SOIL AND VEGETATION INVENTORY

OF WAGNER NATURAL AREA, ALBERTA

Prepared for:

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EXECUTIVE SUMMARY

Wagner Natural Area is situated approximately 6.4 km west of the present city limits of Edmonton, Alberta, and encompasses approximately 160 ha of crown land. The *Wagner Natural Area Management Plan* (Wagner Natural Area Society and Alberta Environmental Protection (WNAS and AEP) 1999) stated that site has been "designated by policy as a Conservation Natural Area". Wagner Natural Area is also one of over 80 Ecological Monitoring and Assessment Network (EMAN) sites that have been established across Canada to conduct long-term ecological monitoring with the objective of understanding ecosystem change.

The cumulative effects of the present uses of the site for research, education and limited recreation, and the increasing demand for urbanization and recreation, may cause negative impacts on the site itself as well as conflicts among users of the Natural Area. WNAS and AEP (1999) provides guidelines for protecting natural features of the site while allowing restricted use for research, education and recreation. In support of management initiatives, Alberta Environment contracted Geowest Environmental Consultants Ltd. to update and standardize information on soils and vegetation for the Natural Area.

The following specific project objectives were identified:

- Complete a detailed soil survey and produce a soils map and legend at 1:5,000 scale of Wagner Natural Area;
- Complete a detailed vegetation inventory and produce a vegetation community type map and legend at 1:5,000 scale of Wagner Natural Area;
- Complete a plant community classification for Wagner Natural Area based on a field survey, previously collected data, and correlation with other work (vegetation classifications published in the relevant literature);

- Produce a report outlining the details of field and analytical methods, study results and a discussion of possible applications of the soil and vegetation inventories to biodiversity monitoring.

Field work was conducted during July 5-23/1999, from which data for 18 detailed and 73 reconnaissance plots were collected in compliance with the guidelines provided in the *Ecological Land Survey Site Description Manual*, *Alberta Forest Service Range Survey Manual* and the *Canadian System of Soil Classification.*

Soil mapping of Wagner Natural Area resulted in the identification of 17 soil units (46 soil and landscape polygons). The dominant soils of the area are carbonated Organics (various subgroups). Mineral soils are confined to a few developed upland areas (hay fields and the old cabin area). The mineral soils are dominantly Dark Gray Luvisols developed on medium textured glaciofluvial deposits. The majority of the area is level (slopes less than 1 percent).

Secondary carbonates were present in many of the mapped organic and mineral soils. The presence of carbonates in the soil profile is caused by precipitation from calcium carbonate enriched groundwater.

Aerial photo interpretation and related plot data, supported by two cluster analyses, resulted in the classification and mapping of eight native vegetation community types that were further subdivided into 20 subtypes based on differences in the dominant understory species. Within the study area, a black spruce-tamarack community type dominates forested areas, followed by the white spruce-black spruce, white spruce-balsam poplar, balsam poplar-aspen, Alaska birch-balsam poplar, and white spruce community types. Willow/sedge-bluejoint was the only shrubland community identified. The rich calcareous fen community type was also described. Miscellaneous cover types, such as agricultural fields, are also identified and mapped.

Certain relationships between vegetation communities and local environmental conditions were noted. Mineral soils in the agricultural fields occupy the dry end of the soil moisture gradient and are also the

least minerotrophic of all soils found in the area. The soils from fen communities occupy the wettest end of the moisture gradient. They are also the most nutrient rich. Higher water tables and lower nutrient concentrations in the top 30 cm of the soil distinguish the soils supporting black spruce-tamarack communities from those found in other community types. Soils found in association with the remaining vegetation community types in Wagner Natural Area are in the middle range of moisture and nutrient regimes. The reasons for the present distribution of deciduous, mixedwood, and white spruce community types can only be hypothesized. More detailed long-term studies on geomorphology, hydrology, soil micronutrient dynamics and disturbance history are needed to better understand ecosystem functions in Wagner Natural Area.

In addition to the soil and vegetation inventory, the establishment of 18 permanent monitoring plots in accordance with EMAN protocols was achieved in this study. It is hoped that the information on soils and present vegetation composition within the study area, in conjunction with the establishment of the monitoring plots, will provide an opportunity to assess and document vegetation community changes over time.

ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

1.1 Location

Wagner Natural Area is a small, protected area of about 144 ha of crown land located approximately 6.4 km west of the present city limits of Edmonton, Alberta. It includes parts of Sections 7 and 8, within Township 53, Range 26, West of the 4th Meridian (legal description NE7, NW8, SW8-53-26-W4M) (Figure 1). Portions of Section 8 were added to Wagner Natural Area in 1991 subsequent to the development of an interchange between Highway 16 and secondary Highway 794 (a connection road south of Highway 16) just east of Wagner Natural Area (P. Clayton, personal communication).

1.2 Background Information

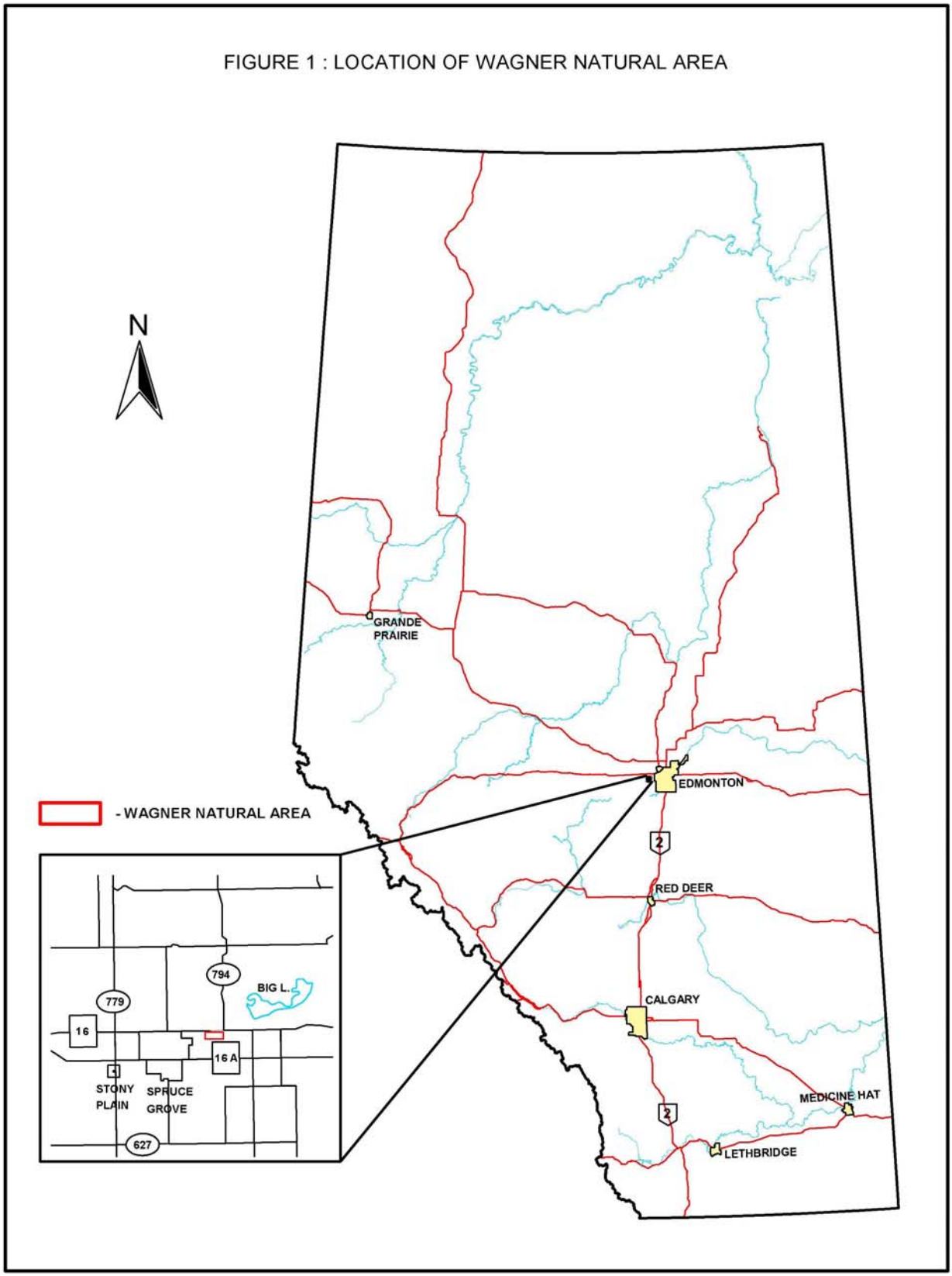
Wagner Natural Area is part of a rich calcareous peatland, popularly known as " Wagner bog" east of Spruce Grove. The site received its legal Natural Area status in 1987, and it has been designated by provincial government policy as a Conservation Natural Area. Wagner Natural Area is also one of over 80 Ecological Monitoring and Assessment Network (EMAN) sites that have been established across the country to conduct long-term ecological monitoring with the objective of understanding ecosystem change (Roberts-Pichette and Gillespie 1999).

The most ecologically significant features of Wagner Natural Area are the rich* calcareous fen and marl pond habitats occupying approximately 8% of the site, and the presence of a number of rare and/or significant species, including 16 of the 26 species of orchid that occur in Alberta (McIsaac and Macdonald n.d., Moss 1983). Fourteen plant species occurring within Wagner Natural Area are presently included in the Alberta Natural Heritage Information Centre (ANHIC) vascular and moss tracking lists (J. Rintoul, personal communication).

Prior to the acquisition of Wagner Natural Area by the Alberta government in 1971, the Alberta Panel of the Conservation Committee of the Canadian Committee for the International Biological Programme

* Originaly suggested by Swedish ecologist Heinar Du Reitz, word "rich" meant areas rich in plant indicator species; in present days, it refers to the areas with highly minerotrophic ground water (Vitt 1982)

FIGURE 1 : LOCATION OF WAGNER NATURAL AREA



(Terrestrial Subsection) (CC-IBP-CT) surveyed the Wagner property (N1/2 7-53-23-W4M) and found it to have "very interesting calcareous fens, marl bogs and a nesting colony of Bonaparte's gulls and hence "value as a prospective nature sanctuary." The first attempt at an ecological and biological survey of the property was undertaken in 1972 by Dr. George LaRoi and Mr. A.D. Raszewski of the University of Alberta, who deposited their check-sheet of findings in the database of the IBP (correspondence and minutes in government file 09733-W01 Vol 01, Alberta Environment). For the last 25 years efforts to catalogue Wagner 's biodiversity have continued with formal or informal studies done by specialists, graduate students of the University of Alberta, summer students working in the employ of the Wagner Natural Area Society and members of the Wagner Natural Area Society and other volunteers. To date, about 317 vascular plant species are listed for the Natural Area (Appendix 7), as well as 70 mosses, 12 liverworts, 75 lichens and 69 species of fungi (Appendix 8). These numbers are likely to change as the inventorying process continues by the Wagner Natural Area Society and others. However, until the summer of 1999, no systematic biophysical inventory of the vegetation communities and associated soils had been done.

The Natural Area provides habitat for at least 3 fish, 6 herptile, 138 bird, 41 mammal, and so far as is known, more than 2000 insect species (Wagner Natural Area Society and Alberta Environmental Protection 1999).

The unusual diversity of flora and fauna within a relatively small area attracts numerous researchers to Wagner Natural Area. At the same time, because of its proximity to several urban centres (Edmonton, St. Albert, Spruce Grove), Wagner Natural Area is under increasing pressure from urbanization and recreational use. These multiple, and sometimes conflicting uses of the Natural Area may negatively impact the site in the future without careful management (WNAS and AEP 1999).

The *Wilderness Areas, Ecological Reserves and Natural Areas Act* (Province of Alberta 1989) provides general protective status for Wagner Natural Area. The recently completed Wagner Natural Area Management Plan (Wagner Natural Area Society and Alberta Environmental Protection 1999) provides site-specific guidelines for management. The primary goals for management of this site are: 1) to maintain natural ecological diversity, ecological processes, native species and habitats; 2) to protect

rare and significant natural features; 3) to support environmental education use; and 4) to permit a limited range of other activities, such as research, and some recreation.

The inadequacy and poor reliability of the existing ecological baseline information for the Natural Area limits current management plan implementation. Some biophysical data were available for the site before this study; however, different levels of information have been collected at different times and for different portions of the Natural Area. The collection of baseline information for existing vegetation and soil conditions was needed as a solid foundation for appropriate management and subsequent monitoring. The purpose of this project, therefore, was to update and standardize soils and vegetation baseline information for the Natural Area.

To ensure the protection of native species and habitats, as well as rare and significant natural features of Wagner Natural Area, and because the area is also an EMAN site, the management plan proposed the implementation of a site and ecosystem monitoring program. Therefore, a second component of this project was to initiate a site and ecosystem-monitoring program by establishing permanently marked sample areas in accordance with EMAN protocol.

1.3 Project Objectives

The overall goal of this project was to provide spatial and attribute data for the soils and vegetation communities of Wagner Natural Area that can be used: a) to select soil and vegetation community attributes that could potentially be included in the overall biodiversity monitoring strategy for Wagner Natural Area; and (b) to determine suitable sites for monitoring elements of biodiversity (including bird, arthropod, amphibian, mammal, and plant species) using EMAN protocols.

To meet the goal, the following specific project objectives were identified:

1. Complete a detailed soil survey and produce a soils map and legend at 1:5,000 scale of Wagner Natural Area;

2. Complete a detailed vegetation inventory and produce a vegetation community type map and legend at 1:5,000 scale of Wagner Natural Area;

3. Complete a plant community classification for Wagner Natural Area based on the field survey, previously collected data, and other work (vegetation classifications published in the relevant literature);

4. Produce a report outlining the details of field and analytical methods, study results and a discussion of possible applications of the soil and vegetation inventories to biodiversity monitoring.

2.0 STUDY AREA DESCRIPTION

2.1 Climate

Geographically, Wagner Natural Area is situated in the north-west portion of the Central Parkland Sub-Region of the Parkland Natural Region (Achuff 1994). The Sub-region is characterized by having a mean annual temperature of 2 ^{o}C and a mean annual precipitation of 350-450 mm, with most of the precipitation occurring during the summer. In addition, there is a spatial moisture gradient within the Central Parkland Sub-Region, with the available moisture increasing from the southeast to the northwest (Vujnovic 1998). Wagner Natural Area falls within the wettest part of the Sub-region. This is further confirmed by the climate normals from the Edmonton/Stony Plain climate station, which suggest an average annual temperature of 3.1^{o}C, and a mean annual precipitation of 540.2 mm (Environment Canada 1993). Achuff (1994) and Environment Canada (1993) provide additional information on the climatic conditions of the Central Parkland Sub-Region of Alberta and for the Edmonton/Stony Plain area, respectively.

Peatlands such as those in Wagner Natural Area, and their associated vegetation communities, are uncommon within the Central Parkland Sub-Region of Alberta (Government of Alberta 1994) where they occur on their southern limit of geographical distribution as a result of microclimatic and edaphic factors.

2.2 Bedrock and Surficial Geology

The study area is underlain by the Horseshoe Canyon Formation (Hamilton et al.1999). The Horseshoe Canyon Formation is described as gray, feldspathic, clayey sandstone; gray bentonitic mudstone and carbonaceous shale; concretionary ironstone beds, scattered coal and bentonitic beds of variable thickness; minor limestone beds; mainly non-marine (Hamilton et al. 1999).

Surficial deposits in the region are dominantly ice-contact lacustrine and fluvial deposits (undivided) and lacustrine deposits (Shetsen 1990). The ice-contact lacustrine and fluvial deposits consist of gravel, sand, silt and clay, and local till up to 25 metres thick, deposited in supraglacial lakes and

streams, or at margins of proglacial lakes. Topography is undulating to hummocky. The lacustrine deposits are described as silt and clay with local ice-rafted stones, up to 80 metres thick, deposited mainly in proglacial lakes, and include recent lake sediment. Topography is level to gently undulating.

2.3 Hydrogeology

The sand and gravel deposits resulting from the Pleistocene glaciation are the major aquifer in Wagner Natural Area (Prosser 1982). A catchment area to the south of the study site receives precipitation that soaks into the ground and, as it moves down-slope through the aquifer, dissolves some of the calcium rich sediments. In certain areas of the Natural Area, the ground surface dips below the piezometric surface resulting in a number of springs. These springs are rich in calcium carbonate and some contain sodium and sulfates as well. Calcium carbonate precipitating from the spring water is called marl. Precipitation of calcium carbonate is a result of two separate processes. First, the carbon dioxide in the spring water equilibrates with the atmosphere, resulting in the over saturation of water with calcium carbonate which was held in a solution by the raised carbon dioxide concentration (Presser 1982). Secondly, carbon dioxide is removed from the spring water through photosynthesis by *Chara* species (Wagner Natural Area Society 1986, Crum 1988). The temperature of the spring water is around 4^{o}C all year round, preventing deep frost from penetrating into the ground in the immediate area. Prosser (1982) provides a more detailed description and diagram of the geology and hydrology of the area.

2.4 Soils

Wagner Natural Area lies within a transition of the Thick Black, Gray and Dark Gray Soil Zones of Central Alberta (Brierley et al. 1998). The soils were originally mapped as undifferentiated Organics and Dark Gray Luvisols developed on medium to moderately fine textured (sandy loam, silt loam or silty clay loam) glaciofluvial materials (Carvel series) (Bowser et al. 1962). More recently the soils were mapped as a mix of undifferentiated Organics and Dark Gray Luvisols developed on moderately coarse (sandy loam) glaciofluvial deposits (Brightbank series) (CAESA Soil Inventory Working Group 1998). The northwest corner of the area was mapped as having equal amounts of undifferentiated Organics, Eluviated and Gleyed Black Chernozemics developed on fine (clay) glaciolacustrine deposits (Malmo and Navarre series).

