cross-pollination. This may explain the lack of variation among individuals (Clewell 1966).

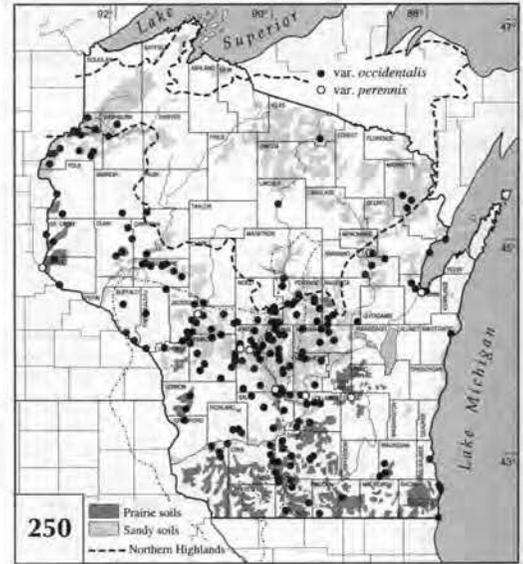


249. *Lespedeza violacea* (L.) Pers. VIOLET BUSH-CLOVER (Special Concern). Midwestern and northeastern United States from northeastern Texas to southwestern Wisconsin, east mostly in the Prairie Peninsula, but scattered beyond to Virginia and Massachusetts; in Wisconsin at its northwestern limit, in dry, open oak woods, thickets and glades; occasional in rocky openings along the sides and tops of Mississippi River bluffs to the mouth of the Wisconsin River, scattered in brushy prairies and banks in former oak savanna country near the Wisconsin and Sugar rivers with mixtures of mesic prairie, forest and weed species, very locally frequent in the Baraboo Hills on **exposed cliffs** of quartzite and/or quartzite conglomerate with glade vegetation and stunted oaks and hickories. (1) Flowering in August, fruiting from mid August to mid October.

Lespedeza virginica (L.) Britton. VIRGINIA LESPEDEZA, SLENDER BUSH-CLOVER (Threatened). Throughout the eastern United States; in Wisconsin disjunct to four stations in the Baraboo Hills and one in Marquette County.

250. *Lupinus perennis* L. WILD LUPINE. Our only species of a large, mostly western genus, widespread from Florida to Maine (mostly the var. *perennis*) and then in the glaciated Midwest to Wisconsin and southeastern Minnesota (here mostly var. *occidentalis* S. Watson); locally common in Wisconsin, particularly on the Central Plain, lacking from dolomite formations and the Northern Highlands, in very sandy, open and sunny (sometimes partly shaded) borders or clearings in open, dry black oak-Hill's oak-jack pine woods, **oak barrens**, sandy prairies, roadsides and old fields, and infrequently on sandstone bluffs and ridges. (7) Flowering from mid May through June (sporadically to early August), fruiting in July.

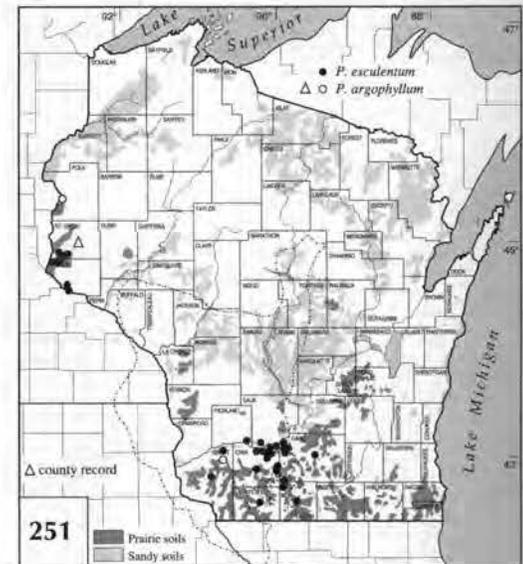
Wild Lupine, like many other species (e.g., *Amphicarpaea bracteata*, 234), shows a clinal westward increase in pubescence correlated with aridity. It is of interest to preservationists as the host plant of the endangered Karner Blue Butterfly.



251. *Pedimelum argophyllum* (Pursh) J. W. Grimes [*Psoralea argophylla*]. SILVERY SCURF-PEA (Special Concern). Very common in the Great Plains to the west of us (northern Oklahoma and northern New Mexico to southern Alberta); like many Great Plains species, at its eastern range limit in westernmost Wisconsin, native only on **mesic prairies** in Polk, St. Croix and Grant counties; rarely collected. (1) Flowering in September.

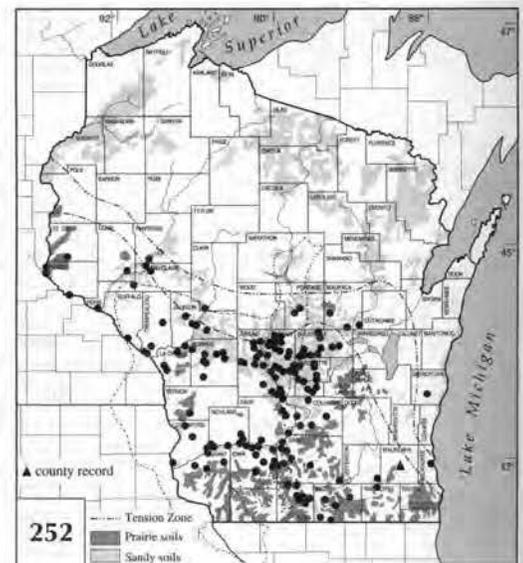
***Pedimelum esculentum* (Pursh) Rydb.** [*Psoralea esculenta*]. PRAIRIE-TURNIP (Special Concern). Dry prairies on the Great Plains, having the same overall range as the above; in Wisconsin at its eastern limit, very rare and now restricted to relic **dry prairies** mostly within the Driftless Area and far west on south- to west-facing, gravelly to rocky knolltops, hillsides and bluffs, very rarely persisting on roadsides; seemingly tolerant of light to moderate cattle grazing. (2) Flowering in June, fruiting in late July through August.

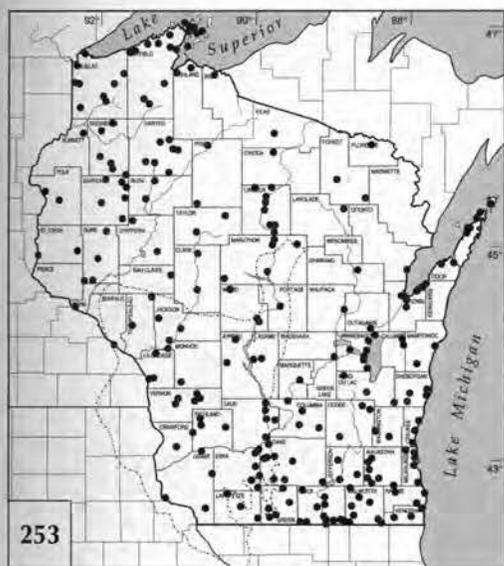
Though producing a thick edible root, this should not, because of its rarity, ever be dug.



252. *Tephrosia virginiana* (L.) Pers. [*T. v. var. holsericea*]. GOAT'S-RUE, RABBIT-PEA. A sand plant of the eastern and southern United States, from the Atlantic to southeastern Minnesota and the southern Great Plains of Texas; in Wisconsin locally frequent south of the Tension Zone on sandy, less so on prairie soils, most prevalent in sunny **oak barrens**, also characteristic of scrub oak-jack pine woodlands, sand prairies (sometimes with *Opuntia humifusa*), old fields, roadsides, railroad cuts, slopes, banks and sandstone outcrops, occasionally in bur oak openings or clearings in dry woods of oak-white pine or red oak-white oak; rarely on dry lakeshores. (7) Flowering from June through July (August), fruiting from August to late October.

As with other widespread, basically eastern forest species, clines related to increasing aridity lead to greater pubescence in the northern Middle West, making var. *holosericea* (Nutt.) Torr. & A. Gray our predominant form.





253. *Vicia americana* Muhl. AMERICAN VETCH. Transcontinental (western Quebec to southeastern Alaska, south to Georgia and eastern Texas); common throughout Wisconsin in a variety of mesic to dry, open to shaded habitats, most common in disturbed deciduous woods of beech-maple, maple-basswood, mixed or lowland hardwoods, oak-hickory, aspen communities and pine relics, especially in open spots and along borders; also in old clearings, degraded prairies (**wet-mesic prairies**), dry to moist thickets, fields, roadsides, railroads and quarries with mixtures of weeds plus woodland or prairie plants; and in grassy, brushy or disturbed places on riverbanks and shores. (11) Flowering from mid May through September, fruiting from July to mid August (probably into October). An extremely variable species, with our material belonging to the largely eastern ssp. *americana* [including var. *truncata*].

GENTIANACEAE—the Gentian Family

These mostly annual or perennial, glabrous herbs, beloved by botanists (especially) throughout the world, are famous for their often showy, saucer- to bell-shaped or tubular corollas of 4 or 5 united petals, their lobes often joined by folds or plaits, bearing alternately 4 or 5 stamens deep within the throat. Leaves opposite, with each pair arising at right angles to the pair above and the pair below, or whorled. Fruit a superior, 2-valved capsule with numerous small, delicately netted, lined or pitted seeds. (Gillett 1957; Mason & Iltis 1966; Pringle 1964, 1967; Wood & Weaver 1982)

A large cosmopolitan family, mostly in moist, cool habitats. Our gentians are all essentially prairie and fen species that, becoming rarer year by year, should never be picked nor transplanted except as a last resort in the face of impending destruction. They are difficult to grow, their roots being mycorrhizal.



254. *Gentiana alba* Muhl. ex Nutt. [*G. flavida* A. Gray]. CREAM GENTIAN (Threatened). Concentrated in the Prairie Peninsula, from the Great Plains of eastern Kansas and southeastern Minnesota to southern Ontario, scattered to Pennsylvania and North Carolina; in Wisconsin rare within the limestone region and mostly south of the Tension Zone, on dry to moist, sometimes calcareous relic prairies such as **mesic prairies** along railroads, in old unmowed cemeteries, on calcareous morainal hills, open wooded ridges or ravines, edges of dry oak woods, in oak openings and roadsides. (2) Flowering from early August to late September, with a peak in the last week of August.

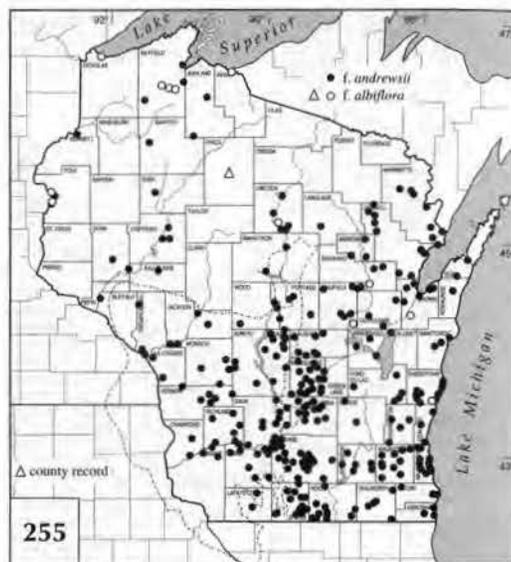
Though our prairie gentians show seasonal, ecological and floral isolation (Mason & Iltis 1966, Pringle 1964), several collections document hybridization of *Gentiana alba* with *G. andrewsii* and *G. puberulenta* (see Pringle 1964, 1965a, b).

The abundance of map locations is deceptive, because this species has been over collected. A single flower and leaf, plus a color photograph, are enough to voucher its presence.

255. *Gentiana andrewsii* Griseb. CLOSED or BOTTLE GENTIAN. An Appalachian element, from Maryland and West Virginia to eastern Quebec, west to Missouri and the northern Great Plains; in Wisconsin our most common gentian, most often in damp or wet soil of sedge meadows, **wet-mesic prairies**, streambanks, grassy lakeshores, swales and damp thickets, sometimes in woods and on roadsides. (8) Flowering from (early) late August to mid October, seasonally and/or ecologically isolated from the three other species of *Gentiana*, all of which may hybridize with it (Mason 1959, Pringle 1964, 1965b).

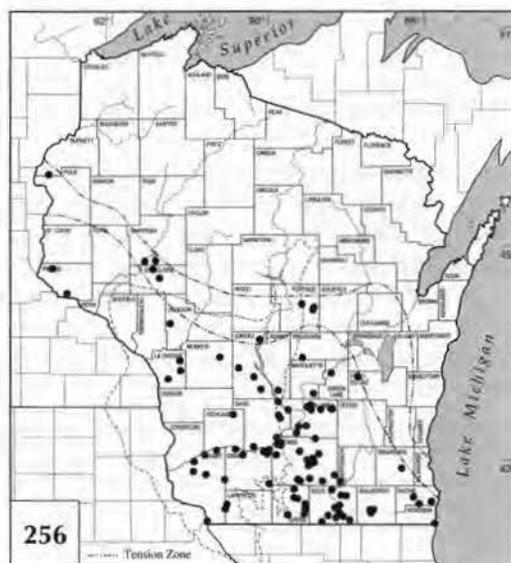
Ordinarily blue-flowered (f. *andrewsii*). The white-flowered f. *albiflora* Britton differs from *G. alba* (254) by closed flowers, absence of corolla lobes, and later flowering.

Gentiana rubricaulis Schwein., Red-stemmed Gentian, with longer stem internodes than *G. andrewsii*, occurs chiefly in northern sedge meadows but rarely extends south into central Wisconsin, in alkaline sedge meadows and moist prairies.



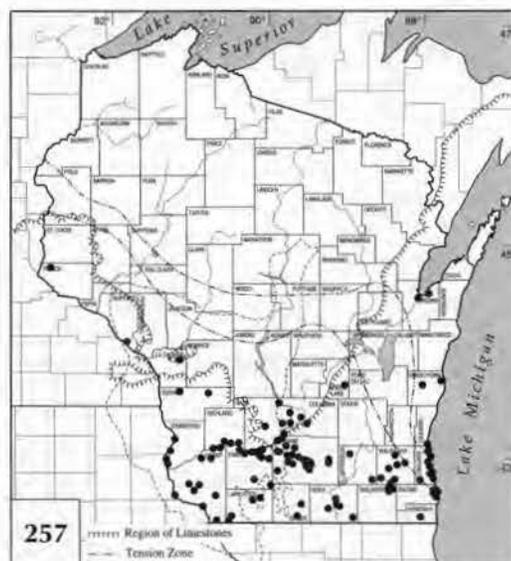
256. *Gentiana puberulenta* J. S. Pringle [*G. puberula* of older floras; *G. saponaria* in Curtis 1959, both misapplied]. DOWNY or PRAIRIE GENTIAN. From the eastern Great Plains (northwestern Arkansas and Kansas to Manitoba) in the prairies to Indiana, and rarely beyond; in Wisconsin locally common in dry sandy prairies, rich dry-mesic to **mesic prairies** along railroads, in very dry steep calcareous "goat prairies," less often in damp, calcareous prairies and rarely in dry upland woods (former oak savannas). (6) Flowering from (mid August) early September to mid October (peaking in the third week of September), the last of our perennial gentians to bloom.

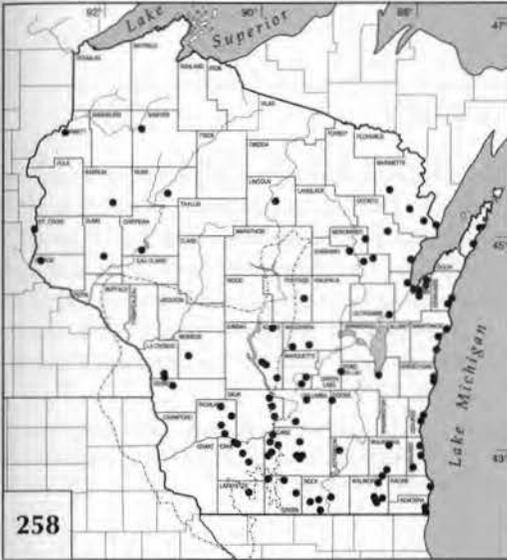
This gorgeous species, so characteristic of prairies, deserves protection. Curtis (1959, p. 271) writes admiringly that "Many of the xeric prairies support large populations of the downy gentian (*Gentiana puberula*), which is by all odds the most beautiful member of this famed genus in Wisconsin and which at its best compares favorably with the species from the high Himalayas that are so prized by rock gardeners."



257. *Gentianella quinquefolia* (L.) Small ssp. *occidentalis* (A. Gray) J. M. Gillett [*Gentiana q.* var. *o.*]. STIFF GENTIAN, AGUE-WEED, FIVE-FLOWERED [sic!] GENTIAN. The western phase of the species, from the Arkansas Ozarks and the Kentucky Cumberlands to southeast Minnesota and Ohio (allopatric to the Appalachian ssp. *quinquefolia*); in Wisconsin in the limestone region, from dry, south-facing, steep, rocky "goat prairies" and bluffs, north-facing slopes on upland **dry-mesic prairies**, well-drained ridges in deep-soil prairies (e.g., Juda Prairie, Green County), oak openings and edges of oak-hickory woods to moist calcareous prairies, marshy gravelly depressions and moist clay seepage on Lake Michigan bluffs, and rarely on damp calcareous sandstone cliffs or shaded earth banks along roads. (1) Flowering from early September to late October, one of the very last species in our flora to bloom.

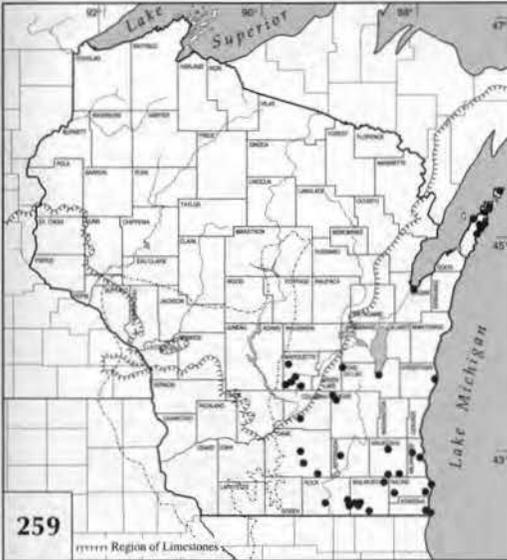
This winter annual (biennial) requires calcareous soil and an "ecologically" open or slightly disturbed microhabitat without too much competition.



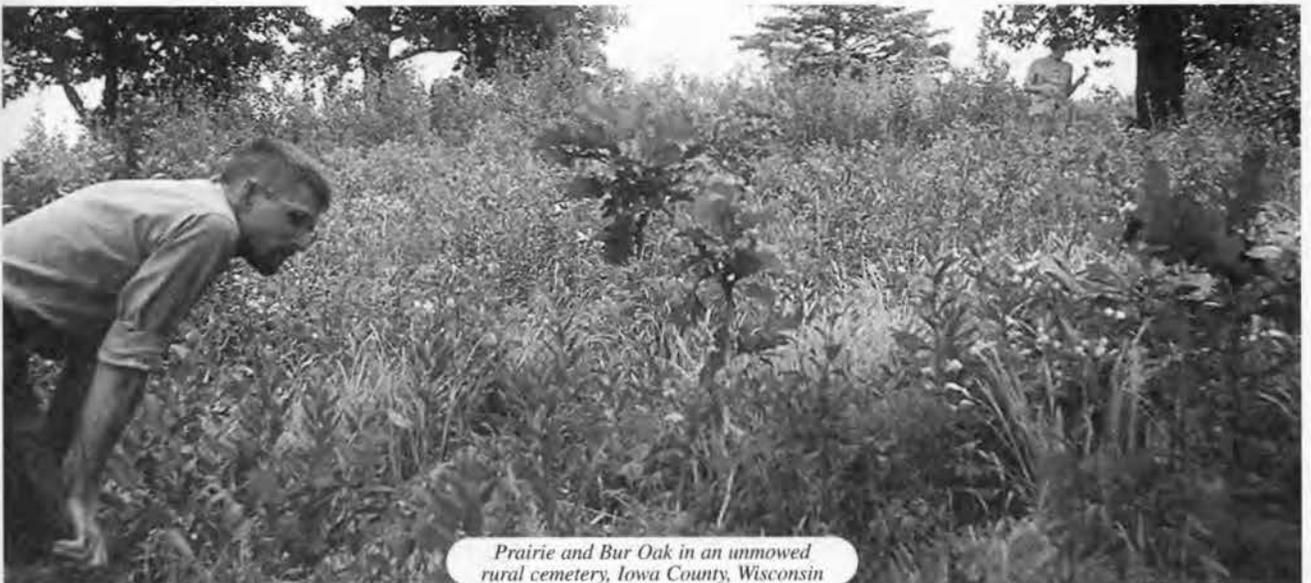


258. *Gentianopsis crinita* (Froel.) Ma [*Gentiana c.*]. FRINGED GENTIAN. An eastern North American, Appalachian element, chiefly from (Georgia) Maryland to Maine, west near the Great Lakes to Wisconsin and into North Dakota and Manitoba; in Wisconsin widely distributed but rare to only locally common, both in the region of limestones as well as those of acidic rocks, in sunny or shady moist habitats, especially **wet-mesic prairies** that are flooded in spring, in marshes or sandy sedge meadows, along Lake Michigan in swales behind dunes and on moist dunes, seepage slopes, low, wet, sandy or gravelly flats or rock pavements, rarely in damp open woods and shaded, dolomite-capped sandstone cliffs. (2) Flowering from mid August into October, peaking in the second and third weeks of September, a little later than *G. procera*.

Apparently not requiring, but tolerating, as calcareous a habitat as *Gentianopsis procera*, with which it rarely grows on fens and calcareous low prairies along Lake Michigan, and where the two species hybridize (see Mason & Iltis 1966).



259. *Gentianopsis procera* (Holm) Ma [*Gentiana p.*]. GREAT PLAINS FRINGED GENTIAN (Special Concern). A northern Great Plains (cordilleran?) element that avoids the acidic Canadian shield (including our Northern Highlands), from Alberta to the Gaspé, south to Ohio and Iowa; in Wisconsin restricted to the region of limestones and more local than *G. crinita* (258) [its eastern sister species (vicariad), with which it rarely grows], in full sun in generally alkaline habitats such as marly, often springy sedge meadows, low prairies, **fens** and moist calcareous gravels, sands or limestone pavements on Lake Michigan, seepage slopes on Lake Michigan bluffs, often on bare sand, black soil or clay, as well as on grassy shores. (3) Flowering from (mid) late August to early October, peaking in the second week of September, a little earlier than *G. crinita*, as would be expected of a species that evolved in the shorter growing season of the northern Great Plains.



Prairie and Bur Oak in an unmowed rural cemetery, Iowa County, Wisconsin

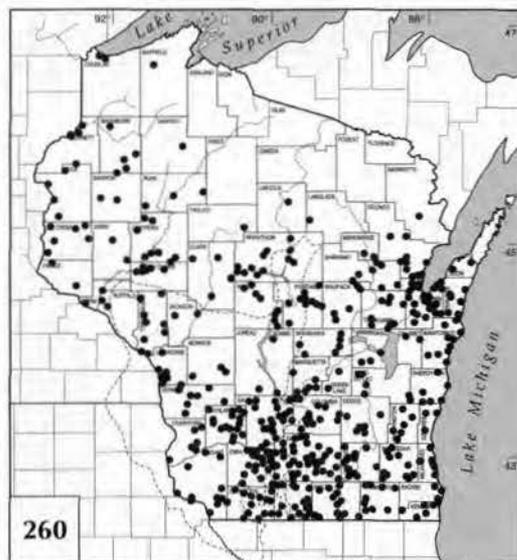


GERANIACEAE—the Geranium Family

These perennial herbs or soft-woody subshrubs have palmately (or pinnately, in *Erodium*) veined leaves from jointed nodes and often glandular pubescence. Flowers regular to somewhat irregular, usually with 5 free petals, 5 or 10 stamens and 3 to 5 peculiar carpels weakly united into a compound ovary. The carpel bodies (mericarps) and their persistent styles eventually split away from the elongate central column and curl upward and outward or become spirally twisted, the basal, fertile portion of each carpel eventually opening to forcefully eject its single seed (or carpel and style dispersed together, with the seed retained). (Fassett 1933, Robertson 1972)

Best known for the cultivated South African “geraniums” (*Pelargonium*), but the native wild geraniums, or crane’s-bills (*Geranium*), with numerous species in Europe, Asia, North America and on mountains elsewhere, are well appreciated for their usually brightly colored and insect-pollinated flowers.

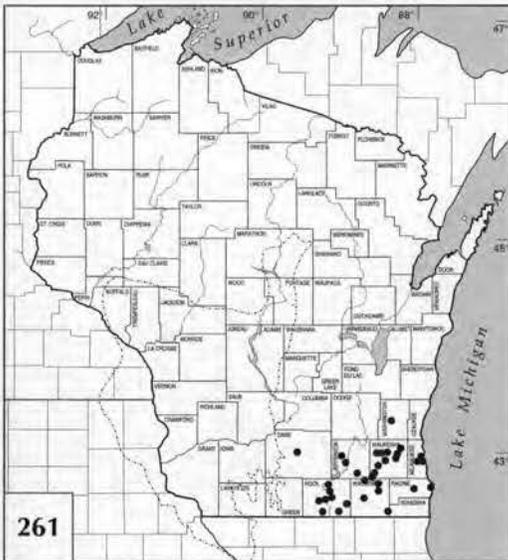
260. *Geranium maculatum* L. WILD GERANIUM, CRANE’S-BILL. Deciduous forests and savannas of eastern North America, from Maine to northern Georgia, westward to the eastern Great Plains; in Wisconsin very common except in the far north, reaching greatest abundance in **southern dry-mesic forests** and rich mesophytic sugar maple, beech and basswood communities, **not uncommon in oak-hickory, aspen-birch or white pine woods**, often in shady ravines and streamside thickets as well as low floodplain forests and white cedar woods, occasionally in mesic prairies and borders of sedge meadows; somewhat weedy and thriving in open or disturbed woods, on soils ranging from dry sand through loam or clay to black muck. (21) Flowering from May to mid June, fruiting from early June to July.



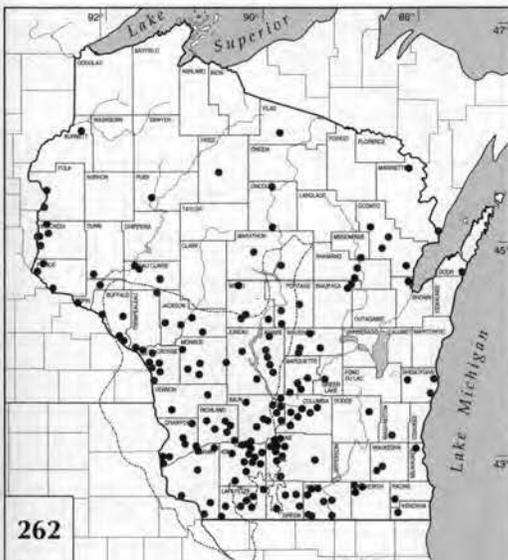
LAMIACEAE [LABIATAE]—the Mint Family

There is hardly a family more highly evolved nor easier to identify than the mints, aromatic herbs or low shrubs with square stems, opposite and decussate (alternate pairs at right angles) or whorled, simple leaves, a typically bilabiate corolla of 5 fused petals with 2 or 4 stamens inserted in the throat, and a distinctive ovary, shallowly to deeply 4-lobed, that ripens into a schizocarp (splitting into 1 to 4 nutlets) or a drupe (enclosing 1 to 5 stones). (Gill 1981, Koeppen 1958, Waterman 1960)

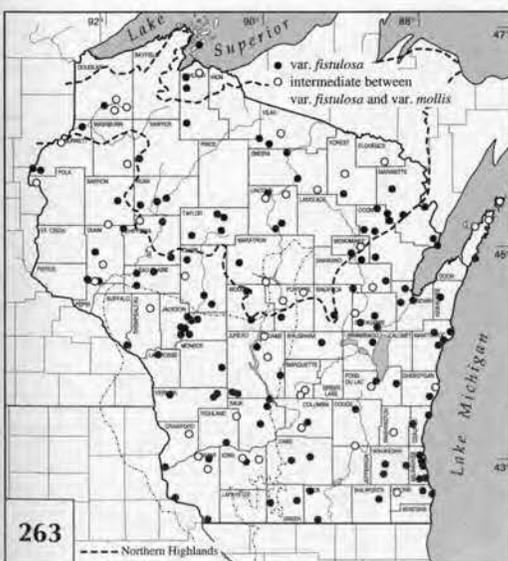
Worldwide, chiefly centered in the Mediterranean basin, economically important as a source of essential oils and culinary herbs (lavender, peppermint, spearmint, rosemary, etc.), medicines and confections (horehound), ornamental plants (Bugleweed, Glory-bower, Dead-nettle, *Coleus*, *Salvia*, numerous others) and timber (including teak). The Lamiaceae are closely related to and derived from the Verbenaceae, and the boundary between the two families has never been all that clear, what with recent studies supporting the transfer to Lamiaceae of approximately two-thirds of the genera traditionally included in the Verbenaceae.



261. *Blephilia ciliata* (L.) Benth. OHIO HORSEMINT. Widespread from Massachusetts to Georgia, west to (northeastern Texas?), northern Arkansas, eastern Kansas and Wisconsin, where confined almost entirely to the southeast, typically in mesic to **wet-mesic prairies** remnants, less often in borders of fens and thickets and low places in open woods; very shade tolerant and associated more with savanna than with prairie habitats. (4) Flowering from May to mid August.



262. *Hedeoma hispida* Pursh. ROUGH FALSE PENNYROYAL. Throughout the Great Plains, from Texas to Montana and Alberta, east to Alabama, southern Minnesota and New York (New England); in Wisconsin frequent throughout much of the state, in dry, sandy or gravelly soil of **dry prairies**, fields and pastures, "often in quite bare patches" (Voss 1996, p. 180), road shoulders, railroad ballast, gravel pits and waste places. (8) Flowering from mid May to early August.

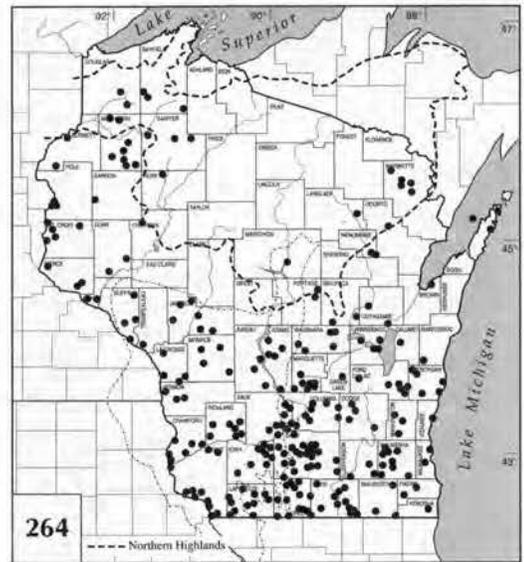


263. *Monarda fistulosa* L. var. *fistulosa*. WILD BERGAMOT. One of the best-known, most widespread mints, in the eastern mountains from Alabama to New England, west to the (eastern) Great Plains (Texas to the Canadian border); in Wisconsin common throughout, on mesic to dry, often sandy or gravelly prairies, pastures, edges of woods, **cedar glades**, oak openings and pine barrens, occasionally in damp places such as sedge meadows, and spreading along roadsides, railroad embankments and waste places. (17) Flowering from the end of June to early September.

Variable, but the varieties that have been named on the basis of relative lengths of hairs and petioles seem insignificant. Plants with some long straight hairs along the nerves on the lower surface are var. *fistulosa*. Almost as frequent as these and sometimes growing with them are plants combining the pubescence characters of both of our varieties.

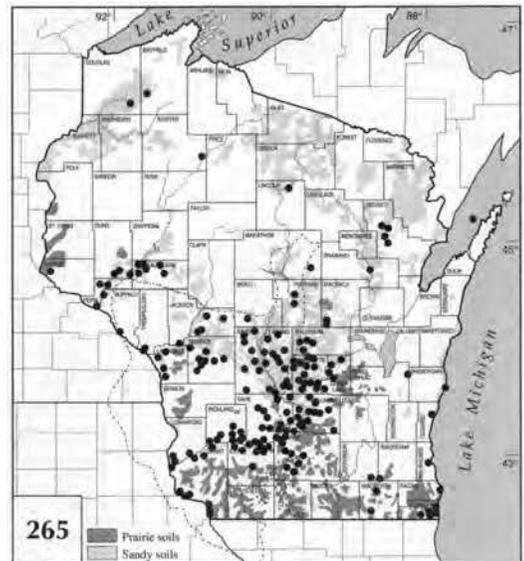
264. *Monarda fistulosa* L. var. *mollis* (L.) Benth. WILD BERGAMOT.

These are the plants with only minute curled pubescence on the lower surface of the leaves. They apparently have the same subcontinental range as the previous, and intergrade not only with it but also to the west of us with a third variety, var. *menthaefolia* (Graham) Fernald. In Wisconsin they are more common than, and occur in the same habitats as var. *fistulosa* (263), except are lacking from the Northern Highlands. (17) Flowering from the end of June to early September.



265. *Monarda punctata* L. ssp. *villicaulis* Pennell [*M. p.* var. v.].

