FILE

LONG RANGE PLAN

SCIENTIFIC AND NATURAL AREAS PROGRAM

July 23, 1980

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Background

The Minnesota legislature first authorized the designation of scientific and natural areas (SNA) by the Department of Natural Resources (DNR) in MN Stat 1969, Section 84.033. The Outdoor Recreation Act, MN Stat 1975, Section 86A.01 to 86A.11) detailed the role of SNAs as a component of Minnesota's outdoor recreation system.

Goal

In keeping with the legislative mandate of the Outdoor Recreation Act of 1975, the DNR has established a goal for the SNA system. This goal is:

> TO PRESERVE AND PERPETUATE THE ECOLOGICAL DIVERSITY OF MINNESOTA'S NATURAL HERITAGE, INCLUDING LANDFORMS, FOSSIL REMAINS, PLANT AND ANIMAL COMMUNITIES, RARE AND ENDANGERED SPECIES OR OTHER BIOTIC FEATURES, AND GEOLOGICAL FORMATIONS, FOR SCIENTIFIC STUDY AND PUBLIC EDIFICATION AS COMPONENTS OF A HEALTHY ENVIRONMENT.

Policy

The commissioner of the Department of Natural Resources established the SNA policy (7/6/79) (Appendix F) based on the Outdoor Recreation Act of 1975. This policy set forth guidelines for identification and evaluation, designation and registration, and management and use of SNAs. The SNA Section of the Division of Parks and Recreation is responsible for the implementation of this policy.

A statewide inventory will be maintained to ensure that all potential SNAs are identified and registered. The conservation efforts of groups, agencies, and individuals will be supported and encouraged.

Identification and Evaluation

The commissioner established an advisory committee (CAC) for the SNA program in 1965. The fifteen member volunteer committee composed of experts in the biological and geological fields and interested citizens make recommendations to the DNR on proposed SNAs.

The Natural Heritage Program (NHP), within the Policy Planning Section of the Office of Planning is responsible for maintaining data on occurrences of natural features and for the development of Element lists (see Table I, p 3) which identify plant and animal species and natural features considered to have statewide priority for protection. In addition, the NHP conducts preliminary evaluation of each nominated SNA to determine if any Elements occur within the boundaries of the proposed area.

Based on the information and recommendations of CAC and NHP, the SNA Section will recommend to the commissioner that a given area be registered and/or designated as an SNA.

Registration and Designation

The SNA Section will maintain a registry of all natural areas that could qualify as an SNA.

Before an area can be designated, the DNR must: hold title, purchase, or obtain a lease or easement. A commissioner's order filed with the secretary of state makes the designation of an area official.

If an area is privately owned, the landowner will be notified and with the landowner's consent and cooperation, the area may be purchased by the state.

If appropriate management of a registered area is ensured, acquisition and designation of that area may not be pursued. In this case, the area remains entirely in the original ownership. The SNA Section will have no legal or financial obligations for management of the tract.

If an area is federally owned or owned and managed by a DNR division other than Parks and Recreation, an inter-agency agreement will be reached which will ensure adequate protection and management. The area will not be designated. (For example, this would be the appropriate action to take if a qualified area is identified within the statutory boundary of a wildlife management area.)

If a written agreement negotiating protection of a qualified area can be secured between the SNA Section and the managing agency or individual, it may be more prudent to leave the area registered, rather than pursue designation.

Management and Use

DNR policy and the Outdoor Recreation Act of 1975 state that a management plan should be written for each designated SNA. These management plans will conform to the policy established by the commissioner in 1979. In addition the Rules and Regulations (NR300-3) will be enforced on all designated SNAs.

Objectives

1. To protect through SNA designation up to three occurrences of each of the following Elements: Plants, Animals, Geological Features, or Other Special Features within each landscape region where they occur. Additional occurrences may be registered (see Table I below, and Figure 1, p 4).

2. To protect through SNA designation up to five occurrences of each Plant Community Element within each landscape region where they occur. Additional occurrences may be registered.

TABLE I

Elements List

The NHP uses the term Element to identify outstanding natural features and species that have priority for protection. These Elements are of particular concern on a national or statewide basis because they are: (1) rare or threatened plant or animal species or (2) uncommon, threatened, or particularly noteworthy examples of plant communities, geologic features, or other special features. For example: the Minnesota trout lily, the piping plover, oak savanna plant communities, eskers, or patterned peatlands.

Elements lists were developed through intensive review of pertinent literature, museum and private collections, and discussions with knowledgeable individuals.

Plants - A list of approximately 300 species considered to be rare or threatened in Minnesota. In most instances they are represented by fewer than five occurrences in the state. (Appendix A)

Animals - A list of approximately 100 species considered to be rare or threatened in Minnesota. (Appendix B)

Geological Features - A list of approximately 25 geologic features identified as being protection priorities because the feature is either uncommon, threatened, or noteworthy on regional basis. (Appendix C)

Other Special Features - This list includes natural features that are protection priorities, but do not fit into categories discussed above. Currently this includes avian colonial nest sites and patterned peatlands. (Appendix D)

Plant Communities - A list of approximately 20 plant communities identified as being protection priorities because the community is uncommon, threatened, or particularly noteworthy in Minnesota. (Appendix E)

Additional Element lists may be developed by the NHP or the SNA Section to catalogue features discussed as priority in the SNA Policy (Appendix F, p. 2), but not currently included in the existing Element lists.

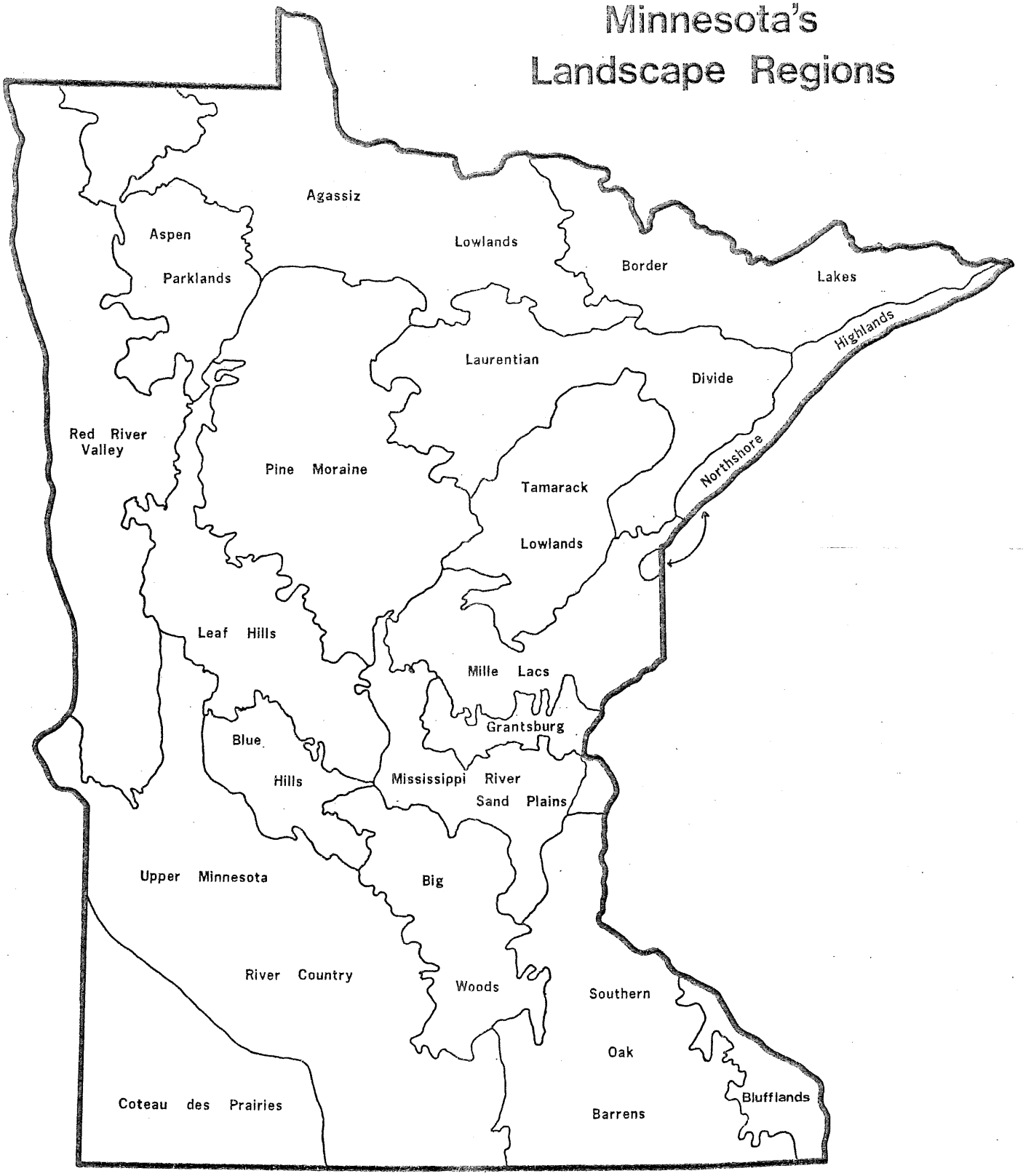

Figure I. Adapted from T. Kratz and G.L. Jensen, An Ecological Geographic Division of Minnesota. (Unpublished, 1977). See Appendix G for descriptions.

Rationale:

There are too many species which comprise the state's biological diversity to deal with them all on an individual basis. Therefore, it was necessary to establish a classification system which would serve as both a coarse and a fine "filter." The coarse "filter" sorts out the plant community Elements and the fine "filter" sorts out the individual species or natural features.

Each of the identified plant community Elements sorted out through the coarse filter is comprised of characteristic species. Therefore, if communities are identified and preserved, the species most commonly associated with them will be preserved.

Those species or natural features sorted out by the fine filtering process comprise only a fraction of the state's natural diversity. They must be dealt with on an individual basis because they are not predictably associated with any one community type.

For all Elements it is necessary to protect more than one occurrence for the following reasons:

To prevent severe damage or loss of an occurrence of an Element resulting from:

A. land-use conflicts (public need may preclude SNA designation)
B. accidental abuse (herbicides, oil spills, mismanagement)
C. deliberate abuse (overuse, vandalism)
D. natural catastrophe (disease, storms).

To provide a sufficient number of natural areas for research and educational uses by:

A. dispersing users thereby decreasing the impact on any one natural area
B. increasing the proximity of natural areas to potential users.

To allow for biological replication of Elements by:

A. protecting genetic variants of species at intervals along environmental gradients
B. protecting sufficient area to meet habitat requirements of species.