2.5 Vegetation

Two previous surveys suggested the existence of six major plant communities within Wagner Natural Area. Mussell (1979) surveyed the portion of the area located in the northern part of Section 7 and approximated the location and boundaries of the following native plant communities: 1) Sedge/Brown moss fen; 2) Black spruce/Labrador tea/Sedge/Sphagnum forest; 3) Birch/Willow/Grass forest; 4) Balsam poplar/Willow/Dewberry Forest; 5) Aspen poplar-Balsam poplar/Willow/Dewberry forest; and 6) White spruce/Willow/Bunchberry forest. Mussell (1979) also proposed 15 community sub-units based on differences in species composition. As part of an environmental impact assessment for a proposed interchange and connector road bordering the Natural Area, Spencer Environmental Management Services (1990) described and mapped plant communities for the part of the area located in Section 8 at a scale 1:2,500. The authors applied the native vegetation classification developed by Mussell (1979) and mapped the same six native vegetation communities.

Orchids represent one of the most studied groups of plants within Wagner Natural Area. While some of the orchid species are more widespread within the Natural Area (e.g. round-leaved orchid, *Orchis rotundifolia*), others are more commonly found in specific habitats. Tall white bog orchid (*Habenaria dilatata*) and hooded ladies's tresses (*Spiranthes romanzoffiana*) occur in wet sedge areas. Pale coral-root (*Corallorhiza trifida*) inhabits mainly white spruce-balsam poplar forests. Blunt-leaved bog orchid (*Habenaria obtusata*), bog adder's mouth (*Malaxis paludosa*) and heart-leaved twayblade (*Listera cordata*) are found mainly in black spruce-tamarack forests, while northern green bog orchid (*Habenaria hyperborea*) occurs commonly in many types of wetland habitats (Thormin 1982a).

Fourteen rare plant species occurring within Wagner Natural Area include flat-topped white aster (*Aster umbellatus,* ranked as S2*), spotted Joe-pye weed (*Eupatorium maculatum,* ranked as S1S2), oblong-leaved sundew (*Drosera anglica,* ranked as S2), bog adder's-mouth (*Malaxis paludosa,* ranked as S1S2), white adder's mouth (*M. monophylla,* ranked as S2), slender spike-rush (*Eleocharis tenuis,* ranked as SU), slender beak-rush (*Rhynchospora capillacea,* ranked as S1), *Amblyodon dealbatus* (ranked as S2), *Brachythecium campestre* (ranked as S2), *B. plumosum* (ranked as S2), and *Campylium*

* Ranking as per Alberta Natural Heritage Information Centre Definitions (Appendix 9)

radicale (ranked as S1), *C. polygamum* (ranked as S3), narrow-leafed chain-teeth moss (*Desmatodon cernuus,* ranked as S1), and brown moss (*Drepanocladus crassicostatus*, ranked as S1) (ANHIC 2000, J. Rintoul, personal communication). Moreover, bog adder's-mouth "is likely the rarest viable plant species in Alberta" (Fairbarns 1989).

2.6 Wildlife

Numerous wildlife species inhabit Wagner Natural Area. Mule Deer (*Odocoileus hemionus*), White-tailed Deer (*Odocoileus virginianus*), Moose (*Alces alces*), Coyote (*Canis latrans*), Porcupine (*Erethizon dorsatum*), Masked Shrew (*Sorex cinereus*), Snowshoe Hare (*Lepus americanus*), Little Brown Bat (*Myotis lucifugus*), Beaver (*Castor canadensis*), and Muskrat (*Ondatra zibethicus*) are some of the mammals whose presence within the Natural Area has been confirmed (Wagner Natural Area Society 1988).

The diversity of vegetation communities within Wagner Natural Area provides habitat for numerous fauna with specific habitat requirements. For example, a number of the butterfly species reported for Wagner Natural Area can be found only in certain vegetation types. Pearl Crescent (*Phyciodes tharos*) and Hoary Elfin (*Callophrys polios*) inhabit open and shrub fen areas while White Admiral (*Limenitis arthemis*) lives mainly in deciduous or mixedwood forests. Black spruce forest is home to Holland's Atlantis Fritillary (*Speyeria atlantis hollandi*) and Mustard White (*Pieris napi*) is a butterfly of open fields and white spruce forests (Thormin 1982b).

The different vegetation communities also provide nesting habitats for variety of birds. The mixed white spruce-balsam poplar forests provide nesting sites for species such as Ruffed Grouse (*Bonasa umbellus*)*, Pileated Woodpecker (*Dryocopus pileatus*), Golden-crowned Kinglet (*Regulus satrapa*), Warbling Vireo (*Vireo gilvus*), Purple Finche (*Carpodacus purpureus*) and Swainson's Thrushe (*Catharus ustulatus*). Species inhabiting black spruce-tamarack forest include Boreal Chickadee (*Poecile hudsonicus*), Red-breasted Nuthatch (*Sitta canadensis*), Yellow-rumped Warbler (*Dendroica coronata*) and Dark-eyed Junco (*Junco hyemalis*). Tennessee (*Vermivora peregrina*) and Yellow

* Nomenclature for Latin names of birds follows American Ornithologists' Union (1998).

Warblers (*Dendroica petechia*), Alder Flycather (*Empidonax alnorum*), and Common Yellowthroat (*Geothlypis trichas*) are some of the bird species that utilize wet willow/sedge areas. The Solitary Sandpiper (*Tringa solitaria*) and Lesser Yellowleg (*Tringa flavipes*) frequent the edges of marl ponds (Thormin 1982c).

2.7 Natural and Anthropogenic Disturbances

Wagner Natural Area has been influenced by various natural and man-made disturbances. Beaver activity has caused periodic flooding (WNAS and AEP 1999). Four fields (about 16 ha) were cleared for agriculture since the turn of the century; three continue to be used for hay production and one has been allowed to undergo natural succession. A dugout was constructed in the past near Atim Lake Road, and timber removal occurred around the turn of the century in the eastern portion of the Natural Area. In addition, a seismic line was established in the southwestern corner and 23 bore holes were drilled on the site (WNAS and AEP 1999). Wagner Natural Area also has two permanent trails. The trail situated in the western portion of the area, the 'Marl Pond Trail', is used frequently for educational and recreational purposes. The 'Cabin Trail' is located in the east-central portion of the Natural Area and is used only occasionally, primarily for educational purposes (e.g. orchid walks) (P. Cotterill, personal communication).

3.0 METHODS

3.1 Collection of Background Information

A detailed review of existing literature for the Natural Area was completed in June, 1999, and all relevant available material was also obtained from the Wagner Natural Area Society as well as from the Alberta Natural Heritage Information Centre of Alberta Environment.

3.2 Preliminary Air-photo Interpretation

Large-scale aerial photography was not available for the study area during the preliminary interpretation phase. Therefore, 1:20,000 black-and-white aerial photography was used for initial stratification (delineation of polygons representing different soil/vegetation types) of vegetation and soils prior to the initiation of fieldwork. This allowed the soil and vegetation mapping team to develop preliminary map unit concepts. In addition, background information on surficial and bedrock geology, hydrology, soils and vegetation supported this initial stratification of the Natural Area.

3.3 Field Survey

The field survey consisted of four different components: plot selection and location, plot demarcation, soil data collection and sampling, and vegetation data collection and sampling.

3.3.1 Plot Selection and Location

Field plot selection, demarcation and field data collection were conducted over two time periods - the first (July 5 to July 13, 1999) to complete reconnaissance level plots, and the second (July 19 to July 23, 1999) to establish more purposeful detailed (permanent monitoring) plots. The first field survey phase resulted in the establishment of 73 reconnaissance plots requiring collection of site, soil, and vegetation data. The second phase resulted in the establishment of 18 detailed plots requiring site, soil, and vegetation field data collection, as well as establishment of monitoring plots, and soil sampling for subsequent laboratory analyses (for mineral soils only).

Reconnaissance sites were selected using a modified systematic sampling approach. The study team established a 100 m (west/east) x 200 m (north/south) grid across the study area and located a reconnaissance plot at, or in the vicinity of, each intersecting point. Purposeful modifications of the final plot locations were carried out to avoid sampling in obvious ecotone areas, and to adequately sample all soil and vegetation types. However, attempts were made to keep these adjustments to a minimum. The initial plot was established approximately 200 m south and 100 m east of the northwest corner of the Natural Area.

Eighteen detailed sites were purposefully selected to ensure that a minimum of one plot was located in each soil and vegetation community type within the study area. At each detailed site, the study team established a 20 m x 20 m quadrat for future monitoring using the protocols described by the Ecological Monitoring and Assessment Network (EMAN) (Roberts-Pichette and Gillespie 1999). Only one plot (plot No. 14) located in the dwarf birch/sedge/moss fen, was 5 m x 5 m in size. In this case, the decision to establish a smaller monitoring plot was based on an estimation of the minimum area needed to sample the representative species in this community, and on an attempt to avoid sampling transitional areas between this and the adjacent forested communities. The size of the monitoring quadrats is in agreement with EMAN protocols (Roberts-Pichette and Gillespie 1999) for the shrub stratum.

3.3.2 Plot Demarcation

The precise location of the southwest corner of each survey plot (reconnaissance and detailed) was marked with a pin-prick on the 1:5,000 color aerial photographs provided for mapping purposes after the field survey was completed. Each plot number corresponding to the field survey form was printed using black waterproof ink on the back of the aerial photograph, adjacent to the appropriate circled pin-prick.

Establishment of the 20 m x 20 m EMAN quadrats followed protocols defined in Roberts-Pichette and Gillespie (1999). Each detailed plot area was surveyed in a horizontal plane using a theodolite (TOPCON DT104) with tripod and survey rod. No correction for slope was required because of the

small size of the plot area and low inclinations (generally below 4%). Upon establishment, quadrats were permanently marked at each corner with metal stakes and tagged with an aluminum tag and light blue flagging tape, both indicating plot number and corner position (SW, SE, NW or NE). The corner locations of each detailed plot were determined to the sub-meter using a Global Positioning System (GPS) (GPS positions are listed in Appendix 1). Given the precision specifications and the requirement for differential correction by EMAN protocol, a Trimble Pathfinder ProXRS receiver was used. This equipment uses the OMNI Star satellites to differentially correct positions in real time. The Pathfinder ProXRS receiver enabled the project team to incorporate Position Dilution of Precision (PDOP), Signal to Noise Ratio (SNR), and elevation masks that met or exceeded the specifications defined by EMAN protocols. On a few occasions, the PDOP was raised to access the satellites. The data capture goal was to use real time positioning whenever possible to eliminate the need for post-processing of the data. However, on numerous sites, dense and tall tree canopies prevented collection of real time data. All site positions were corrected afterwards, using base-station correction data obtained from the Resource Data Division, Alberta Environment, and from the Pleiades Data Corporation.

3.3.3 Soil Data Collection and Sampling

All site and soil data collection for the project was performed in accordance with standards and procedures described in the *Ecological Land Survey Site Description Manual* (CFS-LFS 1994) and in the *Canadian System of Soil Classification* (Soil Classification Working Group 1998). In addition, soil landscape models were included in the soil unit descriptions (CAESA Soil Inventory Working Group 1998).

Site selection of 73 reconnaissance and 18 detailed plots insured sampling of the range of landform and soil variability encountered within the study area. At each reconnaissance inspection site, a *Site Description Form* (LISD 15B, Rev. 1/97) and *Soil Description Form* (LISD 16B, Rev. 1/97) were completed. At the detailed plots, the *Supplementary Soil Description Form* (LISD 16C, Rev 3/93) was completed in addition to the *Site Description* and *Soil Description Forms*. The original field forms reside with the Resource Data Division, Alberta Environment.

At each inspection site, the soil profile was described in detail. In areas where mineral soils were found, soil pits were dug with a shovel to 60 cm and hand-augered to the C-horizon. In organic areas, soils were hand augered to either mineral contact or to 2.2 metres (whichever came first). The pits were large enough to allow the pedologist to classify, describe and, for the detailed sites, sample the soils. At each inspection site a tarpaulin was placed on the ground surrounding the soil pit and soil was placed on the tarpaulin, so as to minimize the disturbance of vegetation surrounding the soil pit. Soil was returned to the hole in reverse order of removal, therefore all three (A, B and C) horizon materials were replaced in their appropriate location. Data recorded at each site included:

- soil order
- soil great group
- soil subgroup
- soil series
- soil phase
- humus form class and variants
- soil parent material
- effective rooting depth
- slope class
- slope position
- aspect
- stoniness class
- drainage class
- land use
- horizon type and depth (profile description)
- color
- field texture
- soil structure
- soil consistence

All detailed soil pits were located taking into consideration the dominant characteristics represented by the sampling unit. At each detailed pit, soil samples from the midpoint of each horizon were collected and stored in appropriate sampling bags. In addition, a composite sample from the A and B horizons was collected for each of five hand-augered holes located within a two metre radius of the soil

pit. The samples collected represented the dominant A and B horizons of the soil pit and were removed from approximately the same depth as that collected from the soil pit. The composite samples consist of a thorough mixture of the five samples representing each horizon. Samples were collected of all identified horizons (A, B, and C horizons) to a one meter depth. Bulk density samples were collected for identified horizons greater than 10 cm thick (limitation of bulk density sampling tool) to a depth of 60 cm. All mineral soil samples were collected and stored in a freezer at the Northern Forestry Centre in Edmonton. Analysis of these samples may be conducted at a later date.

3.3.4 Vegetation Data Collection and Sampling

The vegetation data collection and sampling was in accordance with methods described in the *Ecological Land Survey Site Description Manual* (Alberta Land and Forest Services 1994), and the *Alberta Forest Service Range Survey Manual* (Simons and Willoughby 1990). All vegetation data was recorded on *Vegetation Inventory* and *Vegetation Description Forms* (LISD 14B and MF5, respectively). The original field forms were submitted to the Resource Data Division, Alberta Environment. At least one 35 mm photograph of each detailed and a number of the reconnaissance plots was taken. These photographs reside with the Resource Data Division, Alberta Environment. Some photographs of representative project area features are shown in Appendix 2.

The relevé vegetation sampling method was used to ensure that the minimum area adequately representing the plant community was sampled. A visit to the study area prior to field sampling helped to define the minimum plot size and sampling method appropriate for tree, shrub and grass dominated communities. Percent cover of all vascular and non-vascular plant species was visually estimated in 20 m × 20 m plots in forested areas (including forested fen), 10 m × 10 m plots in shrub dominated communities, and 5 m × 5 m plots in agricultural fields. In open fen areas, belt transects covering the area equivalent to 1 m^2, using a Daubenmire (50 cm × 20 cm) sampling frame, were visually positioned. In shrub-dominated fen areas, percent cover of vascular and non-vascular plant species was visually estimated in 10 m × 10 m plots. One 25 m^2 detailed (EMAN) plot was sampled in a shrub dominated fen community using ten 1 m^2 nested plots (this method was applied to provide more accurate data for long term monitoring).

Detailed collection of epiphyte data was not conducted because of time constraints and because vertical rather than horizontal percent cover data could not be used in the community classification for this study. Various species of epiphytic mosses and lichens inhabit trees at different ages or stages of decomposition (Soderstrom 1988). A separate study will have to be undertaken to collect detailed data on the composition of epiphyte plant species and their spatial distribution within Wagner Natural Area if this information is required.

Vegetation sampling requirements at detailed and reconnaissance plots were similar, with the exception of forested detailed plots. At forested detailed plots, substrate characteristics such as snags and downed woody debris were also noted and identified by lifeform (coniferous, deciduous) and decay class. The following decay classes were based on Soderstrom (1988):

1. wood hard, bark remaining intact;
2. wood hard, bark broken up in patches but more than 50% remaining;
3. wood hard, less than 50% bark remaining;
4. wood has started to soften, without bark, texture smooth;
5. wood soft, with small crevices and small pieces lost;
6. wood fragments lost so the outline of the trunk is deformed;
7. the outer surface of the log is hard to define, possibly with the core of harder wood;
8. completely soft without evidence of hard wood, outline indeterminable.

Age class structure and dominant overstory and understory tree heights were also determined for detailed sample plots. Age class structure was determined through the collection of several increment cores at each forested plot and breast height age was adjusted to total (origin) age using adjustment factors listed in Nesby (1997). Dominant overstory and understory tree heights were determined to one-meter accuracy using a laser height finder.

The majority of vascular and a number of non-vascular plant species were identified during the field sampling. All unknown vascular and non-vascular plants were collected (with the exception of rare species and orchids), appropriately labeled and cross-referenced on the field forms prior to submitting voucher samples to a qualified taxonomist for positive identification. A photograph was taken of a

number of rare plants and orchid species for later taxonomic confirmation. Nomenclature for Latin and common names of vascular and non-vascular plant species followed the *Alberta Plants and Fungi – Master Species List and Species Group Checklists* (Alberta Environmental Protection 1993). Nomenclature for *Brachythecium starkei* followed Anderson et al. (1990). When subspecies names were used, nomenclature for Latin names followed Hrapko (1991). Voucher samples were placed in the vascular and cryptogamic herbaria at the University of Alberta.

3.4 Soil Data Analysis

Soil samples were collected and stored in a freezer at the Northern Forestry Centre in Edmonton. A sample list is provided (Appendix 3). All field forms were submitted to the project coordinator for review.

3.5 Vegetation Data Analysis and Classification

All Vegetation Inventory and Vegetation Description forms were submitted to the project coordinator for review. The vegetation classification was not limited to potential or predicted climax communities but was rather applied to existing vegetation at any seral stage (see Braun-Blanquet 1965). Two different clustering methods (TWINSPAN and UPGMA) were employed to ensure that all species were considered in the classification, and to facilitate vegetation classification based on aerial photo interpretation and related plot data.