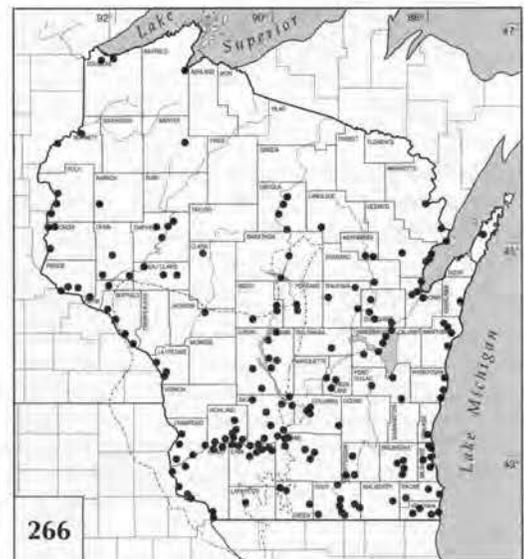
HORSEMINT, DOTTED MONARDA. A highly polymorphic sand species, with nine subspecies in the southern Great Plains and Ozarks, but with this the only northern variant, though also in eastern Oklahoma, mostly in the Prairie Peninsula, from northeastern Arkansas to eastern Minnesota, eastern Michigan, northern Indiana and rarely scattered beyond (Lake Champlain, New Jersey); in Wisconsin locally common in open dry sandy soil, especially on sand prairies, sand barrens, oak openings, jack pine plains, sandstone outcrops, sandy beaches, roadsides and abandoned fields; mostly in the old bed of Glacial Lake Wisconsin and the sands along the Mississippi tributaries. (5) Flowering from the end of June to mid September.

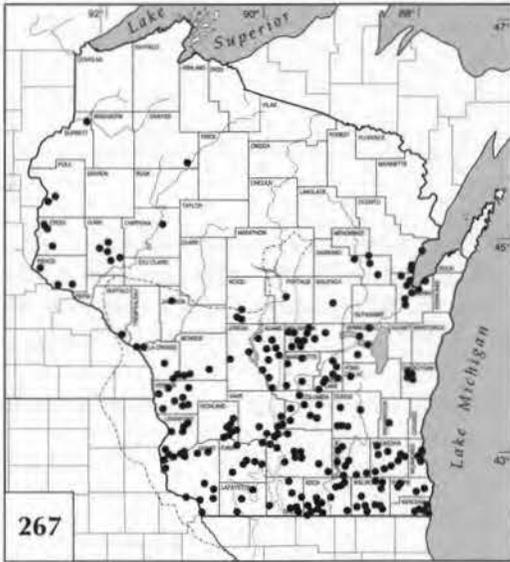


266. *Physostegia virginiana* (L.) Benth. ssp. *virginiana* [*P. formosior* Lunell; *P. speciosa* (Sweet) Sweet]. OBEDIENCE, OBEDIENT PLANT, FALSE DRAGONHEAD. Eastern margin of the Great Plains (Texas to Canada) to Quebec and Florida, our subspecies the more northern within that range; in Wisconsin locally frequent in lowlands throughout the state such as lake, river and stream banks, sedge meadows, marshes, wet prairies, swales, wet thickets and floodplain forests. Flowering from the end of July to early October.

The great majority of our plants are the segregate that has been called *Physostegia formosior* but are now, if recognized, treated as *P. virginiana* var. *speciosa* (Sweet) A. Gray, with some of them stipitate-glandular as in typical var. *virginiana*. Cantino (1982) united the two taxa.

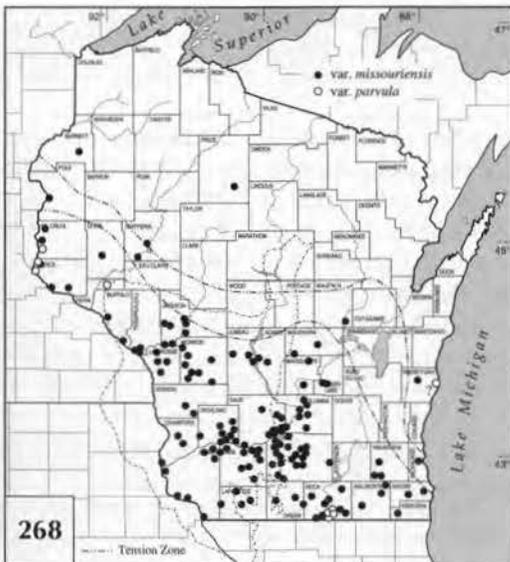
An easily grown, tall perennial with terminal spikes of showy rose-purple (rarely white) flowers. Some specimens possibly represent escapes from cultivation.





267. *Pycnanthemum virginianum* (L.) T. Durand & B. D. Jacks. ex B. L. Rob. & Fernald. MOUNTAIN MINT. Northeastern and midwestern United States, from the eastern Great Plains (Oklahoma to Minnesota) and the Ozarks to New England and Tennessee; in Wisconsin mostly in the southern half of the state, in mesic to **wet-mesic prairies**, bog and marsh borders, meadows, pastures and occasionally dry prairies or oak-pine woods. (11) Flowering from early July to mid September.

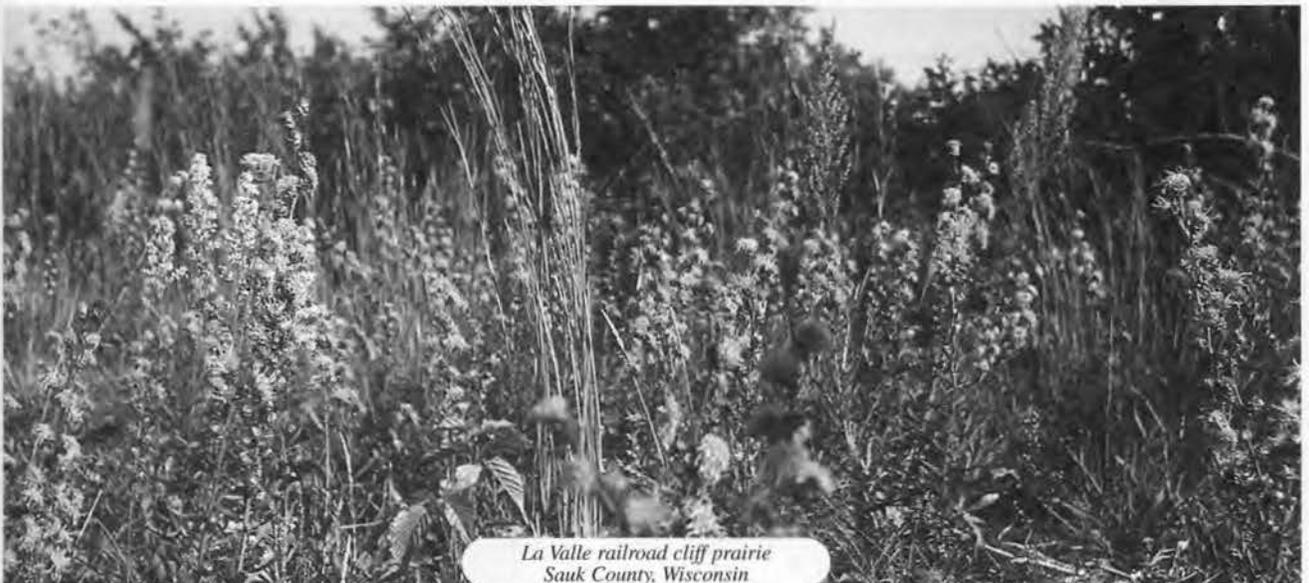
The following have not been mapped even though they are frequent to common in Wisconsin mesic to wet prairies and such related communities as sedge meadows, shrub carrs and fens: *Lycopus americanus* Muhl., Common Water-horehound, and *L. uniflorus* Michx., Northern Bugleweed or Water-horehound; *Mentha arvensis* ssp. *canadensis* (L.) H. Hara [including *M. a.* var. *villosa*], Wild Mint; *Stachys palustris* L. (*S. pilosa* Nutt. sensu stricto), Woundwort; and *Teucrium canadense* L. [including *T. occidentale* A. Gray], Germander.



268. *Scutellaria parvula* Michx. SMALL SKULLCAP. Common in the southwestern third of Wisconsin, sporadic within or just beyond the Driftless Area to Burnett, Price and Sheboygan counties, on rocky bluffs and outcrops of limestone, sandstone and granite, in steep prairies, sandy places in fields, pastures and river bottoms, **cedar glades**, oak openings and jack pine woods. (9) Flowering from the end of May to July.

Scutellaria p. var. *missouriensis* (Torr.) Goodman & C. A. Lawson [*S. p.* var. *leonardii* (Epling) Fernald] is the more widespread sister taxon to *S. p.* var. *parvula*, from the eastern half of the central Great Plains (Kansas to North Dakota), east to Ohio (Virginia) and New England.

Scutellaria p. var. *parvula* (Endangered) is mostly a Midwest, Ozark and Cumberland plateaus calciphile, from (eastern Texas) eastern Oklahoma to southern Wisconsin, east to the Appalachians and Quebec, in Wisconsin much more local than the preceding, and bicentric, the northern of the two areas quite isolated from the rest of the subspecies.



La Valle railroad cliff prairie
Sauk County, Wisconsin



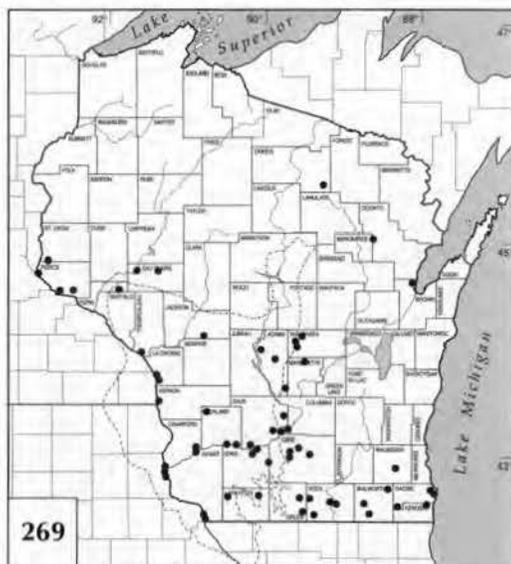
LINACEAE—the Flax Family

Our species (except two blue-flowered escapes from cultivation) are yellow-flowered annuals with small, sessile, entire leaves and regular, 5-merous flowers with persistent sepals, fugacious petals (Lat. *fugax*, from *fugere*, to flee, i.e., falling early), slightly coalescent filaments, and a partly or completely 10-chambered ovary and capsule. (Fassett 1933; Rogers 1963, 1984; Robertson 1971)

A small, worldwide family, of which the perennial, blue-flowered Common Flax (*Linum usitatissimum*) is commercially important for fiber and seed oil.

269. *Linum sulcatum* Riddell. GROOVED YELLOW FLAX. Common annual of the western half of the Great Plains (Texas and Arkansas Ozarks to Manitoba) and the Prairie Peninsula (to Indiana and Michigan) and rarely beyond; in Wisconsin locally frequent throughout the southwest on dry, rocky, calcareous prairies and bluffs, on sandy and, most commonly, **dry-mesic prairies**, on sandy open slopes, recently abandoned fields with *Oenothera clelandii* (276) and *Panicum* spp., older fields with thickets of black oak and jack pine, and on the Mississippi River sand terraces and dunes, rarely in moister places (e.g., riverbanks, swales) or on railroad ballast. (7) Flowering from late June to mid August (September), fruiting from mid July to mid October.

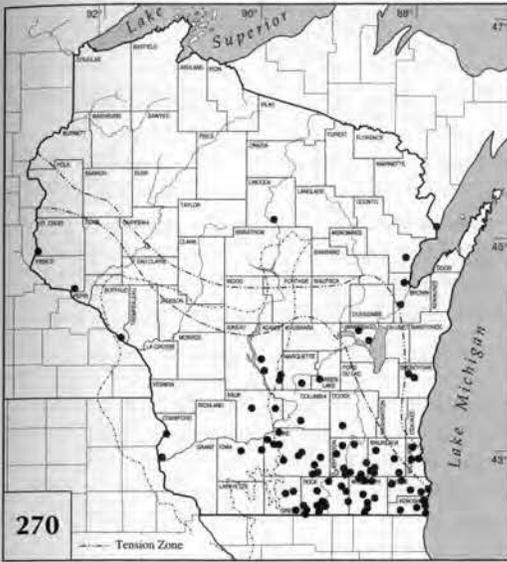
Linum usitatissimum L., Common Flax, widely cultivated for seed and fiber and as a garden flower, is now included regularly in seed mixes to provide early color in wildflower plantings, and it will probably be turning up more frequently about the state.



LYTHRACEAE—the Loosestrife Family

A small family of temperate herbs to tropical trees, with opposite or less often alternate or whorled leaves, regular or somewhat irregular flowers with 4, 6 or 8 petals usually crumpled in bud and borne on the rim of a deep calyx-like tube, deep within which are inserted as many, or twice as many, stamens, and a superior ovary that matures into a capsule. Heterostyly (species with styles of different lengths in flowers of different individuals, some surpassing, others surpassed by, the stamens, thus encouraging out-crossing) is common. (Graham 1964, 1975; Ugent 1963)

The Lythraceae are represented in Wisconsin by marsh, wet prairie and ditch plants, including the now notorious Eurasian Purple Loosestrife (*Lythrum salicaria*). This most terrible invader of our wet prairies and marshes, nonetheless a very attractive garden plant, is still sold by unscrupulous horticulturalists, sometimes as "Queen-of-the-Prairie" (not to be confused with the rare *Filipendula* of that name, *F. rubra*, doubtfully once native in southern Wisconsin near Mazomanie).



270. *Lythrum alatum* Pursh var. *alatum*. WINGED LOOSESTRIFE. Part of a transcontinental complex of three taxa: the western *L. californicum* Torr. & A. Gray (northern Mexico and California to the Great Plains), southeastern var. *lanceolatum* (Ell.) Torr. & A. Gray ex Rothrock (Texas to the Southeast), and northeastern var. *alatum* (northern Great Plains to New England); chiefly in southeastern Wisconsin and the Mississippi river bottoms, in moist to wet sedge meadows, **wet-mesic prairies**, marshes, lakeshores, riverbanks, bogs and wet ditches, on alkaline sedge meadows, fens and moist sandy prairies. (6) Flowering from late June to early October.

MALVACEAE—the Mallow Family

A large cosmopolitan family of herbs (seldom shrubs or small trees in tropical regions) with alternate, stipulate, usually palmately veined leaves and stellate pubescence. Flowers 5-merous, often with a whorl of bractlets so closely subtending the calyx as to suggest an additional outer calyx (paracalyx). Stamens usually numerous, coalescent for most of their length into a tube that surrounds the style and to which the petals are frequently attached. Carpels usually several to many, wholly united into a compound pistil that matures into a capsule or loosely coherent in a ring that splits into separate carpel segments (schizocarps), these either opening to release the seed(s) (as in Velvet-leaf) or single-seeded and remaining closed (Mallow). (Hagen 1933, Utech 1970)

An easily recognized family, widely distributed in temperate and tropical regions. Economically it is of importance for the cotton of commerce (*Gossypium* spp.), the edible fruits of okra (*Hibiscus esculentus*) and other species, many agricultural weeds, and the many native and cultivated species grown for ornament (Hollyhock, Poppy Mallow, Rose-of-Sharon, Flowering-maple, etc.).

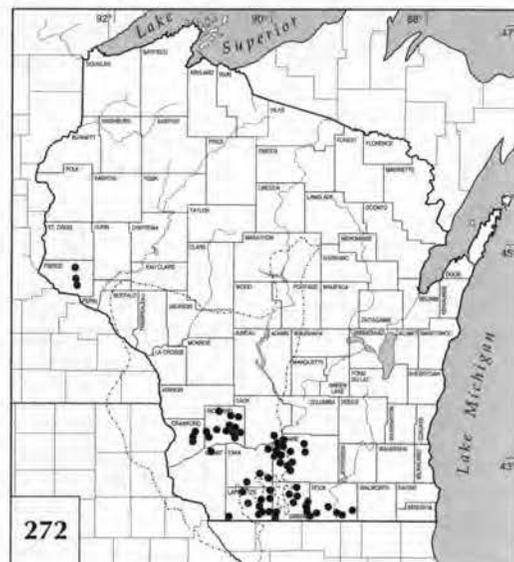


271. *Callirhoe triangulata* (Leavenw.) A. Gray. PURPLE OR CLUSTERED POPPY MALLOW (Special Concern). Rare, showy, sand prairie species of the Upper Midwest [eastern Missouri, northeastern Iowa, southern Wisconsin, to Indiana (one station), once widespread in the northern half of Illinois] and scattered beyond in the Southeast (Mississippi to Georgia); in Wisconsin rare, confined to the dry and sandy valleys of the Wisconsin and Mississippi rivers in dry or **dry-mesic prairies**, as along the railroad west of Blue River (Grant County) and east of Helena (Iowa County), where small populations still survive. (1) Flowering and fruiting from July through August.

This showy species, its deep rose-purple petals with a white basal spot, grows well in open flower beds. Purple Poppy Mallow is available from commercial prairie nurseries, and like other rare plants should never be collected from the wild.

272. *Napaea dioica* L. GLADE MALLOW (Special Concern). A regional endemic of the north-central United States (southern Ohio through Illinois to northeastern Iowa and southeastern Minnesota); in Wisconsin in sections of some southern (Dane, Green, Lafayette, Richland) and far western (Pierce) counties, rare to locally abundant in alluvial soil in sun or semi-shade along streams and rivers, mesic to wet, but most prevalent in **wet-mesic prairies**, ditches and marshy ground, most often seen in moist, rank, weedy vegetation, sometimes mixed in with shrubs, often along railroad rights-of-way in roadbed ballast and adjoining marshy ditches. (2) Flowering from late June to mid August, fruiting from July to early September.

The impressive (to 8') monotypic *Napaea*, the only genus endemic to the north-central U. S. (see Iltis 1963, Utech 1970), is peculiar in its snow-white unisexual flowers (sexes on different plants) and in its thick cylindrical roots that are hollow at the base. Often weedy in Wisconsin, it grows well in a garden if sun and sufficient space are allowed.

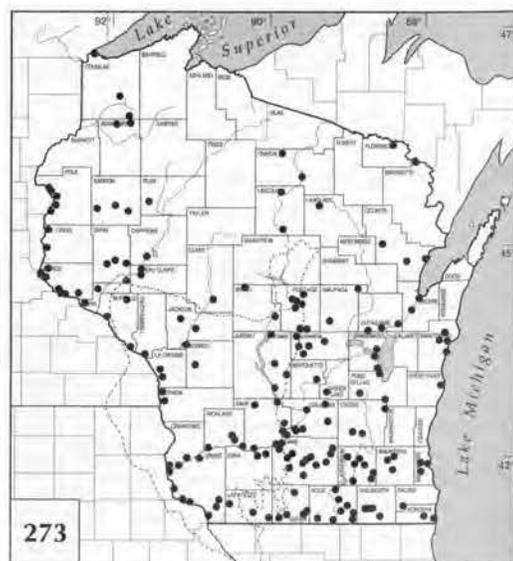


NYCTAGINACEAE—the Four-o'clock Family

Mostly tropical or subtropical and woody, but ours herbs with opposite, simple, entire leaves, jointed stems and funnellform flowers lacking petals, the white or colored calyx functioning as a corolla, its base closely investing the ovary and persisting as a nut-like shell around the indehiscent 1-seeded fruit (an achene, the collective structure called an anthocarp). In *Mirabilis* the inflorescence of 1 to several flowers is enclosed by a prominent involucre of fused bracts, and the base of the calyx tube is modified into a parachute-like wing to facilitate dispersal. (Bogle 1974)

The subtropical woody vine *Bougainvillea*, with large, colorful bracts, is cultivated in greenhouses in the North, and the annual *Mirabilis jalapa*, Four-o'clock, is sometimes grown in Wisconsin in gardens.

273. *Mirabilis nyctaginea* (Michx.) MacMill. [*Oxybaphus* n.]. WILD FOUR-O'CLOCK. Widespread in western North America on the Great Plains from Mexico to Saskatchewan, east to Wisconsin and Tennessee, but beyond often weedy east- and westward to both coasts; throughout southern Wisconsin, where mostly weedy in dry, disturbed sand, cinders and ballast, particularly along railroads and roadsides, pastures and waste ground, less often native in dry to **wet-mesic prairies**, oak-pine woodlands and sand barrens. (5) Flowering from late May to mid July (occasionally September), fruiting from June to September.



ONAGRACEAE—the Evening-primrose Family

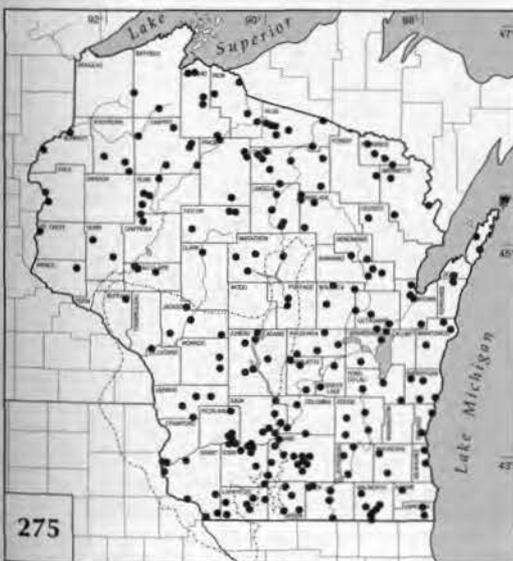
Quite variable in structure, but mostly herbs with flowers of 4 sepals, (2) 4 petals and 8 stamens all borne on the upper edge of a perianth tube, at the base of which lies the inferior ovary, which matures into a capsule or less often a 1- to 4-seeded nutlet or berry. Pollen grains relatively large, lumped together by cobweb-like viscin threads. Style often long, ending in a 4-lobed, capitate or discoid stigma. (Munz 1965, Raven et al. 1980, Ugent 1963)

World-wide, but most diverse in New World temperate and arid regions, two of the largest genera, *Oenothera*, evening-primroses and sundrops, and *Epilobium*, willow-herbs and fireweeds, common in Wisconsin. Showy-flowered species of many genera are grown in homes (the spectacular *Fuchsia*, Lady's-eardrops) and gardens (*Clarkia*, Farewell-to-spring). Evening-primroses are now extensively grown in large fields in Canada and Europe for their seed oil, which contains cis-linoleic and gamma-linolenic acids, sold in health food stores as pills to reduce arterial plaque and cholesterol in cardiac patients.



274. *Gaura biennis* L. BIENNIAL GAURA. Eastern and central United States, from western North Carolina and Texas north to Massachusetts, Quebec and southeastern Minnesota; mainly in the southern quarter of Wisconsin (probably native from Grant to Walworth counties) in moist to **mesic prairies** (often disturbed) along railroads and roadsides, rarely in open woods and fields; near Monticello, Green County and Madison, Dane County, growing in rich, deep, black soil with prairie vegetation between railroad tracks and roads; in the more northern counties probably adventive, with all but two collections from railroad tracks or roadsides. (3). Flowering from mid July to September, fruiting from August to September.

Most Wisconsin specimens are of the widespread eastern var. *biennis*. The similar var. *pitcheri* Torr. & A. Gray, native to the southern Great Plains and rarely adventive in Wisconsin (dates on map indicate year of collection), is now often recognized as a "good" species, *G. longiflora* Spach, which was ancestral to var. *biennis* (see Raven & Gregory 1972).



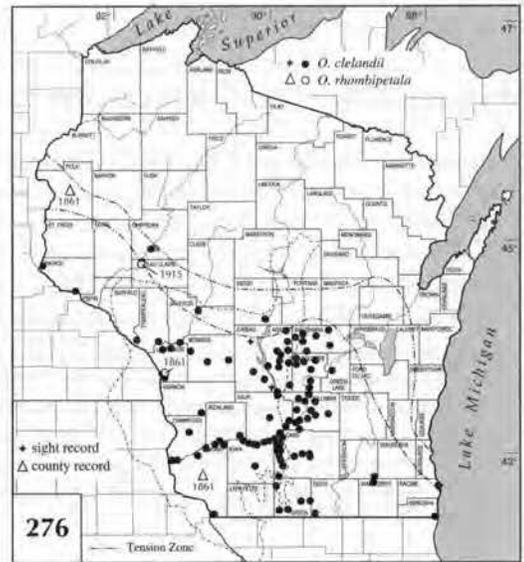
275. *Oenothera biennis* L. COMMON EVENING-PRIMROSE. Throughout the eastern half of North America, common and weedy, in disturbed, sunny, "open" habitats, from the eastern edge of the Great Plains (eastern Texas to Alberta) to the Atlantic Coast (Florida to Newfoundland), naturalized worldwide; in Wisconsin in every county mainly as a weed, but naturally occurring on riverbanks, sandbars and lakeshores, **dry-mesic prairies**, moist meadows, marshes, borders of woods, roadsides, railroad embankments, abandoned or cultivated fields and waste ground in towns. (Undoubtedly including several taxa of the *O. biennis* complex, 14) Flowering from early June to early October, fruiting from late July into October.

The notoriously confusing systematics and peculiar genetics of *Oenothera* section *Oenothera* have recently been re-evaluated (Dietrich et al. 1997), and though all taxa are weedy, the geographic and systematic patterns finally make sense. Our maps and concepts are based on specimens examined by these authors.

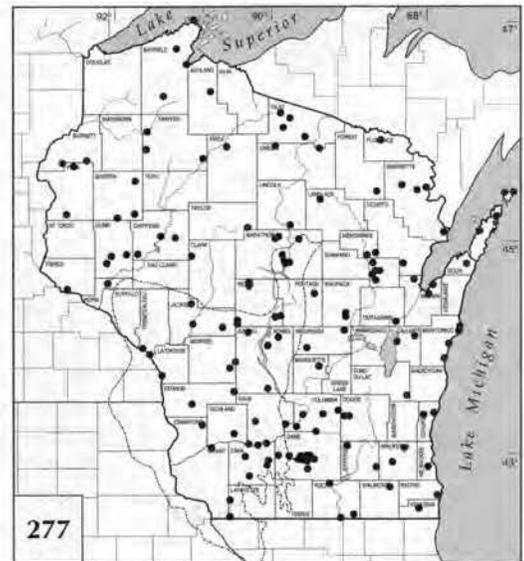
276. *Oenothera clelandii* W. Dietr., P. H. Raven & W. L. Wagner [*O. rhombipetala*, in part]. SAND EVENING-PRIMROSE. Upper Midwest from southern Illinois, Iowa and eastern Minnesota, east in the Prairie Peninsula to Indiana and southern Michigan; in Wisconsin in disturbed sandy soils south of the Tension Zone, common in the central Wisconsin, Wisconsin River and Black River sand areas, in sandy prairies and open jack pine-oak woods, frequently in abandoned sandy fields, **sand barrens**, “goat prairies,” river terraces, lakeshores, roadsides and railroad ballast. (3) Flowering from early July to early October, fruiting from late July to early October.

Virtually all Wisconsin specimens identified as *Oenothera rhombipetala* in the past belong to this relatively small-flowered, half-fertile species (see Dietrich & Wagner 1988).

Oenothera rhombipetala Nutt. ex Torr. & A. Gray. LONG-SPIKE EVENING-PRIMROSE. Great Plains, sporadic eastward as far as southern Michigan; very rare and probably adventive in western Wisconsin. Closely related to *O. clelandii*, but larger flowered and fully fertile.

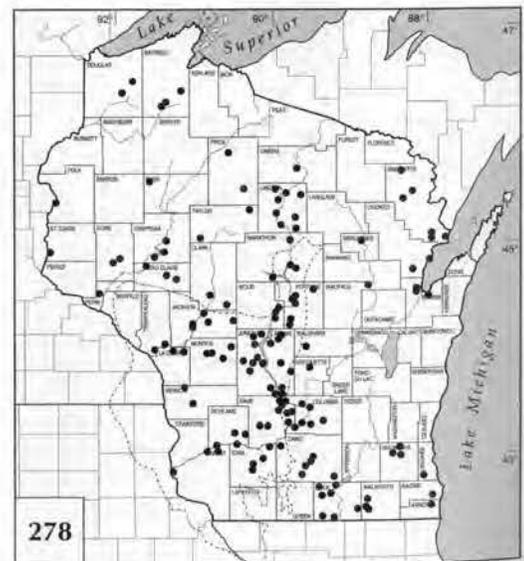


277. *Oenothera parviflora* L. [including *O. cruciata* Nutt. ex G. Don, a narrow-petalled mutant]. SMALL-FLOWERED EVENING-PRIMROSE. Widespread in northeastern North America to the Upper Midwest (basically an Appalachian element with “Northern Hardwoods” distribution), from the North Carolina mountains to the Gaspé and Newfoundland, west across Indiana to Iowa, Minnesota and Manitoba, sparingly naturalized elsewhere; in Wisconsin almost as common as, and in the same open, sunny, disturbed habitats as, *O. biennis* (275, from which it is distinguished by the free sepal tips, terminal or subterminal in bud), often along lakeshores, riverbanks, roadsides, railroad tracks and cliffs, frequently in abandoned or cultivated fields, pastures, sedge meadows, prairies and openings in woods; generally in sandy or gravelly soil. Flowering from early June to mid October, with an extended peak lasting from mid July through August, fruiting from early August to mid October.



278. *Oenothera perennis* L. SMALL SUNDROPS. Northeastern North America, from Newfoundland to southern Manitoba and northern Minnesota, south to Missouri and in the mountains to the Carolinas; widespread in Wisconsin in mesic to **wet-mesic prairies**, sedge meadows, pastures, sandy or muddy margins of marshes, shallow bogs, streams and rivers, moist cliffs, sandy roadsides, and occasionally in open oak-hickory woods and along railroad tracks. (4) Flowering from late May to mid September, fruiting mid June to September.

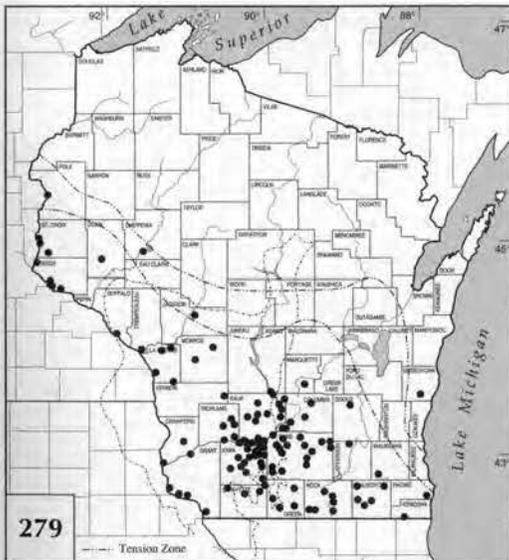
Often and easily cultivated, as are *Oenothera pilosella* Raf., Prairie Sundrops, and *O. fruticosa* L., Shrubby Sundrops. The sundrops are day-flowering perennials unlike the evening-primroses, which are generally evening flowering.



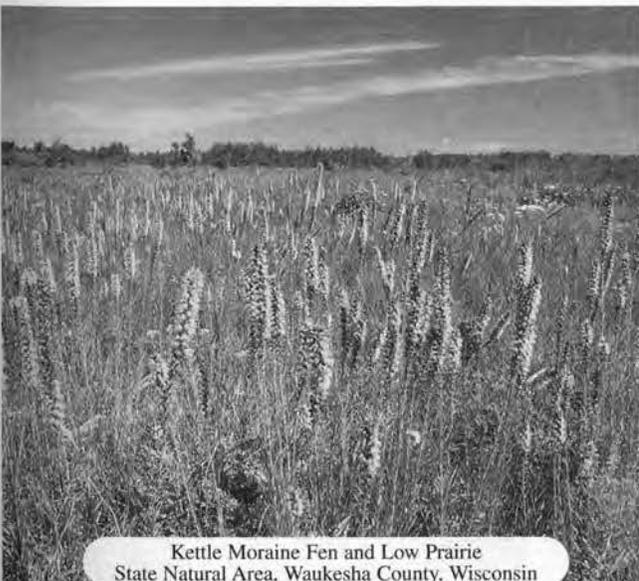
OXALIDACEAE—the Wood-sorrel Family

Anyone who weeds a garden in Wisconsin soon gets to know the common weedy, yellow-flowered wood sorrels or sour-clovers, with 3 clover-like leaflets characteristically folding at night; flowers with 5 sepals, 5 petals, 10 stamens and 5 carpels united into a compound ovary; fruits that are elongate, pentagonal, superior capsules with 2 or more seeds in each chamber; and seeds with a large basal aril, an outgrowth that functions in expelling the seed from the capsule and attracting ants for its wide dispersal. (Eiten 1963, Fassett 1933, Robertson 1975)

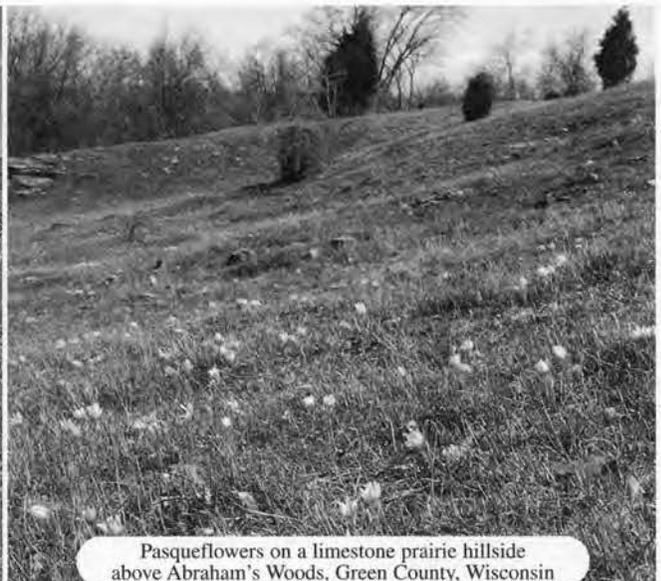
The presence of oxalic acid accounts for the sour taste of the foliage (hence Sour-clover). The petals of our prairie and woodland species (see below) are rose-violet, those of circumpolar forest species (*Oxalis acetosella*) white with pink veins. Many species, often with white or pink flowers, are horticultural.