It is necessary to designate up to five occurrences of plant communities Elements within a given landscape region because plant communities protect: subtle differences and interactions between species; a diversity of common and uncommon organisms; and finally, aspects of an ecosystem which human's don't even yet understand. Designation of up to three occurrences of an individual species or features is sufficient to ensure protection and perpetuation of these elements. Through this designation process, outstanding examples of the major portion of the biological diversity of the state will be preserved.

Discussion:

The long-range objectives are based on the need to protect an acreage base sufficient to ensure the maintenance and perpetuation of examples of all of Minnesota's remaining natural Elements. It is expected that in order to reach this objective approximately one-tenth of one percent of the state or 52,000 acres will be protected in a system of designated scientific and natural areas. This figure was established, in part, by estimating the availability of quality natural areas existing in each of the landscape regions in the state today. However, in some landscape regions this may be unattainable. For example, the Coteau des Prairie was once all prairie. One-tenth of one percent of the region comprises nearly 3,000 acres. It is improbable this number of acres of natural prairie remains today.

Other natural area programs such as the Scientific Areas Program of the Wisconsin Department of Natural Resources have been actively preserving natural areas for about 30 years. During this period, 160 acres totaling approximately 24,000 acres have been designated. The Ohio State Nature Preserves System of the Division of Natural Areas and Preserves has a long-range objective to establish three-tenths of one percent of the state in a natural areas system (approximately 50,000 acres). Ohio has designated 49 areas totaling approximately 10,000 acres since the program began ten years ago. The SNA Program in Minnesota which began in 1969 has designated 10 areas totaling approximately 2,200 acres.

Because there is little land remaining in its natural state and based on the history of other state natural area programs, the expectation that one-tenth of one percent of the state needs to be protected in a scientific and natural areas system is a reasonable and realistic long-range objective.

Implementation

The implementation of site registration and/or designation will utilize a Protection Status Matrix, the Element lists developed by NHP, and a set of criteria for ranking priorities. The Protection Status Matrix will be used to illustrate which tracts in a landscape region provide adequate protection, partial protection, or inadequate protection for each Element in that region (Table II, p. 7).

Adequately Protected (AP): Elements that occur within designated SNAs, federal research natural areas, and federal and state wilderness areas are considered adequately protected because of both the strong legal and management protection granted to this type of managed areas.

Partially Protected (PP): Elements that occur within natural state parks, wildlife management areas, The Nature Conservancy tracts and on lands owned by other government or private groups that manage the land in a natural condition. These areas are considered only partially protected because their policy and management objectives are different than those of the SNA program.

Inadequately Protected (IP): Elements that occur on public or privately owned land but receive no protection and/or are managed in a manner that conflicts with SNA policy.

Table II

PROTECTION STATUS MATRIX

Landscape Region _____

Date _____

AP = Protected
PP = Partially Protected
IP = Inadequately Protected

Potential & Designated SNA / Elements							Total

By using the matrix, the number of sites which are adequately protecting a given Element in a given landscape region. For example, the matrix might show Element X in three protected areas, Element Y in two protected areas, and Element Z in no protected areas. In this manner, the matrix illustrates which Elements are most in need of protection. In addition, the matrix helps to identify those potential SNAs that contain the greatest number of unprotected Elements.

From the matrix, potential SNAs will be selected for possible designation. The following criteria will be used in ranking these areas:

A. rareness of Elements present in an area on a national or state scale
B. excellence and completeness of Element occurrences found in an area
C. degree to which an area or its Elements are threatened with incompatible use
D. degree of protection afforded similar Elements elsewhere in the landscape region
E. the adequacy of representation of Element in terms of genetic diversity.

For the most part this ranking will be accomplished by the NHP assigning priorities to Elements on the Element list. In addition the SNA staff and CAC will prioritize potential areas for designation by taking into account such considerations as:

A. feasibility of managing the area
B. availability of the area
C. funding for acquisition, maintenance, and operations
D. established research and educational use.

As Elements are protected through SNA designation or registration, the status of Elements on the matrix will change.

This process is designed to assist the SNA Section in making the most viable decisions in the SNA designation process. However, it is important to note that throughout this long-range plan the process of identifying potential SNAs cannot always be reduced to a simple formula. In specific instances, scientific judgment may argue that strict adherence to these guidelines will not result in the best possible decisions. This situation might arise when a compelling argument is made regarding inadequacies in the Element lists, shortcomings in the landscape region system, or cases where a larger number of protected sites is essential for perpetuation of a particular Element. Such overriding considerations will be the exception rather than the rule, but it is important to recognize the need for this type of flexibility.

Budgetary Considerations

The long-range goal of protecting the ecological diversity of Minnesota's natural heritage through establishing a system of scientific and natural areas will provide overall direction for the SNA Program. However, budgetary constraints may limit the size and number of designated SNAs. Costs can be broken down into three catagories: acquisition, planning and development, and maintenance and operations. Savings in acquisition costs are apparent when designating SNAs within a state park or other state owned lands. Potential SNAs have also been acquired via free-lease, gift, or bargain sale. Wolsfeld Woods SNA is an example of an area received by the state as a gift. Acquisiton would otherwise have cost the state $750,000.

Each designated SNA must have a management plan. The estimated cost of completing an inventory and writing the plan is estimated to be approximately $5,000 per SNA. There are few development requirements in SNAs. They may include: posting and fencing boundaries, developing trails and parking facilities, and resource management. These costs will range from $500 to $5,000 per unit.

Operations and maintenance costs include prescribed burns, maintenance of trails, interpretation, enforcement, and supervising research and educational activities. It is anticipated that annual operational costs should be less that $500 per unit annually.

Because the SNA program receives generous volunteer support and land gifts acquisition, planning and development, and operations and maintenance cost to the state are low.

Review Process

The long-range plan for selecting scientific and natural areas will be reviewed every six years. Element lists will be reviewed at least every two years. The review process will be conducted cooperatively by the SNA Section and the NHP. CAC will review and advise throughout the review process.

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX A

PLANT ELEMENTS

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MINNESOTA NATURAL HERITAGE PROGRAM

Appendix A — Rare Plants in Minnesota

Scientific Name	Common Name	Family	MNHP STATUS
Achillea sibirica	Siberian Yarrow	Compositae	Undetermined
Actaea pachypoda	White Baneberry	Ranunculaceae	Rare
Agastache nepetoides	Yellow Giant Hyssop	Labiatae	Undetermined
Agrostis geminata	Bentgrass	Graminae	Rare
Agrostis hyemalis	Ticklegrass	Graminae	Undetermined
Allium schoenoprasum var. sibiricum	Siberian Chives	Liliaceae	Rare
Alopecurus carolinianus	Carolina Foxtail	Graminae	Rare
Ammophila breviligulata	Beachgrass	Graminae	Threatened
Androsace septentrionalis var. pulverulenta	Androsace. No Common Name	Primulaceae	Threatened
Anemone multifida	Anemone. No Common Name	Ranunculaceae	Undetermined
Antennaria aprica	Pussy's-Toes	Compositae	Rare
Arabis holboellii var. retrofracta	Holboll's Rock-Cress	Cruciferae	Threatened
Arabis laevigata	Smoothed Rock-Cress	Cruciferae	Rare
Arabis pycnocarpa var. adpressipilis	Rock-Cress	Cruciferae	Threatened
Arenaria stricta ssp. dawsonensis	Rock Sandwort	Caryophyllaceae	Rare
Arenaria macrophylla	Large-Leaved Sandwort	Caryophyllaceae	Threatened
Arisaema dracontium	Green Dragon	Araceae	Rare
Arisaema triphyllum var. stewardsonii	Small Jack-in-the-Pulpit	Araceae	Rare
Aristida longiseta	Long-Awned Needlegrass	Graminae	Rare

Aristida tuberculosa	Seabeach Needlegrass	Graminae	Rare
Artemisia canadensis	Canadian Wormwood	Compositae	Rare
Asclepias amplexicaulis	Milkweed	Compositae	Threatened
Asclepias purpurascens	Purple Milkweed	Compositae	Undetermined
Asclepias stenophylla	Narrow-Leaved Milkweed	Compositae	Endangered
Asclepias sullivantii	Sullivant's Milkweed	Asclepiadaceae	Rare
Asplenium platyneuron	Ebony Spleenwort	Polypodiaceae	Threatened
Asplenium trichomanes	Maidenhair Spleenwort	Polypodiaceae	Threatened
Aster pilosus	Hairy Aster	Compositae	Threatened
Aster praealtus	Tall Aster	Compositae	Threatened
Aster prenanthoides	Rattlesnake Root Aster	Compositae	Rare
Aster shortii	Short's Aster	Compositae	Threatened
Aster undulatus	Undulate Aster	Compositae	Undetermined
Astragalus flexuosus	Milk-Vetch	Leguminosae	Endangered
Astragalus lotiflorus	Low Milk-Vetch	Leguminosae	Rare
Astragalus missouriensis	Missouri Milk-Vetch	Leguminosae	Rare
Astragalus racemosus	Racemose Milk-Vetch	Leguminosae	Undetermined
Astragalus tennellus	Loose-Flowered Milk-Vetch	Leguminosae	Undetermined
Athyrium pycnocarpon	Narrow-Leaved Spleenwort	Polypodiaceae	Threatened
Athyrium thelypterioides	Silvery Spleenwort	Polypodiaceae	Threatened
Atriplex glabriuscula	Smoothish Orach	Chenopodiaceae	Rare
Aureolaria grandiflora	Large-Flowered False Foxgloves	Scrophulariaceae	Undetermined
Aureolaria pedicularia	False Foxgloves	Scrophulariaceae	Undetermined
Bacopa rotundifolia	Water Hyssop	Scrophulariaceae	Rare

Baptisia leucantha	White False Indigo	Leguminosae	Rare
Baptisia leucophaea	False Indigo	Leguminosae	Rare
Baptisia tinctoria	Wild Indigo	Leguminosae	Undetermined
Bartonia virginica	Bartonia. No Common Name.	Gentianaceae	Endangered
Besseya bullii	Besseya. No Common Name.	Scrophulariaceae	Sp. Concern
Bidens discoidea	Bur Marigold	Compositae	Undetermined
Blephilia hirsuta	Wood Mint	Labiatae	Rare
Botrychium dissectum includes forma obliquum	Grapefern	Ophioglossaceae	Rare
Botrychium lanceolatum var. angustisegmentum	Grapefern	Ophioglossaceae	Undetermined
Botrychium lunaria	Moonwort	Ophioglossaceae	Rare
Botrychium matricariaefolium	Grapefern	Ophioglossaceae	Rare
Buchloe dactyloides	Buffalo-Grass	Graminae	Rare
Cacalia suaveolens	Indian Plantain	Compositae	Threatened
Calamagrostis lacustris	Pond Reedgrass	Graminae	Undetermined
Calamagrostis montanensis	Plains Reedgrass	Graminae	Rare
Calamagrostis purpurascens	Purple Reedgrass	Graminae	Threatened
Caltha natans	Marsh Marigold	Ranunculaceae	Threatened
Callitriche heterophylla	Water-Starwort	Callitrichaceae	Rare
Cardamine pratensis var. palustris	Cuckoo Flower	Cruciferae	Undetermined
Carex annectens var. xanthocarpa	Sedge	Cyperaceae	Endangered
Carex bromoides	Sedge	Cyperaceae	Rare
Carex capillaris var. major	Sedge	Cyperaceae	Rare
Carex conjuncta	Sedge	Cyperaceae	Endangered
Carex conoidea	Sedge	Cyperaceae	Threatened