TWINSPAN is a polythetic divisive method of classification (Hill 1979, Kent and Coker 1992). It clusters both plots and species and constructs a two-way table from a plot-by-species matrix. It assumes that each group of plots can be characterized by a group of species that prevail on one side of the dichotomy (differential species). Quantitative data (% cover) are first replaced with the qualitative equivalent. This equivalent is the "pseudospecies". Any species-abundance scale is partitioned into a series of "pseudospecies" similar to a crude scale, such as the Braun-Blanquet scale of cover-abundance (Mueller-Dombois and Ellenberg 1974). The levels of abundance that are used in TWINSPAN to define the scale are called "pseudospecies cut levels" and are chosen by the user. The suitability of three different "pseudospecies" cut-levels was explored in this study: 0, 2, 5, 10, 20 (the default); 0,

5, 10, 20, 50; and 0, 5, 10, 20, 50, 75. TWINSPAN then proceeds with the ordination of samples by correspondence analysis (Hill 1973) and a crude division into negative and positive sides of a dichotomy. Subsequent dichotomies are constructed by using frequencies of the species on the positive and negative sides. Detailed procedures of clustering of species and plots and the construction of a species-by-plots table are given in Jongman et al. (1987).

A second clustering method uses a hierarchical agglomerative clustering that proceeds from individual samples or plots and progressively combines them based on their similarity until all samples are in one group (similarity analysis). Dissimilarity (D) is related to similarity (S) in the following way:

$$D=1-S$$

From eight similarity/dissimilarity measurements available in PC-ORD (version 4.0), the Bray-Curtis dissimilarity coefficient was chosen to obtain a dissimilarity matrix (Legendre and Legendre 1983). The Bray-Curtis coefficient is a semimetric measure that uses data on species abundance to calculate the distance between plots. The formula for the Bray-Curtis coefficient is:

$$D_{(i,h)} = \Sigma |X_{ij} - X_{hj}| / \Sigma (X_{ij} + X_{hj})$$

where $D_{(i, h)}$ represents the percentage difference between quadrats i and h, X_{ij} is the value of species j for quadrat i, and |X| means the absolute value of quantity X. The property of that distance measure is that a set difference contributes the same amount to the distance, whether it occurs between rare or abundant species. Bloom (1981) emphasized the ability of the Bray-Curtis distance measure to identify accurately the true resemblance of plots along the entire range of species abundance. The agglomerative clustering method used in this study was Unweighted Arithmetical Average Clustering (UPGMA). In the computation of the arithmetic average for two clusters, UPGMA gives equal weights to all objects. Both the TWINSPAN and the UPGMA analyses were carried out using the PC-ORD (Version 4.0) analysis program.

3.6 Soil Mapping and Database Development

Soil mapping was conducted in accordance with procedures documented by the Mapping Systems Working Group (1981). Given the number of reconnaissance and detailed sites and actual size of the area, the final publication was set at 1:5,000 scale. This means that the minimum size delineation, used

mostly for highly contrasting sites, like marl ponds, is approximately 0.5 cm^2 (about 0.1 hectare at 1:5,000 scale).

The pre-stratification of soils and landforms was conducted on 1:20,000 scale, black-and-white aerial photographs. These polygons were checked in the field and modified slightly after colour 1:5,000 scale, aerial photographs became available (after fieldwork was completed). The polygon line work and positions of all reconnaissance plots were transferred onto a plot of the orthophoto base and subsequently digitized from the orthophoto base using Microstation SE and imported into ARC/INFO. The final map was registered to the provincial digital 1:20,000 base (NAD 83 datum). The final orthophoto map, complete with a title block, map scale, and controlled legend was then produced.

Once map units were delineated, an attribute database was prepared and loaded into an INFO table. The following information was included in the INFO table (Appendix 4):

- Soil unit
- Landscape model symbol
- Dominant series
- Co-dominant series (1) and co-dominant series (2)
- Significant series (1) and significant series (2)
- Dominant subgroup
- Co-dominant subgroup (1) and co-dominant subgroup (2)
- Significant subgroup (1) and significant subgroup (2)
- Parent material (1) and parent material (2)
- Parent material texture (1) and parent material texture (2)
- Drainage
- Perviousness

3.7 Vegetation Mapping and Database Development

Vegetation community type/subtype polygons were first interpreted on 1:5,000 colour aerial photography. Polygon labels were neatly and legibly hand-inked onto the aerial photographs in black ink. The line work and the locations of all reconnaissance plots from the aerial photography were then

transferred onto a plot of the orthophoto base and subsequently digitized off of the orthophoto base using Microstation SE and imported into ARCINFO. Polygons were then numbered in the ARCINFO and the final digital maps were produced. Considering the relatively large scale of mapping, an effort was made to avoid the use of complex vegetation units, hence, the final vegetation polygons contain only simple vegetation units. The GPS digital positional data were used to indicate the locations of the 18 detailed plots on the final map.

A digital database, which incorporates the key attributes of each map polygon, was prepared. The database was created using DBASE IV and structured so that it could be easily linked with the digital spatial data files for future Geographical Information System (GIS) analysis and presentation (Appendix 5). As specified in the study Terms of Reference, the database contains the following fields:

- A vegetation unit using the labels from the interpreted aerial photography
- Plot number
- A description of the community type/subtype
- Successional status
- Ecological moisture regime
- Nutrient regime
- Disturbance factors
- Dominant/Co-dominant Soil Unit
- Presence of standing dead timber (yes/no)

4.0 RESULTS AND DISCUSSION

4.1 Soils and Landscapes

Soil mapping of Wagner Natural Area resulted in the creation of 46 soil polygons and 17 soil units (Table 1). The soils for the majority of the area are poorly drained (organic or peaty mineral) and enriched by secondary carbonates. These carbonates are likely deposited by lateral flow of carbonate enriched groundwater through the area. The variability of decomposition and thickness of organic deposits coupled with secondary carbonate enrichment made the classification and mapping of organics, to a large scale, difficult. That is, soil variability was high, and hence some generalizing of mapping concepts was necessary to produce the final soil map.

Moderately well drained areas are confined to the cultivated (hay) fields. The hay fields have Dark Gray Luvisols and Orthic Dark Gray Chernozems developed on medium textured glaciofluvial deposits. Some soils in the upland areas are also enriched with secondary carbonates due to groundwater discharge.

The majority of poorly and very poorly drained soils are Organic with few Gleysols present. Marl and coprogenous earth is present in many of the soils found in the area. These soils, containing limnic layers, were classified as carbonated Rego and Orthic Humic Gleysols. This classification resulted in the creation of a new Alberta soil series, 'Wagner'. The 'Wagner' soils were found in poorly and very poorly drained areas, as well as in an upland (imperfectly drained) area. This upland area (vegetation polygon #55) was unique in that it had 30-metre high white spruce (*Picea glauca*) as the dominant vegetation. A hypothesis could not be formulated as to how these trees could establish and grow so well on this media and what had caused a lowering of the water table. A description of the Wagner soil series is provided (Section 4.1.5).

The surface forms were classified in accordance with procedures defined by the CAESA Soil Inventory Working Group (1998). The majority of Wagner Natural Area is level to nearly level with slopes of

Table 1. Soils Legend

Soil Unit	Landscape Model	Parent Material	Dominant (>70%) or Co-dominant (30 - 60%) Soils	Significant (<15%) Soils	Soil Polygon Numbers
MODERATELY WELL DRAINED SOILS					
BRK1	U1l	Glaciofluvial	Dark Gray Luvisols		36
CVL1	U1l	Glaciofluvial	Dark Gray Luvisols (CVL)	Dark Gray Luvisols (BRK)	40
CVL2	U1l		carbonated Gleyed Dark Gray Luvisols	carbonated peaty Orthic Humic Gleysols	16, 25, 46
CVL3	U1l		Calcareous Dark Gray Chernozems		44
POORLY AND VERY POORLY DRAINED SOILS					
GSP1	O1	Fen peat	carbonated Terric Mesisols		12, 14, 23, 43
GSP2	SC1l		carbonated Terric Mesisols		24
GSP3	O1		carbonated Terric Mesisols and carbonated Terric Humisols	carbonated Typic Mesisols	4, 22
GSP4			carbonated Terric Mesic Humisols	carbonated Typic Mesisols, carbonated Fibric Mesisols and carbonated Humic Mesisols	31, 35
GSP5			carbonated Terric Humisols	carbonated Typic Mesisols	13, 38
GSP6			carbonated Terric Mesic Humisols	carbonated Typic Mesisols	37
GSP7			Typic Humisols	Typic Mesisols	1, 45
GSP8		Forest peat	carbonated Typic Mesisols	Limnic Mesisols and carbonated Mesic Humisols	15, 39
RVN1	L1	Glaciolacustrine	carbonated peaty Orthic Humic Gleysols	carbonated Terric Mesisols	26, 27
	IUl				9
WNR1	O1	Marl	carbonated Rego Gleysols	Water	3, 5, 8, 11, 18, 20, 28, 33
WNR2			carbonated Rego Gleysols	carbonated Terric Mesisols	6, 7
STANDING WATER					
ZWA1	W3	Water	Standing water		2, 10, 17, 19, 21, 29, 30, 32, 34
ZWA2			Standing water	carbonated Terric Mesisols	42

(organic) or W3 (water). Small areas of inclined and undulating slopes (IUl) are present in the northern portions of the area and one polygon was mapped as a low relief stream channel (SC1l).

4.1.1 Brightbank (BRK) Soil Unit

4.1.1.1 BRK1 Soil Unit

The BRK1 soil unit consists of moderately well drained Dark Gray Luvisols (BRK) developed on moderately coarse textured glaciofluvial deposits. The BRK soils are characterized by a thick (15 to 20 cm), friable, sandy loam textured Ap horizon overlying a thin (10 to 15 cm), friable, sandy loam Ae horizon. The Ae horizon overlies a sandy clay loam textured, friable to firm, non-stony Bt horizon. The Bt is underlain by a weakly calcareous, sandy loam textured Ck horizon. A description of a typical BRK profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Ap	0 – 20	Very dark grayish brown (10YR 3/2 moist); sandy loam; weak fine granular; friable
Ae	20 – 34	Dark brown (10YR 3/3 moist); sandy loam; weak fine platy; friable
Bt	34 – 70	Brown to dark brown (10YR 4/3 moist); sandy clay loam; weak fine subangular blocky; friable to firm
Ck	70 – 120+	Brown to dark brown (10YR 4/3 moist); sandy loam; massive; friable

One BRK1 soil unit was mapped (polygon #36). The soils are found on low relief undulating (U1l) landscapes having slopes of 2 to 4 percent.

4.1.2 Carvel (CVL) Soil Units

4.1.2.1 CVL1 Soil Unit

The CVL1 soil unit consists of dominantly (>70%) moderately well drained Dark Gray Luvisols (CVL) developed on medium textured glaciofluvial deposits. Minor amounts (<15%) of Brightbank (BRK) soils developed on moderately well drained, moderately coarse textured glaciofluvial deposits occur randomly throughout the unit.

The Carvel soils are characterized by a thick (15 to 20 cm), friable, loam textured Ap horizon overlying a thin (10 to 20 cm), friable, sandy loam Ae horizon. The Ae horizon overlies a sandy clay loam textured, friable to firm, non-stony Bt horizon. The Bt is underlain by a sandy clay loam textured BC horizon. A description of a typical CVL profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Ap	0 – 20	Dark grayish brown (10YR 4/2 moist); sandy loam; moderate fine granular; friable
Ae	20 – 35	Brown (10YR 5/3 moist); sandy loam; weak fine platy; friable
Bt	35 – 70	Yellowish brown (10YR 5/4 moist); sandy clay loam; moderate fine subangular blocky; firm
BC	70 – 100+	Yellowish brown (10YR 5/4 moist); sandy clay loam; moderate fine subangular blocky; firm

One CVL1 soil unit was mapped in a hay field (polygon #40). The soils are found on low relief undulating (U1l) landscapes having slopes of 2 to 4 percent.

4.1.2.2 CVL2 Soil Unit

The CVL2 soil unit consists of dominantly (>70%) imperfectly drained, carbonated Gleyed Dark Gray Luvisols (CVLcrgl) developed on medium textured glaciofluvial deposits. Minor amounts (<15%) of carbonated peaty Orthic Humic Gleysols (RVNcrpt) developed on poorly drained, medium textured

glaciofluvial deposits are present in depressional areas of the unit. The water table depth varies from 40 to 100 cm.

The CVLcrgl soils are characterized by a thick (15 to 30 cm), friable, silt loam textured, weakly calcareous Apk horizon overlying a thick (20 to 35 cm), friable, loam, weakly calcareous Aek horizon. The Aek horizon overlies a silty clay loam textured, firm, non-stony, weakly calcareous Btk horizon. The Btk is underlain by a silty clay textured, moderately calcareous, weakly gleyed Ckgj horizon. A description of a typical CVLcrgl profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Apk	0 – 26	Very dark gray (10YR 3/1 moist); silt loam; moderate fine granular; friable
Aek	26 – 54	Dark yellowish brown (10YR 4/4 moist); loam; weak fine platy; friable
Btk	54 – 75	Dark brown (10YR 3/3 moist); silty clay; moderate fine subangular blocky; firm
Ckgj	75 – 120+	Very dark grayish brown (10YR 3/2 moist); clay; massive; firm

Three CVL2 soil units were mapped (polygon #16, #25 and #46). The soils are found on low relief undulating (U1l) landscapes with slopes of 1 to 3 percent.

4.1.2.3 CVL3 Soil Unit

The CVL3 soil unit consists of dominantly (>70%) moderately well drained Orthic Dark Gray Chernozems (CVLzz) developed on medium textured glaciofluvial deposits. Minor amounts (<15%) of carbonated Orthic Dark Gray Chernozems (CVLcrzz) developed on moderately well drained, medium textured glaciofluvial deposits occur at random in the unit. The CVLzz soils are characterized by a thick (15 to 30 cm), friable, loam textured, weakly calcareous Apk horizon. The Apk horizon overlies a silty clay textured, firm, non-stony, weakly calcareous Btk horizon. The Btk is underlain by a silty clay textured, moderately calcareous, Ck horizon. A description of a CVLzz profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Apk	0 – 25	Very dark gray (10YR 3/1 moist); loam; moderate fine granular; friable
Btk	25 – 55	Dark brown (10YR 3/3 moist); silty clay; moderate medium angular blocky; firm
Ck	55 – 120+	Dark brown (10YR 3/3 moist); silty clay; massive; firm

One CVL3 soil unit was mapped (polygon #44). The soils are found on low relief undulating (U1l) landscapes with slopes of 2 to 4 percent.

4.1.3 Goldenspike (GSP) Soil Units

4.1.3.1 GSP1 Soil Unit

The GSP1 soil unit consists of dominantly (>70%) poorly drained carbonated Terric Mesisols (GSPcrxc) developed on moderately decomposed sedimentary peat overlying medium to moderately fine textured glaciolacustrine deposits. The water table is found within 20 cm of the soil surface.

The GSPcrxc soils are characterized by a thick (60 to 150 cm), moderately decomposed, carbonated, Omk horizon overlying a slightly sticky, silt loam, gleyed Ckg horizon. The Omk horizon may contain layers of marl. A description of a typical GSPcrxc profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Omk	0 – 20	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Oco	20 – 50	Dark gray (10YR 4/1 moist); mix of organic material and marl
Om	50 – 100	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Ckg	100+	Black (10YR 2/1 moist); silt loam; massive; slightly sticky

Four GSP1 soil units were mapped (polygon #12, #14, #23 and #43). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.2 GSP2 Soil Unit

The GSP2 soil unit consists of dominantly (>70%) poorly drained carbonated Terric Mesisols (GSPcrxc) developed on moderately decomposed fen peat overlying medium to moderately fine textured glaciolacustrine deposits. The water table is found within 20 to 90 cm of the soil surface.

The GSPcrxc soils are characterized by a thick (100 to 150 cm), moderately decomposed, carbonated, Omk horizon overlying a slightly sticky, silt loam, gleyed, moderately calcareous Ckg horizon. The Omk horizon may contain layers of marl.

One GSP2 soil unit was mapped (polygon #24). The soils are found on a stream channel with slopes < 9 percent (SC1l). The only difference between GSP2 and GSP1 soil units is that GSP2 are located on a different surface form.

4.1.3.3 GSP3 Soil Unit

The GSP3 soil unit consists of co-dominantly (30 to 60%) each of poorly drained carbonated Terric Mesisols (GSPcrxc) developed on moderately decomposed fen peat deposits and carbonated Terric Humisols (GSPcrxczh) developed on highly decomposed fen peat overlying medium to moderately fine textured glaciolacustrine deposits. Minor amounts (<15%) of carbonated Typic Mesisols (GSPcr) developed on poorly drained, moderately decomposed organic deposits occur at random in the unit. The water table is found within 20 cm of the soil surface.

The GSPcrxc soils are characterized by having a thick (60 to 150 cm), moderately decomposed, carbonated, Omk horizon overlying a slightly sticky, silt loam, gleyed, moderately calcareous Ckg horizon. The Omk horizon may contain layers of marl. A description of a typical GSPcrxc profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Omk	0 – 20	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Oco	20 – 50	Dark gray (10YR 4/1 moist); mix of organic material and marl
Om	50 – 100	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Ckg	100+	Black (10YR 2/1 moist); silt loam; massive; slightly sticky

The GSPcrxczh soils are characterized by having a thick (100 to 150 cm), highly decomposed, carbonated Ohk horizon overlying a sticky, silty clay to clay, gleyed, moderately calcareous Ckg horizon. The Ohk horizon may contain layers of marl. A description of a typical GSPcrxczh profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Ohco	0 – 100	Black (10YR 2/1 moist); highly decomposed undifferentiated organic material
Ckg	100 - 120+	Black (10YR 2/1 moist); clay; massive; sticky

Two GSP3 soil units were mapped (polygon #4 and #22). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.4 GSP4 Soil Unit

The GSP4 soil unit consists of dominantly (> 70%) poorly drained carbonated Terric Mesic Humisols (GSPcrxczh) developed on moderately to highly decomposed fen peat overlying moderately fine to fine textured glaciolacustrine deposits. Minor amounts (<15% each) of carbonated Typic Mesisols (GSPcr), carbonated Fibric Mesisols (GSPcrzf) and carbonated Humic Mesisols occur at random in the unit. The water table is found within 20 cm of the soil surface.