- 279. *Oxalis violacea* L. VIOLET WOOD-SORREL.** Widespread in the eastern United States from the Atlantic to the eastern Great Plains of North Dakota, south to Florida and Texas; in Wisconsin rare to locally common south of the Tension Zone, in open or partly shaded habitats, usually in sandy, gravelly or rocky soil, most common in dry upland woods (oak with hickory, aspen or basswood, pine relics), especially grassy openings and edges, and on grassy, brushy or wooded slopes and tops of sandstone or limestone hills and bluffs, **mesic prairies**, dry calcareous or "goat prairies," bedrock glades, sometimes on cliffs, outcrops and talus, sandy borders and gravelly terraces along rivers, rarely in old fields or along railroads. (11) Flowering from late April through June (sporadically through August), fruiting from late May through June (August).



Kettle Moraine Fen and Low Prairie
State Natural Area, Waukesha County, Wisconsin



Pasqueflowers on a limestone prairie hillside
above Abraham's Woods, Green County, Wisconsin



PLANTAGINACEAE—the Plantain Family

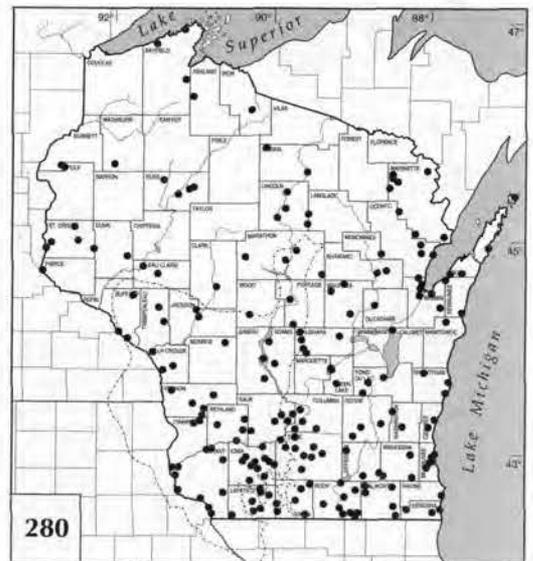
Weedy herbs with parallel-veined, basal leaves and spikelike or headlike inflorescences terminal on a leafless stem. Flowers small, white or greenish, regular and ordinarily 4-merous. Calyx and corolla both persistent, the former herbaceous, the latter dry and chaffy. Once the simple elongate stigma withers, the corolla-lobes reflex, the filaments elongate and the large anthers release their copious pollen. Pistil usually 2-locular (in two small genera 1-locular), maturing into a dry fruit, which in *Plantago* is a membranous capsule opening at or below the middle by an encircling transverse line. Seed coat often becoming mucilaginous when moistened. (Bassett 1973, Hawthorne 1974, Rosatti 1984, Tessene 1968)

Mainly in temperate regions and the montane tropics. The only important genus is *Plantago* (200+ species), Plantain, some of them noxious lawn weeds. The numerous small flowers are generally wind-pollinated.

280. *Plantago rugelii* Decne. AMERICAN OR RED-STALKED PLANTAIN. Eastern North America, west to Manitoba and Texas, widely introduced elsewhere; very common in Wisconsin, in **dry-mesic prairies**, but also often weedy in all sorts of rich habitats such as open bottomlands, mud flats, talus slopes, roadbeds, paths, lawns, cracks in masonry and gravel pits. (1) Flowering from early June to November (peaking in July), fruiting from July into November.

Although supposedly native in our region, this ubiquitous weed of lawns and waste ground "is rarely, if ever, part of any undisturbed native community" (Swink & Wilhelm 1994). It is morphologically and ecologically nearly identical to, and much more common than, the weedy Eurasian *Plantago major* L., Common Plantain.

Plantago patagonica Jacq. [*P. purshii*, misapplied], Woolly Plantain, a slender annual of sand prairies and road shoulders throughout the Great Plains, is locally common in southern and western Wisconsin.



280



POLEMONIACEAE—the Phlox Family

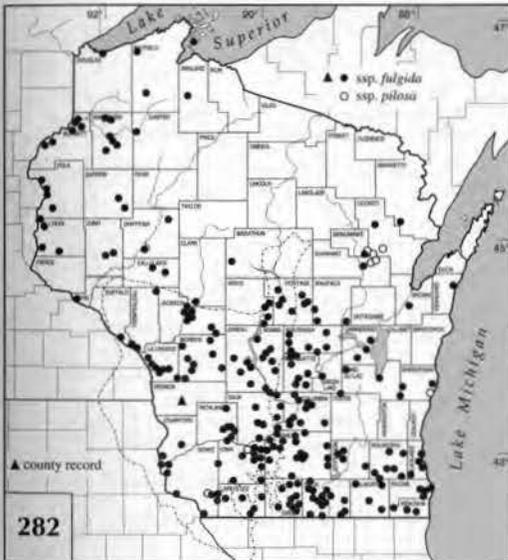
Most genera (including all ours) are annual or perennial herbs with beautifully colored, radially symmetrical, 5-merous flowers with a calyx of united sepals and a corolla of united petals (contorted in bud) that are usually salverform (with slender tube and abruptly spreading lobes, as in *Phlox*) or saucer-, funnel- or bell-shaped (as in *Polemonium*), stamens inserted on the corolla tube alternating with its lobes, a superior ovary composed of 3 (2 to 4) carpels, and a capsular fruit containing several to many seeds. (Grant & Grant 1965, Smith & Levin 1967, Wilson 1960a)

Mostly a North American and Eurasian family, best developed in the western United States, but extending into South America. Besides Phlox and Jacob's-ladder, ornamentals grown in Wisconsin include the hummingbird-pollinated Standing-cypress (*Ipomopsis rubra*) and the neotropical, bat-pollinated Cup-and-saucer Vine (*Cobaea scandens*).

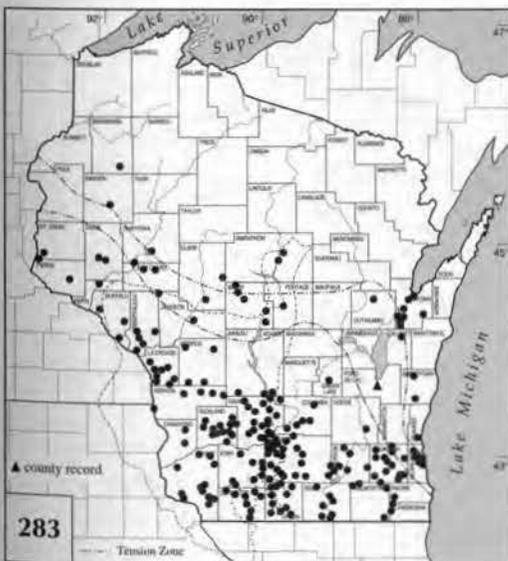


- 281. *Phlox glaberrima* L. ssp. *interior* Wherry. SMOOTH PHLOX (Endangered).** A widespread species of wet woods and grasslands of the southern United States, polymorphic, with our plants belonging to "A subspecies of the interior low plateaus from Arkansas to [southwestern] Ohio...and the westernmost lowland derivative of the Appalachian *P. glaberrima*" (Smith & Levin 1967, pp. 250, 246); in Wisconsin only in Kenosha (Chiwaukee Prairie, Carol Beach) and Racine (east of Rochester) counties, in rich, dense, fen-like prairies, sedge depressions and lowland savannas (**oak openings**) overlying the Silurian Niagara dolomite along Lake Michigan; in calcareous soils derived from Glacial Lake Chicago sands. (3) Flowering from late June through July.

This beautiful phlox (an excellent garden plant) is associated with other rarities such as Chestnut Sedge (*Fimbristylis puberula* (Michx.) Vahl), Nodding Wild Onion (21), Prairie White Fringed Orchid (31), Marsh Gay-feather (175), Ohio Goldenrod (201) and Riddell's Goldenrod (203).



- 282. *Phlox pilosa* L. DOWNY or PRAIRIE PHLOX.** An enormously complex species (nine subspecies are currently recognized) widespread throughout the eastern United States; in Wisconsin represented by two subspecies: ssp. *pilosa* (glandular pubescence), the most widespread subspecies, reaching northwestward to southern and eastern Wisconsin, where it is rare and sporadic in dry woodlands (especially oak barrens), sand prairies, disturbed areas, etc., intergrading to some extent with ssp. *fulgida* (Wherry) Wherry (lustrous, non-glandular pubescence), restricted to the Prairie Peninsula from eastern Kansas and central Illinois to Manitoba and Wisconsin, where it is common south of the Tension Zone (except in some sand areas) in a wide variety of sunny habitats, from dry to **wet-mesic prairies**, prairie relics along railroads, limy "goat prairies," oak savannas and woodlands, and burned-over jack pine stands. (18) Flowering from mid May to late July, fruiting from late June to late July.



- 283. *Polemonium reptans* L. var. *reptans*. JACOB'S-LADDER.** Widespread in the eastern United States deciduous forest (mostly west of the Appalachians and lacking from the Coastal Plain); common in Wisconsin south of the floristic Tension Zone in **southern dry-mesic forests**, rich, often moist hardwoods of sugar maple, basswood, elm and oak, northward in white pine-red maple forests, mesic oak savannas, frequently in low meadows, marshes and even sphagnum bogs, on wooded bluffs of sandstone (rarely limestone), uncommonly in deep-soil, wet-mesic and wet prairies (where according to Bray 1957, derived from survivors of fire-devastated climax maple forests, e.g., Juda Prairie, Green County), now sometimes along roadsides and railroad rights-of-way. (10) Flowering from early May to mid June, fruiting from late May to August.

Var. *villosum* E. Braun is local in southern Ohio and Kentucky.



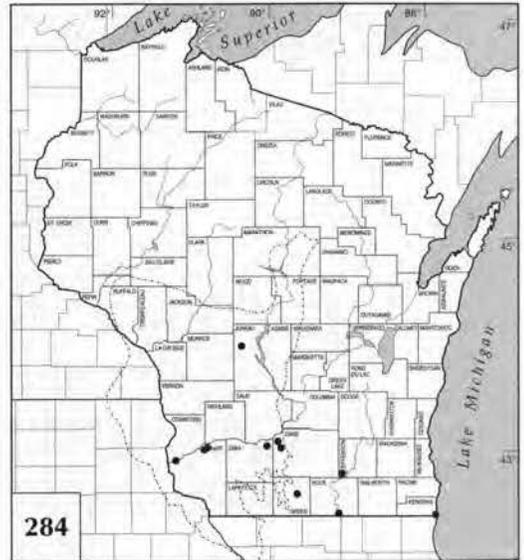
POLYGALACEAE—the Milkwort Family

A cosmopolitan family of shrubs, vines and trees in the tropics, but ours are all small herbs belonging to *Polygala* (500 species worldwide), with alternate or whorled, simple leaves and open to dense racemes. The flowers appear as if papilionaceous, superficially resembling, by convergent evolution, those of the Pea Family (or in one case, even a bog orchid), with 5 unequal sepals (the inner pair, the “wings,” often petaloid), 3 petals (the lower one, the “keel,” boat-shaped), 6 or 8 stamens with all the filaments fused, and usually arillate seeds that are ant dispersed. (Fassett 1933, Gillett 1968, Miller 1971)

Economically the family is of little importance. Representatives of *Monnina*, *Polygala* and *Securidacea* are cultivated for ornament; a few species of *Polygala* yield dyes, and one a fiber.

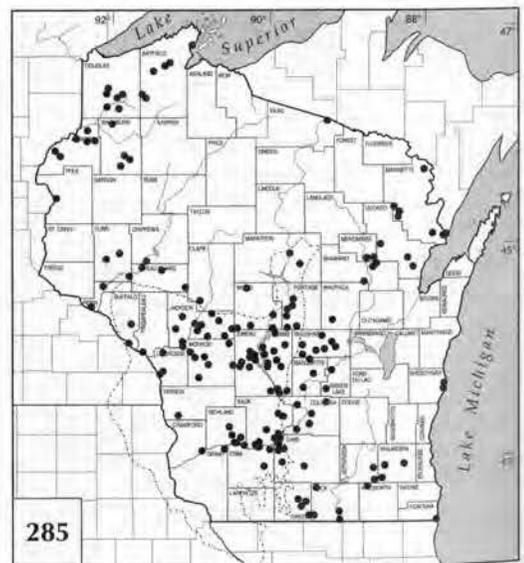
284. *Polygala incarnata* L. PINK MILKWORT (Endangered). Prairies, savannas and woodlands of eastern North America, from Florida and Texas, north to New York, southern Ontario, southern Wisconsin and Iowa; now exceedingly rare in prairie habitats in Wisconsin, locally distributed in the southern two tiers of counties and near extirpation, still surviving in three high-quality dry-mesic prairies: Chiwaukee Prairie State Natural Area, Kenosha County; Watterstown Railroad Prairie between Boscobel and Blue River, Grant County; and Vale Prairie between Monticello and Albany, Green County (2 plants in 1992, on shallow silt loam overlying dolomite). Flowering from early July to mid September.

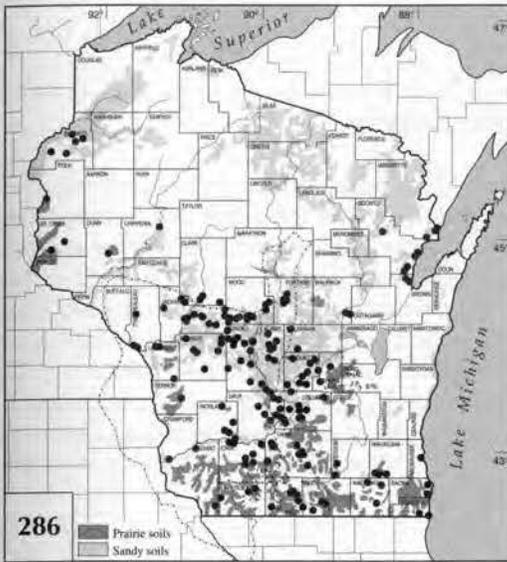
This is a very peculiar, unbranched or little-branched, glaucous annual with hardly any root system, suggesting that it might be a hemiparasite.



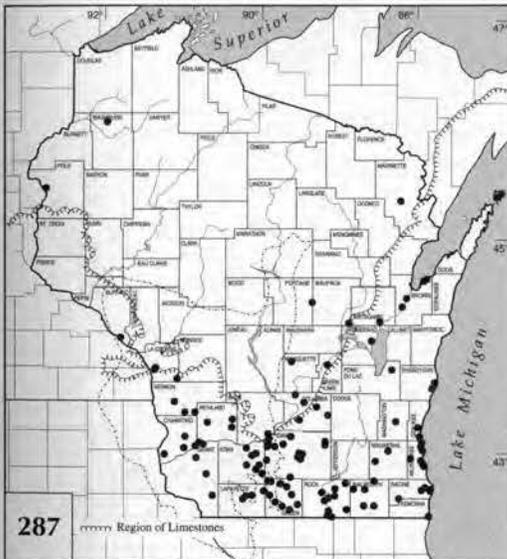
285. *Polygala polygama* Walter. PURPLE MILKWORT. Eastern and central North America, from Nova Scotia across New England to eastern Minnesota, south to the Virginia mountains, Kentucky and Iowa, and along the Coastal Plain from Virginia to Texas; in Wisconsin frequent in dry, sandy, gravelly or rocky prairies, **sand barrens** and sand blows, in open woods (oaks, jack or white pine, red cedar), pastured slopes, fields and roadsides; sometimes in moist sands near lakes and ponds, rarely on sandstone ledges or granite outcrops (i.e., Redrock Bluffs, Marinette County). (8) Flowering (petaliferous above-ground flowers) from early June to early August, fruiting from late August to early October.

This plant produces an abundance of white or pale green cleistogamous (self-fertilized) flowers and small plump capsules in prostrate racemes at the base of the stem, these usually buried, but occasionally just above the soil surface. Our plants are generally considered to belong to the northern var. *obtusata* Chodat, lumped by some authors with the typical variety.





286. *Polygala sanguinea* L. FIELD MILKWORT. Open habitats on dry to moist, acidic soils, from Nova Scotia to Minnesota (rare in the Black Hills) and the southeastern Great Plains, south to South Carolina and Texas; equally frequent in Wisconsin in wet, mesic or dry, sandy or rocky prairies, **cedar glades**, open woods of oak, pine or aspen, outcrops (sandstone cliffs and ledges, granite mounds, quartzite glades, basalt bluffs) and sandy roadsides; less often in abandoned fields and various disturbed (ditches, trails, fire lanes, excavations in cranberry bogs) or relatively undisturbed (sedge meadow edges, shores, clearings) places. (6) Flowering from early July to early October, blooming continuously over a long season and producing hairy, arillate seeds almost the whole time (late July into October).



287. *Polygala senega* L. SENECA SNAKEROOT. Eastern Canada to Alberta, south to Georgia and the Ozarks of Arkansas and Oklahoma; locally frequent throughout the southern half of Wisconsin in a diversity of dry to moist woods, thickets and prairies or prairie-like habitats, in **fens**, dry open woods (oak-hickory, red cedar, occasionally jack pine), mesic forest clearings and borders (oak-maple, maple-basswood, in the north balsam fir), damp brushy banks, dunes (Door County) and shores, prairies (dry mesic bluff openings, mesic railroad and cemetery remnants, rich mesic to moist flats along Lake Michigan) and other open ground. (8) Flowering from early May through June, fruiting from early June to late July.

Polygala senega is the source of a medicinal extract used by Native Americans to cure snake bites.



288. *Polygala verticillata* L. WHORLED MILKWORT. Distinctive but inconspicuous species of the Great Plains, prairies, savannas and fields, the aggregate species from Florida, Texas and Utah, north to Massachusetts and southern Manitoba; in Wisconsin usually on dry or moist prairies (e.g., Avoca Prairie and Savanna, Iowa County, and Pleasant Prairie, Kenosha County), especially dry and calcareous "goat prairies," hill prairies, sand prairies and open grassy ground; sometimes in **cedar glades** such as at Gibraltar Rock, Columbia County or woods. (3) Flowering from early July to late September, fruiting from late August to late September.

A polymorphic species, three of the five defined entities occurring in Wisconsin. Two of these are rarely encountered: var. *ambigua* (Nutt.) A. W. Wood, which some authors treat as a separate species, and var. *sphenostachya* Pennell, which is often either ignored altogether or included under var. *isocycla* Fernald.



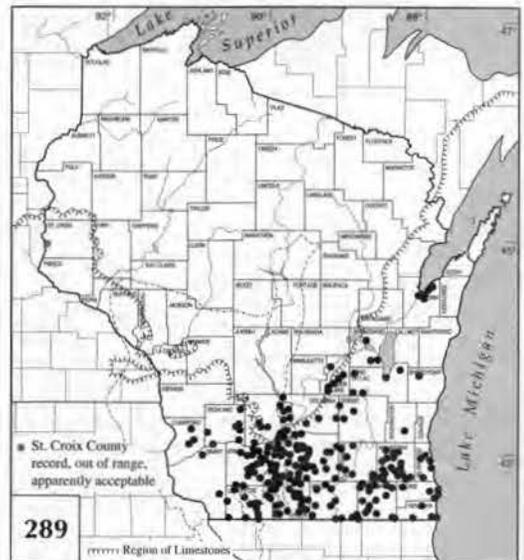
PRIMULACEAE—the Primrose Family

Herbs with mostly opposite or whorled (or all basal) leaves. Flowers regular, typically 5-merous, the corolla with a short to long tube and 4 to 9 overlapping lobes (lobes reflexed in *Dodecatheon* and *Cyclamen*). Stamens as many as the corolla lobes and opposite them. Pistil probably of 5 united carpels, but the ovary 1-celled with the ovules borne on a free-standing column from the floor of the locule. Fruit a capsule that opens by teeth or valves or less commonly, an encircling transverse line (circumscissile). (Channell & Wood 1959, Iltis & Shaughnessy 1960)

Widely distributed, but commonest in temperate, arctic and alpine parts of the Northern Hemisphere. One-fifth of the 1,000 species belong to *Primula*, of which we have only one rare diminutive species on cliffs and gravelly shores. Besides *Primula*, species of *Cyclamen*, *Anagallis*, *Soldanella* and other genera are cultivated for ornament.

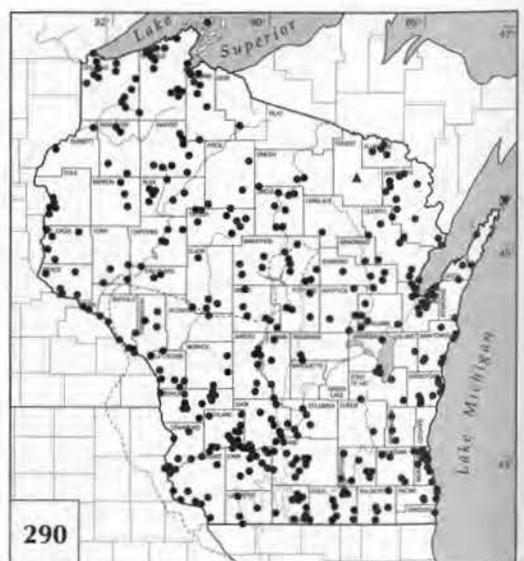
- 289. *Dodecatheon meadia* L. EASTERN SHOOTING-STAR.** A small North American montane genus with only this species widespread in the East, from Texas, the Ozarks and northern Georgia to Pennsylvania, southern Michigan and southern Minnesota (one station); in the southeastern third of Wisconsin widespread and once common from dry high lime to **wet-mesic prairies**, as well as in fens, open sunny deciduous woods and oak openings and moist to dry bluffs or sandstone cliffs; once frequently collected from prairie relics along railroads, but now disappearing locally due to changing community composition (competition and shading), cessation of maintenance practices (periodic fire or mowing) and spraying. (14) Flowering from early May through June, fruiting from late June through August.

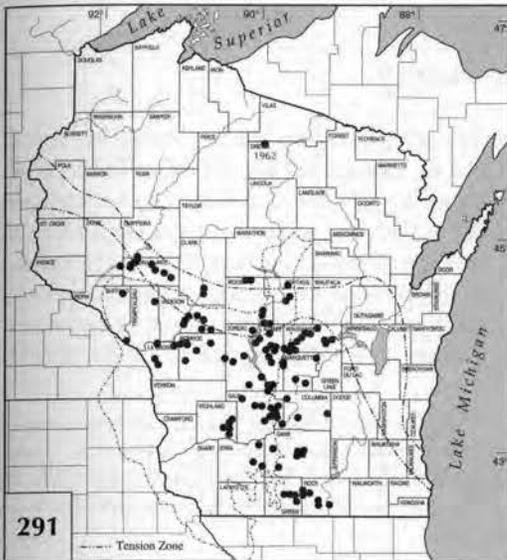
This captivating spring wildflower is enormously variable in its corolla colors, with deep magenta- to pure white-flowered plants intermixed within the same population, as one can see in late May at Chiwaukee Prairie, Kenosha County. It can spread abundantly, if seeded into a moderately dry, sunny, well-drained lawn, rock garden or wildflower meadow.



- 290. *Lysimachia ciliata* L. [*Steironema* c.]. FRINGED LOOSESTRIFE.** Nearly continent-wide in temperate North America, from the southern Appalachians (northern Alabama) and the Ozarks to New England and James Bay, also in the Rocky Mountains and Pacific Northwest; in Wisconsin very common throughout, in a great variety of moist or wet, open or shady habitats of both upland and lowland forests, especially in floodplain forests, along streams, rivers and lakes, in aspen-birch lowlands, tamarack bogs, marshes, damp meadows and low prairies. Flowering from late June to early August, fruiting from the end of July to October.

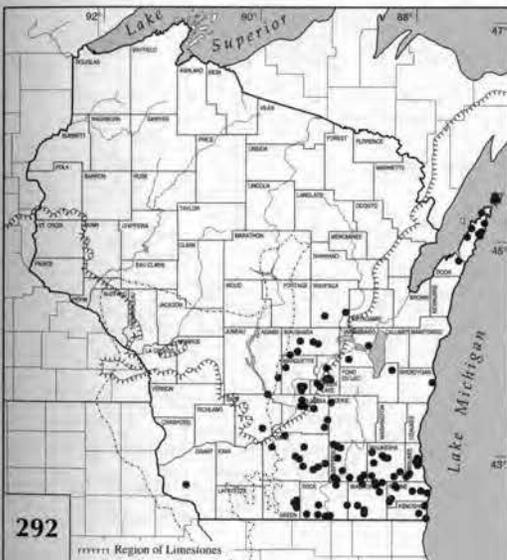
Lysimachia hybrida Michx. [*Steironema* h.], Lowland Yellow Loosestrife, a morphologically intermediate, putative stabilized hybrid between *L. ciliata* (290) and *L. lanceolata* (291) and roughly of the same wide geographical distribution as the former, is not uncommon in bottomlands of the Wisconsin and Mississippi River valleys. It is rarely found in low prairies (as at Thomas Wet Prairie, Grant County) and fens.



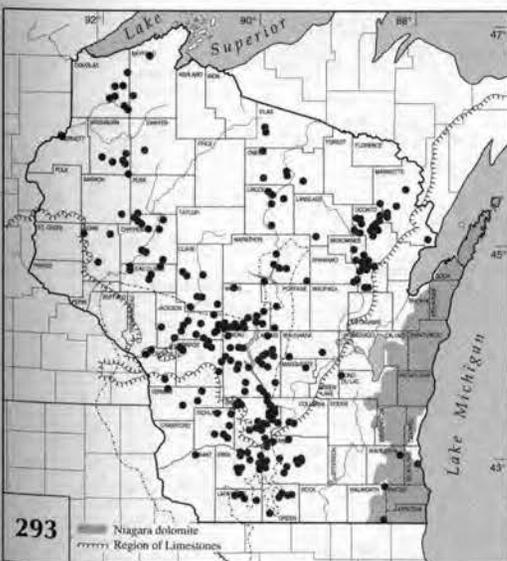


291. *Lysimachia lanceolata* Walter [*Steironema l.*]. LANCE-LEAVED LOOSESTRIFE. Widespread in sunny places, from northern Florida and northeast Texas, north to southern Pennsylvania, southern Michigan and Iowa; frequent in central and southwestern Wisconsin in dry, mesic or moist, more or less sandy prairies or prairie openings, in very sandy prairies on the edges of pine-oak scrub, on sandstone cliffs in white pine relics, sand terraces, open dunes, in open, generally sandy and mesic to moist woods, and along sandy roadsides. Flowering from the end of June to mid August, fruiting from the end of July to September.

A collection from "Wisconsin Gardens," Oneida County, is well beyond the otherwise well-known range and may represent an introduced population.



292. *Lysimachia quadriflora* Sims. NARROW-LEAVED or SMOOTH LOOSESTRIFE. An Ozarkian element, from Arkansas to Minnesota, Saskatchewan and southern Ontario, and rarely scattered south- and eastward to the Appalachians; widespread throughout the southeastern third of Wisconsin, reappearing in Door County (apparently lacking in the well-drained Driftless Area), in wet, sunny, grassy, non-acid habitats such as sedge bogs, marshes and low prairies, characteristic of marly sedge-grass meadows (fens and swales), occasionally around calcareous springs. Flowering from early July to the end of August, fruiting from late July to October.



293. *Lysimachia quadrifolia* L. WHORLED LOOSESTRIFE. Eastern deciduous forest region, from the Carolinas in the southernmost Appalachians (northern Alabama) to New England, southern Michigan and Illinois; throughout most of Wisconsin but nearly completely lacking on the limestones of the eastern third and southwestern corner, usually in wooded or semi-wooded, acidulous, mesic to moist, frequently sandy or rocky habitats (quartzite, granite, sandstone); in dry woods, open oak and pine woodlands and savannas (**pine barrens**), less frequently in sandy or moist prairies, on edges of bogs or beaver dams, in open, poorly drained, river-bottom forests and along sandy roadsides. (8) Flowering from early June to the end of July, fruiting from mid July to mid September.

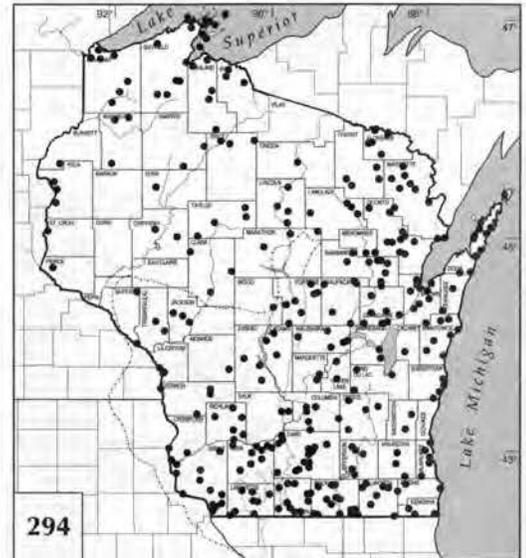


RANUNCULACEAE—the Buttercup Family

This is a moderately large, temperate to boreal family, evidently old (i.e., relatively primitive), and hence with many morphologically diverse, often small genera. Most are perennial herbs, a few are shrubs or vines, with often palmately divided leaves and extremely diverse, regular to bilaterally symmetrical flowers with free sepals (often petaloid) and petals (often modified, sometimes absent) variable in number, mostly in 3s to 5s; usually numerous, spirally arranged stamens; and 1 to many apocarpous (non-fused carpels, an evolutionarily ancient condition) fruits, either spirally arranged one-seeded achenes or cyclic several-seeded follicles or berries. (Almon 1930, Fassett 1946, Mitchell & Dean 1982, Whittemore et al. 1997)

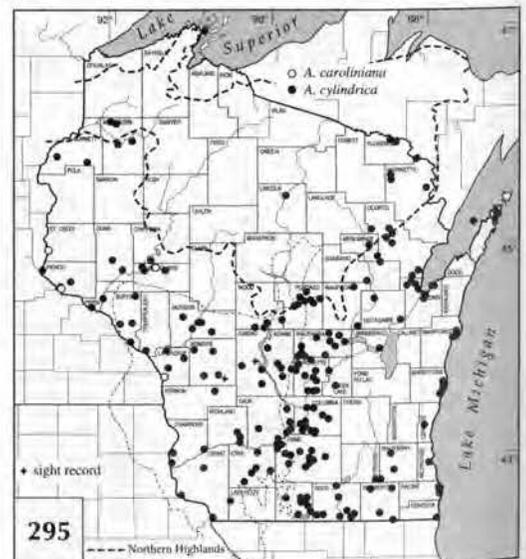
The family is especially diverse in eastern Asia and eastern North America (where native genera include *Anemone*, *Aquilegia*, *Caltha*, *Clematis*, *Delphinium*, *Ranunculus* and *Thalictrum*), many of which are ornamental. Monkshood (*Aconitum*), Larkspur (*Delphinium*) and Baneberry (*Actaea*) are exceedingly poisonous. A prime family for teaching the role of evolution in classification because of primitive character retention, morphological specialization and pollination ecology (insect/flower co-evolution).

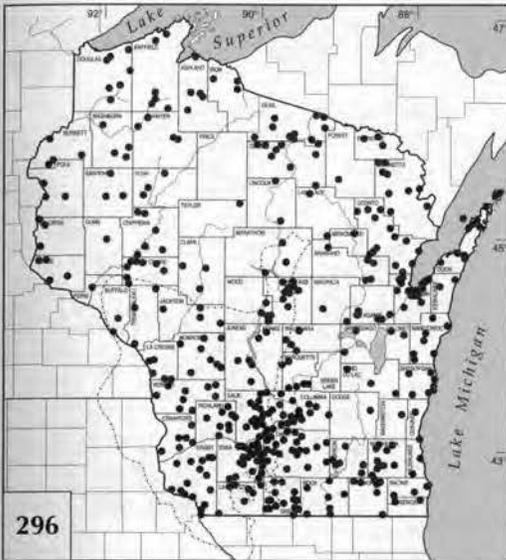
294. *Anemone canadensis* L. CANADA ANEMONE. Subarctic to cool-temperate North America, from Newfoundland to Hudson Bay and British Columbia, south to Maryland, Missouri, Kansas and in the Rockies to New Mexico; locally common throughout Wisconsin in open or partly shaded, usually mesic to moist ground, most frequently in **southern sedge meadows**, along borders and clearings in oak, sugar maple, basswood and silver maple woods, sometimes in mixed conifer-hardwood forests, locally on roadsides, railroads, grassy or brushy stream banks and stony shores, and in mesic to moist prairies, marshes, swales and shrub carrs; often thriving where native associates have been destroyed (e.g., floodplain pastures, drained swamps, ditches, banks, levees). (15) Flowering from late May through July (sporadically to early September), fruiting from late June through September.



295. *Anemone caroliniana* Walter. CAROLINA ANEMONE (Endangered). A distinctive species of the southern states and Great Plains, from Texas to Wisconsin, east to Indiana (extirpated); very rare in five western Wisconsin counties on dry prairies and barrens. Development, grazing and natural succession have caused its near extinction in Wisconsin (Tans & Read 1975).