Carex crinita var. gynandra	Sedge	Cyperaceae	Rare
Carex crus-corvi	Sedge	Cyperaceae	Undetermined
Carex davisii	Sedge	Cyperaceae	Endangered
Carex exilis	Sedge	Cyperaceae	Threatened
Carex flava	Sedge	Cyperaceae	Rare
Carex formosa	Sedge	Cyperaceae	Threatened
Carex grayi	Sedge	Cyperaceae	Rare
Carex grayi var. hispidula	Sedge	Cyperaceae	Endangered
Carex hallii	Sedge	Cyperaceae	Threatened
Carex katahdinensis	Sedge	Cyperaceae	Threatened
Carex laevivaginata	Sedge	Cyperaceae	Endangered
Carex laxiculmis	Sedge	Cyperaceae	Rare
Carex lurida	Sedge	Cyperaceae	Undetermined
Carex media	Sedge	Cyperaceae	Rare
Carex michauxiana	Sedge	Cyperaceae	Threatened
Carex muskingumensis	Sedge	Cyperaceae	Rare
Carex obtusata	Sedge	Cyperaceae	Rare
Carex ormostachya	Sedge	Cyperaceae	Rare
Carex pallescens var. neogaea	Sedge	Cyperaceae	Endangered
Carex plantaginea	Sedge	Cyperaceae	Endangered
Carex praticola	Sedge	Cyperaceae	Threatened
Carex rossii	Sedge	Cyperaceae	Endangered
Carex scirpiformis	Sedge	Cyperaceae	Threatened
Carex squarrosa	Sedge	Cyperaceae	Undetermined
Carex sterilis	Sedge	Cyperaceae	Rare
Carex supina	Sedge	Cyperaceae	Endangered
Carex typhina	Sedge	Cyperaceae	Rare

Carex woodii	Sedge	Cyperaceae	Rare
Carex xerantica	Sedge	Cyperaceae	Endangered
Castilleja septentrionalis	Northern Painted Cup	Scrophulariaceae	Undetermined
Cephalanthus occidentalis	Buttonbush	Rubiaceae	Threatened
Cerastium brachypodum	Mouse-Ear Chickweed	Caryophyllaceae	Rare
Chamaerhodos nuttallii	Chamaerhodos. No Common Name.	Rosaceae	Rare
Cheilanthes feei	Slender Lip-Fern	Polypodiaceae	Rare
Chrysosplenium iowense	Golden Saxifrage	Saxifragaceae	Endangered
Cladium mariscoides	Twig-Rush	Cyperaceae	Rare
Claytonia caroliniana	Spring Beauty	Portulacaceae	Rare
Corallorhiza odontorhiza	Autumn Coral-Root	Orchidaceae	Rare
Crataegus douglasii	Douglas Hawthorn	Rosaceae	Rare
Cristatella jamesii	Cristatella. No Common Name.	Capparidaceae	Endangered
Cuscuta obtusiflora var. glandulosa	Dodder	Convolulaceae	Undetermined
Cuscuta polygonorum	Dodder	Convolulaceae	Threatened
Cyperus acuminatus	Umbrella Sedge	Cyperaceae	Threatened
Cypripedium arietinum	Ram's-Head Lady-Slipper	Orchidaceae	Rare
Decodon verticillatus	Water Willow	Lythraceae	Rare
Deschampsia flexuosa	Common Hairgrass	Graminae	Threatened
Desmanthus illinoense	Prairie Mimosa	Leguminosae	Rare
Desmodium cuspidatum var. longifolium	Long-Leaved Tick-Trefoil	Leguminosae	Rare
Desmodium illinoense	Tick-Trefoil	Leguminosae	Threatened
Desmodium nudiflorum	Tick-Trefoil	Leguminosae	Undetermined
Dicentra canadensis	Squirrel-Corn	Fumariaceae	Threatened

Didiplis diandra	Water Purslane	Lythraceae	Undetermined
Dodecatheon amethystinum	American Cowslip	Primulaceae	Sp. Concern
Draba arabisans	Draba. No Common Name.	Cruciferae	Rare
Draba norvegica	Draba. No Common Name.	Cruciferae	Endangered
Drosera anglica	Sundew	Droseraceae	Threatened
Drosera linearis	Sundew	Droseraceae	Endangered
Dryopteris goldiana	Goldie's Fern	Polypodiaceae	Undetermined
Dyssodia paplosa	Fetid Marigold	Compositae	Undetermined
Echinochloa walteri	Echinochloa. No Common Name.	Graminae	Rare
Elatine triandra	Waterwort	Elatinaceae	Rare
Eleocharis halophila	Salt-Loving Spike-Rush	Cyperaceae	Undetermined
Eleocharis nitida	Neat Spike-Rush	Cyperaceae	Rare
Eleocharis olivacea	Spike-Rush	Cyperaceae	Rare
Eleocharis parvula	Bristleless Spike-Rush	Cyperaceae	Rare
Eleocharis pauciflora var. fernaldii	Fernald's Spike-Rush	Cyperaceae	Rare
Eleocharis wolfii	Wolf's Spike-Rush	Cyperaceae	Rare
Empetrum atropurpureum	Purple Crowberry	Empetraceae	Endangered
Empetrum nigrum	Black Crowberry	Empetraceae	Endangered
Epilobium hornemannii	Willow Herb	Nymphaeaceae	Undetermined
Erythronium propullans	Minnesota Trout Lily	Liliaceae	Endangered
Eupatorium sessilifolium var. brittonianum	Upland Boneset	Compositae	Undetermined
Euphorbia hexagona	Spurge	Euphorbiaceae	Undetermined

Euphorbia missurica var. *intermedia*	Missouri Spurge	Euphorbiaceae	Undetermined
Euphrasia hudsoniana	Hudson Bay Eyebright	Scrophulariaceae	Rare
Festuca paradoxa	Fescue Grass	Graminae	Undetermined
Floerkea proserpinacoides	False Mermaid	Limnanthaceae	Endangered
Gaura biennis	Evening Primrose	Onagraceae	Threatened
Gentiana affinis	Gentiana	Gentianaceae	Rare
Gentiana amarella	Felwort	Gentianaceae	Threatened
Gentiana macounii	Gentian	Gentianaceae	Threatened
Geocaulon lividum	Northern Comandra	Santalaceae	Rare
Gerardia auriculata	Eared Gerardia	Scrophulariaceae	Rare
Gerardia gattingeri	Gerardia	Scrophulariaceae	Rare
Gerardia purpurea	Purple Gerardia	Scrophulariaceae	Undetermined
Geum laciniatum var. *trichocarpum*	Avens	Rosaceae	Threatened
Glaux maritima	Sea Milkwort	Primulaceae	Undetermined
Gleditsia triacanthos	Honey-Shuck	Leguminosae	Undetermined
Glyceria pallida	Pale Manna Grass	Graminae	Threatened
Habenaria clavellata	Green Woodland Orchis	Orchidaceae	Rare
Habenaria flava	Pale Green Orchis	Orchidaceae	Undetermined
Habenaria leucophaea	Prairie (White-Fringed) Orchis	Orchidaceae	Threatened
Hamamelis virginiana	Witch Hazel	Hamamelidaceae	Threatened
Haplopappus spinulosus	Haplopappus. No Common Name.	Compositae	Threatened
Hedeoma pulegioides	Pennyroyal	Labiatae	Rare

Helianthemum canadense	Frostweed	Cistaceae	Rare
Helianthus nuttallii ssp rydbergii	Nuttall's Sunflower	Compositae	Rare
Heteranthera limosa	Heteranthera	Pontederiaceae	Threatened
Hieracium longipilum	Hawkweed	Compositae	Rare
Hordeum pusillum	Little Barley	Graminae	Rare
Hydrastis canadensis	Golden-Seal	Ranunculaceae	Undetermined
Hydrocotyle americana	American Water Pennywort	Umbelliferae	Rare
Iodanthus pinnatifidus	Purple Rocket	Cruciferae	Threatened
Isoetes melanopoda	Black-Footed Quillwort	Isoetaceae	Endangered
Jeffersonia diphylla	Twinleaf	Berberidaceae	Threatened
Juncus articulatus	Jointed Rush	Juncaceae	Threatened
Juncus brachycarpus	Short-Fruited Rush	Juncaceae	Endangered
Juncus brachycephalus	Short-Headed Rush	Juncaceae	Rare
Juncus gerardii	Black Grass	Juncaceae	Rare
Juncus marginatus	Rush	Juncaceae	Endangered
Juncus stygius var. americanus	Juncus	Juncaceae	Threatened
Lactuca floridana	Florida Lettuce	Compositae	Undetermined
Leersia lenticularis	Catchfly Grass	Graminae	Rare
Lespedeza leptostachya	Bush Clover	Leguminosae	Threatened
Lesquerella ludoviciana	Lesquerella. No Common Name.	Cruciferae	Endangered
Limosella aquatica	Mudwort	Scrophulariaceae	Rare
Linaria canadensis	Old Field Toadflax	Scrophulariaceae	Rare