The GSPcrxczh soils are characterized by having a thick (60 to 90 cm), moderately decomposed, carbonated Omk horizon overlying a thick (60 to 90 cm) highly decomposed, carbonated Ohk horizon. The Ohk horizon overlies the sticky, clay, gleyed, moderately calcareous Ckg horizon. A description of a typical GSPcrxczh profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Omk	0 – 70	Very dark brown (10YR 2/2 moist); moderately decomposed undifferentiated organic material
Ohk	70 - 140	Very dark brown (10YR 2/2 moist); highly decomposed undifferentiated organic material
Ckg	140 - 180+	Dark gray (2.5Y 4/0 moist); clay; massive; sticky

Two GSP4 soil units were mapped (polygon #31 and #35). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.5 GSP5 Soil Unit

The GSP5 soil unit consists of dominantly (> 70%) poorly drained carbonated Terric Humisols (GSPcrxczh) developed on highly decomposed fen peat overlying medium to moderately fine textured glaciolacustrine deposits. The water table is found within 50 cm of the soil surface.

Minor amounts (<15%) of carbonated Terric Mesisols (GSPcrxc) occur at random in the unit. The GSPcrxczh soils are characterized by having a thick (50 to 75 cm), highly decomposed, carbonated Ohk overlying a sticky, silt loam to silty clay, gleyed, moderately calcareous Ckg horizon. A description of a typical GSPcrxczh profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Ohk	0 – 60	Very dark brown (10YR 2/2 moist); highly decomposed undifferentiated organic material

Ckg1	60 - 75	Very dark gray (10YR 3/1 moist); loam; massive; sticky
Ckg2	75 - 90	Light gray (10YR 7/2 moist); silt loam; massive; slightly to non-sticky
Ckg3	90 - 120	Gray (10YR 5/1 moist); silty clay loam; massive; sticky

Two GSP5 soil units were mapped (polygon #13 and #38). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.6 GSP6 Soil Unit

The GSP6 soil unit consists of dominantly (> 70%) poorly drained carbonated Terric Mesic Humisols (GSPcrxczz) developed on moderately to highly decomposed fen peat overlying moderately fine to fine textured glaciolacustrine deposits. Minor amounts (<15%) of carbonated Terric Mesisols (GSPcrxc) occur at random in the unit. The water table is found within 20 cm of the soil surface.

The GSPcrxczz soils are characterized by having a thick (40 cm), moderately decomposed, carbonated Omk overlying a thick (100 cm) carbonated, highly decomposed Ohk horizon. The Ohk is underlain by a sticky, clay, gleyed, moderately calcareous Ckg horizon. A description of a typical GSPcrxczz profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Omk	0 – 40	Very dark brown (10YR 2/2 moist); moderately decomposed undifferentiated organic material
Ohk	40 - 140	Very dark brown (10YR 2/2 moist); highly decomposed undifferentiated organic material
Ckg	140 - 175	Dark gray (2.5Y 4/0 moist); clay; massive; sticky

One GSP6 soil unit was mapped (polygon #37). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.7 GSP7 Soil Unit

The GSP7 soil unit consists of dominantly (> 70%) poorly drained Typic Humisols (GSPzh) developed on moderately to highly decomposed fen peat. Minor amounts (<15%) of Typic Mesisols (GSP) occur at random in the unit. The water table is found within 20 cm of the soil surface.

The GSPzh soils are characterized by having a thick (30 cm), slightly decomposed Of horizon overlying a thick (>170 cm) carbonated, highly decomposed Ohk horizon. A description of a typical GSPzh profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Of	0 – 30	Very dark grayish brown (10YR 3/2 moist); slightly decomposed undifferentiated organic material
Ohk	30 – 220+	Very dark brown (10YR 2/2 moist); highly decomposed undifferentiated organic material

Two GSP7 soil units were mapped (polygon #1 and 45). The soils are found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.3.8 GSP8 Soil Unit

The GSP8 soil unit consists of dominantly (> 70%) very poorly drained, carbonated Typic Mesisols (GSPcr) developed on moderately decomposed forest peat. Minor amounts (<15% each) of Limnic Mesisols (GSPcrzz) and carbonated Mesic Humisols (GSPcrzh) occur at random in the unit. The water table is at the soil surface.

The GSPcr soils are characterized by having a thick (40 to 80 cm), moderately decomposed Omk horizon overlying a thick (120 to 200 cm) carbonated, highly decomposed Ocoh horizon. A moderately calcareous, slightly sticky, loam, gleyed Ckg horizon, underlies the Ocoh. A description of a typical GSPcr profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Omk	0 – 60	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Ocoh	60 – 220	Black (10YR 2/1 moist); highly decomposed undifferentiated organic material mixed with marl
Ckg	220 – 230+	Black (10YR 2/1 moist); loam; massive; slightly sticky

Two GSP8 soil units were mapped (polygon #15 and 39). The soils were found on level organic (Ol) landscapes having slopes of < 1 percent.

4.1.4 Raven (RVN) Soil Units

4.1.4.1 RVN1 Soil Unit

The RVN1 soil unit consists of dominantly (> 70%) poorly drained, carbonated peaty Orthic Humic Gleysols (RVNcrpt) developed on fine textured glaciolacustrine deposits. Minor amounts (<15%) of carbonated Terric Mesisols (GSPcrxc) occur at random in the unit. The water table is found at 20 to 50 cm below the soil surface.

The RVNcrpt soils are characterized by having a thick (15 to 30 cm), moderately decomposed Omk horizon overlying a carbonated, silty clay, gleyed Bgk horizon. The Bgk is underlain by moderately calcareous, clay, sticky, gleyed Ckg horizon. A description of a typical RVNcrpt profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description

Omk	0 – 21	Black (10YR 2/1 moist); moderately decomposed undifferentiated organic material
Bgk	21 – 60	Very dark grayish brown (10YR 3/2 moist); silty clay; weak fine subangular blocky; sticky
Ckg	60 – 100+	Grayish brown (10YR 5/2 moist); clay; massive; sticky

Three RVN1 soil units were mapped. The soils are found on level (Ll) landscapes having slopes of < 1 percent (polygon #26 and #27) and low relief inclined and undulating (IUl) landscapes having slopes of 2 to 4 percent (polygon #9).

4.1.5 Wagner (WNR) Soil Units

4.1.5.1 WNR1 Soil Unit

The WNR1 soil unit consists of dominantly (> 70%) very poorly drained, carbonated Rego Gleysols (WNR) developed on marl deposits. Minor amounts (<15% each) of open water and of carbonated Terric Mesisols (GSPcrxc) occur at random in the unit. The water table is found at the soil surface.

The WNR soils are characterized by having a thick (> 100 cm), Ckg horizon (marl) overlying mixed layers of fen peat (Ofk, Omk or Ohk). A description of a typical WNR profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
Ckg	0 – 170	White (10YR 8/1 dry); marl; non-sticky
Ofk	170 – 220+	Dark brown (10YR 3/3 moist); slightly decomposed undifferentiated organic material

Eight WNR1 soil units were mapped (polygon #3, #5, #8, #11, #18, #20, #28 and #33). The soils are found on level (Ll) landscapes having slopes of < 1 percent.

4.1.5.2 WNR2 Soil Unit

The WNR2 soil unit consists of dominantly (> 70%) imperfectly to poorly drained, carbonated Rego Gleysols (WNR) developed on marl deposits. Minor amounts (<15%) of carbonated Terric Mesisols (GSPcrxc) occur at random in the unit. The water table is found at 100 to 150 cm below the soil surface.

The WNR soils in this unit are characterized by having a thin forest litter layer and a weakly developed Ah horizon overlying a thick (> 100 cm) Ckg horizon (marl). Mixed layers of fen peat (Ofk, Omk or Ohk) underlie the Ckg. The WNR2 soils differ from WNR1 soils in that the WNR2 soils are imperfectly drained, have a LF layer and a weakly developed Ah horizon. A description of a WNR profile found in this soil unit is as follows:

Horizon	Depth (cm)	Description
LF	12 – 0	Semi-decomposed leaf litter
Ahk	0 - 13+	Black (10YR 2/1 moist); silt loam; weak fine platy; friable
Ckg1	13 – 31+	Very pale brown (10YR 7/3 moist); silt loam; weak fine platy; friable
Ckg2	31 – 50	Dark brown (7.5YR 3/4 moist) with strong brown (7.5YR 4/6 mottles); silt loam; weak fine platy; friable
Ckg3	50 – 90	Light yellowish brown (10YR 6/4 moist) with strong brown (7.5YR 4/6 mottles); silt loam; weak fine platy; friable
Ckg4	90 – 110	Gray (10YR 5/1 moist) with light brownish gray (10YR 6/2 mottles); silt loam; weak fine platy; friable

Two WNR2 soil units were mapped (polygon #6 and #7). The soils were found on level (Ll) landscapes having slopes of < 1 percent.

4.1.6 Water (ZWA) Units

4.1.6.1 ZWA1 Soil Unit

The ZWA1 unit consists of dominantly (> 90%) open water. Nine ZWA1 units were mapped (polygon #2, #10, #17, #19, #21, #29, #30, #32 and #34). The unit was found on level (W3) landscapes having slopes of < 0.5 percent.

4.1.6.2 ZWA2 Soil Unit

The ZWA1 unit consists of dominantly (> 80%) open water. Minor amounts of carbonated Terric Mesisols developed on moderately decomposed undifferentiated organic material are found in the unit. One ZWA2 unit was mapped (polygon #42). The unit was found on level (W3) landscapes having slopes of < 0.5 percent.

4.2 Native Vegetation Communities and Miscellaneous Cover Types

The total number of plant species recorded in this study was 256, of which 203 were vascular plants, 40 were mosses and liverworts, and 13 were lichens. All scientific and common names for vascular and non-vascular plant species with associated seven-letter codes are listed in Appendix 6. Aerial photo interpretation and related plot data, supported by two computer data analyses, resulted in the identification of eight native vegetation community types and five miscellaneous cover types. The eight native vegetation community types were further subdivided into 20 subtypes (Table 2) based on differences in the dominant species of the understory (shrub, herb and moss layers).

All vegetation community types/subtypes were named as follows: dominant plant species in each structural vegetation layer or stratum are listed and separated by forward slashes (/) indicating a change to a different layer. A dash (-) is used to name co-dominants within the same stratum. Two-letter codes for tree species are used in the tree component of the abbreviated names for vegetation community subtypes.

Table 2. Native vegetation community types, subtypes, and miscellaneous cover types mapped within Wagner Natural Area.

Native Vegetation Communities			
Type Code	**Type Name**	**Subtype Code**	**Subtype Name**
BP	Alaska birch-balsam poplar	BP1	Bw-Pb/dewberry/sedge
		BP2	Bw-Pb/bunchberry
FE	fen	FE1	bulrush-sedge/moss fen
		FE2	dwarf birch/sedge/moss fen
		FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen
PA	balsam poplar-aspen	PA1	Pb-Aw/dewberry
		PA2	Pb-Aw/willow/bluejoint
		PA3	Pb-Aw/bluejoint-sedge
		PA4	Pb-Aw/dogwood
SL	black spruce-tamarack	SL1	Sb-Lt/Labrador tea/feather moss
		SL2	Sb-Lt/Labrador tea/feather moss-peat moss
SP	white spruce-balsam poplar	SP1	Sw-Pb/dewberry
		SP2	Sw-Pb/willow-dogwood
		SP3	Sw-Pb/bunchberry/horsetail
		SP4	Sw-Pb/clover
		SP5	Sw-Pb/moss
SS	white spruce-black spruce	SS1	Sw-Sb/dewberry/sedge/feather moss
		SS2	Sw-Sb/horsetail
SW	white spruce	SW	Sw/bunchberry/feather moss
WS	willow	WS	willow/sedge-bluejoint

Miscellaneous Cover Types	
Code	**Name**
AF	abandoned field
BE	beaver pond and associated flooding area
CL	clearing
HF	hay field
MP	marl pond

These are:

Aw (aspen)	Pb (balsam poplar)
Bw (Alaska birch)	Sb (black spruce)
Lt (tamarack)	Sw (white spruce)

4.2.1 Floristic and Ecological Characteristics of Native Vegetation Communities

Native vegetation communities described in this study can be grouped within five broader vegetation categories: deciduous, mixedwood, coniferous, shrubland, and wetland communities. The DECIDUOUS vegetation category includes all vegetation communities that are dominated by deciduous tree species (balsam poplar, Alaska birch, aspen). The MIXEDWOOD category includes communities where both deciduous and coniferous tree species dominate the tree stratum. Communities dominated by the coniferous tree species only (white spruce, black spruce, tamarack) are grouped into CONIFEROUS category. The SHRUBLAND category includes one vegetation community that does not have an overstory tree canopy but is dominated by different species of willows. Finally, the WETLAND category includes fen vegetation communities.

4.2.1.1 Deciduous Communities

Bw-Pb/dewberry/sedge (BP1)

A significant cover of Alaska birch (*Betula neoalaskana*) intermixed with balsam poplar (*Populus balsamifera*), aspen (*Populus tremuloides*), and white spruce characterizes this community (Plate 1). Dewberry (*Rubus pubescens*) dominates the shrub stratum, accompanied by bunchberry (*Cornus canadensis)* and common Labrador tea (*Ledum groenlandicum*). Two-seeded sedge (*Carex disperma*) dominates significant portions of the herb layer; twin-flower (*Linnaea borealis* L. ssp. *americana*), bishop's cap (*Mitella nuda*), tall lungwort (*Lungwort paniculata*), and three-leaved Solomon's-seal (*Smilacina stellata*) are some of the additional species in the herb layer. Common horsetail (*Equisetum*

arvense) frequently dominates wetter depressions. Feather mosses cover most of the ground. Subhygric moisture conditions and permesotrophic to mesotrophic nutrient regimes characterize soils occupied by this community. The water table varied from 5 cm to 80 cm below the soil surface and carbonates were generally close to the soil surface. Three soils described within the white birch-balsam poplar/dewberry/sedge forests included carbonated peaty Orthic Humic Gleysols, carbonated Terric Humisols and carbonated Terric Mesisols (soil units RVN1 and GSP3). This community subtype covers only small portions of the eastern half of Wagner Natural Area (Map 1, polygon #25 and #65).

Bw-Pb/bunchberry (BP2)

This community subtype has a more open tree canopy and older, taller trees compared to BP1 (Plate 2). Bunchberry dominates the shrub layer, accompanied by various other shrub species, of which dewberry, wild red raspberry (*Rubus idaeus*) and red-osier dogwood (*Cornus stolonifera*) have the highest cover. Wild sarsaparilla (*Aralia nudicaulis*) and sedges such as bristle-stalked sedge (*Carex leptalea*) and sheathed sedge (*Carex vaginata*) dominate the herb layer, while bishop's cap, tall lungwort, wild strawberry (*Fragaria virginiana* Duchesne ssp. *glauca*), and numerous other forb and sedge species occur at low covers. Leaf litter covers most of the ground while various brown moss and feather moss species make up small portions of the total ground cover. Carbonated Rego Gleysols (soil unit WNR2) with hygric to subhygric moisture conditions and a permesotrophic nutrient regime characterize this plant community. The water table was located at about 90 cm below the soil surface. Carbonates were found within 40 cm of the soil surface. One white birch-balsam poplar/bunchberry forest community is located in the very eastern portion of the study area (Map 1, polygon #54).

Pb-Aw/dewberry (PA1)

Co-dominance of balsam poplar and aspen with a sporadic presence of white spruce and Alaska birch characterizes this community. Dewberry, in association with wild red raspberry and red-osier dogwood, generally dominates the shrub layer. Palmate-leaved coltsfoot (*Petasites palmatus*), wild sarsaparilla and tall lungwort are some of the numerous forbs occupying the herb layer. Sedge species, such as Dewey's sedge (*Carex deweyana*) and hair-like sedge (*Carex capillaris*) are frequently associated with

the presence of white spruce and Alaska birch. Mosses are rare and leaf litter covers most of the ground. Subhygric to mesic moisture conditions and mesotrophic to permesotrophic nutrient regimes characterize the soils occupied by the balsam poplar-aspen/dewberry community. Water tables were generally located at more than 1.5 meters below the soil surface. Carbonates were found close to the soil surface in most of the soil pits. Soils described in PA1 include carbonated Gleyed Dark Gray Luvisols, carbonated Terric Humisols and carbonated Terric Mesisols (soil units CVL2, GSP1, GSP2, GSP3, GSP5). Balsam poplar-aspen/dewberry forest is found adjacent to the hay fields and within the southwestern portion of the study area (Map 1, polygon #38, #42, #60, #62, #83 and #98).

Pb-Aw/willow/bluejoint (PA2)

Scattered patches of balsam poplar and aspen in the overstory and the dominance of various willow species in the shrub layer characterizes this community subtype. Beaked willow (*Salix bebbiana*) and false mountain willow (*Salix pseudomonticola*) are two of the dominant willow species. Bluejoint (*Calamogrostis canadensis*) and fowl manna grass (*Glyceria striata*) frequently dominate the herb layer in association with wire rush (*Juncus balticus*), various sedges, and numerous forb species, such as star-flowered Solomon's-seal, marsh marigold (*Caltha palustris*) and yellow avens (*Geum aleppicum*). Leaf litter covers most of the ground with the exception of the small, scattered areas with shallow standing water. Subhygric to hygric moisture conditions and a permesotrophic nutrient regime characterize the soils within the area. The depth of the water table in soil pits averaged 40 cm. Carbonates were generally found near the soil surface. Soils found within this unit include carbonated Terric Mesisols and carbonated Terric Humisols (soil units GSP5 and GSP1). Two PA2 units occur adjacent to the agricultural field located in the western portion of the study area and another borders the eastern study area boundary (Map 1, polygon #14, #56, #73 and #93).

Pb-Aw/bluejoint-sedge (PA3)

Balsam poplar and aspen dominate the tree stratum in this community. The shrub layer consists mainly of red-osier dogwood associated with a number of other species such as wild and northern black currants (*Ribes americanum and R. hudsonianum*, respectively), beaked willow, and dewberry.