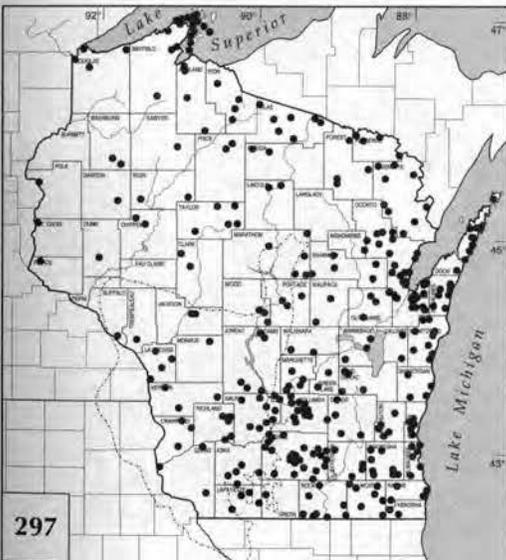
Anemone cylindrica A. Gray. THIMBLEWEED. A western element from the Rockies (British Columbia to New Mexico) and the Great Plains (Alberta to northeast Kansas) east to northern Indiana and southern Ontario, rarely beyond; in Wisconsin in dry to mesic prairies, **cedar glades**, sandy barrens with scrub oaks and/or jack pine, oak openings, and dry or occasionally mesic woods, especially along borders and clearings, also in abandoned fields, on sand plains, limestone flats, bluffs, outcrops, banks, dunes, fields, roadsides and railroads; lacking from the Northern Highlands. (16) Flowering from late May through July, fruiting from early July to early November.



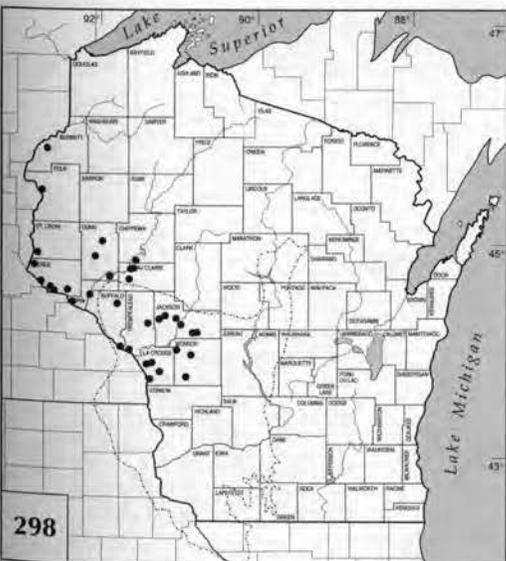


296. *Aquilegia canadensis* L. WILD COLUMBINE. Throughout much of the eastern North American deciduous forest, from southern Quebec and southeastern Saskatchewan to northern Florida and western Oklahoma (Texas); throughout Wisconsin in dry to mesic or even low woods, especially along borders or clearings of oak-hickory, oak-maple and maple-basswood forests, black oak savannas, **cedar glades**, pine woods and mixed conifer hardwood forests, also on a variety of more or less wooded to often open rocky hillsides, bluffs, calcareous cliffs, outcrops, ledges and talus, and frequently on banks, beach ridges, gravelly shores, roadsides and quarries. (19) Flowering from May through July, fruiting from mid May to early September.

This familiar flower is one of our few native plants pollinated by hummingbirds. It has the same showy, curiously shaped flowers as all columbines: downward-facing, with all petals prolonged backward into a tubular spur.



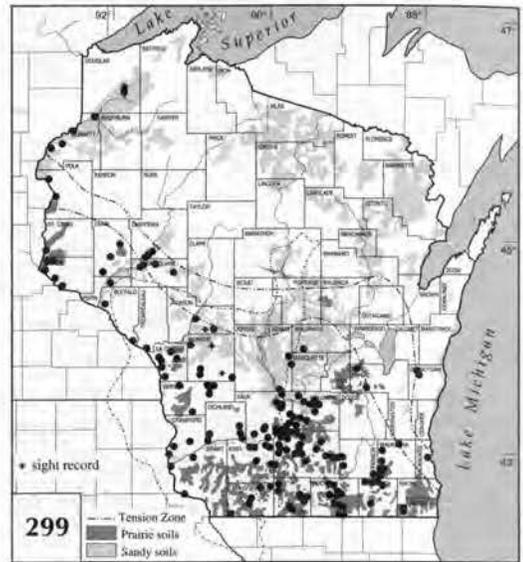
297. *Caltha palustris* L. MARSH-MARIGOLD, COWSLIP. A circumboreal, holarctic element, in Eurasia, and from Alaska to Newfoundland, south to Missouri, Virginia and, very rarely, the southern Appalachians; common throughout Wisconsin in open or partly shaded, wet, often cold habitats such as marshy spots in low prairies, sedge meadows and **fens**, or more often borders of sloughs and streams, springy places, including seepage slopes, swampy woods and thickets (deciduous and/or coniferous, including tamarack bogs), pools and wet depressions in woods of all kinds, and drainage ditches. (13) Flowering from April to mid June, fruiting from late May to early August.



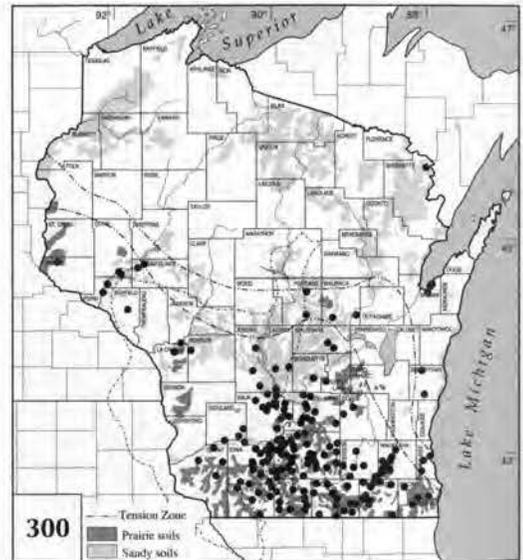
298. *Delphinium carolinianum* Walter ssp. *virescens* (Nutt.) R. E. Brooks [*D. virescens*, *D. carolinianum* ssp. *penardii*]. PLAINS LARKSPUR. North American prairies and plains, from southern Texas and eastern Colorado to southern Manitoba, eastward to Missouri and western Wisconsin; here rare to locally common in ecologically open, **dry-mesic prairies** and prairie-like habitats on limestone (dolomite) bluffs, dry sand prairies, cedar glades and black oak-jack pine barrens, infrequently spreading to lakeshores, along sandy or gravelly roadsides and rarely to abandoned sandy fields. (1) Flowering from June to mid July, fruiting from late June through July.

299. *Pulsatilla patens* (L.) Mill. ssp. *multifida* (Pritz.) Zämelis [*Anemone patens* L. var. *multifida* Pritz.; *A. p.* var. *wolfgangiana*]. PASQUE-FLOWER. A member of the widespread Holarctic subgenus (or genus) *Pulsatilla*, with many species in Siberia, in America from Alaska and the Yukon to New Mexico, and from Nebraska to northern Illinois; in Wisconsin locally abundant on sandy, gravelly or rocky hillsides, sandy or gravelly glacial outwash, shallow-soil prairies on steep bluffs or undulating agricultural land with limestone outcrops, **dry prairies**, including xeric, very sandy *Bouteloua-Schizachyrium* prairies, cliffs and outcrops (sandstone and limestone, sometimes becoming shaded out by red cedar and/or white birch), open scrub oak-jack pine barrens, rarely in mesic prairies with *Gentiana*, *Liatris* and *Valeriana*. (10) Flowering from late March through May, fruiting from mid May to early June.

A familiar plant to many people as the earliest harbinger of spring, carpeting the prairies and barrens with lovely, soft-purple flowers. In fruit, similar to Prairie-smoke (308).

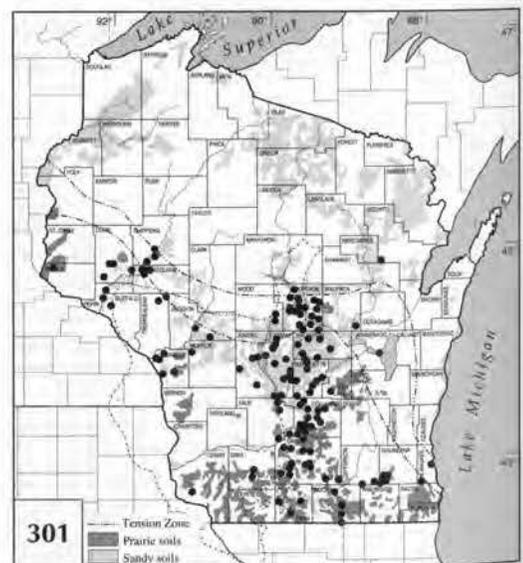


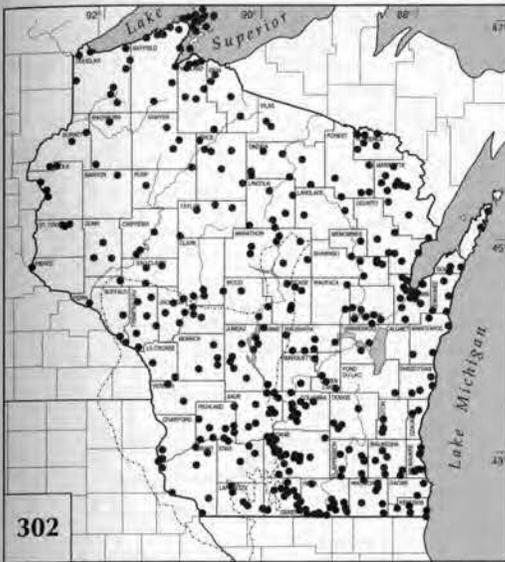
300. *Ranunculus fascicularis* Muhl. ex J. M. Bigelow. EARLY BUTTERCUP. Prairies, ledges and dry open woods of eastern North America from Massachusetts to Minnesota, south to Georgia, Mississippi and Texas; in Wisconsin relatively common south of or within the Tension Zone in open oak, oak-hickory or pine woods, **oak openings**, cedar glades and pine relics; rare to abundant on dry to mesic, sandy or gravelly prairies, and on ledges, cliffs and bluffs of sandstone, limestone, quartzite or granite, sometimes on roadsides and other dry grassy sites. (8) Flowering from (mid March) April through May, fruiting from mid May to early June.



301. *Ranunculus rhomboideus* Goldie. PRAIRIE BUTTERCUP, PRAIRIE CROWFOOT. A northern Great Plains element in mesic to dry grasslands, open woods and rock outcrops, from Nebraska, northern Illinois and southern Ontario (in Quebec, New York, etc., extirpated) northwest through Manitoba to Alberta and southern Mackenzie; in central and southern Wisconsin frequent in dry open oak or pine woods, sandy, gravelly or rocky prairies (as on Muralt Bluff, a limestone-capped sandstone ridge in Green County, or Pardeeville Railroad Prairie in Columbia County), **exposed cliffs**, oak openings, cedar glades, and dry, open, grassy fields, hillsides and roadsides. (4) Flowering from late March to early (late) June, fruiting from May to early July.

Formerly common or locally abundant, although only half as frequent as *Ranunculus fascicularis* (300), with which it sometimes grows. Prairie Buttercup has an affinity for north-facing slopes when in open prairie habitats, and may have been more characteristic of savannas than prairies.





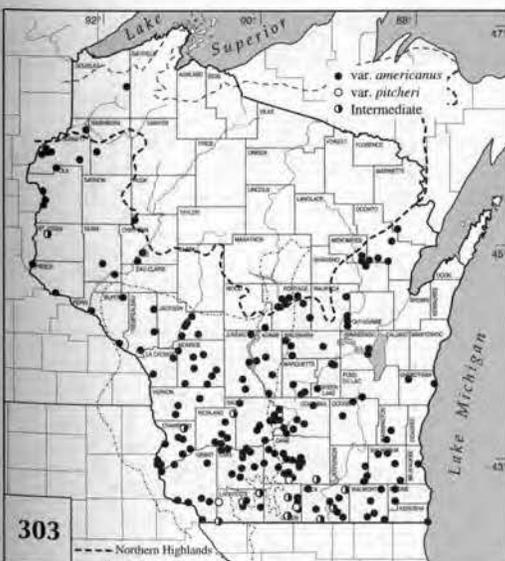
302. *Thalictrum dasycarpum* Fisch. & Avé-Lall. [*T. d.* var. *hypoglau-cum*]. PURPLE or TALL MEADOW-RUE. A widespread, western element of the Rocky Mountains and central North America, from Arizona to Alberta and Louisiana to James Bay, east to Ohio; in Wisconsin very common in moist to wet marshes (*Typha-Carex-Iris-Sparganium*), sedge meadows, wet to mesic prairies, **fens**, thickets and openings on shores and along streams, swales, sloughs and ditches, mesic forest edges, low deciduous or coniferous woods and tamarack bogs. (19) Flowering from early June to mid July, fruiting from July to mid September.

Thalictrum revolutum DC., Wax-leaf Meadow-rue (Special Concern), a southeastern North American element, from the Gulf States to New England and northeastern Minnesota (Rocky Mountains), similar to the above, except for fetid glandular leaves, is rare in deciduous forests and mesic prairies in eastern and northern Wisconsin.

RHAMNACEAE—the Buckthorn Family

Mostly shrubs, trees or woody vines, sometimes spiny, with simple, unlobed leaves. Flowers small, often fragrant, 4- or 5-merous and conspicuously perigynous, that is, having the perianth and stamens fused into or borne upon a floral cup (hypanthium), which in this case may be either free from or attached to the base of the ovary. Stamens opposite to and often enfolded by the hooded to concave petals. Fruit a few-seeded drupe or sometimes a capsule or samara (indehiscent and winged as in maple and ash). (Brizicky 1964b, Pohl 1941)

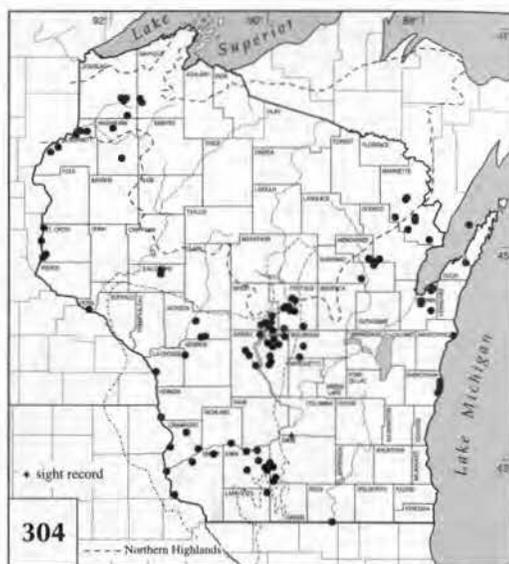
Almost cosmopolitan, commoner in warm regions. *Rhamnus*, the largest genus (100 species), is represented in Wisconsin by both native and introduced species, two of which are notorious invaders of native ecosystems. The alternate-leaved European Alder Buckthorn, *R. frangula*, is rampant in fens and like the more thoroughly naturalized, mostly opposite-leaved, Common Buckthorn, *R. cathartica*, it poses a long-term serious threat to the native plants in natural habitats.



303. *Ceanothus americanus* L. NEW JERSEY TEA. A polymorphic species of eastern North America, from Florida to Texas, north to Maine and southern Quebec, west to Kansas, Iowa and southern Manitoba; in Wisconsin frequent (but lacking from the Northern Highlands), in dry to **mesic prairies**, dry woodlands (oak, oak-pine and oak-aspen woods, oak openings and barrens, borders of rich deciduous woods), brushy pastures, sandy, gravelly or rocky slopes and banks, sandstone or limestone bluffs and outcrops, sometimes along railroads and roadsides, rarely on sandy lake shores; often in prairie-like openings on slopes and crests and transition zones between prairies and woodlands. (12) Flowering from late June through August, fruiting from late July to mid October.

Divisible into three weak varieties, two of which occur in Wisconsin: the typical variety is frequent over much of the state; var. *pitcheri* Torr. & A. Gray is local in a few southern counties. During colonial times the dried leaves were used as a tea substitute.

304. *Ceanothus herbaceus* Raf. [*C. ovatus*; *C. pubescens*] INLAND NEW JERSEY TEA, PRAIRIE RED-ROOT. A southern and central Great Plains element of sandy or rocky prairies, plains and open woods from northern Texas and Arkansas to Manitoba, and locally eastward in glaciated sands to northern Indiana, northern Michigan and scattered beyond to Vermont; in Wisconsin less common than *C. americanus* (303), but like it shunning the acidic Northern Highlands, scattered or locally frequent in dry upland woods and **pine barrens (mostly with jack pine or Hill's oak or both, seldom in more mesic woods), in sandy or high lime prairies, commonly on sandy glacial outwash plains, dry, sandy hillsides, limestone or sandstone bluffs and outcrops, banks, fields and roadsides, also dunes along Lake Michigan; generally in sun or semishade with such barrens, prairie and glade species as June Grass, Prairie Phlox, Wild Lupine, Hoary Puccoon, Tall Cinquefoil and Bearberry. (6) Flowering from the end of May to early July, fruiting throughout July (late September).**



ROSACEAE—the Rose Family

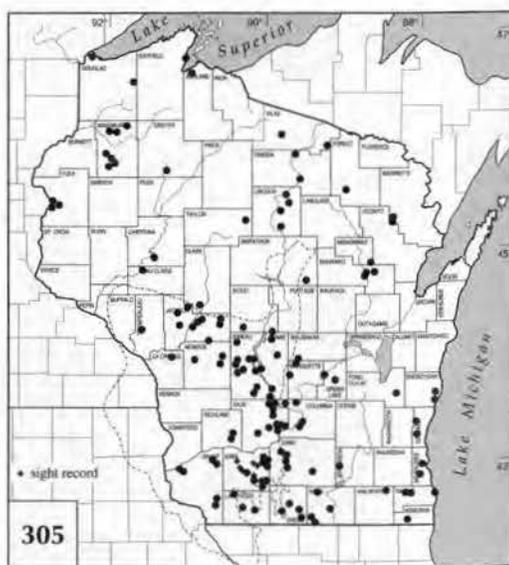


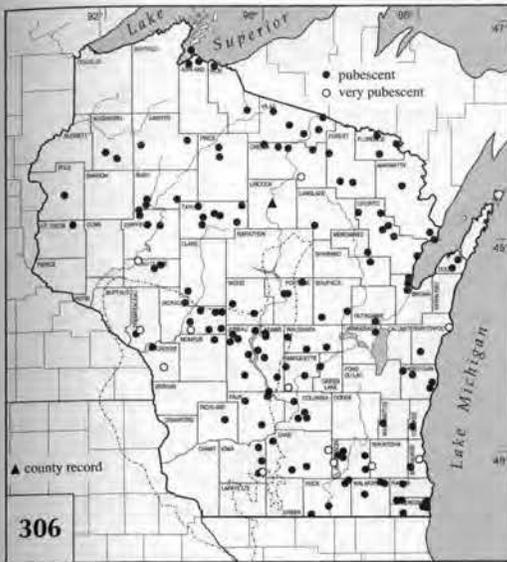
This large, heterogeneous family, from low herbs (Strawberry) to tall trees (Black Cherry), is of great ecological and economic importance in temperate climates of the world. Common characters include alternate, stipulate leaves, radially symmetrical flowers with 5 distinct petals, saucer-, cup- or urn-shaped floral cups (hypanthia) either free or fused to the ovary, and many exerted stamens. Although flowers are fairly uniform, fruit evolution exploded into a diversity of dispersal types, from 1-seeded achenes (strongly plumed in Prairie-smoke, hooked in Avens, completely enclosed by the floral cup in roses) or pod-like follicles (Ninebark, Spiraea) to fleshy drupes (peaches, plums and cherries, aggregated in blackberries) and pomes (apples, pears, mountain-ashes). (Mason & Iltis 1959, Robertson 1974)

Certain species clusters in several genera common in Wisconsin, i.e., *Amelanchier*, *Crataegus*, *Rosa* and *Rubus*, are notoriously difficult taxonomically because of hybridization, polyploidy and apomixis (setting seed without fertilization).

305. *Aronia melanocarpa* (Michx.) Elliott [*Pyrus m.*] BLACK CHOKEBERRY, smooth form. A widespread shrub of eastern North America, from the Appalachians of northern Alabama and northern Georgia to Newfoundland and Labrador, westward to northeast Iowa and eastern Minnesota (and southeastern Missouri—one station); throughout Wisconsin, often forming dense thickets in acid, usually damp soils of tamarack bogs, marshes, swampy thickets, boggy swales and shores of lakes, occasionally scattered in oak-pine woods, **dry prairies, or on granite outcrops, limestone and sandstone ridges, bluffs and cliffs. (12) Flowering from May to June, fruiting into September.**

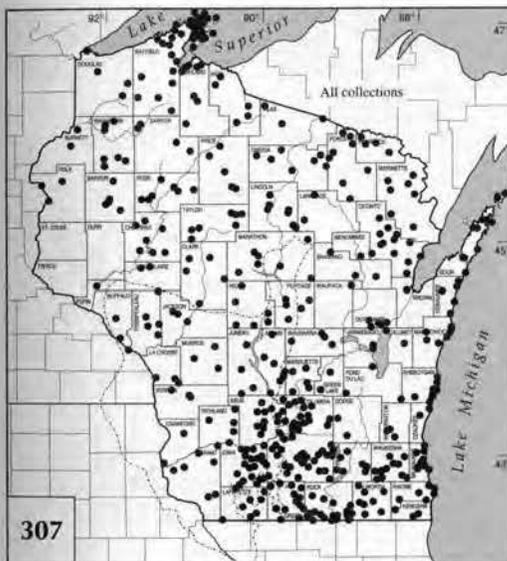
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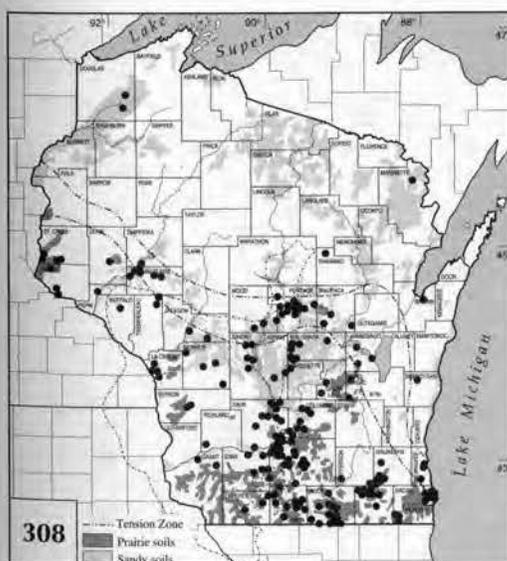
306. *Aronia* × *prunifolia* (Marshall) Rehder [*A. arbutifolia* (L.) Elliott × *A. melanocarpa*; *A. a.* var. *atropurpurea* (Britton) F. Seym.]. FLORIDA OR PURPLE CHOKEBERRY, hairy forms. Throughout Wisconsin in acid, usually damp soils of tamarack bogs, marshes, woods, granite outcrops, limestone and sandstone ridges, **dry prairies**, bluffs, cliffs and shores of lakes. (Included in *A. melanocarpa*, 12) Flowering from May to June.

Our purple chokeberries are pubescent forms of *Aronia melanocarpa*, agamospermous (apomictic) and with much the same geography and ecology, probably derived from ancient (and, where sympatric, recent) hybridizations with the copiously pubescent *A. arbutifolia*, Red Chokeberry, of the southern and Atlantic states to Newfoundland (see Hardin 1973, Uttal 1984).



307. *Fragaria virginiana* Duchesne [including ssp. *glauca* and ssp. *grayana* (var. *illinoensis*)]. WILD OR VIRGINIA STRAWBERRY. Newfoundland to Alberta, south to Georgia, Tennessee and Texas, and from Alaska to Colorado and California; nearly ubiquitous in Wisconsin in a great number of disturbed or undisturbed habitats, from dry sandy woodlands to moist forests and swamps (deciduous, coniferous or mixed), abundant in **northern dry forests**, along wooded riverbanks and borders and clearings of woods, marshes and bogs, common in old fields, roadsides and railroads, also in rocky openings and on shores; preferring open grassy places with little or no shade. (25) Flowering from late April to mid June with a second minor period in September, fruiting from late May through July.

One of our most common native species, quite variable, with no agreement as to how many variants to recognize or what to call them. We are following most recent authors in not granting any of them recognition.

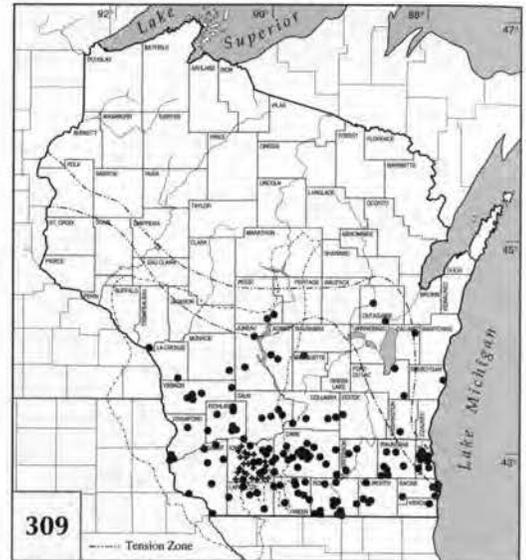


308. *Geum triflorum* Pursh [*Sieversia* t.]. PRAIRIE-SMOKE. Dry, calcareous or sandy prairies and open woodlands of the northern Great Plains, ours (var. *triflorum*—other varieties in the western mountains) from Alberta to Nebraska, eastward to Minnesota, northern Illinois and Michigan (a New York station extirpated); common over southern Wisconsin on **dry prairies**, hillsides, jack pine barrens, sandy prairie relicts, open sandy ridges and bluffs of exposed sandstone, on poor dry soil of open fields, hillsides, pastures and roadsides; occasionally in moist meadows and marshes; tolerant of light to moderate cattle grazing. (8) Flowering from April to June.

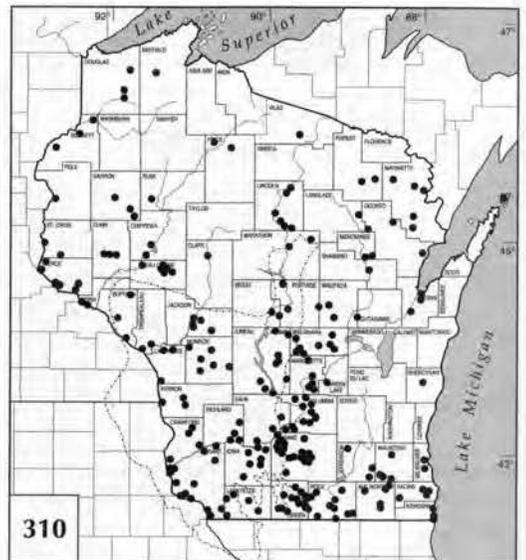
A member of the arctic-alpine-boreal subgenus *Sieversia*. The fruiting "heads," with their elongate, feathery styles, resemble (by convergent evolution) those of the Pasqueflower (299), a common associate with a similar distributional range and history. *Geum aleppicum* Jacq., Yellow Avens, and *G. laciniatum* Murray, Rough Avens, are not uncommon in moist prairies, sedge meadows and fens in much of Wisconsin.

309. *Malus ioensis* (A. W. Wood) Britton [*Pyrus i.*]. IOWA CRAB. A prairie-forest transition element mostly of the Prairie Peninsula, from the eastern Great Plains (northern Texas to South Dakota) through Missouri and Illinois to northern Indiana; in Wisconsin within or south of the Tension Zone in open woods, thickets, fencerows, pastures, oak openings, hillsides and bluffs, prairies, and dryish borders of marshes and swamps. Flowering from mid May to early June, fruiting into September.

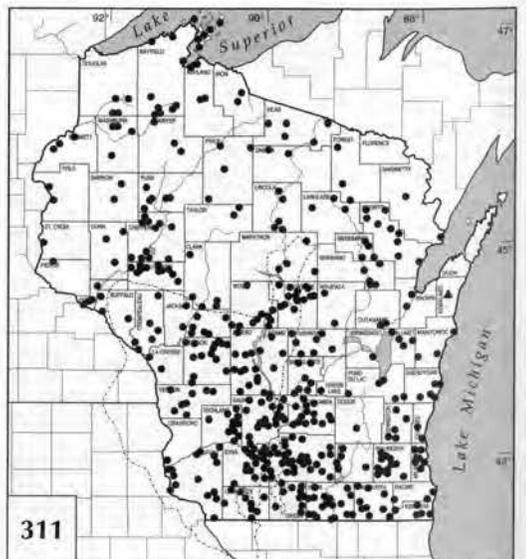
This species, together with the southern *Malus angustifolia* (Aiton) Michx., Southern Crab, and the eastern *M. coronaria* (L.) Mill., Sweet Crab, is a member of an essentially allopatric, eastern deciduous forest phylad. Strikingly beautiful with their white to light pink flowers, these small trees deserve horticultural attention.

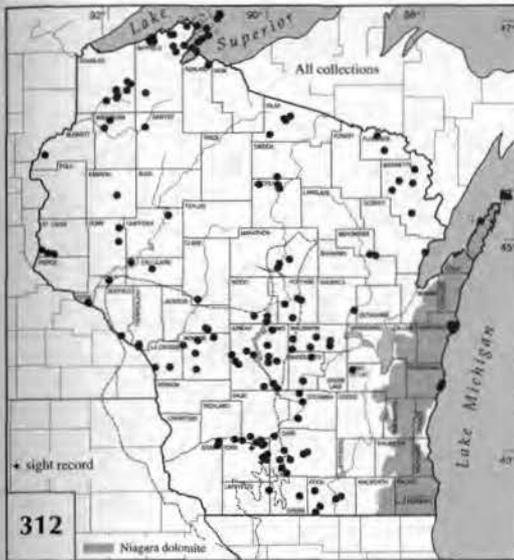


310. *Potentilla arguta* Pursh. TALL POTENTILLA, PRAIRIE CINQUEFOIL. Part of a western mountain complex, from Alaska to Arizona, east in the Great Plains through the Prairie Peninsula to New York and Quebec's Gaspé; in Wisconsin common on dry, open ground, in low, mesic and sand prairies, especially common on high lime "goat prairies," cedar glades and pastures, often on bluffs of granite or limestone, open woods, and along roadsides and railroad rights-of-way, but rarely truly weedy. (14) Flowering from June to August, fruiting into October.



311. *Potentilla simplex* Michx. OLD-FIELD CINQUEFOIL. Widespread from the eastern Great Plains (Manitoba to Texas) to the Atlantic Ocean; in Wisconsin very common throughout, especially in the southern half, in dry to moist prairies, oak openings, southern dry forests (pine, oak), also in moist woods (maple) and thickets, and often weedy in abandoned sandy fields, roadsides and railroad rights-of-way. (16) Flowering from mid May to mid July, fruiting from mid June to early August.





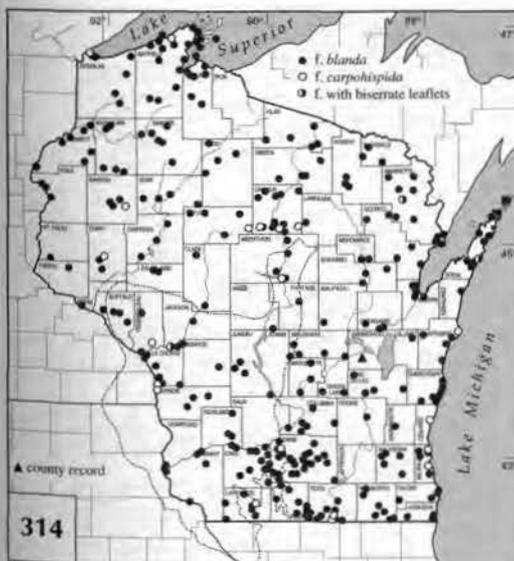
312. *Prunus pumila* L. SAND CHERRY. A complex species of East-West ecotypes centered on two unglaciated "survivia:" from Kansas to Saskatchewan, and sweeping eastward to the Great Lakes and beyond; and the Pennsylvanian Appalachians, ranging north to the St. Lawrence Basin and west to the Great Lakes; in Wisconsin locally common throughout (except in the east and southeast, where, save for Lake Michigan dunes, it shuns the Niagara Upland), in sandy, well-drained, open habitats: hillsides, open woods (jack pine, bur oak-Hill's oak), bluffs, sandstone cliffs and outcrops, sand prairies, dunes, beaches, rocky shores, outwash plains, sand blows and barrens. Flowering from mid May to early July, fruiting from late June to early September.

Wisconsin specimens exhibit thoroughly intergrading morphological variation from the short-leaved western *Prunus p.* var. *besseyi* (L. H. Bailey) Gleason to the long-leaved eastern vars. *pumila* and *cuneata* (Raf.) L. H. Bailey [var. *susquehanae* (hort. ex Willd.) H. Jaeger] (see Mason & Iltis 1959).



313. *Rosa arkansana* Porter [*R. suffulta*, *R. a.* var. *suffulta*]. PRAIRIE or SUNSHINE ROSE. Widespread on the Great Plains, from Alberta south to New Mexico, eastward to Illinois and beyond; in Wisconsin frequent, especially in the southern half and northwest quarter, on prairies, sandy fields, grassy banks and gravelly or rocky hillsides, rarely on borders of oak woods, spreading along roadsides and railroads; once forming large colonies in dry open ground on the Central Plain and sand terraces along the major rivers, still locally common in our few remaining wet-mesic to **mesic prairie** remnants, but most conspicuous along rights-of-way, where perhaps adventive as often as native. (26, as *Rosa* spp.) Flowering from mid June to mid September, fruiting from early July into winter.

Nearly all of our plants are var. *suffulta* (Greene) Cockerell (sometimes treated as a distinct species, *Rosa suffulta*). Hybridization and introgression between *R. arkansana* and *R. carolina*, both tetraploids, occur over a very broad area of the Middle West, including southwestern Wisconsin.