Liparis auriculata	Lilia-Leaved Twayblade	Orchidaceae	Rare
Listera auriculata	Auricled Twayblade	Orchidaceae	Threatened
Listera convallarioides	Broad-Lipped Twayblade	Orchidaceae	Endangered
Littorella americana	Littorella. No Common Name.	Plantaginaceae	Threatened
Luzula parviflora	Luzula.	Juncaceae	Threatened
Lycopus virginicus	Water Horehound	Labiatae	Rare
Lygodesmia rostrata	Lygodesmia. No Common Name.	Compositae	Endangered
Malaxis brachypoda	Malaxis	Orchidaceae	Rare
Malaxis paludosa	Bog Adder's-Mouth	Orchidaceae	Endangered
Mamillaria vivipara	Mamillaria. No. Common Name.	Cactaceae	Endangered
Marsilea mucronata	Marsilea	Marsileaceae	Endangered
Melica nitens	Melic-Grass	Graminae	Threatened
Monolepsis nuttalliana	Povertyweed	Chenopodiaceae	Rare
Montia chamissoi	Montia. No. Common Name.	Portulacaceae	Endangered
Morus rubra	Red Mulberry	Moraceae	Undetermined
Muhlenbergia schreberi	Drop-Seed	Graminae	Rare
Muhlenbergia uniflora	Muhlenbergia. No. Common Name.	Graminae	Rare
Myosotis verna	Forget-Me-Not	Boraginaceae	Threatened
Myosurus minimus	Mousetail	Ranunculaceae	Rare
Myriophyllum tenellum	Water Milfoil	Haloragaceae	Rare
Najas gracillima	Naiad	Najadaceae	Undetermined

Napaea dioica	Glade Mallow	Malvaceae	Undetermined
Nymphaea tetragona	Four-Angled Water-Lily	Numphaeaceae	Rare
Oenothera laciniata	Slashed Evening Primrose	Onagraceae	Endangered
Oenothera rhombipetala	Rhombic-Petaled Evening Primrose	Onagraceae	Rare
Ophioglossum vulgatum var. pseudopodum	False-Foot Adder's-Tongue	Ophioglossaceae	Rare
Opuntia humifusa	Prickly Pear Cactus	Cactaceae	Rare
Orobanche fasciculata	Broom-Rape	Orobanchaceae	Rare
Orobanche ludoviciana	Louisiana Broom-Rape	Orobanchaceae	Rare
Orobanche uniflora	One-Flowered Cancer Root	Orobanchaceae	Rare
Oryzopsis hymenoides	Silkgrass	Graminae	Endangered
Osmorhiza chilensis	Sweet Cicely	Umbelliferae	Rare
Osmorhiza obtusa	Blunt Sweet Cicely	Umbelliferae	Undetermined
Oxypolis rigidior	Cowbane	Umbelliferae	Endangered
Oxytropis viscida	Oxytropis. No Common Name.	Leguminosae	Endangered
Panax quinquefolius	Ginseng; Sang	Araliaceae	Sp. Concern
Paronychia canadensis	Canadian Forked Chickweed	Caryophyllaceae	Threatened
Paronychia fastigiata	Forked Chickweed	Caryophyllaceae	Threatened
Penstemon digitalis	Beard-Tongue	Scrophulariaceae	Undetermined
Penstemon pallidus	Pale Beard-Tongue	Scrophulariaceae	Undetermined
Parthenium integrifolium	Wild Quinine	Compositae	Rare
Pellaea atropurpurea	Purple Cliff-Brake	Polypodiaceae	Endangered

Phacelia franklinii	Scorpion Weed	Hydrophyllaceae	Rare
Pinguicula vulgaris	Butterwort	Lentibulariaceae	Rare
Plantago elongata	Plantain	Plantaginaceae	Threatened
Poa arida	Bunch Speargrass	Graminae	Threatened
Poa sylvestris	Speargrass	Graminae	Rare
Poa wolfii	Wolf's Speargrass	Graminae	Rare
Polemonium occidentale var. lacustre	Jacob's Ladder	Polemoniaceae	Undetermined
Polygala cruciata	Polygala	Polygalaceae	Rare
Polygonum arifolium	Halberd-Leaved Tearthumb	Polygonaceae	Rare
Polygonum careyi	Carey's Tearthumb	Polygonaceae	Endangered
Polygonum hydropiperoides	Mild Winter-Pepper	Polygonaceae	Undetermined
Polygonum viviparum	Alpine-Bistort	Polygonaceae	Rare
Polystichum acrostichoides	Christmas Fern	Polypodiaceae	Threatened
Polystichum braunii var. purshii	Braun's Holly Fern	Polypodiaceae	Endangered
Polytaenia nuttallii	Prairie Parsley	Umbelliferae	Threatened
Potamogeton diversifolius	Pondweed	Potamogetonaceae	Endangered
Potamogeton vaseyi	Vasey's Pondweed	Potamogetonaceae	Rare
Potentilla effusa	Cinquefoil	Rosaceae	Undetermined
Potentilla nicolletii	Nicollet's Cinquefoil	Rosaceae	Threatened
Prenanthes crepidinea	Rattlesnake Root	Compositae	Undetermined
Psoralea tenuiflora var. floribunda	Scurf Pea	Leguminosae	Threatened
Puccinellia nuttalliana	Alkali Grass	Graminae	Rare
Pyrola minor	Wintergreen	Pyrolaceae	Rare
Quercus prinoides var. acuminata	Dwarf Chestnut Oak	Fagaceae	Undetermined

Ranunculus gmelini	Small Yellow Water Crowfoot	Ranunculaceae	Rare
Ranunculus lapponicus	Crowfoot	Ranunculaceae	Rare
Rhynchospora capillacea	Hair-Like Beak-Rush	Cyperaceae	Threatened
Rhynchospora fusca	Beak-Rush	Cyperaceae	Rare
Rorippa sessiliflora	Yellow Cress	Cruciferae	Threatened
Rotala ramosior	Tooth Cup	Lythraceae	Rare
Rubus chamaemorus	Baked-Apple Berry	Rosaceae	Endangered
Rubus semisetosus	Half-Bristly Bramble	Rosaceae	Threatened
Rudbeckia triloba	Three-Lobed Coneflower	Compositae	Rare
Ruellia humilis	Ruellia	Acanthaceae	Undetermined
Rumex occidentalis	Sorrel	Polygonaceae	Rare
Sagina nodosa	Pearlwort	Caryophyllaceae	Threatened
Sagittaria brevirostra	Short-Beaked Arrowhead	Alismataceae	Undetermined
Sagittaria montevidensis ssp calycina	Arrowhead	Alismataceae	Rare
Sagittaria graminea	Grass-Like Arrowhead	Alismataceae	Threatened
Salicornia rubra	Glasswort	Chenopodiaceae	Threatened
Salix humilis var. keweenawensis	Prairie Willow	Salicaceae	Rare
Salix pellita	Willow	Salicaceae	Rare
Sanicula canadensis (includes var. grandis)	Black Snakeroot	Umbelliferae	Rare
Sanicula trifoliata	Black Snakeroot	Umbelliferae	Rare
Saxifraga aizoon var. neogaea	Saxifrage	Saxifragaceae	Endangered
Saxifraga cernua	Saxifrage	Saxifragaceae	Endangered
Schedonnardus paniculatus	Schedonnardus. No Common Name.	Graminae	Rare

Scirpus georgianus	Georgia Bulrush	Cyperaceae	Rare
Scirpus pedicellatus	Woolgrass	Cyperaceae	Threatened
Scleria triglomerata	Nut-Rush	Cyperaceae	Endangered
Scleria verticillata	Nut-Rush	Cyperaceae	Endangered
Scutellaria ovata var. versicolor	Skullcap	Labiatae	Rare
Sedum rosea var. leedyi	Roseroot	Crassulaceae	Endangered
Selaginella selaginoides	Spikemoss	Selaginellaceae	Threatened
Senecio canus	Senecio. No Common Name.	Compositae	Endangered
Senecio indecorus	Unsightly Groundsel	Compositae	Rare
Silene nivea	Snowy Campion	Caryophyllaceae	Undetermined
Silphium laciniatum	Compass-Plant	Compositae	Sp. Concern
Solidago mollis	Soft Goldenrod	Compositae	Undetermined
Solidago sciaphila	Shade-Loving Goldenrod	Copmpositae	Undetermined
Sparganium glomeratum	Bur Reed	Sparganiaceae	Rare
Stellaria longipes	Long-Stalked Chickweed	Caryophyllaceae	Rare
Subularia aquatica	Awlwort	Cruciferae	Rare
Sullivantia renifolia	Sullivantia. No. Common Name.	Saxifragaceae	Threatened
Taenidia integerrima	Yellow Pimpernel	Umbelliferae	Rare
Talinum rugospermum	Fameflower	Portulacaceae	Undetermined
Tephrosia virginiana	Goat's Rue	Leguminosae	Threatened
Thalictrum dasycarpum var. hypoglaucum	Purple Meadow-Rue	Ranunculaceae	Endangered
Thelypteris hexagonoptera	Broac Beech Fern	Polypodiaceae	Threatened
Tiarella cordifolia	False Miterwort	Saxifragaceae	Undetermined

Tillaea aquatica	Pigmyweed	Crassulaceae	Endangered
Tofieldia glutinosa	Sticky False Asphodel	Liliaceae	Rare
Tofieldia pusilla	Small False Asphodel	Liliaceae	Threatened
Tradescantia ohiensis	Ohio Spiderwort	Commelinaceae	Threatened
Triglochin palustris	Arrow Grass	Juncaginaceae	Rare
Triodanis leptocarpa	Venus's Looking-Glass	Campanulaceae	Undetermined
Triplasis purpurea	Sand Grass	Graminae	Undetermined
Tsuga canadensis	Hemlock	Pinaceae	Endangered
Utricularia gibba	Bladderwort	Lentibulariaceae	Rare
Vaccinium uliginosum var. alpinum	Alpine Bilberry	Ericaceae	Endangered
Verbena simplex	Simple Verbain	Verbenaceae	Rare
Vernonia baldwini var. interior	Ironweed	Compositae	Undetermined
Viola lanceolata	Lance-Leaved Violet	Violaceae	Threatened
Vitis aestivalis var. argentifolia	Silverleaf Grape	Vitaceae	Threatened
Vitis riparia var. syrticola	Dune Grape	Vitaceae	Rare
Waldsteinia fragarioides	Barren Strawberry	Rosaceae	Endangered
Woodsia glabella	Smooth Woodsia	Polypodiaceae	Rare
Woodsia scopulina	Rocky Mountain Woodsia	Polypodiaceae	Threatened
Xyris montana	Yellow-Eyed Grass	Xyridaceae	Rare
Xyrix torta	Twisted Yellow-Eyed Grass	Xyridaceae	Threatened