Bluejoint covers extensive areas accompanied by scattered grass and forb species including awned sedge (*Carex atherodes*), spotted touch-me-not (*Impatiens capensis*), purple-stemmed aster (*Aster puniceus*), and common nettle (*Urtica dioica* L. ssp. *gracilis*). Carbonated Terric Mesic Humisols (soil unit GSP6) occur within this community with subhygric to subhydric moisture conditions and a permesotrophic nutrient regime. Carbonates and the water table were found near the soil surface. The PA3 community subtype is limited to one small area within the northwestern portion of the study site (Map 1, polygon #96).

Pb-Aw/dogwood (PA4)

This community differs from the PA3 community because of a substantially higher cover of red-osier dogwood and a much lower abundance of bluejoint in the herb layer (Plate 3). Litter covers most of the ground, with *Plagiomnium ellipticum* and *Brachythecium turgidum* occasionally present in wetter depressions. Subhygric to hygric moisture conditions and a permesotrophic to mesotrophic nutrient regime characterize the soils of the PA4 community subtype. The water table was generally located more than a meter below the soil surface. Carbonates were found close to the soil surface in all pits. Soils described within the PA4 map units are carbonated Terric Mesisols, carbonated Terric Mesic Humisols and carbonated Typic Mesisols (soil units GSP4, GSP1 and GSP8). Four distinct sites representing the PA4 community subtype are located in the western portion of Wagner Natural Area (Map 1, polygon #37, #40, #41 and #70).

4.2.1.2 Mixedwood communities:

Sw-Pb/dewberry (SP1)

White spruce and balsam poplar dominate the tree stratum in this community with the occasional presence of Alaska birch and black spruce (*Picea mariana*) (Plate 4). Dewberry dominates the shrub layer accompanied by other shrub species such as common Labrador tea, bracted honeysuckle (*Lonicera involucrata*), prickly rose (*Rosa acicularis*) and several species of currant. Dominant forb species include twin-flower, bishop's cap, tall lungwort and wild sarsaparilla. Hair-like sedge, two-

seeded sedge and several other sedge species occur sporadically. Groundcover consists mainly of leaf litter with the occasional presence of *Eurhynchium pulchellum*, *Plagiomnium cuspidatum*, or *Brachythecium* moss species. Soils in the area are subhygric with permesotrophic nutrient regime. The water table was located at about 70 cm below the soil surface. Carbonates were generally found near the soil surface. Carbonated peaty Orthic Humic Gleysols, carbonated Terric Humisols, and carbonated Terric Mesisols (soil unit RVN1, GSP3, and GSP2) are the dominant soils supporting this community type. Carbonated Rego Gleysols and carbonated Terric Mesic Humisols occupy smaller areas (soil units WNR2 and GSP4). The SP1 vegetation community subtype occurs as scattered patches within the central and eastern portion of the study area (Map 1, polygon #16, #27, #45, #58, #66, #68, #80 and #90).

Sw-Pb/willow-dogwood (SP2)

An open canopy of white spruce and balsam poplar, intermixed with Alaska birch and river alder (*Alnus tenuifolia*) characterizes this community. The dense shrub layer consists mainly of various willow species, red-osier dogwood, and numerous *Rubus* and *Ribes* species. Common nettle, marsh marigold, and marsh horsetail (*Equisetum palustre*) are some of the common forbs, while dominant grass species include bluejoint, reed canary grass (*Phalaris arundinacea*), fowl bluegrass (*Poa palustris*) and fowl manna grass. Mosses include species of *Plagiomnium*, *Brachythecium*, and *Drepanocladus*. Hygric to subhydric moisture conditions and permesotrophic nutrient regimes characterize the soils within the area. Carbonated Terric Mesisols, carbonated Terric Humisols and carbonated Terric Mesic Humisols (soil units GSP4 and GSP3) are the three dominant soils supporting this community. The water table was located at about 20 cm below the soil surface. Carbonates were also found near the soil surface. Three small units representing the SP2 community subtype were mapped within Wagner Natural Area (Map 1, polygon #39, #82 and #94).

Sw-Pb/bunchberry/horsetail (SP3)

A shrub layer dominated by bunchberry and an extensive cover of common horsetail in the herb layer distinguishes this community subtype from the SP1 subtype. *Plagiomnium cuspidatum* and *Ptilium*

crista-castrensis dominate the well-developed moss layer. Soils were carbonated peaty Orthic Humic Gleysols (soil unit RVN1), typically with hygric moisture conditions and permesotrophic nutrient regimes. A soil pit showed the depth of the water table at about 30 cm, and location of carbonates near the soil surface. The SP3 community subtype occupies one small area in the central portion of the study area (Map 1, polygon #28).

Sw-Pb/clover (SP4)

An unusually high diversity of plant species in the herb layer and a dominance of white clover (*Trifolium repens*) distinguish this community from the SP1 subtype. The shrub layer consists primarily of Canada buffaloberry (*Shepherdia canadensis*) and bracted honeysuckle. *Thuidium recognitum*, *Pleurozium schreberi*, and *Tomenthypnum nitens* provide significant ground cover. Subhygric moisture conditions and permesotrophic nutrient regime characterize the soils within the area. The water table was found at about 60 cm below the soil surface. Carbonates were reported near the soil surface. Soils were mostly carbonated peaty Orthic Humic Gleysols (soil unit RVN1). The dominance of white clover and the high diversity of plant species in the understory indicate that this vegetation community may have bean subjected to vegetation disturbances in the past. It has already been documented that vegetation disturbances may result in the invasion of non-native species and in the increase of overall species diversity (Vujnovic 1998). Although the SP4 community type may be an aberrant type of some other (SP1 or SP5) community types, we decided to classify it as a separate vegetation type in this study with hope that future monitoring will show whether this will remain as a unique community within the Natural Area or will have to be reclassified as a different community type. The SP4 community subtype is located in one small area in the central portion of the study area (Map 1, polygon #79).

Sw-Pb/moss (SP5)

This community subtype differs from the SP1 subtype by having more Alaska birch, a sparse shrub and herb layer, and a significant cover of numerous moss species including *Aulacomnium palustre*, *Thuidium recognitum*, and *Hypnum lindbergii*. Soils are carbonated peaty Orthic Humic Gleysols (soil unit RVN1) and are subhygric with a permesotrophic nutrient regime. Both water table and carbonates

were recorded at a depth of 20 cm. This community subtype is restricted to one small area in the central portion of the study area (Map 1, polygon #26).

4.2.1.3 Coniferous Communities:

Sb-Lt/labrador tea/feather moss (SL1)

This community is dominated by black spruce, with scattered tamarack (*Larix laricina*) (Plate 5). Common Labrador tea dominates the shrub layer, while bracted honeysuckle and dewberry occur only sporadically in small patches. Twin-flower, round-leaved orchid, and three-leaved Solomon's-seal are frequent forbs, while bristle-stalked sedge represents one of the few sedge species occurring within this community. *Pleurozium schreberi*, *Hylocomium splendens*, and to a lesser extent, *Ptilium crista-castrensis* dominate the well-developed moss layer. Small hummocks dominated by *Sphagnum* mosses (mainly *Sphagnum fuscum* and *S. capillifolium*), *Polytrichum strictum* and shrubs species such as crowberry (*Empetrum nigrum*), bog cranberry (*Vaccinium vitis-idaea* L. ssp. *minus*), and small bog cranberry (*Oxycoccus microcarpus*) occur sporadically within the subtype. Hygric to subhydric moisture conditions and permesotrophic nutrient regime characterize the soils within the area. Soils supporting this community include carbonated Terric Mesisols, carbonated Terric Humisols, Typic Humisols, carbonated Terric Mesic Humisols, and carbonated Rego Gleysols (soil units GSP7, GSP3, GSP4, WNR1, WNR2). The water table was generally found at less then 15 cm below the soil surface. Carbonates were predominantly recorded at a depth of less than 30 cm from the soil surface. The SL1 subtype is the predominant vegetation community subtype covering more than 30% of Wagner Natural Area (Map 1).

Sb-Lt/labrador tea/feather moss-peat moss (SL2)

This community differs from the SL1 subtype by having a much higher cover of *Sphagnum*-dominated hummocks (ca. 30%). Soils found in the area were carbonated Terric Mesic Humisols (soil unit GSP4) that are characterized by hygric moisture conditions and a permesotrophic nutrient regime. The water table and carbonates were found near the soil surface. Only one polygon represents this community (Map 1, polygon #33).

Sw-Sb/dewberry/sedge/feather moss (SS1)

White and black spruce co-dominate this community which has also sporadic occurrences of tamarack and Alaska birch (Plate 6). The shrub layer, which never reaches high cover, includes species such as twin-flower, common Labrador tea, dewberry, and bracted honeysuckle. The diverse forb layer includes bishop's cap, three-leaved Solomon's-seal, and wild sarsaparilla, while bristle-stalked sedge, northern bog sedge (*Carex gynocrates*), and hair-like sedge represent some of the sedge species frequently found in the area. Common horsetail and bristle-stalked sedge sporadically dominate the herb layer. Feather mosses dominate the well-developed moss layer. Subhygric to hygric moisture conditions and a permesotrophic nutrient regime characterize the soils within the area. The water table was generally located at about 15 cm below the soil surface. Carbonates were found in a range from 5 to 70 cm below the soil surface. Soils supporting this community included carbonated Terric Mesisols, carbonated Terric Humisols, and carbonated Terric Mesic Humisols, with minor occurrences of carbonated Rego Gleysols, carbonated peaty Orthic Humic Gleysols and carbonated Gleyed Dark Gray Luvisols (soil units GSP3, GSP4, WNR2, CVL2, RVN1). The SS1 community subtype occurs as isolated patches throughout the study area (Map 1, polygon #20, #24, #29, #31, #36, #44, #67, #72, #78, #81 and #92)

Sw-Sb/horsetail (SS2)

Extensive areas occupied by common, and to a lesser extent by meadow horsetail (*Equisetum pratense*), as well as a low abundance of feather mosses in the moss layer distinguish this community from the SS1 subtype. *Tomenthypnum nitens* or *Plagiomnium cuspidatum* occasionally dominate the moss layer. Soils in the area are subhydric to hygric with mesotrophic to permesotrophic nutrient regimes. Carbonated Terric Mesisols and carbonated Terric Humisols (soil unit GSP3) are the two soil subgroups most commonly found within this community. The water table and carbonates are found at less then 10 cm below the soil surface.. The SS2 subtype is restricted to two areas located within the central portion of the study area (Map 1, polygon #30 and #51)

Sw/bunchberry/feather moss (SW)

White spruce dominates the tree layer in this community with a sporadic occurrence of balsam poplar, aspen and Alaska birch (Plate 11). Bunchberry frequently dominates the well-developed shrub layer in association with dewberry, bracted honeysuckle and willows such as beaked willow, pussy willow (*Salix discolor*), and myrtle-leaved willow (*Salix myrtillifolia*). Dominant species in the herb layer include wild sarsaparilla, and wild strawberry, with frequent occurrence of palmate-leaved coltsfoot, kidney-leaved violet (*Viola renifolia*), and tall lungwort. Grasses and sedges are rare and include bluejoint, bristle-stalked sedge, hair-like sedge, and Dewey's sedge. Feather mosses provide extensive ground cover. Mesic to subhygric moisture conditions and mesotrophic to permesotrophic nutrient regimes characterize the soils occupied by this community. The water table was generally located more than 1.5 meters below the soil surface and carbonates were found close to the soil surface in most of the soil pits. Carbonated Rego Gleysols and carbonated Gleyed Dark Gray Luvisols are the dominant soils, with minor occurrences of carbonated Terric Mesisols, and carbonated Terric Humisols (soil units WNR2, CVL2, GSP3, GSP1). White spruce forests are scattered within the eastern portion of the study area (Map 1, polygon #10, #13, #52, #55, #57, #63 and #64).

4.2.1.4 Shrubland Communities:

Willow/sedge-bluejoint (WS)

This community is dominated by species such as beaked willow, pussy willow, and velvet-fruited willow (*Salix maccalliana*) (Plate 9). Other shrub species include red-osier dogwood, wild red raspberry and northern gooseberry (*Ribes oxyacanthoides*). Water sedge (*Carex aquatilis*), awned sedge and bluejoint dominate the herb layer accompanied by numerous forbs such as marsh marigold, touch-me-not, common skullcap (*Scutellaria galericulata*), and wild mint (*Mentha arvensis*). *Plagiomnium cuspidatum* and *Drepanocladus aduncus* dominate the moss layer when present, but not in a close association. Soils in the area are hygric to hydric with permesotrophic nutrient regimes. Carbonated Typic Mesisols (soil unit GSP8) are the only soils described within this vegetation community. Water

table and carbonates were generally found near or at the soil surface. The WS community subtype is restricted to the northwestern portion of Wagner Natural Area (Map 1, polygon #97).

4.2.1.5 Wetland Communities:

Bulrush-sedge/moss fen (FE1)

Bulrushes, sedges and mosses dominate this community. Generally, there are few trees and total shrub cover is less then 20%. This fen community subtype is a mosaic of shallow water areas (marl ponds), slightly raised areas mainly supporting moss and herb species, and small hummocks inhabited by shrub and stunted tree species with associated moss and forb vegetation. Great bulrush (*Scirpus acutus*), flat-leaved bladderwort (*Utricularia intermedia*), and *Chara* algae inhabit shallow marl ponds. Dominant bulrushes and sedges of the raised areas include tufted bulrush (*Scirpus cespitosus* L. var. *callosus*), three-square bulrush (*Scirpus pungens* Vahl ssp. *pungens*), mud sedge (*Carex limosa*), livid sedge (*Carex livida*), green sedge (*Carex viridula*) and prairie sedge (*Carex prairea*). Common forbs include seaside arrow-grass (*Triglochin maritima*), saline shooting-star (*Dodecatheon pulchellum*), marsh aster (*Aster borealis*), northern grass-of-Parnassus (*Parnassia palustris* L. var. *neogaea*), and common butterwort (*Pinguicula vulgaris*). Oblong-leaved sundew, which is considered rare in Alberta, is locally abundant, while the provincially more common species, round-leaved sundew, occurs more sporadically and in association with sparse S*phagnum* dominated hummocks. Dominant mosses include *Scorpidium scorpioides* (generally inhabiting edges of marl ponds), followed by *Drepanocladus revolvens* and *Campylium stellatum* in somewhat drier areas, and *Tomenthypnum nitens* in the driest microsites. *Sphagnum warnstorfii* is the dominant S*phagnum* species. Dwarf birch (*Betula pumila* L. var. *glandulifera*), dwarf raspberry (*Rubus arcticus* L. ssp. *acaulis*), Athabasca willow (*Salix athabascensis*), hoary willow (*Salix candida*) and bog rosemary (*Andromeda polifolia*) dominate the sparse shrub layer with sporadic occurrences of stunted black spruce and tamarack. Carbonated Rego Gleysols (soil unit WNR1) are the dominant soils characterizing this community. Moisture conditions are generally subhydric to hydric with a eutrophic nutrient regime. The water table and carbonates were recorded at or near the soil surface. The bulrush-sedge/moss fen community is located in the central portion of the study area (Map 1, polygon #48).

Dwarf birch/sedge/moss fen (FE2)

This community differs from FE1 by having a higher proportion of shrub cover, including stunted black spruce and tamarack, but the overall species composition is very similar to FE1 (Plate 7). Frequent forb species associated with these shrub dominated areas include Labrador bedstraw (*Galium labradoricum*), northern green bog orchid, wild lily-of-the-valley (*Maianthemum canadense* Desf. var. *interius*), bog violet (*Viola nephrophylla*), and western wood lily (*Lilium philadelphicum* L. var *andinum*). Elephant's-head (*Pedicularis groenlandica*) (Plate 14) grows mostly in the transitional areas between FE2 and black spruce-tamarack/Labrador tea/feather moss communities. Soils are generally the same as within the FE1 community, with some areas having a permesotrophic nutrient regime. The water table and carbonates were found at or near the soil surface. The FE2 subtype occurs within the central and eastern portions of Wagner Natural Area (Map 1, polygon #7, #18, #23, #32, #84, and #88).

Lt-Sb/dwarf birch-willow/sedge/moss fen (FE3)

Significant cover of tamarack and black spruce in the tree layer (>10%) represents the main difference between this community subtype and the two previous wetland types. Prairie sedge and inland sedge (*Carex interior*) are the dominant sedge species. Moss hummocks, dominated by *Sphagnum capillifolium* and *S. fuscum* and associated vascular plant species (bog rosemary, small bog cranberry, common Labrador tea), are also more common than in the FE1 subtype. Carbonated Rego Gleysols (soil unit WNR1) are the dominant soils characterizing the FE3 subtype, with minor occurrence of carbonated Terric Mesic Humisols (GSP4). Soil moisture conditions are hygric to hydric with a permesotrophic to eutrophic nutrient regime. The water table and carbonates were recorded at or near the soil surface. This treed fen community is restricted to three small areas located in the central and southeastern portions of the study area (Map 1, polygon #5, #11 and #86)

4.2.2 Miscellaneous Cover Types:

Abandoned field (AF)

One of the previously cleared fields has not been hayed for some time and contains a number of native species in addition to a number of exotic species described for the HF type below. Native species include common wild rose, false mountain willow, Canada goldenrod (*Solidago canadensis*), and common yarrow (*Achillea millefolium* L. ssp. *lanulosa*). Soils in this type have subxeric to submesic moisture conditions with mesotrophic to permesotrophic nutrient regimes. Dark Gray Luvisols (soil unit BRK1) are the dominant soils. This field is located in the northwestern part of the study area (Map 1, polygon #95).