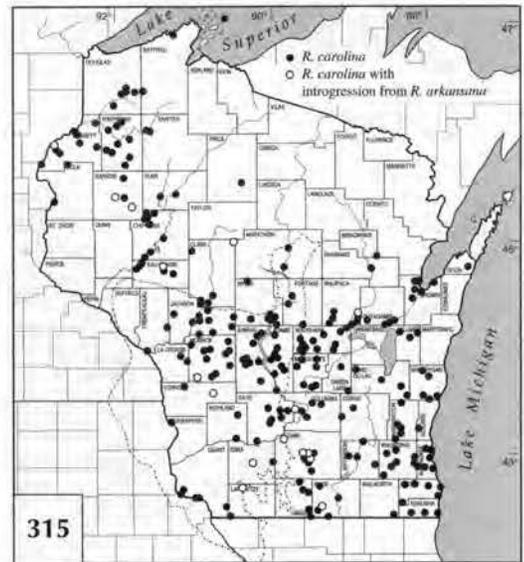


314. *Rosa blanda* Aiton [including *R. blanda* var. *glandulosa*, *R. blanda* var. *hispida*]. WILD ROSE. Highly polymorphic and widely distributed, from Manitoba to Kansas, east to Indiana, Pennsylvania and Quebec; in Wisconsin common throughout in a variety of open or disturbed habitats, most common on dry to moist, but especially **mesic prairies** and borders of woods and thickets (from southern mesic to moist, deciduous types to northern dry forests of jack pine-trembling aspen-Hill's oak or white pine-red oak-white birch), frequent in ecotones between shorelines, marshes or regenerating pastures and woods, also sandy lakeshores (including those of the Great Lakes), streambanks and dunes, as well as along fencerows, roadsides and railroads. (26, as *Rosa* spp.) Flowering from late May to August, fruiting from late June into winter (hips persisting on the plants until early the following summer).

Our native roses are notoriously difficult to separate into distinct species owing to polyploidy, rampant hybridization and the extraordinary variability of each species (see Lewis 1962).

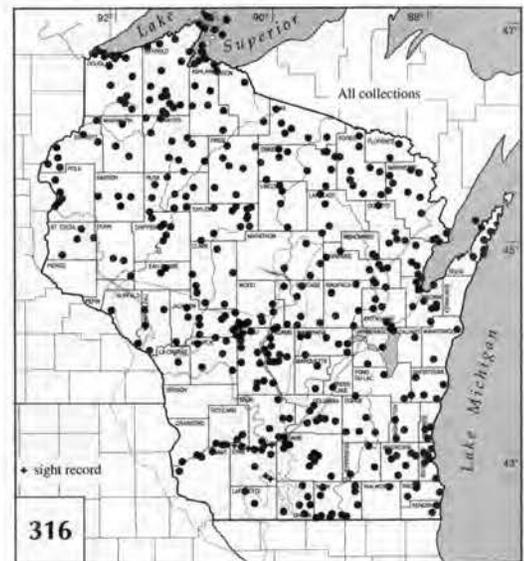
- 315. *Rosa carolina* L. PASTURE ROSE.** Throughout the eastern deciduous forest region, from Florida to eastern Texas, north to Nova Scotia and Minnesota; throughout Wisconsin except the South Superior Uplands, common on dry, as well as rich, moist to **mesic prairies**, locally abundant on embankments and hill-sides, dry upland oak woods, oak openings, pine forests and barrens, rare in mesic woods; usually on sandy, gravelly or clayey soil, on granite, quartzite and sandstone, occasionally on lakeshores and streambanks, tending only slightly to spread into disturbed sandy areas such as old fields, roadsides, railroads and fencerows. (26, as *Rosa* spp.) Flowering from late May to late September, fruiting from late July through October (hips persist on the plant into the next summer).

This variable species freely hybridizes with *Rosa arkansana*, producing fertile hybrid swarms. Plants more closely related to *R. carolina* than to *R. arkansana* are mapped here as introgressants; those most nearly intermediate have been mapped above (313) as hybrids (= *R. × rudiusscula* Greene).

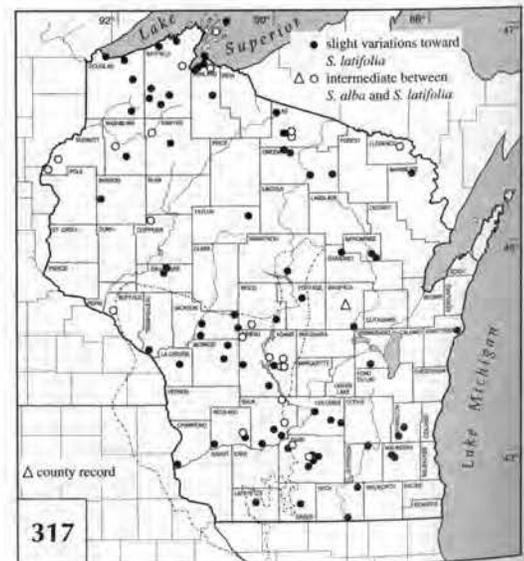


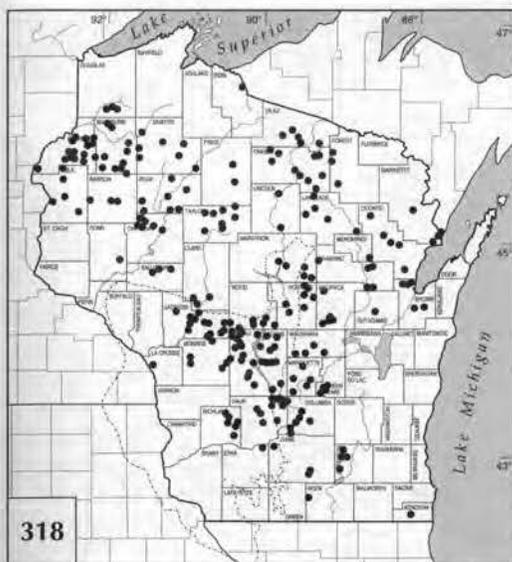
- 316. *Spiraea alba* Du Roi var. *alba*.** MEADOWSWEET. Widespread, the mainly midwestern var. *alba* from southern Alberta to Missouri, east to Quebec, Indiana and in the mountains to North Carolina (the eastern var. *latifolia* (Aiton) Dippel occurs from Newfoundland to Michigan, south in the mountains to North Carolina); common throughout Wisconsin in wet to mesic, rarely dry habitats such as sandy and boggy shores, streambanks, sedge meadows, wet prairies, bogs, **alder thickets**, swamps and moist woods, as well as prairies, swales, ditches, sand barrens and along railroads. (16) Flowering from mid June through September.

Most recent authors treat the eastern *Spiraea latifolia* (Aiton) Borkh. as a variety of *S. alba*, although until the 1960s the former was generally considered to be a separate species. The extremes are distinctive, but the two overlap geographically and intergrade morphologically (317), "presumably the result of long hybridization between eastern and western (or southern) populations which are more distinct—or the whole complex can be looked upon as a cline" (Voss 1985, p. 376).



- 317. *Spiraea alba*-*S. latifolia* complex.** Although pure var. *latifolia* (Aiton) Dippel does not occur in Wisconsin, typical var. *alba* (316) is widespread throughout, as well as many plants showing evidence of introgression with var. *latifolia*; namely, they have leaves that are broader and more obovate, and with deeper, more irregular serrations than typical *S. alba*; and/or have a less densely pubescent inflorescence; and/or have reddish- to purplish-brown twigs. The map shows those plants of the *S. alba*-*S. latifolia* complex varying only slightly toward *S. alba*, as well as those that are intermediate in several characters.





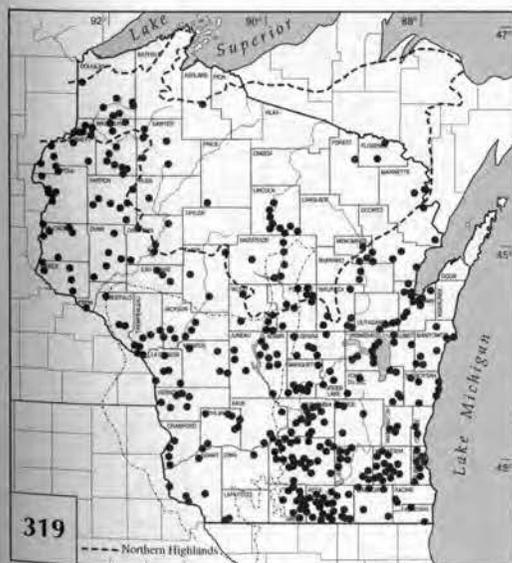
- 318. *Spiraea tomentosa* L. HARDHACK.** Widespread from Arkansas to the Carolinas, northward to Nova Scotia and east-central Minnesota; in Wisconsin frequent near lakes and ponds on sandy, gravelly and peaty shores, in sphagnum bogs, tamarack swamps, boggy meadows (especially sphagnum and **northern sedge meadows**), quaking sedge mats, edges of and/or weedy in cranberry marshes and coniferous swamps (tamarack, spruce, fir), dry to moist abandoned fields, dried lake beds and drainage ditches, also on weathered, water-seeping sandstone cliffs in Juneau and Richland counties; generally on moist, slightly acid substrates, often growing with *S. alba* (316, 317); not really a prairie species, but in central Wisconsin in moist habitats grading into prairies. (8) Flowering from early July to early September, fruiting from early September through October and beyond (follicles persisting into the following year).

This handsome flowering shrub is variable in flower color and fruit pubescence. Our plants have been assigned to var. *rosea* (Raf.) Fernald, a form poorly differentiated from the mostly Appalachian var. *tomentosa* and hardly worthy of recognition.

RUBIACEAE—the Madder Family

Most of the 6,500 species are tropical to subtropical trees or shrubs, the 18 natives of Wisconsin being but a paltry sampling of one of the largest flowering plant families. All are characterized by opposite leaves with stipules (or leaves apparently whorled), regular flowers with usually 4 or 5 sepals, 4 or 5 fused petals, 4 or 5 stamens on the corolla tube, and an inferior, mostly 2 (–5)-carpellate ovary producing in our genera a capsule or 1 or 2 nutlets, drupelets or berries. (Iltis 1957; Moore 1988; Puff 1976, 1977; Urban & Iltis 1958)

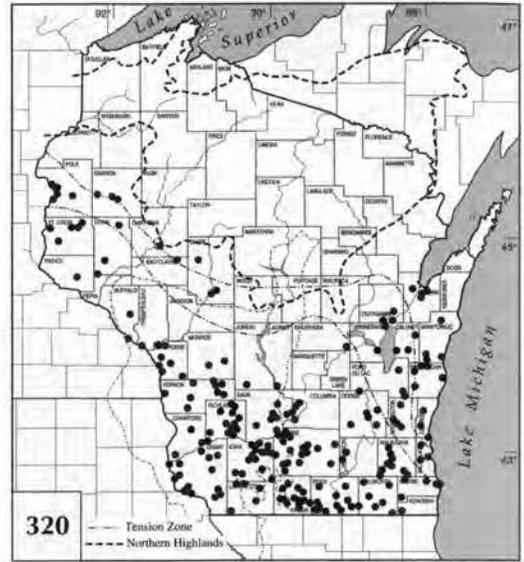
Besides such familiar herbs as Bedstraw or Cleavers, Bluets and Partridge-berry, we have the shrubby Buttonbush, *Cephalanthus occidentalis*, which ranges all the way to Mexico and the West Indies. Among several important products of this family are coffee (*Coffea*) and the anti-malarial drug quinine (*Cinchona*); species from such genera as *Gardenia* (Cape Jasmine), *Rubia* (Madder) and *Asperula* (Woodruff) are popular as ornamentals.



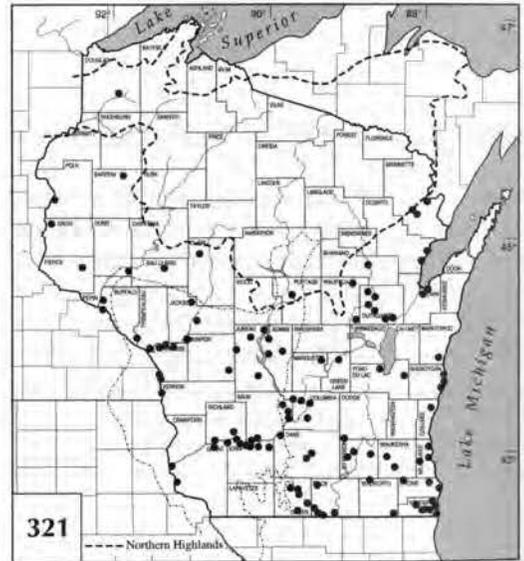
- 319. *Galium boreale* L. NORTHERN BEDSTRAW.** All across temperate Eurasia and North America, from West Virginia to Iowa and the northern Great Plains, the Rocky Mountains, Pacific Slope and Alaska; in Wisconsin ubiquitous (except in the Northern Highlands) in moist to mesic prairies, **fens**, open hardwood forests, both southern and northern, oak openings and a variety of other habitats, showing its best growth in those that are sunny. (20) Flowering from early June to mid July (peaking in late June), the characteristic twin fruits forming quickly, ripe from early July to late September.

One of the most widespread species of this widespread genus, circumboreal and highly polymorphic, with the American plants sometimes segregated as ssp. *septentrionale* (Roem. & Schult.) Hara from the Eurasian ssp. *boreale* (Löve & Löve 1954, Urban & Iltis 1958).

320. *Galium concinnum* Torr. & A. Gray. SHINING BEDSTRAW. An Ozarkian element, mostly from eastern Kansas and Arkansas to southeastern Minnesota, east to Kentucky and Pennsylvania; in Wisconsin very common in, and characteristic of, dry oak and oak-hickory woods (**southern dry-mesic forests**) and thickets throughout most of the southern and western counties within and south of the Tension Zone; on soils derived from glacial drift and limestones (dolomites) and absent from the Northern Highlands and sands of the Central Plain. (12) Flowering from June to early August.

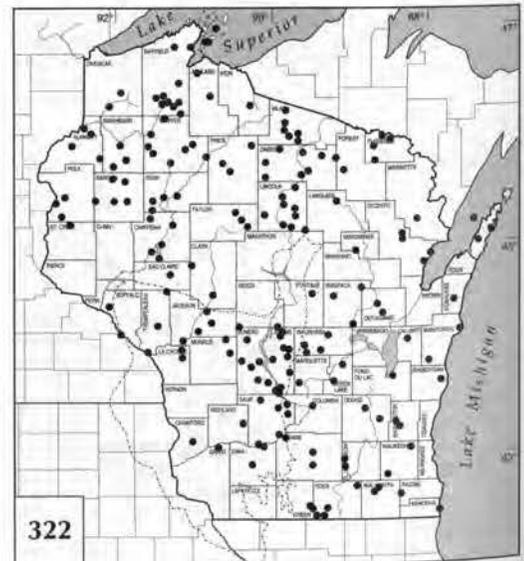


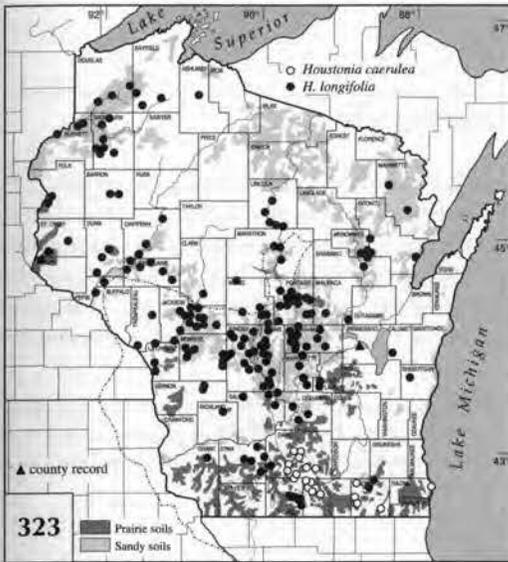
321. *Galium obtusum* Bigelow ssp. *obtusum* [*G. o.* var. *ramosum*]. WILD MADDER. Throughout the northeastern United States and into the central Great Plains from Texas to Minnesota; in Wisconsin locally frequent throughout (except in the Northern Highlands) in moist ground such as low woods, swamps, **southern sedge meadows**, low prairies and wet shores. (6) Flowering from late May to July.



Galium labradoricum (Wiegand) Wiegand, Labrador Marsh Bedstraw, of subarctic to boreal eastern Canada and northeastern United States, is a close relative with shorter, narrower leaves that are strongly deflexed. It occurs in sphagnum tamarack swamps and calcareous marshes and fens, and has about the same geographical distribution in Wisconsin as *G. obtusum* (Urban & Iltis 1958).

322. *Galium tinctorium* L. ssp. *tinctorium*. STIFF OR SOUTHERN THREE-LOBED BEDSTRAW. From the mountains of Georgia and South Carolina to Newfoundland, west to Minnesota and Iowa (another subspecies, ssp. *floridanum* (Wiegand) Puff, occurs on the coastal plain of the southeastern states); in Wisconsin quite common throughout in marshes, swamps, sedge meadows, **wet prairies** and other damp places; preferring circumneutral or somewhat alkaline soils. (8) Flowering throughout June to early September.





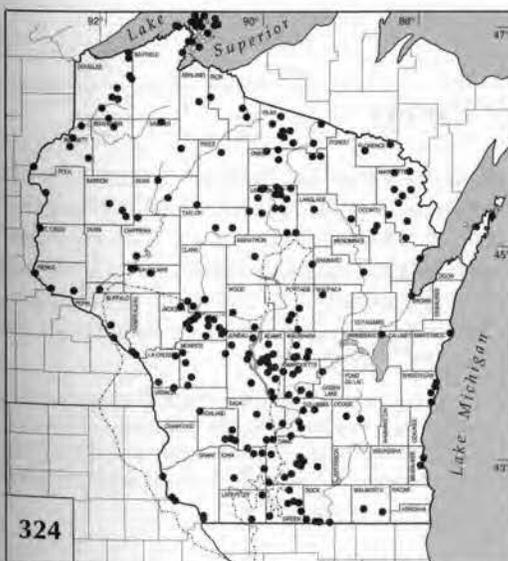
323. *Houstonia caerulea* L. [*Hedyotis* c.]. BLUETS, INNOCENCE, QUAKER LADIES (Special Concern). One of the widest-ranging and best-loved species of *Houstonia*, from the Gulf and Atlantic coastal states to Arkansas, Iowa, and northeast to the Maritimes (for map see Terrell 1996); in Wisconsin locally frequent in moist meadows, **wet prairies**, fields and open woods in five southeastern counties, northward to Dane County, here at its northern range limit. (1) Flowering from late April to early June.

Houstonia longifolia Gaertn. [*Hedyotis* L.]. LONG-LEAVED BLUETS. A member of the *H. purpurea* complex (Terrell 1959, 1996), this species is much more widespread in Wisconsin (and in eastern and central North America) than the preceding. It occurs in a variety of acid habitats, from dry thin woods, **sand barrens** and rocky, gravelly or sandy places to prairies, sedge meadows, fields and lakeshores. (6) Flowering from early June through August (October).

SALICACEAE—the Willow Family

North temperate to arctic, prostrate shrublets to large trees, all having simple, alternate, stipulate leaves and minute flowers in dense, dry, scaly spikes (catkins or aments). Male and female flowers (all lacking petals or sepals) produced on different plants, the poplars, aspens and cottonwoods (*Populus*) wind-pollinated and the willows (*Salix*) insect-pollinated. Fruit a small 1-celled capsule, its seeds covered with long, soft hairs and adapted for wind dispersal. (Argus 1965, Costello 1935, Dorn 1976)

Important ecologically, mostly in moist places, the willows and poplars have had a fossil record going back some 50 million years. Many species of these rapidly growing, soft-wooded plants are grown as ornamentals, e.g., Weeping Willow (*Salix babylonica*), White or Silver Poplar (*Populus alba*) and Lombardy Poplar (*P. nigra* cv. 'Italica'). Medicinal bark (containing salicylic acid) is obtained from *Salix*.



324. *Salix humilis* Marshall. UPLAND OR PRAIRIE WILLOW. A very wide-ranging North American species, from Labrador south to Florida and west to the northern Great Plains; in Wisconsin common in dry to **wet prairies**, willow thickets grading into sedge meadows, swinging marsh mats and bogs, also in sandy uplands in pine or oak barrens and at the base of sandstone bluffs and ledges. (10) Flowering from mid April to mid May, fruiting from mid May to mid June.

Salix humilis var. *tristis* (Aiton) Griggs [*S. occidentalis*; *S. h.* var. *microphylla*], occasional in the southernmost counties, is a clone-forming shrub that occupies much of the same geographical area and the same range of habitats as var. *humilis* (see Argus 1986). Several other species of willow (e.g., *S. eriocephala* Michx., *S. exigua* Nutt., *S. petiolaris* Sm.) are common or locally frequent in marshy or swampy ground and may be expected in wet prairies (or even mesic prairies, especially *S. discolor* Muhl., Pussy Willow) and fens. Prairie Willow is the only one that regularly occurs in dry upland sites.



SANTALACEAE—the Sandalwood Family

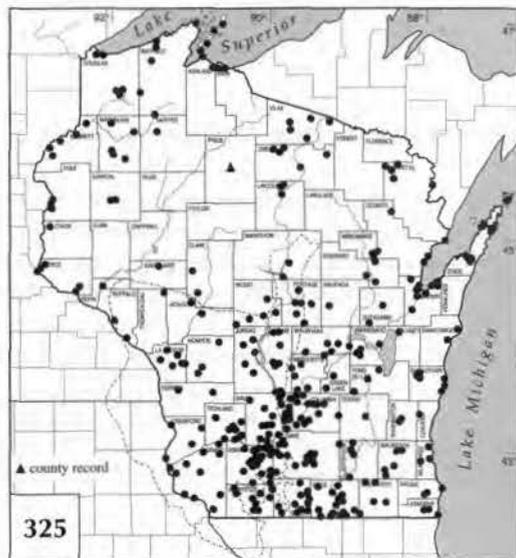
Here in Wisconsin we have only two inconspicuous herbs representing the largely subtropical to tropical sandalwoods, prized for their sweet-scented wood by cabinet makers and for their aromatic oil by perfumers for use in soap and incense. Ours have rather small, alternate or scattered, entire leaves; small flowers with 4 or 5 tepals, these free (*Geocaulon*) or basally fused into a fleshy floral cup (*Comandra*); stamens as many as the tepals; and a solitary pistil, the ovary either wholly or partly inferior, developing into a dry or juicy drupe. (Piehl 1965.)

Like the related mistletoes, some Santalaceae (including ours) are hemiparasites, photosynthesizing carbohydrates, but relying on the roots of the host for water and minerals. *Comandra* has whitish flowers in a compact terminal inflorescence; the scarlet-fruited *Geocaulon lividum*, which occurs very rarely in Door County, has bronze, purplish or green flowers in few-flowered axillary clusters.

325. *Comandra umbellata* (L.) Nutt. ssp. *umbellata* [*C. richardsoniana*]. BASTARD TOAD-FLAX. Widely distributed, the aggregate species from Newfoundland to the Yukon, south to Georgia, Texas and Arizona; in Wisconsin very common in prairies, from dry, steep, limy and sandy prairies through mesic deep-soil to dense peaty wet-mesic prairies, in **oak barrens** and open upland oak-hickory, aspen and/or pine woods, on slopes, bluffs and outcrops, sandy or gravelly shores, rock flats and dunes of the Great Lakes, and banks along roadsides and railroads. (21) Flowering from early May to mid June, fruiting from late June to late July.

Extremely variable, split into 3 intergrading subspecies, only one of which, *Comandra umbellata* ssp. *umbellata* of eastern North America, enters Wisconsin.

Bastard Toad-flax, a hemiparasite on the roots of many plants, spreads by long horizontal stoloniferous rootstocks, and survives considerable disturbance.

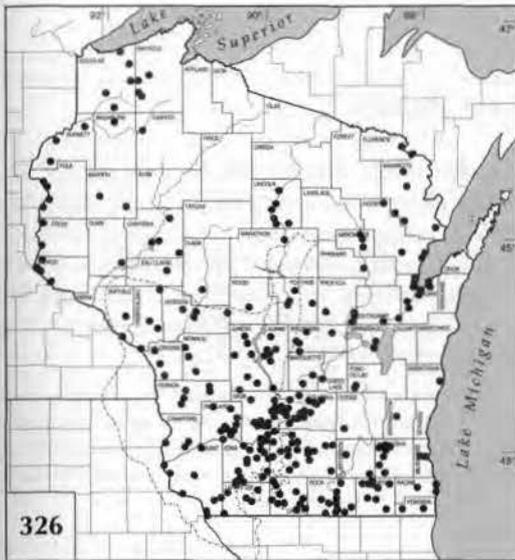


SAXIFRAGACEAE—the Saxifrage Family



To quote Heywood (1978, p. 147), "The uncertainty as to the limits of the family is due partly to its unspecialized nature...and consequently to the absence of any striking distinctive characters." Herbs with mostly alternate or basal leaves that are often palmately veined and usually without stipules, and flowers with floral tubes usually well developed, mostly 4 or 5 free petals, 10 or more stamens and usually 2 to 5 carpels, these ranging from completely fused to quite separate and ripening into capsules or follicles (if the carpels are distinct). (Fassett 1932b, Sponberg 1972, Wells 1984.)

A cosmopolitan, mostly temperate, arctic and alpine family that is close to the Rosaceae. Taxonomists have long grappled with the problem of its circumscription, subdividing this diverse family into several or more (up to 17) subfamilies, some of which are often treated as independent families. As described here, the Saxifragaceae includes *Penthorum* and *Parnassia* but not woody plants often segregated as the Hydrangea Family and Gooseberry Family.

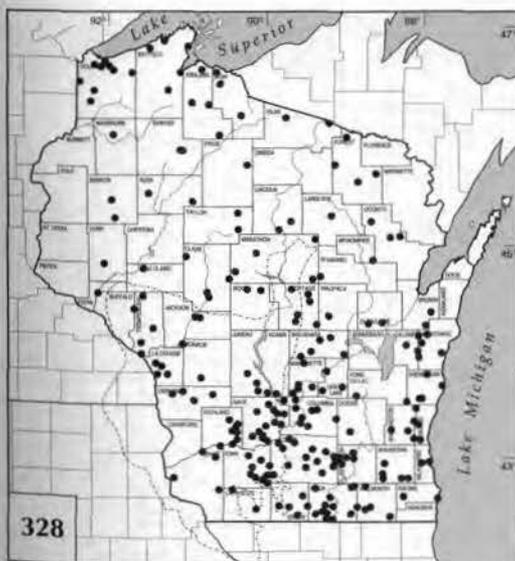


326. *Heuchera richardsonii* R. Br. ALUM-ROOT. A northern Great Plains element, from eastern Colorado and northern Nebraska to Alberta, and from eastern Kansas east to southern Michigan; in Wisconsin frequent in the southern and western parts, occasional in the north (especially along major rivers), in open to lightly wooded rocky ground (ledges, outcrops, cliffs, bluffs), oak, oak-hickory, pine-oak and other deciduous woods, including oak openings, jack pine barrens and **cedar glades**, on sandstone, dolomite and other rock types, loam, sand or gravel, as well as commonly on low, mesic or dry prairies, banks and roadsides. (18) Flowering from (mid) late May to late July, fruiting from mid June to mid September.



327. *Parnassia glauca* Raf. [*P. americana*]. GRASS-OF-PARNASSUS. Subarctic and temperate eastern North America (apparently only in glaciated areas), from New Jersey to northern Ohio and the eastern Dakotas, north to Newfoundland and Manitoba; scattered or only locally common throughout limy parts of Wisconsin, in **fens** (consistently with *Gentianopsis procera*, *Lobelia kalmii*, *Pentaphylloides floribunda* and *Solidago riddellii*) and fen-like habitats: rich mesic to moist prairies, wet marly and/or peaty banks, seepage slopes, edges of springs and spring-fed streams, openings in white cedar thickets and damp sandy or peaty soil along Lake Michigan in Door County, very rarely on seeping, shaded, calcareous sandstone cliffs in the Driftless Area. (4) Flowering from early August to early October, fruiting from mid-August to late October.

Parnassia is a circumpolar, subarctic to temperate genus. Two other species occur in Wisconsin, *P. parviflora* (Endangered), known only from Door County, and *P. palustris* (Threatened), known only from Ashland and Douglas counties.



328. *Saxifraga pensylvanica* L. [*S. forbesii* Vasey; *S. p.* var. *f.*]. SWAMP SAXIFRAGE. Northeastern United States, from the southern Appalachians to Maine, west, mostly in unglaciated terrain, to Missouri and Minnesota; in Wisconsin throughout although somewhat local, in sun or shade, often in calcareous, mesic to **wet prairies**, sedge meadows, borders of marshes, low wet woods (e.g., tamarack bogs, black ash-white cedar swamps, floodplain forests, hollows, ravines, streambanks and springy slopes in rich deciduous woods) and alder thickets, sometimes in wet ditches; in the Driftless Area almost exclusively on dry to dripping wet, wooded sandstone cliffs and slopes. (13) Flowering from early May to late June, fruiting from early June to early August.

Populations on unglaciated sandstone bluffs were once treated as a distinct taxon (*S. forbesii*; *S. p.* var. *forbesii*). However, there are no definite morphological or cytological correlations to justify its segregation (Phillips 1977, Phillips & Kowal 1983).



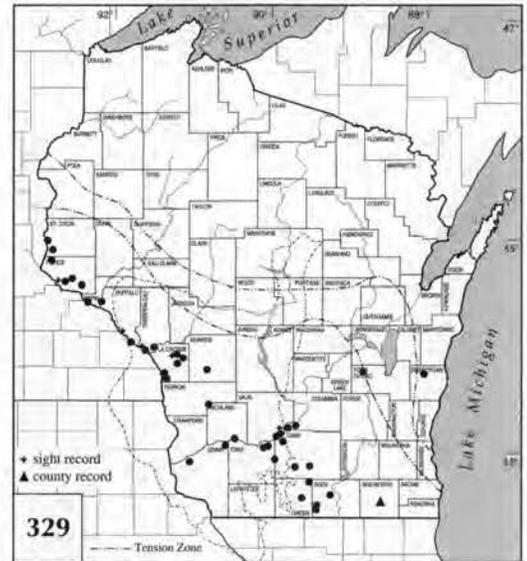
SCROPHULARIACEAE—the Figwort Family

With flowers quite diverse, these 4,000 worldwide mostly temperate herbs share attractively colored corollas of 4 or 5 united petals (mostly tubular and nearly regular to strongly bilabiate, with 3 lobes below, 2 above) and 2 or 4 stamens (sometimes 4 fertile plus a staminode, rarely all 5 fertile). The variation in corolla structure and color can be correlated with particular insect and hummingbird pollinators. Although in many ways resembling the Lamiaceae, the “scrophs” lack the mint odor and have usually alternate leaves, round stems and diverse capsules with numerous small seeds. (Pennell 1935, Salamun 1951)

Besides the drug plant *Digitalis*, the Scrophulariaceae are the source of many ornamentals, among them snapdragons, beard-tongues, toad-flaxes, slipper-flowers and speedwells. Some genera, including such beautiful Wisconsin natives as *Castilleja*, *Dasistoma* and *Pedicularis*, are hemiparasitic, hence difficult or impossible to transplant (so please don't!). *Verbascum thapsus*, Common Mullein, is often adventive on dry prairies. The maps are largely based on an as-yet unpublished family treatment by F. S. Crosswhite.

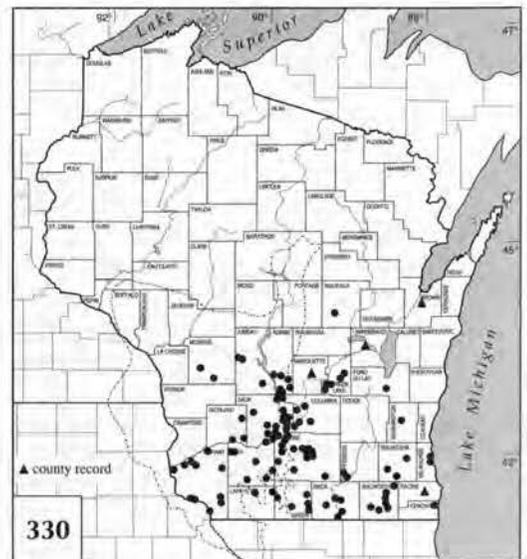
- 329. *Agalinis aspera*** (Douglas ex Benth.) Britton [*Gerardia a.*]. ROUGH AGALINIS, ROUGH FALSE FOXGLOVE. A Great Plains prairie species, ranging from Oklahoma north to Manitoba and Wisconsin; locally frequent south of the Tension Zone on basic soils, (**wet prairies** [?], fide Curtis 1959), dry rocky or sandy prairies on limestone or limestone-capped bluffs, steep sandy hillsides and sandy-gravelly moraines. (3) Flowering from mid July to mid September, fruiting from early September to mid October.

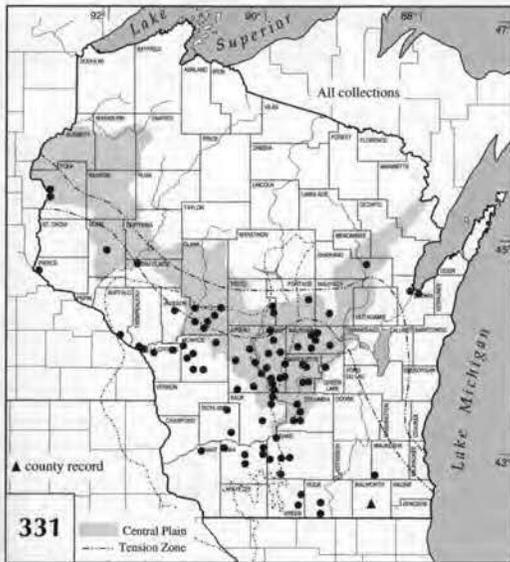
Our six *Agalinis* species are all hemiparasitic annual herbs, three of moist habitats (lakeshores, swales, sandy depressions, wetlands) and three of dry prairies. Of the latter, *A. aspera* is easily distinguished, but the rare Ozarkian *A. skinneriana* (A. Wood) Britton (Endangered) and southeastern *A. gatteringi* (Small) Small (Threatened) are not only similar to each other but also to *A. tenuifolia* (Vahl) Raf., a widespread common species of moist places. All these can be identified only after careful consideration of minute, mostly corolla characters.