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX B

ANIMAL ELEMENTS

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX B Mammal Elements

SPECIES	COMMON NAME	MNHP STATUS
Microtus chrotorrhinus	Rock Vole	Endangered
Cervus canadensis	American Elk	
Microtus ochrogaster	Prairie Vole	Threatened
Canis lupus	Eastern Timber Wolf	
Pipistrellus subflavus	Eastern Pipistrel	Rare
Thomomys talpoides	Northern Pocket Gopher	
Reithrodontomys megalotis	Harvest Mouse	
Perognathus flavescens	Plains Pocket Mouse	
Onychomys leucogaster	Grasshopper Mouse	
Synaptomys borealis	Northern Bog Lemming	
Microtus pinetorum	Pine Vole	
Martes americana	Pine Marten	
Spilogale putorius	Spotted Skunk	
Felis concolor	Mountain Lion	
Lynx canadensis	Canada Lynx	
Cryptotis parva	Least Shrew	Undetermined
Phenacomys intermedius	Mountain Phenacomys	
Ursus horribilus	Grizzly Bear	Extinct
Rangifer caribou	Woodland Caribou	
Bison bison	Bison	

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Amphibian Elements

SPECIES	COMMON NAME	MNHP STATUS
Acris crepitans	Blanchard's Cricket Frog	Rare
Rana catesbeiana	Bullfrog	
Rana palustris	Pickerel Frog	
Hyla chrysoscelis	Gray Tree Frog	Undetermined

Reptile Elements

Eumeces fasciatus	Five-lined Skink	Endangered
Elaphe obsoleta	Black Rat Snake	Threatened
Coluber constrictor foxi	Blue Racer	
Sistrurus catenatus catenatus	Eastern Massasauga	
Notophthalmus viridescens	Common Newt	Rare
Plethodon cinereus	Red-backed Salamander	
Cnemidophorus sexlineatus	Six-lined Racerunner	
Diadophis punctatus aryni	Prairie Ringneck Snake	
Diadophis punctatus edwardsi	Northern Ringneck Snake	
Clemmys insculpta	Wood Turtle	
Graptemys pseudogeographica	False Map Turtle	
Trionyx muticus	Smooth Soft-shelled Turtle	
Emydoidea blandingii	Blanding's Turtle	Special Concern

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Fish Elements

SPECIES	COMMON NAME	MNHP STATUS
Acipenser fulvescens	Lake Sturgeon	Threatened
Hybopsis x-punctata	Gravel Chub	
Cycleptus elongatus	Blue Sucker	
Polyodon spathula	Paddlefish	Rare
Scaphirhynchus platorhynchus	Shovelnose Sturgeon	
Opsopoeodus emilae	Pugnose Minnow	
Notropis amnis	Pallid Shiner	
Notropis anogenus	Pugnose Shiner	
Notropis topeka	Topeka Shiner	
Notropis lutrensis	Red Shiner	
Carpiodes velifer	Highfin Carpsucker	
Moxostoma carinatum	River Redhorse	
Moxostoma valenciennesi	Greater Redhorse	
Moxostoma duquesnei	Black Redhorse	
Noturus exilis	Slender Madtom	
Anguilla rostrata	American Eel	
Fundulus sciadicus	Plains Top Minnow	
Ammocrypta asprella	Crystal Darter	
Percina evides	Gilt Darter	
Etheostoma chlorosomum	Bluntnose Darter	
Coregonus zenithicus	Shortjaw Cisco	Special Concern
Coregonus kiyi	Kiyi	
Clinostomus elongatus	Redside Dace	
Dionda nubila	Ozark Minnow	
Carpoides carpio	River Carpsucker	Undetermined
Aphredoderus sayanus	Pirate Perch	
Lepomis megalotis	Longear Sunfish	
Alosa chrysochloris	Skipjack Herring	Extirpated

MINNESOTA NATURAL HERITAGE PROGRAM

Mussel Elements

SPECIES	COMMON NAME	MNHP STATUS
Tritogonia verrucosa	Buckhorn	Endangered
Cyclonaias tuberculata	Purple Pimpleback	
Fusconaia ebena	Ebony Shell	
Plethobasus cyphus	Bullhead	
Elliptio crassidens	Elephant's Ear	
Potamilus capax	Fat Pocketbook	
Lampsilis teres	Yellow Sandshell	
Lampsilis higginsi	Higgin's Eye Pearly Mussel	
Quadrula metanevra	Monkeyface	Threatened
Ellipsaria lineolata	Butterfly	
Actinonaias carinata	Mucket	
Lasmigona costata	Fluted Shell	
Pleurobema cordatum	Ohio River Pigtoe	Rare
Elliptio complanatus		
Ligumia recta	Black Sandshell	
Arcidens confragosus	Rockshell	
Actinonaias ellipsiformis	Ellipse	Undetermined
Anodonta suborbiculata	Flat Floater	

MINNESOTA NATURAL HERITAGE PROGRAM

Butterfly Elements

SPECIES	COMMON NAME	MNHP STATUS
Hesperia uncas	Uncas Skipper	None Assigned
Hesperia assiniboia	Assiniboia Skipper	
Hesperia ottoe	Ottoe Skipper	
Hesperia dacotae	Dakota Skipper	
Oarisma garita	Garita Skipper	
Pyrgus centaureae freija	Grizzled Skipper	
Erynnis baptisiae	Wild Indigo Dusky Wing	
Eurema lisa	Little Sulphur	
Callophrys gryneus	Olive Hairstreak	
Plebejus samuelis	Karner Blue	
Plebejus argyrognomon nabokovi	Northern Blue	
Polygonia gracilis	Hoary Comma	
Oeneis uhleri varuna	Uhler's Arctic	
Erebia disa mancinus	Disa Alpine	

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX B Breeding Bird Elements

SPECIES	COMMON NAME	MNHP STATUS
[1]*Falco peregrinus anatum*	American Peregrine Falcon	Endangered
[1,2]*Falco peregrinus tundrius*	Arctic Peregrine Falcon	
[1,2]*Grus americana*	Whooping Crane	
Charadrius melodus	Piping Plover	
Athene cunicularia	Burrowing Owl	
Anthus spragueii	Sprague's Pipit	
Ammodramus bairdii	Baird's Sparrow	
Calcarius ornatus	Chestnut-collared Longspur	
[1]*Haliaeetus leucocephalus*	Bald Eagle	Threatened
Colinus virginianus	Bobwhite	
Tympanuchus cupido	Greater Prairie Chicken	
Grus canadensis	Sandhill Crane	
Asio flammeus	Short-eared Owl	
Lanius ludovicianus	Loggerhead Shrike	
Podiceps auritus	Horned Grebe	Rare
Accipiter gentilis	Goshawk	
Accipiter cooperii	Cooper's Hawk	
Falco columbarius	Merlin	
Coturnicops noveboracensis	Yellow Rail	
Gallinula chloropus	Common Gallinule	
Limosa fedoa	Marbled Godwit	
Steganopus tricolor	Wilson's Phalarope	
Strix nebulosa	Great Gray Owl	
Empidonax virescens	Acadian Flycatcher	
Parus bicolor	Tufted Titmouse	
Vireo bellii	Bell's Vireo	
Dendroica caerulescens	Black-throated Blue Warbler	
Seiurus motacilla	Louisiana Waterthrush	
Guiraca caerulea	Blue Grosbeak	
Ammodramus henslowii	Henslow's Sparrow	
Ammospiza caudacuta	Sharp-tailed Sparrow	

[1]This species officially receives an identical status designation by the U.S. Department of Interior, Fish and Wildlife Service and by the State of Minnesota.

[2]This species is not a breeding bird of the state but only occurs during migration. It is listed here due to its inclusion on the federal endangered species list.

MINNESOTA NATURAL HERITAGE PROGRAM

Breeding Bird Elements continued

SPECIES	COMMON NAME	MNHP STATUS
Gavia immer	Common Loon	Special Concern
Podiceps grisegena	Red-necked Grebe	
Pandion haliaetus	Osprey	
Bartramia longicauda	Upland Sandpiper	
Florida caerulea	Little Blue Heron	Undetermined
Bubulcus ibis	Cattle Egret	
Egretta thula	Snowy Egret	
Nyctanassa violacea	Yellow-crowned Night Heron	
Rallus elegans	King Rail	
Catoptrophorus semipalmatus	Willet	
Recurvirostra americana	American Avocet	
Tyto alba	Barn Owl	
Aegolius funereus	Boreal Owl	
Picoides tridactylus	Northern Three-toed Woodpecker	
Pica pica	Black-billed Magpie	
Mimus polyglottos	Mockingbird	
Icteria virens	Yellow-breasted Chat	
Wilsonia pusilla	Wilson's Warbler	
Euphagus carolinus	Rusty Blackbird	
Calamospiza melanocorys	Lark Bunting	
Plegadis chihi	White-faced Ibis	Extirpated
Olor buccinator	Trumpeter Swan	
Elanoides forficatus	Swallow-tailed Kite	
Numenius phaeopus	Long-billed Curlew	
Calcarius mccownii	McCown's Longspur	
Ectopistes migratorius	Passenger Pigeon	Extinct

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX C

GEOLOGICAL FEATURE ELEMENTS

APPENDIX C Geologic Features

The Element List for geologic features is not yet complete. The geologic Element list is currently being developed by a geologist hired on contract by the NHP. The final report, that includes a geologic Element list, will be available July 25, 1980.

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX D

OTHER SPECIAL FEATURE ELEMENTS

APPENDIX D Other Element List

The Other Element List includes a variety of significant natural features that do not fit logically into the plant, animal, plant community or geologic Element lists. At this time, this Element includes avian colonial nest sites and patterned peatlands. The patterned peatland Element list is being developed in conjunction with the Peat Program of the Minnesota Division of DNR. It is not yet available.

MINNESOTA NATURAL HERITAGE PROGRAM

Colonial Nesting Site Element

This Element concerns one or more of the species listed below. The nest sites containing species marked with an asterisk (*) should receive greater consideration since these species are known to nest in relatively few locations.

SPECIES	COMMON NAME	MNHP STATUS
**Podiceps nigricollis*	*Eared Grebe	Special Concern
Aechmophorus occidentalis	Western Grebe	
**Pelicanus erythrorhynchos*	*White Pelican	
**Phalacrocorax auritus*	*Double-crested Cormorant	
Ardea herodias	Great Blue Heron	
Casmerodias albus	Great Egret	
Nycticorax nycticorax	Black-crowned Night Heron	
Larus argentatus	Herring Gull	
Larus delawarensis	Ring-billed Gull	
**Larus pipixcan*	*Franklin's Gull	
Sterna forsteri	Forster's Tern	
**Sterna hirundo*	*Common Tern	

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX E

PLANT COMMUNITY ELEMENTS

MINNESOTA NATURAL HERITAGE PROGRAM

APPENDIX E

Plant Community Elements

Name	Designation in NHP Plant Community Classification	Description/Basis for Concern
Northern Hardwoods	cover class, A2.*00 (especially cover type, A2.A00)	Good stands of mature northern hardwoods (sugar maple-basswood-birch), especially those with mature yellow birch, appear to be rare in Minnesota, possibly due to logging.
"Big Woods"	cover class, A3.*00	The deciduous woods of central and southeastern Minnesota that are dominated by sugar maple, basswood, American elm and red oak have historically been referred to as the "Big Woods." Remnant woodlots of this once common plant community that have been relatively undisturbed by logging or grazing are a protection priority. Special attention to stands (1) with a rich herbaceous layer, (2) with Kentucky coffeetree or (3) occurring near the western edge of the former extent of the "Big Woods."
Floodplain Forest	cover class, A5.*00	Mature floodplain forests containing a diverse herbaceous layer are presumed to have been more common in the past. Because of their relative rarity and vulnerability to disturbance, this community is considered a protection priority. Special attention to stands containing river birch or swamp white oak.
Oak-Hickory Woods	cover type, A6.A00	Oak-hickory stands may be hypothetical in Minnesota. The envisioned plant community is a dry, upland woods in southeastern Minnesota containing black oak and shagbark hickory with an herbaceous layer quite different from that found in the "Big Woods."