Hay field (HF)

Three hay fields within Wagner Natural Area have been cleared in the past and seeded into exotic grasses and forbs. These fields are harvested annually. Dominant grasses include Kentucky bluegrass (*Poa pratensis*), red fescue (*Festuca rubra*), awnless brome (*Bromus inermis* Leyss.ssp. *inermis*), and timothy (*Phleum pratense*). Alfalfa (*Medicago sativa*), alsike clover (*Trifolium hybridum*) and red clover (*Trifolium pratense*) dominate sporadically. Wild vetch (*Vicia americana*) is one of the few native plants found in these fields. Soils are Dark Gray Luvisols, carbonated Gleyed Dark Gray Luvisols and Calcareous Dark Gray Chernozems (soil units CVL1, CVL2, CVL3), characterized by submesic to subhygric moisture conditions and a mesotrophic nutrient regime. The hay fields are located in the western and northeastern portion of Wagner Natural Area (Map 1, polygon #75, #77, and #99).

Beaver pond and associated flooding area (BE)

Two beaver ponds exist within Wagner Natural Area. The larger pond is located along the western edge of the area and floods the dugout described for this area in previous reports (WNAS and AEP 1999). The beaver dam in the eastern portion of Wagner Natural Area is partially broken and vegetation is

starting to occupy previously flooded ground. Canada thistle (*Cirsium arvense*), smooth perennial sow-thistle (*Sonchus uliginosus*), common cattail (*Typha latifolia*), Philadelphia fleabane (*Erigeron philadelphicus*), bluejoint, wild mint, and various sedge and willow species are some of the plants that occur in this area. Soils in the area were carbonated Terric Mesisols (soil units GSP1 and ZWA2). See Map 1 (polygon #15 and #74) for the location of the two beaver ponds.

Clearing (CL)

Small portions of the area have been continually disturbed as road allowances and road right-of-ways. These areas occur only within the eastern portion of the Natural Area (Map 1, polygon #3, #8, #12, and #76). Typic Humisols, carbonated Terric Mesisols, and carbonated Rego Gleysols (soil units GSP7, GSP1, WNR1, WNR2) are the dominant soils found in the cleared areas.

Marl pond (MP)

One large pond (Jones's Pond) and numerous small ponds (in the fen community) are occupied by shallow water overlaying marl deposits (Map 1, polygon #4, #35, #50, #69, #85, #89 and #91). Flat-leaved bladderwort inhabits small ponds and edges of Jones's Pond, while algae such as *Chara* and numerous diatoms (Alice Hendry, personal communication) inhabit open water areas.

4.2.3 Cluster Analysis of Vegetation Communities:

The TWINSPAN analysis generally agreed with the classification that was based on aerial photo interpretation and related plot data. It revealed 11 meaningful vegetation groups within the first five division levels. Each group was assigned a unique letter (a-k) to assist the viewing of the TWINSPAN two-way table (Table 3). Division 1 strongly separated agricultural fields (j-k) from the rest of the native plant communities (Eigenvalue = 0.7716). The fen community type (a-b) separated from the rest of the native plant communities in the second division (Eigenvalue = 0.6224). Division 3 separated the abandoned field (k) from the other three fields (j) that have been hayed annually (Eigenvalue = 0.4199). The Lt-Sb/dwarf birch-willow/sedge/moss fen (b) separated from the other two fen

Table 3*. TWINSPAN classification of 90 plots and 256 vascular and non-vascular plant species in Wagner Natural Area. Plot numbers (1-90) and plot groups (**a-k**) are listed across the top of the table, while species seven letter codes and species groups (**A-G**) are listed on the left hand side.

* Because of its large size, Table 3 was placed in the map pocket at the back of the report

community subtypes (a) in division 4 (Eigenvalue = 0.3735). Division 5 isolated deciduous and shrubland community types (g-i) from mixedwood (e) and coniferous (c-d) community types (Eigenvalue = 0.5604). The white spruce-balsam poplar community type (e) was set apart from coniferous communities (c-d) in division 10 (Eigenvalue = 0.4016). Division 11 separated the willow/sedge-bluejoint community (g) from the balsam poplar-aspen community type (h-i) (Eigenvalue = 0.4180). Black spruce-tamarack forests (c) were separated somewhat weakly from the white spruce-black spruce forests (d), in division 20 (Eigenvalue = 0.2346). Division 21 sets the white spruce-balsam poplar/clover forest (f) apart from the rest of the white spruce-balsam poplar community subtypes (e) (Eigenvalue = 0.2859). Finally, at division 46, the balsam poplar-aspen/marsh reed grass/sedge community subtype (h) separated from the rest of the balsam poplar-aspen community subtypes (i) (Eigenvalue = 0.3472).

TWINSPAN failed to separate out Alaska birch-balsam poplar and white spruce forests from mixed white spruce-balsam poplar vegetation community types.

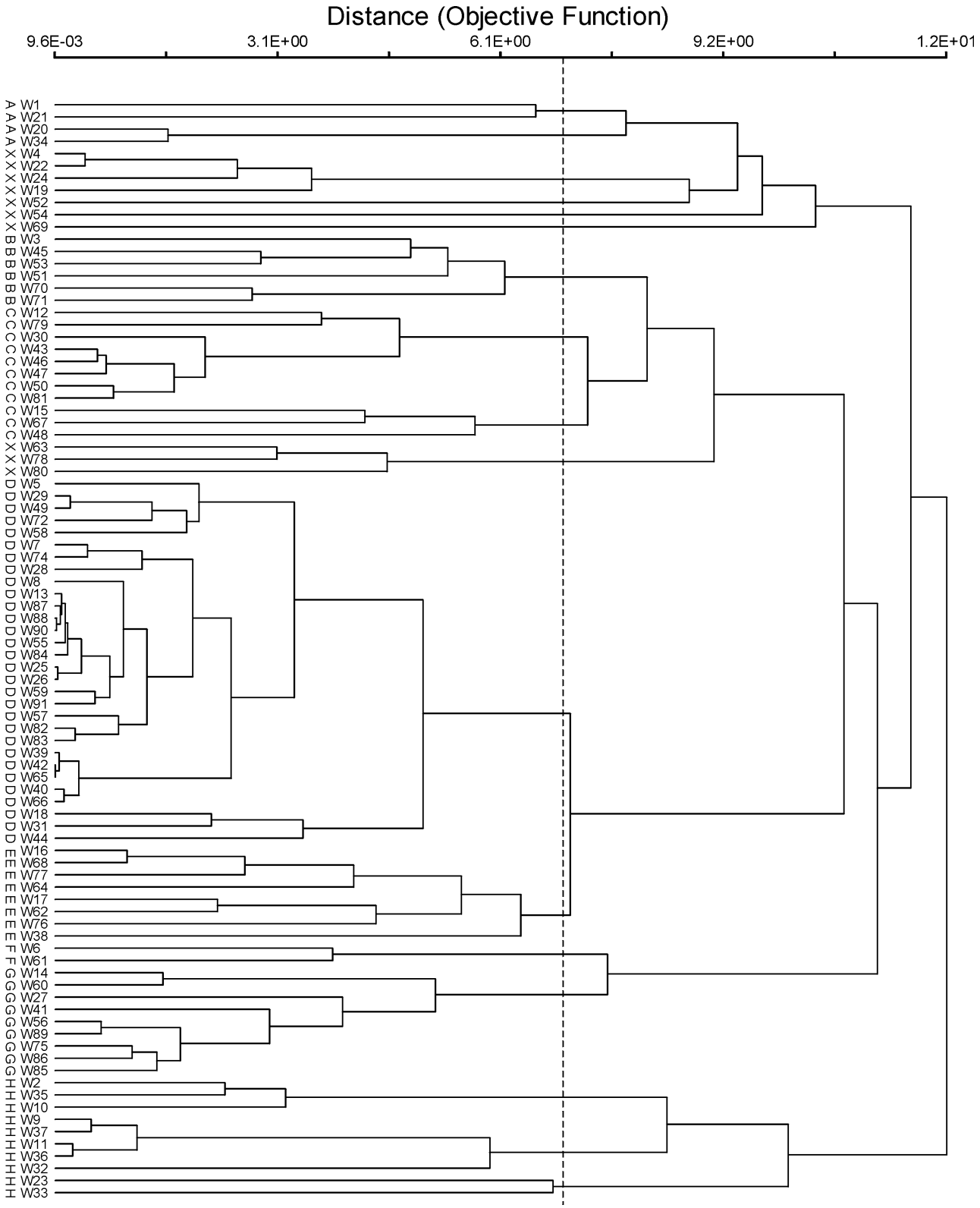
As opposed to relatively high statistical significance observed in plot divisions, the species groups derived by TWINSPAN showed generally low Eigenvalues. However, seven main species groups could still be identified. In Table 3, those species groups are labeled with capital letters A-G. The majority of species in group A are restricted to the fen community type. Species in group B characterize the willow/sedge-bluejoint community. Group C species dominate the balsam poplar-aspen community type, but are also found frequently in the mixed white spruce-balsam poplar community type. Species in group D characterize the white spruce-balsam poplar community type, although a number of them inhabit mixed white spruce-black spruce and black spruce-tamarack communities as well. Group E species dominate both black spruce-tamarack and white spruce-black spruce community types, which explains the somewhat low statistical significance of separation between these two vegetation community types. Finally, F and G species groups defined agricultural fields, with G clearly dominating the present hay fields, and F distinguishing the abandoned field.

Unweighted Arithmetical Average Clustering (UPGMA) produced similar results to TWINSPAN clustering. Once again, classification of the 90 plots reflected the wide distribution of the majority of plant species that make up plant communities in Wagner Natural Area. An objective cut at 7.05E+00

(Bray-Curtis Distance) revealed 17 plot groups (Figure 2). They were further subjectively organized into eight meaningful groups (community types/subtypes) by combining back some of the groups that were not supported by the field observations. On Figure 2 eight plot groups are labeled A-H (misclassified groups are labeled X). Group A represents a willow/sedge-bluejoint vegetation community. The balsam poplar-aspen community (B) is the most similar to the white spruce-balsam poplar community (C). Plots in group D belong to the black spruce-tamarack community type and are the most similar to group E which represents a mixture of white spruce and white spruce-black spruce community types. Two plots representing Lt-Sb/dwarf birch-willow/sedge/moss fen are labeled as F on the graph, while G represents the other two fen communities. Finally, group H represents the agricultural fields, including the abandoned one. Similar to the TWINSPAN analysis, UPGMA failed to clearly separate some of the plant communities that were recognized based on air photo interpretation and related plot data. UPGMA placed plots sampled within the Alaska birch-balsam poplar community together with plots from other mixed communities (balsam poplar-aspen and white spruce-balsam poplar). Some of the plots representing white spruce-black spruce forests were placed within the balsam poplar-aspen and white spruce-balsam poplar plot groups, and some were mixed with the plots from the white spruce community. Overall, TWINSPAN provided better separation of the observed and mapped plant communities within Wagner Natural Area than did the UPGMA analysis.

Narrow ranges of moisture conditions (subhygric to subhydric) and nutrient regimes (mesotrophic to permesotrophic) characterizing many community types and subtypes within Wagner Natural Area may explain the difficulties in separating different community types using TWINSPAN and UPGMA cluster analyses. The best clustering of vegetation communities is generally obtained when there is a clear gradient in one or a few environmental variables (e.g. moisture, elevation) governing plant species distribution within a study area (Kent and Coker 1992). Zoltai and Johnson (1987) reported high vegetation sensitivity to relatively small nutrient fluctuation at low nutrient levels (oligotrophic and submesotrophic). In contrast, they found that as the concentration of nutrients increased, only much higher changes in nutrient levels influence differences in the distribution of plant species. This may

Figure 2. Eight plot groups (**A - H**) derived by the Unweighted Arithmetical Average Clustering (UPGMA) of 90 plots and 256 vascular and non-vascular plant species in Wagner Natural Area. Misclassified groups are labeled **X.** An objective cut was made at Bray-Curtis Distance of 7.05E+00.


Distance (Objective Function)
9.6E-03
3.1E+00
6.1E+00
9.2E+00
1.2E+01
A W1
A W21
A W20
A W34
X W4
X W22
X W24
X W19
X W52
X W54
X W69
B W3
B W45
B W53
B W51
B W70
B W71
C W12
C W79
C W30
C W43
C W46
C W47
C W50
C W81
C W15
C W67
C W48
X W63
X W78
X W80
D W5
D W29
D W49
D W72
D W58
D W7
D W74
D W28
D W8
D W13
D W87
D W88
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D W55
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D W40
D W66
D W18
D W31
D W44
E W16
E W68
E W77
E W64
E W17
E W62
E W76
E W38
F W6
F W61
G W14
G W60
G W27
G W41
G W56
G W89
G W75
G W86
G W85
H W2
H W35
H W10
H W9
H W37
H W11
H W36
H W32
H W23
H W33

explain why many of the same plant species occur in a variety of vegetation communities within Wagner Natural Area (Table 3). In addition, when describing plant communities, an effort is usually made to sample only representative areas of the vegetation communities and to avoid areas where adjacent communities blend into each other (ecotones) (Braun-Blanquet 1965). Unfortunately, the fairly restricted grid sampling system applied in this study, and the large number of plots sampled in a relatively small area, most likely resulted in the sampling of some areas that represented ecotones between vegetation communities.

4.3 Rare Plant Occurrences

Of the 7 rare vascular plant species recorded for Wagner Natural Area, two (white adder's mouth and oblong-leaved sundew) were found in this study. Of the 7 rare moss species known to occur in Wagner Natural Area, one (*Brachythecium campestre*) was located within our study plots.

Brachythecium campestre was found once during this study (Map 1, plot #47) in the balsam poplar-aspen/dewberry forest. This species has been reported previously from the northcentral portion of the Wagner Natural Area (J.Rintoul, personal communication). *Brachythecium campestre* sporadically occurs on tree bases, logs, and on mineral soil in mixedwood forests in Alberta.

White adder's mouth was recorded in three field plots located within the black spruce-tamarack/Labrador tea/feather moss subtype (Map 1, plot #18, #57 and #90); once within the white spruce-black spruce/dewberry/sedge/feather moss subtype (plot #72); and in one plot sampled in the white spruce-balsam poplar/clover subtype (Map 1, plot #12). Previous reports of this species for the Wagner Natural Area do not specify its precise location (J. Rintoul, personal communication). The species occurred as an individual plant in most cases (Plate 12).

Oblong-leaved sundew was found in 4 sample plots within the shrub fen community (Plot #14, #85, #86, and #89) (Plate 8). This species grows in nutrient rich fen habitats and is more common in Wagner Natural Area than the round-leaved sundew (*Drosera rotundifolia*) which more commonly occurs on

sites dominated by *Sphagnum* mosses. Previous reports of oblong-leaved sundew in the Wagner Natural Area do not specify its precise location (J. Rintoul, personal communication).

4.4 Other Plant Occurrences

Many of the plant species recorded for Wagner Natural Area are typical of peatlands with calcareous (carbonated) soils and high water tables, which are common within the adjacent Boreal Forest Natural Region (Achuff 1994) but occur uncommonly within the Central Parkland Sub-region. In addition to the large number of representatives of the Cyperaceae family (e.g. 27 species of sedges), 16 orchid and 6 carnivorous plant species also occur (McIsaac and Macdonald n.d.). All orchid and carnivorous plant species recorded during the field data collection, with their locations as indicated on Map 1, are discussed in the following section:

4.4.1 Orchids

Wagner Natural Area is known for its orchid populations. Although at least 16 different species of orchids reside within the Natural Area (Hrapko 1991), only those species recorded during the field sampling are listed below:

Cypripedium calceolus (yellow lady's –slipper) was found in sample plots within white spruce-balsam poplar, white spruce-black-spruce, and black spruce-tamarack community types (Plot #12, #28, #30, #31, #38, #64, #66, #77, #79, #90, and #91). In sample plot #30 (white spruce-balsam poplar/dewberry forest) the species covered approximately 10% of the area, whereas in other plots it was generally represented by approximately 10 to 20 individual plants.

Goodyera repens (dwarf rattlesnake plantain) was found only once, at the SW corner of permanent plot #16, in the white spruce forest. Each of the two flowering individuals were about 10 cm tall (Plate 13). Although widespread within the Dry Mixedwood Sub-region, this species is uncommon in the Central Parkland Sub-Region (Moss 1983) and it has been reported only once before for Wagner Natural Area.

The precise location of the first observation is not known, but is reported to have been found in approximately the same area as reported this year (P. Cotterill, personal communication).

Habenaria dilatata (tall white bog orchid) was found only once, in plot no. 75, within the dwarf birch/sedge/moss fen community.

Habenaria hyperborea (northern green bog orchid) was found scattered within the black spruce-tamarack forest and fen areas. It usually occurs as individual plants or in small groups (Plot #5, #6, #12, #18, #27, #28, #44, #48, #55, #56, #66, #72, #75 and #90).

Habenaria obtusata (blunt-leaved bog orchid) was found as individual plants in only four plots within the white spruce-black spruce and white spruce-balsam poplar forests, and in the open fen area (Plot # 58, #60, #77 and #79).

Listera cordata (heart-leaved twayblade) was found in 8 plots, mainly in the black spruce-tamarack forest community (Plot # 7, #13, #57, #83, #84, #88, #90 and #91). It usually occurs in groups of 10 to 30 individuals, but because of its small size it covers only small areas on mossy ground.

Orchis rotundifolia (round-leaved orchid) is the most common orchid species within Wagner Natural Area. It was reported within 29 sampling plots where it frequently covered up to 3% of the plot area.

4.4.2 Carnivorous Plants

Carnivorous plants are another interesting group of plant species inhabiting the Natural Area. These species thrive in calcium rich fens because of their ability to supplement nitrogen and phosphorus (elements with generally low concentrations in calcium rich soils) obtained from animal tissues (Vitt, 1982). The previously mentioned oblong-leaved sundew is one of the six carnivorous species listed for Wagner Natural Area (McIsaac and Macdonald n.d.).

Drosera rotundifolia (round-leaved sundew) was found only twice during the field data collection (plot #6 and #61), both times covering small areas within the tree dominated fen areas. Although generally more widespread within the province than the related species *D. anglica* (Moss 1983), round-leaved sundew tolerates ombrotrophic nutrient conditions and is therefore restricted to the top of *Sphagnum* hummocks within this nutrient-rich wetland area.

Pinguicula vulgaris (common butterwort) was recorded four times, in the fen vegetation community (plot # 27, #41, #61 and #86).