- 330. *Aureolaria grandiflora*** (Benth.) Pennell var. *pulchra* Pennell [*Gerardia g.*]. YELLOW FALSE FOXGLOVE. A complex species, from Texas to the lake states, with var. *pulchra* (allopatric northern taxon to the ancestral Texan-Ozarkian variety) ranging from southeastern Missouri to northwestern Indiana, southeasternmost Minnesota (only one station) and Wisconsin, here in sandy or rocky open oak woods, **cedar glades**, scrub oak barrens, bur oak openings and Driftless Area pine relics, frequent in prairie openings, occasional on edges of mixed hardwood stands or maple woods; locally abundant on eroded sandstone bluffs, ridges and sand flats in southern Wisconsin but nearly absent from the uplands north of the Wisconsin River. (9) Flowering from late July to mid October, fruiting from late August into December.

This variety represents a rare instance of recent evolution (Pennell 1935; see 332). It is usually a perennial (R. Henderson pers. comm.), and like all *Aureolaria* species, *A. grandiflora* is hemiparasitic on oaks, primarily the white oaks of *Quercus* section *Quercus* in this case (Musselman 1969, Pennell 1935).

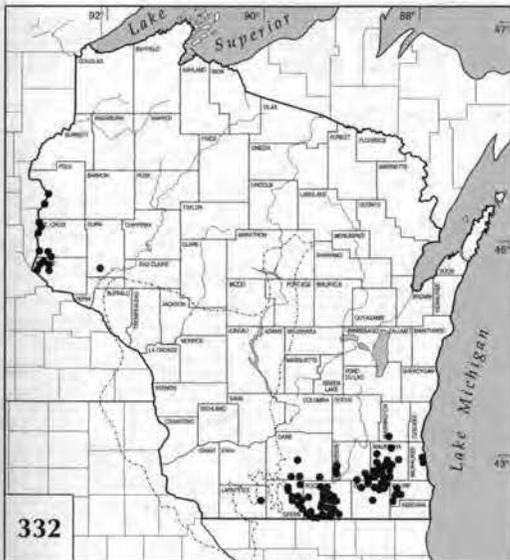




- 331. *Aureolaria pedicularia* (L.) Raf. [*Gerardia p.*]. CLAMMY FALSE FOXGLOVE.** An Appalachian floristic element, variable and polymorphic below the glacial maximum, from the Georgia mountains to Maine, west to northern Indiana and (barely) Minnesota; in Wisconsin locally frequent south of the Tension Zone in dry, sandy or rocky, open woods (black oak-white oak woodland, oak scrub margins, oak barrens), transition zones between savanna and marsh, **shaded cliffs** and occasionally on Precambrian granite monadnocks; in partial shade in sterile acid soils. (1) Flowering from late July to early October, fruiting from late August into December or later.

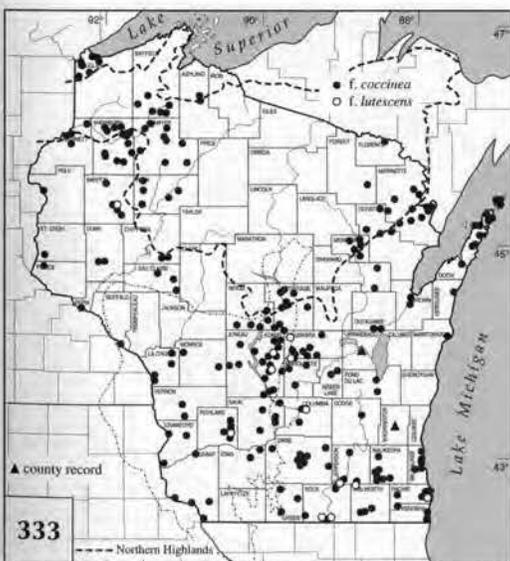
According to Pennell (1935), var. *pedicularia* and var. *intercedens* Pennell are rare and sporadic in Wisconsin, and var. *ambigens* (Fernald) Farw. locally frequent on the Central Sand Plain.

Long known to parasitize the roots of black oaks (*Quercus* section *Lobatae*) (Pennell 1928), this annual or winter annual has been found more recently to be hemiparasitic on the roots of Ericaceae in the Southeast (Werth & Riopel 1979).



- 332. *Besseyia bullii* (Eaton) Rydb. [*Wulfenia b.*]. KITTEN'S-TAIL (Threatened).** A Midwest endemic, rare and in scattered populations, but locally common, from southern Michigan and Ohio (extirpated) to Iowa and Minnesota; in two disjunct areas of southeastern and northwestern Wisconsin, absent from the Driftless Area, in **oak openings** and dry to dry-mesic prairies, on gravelly hillsides, dry river-bluff prairies, sandstone ridges and sandy outwash, sometimes along railroads. (4) Flowering from (late April) May to early June, fruiting from early May to early July (sporadically to mid August).

A very special, presumably post-glacially evolved, endemic on or near the moraines and outwashes of the Wisconsin ice advances. The eight other *Besseyia* species grow in the alpine or montane zones of the Rocky Mountains and other isolated peaks of the West.

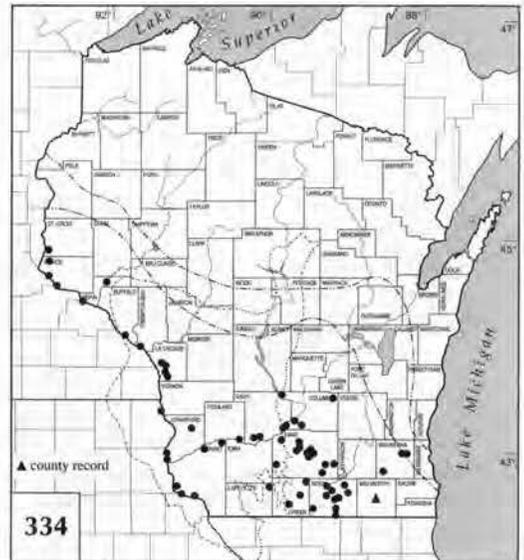


- 333. *Castilleja coccinea* (L.) Spreng. INDIAN PAINTBRUSH, SCARLET PAINTED-CUP.** Widespread in eastern North America, from the Gulf states and the Ozarks to the southern Appalachians, north to New England and southern Manitoba; infrequent to locally common throughout much of Wisconsin, in low open ground in full sun, especially in damp sandy prairies and sandy-marly flats and swales, also sandy lakeshores, meadows, **fens**, old marshes and moist glades; absent from the Precambrian granitic shield underlying the Northern Highlands. (5) Flowering from May to early September, fruiting from late May to early August (or later).

A hummingbird-pollinated hemiparasite, the roots of which must attach to nearby roots of other species (it is not host specific) in order for the plant to mature beyond the seedling stage (Malcolm 1966).

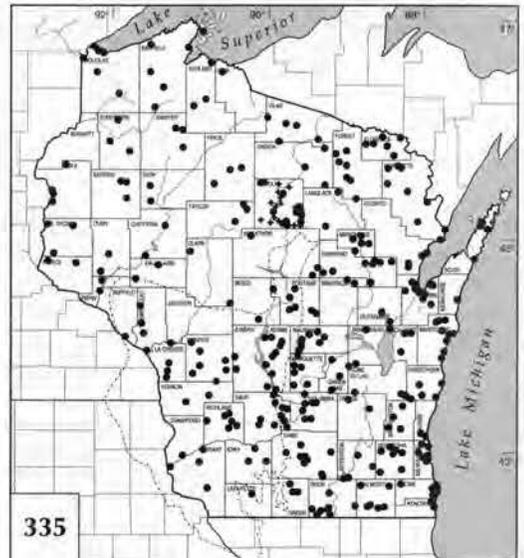
334. *Castilleja sessiliflora* Pursh. DOWNY PAINTBRUSH, DOWNY PAINTED-CUP. A floristic element of the dry Great Plains, from northern Mexico, southeastern Arizona and western Texas north to Saskatchewan, east to Iowa, northeastern Illinois and Wisconsin; here rather rare and restricted to south of the Tension Zone, on south- and west-facing, calcareous, sandy, gravelly or rocky **dry prairies** such as on hills or knolls of glacial drift, and especially steep dolomite ridges such as on the Mississippi, Wisconsin and St. Croix river bluffs, where sometimes growing with other rare or restricted dry-prairie species. (5) Flowering from May to late July, fruiting from late June to early August.

Except for the steep river-bluff "goat prairies," this species is essentially lacking from the Driftless Area, a fact noted by Pennell (1935, p. 525), who attributes this to its inability to invade the already plant-occupied, unglaciated (at least during the Wisconsin) "driftless" region after the ice recession. Pollinated by bumblebees (Crosswhite & Crosswhite 1970).



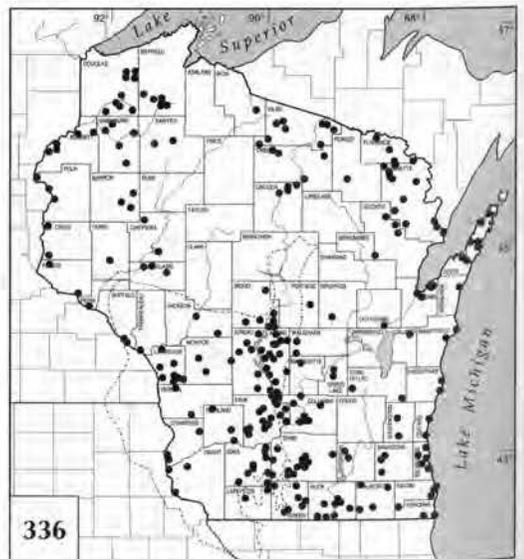
335. *Chelone glabra* L. [including var. *linifolia*]. WHITE TURTLEHEAD. An eastern forest element, from the Alabama Appalachian uplands to Newfoundland, west through the Great Lakes states to Minnesota and southern Manitoba; common throughout Wisconsin in low wet habitats with black soil, peat or muck such as marshes, sedge meadows, wet prairies, fens, swales, edges of tamarack bogs and cedar swamps, willow or **alder thickets**, floodplain forests, wet shores and stream banks. (9) Flowering from early July to early October, fruiting from mid August to early October.

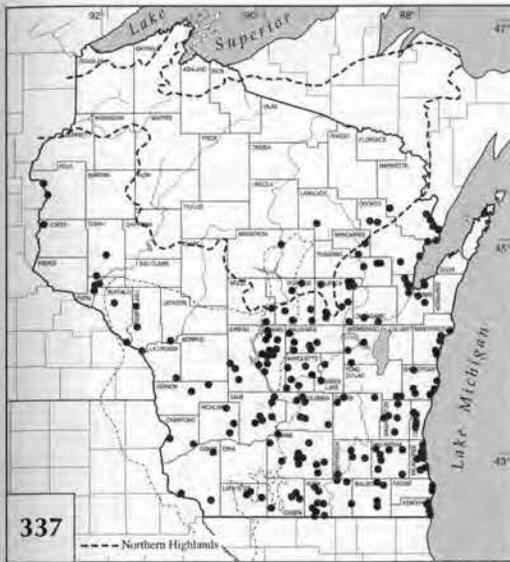
Leaf shape and pubescence and corolla color vary a great deal in this species; however, the variation is continuous, and few authors (Crosswhite 1965a) consider this taxonomically significant. The generic name (Gk. *chelone*, a tortoise) and common name refer to the corolla, resembling a turtle's head with its mouth open. A plant with horticultural promise, White Turtlehead's large white- or cream-colored, bumblebee-pollinated flowers make a show from midsummer until the first hard frost.



336. *Pedicularis canadensis* L. WOOD-BETONY, LOUSEWORT. On uplands throughout the eastern United States from the Gulf Coast to the Great Lakes, west to the Great Plains, also Colorado to northern Mexico; occasional to locally common throughout Wisconsin on sandy or light loamy soils (absent from the north-central yellow silt-loams), in dry to mesic prairies, open oak or pine woods, black oak savannas, **cedar glades**, bracken grasslands or openings in maple-basswood forests; frequently on steep prairie hillsides with sandstone or limestone outcrops, less often on clay bluffs along Lake Michigan; often forming large clonal colonies. (17) Flowering from May to June, fruiting from mid May to mid August.

Linaria canadensis (L.) Dum. Cours., Blue Toadflax, is one of an assemblage of annuals (see 218) that in Wisconsin achieves maximum presence in sand barrens. Blue Toadflax is locally common within and slightly outside of the Driftless Area in open, sandy or rocky places, including oak and jack pine woodlands, sandy prairies, abandoned fields and pastures.





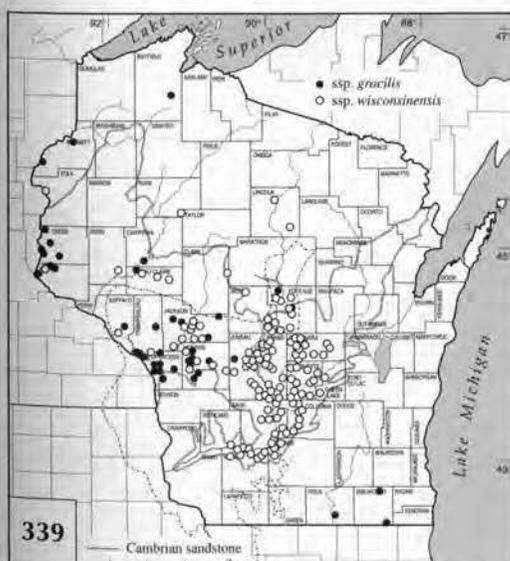
337. *Pedicularis lanceolata* Michx. FEN- or SWAMP-BETONY. A calciphilic Appalachian element, from North Carolina's mountains to Massachusetts, west in glaciated areas to Illinois and on the northern Great Plains to Manitoba (and Missouri's calcareous springs); frequent in the southern two-thirds of Wisconsin, but essentially lacking from the acidic granitic Northern Highlands except at its southeastern edge (where Cambrian sandstones may be calcareous), in low wet calcareous habitats such as wet prairies, fens, swales, sedge meadows, marshes, shrub carrs, alder thickets, wooded wetlands and black muck pastures. (11) Flowering from early August to October, fruiting from mid August to early October.

A handsome member of an enormous genus, the 500 species of which are mostly Himalayan or Siberian.



338. *Penstemon digitalis* Nutt. ex Sims. TALL or FOXGLOVE BEARD-TONGUE. Originally from the Ozark and Ouachita provinces, but aggressively spreading in disturbed areas in the later nineteenth century (Pennell 1935), to eastern Minnesota, Tennessee, Virginia and New England; occasional but sometimes locally abundant throughout central and southern Wisconsin, on roadsides, low pastures and formerly disturbed areas such as old fields, weedy, dry to mesic prairies and shrubby clearings in mesic woods; usually in full sun on sandy loam. (1) Flowering from mid June to mid July, fruiting from mid July to early September.

This species spread widely in historic times and probably did not escape from Wisconsin gardens before the 1890s. The earliest collections are from 1892 (Waukesha Co.), 1913 (Fish Creek, Door Co.), 1916 (Taylor, Jackson cos.) and 1919 (Blue Mounds, Iowa Co.). *Penstemon digitalis* is now locally abundant in formerly pastured fields or other disturbed areas, and it will become an important part of the floristic landscape.

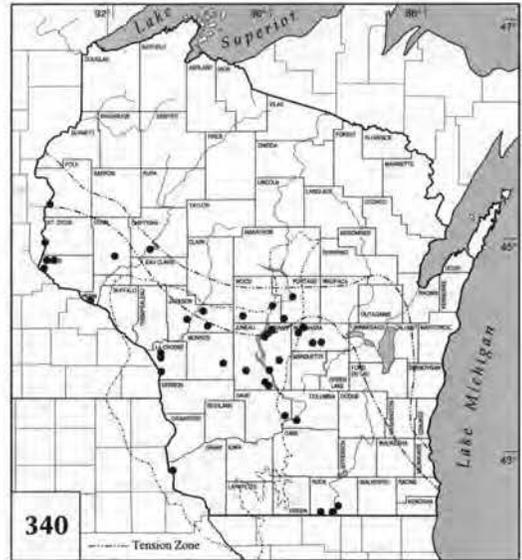


339. *Penstemon gracilis* Nutt. SLENDER BEARD-TONGUE. A Rocky Mountain (New Mexico to Alberta) and northern Great Plains element, eastward to western Wisconsin, where locally frequent in sand prairies, dry open woods (scattered pine, juniper, oak), pine or oak barrens, abandoned sandy fields, pine plantations and sandy roadsides, occasionally on cliffs and ledges. (3) Flowering from late May through July, fruiting from late June to the beginning of September.

Penstemon gracilis ssp. *gracilis* is frequent on sand, sandy loam and sandstone outcrops in far western, west-central and (rarely) southernmost Wisconsin; ssp. *wisconsinensis* (Pennell) Pennell is common on the sandy acid soils of the Central Plain, especially on the old bed of Glacial Lake Wisconsin. One of our few microendemics, it evidently originated by introgressive hybridization of the Ozarkian *P. pallidus* (342) into *P. gracilis* ssp. *gracilis*, forming a large stabilized population in central Wisconsin (Crosswhite 1965b).

340. *Penstemon grandiflorus* Nutt. [*P. bradburii* Pursh]. LARGE-FLOWERED BEARD-TONGUE. A northern Great Plains element, ranging from Texas to Nebraska and Saskatchewan, and east to Minnesota and adjoining Wisconsin, where infrequent south of the Tension Zone in dry sandy or gravelly prairies and **oak barrens**, and surviving in old cemeteries, but now mostly adventive along roadsides and in gravel pits. (1) Flowering from early June to early July, fruiting from mid June to mid August.

Unlike all of our other penstemons, this species, glorious in color and rather rare, is related to the few hundred species of the western mountains.



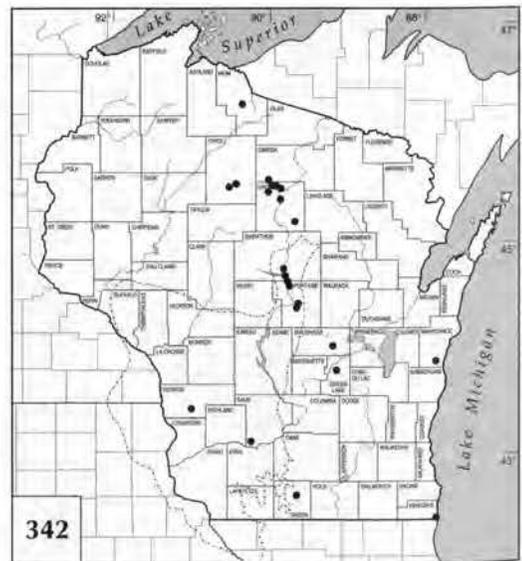
341. *Penstemon hirsutus* (L.) Willd. HAIRY BEARD-TONGUE (Special Concern). Mostly an eastern species, from northern Virginia and Tennessee to Vermont and southern Ontario, west to the Great Lakes states (northern Michigan, northern Illinois and Wisconsin); in Wisconsin local in the southeast, there now rare, in prairies and open woods on **exposed cliffs**, ravines and hillsides, usually on shallow alkaline soil underlain by glacial gravel or dolomite bedrock; in northern Wisconsin (Marinette and Vilas counties) known from waste places, and most often in ruderal sites (e.g., cement mills) even around Milwaukee, where collected by I. A. Lapham early on (1860s?), and judging from the overall geographical distribution, native there. (2) Flowering throughout June and July, fruiting from late June through July (probably late August).

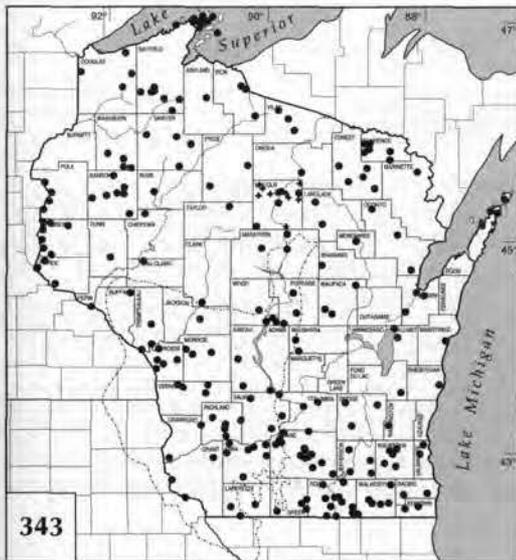
Most eastern penstemons tend to favor calcareous, somewhat disturbed sites, and *Penstemon hirsutus* is no exception.



342. *Penstemon pallidus* Small. PALE BEARD-TONGUE (Special Concern). An Ozarkian element, abundant from northern Arkansas and Missouri to southeastern Iowa and southern Illinois, scattered northward to Wisconsin, rarely adventive in the Southeast and rarely naturalized in the Northeast, to Michigan, New Jersey and Maine; in Wisconsin quite sporadic and rare, usually in full sun in dry sandy prairies, old fields and along roadsides and railroads, less often in jack pine stands and ledges in dry woods. Flowering from late May to early July, fruiting from (mid June?) early July and probably through August.

Penstemon pallidus is another beard-tongue that in Wisconsin has spread extensively in historic time (1890s) owing perhaps to its weedy propensities. As the other putative parent of *P. gracilis* ssp. *wisconsinensis* (339), it must have invaded the sand plains of Glacial Lake Wisconsin shortly after it drained, only to be swamped out genetically through local hybridization with the more abundant *P. g.* ssp. *gracilis*.

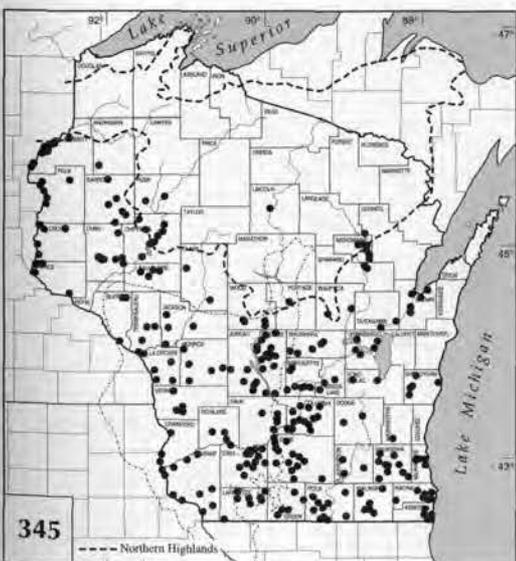




343. *Scrophularia lanceolata* Pursh. EARLY FIGWORT. Transcontinental western element, from the non-glaciated Pacific Northwest and the Rocky Mountains across the glaciated Great Lakes states to Quebec and Nova Scotia, south only in the Virginia mountains (a temperature-controlled range, fide Pennell 1935); frequent throughout Wisconsin in woods, especially in openings, at borders and along old roads, **cedar glades** [sic], clearings, edges of thickets, wooded rights-of-way, fencerows, cut-over areas, ravines, bases of cliffs and rocky banks; in loam, clay or sandy soils, often thriving where the understory has been disturbed. (6) Flowering from mid May to early August, fruiting from late June through September.



344. *Tomanthera auriculata* (Michx.) Raf. [*Gerardia a.*, *Agalinis a.*]. EARED FALSE FOXGLOVE, EAR-LEAVED GERARDIA (Special Concern). A peculiar annual hemiparasite, centering on northern Texas, eastern Kansas and Missouri, scattered and very rare beyond, from Mississippi and Alabama to southern Minnesota, southern Michigan (extirpated), and Washington, D.C. and New Jersey in the East (said to be introduced there, but old collections exist); extremely rare in Wisconsin, where known historically from four stations in Dane, Lafayette and Racine counties (none with data on exact location or habitat), and presently from two newly discovered populations on wet-mesic prairies in Walworth and Waukesha counties. Older records for this species, long thought to be extirpated in Wisconsin, presumably were from "wet meadows" as in Minnesota (Coffin & Pfannmuller 1988) or "moist prairies" as in the Chicago region (Swink & Wilhelm 1994), just about all of which have long since been plowed and turned into fields. Flowering from late August to early September.



345. *Veronicastrum virginicum* (L.) Farw. CULVER'S-ROOT. A strikingly handsome widespread herb of the eastern deciduous forest, from the Ozarks and the southern Appalachians to Minnesota, the southern Great Lakes and New England; common throughout southern and western Wisconsin, conspicuously absent from the granitic Northern Highlands, from **wet-mesic prairies** to mesic prairies, fens, oak openings, edges of moist to dry woods, occasionally on lakeshores and ditches; preferring deep loamy soil (black, clayey or sandy), often growing in partial shade. (18) Flowering from late June to August, fruiting from mid August to early October.

The only other species in this genus is *Veronicastrum sibiricum* (L.) Hara of eastern Russia, reflecting a typical ancient Arcto-Tertiary disjunction such as shown by *Trillium*, *Hydrastis* (Goldenseal) or *Podophyllum* (May-apple) and many other species.

Once called Culver's-physic in reference to its use in folk medicine.

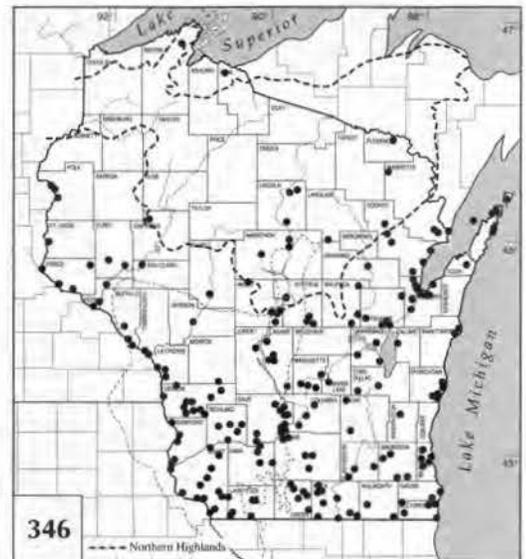


SOLANACEAE—the Nightshade Family

Plants chiefly herbaceous with mostly alternate, exstipulate leaves. Flowers typically 5-merous, generally with a persistent calyx and a saucer-shaped to tubular corolla. Stamens inserted on the tube of the corolla, the anthers occasionally forming a cone around the style, opening by terminal pores (*Solanum*) or longitudinal slits (*Lycopersicon*) or both, their pollen is “buzzed” out by bees, as in *Dodecatheon*. Pistil of 2 united carpels, maturing into a capsule (Jimson-weed, tobacco) or many-seeded berry (nightshades, tomato). (Fassett 1944b, Hawkes et al. 1979, Waterfall 1958)

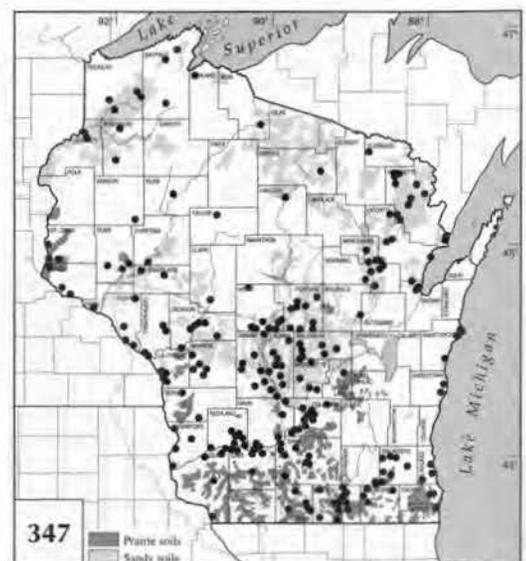
A large family (2,800 species), chiefly Latin American but world-wide in temperate and warm regions. The Solanaceae are of a leading source of foods such as the potato and eggplant (*Solanum* species), tomato (*Lycopersicon*), ground-cherries (*Physalis*) and red peppers (*Capsicum*); drugs such as belladonna and atropine (from *Atropa*), nicotine (*Nicotiana*); and many ornamentals, among them *Browallia*, *Cestrum*, *Datura* and *Petunia*.

346. *Physalis heterophylla* Nees [*P. h.* var. *ambigua*]. CLAMMY GROUND-CHERRY. Throughout much of the eastern United States and “Prairies and Plains” region, extending from Texas into southern Canada, the Rocky Mountains and the Great Basin; infrequent to locally common in Wisconsin except in the Northern Highlands (but there along U.S. Hwy. 51), mainly in mesic to **dry prairies**, adjoining open woods of jack pine or white and black oak, and cultivated and fallow fields, less common on cleared or pastured hillsides, embankments, fencerows, roadsides, railroads and other disturbed habitats. (9) Flowering from early June to the end of August, fruiting from early September to early October.



347. *Physalis virginiana* Mill. VIRGINIA GROUND-CHERRY. Widely distributed in North America, most common in the eastern and central United States, especially on the eastern Great Plains, ranging into Canada and the central Rocky Mountains; in Wisconsin occasional to locally abundant (our most common *Physalis*), especially in dry sandy prairies and other ecologically open habitats such as high lime prairies, gravel hill prairies, jack pine-black oak **barrens**, steep hillsides, open ridge tops and sandstone outcrops, also mesic prairies and inner beaches and dunes on Lake Michigan; often weedy in abandoned sandy fields and along sandy or gravelly roadsides and railroads. (14) Flowering from late May to early September, fruiting from early July to mid November.

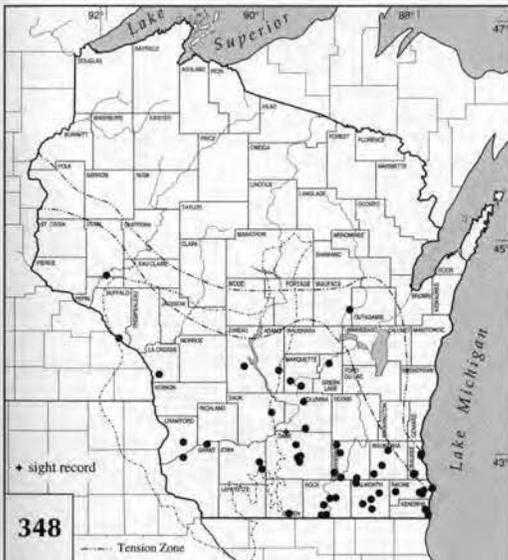
A widespread but mostly western taxon, *Physalis longifolia* Nutt. var. *subglabrata* (Mack. & Bush) Cronquist [*P. virginiana* var. *subglabrata*], Smooth Long-leaf Ground-cherry, is found in Wisconsin in prairies but more often in pastures, fields and cultivated and waste ground.



VALERIANACEAE—the Valerian Family

A medium-sized family of herbs, largely of north temperate regions but well-represented in the Andes and other neotropical mountains, with opposite, often pinnately divided leaves, these (especially when dry) with the characteristic rank odor of valerianic acid (this also in *Penstemon*, of the unrelated Scrophulariaceae). Flowers many, usually crowded into cymose inflorescences (flat-topped clusters in which the terminal, rather than the lower, flowers bloom first), with 5 petals united into a tube upon which are borne 3 stamens, and an inferior ovary composed of 3 united carpels, the single fertile carpel maturing into an achene often dispersed by a parachute-like ring of several to many plumose segments derived from the calyx. (Ferguson 1965, Meyer 1951)

Medicinal extracts from roots and leaves of *Valeriana* (its 200 species constitute two-thirds of the family) are used for nervous and cardiac complaints.



348. *Valeriana edulis* Nutt. ex Torr. & A. Gray. VALERIAN. A montane to subalpine cordilleran element throughout the western mountains (British Columbia to northern Mexico), the Black Hills, and, disjunct, from the southeastern corner of Minnesota to southern Ontario and Ohio; in Wisconsin rare to locally common south of the Tension Zone, confined to calcareous prairies, wet or dry, and **fens** (as in the low grass-edge meadows of Endeavor Marsh and Ennis Lake, Marquette County, and Briggs Wetland, Rock County), dense, rich, mesic to moist prairies (as at Kessler Road, Rock County, and Carol Beach, Kenosha County), dry-mesic to dry limy prairies on north- or northeast-facing slopes of knolls, bluffs and gravelly hills. (4) Flowering from mid June to mid August, fruiting from mid August to early October.

Our eastern population is usually as segregated as *ssp. ciliata* (Torr. & A. Gray) F. G. Mey. [*V. e.* var. *c.*], but the morphological basis and ecological grounds that supposedly distinguish it from *ssp. edulis* in the West are unsubstantial.