Plant Community Elements continued

Name	Designation in NHP Plant Community Classification	Description/Basis for Concern
Spruce-Fir Stands	cover type, C1.A00	Pure spruce-fir stands may be hypothetical. If existing as a stable, mature plant community, this type is a protection priority.
Upland Stands of White Cedar	cover type, C1.D00	In northeastern Minnesota, this type is considered by some to be a climax community on upland sites. The successional status and frequency of occurrence of this type is uncertain. The outpost of white cedars at Queen's Bluff in southeastern Minnesota is certainly a protection priority.
Balsam Fir Outliers	cover type, C1.G00 with geographical considerations	Outlying populations of balsam fir are considered Elements (Fillmore County, a Pope County herbarium collection - a natural stand?).
Conifer Wetland Outliers	cover class, C2.*00 with geographical considerations	Of interest are: tamarack stands at the southern and western edges of its range (Rice County - site destroyed?; Carver County; a Pennington County herbarium collection - a natural community?; Grant or Douglas County?); black spruce stands and white cedar wetland stands at edge of range (Anoka County).
Jack Pine Wetland	cover type, C2.G00	An ericaceous bog community with a somewhat unusual dominant, jack pine, occurs on the Anoka Sandplain. Apparently rare in Minnesota.
Pine Stands	cover class, C3.*00	Mature pine stands located outside of the BWCA and federal RNAs are a protection priority. Special attention to mature native white pine stands in southeastern Minnesota?
Jack Pine Outliers	cover type, C3.E00 with geographical considerations	Outlying populations of jack pine (in Wabasha, Winona, Fillmore and Kittson? Counties) are considered protection priorities.

Plant Community Elements continued

Name	Designation in NHP Plant Community Classification	Description/Basis for Concern
Coniferous Savanna	cover class, G1.*00	If hill (goat) prairies with red cedar can be shown to be something other than a manifestation of overgrazing, then this plant community should be considered a protection priority. The status of jack pine barrens also needs to be determined.
Oak Savanna	cover type, G2.A00	Natural oak savannas, maintained by fire, are apparently uncommon in Minnesota and are therefore considered to be a protection priority.
Calcareous Fens	cover type, J4.0A0	Calcareous fens are an unusual type of wetland plant community that is dependent upon very localized water chemistry and hydrologic conditions and is characterized by a distinctive calciphilic flora. Apparently very rare in Minnesota.
Wet Prairie	cover class, L4.00*	Although prairies once covered approximately one-third of the state, only a small fraction of these plant communities remain and many of the prairie remnants are threatened by agricultural development. Hence, all five prairie cover classes are considered protection priorities. Of special interest are: halophytic plant communities (Lac Qui Parle County); high-lime (dry) prairies; hill or "goat" prairies occurring on steep south- or west-facing bluffs in southeastern Minnesota; and dune plant communities.
Wet-Mesic Prairie	cover class, L5.00*	
Mesic Prairie	cover class, L6.00*	
Dry-Mesic Prairie	cover class, L7.00*	
Dry Prairie	cover class, L8.00*	

OFFICE OF PLANNING, RESEARCH AND POLICY SECTION

SCIENTIFIC AND NATURAL AREAS POLICY (1979)

DEPARTMENT OF NATURAL RESOURCES

Policy

Effective Date Interim 7/6/79	Approved:
Number 4	
Supersedes Number ____	Other Guidelines
Date ____	Commissioner Orders # ____
	Rules & Regulations NR 300-3
	Operational Order ____
	Dept. Manual ____
	Other Minn. Statutes 86A

0103A

SUBJECT: SCIENTIFIC AND NATURAL AREAS

Preamble:

The Outdoor Recreation Act of 1975, Minnesota Statutes 86A.01 to 86A.11, establishes an outdoor recreation system which will (1) preserve an accurate representation of Minnesota's natural and historical heritage for public understanding and enjoyment and (2) provide an adequate supply of scenic, accessible, and useable lands and waters to accommodate the outdoor recreational needs of Minnesota's citizens. Scientific and Natural Areas are established as one component of this outdoor recreation system.

In keeping with the Legislative mandate of the Outdoor Recreation Act of 1975, the Department has established a goal, policies, and objectives for Minnesota Scientific and Natural Areas. It is the goal of the Department of Natural Resources for the SNA system to:

PRESERVE AND PERPETUATE THE ECOLOGICAL DIVERSITY OF MINNESOTA'S NATURAL HERITAGE, INCLUDING LANDFORMS, FOSSIL REMAINS, PLANT AND ANIMAL COMMUNITIES, RARE AND ENDANGERED SPECIES OR OTHER BIOTIC FEATURES AND GEOLOGICAL FORMATIONS, FOR SCIENTIFIC STUDY AND PUBLIC EDIFICATION AS COMPONENTS OF A HEALTHY ENVIRONMENT.

In order to facilitate meeting this goal, objectives and policies have been formulated for the following areas:

Designation

I. Scientific and Natural Areas (SNA) Evaluation Criteria

Management

I. Resource Management

II. Human Use Management

Appendix F: Scientific and Natural Areas Policy

DESIGNATION

I. Scientific and Natural Areas Evaluation Criteria

GENERAL POLICY

It is the objective of the Department to ensure that SNAs meet the following criteria:

A. Areas shall feature elements of natural diversity of exceptional scientific and educational value.

B. Areas shall be large enough to preserve their inherent natural values and permit effective research or educational functions.

Specific Policy

It is Department policy that each proposed SNA be evaluated in accordance with the policies outlined below:

1. Areas selected shall have one or more of the following features (M.S. 86A.05, Subd. 5.), which include but are not limited to;

   a) natural formations or features which significantly illustrate geological processes;
   b) significant fossil evidence of the development of life on earth;
   c) an undisturbed plant community maintaining itself under prevailing natural conditions typical of Minnesota;
   d) an ecological community significantly illustrating the process of succession and restoration to natural conditions following disruptive change;
   e) a habitat supporting a vanishing, rare, endangered, or restricted species of plant or animal;
   f) a relic flora or fauna persisting from an earlier period; or
   g) a seasonal haven for concentrations of birds and animals, or a vantage point for observing concentrated populations, such as a constricted migration route.

2. Area selection will be based on priorities dictated by one or more of the following considerations:

   a) rareness on a National, State or landscape region scale
   b) excellence and completeness of the natural features found in the area
   c) representativeness of the area in relation to the landscape regions of the state
   d) degree to which an area or its elements are threatened with incompatible use
   e) degree of protection afforded similar elements elsewhere in the landscape region

3. Area selection will consider the feasibility of managing the area for the significant element(s).

General Procedural Policy

It is the objective of the Department to ensure that the SNAs program continues collecting information and encouraging the preservation efforts of others. In furtherance of this objective, the following specific policies will be followed:

Specific Procedural Policy

A. The program will promote and maintain a statewide inventory so that all potential SNA areas are identified and catalogued.

B. The program will support and encourage conservation efforts of other groups, agencies and individuals by incorporating areas that qualify into the SNA system.

1. Proposals for SNA designation may be submitted by any agency, division of the Department of Natural Resources, organization or individual to the Commissioner's Advisory Committee (CAC) on SNAs.

2. The Department of Natural Resources will maintain a file on proposals submitted.

C. The program will submit all SNA proposals received to CAC to determine if the area qualifies on the basis of established designation criteria and policies. To aid in decision making CAC will consult:

1. Published or unpublished reports, Heritage Program file information and/or findings from on-site inspections by qualified persons to determine natural feature qualities.

2. Use a quantitative and qualitative evalution system that considers the criteria cited on page 2, under policies B., 2. (a-e) of the Designation Policies.

D. The program will develop and maintain a registry of qualified areas for public information or administrative purposes.

1. Contact with landowners will be established and maintained to discuss with them and demonstrate the significance of natural features on their lands.

E. The program (using CAC's recommendations) will recommend areas for designation to the Commissioner, based, to the maximum extent possible, on priorities for protection as established by the Natural Heritage Program.

F. Proposed areas having been found to qualify will be designated as SNA by the Commissioner. The Commissioner considering the recommendations of CAC will assign each SNA to one of the following unit-types as specified in the Outdoor Recreation Act of 1975 (M.S. 86A.05. Subd. 5).

1. Research unit. Use is limited to programs conducted by qualified scientists and college graduate and post-graduate students.

2. Educational unit. Permitted uses include all activities permitted in research units, and primary, secondary, and college undergraduate programs.

3. Public use unit. Permitted uses include all activities specified to Research and Education units and Interpretive programs for the benefit of the general public.

G. All research projects proposed in SNAs will be submitted to the SNA program for review and approval. Those projects found to be acceptable will be approved by the Commissioner.

MANAGEMENT

GENERAL POLICY

A. Management shall emphasize resource preservation over resource use.

B. SNAs shall be managed only to the extent necessary to preserve the natural features for which they were established.

C. Management plans for SNAs will be written which conform to the goals, objectives and policies expressed in the sections on Designation and Management. CAC will review and make recommendations on management plans.

D. Preparation of a management plan should be proceeded by an inventory of each SNA.

E. Management will promote the collection of resource data and historical records relevant to the resources of each SNA.

I. Resource Management

GENERAL POLICY

The Department will rely on the following administrative objectives to ensure preservation of the elements of natural diversity of SNAs.

A. Identify and catalog the natural features of each area.

B. Ensure that resource management is directed toward preservation and maintenance of all significant elements of the area.

C. Manage the areas in so far as possible, to perpetuate or establish natural processes and limit the effects of human activities.