Utricularia intermedia (flat-leaved bladderwort) is the only aquatic carnivorous plant recorded during the field sampling. It inhabits shallow marl ponds within the fen community (plot #14, #41, #56, #60 and #89).

4.5 Correlation Between Native Vegetation Communities Described in Wagner Natural Area and Communities Listed in the Relevant Literature

The correlation between native plant communities described in this study and related communities described in the relevant literature is shown in Table 4. Beckingham and Archibald (1996) and Willoughby et al. (1997) described numerous vegetation communities similar to those found in Wagner Natural Area. However, very few names of the previously described communities could be used directly to describe communities in Wagner Natural Area because of differences in plant species composition and related environmental conditions. There are several possible explanations for these differences. First, the scale at which the vegetation communities have been described and mapped in Wagner Natural Area in this study is more detailed than that used to describe communities in the Northern Alberta studies (Beckingham and Archibald 1996; Willoughby et al. 1997). Second, unique environmental conditions characterizing Wagner Natural Area, such as unusually high concentrations of carbonates in the soils, combined with the high soil moisture, may have allowed species or species combinations different from those found in the northern portion of the province to predominate in the communities of Wagner Natural Area.

Table 4: Correlations between vegetation community subtypes described in Wagner Natural Area 2000 study and similar community types listed in other relevant literature.

Wagner Natural Area (2000)	Beckingham and Archibald (1996)	Willoughby et al. (1997)	Mussell (1979)
Bw-Pb/dewberry/sedge	Pb-Sw/horsetail	-	Bw/Willow/Grass (type c)
Bw-Pb/bunchberry	-	-	Sw/Willow/Bunchberry (type b)
bulrush-sedge/moss fen	sedge fen	-	Sedge/*Tomenthypnum* moss fen (type a)
dwarf shrub/sedge/moss fen	dwarf birch/sedge/golden moss	-	Sedge/*Tomenthypnum* moss fen (type c)
Lt-Sb/dwarf birch-willow/sedge/moss fen	Lt/dwarf birch/sedge/golden moss	Sb/Willow/Moss;	-
Pb-Aw/dewberry	dogwood Pb-Aw (ecosite phase)	Pb-Aw	Aw-Pb/Willow/Dewberry (type a)
Pb-Aw/willow/bluejoint	-	-	Pb/Willow/Dewberry (type b)
Pb-Aw/bluejoint-sedge	dogwood Pb-Aw (ecosite phase)	Pb/Red-Osier dogwood-Rose	Pb/Willow/Dewberry (type a)
Pb-Aw/dogwood	Pb-Aw/dogwood/fern	Pb/Red-Osier dogwood-Rose	Aw-Pb/Willow/Dewberry (type a)
Sb-Lt/Labrador tea/feather moss	Sb-Lt/dwarf birch/sedge/peat moss	Sb/Labrador tea/Moss	Sb/Sedge/Sphagnum (type b)
Sb-Lt/Labrador tea/feather moss-peat moss	Sb-Lt/dwarf birch/sedge/peat moss	Sb/Labrador tea/Moss	Sb/Sedge/Sphagnum (type a)
Sw-Sb/dewberry/sedge/feather moss	Sw-Sb/Labrador tea/feather moss	-	-
Sw-Sb/horsetail	Sw-Sb/Labrador tea/horsetail	-	-
Sw-Pb/dewberry	dogwood Pb-Sw (ecosite phase)	Sw-Pb-Aw/Rose/Twinflower	-
Sw-Pb/willow-dogwood	Pb-Sw/dogwood/fern	Aw-Pb-Sw/Willow/Wild sarsaparilla	Sw/Willow/Bunchberry (type a)
Sw-Pb/bunchberry/horsetail	Pb-Sw/horsetail	Sw-Pb-Aw/Rose/Twinflower	Sw/Willow/Bunchberry (type a)
Sw-Pb/clover	dogwood Pb-Sw (ecosiite phase)	Sw-Pb-Aw/Rose/Twinflower	-
Sw-Pb/moss	Pb-Sw/fern/feather moss	Sw-Pb-Aw/Rose/Twinflower	-
Sw/bunchberry/feather moss	Sw/fern/feather moss	Sw/Moss	Sw/Willow/Bunchberry (type c)
willow/sedge-bluejoint	-	Willow/Sedge; Willow/Marsh reedgrass	-

The differences between vegetation communities described in this study and those previously described for Wagner Natural Area (Mussell 1979) are probably the result of differing sampling intensities and methods. However, the lack of a description of the methodology used in Mussell's (1979) study does not allow resolution of this matter.

4.6 Relationships Between Native Vegetation Communities in Wagner Natural Area and Local Environmental Conditions

Eight main native vegetation community types with twenty subtypes reflect the complexity of habitat characteristics in Wagner Natural Area and challenged our ability to depict the diversity of vegetation communities at a scale of 1:5,000.

Contrary to our general expectations of finding the majority of 'upland' communities growing on mineral soils (Mussell 1979), we found very few areas with mineral soils, other than those associated with agricultural fields (Map 2, RVN1, and CVL2). General climatic and local environmental conditions (relatively flat surface and high water table) have resulted in the development of peaty soils over much of the natural area. The peat basal layer is estimated to be close to 4700 years old (Johnson, 1982). The ground water in the area is highly minerotrophic (Karlin and Bliss, 1983) and generally high water tables result in moderate to high minerotrophic conditions of the peat. This may explain the existence of vegetation communities such as white spruce-balsam poplar, balsam poplar-aspen, and Alaska birch-balsam poplar on shallow organic soils. In the balsam poplar-aspen/dewberry community, balsam poplar-aspen /dogwood forests, and white spruce forests the water tables were not as high during the field season as those in other vegetation communities. However, the presence of carbonates near the soil surface indicated that, at least during the springtime, water tables are high enough to enrich peat with nutrients sufficient to support these forest communities.

The analyses of soil and vegetation relevé data revealed certain relationships between vegetation communities and local environmental conditions such as soil type, soil moisture regime and soil nutrient regime. Mineral soils found on the agricultural fields occupy the dry end of the moisture gradient. They are also the least minerotrophic of all soils found in the area. The soils found in the three

fen communities occupy the wettest end of the moisture gradient and are also the most nutrient rich. The three fen community subtypes varied somewhat in soil moisture and nutrient regimes, but all three had very high water tables. The Lt-Sb/dwarf birch-willow/sedge/moss fen had the driest and the least nutrient rich soils of the three fen subtypes while the bulrush-sedge/moss fen had the wettest and the most nutrient rich soils.

Higher water tables (at or near the soil surface) and lower nutrient concentrations in the top 30 cm of the peat distinguishes the soils supporting the black spruce-tamarack/Labrador tea/feather moss forest from those found in other community types. The lack of extensive areas dominated by *Sphagnum* species such as *Sphagnum fuscum* and the significant cover of tamarack show generally minerotrophic conditions governing plant species composition within this vegetation community. Black spruce is known to grow well in a broad range of peatland types while tamarack prefers strongly to moderately minerotrophic soil conditions (Karlin and Bliss, 1983). The extensive cover of feather mosses and the significant presence of other moss species such as *Tomenthypnum nitens*, *Aulacomnium palustre* and *Dicranum undulatum* are also indicators of weakly to moderately minerotrophic soil conditions (Karlin and Bliss, 1983). Although *Sphagnum* hummocks are not abundant within the black spruce-tamarack/Labrador tea/feather moss forest, their presence indicates local ombrotrophic substrate conditions. Shallowly rooted species such as common Labrador tea, crowberry, and small bog cranberry are well adapted to the low nutrient status characterizing these hummocks. Karlin and Bliss (1983) suggest that minerotrophic peatlands with localized ombrotrophic environmental conditions such as those occurring in the Natural Area, should be called '*mixed mire*'. The considerably higher proportion of peat moss dominated hummocks in the black spruce-tamarack/Labrador tea/feather moss-peat moss community can not be explained by environmental data collected during this study; however, it is likely related to localized patterns of ground water flow in the area.

Soils found in association with the remaining vegetation community types in Wagner Natural Area are in the middle range of moisture and nutrient regimes. The reasons for the present day distribution of deciduous, mixedwood, and white spruce community types can only be surmised, and more detailed and long term studies on geomorphology, hydrology, soil micronutrient dynamics and the history of disturbances are needed to better understand ecosystem functioning in Wagner Natural Area.

Disturbances such as fire, beaver activities, and wind-throws (Plate 10), are well known as factors that drive forest succession. Long term climatic cycles such as prolonged periods of drought or cold, in conjunction with microsite environmental conditions, influence the direction of succession and the longevity of each successional (seral) stage (Barbour et al. 1980, Kimmins 1987).

The detailed soil and vegetation inventory, and establishment of permanent monitoring plots achieved with this study, provide a baseline for future monitoring of soil conditions and the composition and spatial distribution of vegetation communities. Wagner Natural Area receives most of its ground water from the land to the south, hence future monitoring of groundwater hydrology may also be necessary to explain soil and vegetation dynamics within Wagner Natural Area.

4.7 Application of Inventory to EMAN Biodiversity Monitoring

The EMAN protocols provide guidance for "monitoring plant diversity change over time in the various strata of those plant communities that make up Canadian terrestrial ecosystems"(Roberts-Pichette and Gillespie 1999). The soil and vegetation inventories completed during this study provide essential information on the present soil and vegetation diversity within the Natural Area. An attempt was made to locate the 18 monitoring (EMAN) plots within the Natural Area in such a way as to document as many identified vegetation communities and soil units as possible. Hay fields were included because they are located on mineral soils within the Natural Area, as well as to provide baseline soil and vegetation data for future monitoring of vegetation succession if hay production is discontinued. Although the long-term monitoring of soil conditions (moisture, nutrients) is not a required component of the EMAN biodiversity monitoring strategy, the soil information collected during this study may provide some insight into vegetation community changes over time.

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APPENDIX 1
GPS Positions of Detailed Plots in Wagner Natural Area

Appendix 1. GPS Positions of Detailed Plots in Wagner Natural Area

Detailed plot#	Plot Corner	Latitude	Longitude	Easting	Northing	GPS points collected	Horizontal precision differential correction (m)
1	SW	53°34' 04.89638	113°50' 03.59370	312315.281	5939198.0	51	0.373
	NW	53°34' 05.53296	113°50' 03.52657	-	-	50	0.393
	NE	53°34' 05.49658	113°50' 02.49705	-	-	51	0.270
	SE	53°34' 04.88774	113°50' 02.50549	-	-	51	0.380
2	SW	53°34' 08.48267	113°50' 08.23864	312234.281	5939312.5	181	0.273
	NW	53°34' 09.13905	113°50' 08.35688	-	-	181	0.268
	NE	53°34' 09.19460	113°50' 07.28088	-	-	180	0.264
	SE	53°34' 08.55968	113°50' 07.17711	-	-	180	0.253
3	SW	53°33' 48.46939	113°50' 06.61552	312239.500	5938693.0	30	0.285
	NW	53°33' 49.23433	113°50' 06.67571	-	-	80	0.487
	NE	53°33' 49.27831	113°50' 05.59935	-	-	101	0.516
	SE	53°33' 48.59754	113°50' 05.55755	-	-	151	0.328
4	SW	53°34' 09.65077	113°49' 49.12233	312587.250	5939334.5	107	0.268
	NW	53°34' 10.30560	113°49' 49.42554	-	-	123	0.316
	NE	53°34' 10.43721	113°49' 48.30362	-	-	131	0.282
	SE	53°34' 09.86316	113°49' 48.05714	-	-	180	0.340
5	SW	53°33' 55.12135	113°49' 33.22286	312861.781	5938874.0	181	0.373
	NW	53°33' 55.72876	113°49' 33.37524	-	-	183	0.287
	NE	53°33' 55.73599	113°49' 32.29199	-	-	180	0.382
	SE	53°33' 55.17777	113°49' 32.20957	-	-	57	0.230
6	SW	53°33' 59.21169	113°49' 35.09838	312832.313	5939001.5	183	0.264
	NW	53°33' 59.86100	113°49' 35.15226	-	-	184	0.266
	NE	53°33' 59.88637	113°49' 34.03125	-	-	143	0.299
	SE	53°33' 59.21711	113°49' 34.01951	-	-	181	0.364
7	SW	53°34' 03.16086	113°49' 32.53890	312884.219	5939122.0	180	0.280
	NW	53°34' 03.78821	113°49' 32.71866	-	-	180	0.328
	NE	53°34' 03.85251	113°49' 31.60285	-	-	180	0.415
	SE	53°34' 03.24927	113°49' 31.38053	-	-	98	0.348
8	SW	53°34' 10.11794	113°49' 31.56646	312910.656	5939336.0	209	0.291
	NW	53°34' 10.75148	113°49' 31.41186	-	-	161	0.212
	NE	53°34' 10.65084	113°49' 30.36908	-	-	165	0.320
	SE	53°34' 10.01816	113°49' 30.54914	-	-	143	0.232

Appendix 1. (Cont'd)

Detailed plot#	Plot Corner	Latitude	Longitude	Easting	Northing	GPS points collected	Horizontal precision differential correction (m)
9	SW	53°34' 01.18929	113°49' 51.11260	312540.250	5939074.5	1000	0.131
	NW	53°34' 01.84498	113°49' 51.11042	-	-	1010	0.190
	NE	53°34' 01.82979	113°49' 50.01518	-	-	1001	0.164
	SE	53°34' 01.17259	113°49' 50.02099	-	-	1005	0.144
10	SW	53°34' 08.13667	113°49' 42.27611	312711.250	5939282.0	1200	0.103
	NW	53°34' 08.76110	113°49' 42.43658	-	-	1227	0.120
	NE	53°34' 08.85962	113°49' 41.36795	-	-	1201	0.123
	SE	53°34' 08.21920	113°49' 41.22667	-	-	1200	0.122
11	SW	53°34' 05.92946	113°48' 54.14698	313595.719	5939179.0	1200	0.134
	NW	53°34' 06.58275	113°48' 54.12196	-	-	1200	0.095
	NE	53°34' 06.56470	113°48' 53.04538	-	-	1226	0.109
	SE	53°34' 05.91824	113°48' 53.06697	-	-	1200	0.114
12	SW	53°34' 08.63048	113°49' 08.30753	313337.344	5939272.5	1621	0.114
	NW	53°34' 09.25243	113°49' 08.48749	-	-	908	0.115
	NE	53°34' 09.39395	113°49' 07.43955	-	-	1155	0.140
	SE	53°34' 08.75321	113°49' 07.22356	-	-	339	0.258
13	SW	53°33' 41.04597	113°48' 37.64951	313865.688	5938397.5	881	0.137
	NW	53°33' 41.66357	113°48' 37.48387	-	-	627	0.300
	NE	53°33' 41.60516	113°48' 36.41210	-	-	552	0.199
	SE	53°33' 41.00250	113°48' 36.54995	-	-	494	0.109
14	centre	53°33' 50.74949	113°48' 38.20806	313865.688	5938697.5	1300	0.115
15	SW	53°33' 55.30835	113°48' 36.65012	313902.969	5938837.5	1200	0.169
	NW	53°33' 55.90359	113°48' 36.73142	-	-	1765	0.120
	NE	53°33' 55.98198	113°48' 35.67792	-	-	1197	0.132
	SE	53°33' 55.35461	113°48' 35.59198	-	-	906	0.173
16	SW	53°33' 54.87350	113°48' 32.34858	313982.094	5938823.5	608	0.018
	NW	53°33' 55.60196	113°48' 32.37951	-	-	601	0.182
	NE	53°33' 55.59505	113°48' 31.33403	-	-	222	0.171
	SE	53°33' 54.98934	113°48' 31.27864	-	-	81	0.213
17	SW	53°33' 55.69812	113°49' 03.54245	313409.469	5938870.0	553	0.219
	NW	53°33' 56.41476	113°49' 03.75723	-	-	660	0.197
	NE	53°33' 56.51637	113°49' 02.69394	-	-	308	0.341
	SE	53°33' 55.90280	113°49' 02.46085	-	-	750	0.195

Appendix 1. (Cont'd)

Detailed plot#	Plot Corner	Latitude	Longitude	Easting	Northing	GPS points collected	Horizontal precision differential correction (m)
18	SW	53°34' 02.22217	113°49' 08.51287	313325.688	5939074.5	900	0.257
	NW	53°34' 02.85396	113°49' 08.55727	-	-	511	0.187
	NE	53°34' 02.88212	113°49' 07.47769	-	-	1480	0.134
	SE	53°34' 02.20462	113°49' 07.49285	-	-	1202	0.164

APPENDIX 2

Color Photographs of Representative Features

Plate 1: Alaska birch-balsam poplar/dewberry/sedge community subtype (BP1) occurring on Orthic Gleysols, carbonated Terric Humisols and carbonated Terric Mesisols. This photo was taken in the vicinity of detailed plot #62.

Plate 2: Alaska birch-balsam poplar /bunchberry community subtype (BP2) occupying carbonated Rego Gleysols. This community subtype has a more open tree canopy and older, taller trees compared to BP1 community subtype. This photo was taken at reconnaissance plot #67.

Plate 3: Balsam poplar-aspen/dogwood community subtype (PA4) occurring on carbonated Terric Mesisols, carbonated Terric Mesic Humisols and Typic Mesisols. This photo was taken north of reconnaissance plot #51.

Plate 4: White spruce-balsam poplar/dewberry community subtype (SP1) occupying Orthic Gleysols, carbonated Terric Humisols, and carbonated Terric Mesisols. This photo was taken at reconnaissance plot #81.

Plate 5: Black spruce-tamarack/Labrador tea/feather moss community subtype (SL1) occurring on various organic soils. The establishment of the plot area using a theodolite is also shown. This photo was taken at detailed plot #8.

Plate 6: White spruce-black spruce/dewberry/sedge/feather moss community subtype (SS1) mainly occurring on carbonated Terric Mesisols, carbonated Terric Humisols, carbonated Terric Mesic Humisols, and carbonated Rego Gleysols. This photo was taken at reconnaissance plot #72.