Dewey Heights State Natural Area, Grant County, Wisconsin, overlooking the Mississippi River bottoms



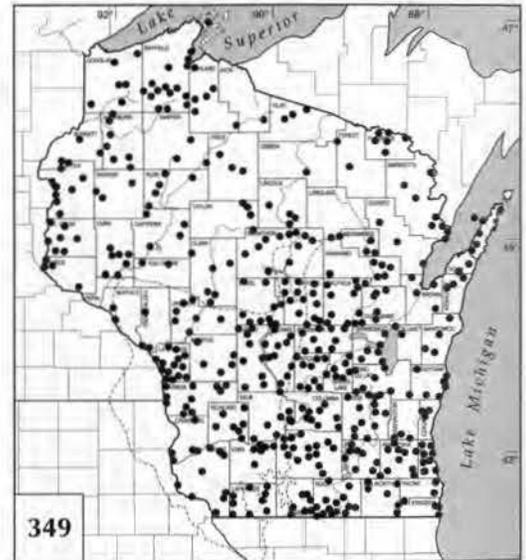
VERBENACEAE—the Vervain Family

Trees, shrubs or (ours) herbs, usually not aromatic, with opposite or whorled leaves and mostly 4-angled stems. Flowers typically small and somewhat irregular, with colorful tubular corollas, usually attracting bees and flies. Ovary basically 2-celled but typically appearing 4-celled due to the intrusion of false partitions (1-celled and ripening into an achene in *Phryma*, sometimes included within the Verbenaceae); style strictly terminal. Fruit fleshy with 2 or 4 stones or splitting at maturity into 2 or 4 nutlets. (Tans & Iltis 1980)

Mostly tropical and subtropical, with only a limited number of temperate representatives. *Verbena*, Vervain and *Lantana* contain ornamental herbs, shrubs and climbers. Modern taxonomists have transferred two-thirds (three former subfamilies) of the conventional Verbenaceae to the Lamiaceae *sensu lato*, leaving a very narrowly defined Verbenaceae. Major differences between the Verbenaceae and the newly enlarged Lamiaceae include inflorescence structure and details of ovule attachment, pollen-wall anatomy and hair type.

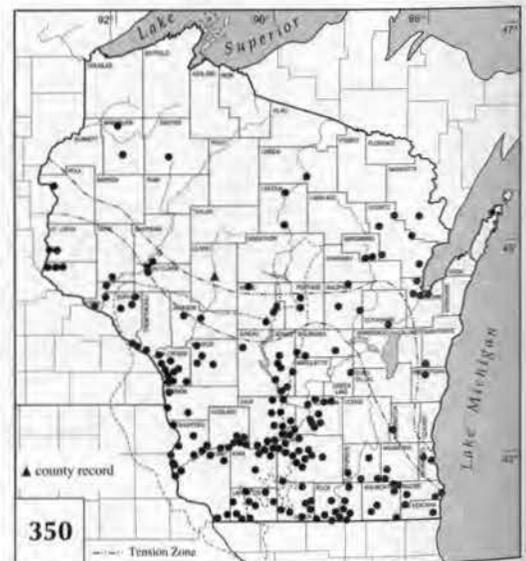
349. *Verbena hastata* L. BLUE VERVAIN. Ubiquitous throughout the Great Plains (Texas to Canada), but also sporadic in the West and rare in the Southeast; in Wisconsin very common in moist sunny habitats such as marshes, **northern sedge meadows**, stream edges, lakeshores, shrub-carrs, low prairies, sedge meadows and rarely in moist forests, tolerating much habitat disturbance, hence common in heavily grazed pastures, roadsides and railroad rights-of-way and occasionally abandoned sandy fields. (7) Flowering from late June to September, fruiting from early July to mid October.

Our native *Verbena* species are all wide ranging, sympatric diploids interfertile with one another. *Verbena hastata* hybridizes frequently with *V. urticifolia* L. to form *V.* × *engelmannii* Moldenke, Engelmann's Vervain.



350. *Verbena stricta* Vent. HOARY VERVAIN. A native of the Great Plains' prairies and steppes, from northern Mexico and Texas to the Dakotas, southern Minnesota, Ohio and Ontario; in Wisconsin mostly south of the Tension Zone in various sunny habitats such as xeric and sandy **dry prairies**, limy or "goat prairies," abundant in heavily grazed, sandy or gravelly pastures and abandoned fields, less frequently in open oak or oak-jack pine woods, roadsides and railroad rights-of-way; northern stations probably adventive. (6) Flowering from late June to early October, fruiting from early July to October.

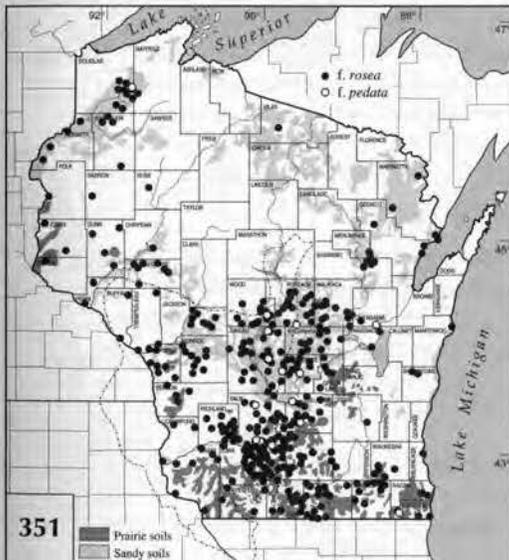
Hybridizes frequently with *Verbena hastata* (349) to form *V.* × *rydbergii* Moldenke, Rydberg's Vervain.



VIOLACEAE—the Violet Family

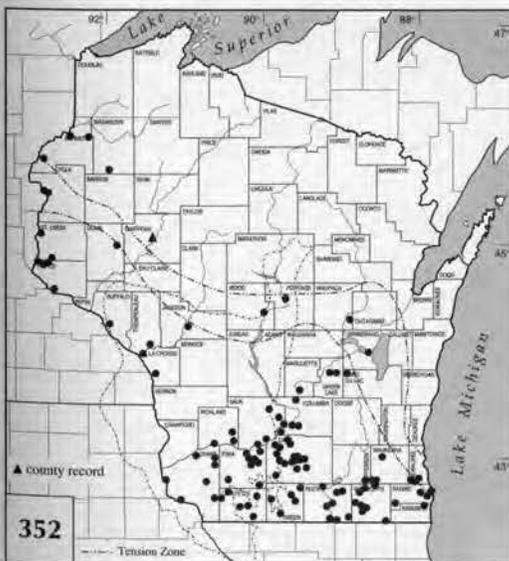
Herbs (temperate species) to shrubs or small trees, with usually alternate or basal leaves with minute or leafy basal appendages (stipules). Flowers solitary and strongly bilaterally symmetrical in our genera, with 5 sepals and 5 petals, the lowest petal often spurred and larger than the others. Stamens 5, standing together or sometimes grown together into a ring closely surrounding the single pistil, the filaments very short or lacking but with broad zones of tissue connecting the pollen-sacs. Ovary 1-celled; style flexuous, the stigma variously shaped. Fruit an explosively dehiscent, 3-valved capsule (ours) or a berry, the seeds often with an appendage (caruncle) associated with dispersal by ants. (Ballard 1994; McKinney 1992; Russell 1960, 1965)

A cosmopolitan family, with about half the species belonging to *Viola* (400 species plus numerous hybrids), Violet and Pansy, whose characteristic flowers are highly specialized for insect pollination (or the showy flowers may be sterile). Many species of *Viola* and *Hybanthus*, Green Violet, also bear inconspicuous or even subterranean bud-like "closed" (cleistogamous) flowers that, self-pollinating, are more fruitful than the normal flowers.



- 351. *Viola pedata* L. BIRD'S-FOOT VIOLET.** Widespread in the eastern United States, from Florida and Texas north to Vermont, the Canadian border and southeastern Minnesota; common in southern and central Wisconsin but lacking from the Northern Highlands and the Niagara Uplands, in dry, sandy, gravelly or rocky prairies, on sandstone cliffs and ridges, limestone bluffs and quartzite or granite outcrops; also in well-drained open oak and/or pine woodlands, black oak savannas, jack pine barrens, **cedar glades**, open oak-hickory woods and pine plantations, often thriving in open sandy areas such as abandoned fields, hillsides, roadsides, banks and sand blows. (14) Flowering mostly from late April to mid June (irregularly into October), fruiting from mid May to September.

Nearly all our specimens are *f. rosea* Sanders, with concolorous corollas (all five petals light violet or lilac-purple). The strikingly beautiful, almost bizarrely bicolored *f. pedata* (the lower three petals light blue-violet, the upper pair very dark velvety purple) is rare and local in Wisconsin.

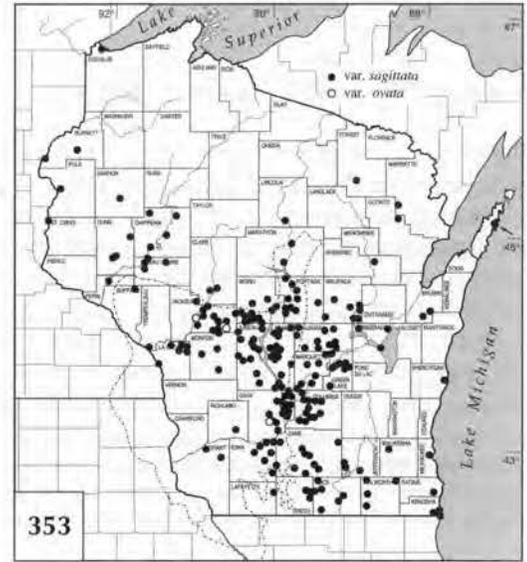


- 352. *Viola pedatifida* G. Don [*V. palmata* var. *p.*]. PRAIRIE VIOLET.** A mesic prairie species, widespread on the Great Plains from Oklahoma to Manitoba, east in the Prairie Peninsula to Minnesota and northern Ohio; in Wisconsin locally frequent south of the Tension Zone, from steep rocky dry prairies with sandstone or limestone cliffs, through xeric sand, high lime and gravel-hill prairies to rich deep black-soil **mesic prairies**, often in oak savannas, open sandy hillsides, fields, banks and borders of woods, sometimes in grazed oak woods and red cedar stands. (9) Flowering from late April to early June, fruiting from mid June to mid October.

Less common than *Viola pedata*, with which it may grow and be confused because of its divided leaves. *Viola pedatifida* is considered by some to be conspecific with *V. × subsinuata* (*V. palmata* of authors; see 354) based on apparent intergradation between the two in the Great Lakes region. However, *V. pedatifida* is distinct and is maintained as a separate species by Russell (1965), McKinney (1992) and Ballard (1994).

353. *Viola sagittata* Aiton. ARROW-LEAVED VIOLET. Throughout the eastern United States, from Georgia to Texas and southeast Kansas, north to eastern Minnesota and Maine; widespread in southern Wisconsin in the boggy to dry, sandy Central Plain, locally frequent to abundant in **oak barrens** and similar dry woods and savannas (i.e., oak, oak with jack pine, hickory or white birch, red cedar), as well as on edges of low woods; also in dry to wet-mesic prairies, old fields, pastures, sandstone cliffs, granite outcrops, low sandy to peaty meadows, swales, shores and ditches, rarely weedy on road shoulders. (9) Flowering from late April to mid July, fruiting from late May to October.

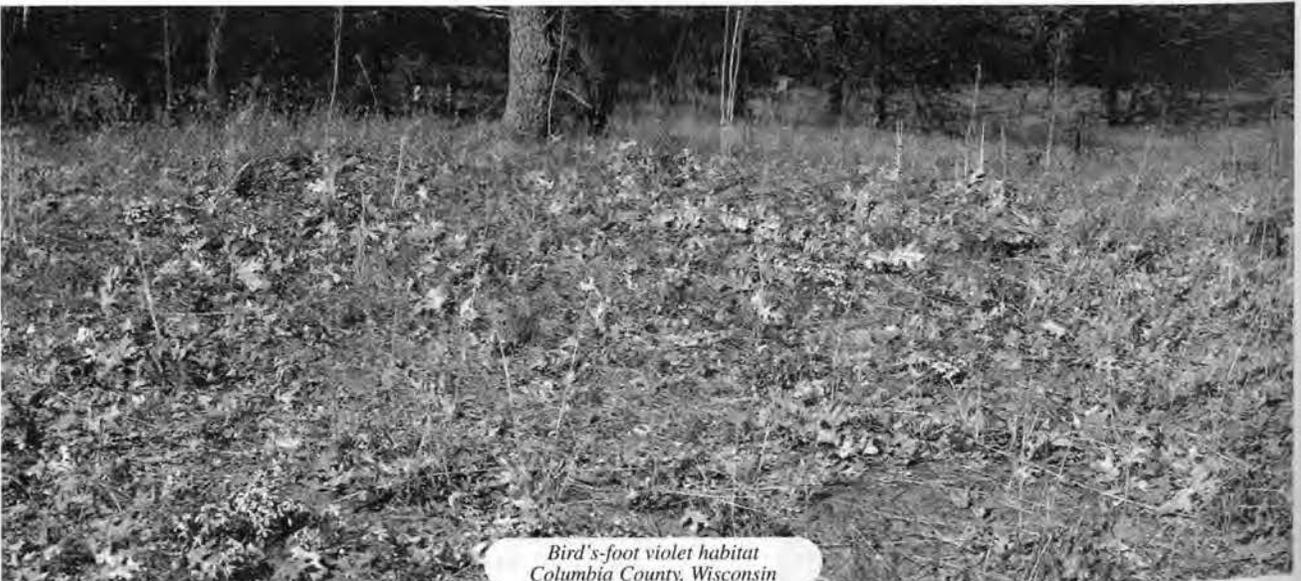
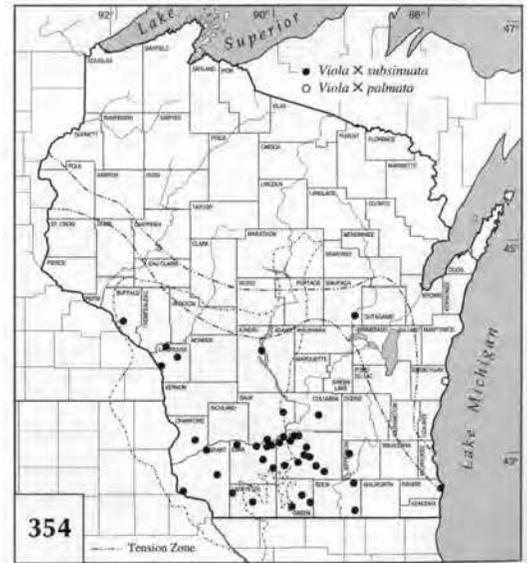
Viola sagittata is here treated as a single variable species (McKinney 1992, Ballard 1994), with nearly all of our specimens placed in a broadly defined, widely distributed var. *sagittata*. The more narrowly delimited, mostly Appalachian var. *ovata* (Nutt.) Torr. & A. Gray [*V. fimbriatula*] (Endangered), is represented in Wisconsin by only three collections.



354. *Viola* × *subsinuata* (Greene) Greene [*V. pedatifida* × *V. sororia*; *V. palmata* of authors, not L.]. EARLY BLUE VIOLET, LOBED VIOLET. Eastern United States; occasional in Wisconsin south of the Tension Zone in dry to low prairies, savannas and prairie-forest ecotones such as dry sandy or limy prairies, dry-mesic high prairies, open or wooded sandy hillsides and limestone bluff tops with mixtures of prairie and forest species, oak openings, and deciduous woods and thickets. Flowering in May.

This taxon is accepted either as the distinct species *V. subsinuata* (McKinney 1992) or as a hybrid of *V. pedatifida* with *V. sororia* (Ballard 1994). It is usually found with *Viola pedatifida* (352) and near *V. sororia* Willd., the Woolly Blue Violet, and is most prevalent in open oak woods adjacent to prairies and in brushy growth that has sprung up on the open prairies. True *Viola* × *palmata* L. [*V. sagittata* × *V. sororia*], Three-lobed Violet, has been collected once in Wisconsin at Sheboygan.

Other violets that may occur in moist prairies include *Viola affinis*, *V. cucullata*, *V. nephrophylla* and *V. sororia*.



Bird's-foot violet habitat
Columbia County, Wisconsin

APPENDIX A

Excluded Prairie and Savanna Species

Eight species are excluded from this atlas. Six (•) are apparently spontaneous but non-native introductions, and two (§) are not known to occur in Wisconsin. Some of these plants are being used in landscape plantings, along with cultivars of Black-eyed Susan (*Rudbeckia hirta*) and Lance-leaf Tickseed (*Coreopsis lanceolata*).

- *Cirsium undulatum* (Nutt.) Spreng., WAVY-LEAVED THISTLE, is a Great Plains species, the natural range of which is usually reported as being from Minnesota to Missouri and westward. Rarely adventive farther east, it was reported from five Wisconsin counties by Johnson and Iltis (1963).
- *Echinacea purpurea* (L.) Moench, PURPLE CONEFLOWER, is native in the Midwest but to the south of Wisconsin. An all-time favorite of wildflower gardeners, it was first collected as an escape in 1951 in Dane County, and other Wisconsin records all seem to represent rare escapes from cultivation or wildflower plantings, as is the case in the Curtis Prairie at the U. W. Arboretum, Madison, where it is common.
- *Filipendula rubra* (Hill) Robinson, QUEEN-OF-THE-PRAIRIE, has been found in widely scattered locations in Wisconsin, but with one exception all Wisconsin collections are recent and certainly represent escapes from cultivation. There are no confirming specimens from southeastern Wisconsin, where its fen habitat occurs. The lack of information on the label of one old specimen, collected at Mazomanie, Dane County, in 1865, possibly by T. J. Hale, make it doubtful that this record should be accepted even as an escape, let alone a natural population (cf. Mason & Iltis 1958).
- § *Gentiana saponaria* L., SOAPWORD GENTIAN, is a widespread eastern species that has sometimes been reported as occurring in Wisconsin in standard floristic manuals. Such reports were based upon misidentifications of plants resulting from *G. andrewsii* × *G. puberulenta* crosses (Mason 1959). We have seen no specimen apart from these hybrids, and the distribution of this gentian as given by Gleason and Cronquist (1991) or Pringle's revision (1967; cf. also Pringle 1964, Mason & Iltis 1965) does not suggest that it ranges as far north as Wisconsin.
- *Grindelia squarrosa* (Pursh) Dunal, GUMWEED, represented with us by var. *squarrosa* and var. *serrulata* (Rydb.) Steyerl., is quite clearly introduced in Wisconsin as elsewhere in this region, its natural distribution ranging from Minnesota to Texas and westward (Fernald 1950; Wetter pers. comm.). Fairly well naturalized in Wisconsin, it almost always occurs in ruderal habitats but rarely also in ecologically open, dry, gravelly prairies.
- *Helianthus mollis* Lam., SOFT or DOWNY SUNFLOWER, is a southern and southeastern species that should no doubt be regarded as adventive. Our few herbarium collections were made along railroads and roadsides in four eastern and northern counties in the early decades of this century.
- § *Lilium superbum* L., TURK'S-CAP LILY, is native well south of our region. The Wisconsin *Lilium* is usually recognized at the rank of species as *L. michiganense* Farw. Although it was once considered a subspecies of *L. canadense* L., Gleason combined *L. michiganense* with *L. superbum* under the latter name, and Curtis (1959) also called our plants *L. superbum*. The three taxa are certainly closely related.
- *Ratibida columnifera* (Nutt.) Wooton & Standl., LONG-HEADED CONEFLOWER, is abundant on prairies and open ground throughout the Great Plains. Native from Minnesota to Alberta and south into Mexico (Fernald 1950, Gleason & Cronquist 1991), it is here adventive in abandoned fields, gravel pits, railroad yards, and waste ground generally, but also rarely in ecologically open, dry sand prairies.

APPENDIX B

Native Plant Nurseries

The following companies, organizations, and individuals may be able to provide seeds or plants native to Wisconsin or the Midwest. Except as noted, seeds and plants are generally nursery grown. Some companies may also provide consultation, design, landscape installation, and/or maintenance services.

There are several arguments for buying seed and stock from reputable suppliers, as opposed to indulging in the destructive practice of native plant exploitation and collection. Haphazardly moving plants from one location to another contaminates geographical distribution data with artificial range extensions. Moreover, much debate and controversy hinges on the genetic implications of using local ecotypes versus plants of different provenance in plantings and restorations. Genes of the introduced populations may pollute local gene pools and can lead to the phenomenon called "genetic swamping." To protect local gene pools when restoring or re-creating a natural area, be it a large-scale restoration or backyard garden, or to control erosion or enhance forage, it is best to obtain seeds or plants from within or as close as possible to the project site. Furthermore, local sources often possess genotypes that are adapted to the local environment, leading to higher short-term and long-term success rates. To prevent the local extinction of marketable species, native plants should be bought, not dug, and if possible, these plants should be derived from sources that are within a 50-mile radius of the site. If a nursery cannot state that its plants are "nursery propagated," then they may have been collected in the wild. Always ask about their origin when purchasing nursery-propagated plants and seeds. Stocks originating from outside Wisconsin, say from Texas, Nebraska, or North Dakota, generally should not be used, except that Minnesota or northern Illinois populations may be more closely related to those in the project area than populations from farther away in Wisconsin. Landscapers and restorationists have a responsibility to help preserve the genetic structure of the different wild ecotypes or "ecovars" by having knowledge of where, precisely, their plants and seeds originate—and to keep records of major outplantings.

This list was compiled by the Bureau of Endangered Resources, Wisconsin Department of Natural Resources (DNR), and does not imply any endorsement or recommendation by the DNR, or by the Department of Botany, University of Wisconsin. Revisions or additions should be sent to BER, DNR, P.O. Box 7921, Madison WI 53707 (Attn: Kelly Kearns).

Nurseries That Primarily Carry Plant Material Native to Wisconsin

- Agrecol** wholesales seeds and plants of more than 100 species of prairie, wetland, and savanna species. Their nursery stock is from native Wisconsin genotypes. They are continually adding new species. Contact: Steve Banovetz, 1984 Berlin Road, Sun Prairie, WI 53590. 608-825-9765.
- Applied Ecological Services, Inc./TaylorCreek Nursery** has prairie, woodland, and wetland plants for use in restoration projects. They do ecological research and consulting, site design preparation, planting, and management. Contact: Steve Apfelbaum, Route 3, Smith Road, P.O. Box 256, Brodhead, WI 53520. 608-897-8547.
- Bluestem Farm** provides consultation, plants, and services primarily in Baraboo area, no mail order. We specialize in custom propagation of difficult species, including orchids. Contact: Martha Barrett and Scott Weber, S5920 Lehman Road, Baraboo, WI 53913. 608-356-0179.
- Boehlke's Woodland Gardens** supplies prairie grasses and forbs, also wetland and woodland plants. Contact: Boehlke's Woodland Gardens, 5890 Wausaukee Road, West Bend, WI 53095. 262-876-2598.
- Country Road Greenhouse** is a wholesale grower specializing in containerized prairie and wetland forbs, grasses, and sedges. Contact: 19561 East Twombly, Rochelle, IL 61068. 815-384-3311.
- Enders Greenhouse** propagates over 200 species of native woodland, prairie, and wetland plants for retail or large contracts. Plant list available. Contact: Anne Meyer, 104 Enders Drive, Cherry Valley, IL 61016. 815-332-5255, FAX: 815-332-5255.

- Genesis Nursery** carries seeds (and some plants) for over 400 prairie, wetland, and savanna species and containerized plants for about 100 species. Northwest Illinois ecotypes. Also provides consultation, restoration, and planting. Contact: Dennis Lubbs, 23200 Hurd Road, Tampico, IL 61283. 815-438-2220, FAX: 815-438-2222.
- Inn Exchange** specializes in selling prairie, wetland, and savanna seeds and plants native to Wisconsin, Illinois, Iowa, and the general Driftless Area. Contact: Howard and Donna Bright, 1878 Old Mission Drive, Harpers Ferry, IA52146. 319-535-7231, FAX: 319-535-7362.
- Kettle Moraine Natural Landscaping** specializes in locally gathered prairie seeds from east-central Wisconsin. They do consulting, provide custom seed mixes, and have experience with residential, school, and commercial sites. Contact: Connie Ramthun, W996 Birchwood Drive, Campbellsport, WI 53010. 920-533-8939.
- Landscape Alternatives** offers 150 species of prairie, wetland, and woodland plants (no seeds). Catalog is \$2.00. Contact: Roy Robinson, 1705 Albans Street, Roseville, MN 55113. 612-488-3142.
- Little Valley Farm** carries both seeds and plants of many native species of grasses, forbs, shrubs, trees, and vines. Contact: Barbara Glass, Route 3, Box 544, Snead Creek Road, Spring Green, WI 53588. 608-935-3324.
- Midwest Wildflowers** can supply over 100 species of wildflower seeds. Catalog \$1.00. Contact: Leroy Busker, Box 64, Rockton, IL 60172.
- Murn Environmental, Inc.** carries a wide range of seeds and plants for wetland, woodland, and prairie species. They also do restoration, design, planting, management, and research. Contact: Tom Murn, 11643 East Minkey Road, Darien, WI 53114. 262-676-4709, FAX: 262-676-5744.
- Native Plants** fills a unique niche in the native plant industry. They work with local highway departments, developers, and others to salvage native plants from areas where they would otherwise be destroyed. Plants are then used at the site or are available for other projects. Persons interested in purchasing plants can call to place an order for desired plant species or to check on what is currently in stock. Contact: Brad Mrzlak, 22 Langdon Street, Madison, WI 53703. 608-259-0995.
- Oak Prairie Farm** produces Wisconsin Crop Improvement Association certified native prairie seeds and also performs consultation and installation services. Contact: Jim Heinrich, W4642 Highway 33, Pardeeville, WI 53954. 608-429-3882.
- Prairie Future Seed Co.** can supply a wide range of prairie seeds native to Wisconsin. They also do consultation and restoration projects. Contact: Randy R. Powers, P.O. Box 644, Menomonee Falls, WI 53052. 262-246-4019.
- Prairie Moon Nursery** carries seeds and plants of over 400 prairie, wetland, and woodland plant species native to Wisconsin, Minnesota, Illinois, and Iowa. Contact: Alan Wade, Route 3, Box 163, Winona, MN 55987. 507-452-1362, FAX: 507-454-5238.
- Prairie Nursery** has both seeds and plants of many native prairie species as well as some wetland and woodland seeds and plants. They provide an array of consulting services, including: site evaluation, planting design, site preparation, planting, and post-planting management for sites of all sizes. Contact: Neil Diboll, P.O. Box 306, Westfield, WI 53964. 608-296-3679.
- Prairie Restorations, Inc.** specializes in restoration and maintenance of prairies. Retail sale of prairie plants is done mail order or at their nursery northwest of Minneapolis. Contact: Ron Bowen, P.O. Box 327, Princeton, MN 55371. 612-389-4342 (office), 612-389-5733 (nursery).
- Prairie Ridge Nursery/CRM Ecosystems, Inc.** has prairie, wetland, and woodland seeds and plants. They are also available for consulting, planning, planting, and management services for projects of all sizes. Contact: Joyce Powers, RR 2 9738 Overland Road, Mt. Horeb, WI 53572. 608-437-5245.

- Prairie Seed Source** sells local southeast Wisconsin seeds of more than 150 prairie and savanna species, including mixes suited to the soil moisture regime of your project. They can also give slide presentations and provide consulting services. Contact: Robert Ahrenhoerster, P.O. Box 83, North Lake, WI 53064-0083. 262-673-7166.
- Reeseville Ridge Nursery** deals mainly with native trees and shrubs, and specializes in custom propagation of woody plants. Contact: Darrell J. Kromm, P.O. Box 171, 309 South Main Street, Reeseville, WI 53579. 920-927-3291.
- Retzer Nature Center**, as a service of Waukesha County Parks, supplies native prairie, woodland, and wetland plants and seeds for sites within 50 miles from the Waukesha County line. They specialize in prairie mixes and can provide technical assistance on restoration projects. Contact: Jerry Schwarzmeier, W284 S1530 Road DT, Waukesha, WI 53188. 262-521-5407.
- Rohde's Nursery** supplies woodland, wetland, and prairie plants; also provides a complete design service along with the ability to install/build any size project, and help with consultation and restoration. Contact: Lenn Rohde, N8098 Duck Creek Avenue, Neshkoro, WI 54960. 920-293-4373.
- Wehr Nature Center** can provide persons in southeast Wisconsin with prairie seeds and instructions for small scale prairie gardening. Contact: Wehr Nature Center, 9107 West College Avenue, Franklin, WI 53132. 414-425-8550.
- Wood's Edge** sells woodland wildflowers grown from seeds from Grant County. We prefer to sell plants or bareroot stock. Contact: Bernie Galgoci or Martha Peterson, 532 Stanek Road, Muscoda, WI 53573. 608-739-3527, E-mail: woodedge@mwt.net.

Nurseries That Carry Native Midwestern Plants, Non-Native, and/or Wild-dug Plants

The following companies sell plants native to the Midwest but not specifically from Wisconsin or the surrounding region. People who want only native species when creating their very own piece of prairie, woodland, or wetland should be aware that many of these nurseries and seed farms also sell non-native species. So-called "native" grasses, e.g., Sheep Fescue (*Festuca ovina*) and Sand Lovegrass (*Eragrostis trichodes*), and "native" wildflowers, e.g., Blanket-flower (*Gaillardia* spp.), Purple Coneflower (*Echinacea purpurea*), Blue Wild-indigo (*Baptisia australis*), Blue Flax (*Linum lewisii*), etc., may not be native to Wisconsin at all, even though they may occur naturally in other parts of the Midwest or North America. Even if they are attractive in gardens, they should not be used if you want to create a true prairie setting or add authentic native prairie plants to a traditional perennial garden. Use discretion when selecting plants from these nurseries, or ask for plants that came from your area. Several of the following companies sell plants collected from the wild. This is indicated in the nursery description where known.

- Allendan Seed** is an Iowa-based company that offers seeds for a variety of landscaping projects. Contact: Allendan Seed, Route 4 Box 625, Winterset, IA 50273. 515-462-1241.
- Aquatic Resources and Glacial Pond Farms** is a source of both grasses and forbs for prairie plantings, as well as vegetation for wetland landscaping. Contact: Aquatic Resources and Glacial Pond Farms, P.O. Box 2221, Wausau, WI 54402. 715-845-2099.
- Bauer's Garden Center** carries a complete line of garden supplies, as well as a wide selection of wildflowers, all available for sale in 4 1/2 inch pots. Contact: Bauer's Garden Center, 1559 West Forest Home Avenue, Milwaukee, WI 53204. 414-384-7995.

- Bayside Garden Center** is a source for both grasses and forbs of the prairies, as well as wetland and woodland plants. Contact Bayside Garden Center, 400 East Brown Deer Road, Milwaukee, WI 53217. 414-352-6159.
- Berthold Nursery** has a variety of native trees and shrubs. Contact: Rick Repenning, 4510 Dean Street, Woodstock, IL60098. 815-338-4914, 708-439-2600.
- Cascade Forest Nursery** carries woodland plant species. Contact: Cascade Forest Nursery, Route 1, Cascade, IA52033. 319-852-3042.
- Cold Stream Farm** can provide both wetland and woodland plants. Contact: Cold Stream Farm, 2030 Free Soil Road, Free Soil, MI 49411-9752. 616-464-5809.
- Deltor Tree Farm** carries woodland species. Contact: Deltor Tree Farm, Box 6 County P, Plainfield, WI 54966. 715-335-4444.
- Evergreen Nursery Co., Inc.** specializes in woodland plants. Contact: Evergreen Nursery Co., Inc., 5027 County TT, Sturgeon Bay, WI 54235. 920-743-4464.
- The Flower Factory** has an extensive selection of native, non-native, and ornamental plants. Contact: David or Nancy Nedveck, 4062 Highway A, Stoughton, WI 53589. 608-873-8329.
- Glen Flora Nursery** can provide prairie forbs and wetland and woodland plants. Contact: Glen Flora Nursery, 8407 Glen Flora Road, Kiel, WI 53042. 920-773-2493.
- Great Lakes Nursery Co.** grows select native seedlings and transplants of northern trees, shrubs, and some herbaceous plants, non-natives, and cultivars. Contact: Tim Gutsch, 1002 Hamilton Street, Wausau, WI 54403. 715-845-7752.
- A Growing Concern** is a source for seeds and plants of woodlands. Contact: A Growing Concern, 4990 West Donna Drive, Brown Deer, WI 53223. 414-354-1638.
- H & R Nursery, Inc.** carries woodland wild flowers and ferns in addition to horticultural species. They do not sell seeds or mail order their plants. Contact: Dale Rickert, 6520 West Silver Spring Drive, Milwaukee, WI 53218. 414-466-6289.
- Hauser's Superior View Farm** has a large selection of northern-grown perennials and biennials, a few of which are species native to Wisconsin. They have a minimum order of \$25.00. Contact: Jim Hauser, Route 1, Box 199, Bayfield, WI 54814. 715-779-5404.
- Hild & Associates** offers seeds and bareroot material propagated in their nursery from nearby seed sources. They do some consultation and installation and are members of the MN Erosion Control Association, The Vegetation Management Association of MN, and the MN Native Seed and Plant Producers Association. Contact Hild & Associates, 326 Glover Road South, River Falls, WI 54022. 715-426-5131 or 1-800-790-9495, FAX: 715-426-9887, E-mail: ghild@skypoint.com / Website: www.hildnatives.com.
- Itasca Greenhouse, Inc.** grows tree seedlings. Most species are grown to plantable size in less than one year. Custom and contract growing services are available to our customers who want specific trees grown. Contact: Itasca Greenhouse, Inc., P.O. Box 273, Cohasset, MN 55721. 218-328-6261 or 1-800-538-TREE, E-mail: igtrees@northernnet.com.
- J and J Tranzplant** specializes in nursery propagated native as well as non-native aquatic plant material. Available bareroot, 2" plugs to one gallon pots. They also carry a large selection of aquatic seeds native to central WI. 65% of material is nursery-propagated and 35% is collected from the wild. Consulting and planting on a limited basis, 42-page catalog available. Contact: James and Kristine Malchow, P.O. Box 227, Wild Rose, WI 54984-0227. 920-622-3552 or 1-800-622-5055, FAX: 920-622-3660.