D. Promote wise stewardship with users, local residents and special interest groups.

Specific Policy

To fulfill this general policy the Department will:

1. Conduct inventories to obtain the information needed to develop a management plan including:

   a. describing the biological and physical resources of the SNA and past use.

   b. collecting data in a way that permits monitoring the status of the significant natural elements of the area.

2. Monitor and evaluate SNA management periodically to determine if management objectives are being achieved.

3. Use management method(s) considered most natural and appropriate to the total environment of the area and;

   a. not use cost alone to dictate selection of the appropriate management methods.

   b. design management plans to address the ecological integrity of the area to prevent mismanagement.

   c. remove existing developments or unnatural objects unless they are unobstrusive and not detrimental to the purposes for which the area was designated or of historic value.

4. Prohibit the following:

   a. cutting of grass, brush, or other vegetation, thinning of trees, removal of dead wood and windfalls, opening of scenic vistas, or planting except as provided for in the management plan.

   b. intrusions of development on, through or over SNAs unless essential to the management of the unit.

   c. mineral extraction, peat harvesting and water inundation or appropriation.

   d. collection of plant, animal, historic or geological specimens (except by permit) or any consumptive use of natural resources.

   e. introduction of plant, animal or other objects including live seeds or disease organisms unless expressly provided for in the management plan.

5. Provide the following:

   a. special management to transient species only when there is a well defined need.

   b. special management for bald eagle nests and colonial water bird nesting sites where appropriate.

   c. review of Department permits and actions to minimize adverse effects on a designated SNA or unit included on the register.

6. Involve users, local residents, and special interest groups in the management of SNAs and enforcement of rules.

7. Establish a working relationship with adjacent landowners so as to minimize or eliminate those land use practices having an adverse impact on the SNA.

II. Human Use Management

GENERAL POLICY

The Department will rely on the following human use management objectives to ensure the preservation of SNA resources and provide for educational opportunities.

A. Limit human use on SNAs to the amount the resource can tolerate without damage to special features.

B. Provide for the interpretation of the special features and their management.

C. Seek input from users, local residents and special interest groups in decisions regarding most suitable use(s).

D. Require users engaged in scientific study to make information obtained on SNAs available to DNR and encourage users to make their studies available to the scientific community through reports or published articles.

Specific Policy

To fulfill this general policy the Department will:

1. Encourage:

   a. activities which can occur equally well on less vulnerable outdoor areas to be conducted elsewhere.

   b. scientific studies, photography and keeping of phenological records and faunal and floral lists for long term research and educational benefits.

   c. appropriate uses and public support rather than unrestricted public use.

2. Prohibit the following activities unless necessary for management purposes or specifically authorized by the management plan: collecting plants and animals, hunting, fishing, camping, picnicking, horseback riding, motorized vehicle use with the exception of parking facilities and similar activities.

3. Assure structures, trails and signs are as specified in the management plan and in keeping with the natural surroundings and present only so far as required for resource protection and provision of basic user needs.

4. Adapt interpretive techniques and materials to the user.

5. Limit or exclude use from an area for an appropriate period of time when important natural features are threatened as a result of such use.

6. Clearly post the process for obtaining a visitor use permit, when required, at the entrance to the SNA.

7. Notify adjacent landowners and interested parties prior to implementing major management actions.

8. Erect boundary signs as specified in the management plan to discourage encroachment and trespass onto SNAs and onto adjacent property by SNA users.

9. Require a "pack out what you bring in" litter philosophy and enforce litter regulations.

10. Fence only when necessary to correct persistent encroachment or trespass problems to SNA or adjacent property.

11. Regulate use by employing, singly or in combination, methods that include but are not limited to the following:

    a. no access restrictions.

    b. access by permit only.

    c. access on designated trail only.

    d. temporal or spatial zoning.

12. Require:

    a. review of all research proposals planned for SNAs with emphasis on the proposed research methology.

    b. if necessary, bonding of researchers to guarantee cleanup following completion of project(s).

SCIENTIFIC AND NATURAL AREAS SECTION

MINNESOTA'S LANDSCAPE REGIONS

SCIENTIFIC AND NATURAL AREAS SECTION
DIVISION OF PARKS AND RECREATION
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

7/15/80

Appendix G. MINNESOTA'S *LANDSCAPE REGIONS*

Minnesota's outdoor recreation system, including State Scientific and Natural Areas, requires representation of Minnesota based upon *landscape regions*. The eighteen section framework within these broad divisions developed by Kratz and Jensen, 1977, An Ecological Geographic Division of Minnesota, was used for this purpose (Figure 1). This divisional framework was based on earlier work of E.V. Bakuzis, 1959, with boundaries improved by the use of Marschner's, 1930, Original Vegetation of Minnesota map edited by Heinselman, 1974, and glacial geology references. These eighteen *landscape regions* represent areas of the state that are relatively homogeneous ecologically. Variations in climatic factors and the distribution of certain key plant species were important in determining these regions.

The relative abundance of original vegetation is tabulated for Marschner's vegetation types within each *landscape region* (see Table 1). The size of each *landscape region* is summarized (see Table 2).

The following is a short description of each *landscape region* grouped within three broad divisions; the Coniferous Forest, the Deciduous Forest, and the Grassland Divisions.

Coniferous Forest Division

This is the northeastern portion of the state. The southwestern limits of pine, black spruce and balsam fir were used as the dividing line between this division and the deciduous forest division. The area covers two-fifths of the state and is characterized by coniferous, deciduous, and mixed coniferous-deciduous forest communities. The coniferous forest division is separated into seven distinct *landscape regions*.

1. Border Lakes

   This region covers 5.4% of the state. It extends along the Canadian border in a strip approximately 50 km broad from eastern Cook County to western St. Louis County. In this area glacial activity was erosional rather than depositional producing the pattern lakes and ridges characterisitic of the area. Soil is thin and only slightly developed, and bedrock outcrops are common.

2. North Shore Highlands

   This region covers 1.6% of this state. It is a strip 10-20 km broad extending along the north shore of Lake Superior from the Canadian

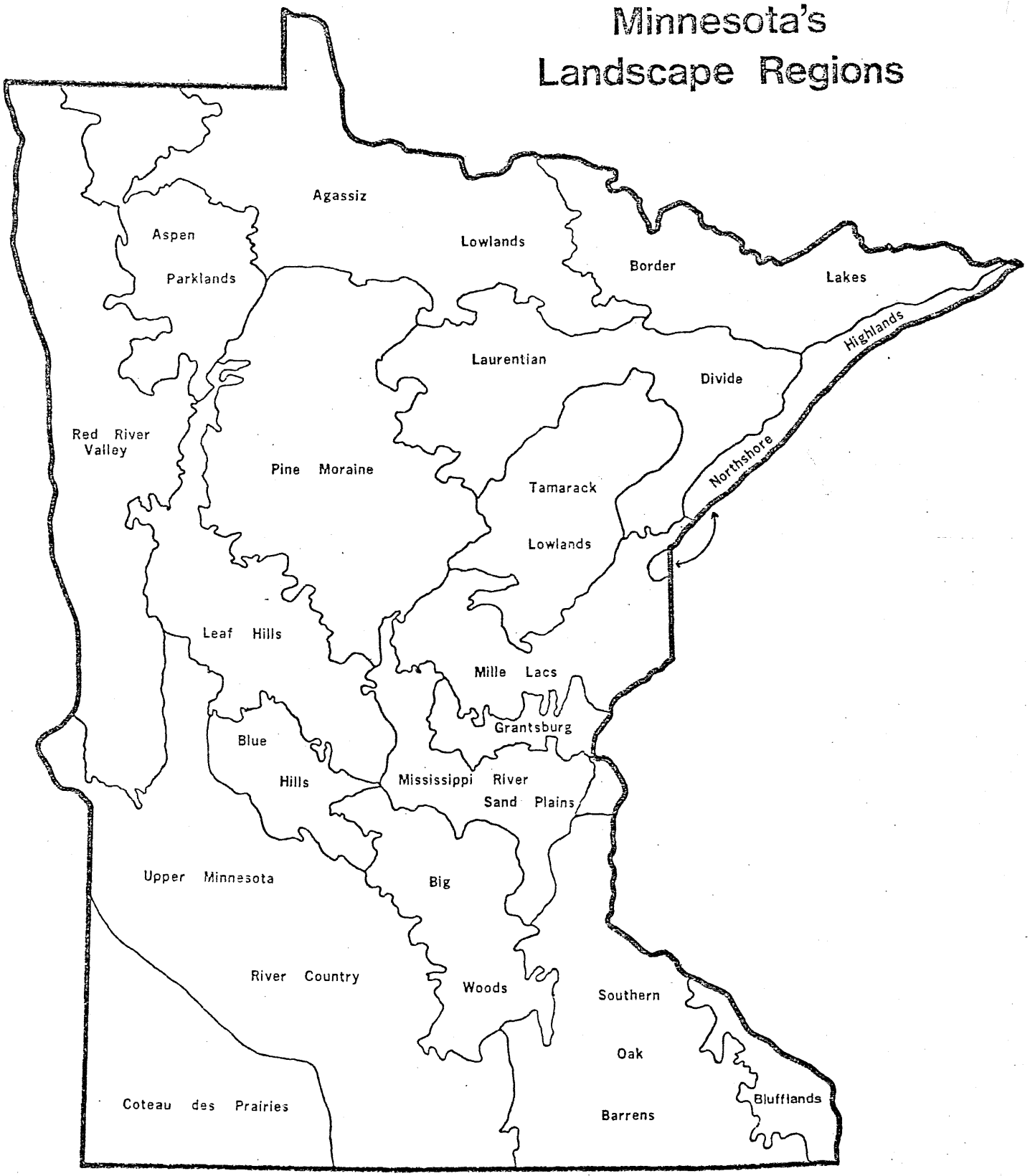

Figure 1. Adapted from T. Kratz and G.L. Jensen, An Ecological Geographic Division of Minnesota (Unpublished, 1977).