- Johnson's Nursery Inc.** are growers of a wide selection of balled and burlapped landscape plants. This diverse selection includes many native trees, shrubs, and vines. Contact: Bill Reichenbach, WI80 N6275 Marcy Road, Menomonee Falls, WI 53051. 262-252-4988.
- Jung Seeds Co.** has a brochure which pictures all the prairie grasses and wildflowers they carry. Most seeds and plants sold without regard to genetic source. Contact: L. L. Olds Seed Co., P.O. Box 77990, Madison, WI 53707. 608-249-9291.
- Kester's Wild Game Food Nurseries, Inc.** carries native wetland species as well as non-native species for wildlife plantings. They carry both wild-collected and nursery-grown stock. Contact: Dave and Patricia Kester, P.O. Box 516, Omro, WI 54963. 920-685-2929.
- Laura's Lane Nursery** is a supplier of woodland plants. Contact: Laura's Lane Nursery, Box 232, Plainfield, WI 54966. 715-366-2477.
- Lodholz North Star Acres, Inc.** specializes in woodland plants. Contact: Lodholz North Star Acres, Inc., 420 Highway A, Tomahawk, WI 54487. 715-453-2976.
- Marshland Transplant Aquatic and Woodland Nursery** sells plants and seeds of aquatic, woodland, and prairie species. Some plants and seeds are wild collected. Contact: Tom Traxler, P.O. Box 1, Berlin, WI 54923. 920-361-4200.
- Midwest Aquatics** specializes in propagated and wild-collected native wetland and aquatic species and custom harvest of seeds. Contact: Douglas Nelson, Route 360-5, Wautoma, WI 54982. 920-787-3282.
- Milaeger's Gardens** carries some prairie grasses and wildflowers in addition to ornamentals. Contact: Milaeger's Gardens, 4838 Douglas Avenue, Racine, WI 53402-2498. 262-639-2371.
- Miller Nurseries** has both prairie forbs and woodland plant species. Contact: Miller Nurseries, P.O. Box 66, Germantown, WI 53022. 262-628-9588.
- Mohn Frontier Seed Company** is a family-owned business in southwestern Minnesota offering wildflower seeds and plants as well as a variety of prairie grasses. Products are suited to prairies, woodlands, and/or wetlands, and are native to Minnesota. Contact: Mohn Frontier Seed Company, Route 1 Box 152, Cottonwood, MN 56229. 507-423-6482, FAX: 507-423-5552.
- The Natural Garden** carries many varieties of native and non-native wetland, prairie, and woodland plants and has landscape design and construction services available. Contact: The Natural Garden, 38W443 Highway 64, St. Charles, IL60174. 708-584-0150.
- Oasis WaterGardens** sells aquatic plants and supplies for water gardens and aquariums. Contact: Jerry Ray, 2968 Pine Tree Road, Oneida, WI 54155. 414-869-1085.
- Orchid Gardens** has wildflowers, ferns, and shrubs indigenous to northern Minnesota. There is a fee for consultation. Contact: Carl A. Phillips, 2232 139th Avenue NW, Andover, MN 55304.
- Osenbaugh Grass Seeds** is a seed supplier for grasses and forbs of the prairie. Contact: Osenbaugh Grass Seeds, RR #1 Box 44, Lucas, IA50151. 515-766-6476 or 1-800-LUCAS88.
- Prairie Frontier** carries over 100 different native and naturalized wildflower and prairie grass seeds, and specializes in large planting projects. Native prairie, meadow, and butterfly mixes as well as 10 other mixes containing some non-native species are available. Mixes and individual species can be purchased in bulk; seeds are generally sold wholesale to developers, landscapers, nurseries, and garden centers or retail through outlet stores or our website at <http://www.prairiefrontier.com>. Contact Jim and Deb Edlhuber, W281 S3606 Pheasant Run, Waukesha, WI 53188. 262-544-0159, FAX: 262-544-6708, E-mail: wildflower@prairiefrontier.com.
- Prairie Grass Unlimited** can provide both prairie and wetland plants. Contact: Prairie Grass Unlimited, P.O. Box 59, Burlington, IA 52601.

Shady Acres Nursery offers an extensive line of perennials and grasses, some of which are native. Contact: Jim Garbe, 5725 S. Martin Road, New Berlin, WI 53146. Catalog available for \$3.00. 262-679-1610.

Smith Nursery Co. sells wholesale native and non-native shrubs, vines, and trees in multiples of 5 and 10. Seeds are also available. Extensive selection in catalog. Contact: Bill Smith, P.O. Box 515, Charles City, LA50616. 515-228-3239.

Sound Solutions provides plants, trees, and seeds for the restoration needs of its clients. It has 70 acres of land devoted to propagating native wetland, prairie, and woodland species, providing customers with seeds, plugs, and bareroot stock to aid in the completion of successful projects. Contact: Daniel Zay, 708 Roosevelt Road, Walkerton, Indiana 46574. 219-586-3400, FAX: 219-586-3446.

Specialty Seeds sells wholesale bulk and mixed seeds. They carry mostly prairie species and some woodland wildflowers and can customize orders for genotype. Contact: Margit Sandor or Frank Nechvatal, 210 Grell Lane, P.O. Box 400, Johnson Creek, WI 53038. 1-800-824-4668.

Wali Nursery specializes in woodland plant species. Contact: Wali Nursery, Route 9 Box 9080, Hayward, WI 54843. 715-462-3565.

Westfork Walnut Nursery is a supplier of woodland plants. Contact: Westfork Walnut Nursery, Route 3 Box 145, Viroqua, WI 54665. 608-637-2528.

Wildflowers from Nature's Way specializes in prairie wildflower and grass seed mixes all from Iowa source plants. They also sell some woodland wildflowers. Contact: Dorothy Baringer, RR 1, Box 62, Woodburn, IA50275. 515-342-6246.

Wildlife Habitat carries prairie grass seeds. Contact: Wildlife Habitat, RR #3 Box 178, Owatonna, MN 55060. 507-451-6771.

Wildlife Nursery specializes in wild-collected wetland and non-native plants that attract wildlife. They also do consulting on a limited basis. Contact: John J. Lemberger, P.O. Box 2724, Oshkosh, WI 54901. 920-231-3780.

Restoration Consultants

The following companies and individuals operate as consultants in Wisconsin and the surrounding areas. Although most simply do consultation, some will provide planting and management services.

Robert Abernathy is a consultant who does botanical inventories and restoration consultation and management in wetlands, woodlands, and prairies. Contact: Robert Abernathy, W 8507 Meadow Brook Road, Argyle, WI 53504. 608-543-3865.

Brian Bader provides consulting services for prairie, savanna, and woodland restoration. He develops comprehensive management plans and coordinates planting plans, site preparation, planting, and management, and advises on propagation needs. Contact: Brian Bader, 1913 Sachtjen Road, Madison, WI. 608-243-7871.

Robert Baller is a botanist/ecologist available for consultation and native plant surveys. Contact: Robert Baller, P.O. Box 533, Beloit, WI 53512. 608-365-2065.

BioLogic Environmental Consulting, LLC specializes in the inventory, assessment, restoration, planning, and management of forests, grasslands, wetlands, and other ecosystems. Restoration services include site evaluation, species selection, site preparation, and planting and management guidelines. Contact: Michael Anderson, 122 Nygard Street, Madison, WI 53713. 608-256-4401.

- Biophilia** specializes in butterfly gardening and native plants that attract butterflies. Contact: Randall Korb, 1903 North Whitney Drive, Appleton, WI 54914. 920-734-1744.
- Bison Belly Futures** serves Wisconsin's Driftless Area with a range of land stewardship services, including consulting, land management, native landscaping, and education. Specific services include site evaluation, brush and invasive species control, installation of small-scale prairie and woodland plantings, prescribed burns, and the development of self-guided nature trails. Contact: Gigi La Budde, S11793 Hazelnut Road, Spring Green, WI 53588. 608-588-2048, E-mail: spikey@mhtc.net / Website: <http://www.mhtc.net/~spikey/bison.html>.
- The Blue Mounds Project** provides landowners in western Dane and Iowa counties with an ecological extension program. Staff consult with landowners interested in restoring any native vegetation, assist with planning, restoration, and management, and train landowners in restoration techniques. Contact: Brian Pruka, P.O. Box 332, Mount Horeb, WI 53572. 608-244-2181.
- Clark Forestry Consulting** is active in conserving, restoring, and protecting native habitats. Specialties: timber sales and services, the development of landscape management plans, and fully insured prescribed burns, including site assessment, firebreak construction and preparation, and post-fire monitoring and mop-up. Contact: Fred Clark, P.O. Box 572, Poynette, WI 53955. 608-356-2801.
- Creative Landscapes** does design and installation of native landscapes. Contact: Charles and Karen Koehler, 3412 Superior Avenue, Sheboygan, WI 53081.
- Sean Dalton of Natural Re-creation!** is a native-landscapes consultant specializing in prairies and savannas. He is available for consultation and site planning, and will do restoration work in the greater La Crosse area. Visit his website at <http://www.paradiselow.com>, e-mail him at sean@win.bright.net, or contact him at Sean Dalton, W20531 Gilbo Lane, Galesville, WI 54630. 608-582-2675.
- Jerry Davis** is available for consultation, either informal or formal, with emphasis on use of trees and shrubs. Contact: Jerry Davis, Biology Department, UW-La Crosse, La Crosse, WI 54601. 608-785-6963.
- Roy Diblik** specializes in utilizing native plants in urban settings. Contact: Roy Diblik, Box 95, Springfield, WI 53176. 262-248-8229.
- Donald L. Vorpahl Associates** provides site evaluation and design, seed and plant selection, planting and management services for restoring and developing native plant communities on commercial and residential sites of all sizes. Contact: Don Vorpahl, N6143 Hilbert Road, Hilbert, WI 54129. 920-853-3729.
- Earthkeepers** provides alternative lawn care and wildflower plantings. Contact: Randy Mueller, N8635 County Hwy E, Watertown, WI 53094. 920-262-9095 or 1-800-261-9095.
- Foth and Van Dyke** has a staff including a biologist, a botanist, and several landscape architects at your disposal. Services include planning of reclamation and restoration of native plant communities. Contact: Bruce Woods, Foth and Van Dyke, Park West, Suite 400, 406 Science Drive, Madison, WI 53711. 608-238-4761, FAX: 608-238-4633.
- Graef, Anhalt, Schloemer, and Associates, Inc.** specializes in evaluating wetlands delineation and functional values as well as planning the restoration and creation of wetland communities. Contact: Eric C. Parker, Environmental Specialist, 345 North 95th Street, Milwaukee, WI 53226-4441. 414-259-1500, FAX: 414-259-0037.
- Inner-Coastal Ecological Services (ICES)** conducts natural area and right-of-way inventories of flora specifically, and fauna as required. ICES utilizes GIS and CAD software to map this information, enabling large scale tracking and planning. ICES designs, installs, and maintains native plant community restorations and manages other natural areas. ICES also contracts for seeds and plant materials and conducts ecological research. Contact: Michael Ulrich, 1935 Winneba-

go Street, Madison, WI 53704. 608-246-8020.

Invasive Plant Control, Inc. offers a variety of services, including workshops, help in developing grants, and plant removal. Contact: Steven Manning, 2713 Larmon Dr., Nashville, TN. 1-800-449-6339, FAX: 615-385-4124, E-mail: info@invasiveplantcontrol.com / Website: www.invasiveplantcontrol.com.

Babette Kis does consultation work and leads workshops on native and invasive species. She also raises wildflowers from seeds collected in Racine County, specializing in propagating more difficult species and working with the pH needs of plants. Contact: Babette Kis, 6048 North 114th Street, Milwaukee, WI 53225-1210. 414-286-3147.

Mick Kennedy is a consultant, designing and building native landscapes and restoring and managing both prairies and woodlands. Contact: Mike Kennedy, Wisconsin Landscapes, Inc., 10921 Spring Creek Road, Blue Mounds, WI 53517. 608-437-3662, FAX: 608-437-8472.

Landscape Lady, Ltd. will do design, installation, and maintenance of natural landscapes. Contact: Gloy Jacobson, 3312 North Weil Street, Milwaukee, WI 53212. 414-933-0540.

Landscapes, Naturally... provides native landscape design services for residential, municipal, commercial, and rural properties, pre- and post-construction land use consultation, plant inventories, landscaping for wildlife, and environmental education services. Contact: Lynn M. White, 2417 Marathon Avenue, Neenah, WI 54956. 920-751-8335.

Mead and Hunt, Inc. does planning, analysis, and construction supervision on wetlands, floodplains, and shores. Contact: Perry Rossa, Environmental Scientist/Wetlands, Mead and Hunt, Inc., 6501 Watts Road, Suite 101, Madison, WI 53719. 608-273-6380.

Midwest Land and Culture, Inc. specializes in consultation on landscape development, management plans, and site evaluation. Contact: Cathie Bruner, 216 N. Dickinson St., Madison, WI 53703. 608-250-2545.

Gail Moede is a landscape architect specializing in prairie and wetland restorations. She will help with residential landscaping incorporating native plant species. Contact: Gail Moede, N 6240 Stonewood Drive, Watertown, WI 53094. 920-699-3737.

Susan B. Murray is available for landscape and environmental design site planning, developing management plans and landscaping plans, and doing consultations on native landscapes. Contact: Susan Murray, Landscape Architect, ASLA, 1230 Bowen Court, Madison, WI 53715. 608-255-9006, FAX: 608-255-8661.

Native Landscapes specializes in the assessment, design, management, and restoration of natural areas and research of rare plant and management-related issues. Contact: Vicki Nuzzo, 1947 Madron Road, Rockford, IL 61107. 815-637-6622.

Natural Lawn and Landscape Service will aid in care of your property, including native plantings, prairie and path mowing, and buckthorn removal. Contact: Gene Haack at 414-344-0131.

North American Butterfly Association advises on constructing butterfly-friendly gardens and habitats. Contact: Program for Butterfly Gardens and Habitat, 909 Birch Street, Baraboo, WI 53913.

Oak Woodland Services consults on safe use of herbicides in forests and prairies in southwestern Wisconsin. Contact: Pat Schroeder, 7385 Timberline Trail, Arena, WI 53503. 608-753-2674.

The Prairie Enthusiasts is a non-profit membership organization of persons interested in identifying, protecting, and managing native prairies. They can provide consultation and management services, including prescribed burning. Members may become active in a wide range of prairie surveys, management, restoration, and education projects. Contact: Gary Eldred, 4192 Sleepy Hollow Trail, Boscobel, WI 54805. 608-375-5271.

- Prairie Sun Consultants** has a botanist/restoration ecologist who will do site assessments and inventories and provide consultation on weed control in and restoration/natural landscaping of prairies, savannas, and woodlands. Contact: Patricia K. Armstrong, 612 Stauton Road, Naperville, IL 60565. 630-983-8404.
- R-8 Landscape Design and Consultation** specializes in native, natural, and traditional landscapes, providing customers with a range of options from perennial to theme gardens. Contact: Carol M. Fuchs, 1337 South 114th Street, West Allis, WI 53214-2235. 414-771-3392, FAX: 414-771-8898.
- Red Buffalo Prairie Restorations** provides prairie and savanna seeds for plants of the Wisconsin Driftless Area, as well as consultation, land management, and brush and tree clearing for restorations or remnants, always with an eye for aesthetics. Experience in controlled burning. Contact: Greg Nessler, RR 1 Box 133A, Viola, WI 54664. 608-627-1376.
- Jim Riemer** does consultation work, most of his experience being in small prairie restorations. Contact: Jim Riemer, Cths Building, Barron, WI 54818. 715-537-6317 or 715-822-3879.
- Kay Rill** specializes in plant inventories. Contact: Kay Rill, 1505 East Nevada Avenue, Oshkosh, WI 54901. 920-233-5527.
- Jim Sime** works mainly in restoring prairies and savannas which are now fading or are on the verge of disappearing in favor of other vegetation. Contact: Jim Sime, 6327 Elmwood Avenue, Middleton, WI 53562. 608-831-9297.
- STS Consultants, LTD.** is a geotechnical and environmental engineering firm that is experienced in large and small scale wetland identification/delineation, assessment, creation, and restoration design and construction management. Contact: Jan Tesch, 1035 Kepler Drive, Green Bay, WI 54313, 414-468-1978; or Chuck Bartelt, 11425 West Lake Park Drive, Milwaukee, WI 53224, 414-359-3030.
- Thompson and Associates Wetland Services** is experienced in all aspects of wetland mitigation and management, including: wetland delineation, wetland mitigation site search, site design, vegetation and hydrological monitoring, as well as native plant surveys and management of wetlands. Contact: Alice Thompson, Wetland Ecologist, 1320 Manitowoc Ave., South Milwaukee, WI 53172. 414-571-8383, FAX: 414-571-8384, E-mail: thompal@execpc.com.
- Robert Wernerehl** does botanical inventories and restoration consultation, especially on lowland forests and sedge meadows. Contact: Robert Wernerehl, 8237 Sweeney Road, Barneveld, WI 53507. 608-795-4244.
- Andrew Williams** can help conduct prairie plant inventories. Contact: Andrew Williams, P.O. Box 1646, Madison, WI 53701. 608-284-1731.
- Windy Oaks Aquatics** sells various waterlilies and marginals, as well as accessories. Consultation, installation, and landscaping services are available. Retail catalog for \$1.00. Contact: Windy Oaks Aquatics, W377 S10677 Betts Road, Eagle, WI 53119. Phone/FAX: 262-594-3033.
- Witness Tree Native Landscapes, Inc.** specializes in analysis, design, and restoration of landscapes. Contact: June Keibler, 121 Ford Street, Geneva, IL 60134.
- Elizabeth Zimmerman** conducts botanical and bird inventories and advises on ecological restoration. She specializes in wetlands statewide and also does botanical illustrations. Contact: Elizabeth Zimmerman, N 3485 Highway A, Fort Atkinson, WI 53538. 920-423-4074.

APPENDIX C

Reports on the Flora of Wisconsin

As the result of intensive field work that has been carried out in Wisconsin over the years, and the numerous taxonomic publications that have appeared dealing with the occurrence of plants in the state, Wisconsin is floristically one of the better known states in some ways. One series of papers in particular is important as a source of information on the vascular plants of Wisconsin: the *Preliminary Reports on the Flora of Wisconsin*. These include some 70 studies of selected families and genera, the more recent ones being submonographic in scope, which have appeared at irregular intervals since 1929 in the *Transactions of the Wisconsin Academy of Sciences, Arts and Letters*. Many of these treatments, which emphasize the detailed geographic distributions of each species within Wisconsin, were written by, or edited by, either the late Norman C. Fassett, Hugh H. Iltis, or Theodore S. Cochrane, and their students or cooperating associates who contributed treatments for plant groups for which they are specialists.

This appendix consists primarily of a comprehensive listing of the *Preliminary Reports*, but also includes other articles or book-length treatments that have been published for a few Wisconsin families. Families for which no references are listed have not been so treated. For the sake of simplicity, "Ferns and Fern Allies" and "Spring Flora" have been treated as though they were family names. For ease of use with this atlas, the families are listed alphabetically, but numbers preceding entries refer to the old-fashioned but eminently useful system of Engler and Prantl. Herbaria, including that of the University of Wisconsin-Madison, and standard identification manuals such as *Gray's Manual of Botany*, 8th ed. (Fernald 1950) are generally arranged according to this classification, in which supposed levels of phylogenetic development are summarized by ranking families in a numerical sequence. Following the *Preliminary Reports* is a cursory list of texts and articles useful to those wanting to consult additional references pertinent to Wisconsin or the Midwest.

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| 266 ACANTHACEAE: (No treatment) | 74 ARISTOLOCHIACEAE: (No treatment) |
| 163 ACERACEAE: Fassett, N. C. 1930. Prel. Rpt. 8. Trans. Wisconsin Acad. 25:195-197. | 248 ASCLEPIADACEAE: Noamesi, G. K. and H. H. Iltis. 1958 ["1957"]. Prel. Rpt. 40. Trans. Wisconsin Acad. 46:107-114. |
| 272 ADOXACEAE: Wade, D. E. and D. R. Wade. 1940. Prel. Rpt. 28. Trans. Wisconsin Acad. 32:92-101. | 280 ASTERACEAE: Shinnars, L. H. 1941. The genus <i>Aster</i> in Wisconsin. Amer. Midl. Naturalist 26:398-420. |
| Cochrane, T. S. and P. J. Salamun. 1974. Prel. Rpt. 64. Trans. Wisconsin Acad. 62:247-252. | Melchert, T. E. 1960. Heliantheae of Wisconsin. M.S. Thesis, Univ. Wisconsin-Madison. 74 pp. + 46 maps. |
| 84 AIZOACEAE: (No treatment) | Johnson, M. F. and H. H. Iltis. 1964 ["1963"]. Prel. Rpt. 48. Compositae I (Tribes Eupatorieae, Veronieae, Cynarieae, and Cichorieae). Trans. Wisconsin Acad. 52:255-342. |
| 15 ALISMACEAE: Fassett, N. C. 1929. Prel. Rpt. 1. Trans. Wisconsin Acad. 24:250-256. | Barkley, T. M. 1964 ["1963"]. Prel. Rpt. 49. Compositae II (the genus <i>Senecio</i>). Trans. Wisconsin Acad. 52:343-352. |
| 79 AMARANTHACEAE: Sauer, J. D. and R. Davidson. 1962. Prel. Rpt. 45. Trans. Wisconsin Acad. 50:75-87. | Salamun, P. J. 1964 ["1963"]. Prel. Rpt. 50. Compositae III (the genus <i>Solidago</i>). Trans. Wisconsin Acad. 52:353-382. |
| 40 AMARYLLIDACEAE: McIntosh, J. M. 1950. Prel. Rpt. 34. Trans. Wisconsin Acad. 40(1):230, 236. | Mickelson, C. J. and H. H. Iltis. 1967 ["1966"]. Prel. Rpt. 55. Compositae IV (Tribes Helenieae and Anthemideae). Trans. Wisconsin Acad. 55:187-222. |
| 153 ANACARDIACEAE: Fassett, N. C. 1940. Prel. Rpt. 29. Trans. Wisconsin Acad. 32:103-106. | Beals, E. W. and R. F. Peters. 1967 ["1966"]. Prel. Rpt. 56. Compositae V (Tribe Inuleae). Trans. Wisconsin Acad. 55:223-242. |
| 157 AQUIFOLIACEAE: (No treatment) | Payne, W. W. 1970. Prel. Rpt. 62. Compositae VI (the genus <i>Ambrosia</i>). Trans. Wisconsin Acad. 58:353-371. |
| 228 APIACEAE: Fassett, N. C. 1941. Wisconsin Plant Ranges No. 1. Dept. Botany, Univ. Wisconsin-Madison. 10 pp. (mimeo), maps 1-20. | 168 BALSAMINACEAE: (No treatment) |
| 247 APOCYNACEAE: (No treatment) | 93 BERBERIDACEAE: Fassett, N. C. 1946. Prel. Rpt. 33. Trans. Wisconsin Acad. 38:206-208. |
| 23 ARACEAE: Fassett, N. C. 1937. Prel. Rpt. 25. Trans. Wisconsin Acad. 30:17, 19. | 61 BETULACEAE: Fassett, N. C. 1930. Prel. Rpt. 7. Trans. Wisconsin Acad. 25:189-194. |
| 227 ARALIACEAE: Fassett, N. C. and H. J. Elser. 1950. Prel. Rpt. 35. Trans. Wisconsin Acad. 40(1): 83-85. | |

- 258 BIGNONIACEAE: (No treatment)
- 252 BORAGINACEAE: Kruschke, E. P. 1946 ["1944"]. Prel. Rpt. 32. Trans. Wisconsin Acad. 36:273-290.
- 105 BRASSICACEAE: Patman, J. P. and H. H. Iltis. 1962 ["1961"]. Prel. Rpt. 44. Trans. Wisconsin Acad. 50:17-72.
- 16 BUTOMACEAE: (No treatment)
- 210 CACTACEAE: Ugent, D. 1963 ["1962"]. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:128-134.
- 128.1 CAESALPINIACEAE: (see Fabaceae, Caesalpiniaceae)
- 148 CALLITRICHACEAE: Fassett, N. C. 1933. Prel. Rpt. 21. Trans. Wisconsin Acad. 28:184-186.
- 276 CAMPANULACEAE, LOBELIACEAE: Mahony, K. L. 1929. Prel. Rpt. 3. Trans. Wisconsin Acad. 24:357-361.
- 107 CAPPARACEAE: (No treatment)
- 271 CAPRIFOLIACEAE: Wade, D. E. and D. R. Wade. 1940. Prel. Rpt. 28. Trans. Wisconsin Acad. 32:91-101.
- Salamun, P. J. 1980. Prel. Rpt. 68. Trans. Wisconsin Acad. 67:103-129.
- 87 CARYOPHYLLACEAE: Schlising, R. A. and H. H. Iltis. 1962 ["1961"]. Prel. Rpt. 46. Trans. Wisconsin Acad. 50:89-139.
- 158 CELASTRACEAE: (No treatment)
- 89 CERATOPHYLLACEAE: Fassett, N. C. 1946. Prel. Rpt. 33. Trans. Wisconsin Acad. 38:192-194.
- 78 CHENOPODIACEAE: (No treatment)
- 193 CISTACEAE: (No treatment)
- 33 COMMELINACEAE: Fassett, N. C. 1932. Prel. Rpt. 16. Trans. Wisconsin Acad. 27:228, 229.
- 280 COMPOSITAE: (see Asteraceae)
- 249 CONVOLVULACEAE: Fogelberg, S. O. 1937. Prel. Rpt. 26. Trans. Wisconsin Acad. 30:21-25.
- 229 CORNACEAE: Drescher, A. A. 1933. Prel. Rpt. 22. Trans. Wisconsin Acad. 28:187-190.
- 115 CRASSULACEAE: (No treatment)
- 105 CRUCIFERAE: (see Brassicaceae)
- 275 CUCURBITACEAE: Mahony, K. L. 1929. Prel. Rpt. 3. Trans. Wisconsin Acad. 24:360-361.
- 20 CYPERACEAE: Greene, H. C. 1953. Prel. Rpt. 37. Cyperaceae, Part I (all genera except *Carex*). Trans. Wisconsin Acad. 42:47-67.
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- 43 DIOSCOREACEAE: McIntosh, J. M. 1950. Prel. Rpt. 34. Trans. Wisconsin Acad. 40(1): 230, 236.
- 274 DIPSACACEAE: Salamun, P. J. and T. S. Cochrane. 1974. Prel. Rpt. 65. Trans. Wisconsin Acad. 62:253-260.
- 112 DROSERACEAE: Livergood, F. B. 1932. Prel. Rpt. 18. Trans. Wisconsin Acad. 27:235-236.
- 189 ELATINACEAE: Fassett, N. C. 1930. Prel. Rpt. 9. Trans. Wisconsin Acad. 25:199-200.
- 215 ELAEAGNACEAE: Ugent, D. 1963 ["1962"]. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:86-87, 89.
- EQUISETACEAE: Hauke, R. L. 1965. Prel. Rpt. 54. Trans. Wisconsin Acad. 54:331-346.
- 233 ERICACEAE: Fassett, N. C. 1929. Prel. Rpt. 2. Trans. Wisconsin Acad. 24:257-268.
- 30 ERIOCAULACEAE: Fassett, N. C. 1932. Prel. Rpt. 16. Trans. Wisconsin Acad. 27:227, 229.
- 147 EUPHORBIACEAE: Fassett, N. C. 1933. Prel. Rpt. 21. Trans. Wisconsin Acad. 28:178, 180-185.
- Richardson, J. W., D. Burch and T. S. Cochrane. 1988 ["1987"]. Prel. Rpt. 69. Trans. Wisconsin Acad. 75:97-129.
- 128 FABACEAE, CAESALPINIACEAE: Fassett, N. C. 1939. The Leguminous Plants of Wisconsin. Univ. Wisconsin Press, Madison. 1-157 pp., figs. 1-60, maps, plates I-XXIV.
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- 246 GENTIANACEAE, MENYANTHACEAE: Mason, C. T., Jr. and H. H. Iltis. 1966 ["1965"]. Prel. Rpt. 53. Trans. Wisconsin Acad. 54:295-329.
- Pringle, J. S. 1964. Prel. Rpt. 52. *Gentiana* hybrids in Wisconsin. Trans. Wisconsin Acad. 53:273-281.
- 129 GERANIACEAE: Fassett, N. C. 1933. Prel. Rpt. 21. Trans. Wisconsin Acad. 28:175-176.
- 19 GRAMINEAE: (see Poaceae)
- 225 HALORAGACEAE: Fassett, N. C. 1930. Prel. Rpt. 10. Trans. Wisconsin Acad. 25:201-203.
- 123 HAMAMELIDACEAE: (No treatment)
- 225.1 HIPPURIDACEAE: Fassett, N. C. 1930. Prel. Rpt. 10. Trans. Wisconsin Acad. 25:202-203.
- Ugent, D. 1962. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:128.
- 17 HYDROCHARITACEAE: (No treatment)
- 251 HYDROPHYLLACEAE: Shields, J. W. 1967. Prel. Rpt. 58. Trans. Wisconsin Acad. 55:255-259.
- 187 HYPERICACEAE: McLaughlin, W. T. 1931. Prel. Rpt. 14. Trans. Wisconsin Acad. 26:281-288.
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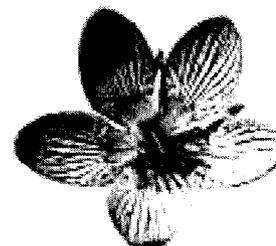
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- 36 JUNCACEAE: McIntosh, J. M. 1950. Prel. Rpt. 34. Trans. Wisconsin Acad. 40(1): 231-234, 238-242.
- 14 JUNCAGINACEAE: Fassett, N. C. 1929. Prel. Rpt. 1. Trans. Wisconsin Acad.Sci. 24:249-250.
- 254 LABIATAE: Koeppen, R. C. 1958 ["1957"]. Prel. Rpt. 41. Trans. Wisconsin Acad. 46:115-140.
- 254 LAMIACEAE: (see Labiatae)
- 102 LAURACEAE: Fassett, N. C. 1946. Prel. Rpt. 33. Trans. Wisconsin Acad. 38:208-209.
- 128 LEGUMINOSAE: (see Fabaceae)
- 24 LEMNACEAE: Fassett, N. C. 1937. Prel. Rpt. 25. Trans. Wisconsin Acad. 30:17-20.
- 264 LENTIBULARIACEAE: Thomson, J. W., Jr. 1940. Prel. Rpt. 27. Trans. Wisconsin Acad. 32:85-89.
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- 38 LILIACEAE: McIntosh, J. M. 1950. Prel. Rpt. 34. Trans. Wisconsin Acad. 40(1):215-229, 235-236.
- 152 LIMNANTHACEAE: (No treatment)
- 132 LINACEAE: Fassett, N. C. 1933. Prel. Rpt. 21. Trans. Wisconsin Acad. 28:171-173.
- 276 LOBELIACEAE: (see Campanulaceae, Lobeliaceae)
- 67 LORANTHACEAE: (No treatment)
- LYCOPODIACEAE, SELAGINELLACEAE: Wilson, L. R. 1929. Prel. Rpt. 4. Trans. Wisconsin Acad. 25:169-175.
- 216 LYTHRACEAE: Ugent, D. 1963 ["1962"]. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:87-92, 95.
- 175 MALVACEAE: Hagen, A. M. 1933. Prel. Rpt. 20. Trans. Wisconsin Acad. 27:247-249.
Utech, F. H. 1970. Prel. Rpt. 60. Trans. Wisconsin Acad. 58:306-323.
- 223 MELASTOMACEAE: Ugent, D. 1963 ["1962"]. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:93, 95.
- 94 MENISPERMACEAE: Fassett, N. C. 1946. Prel. Rpt. 33. Trans. Wisconsin Acad. 38:207-208.
- 246 MENYANTHACEAE: (see Gentianaceae, Menyanthaceae)
- 128.2 MIMOSACEAE: (No treatment)
- 64 MORACEAE: Costello, D. F. 1933. Prel. Rpt. 23. Trans. Wisconsin Acad. 28:192-194.
- 57 MYRICACEAE: Fassett, N. C. 1932. Prel. Rpt. 17. Trans. Wisconsin Acad. 27:231, 233.
- 12 NAJADACEAE: Ross, J. G. and B. M. Calhoun. 1951. Prel. Rpt. 33 [sic, for 37]. Trans. Wisconsin Acad. 40(2): 109-110.
- 80 NYCTAGINACEAE: (No treatment)
- 88 NYMPHAEACEAE: Fassett, N. C. 1946. Prel. Rpt. 33. Trans. Wisconsin Acad. 38:189-194.
- 243 OLEACEAE: (No treatment)
- 224 ONAGRACEAE: Ugent, D. 1963 ["1962"]. Prel. Rpt. 47. Trans. Wisconsin Acad. 51:93-127.
- 50 ORCHIDACEAE: Fuller, A. M. 1933. Studies on the Flora of Wisconsin Part I: the Orchids; Orchidaceae. Milwaukee Public Mus. Bull. 14. 284 pp., plates 1-54, figs. 1-2, maps 1-24.
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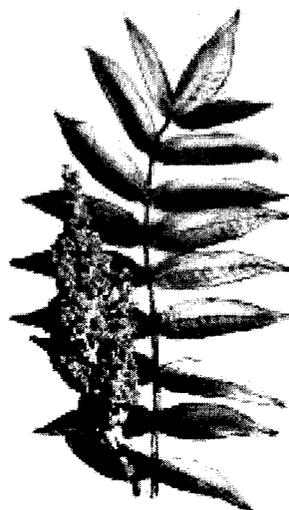
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