RELATIVE ABUNDANCE OF MARSCHNER'S VEGETATION TYPES
WITHIN EACH LANDSCAPE REGION

LANDSCAPE REGIONS	Marschner's Vegetation Types: Aspen-Birch Conifer	Conifer Bogs & Swamps	White & Red Pine	Jack Pine Barrens	White Pine Mixed Hardwood and Pine	Open Muskeg Aspen-Birch Hardwood	Big Woods River Bottom Forest	Oak Openings & Barrens	Aspen-Oak Land	Brush Prairie	Wet Prairie	Prairie	Pine Flats
Border Lakes	2	1	2	2	+	+	1				+		
Agassiz Lowlands	2	3	+	1		1	1	+		+	+	+	
Laurentian Divide	3	2	1	1	+	1	+	+	+		+		
Tamarack Lowlands	2	3	1	+	+	1	! +	+			1		
No. Shore Highlands	2	1	2			1							+
Pine Moraine	2	1	2	2	+	1	1	1	+	+	+	+	
Mille Lacs	1	1	1	+	1	1	+	+	+	+	+		
Leaf Hills	+	1			+	+	+	3		1	1	1	+	+	
Grantsburg	+	+				+	+	3	+	+	+		+		
Big Woods		1						3	+	+	1	1	1	+	
Blufflands								3	1	1		+	+	+	
Sand Plains	+	1					+	+	+	3	1	1	1	1	
Aspen Parkland	+	+		+			+	+	+	+	+	1	2	2	2
Blue Hills		+						+		1	+	+	1	3	
Oak Barrens		+						1	+	2	1	1	1	2	
Red River Valley							+	+	1	+	+	+	1	3	
Upper Minnesota River Country								+	1	+	+	+	1	3	
Coteau des Prairies									+	+			1	3	

3 = over 75% cover
2 = 25% - 75% cover
1 = under 25% cover
+ = very rare (1 or 2 small patches)

TABLE 1

SIZE OF LANDSCAPE REGIONS

	% OF MINN.	Km^2	$Miles^2$
Coniferous Division			
Agassiz Lowlands	9.0	19,510	7,530
Border Lakes	5.4	11,740	4,530
Laurentian Divide	5.9	12,800	4,950
Tamarack Lowlands	5.0	11,000	4,240
North Shore Highlands	1.6	3,520	1,380
Pine Moraine	10.0	21,660	8,360
Mille Lacs	4.1	9,040	3,480
TOTAL	41.0	89,270	34,470
Deciduous Division			
Blufflands	1.3	2,740	1,060
Big Woods	4.1	8,860	3,420
Mississippi River Sand Plains	3.3	7,190	2,770
Grantsburg	1.3	2,890	1,120
Leaf Hills	5.1	11,130	4,300
Aspen Parkland	5.0	10,910	4,210
TOTAL	20.1	43,720	16,880
Grassland Division			
Red River Valley	9.0	19,600	7,570
Blue Hills	2.1	4,570	1,770
Upper Minnesota River Country	14.6	31,680	12,230
Coteau des Prairies	5.6	12,300	4,740
Southern Oak Barrens	7.6	16,590	6,410
TOTAL	38.9	84,740	32,720
GRAND TOTAL	100.0	217,730	84,070

TABLE 2

border to Duluth. The region is approximately 300 m higher in elevation than Lake Superior and has many rivers flowing directly into the lake. The soil is better developed in this region than the Border Lakes region. The climate is influenced by Lake Superior and this is reflected in the vegetation.

3. Laurentian Divide

This region comprises the central portion of St. Louis County and most of the eastern half of Itasca County containing 5.9% of the state. This region is bounded on the north by the Border Lakes region, on the east by the North Shore Highland region and on the northwest by the Herman beach line (separating the Agassiz lowlands from this region) on the south and west, the dividing line is the line which best separates the conifer bog and swamp vegetation type of the Tamarack Lowlands region from the aspen-birch (conifer) types prevalent in this region.

4. Tamarack Lowlands

This region comprises the southwestern portion of St. Louis County, most of Aitkin County and the western half of Carlton County containing 5.0% of the state. This area was once entirely covered by glacial lakes, Aitkin and Uphams; it has little relief. The area is characterized by extensive peatlands intermittently interrupted by stretches of sandy mineral soils.

The area is bounded on the north, east, and west by the Laurentian Divide region, on the south and west; the dividing line is the line which best separates the conifer bog and swamp vegetation type from the pine types. This line coincides with the souther limit of the Automba Drumlin area on the south, and the western limit of the Swatera Plain and Aitkin Lacustrine Plain to the west.

5. Agassiz Lowland

This region covers all of Lake of the Woods County, most of Koochiching County, the eastern one-third of Roseau County, the northeastern part of Beltrami County and the northwestern part of St. Louis County and covers 9.0% of the state. The area was once entirely covered by Glacial Lake Agassiz and has very little relief and characterized by extensive peatlands intermittantly interrupted by stretches of sandy mineral soils.

The region is bounded on the west by the boundary line between the deciduous forest and coniferous forest divisions. To the south and east the borders are extensive mineral soil areas of the Pine Moraine region and the Border Lake region. The boundary to the southeast, between this region and the Laurentian Divide region, is less clear but follows the southern shore of Glacial Lake Agassiz as marked by the Herman beach line.

6. Pine Moraine

This region covers 10.0% of the state and is located in north central Minnesota including Clearwater, Hubbard, and parts of Becker, Cass, Crow Wing and Itasca Counties. This area was originally forested with aspen, white, red and jack pine including some bog areas.

This section is bounded on the west and south by the deciduous forest division, on the north by Agassiz Lowlands, on the east by the western boundary of the Swatera Plain and Aitkin Lucustrine Plain, and on the southeast by the northwest edge of the Brainerd-Pierz Drumlin area.

7. Mille Lacs

This region covers 4.1% of the state in a strip approximately 60 km broad south of a line from the north shore of Mille Lacs Lake to Duluth. This is the region where the white pine lumbering industry flourished near the turn of the century.

The northern boundary is marked by the southern limit of the Automba Drumlin area, the western limit by the western edge of the Brainerd-Pierz Drumlin area, and the southern limit by the deciduous forest border, and the eastern limit by the Wisconsin border.

Deciduous Forest Division

The deciduous forest division is sandwiched between the coniferous forest to the north and east and the grassland to the south and west. Vegetation of this area is transitional in nature, although good maple-basswood forests existed. The southeastern portion of this state has eastern deciduous forest communities such as oak-hickory. Characteristic trees of the division are sugar maple; basswood; red, white, bur, black and northern pin oak; ironwood; elm; hickory; butternut; birch; and trembling and big toothed aspens. The deciduous forest division is separated into six distinct *landscape regions*.

8. Blufflands

The Blufflands region is located in the extreme southeastern part of the state representing 1.3% of Minnesota. It is part of the deeply dissected Rochester Till Plain. The till, where present, is of pre-Wisconsin age and the area is often considered an extension of the driftless area of southwestern Wisconsin. The area is characterized by rugged river valley and bluff topography with sandstone, limestone, and dolomite outcrops adjacent to the Mississippi floodplain, where one sand dune sheet of special interest occurs in Wabasha County.

9. Mississippi River Sand Plains Region

This region covers 3.3% of the state in area predominantly sandy outwash with clusters of dunes extending in a strip running from the

coniferous forest division border west of Mille Lacs Lakes to the Twin Cities. It includes all of the Brainerd and Anoka Sand Plains and Mississippi valley train with their mosaic cover of jack pine, oak savanna, and prairie vegetation.

10. Big Woods Region

This region was very obvious before and during early settlement and covers 4.1% of the state. Today it is mostly in agriculture through clearing the maple-basswood forest. The area stood out as a wooded island situated between two prairie and oak savanna and woodland areas.

Brown calcareous clayey till of the Des Moines lobe and Grantsburg sublobe covers most of the region. Some sandy valley-train is present where the Minnesota River Valley cuts through the region.

11. Grantsburg Region

This region lies north of the Anoka Sand Plain, east of the Mississippi River and south of the coniferous forest division line and covers 1.3% of Minnesota.

The glacial geology of this region is complex. Part of this region was once covered by Glacial Lake Grantsburg and lake sediments can be found in some areas. Both calcareous and noncalcareous parent materials are found in the section, the former being washed into Lake Grantsburg from the Grantsburg sublobe. Today this area is mostly under agricultural use after earlier clearing of the oak woodlands.

12. Leaf Hills Region

This region covers 5.1% of the state which extends in a narrow strip between the coniferous forest and grassland divisions from west of Bagley almost to St. Cloud.

The region encompasses the northern part of the Alexandria moraine complex. The moraine, along with a pitted outwash plain, account for the abundance of lakes in the western portion of the section. The eastern portion of the section is on the St. Croix moraine. There is relatively high relief in the moraine areas.

13. Aspen Parkland Region

This region covers 5.0% of the state and is located in northwestern Minnesota between the grassland and coniferous forest divisions. It is a southern extension of the Aspen Parkland found in Manitoba. It extends from the Canadian border south to the northern limit of the Leaf Hills region.

The region was completely covered by Glacial Lake Agassiz and there is little relief.

Grassland Division

The grassland division covers two-fifths of Minnesota. This represents the eastern extent of the Great Plains of the Dakotas and Iowa. These prime agriculture lands were once characterized by treeless prairie. Grasses such as big bluestem, little bluestem, Indian grass, needle grass and others covered the area.

The grassland division is separated into five distinct *landscape regions*.

14. Red River Valley Region

This region covers 9.0% of the state extending along the North Dakota border from Canada to Traverse County. The region was covered by Glacial Lake Agassiz and heavy lacustrine soils are common in the area. Drainage is to the north via the Red River of the north and its tributaries.

15. Upper Minnesota River Country Region

This region covers 14.6% of the state approximately 50 km on either side of the Minnesota River from Ortonville to Mankato. The area is covered by gray, calcareous till deposited by the Des Moines lobe. The Minnesota River Valley is a distinct feature of the area. The river channel was cut when the river (then Glacial River Warren) drained Glacial Lake Agassiz.

There are few remnant areas of virgin prairie in the region as it is currently under agriculture use. Granite knob outcrops from the valley floor support vegetation of special interest.

16. Blue Hills Region

This region covers 2.1% of the state extending southeast from just south of Alexandria to Litchfield. This region is geologically distinct from the Upper Minnesota River Country region to the southwest, and vegetationally distinct from the Deciduous Forest Division to the northwest. The western part of the region has a rugged topography where the Alexandria moraine complex crosses the region. Just northeast of the moraine the topography is less rugged and the region is covered by an outwash plain.

17. Coteau des Prairies Region

This region covers 5.6% of the state at the southwestern corner of the state. An escarpment of exposed red quartzite rising about 200 m separates this region from the lower region of the Upper Minnesota River Country. The area is covered in part by glacial

deposits several hundred feet thick, but the cretaceous metamorphic quartzite bedrock upland beneath the glacial till probably adds to the relief.

18. Southern Oak Barrens Region

This region covers 7.6% of the state extending from the Twin Cities south to the Iowa border. The region's western border is marked in the north by the Deciduous Forest Division and in the south by the western edge of the Owatonna moraine. On the east the region is bordered by the valley and bluffs of the Bluffland region. This region is a transition zone between the prairie to the west and the deciduous forest to the north and east. Today, most of this region is cleared and under agricultural practice.