Plate 7: Dwarf birch/sedge/moss fen community subtype (FE2) occurring on carbonated Rego Gleysols. This fen community subtype is a mosaic of shallow water areas (marl ponds), slightly raised areas mainly supporting moss and herb species, and the higher areas inhabited by shrub and stunted tree species with associated moss and forb vegetation. This photo was taken at reconnaissance plot #27.

Plate 8: Oblong-leaved sundew (*Drosera anglica*) in bloom. It occupies fen areas within the project area. This photo was taken at reconnaissance plot #86.

Plate 9: Willow/sedge-bluejoint community type (WS) occurring on carbonated Typic Mesisols. This photo was taken at detailed plot #1.

Plate 10: Wind-throw is one of the disturbance types influencing the dynamics of vegetation communities within Wagner Natural Area. This photo was taken near reconnaissance plot #31, within the white spruce-black spruce/dewberry/sedge/feather moss community subtype (SS1).

Plate 11: White spruce/bunchberry/feather moss community type (SW) mainly occurring on carbonated Rego Gleysols and Gleyed Dark Gray Luvisols. The site shown (reconnaissance plot #68) is unique for Wagner Natural Area with its 30-metre high white spruce as the dominant vegetation.

Plate 12: White adder's mouth (*Malaxis monophylla*), found within the black spruce-tamarack/Labrador tea/feather moss subtype (SL1), white spruce-black spruce/dewberry/sedge/feather moss subtype (SS1), and the white spruce-balsam poplar/clover subtype (SP4). This photo was taken at reconnaissance plot #72.

Plate 13: Dwarf rattlesnake plantain (*Goodyera repens*) found in the white spruce/bunchberry/feather moss community type (SW) at detailed plot #16.

Plate 14: Elephant's-head (*Pedicularis groenlandica*), restricted to fen communities within the project area where it occurs as sporadic individuals. This photo was taken near reconnaissance plot #89.

Appendix 3

Soil Sample List

Appendix 3. Soil Sample List

Sample Number	Horizon	Type of Sample
WP2	Apk	Grab
WP2	Apk	Composite
WP2	Apk	Bulk Density
WP2	Btk	Grab
WP2	Btk	Composite
WP2	Btk	Bulk Density
WP2	Ck	Grab
W9	Ap	Grab
W9	Ap	Composite
W9	Ap	Bulk Density
W9	Ahe	Grab
W9	Ae	Grab
W9	Bt	Grab
W9	Bt	Composite
W9	Bt	Bulk Density
W9	BC1	Grab
W9	BC2	Grab
W10	Ap	Grab
W10	Ap	Composite
W10	Ap	Bulk Density
W10	Bt	Grab
W10	Bt	Composite
W10	Bt	Bulk Density
W10	Ck	Grab
W11	Apk	Grab
W11	Apk	Composite
W11	Apk	Bulk Density
W11	Aek	Grab
W11	Aek	Composite
W11	Aek	Bulk Density
W11	Btk	Grab
W11	Btk	Composite
W11	Ck	Grab
W12	Ahk	Grab
W12	Ahk	Composite
W12	Ahk	Bulk Density
W12	Ae	Grab
W12	Ae	Bulk Density
W12	Btkgj	Grab
W12	Btkgj	Composite
W12	Ckg	Grab
W16	Ckg (Oco)	Grab
W16	Ckg (Oco)	Bulk Density

APPENDIX 4

Soil Polygon Attribute Data

Appendix 4. Soil Polygon Attribute Data

ID	GP #	SU	LM	DS	CS (1)	CS (1)	SS (1)	SS (1)	DSG	CSG (1)	CSG (2)	SSG (1)	SSG (2)	PM (1)	PM (2)	PMT (1)	PMT (2)	DR	PE
2	1	GSP7	O1	GSPzh			GSP		TY.H			TY.M		FNPT	FNPT	OH	OM	P	L
3	2	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
4	3	WNR1	L1	WNR			GSPcrxc	ZWA	crR.G			crT.M		MARL	FNPT	VT	OM	VP	L
5	4	GSP3	O1		GSPcrxczh	GSPcrxc	GSPcr			crT.H	crT.M	crTY.M		FNPT	GLLC	OM	FI	P	L
6	5	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
7	6	WNR2	L1	WNR			GSPcrxc		crR.G			crT.M		MARL		VT		VP	L
8	7	WNR2	L1	WNR			GSPcrxc		crR.G					MARL		VT		VP	L
9	8	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
10	9	RVN1	IUl	RVNcrpt			GSPcrxc	GSPxc	crptO.HG			crT.M	T.M	GLLC	FNPT	FI	OM	P	L
11	10	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
12	11	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
13	12	GSP1	O1	GSPcrxc					crT.M					FNPT		OM		P	L
14	13	GSP5	O1	GSPcrxczh			GSPcrxc		crT.H			crT.M		FNPT	FNPT	OH	OM	P	L
15	14	GSP1	O1	GSPcr			GSPcrxczh		crT.M			crT.H		FNPT	FNPT	OM	OH	P	L
16	15	GSP8	O1	GSPcr			GSPcrzz	GSPcrzh	crTY.M			LM.M	crME.H	FOPT		OM		VP	L
17	16	CVL2	L1	CVLcrgl					crGLD.GL					GLFL		MF		I	M
18	17	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
19	18	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
20	19	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
21	20	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
22	21	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
23	22	GSP3	O1		GSPcrxczh	GSPcrxc	GSPcr			crT.H	crT.M	crTY.M		FNPT	GLLC	OM	FI	P	L
24	23	GSP1	O1	GSPcrxc					crT.M					FNPT		OM		P	L
25	24	GSP2	SC1l	GSPcrxc					crT.M					FNPT		OM		P	L
26	25	CVL2	U1l	CVLgl			CVLcrgl	RVNcrpt	GLD.GL			crGLD.GL	crptO.HG	GLFL		ME		I	M
27	26	RVN1	L1	RVNpt			GSPcrxc		crptO.HG			crT.M		GLLC		MF		P	L
28	27	RVN1	L1	RVNpt			GSPcrxc		crptO.HG			crT.M		GLLC		MF		P	L
29	28	WNR1	L1	WNR			GSPcrzh	ZWA	crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
30	29	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
31	30	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
32	31	GSP4	O1	GSPcrxczh			GSPcr	GSPcrzf	crTME.H			crT.M	crFI.M	FNPT	FNPT	OM	OH	P	L
33	32	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
34	33	WNR1	L1	WNR			GSPcrzh		crR.G			crTY.H		MARL	FNPT	VT	OH	VP	L
35	34	ZWA1	W3	ZWA			WNR					crR.G			MARL		VT	VP	L
36	35	GSP4	O1	GSPcrxczh			GSPcr	GSPcrzf	crTME.H			crT.M	crFI.M	FNPT	FNPT	OM	OH	P	L
37	36	BRK1	U1l	BRK					D.GL					GLFL		MC		MW	H
38	37	GSP6	O1	GSPcrxczz			GSPcrxc		crTHU.M			crT.M		FNPT		OM		P	L
39	38	GSP5	O1	GSPcrxczh			GSPcrxc		crT.H			crT.M		FNPT	FNPT	OH	OM	P	L
40	39	GSP8	O1	GSPcr			GSPcrzz	GSPcrzh	crTY.M			LM.M	crME.H	FOPT		OM		VP	L
41	40	CVL1	U1l	CVL			BRK		D.GL			D.GL		GLFL	GLFL	ME	MC	MW	M
42	41	GSP1	O1	GSPcrxc					crT.M					FNPT		OM		P	L
43	42	ZWA1	W3	ZWA			GSPcr					crTY.M			FNPT		OM	VP	L
44	43	GSP1	O1	GSPcrxc					crT.M					FNPT		OM		P	L
45	44	CVL3	U1l	CVLzz			CVLcrzz		CA.DG			crD.GL		GLFL		ME		MW	M
46	45	GSP7	O1	GSPzh			GSP		TY.H			TY.M		FNPT	FNPT	OH	OM	P	L
47	46	CVL2	U1l	CVLcrgl					crGLD.GL					GLFL		MF		I	M

Soil Polygon Attribute Legend

Title

GP	Graphical Polygon
SU	Soil Unit
LM	Landscape Model
DS	Dominant Series
CS	Co-dominant Series
SS	Significant Series
DSG	Dominant Subgroup
CSG	Co-dominant Subgroup
SSG	Significant Subgroup
PM	Parent Material
PMT	Parent Material Texture
DR	Drainage
PE	Perviousness

Series

BRK	Brightbank
CVLcrgl	carbonated, gleyed Carvel
CVL	Carvel
CVLzz	atypical Carvel
GSPcr	carbonated Goldenspike
GSPcrxc	carbonated, terric Goldenspike
GSPcrxczh	carbonated, terric, humic Goldenspike
GSPcrxczz	carbonated, terric, atypical, Goldenspike
GSPcrzf	carbonated, fibric Goldenspike
GSPcrzh	carbonated, humic Goldenspike
GSPcrzz	carbonated, atypical Goldenspike
GSPzh	humic Goldenspike
RVNcrpt	carbonated, peaty Raven
WNR	Wagner
ZWA	Water

Subgroup

CA.DG	Calcareous Dark Gray Chernozem
crGLD.GL	carbonated Gleyed Dark Gray Luvisol
crME.H	carbonated Mesic Humisol
crptO.HG	carbonated peaty Orthic Humic Gleysol
crR.G	carbonated Rego Gleysol
crTHU.M	carbonated Terric Humic Mesisol
crT.H	carbonated Terric Humisol
crT.M	carbonated Terric Mesisol
crTME.H	carbonated Terric Mesic Humisol
crTY.H	carbonated Typic Humisol
crTY.M	carbonated Typic Mesisol
D.GL	Dark Gray Luvisol
LM.M	Limnic Mesisol
TY.H	Typic Humisol
TY.M	Typic Mesisol

Parent Material

FNPT	Fen peat
FOPT	Forest peat
GLLC	Glaciolacustrine
GLFL	Glaciofluvial
MARL	Marl

Parent Material Texture

FI	fine (clay, silty clay)
MC	moderately coarse (sandy loam)
ME	medium (loam, silt loam)
MF	moderately fine (sandy clay loam, clay loam and silty clay loam)
OH	organic, humic
OM	organic, mesic
VT	variable texture

Drainage

I	imperfect
MW	moderately well
P	poor
VP	very poorly

Perviousness

L	Low
M	Medium
H	High

APPENDIX 5
Vegetation Attribute Polygon Data

Appendix 5. Vegetation Attribute Polygon Data; for key to headings, see last page of the appendix 5.

PoN	MU	MUD	PIN	SS	EMR	NR	DI	SU	DT
1	SL1	Sb-Lt/Labrador tea/feather moss	90,91	6			None	GSP7	YES
2	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	GSP7	YES
3	CL	Clearing		1			Maintained road allowance	GSP7	NO
4	MP	Marl pond		10			None	ZWA1	NO
5	FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen		6			None	WNR1	YES
6	CL	Clearing		1			Maintained road allowance	WNR1	NO
7	FE2	Dwarf birch/sedge/moss fen	89	6	8	5	None	WNR1	YES
8	CL	Clearing		1			Abandoned road allowance	GSP7	NO
9	SL1	Sb-Lt/Labrador tea/feather moss	13, 88	6	7, 7	4, 4	None	GSP7	YES
10	SW	Sw/bunchberry/feather moss		6			None	WNR2	YES
11	FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen		6			None	WNR1	YES
12	CL	Clearing		1			Abandoned road allowance	GSP7,	NO
								WNR2	
13	SW	Sw/bunchberry/feather moss		6			Flood related to beaver dam	WNR2	YES
14	PA2	Pb-Aw/willow/bluejoint		2			None	GSP1	YES
15	BE	Beaver pond and associated flooding area		1			Flood and tree cutting	GSP1	NO
							related to beaver dam		
16	SP1	Sw-Pb/dewberry		3			None	WNR2	YES
17	SL1	Sb-Lt/Labrador tea/feather moss		6			None	WNR2	YES
18	FE2	Dwarf birch/sedge/moss fen		6			None	WNR1	YES
19	SL1	Sb-Lt/Labrador tea/feather moss	87	6	7	4	None	GSP7	YES
20	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	WNR2	YES
21	SL1	Sb-Lt/Labrador tea/feather moss		6			None	GSP7	YES
22	SL1	Sb-Lt/Labrador tea/feather moss		6			None	GSP3	YES
23	FE2	Dwarf birch/sedge/moss fen	14, 85, 86	6	9, 8, 9	4, 5, 4	Cutline	WNR1	YES
24	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	GSP3	YES
25	BP1	Bw-Pb/dewberry/sedge		3			Cabin trail	RVN1	YES
26	SP5	Sw-Pb/moss	79	3	6	4	Cabin trail	RVN1	YES
27	SP1	Sw-Pb/dewberry	81	3	6	4	Cabin trail	RVN1	YES
28	SP3	Sw-Pb/dogwood/horsetail	80	3	7	4	None	RVN1	YES
29	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	GSP3	YES

Appendix 5. (Cont'd)

PoN	MU	MUD	PIN	SS	EMR	NR	DI	SU	DT
30	SS2	Sw-Sb/horsetail	78	6	8	4	None	GSP3	YES
31	SS1	Sw-Sb/dewberry/sedge/feather moss	76, 77	6	7, 7	4, 4	None	GSP3	YES
32	FE2	Dwarf birch/sedge/moss fen	6, 41, 56, 75	6	7, 9, 9, 8	4, 5, 5, 5	Cutline	WNR1	YES
33	SL2	Sb-Lt/Labrador tea/feather moss-peat moss	74	6	7	4	Marl Pond trail	GSP4	YES
34	SL1	Sb-Lt/Labrador tea/feather moss		6			None	WNR1	YES
35	MP	Marl pond		10			None	ZWA1	NO
36	SS1	Sw-Sb/dewberry/sedge/feather moss	72	6	6	4	Marl Pond trail, Cutline	GSP4	YES
37	PA4	Pb-Aw/dogwood	70	3	6	4	Beaver cutting	GSP1	YES
38	PA1	Pb-Aw/dewberry	3, 51	3	6, 6	4, 4	Beaver cutting	GSP5	YES
39	SP2	Sw-Pb/willow-dogwood	54, 73	3	8, 7	4, 4	Marl Pond trail, Cutline	GSP4	YES
40	PA4	Pb-Aw/dogwood	52, 71	3	6, 7	3, 4	Marl Pond trail	GSP1	YES
41	PA4	Pb-Aw/dogwood		3			Flood and beaver cutting	GSP8	YES
42	PA1	Pb-Aw/dewberry	53	3	5	3	Marl Pond trail	CVL2	YES
43	MP	Marl pond		10			None	ZWA1	NO
44	SS1	Sw-Sb/dewberry/sedge/feather moss	58	6	6	3	None	GSP3	YES
45	SP1	Sw-Pb/dewberry		3			None	GSP3	YES
46	MP	Marl pond		10			None	ZWA1	NO
47	SL1	Sb-Lt/Labrador tea/feather moss		6			None	WNR1	YES
48	FE1	Bulrush-sedge/moss fen	60	6	8	5	None	WNR1	NO
49	SL1	Sb-Lt/Labrador tea/feather moss	5, 18, 28, 29,	6	8, 7, 8, 6,	4, 4, 4, 4,	Cutline	GSP3	YES
			42, 44, 57, 59		7, 8, 8, 5	4, 4, 4, 3			
50	MP	Marl pond		10			None	ZWA1	NO
51	SS2	Sw-Sb/horsetail	63	6	7	3	None	GSP3	YES
52	SW	Sw/bunchberry/feather moss	64	6	5	3	Cabin trail	CVL2,	YES
								GSP3	
53	SL1	Sb-Lt/Labrador tea/feather moss	49,65, 66, 82,	6	7, 7, 7, 7,	4, 3, 4, 4,	Cutline	GSP3,	YES
			83, 84		7,7	4,4		WNR2	
54	BP2	Bw-Pb/bunchberry	15, 67	3	7, 6	4, 4	None	WNR2	YES
55	SW	Sw/bunchberry/feather moss	16, 68	6	6, 5	4, 3	Bark on numerous Sw	WNR2	YES
							trees damaged by porcupine		
56	PA2	Pb-Aw/willow/bluejoint	69	2	6	4	Disturbances related to	GSP1	YES
							road construction		

Appendix 5. (Cont'd)

PoN	MU	MUD	PIN	SS	EMR	NR	DI	SU	DT
57	SW	Sw/bunchberry/feather moss		5			Disturbances related to	GSP1	NO
							road construction		
58	SP1	Sw-Pb/dewberry	50	3	6	4	None	GSP2,	YES
								WNR2	
60	PA1	Pb-Aw/dewberry		3			None	GSP1,	YES
								GSP2,	
								WNR2	
61	SL1	Sb-Lt/Labrador tea/feather moss		6			None	WNR2	YES
62	PA1	Pb-Aw/dewberry	47, 48	3	5, 6	3, 3	Cabin trail	CVL2,	YES
								GSP3	
63	SW	Sw/bunchberry/feather moss		6			None	CVL2	YES
64	SW	Sw/bunchberry/feather moss		6			Cabin trail	GSP3	YES
65	BP1	Bw-Pb/dewberry/sedge	17, 45, 62	3	6, 6, 6	4, 4, 3	Cabin trail	GSP3	YES
66	SP1	Sw-Pb/dewberry	46	3	6	4	None	GSP3	YES
67	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	GSP3	YES
68	SP1	Sw-Pb/dewberry	43	3	6	4	None	RVN1	YES
69	MP	Marl pond		10			None	ZWA1	NO
70	PA4	Pb-Aw/dogwood		3			None	GSP4	YES
71	SL1	Sb-Lt/Labrador tea/feather moss	7, 8, 25, 26,	6	7, 7, 8, 7,	4, 4, 4, 4,	Marl Pond trail, Cutline	GSP4	YES
			39, 40, 55		7, 7, 7	4, 4, 4			
72	SS1	Sw-Sb/dewberry/sedge/feather moss	38	6	8	4	Marl Pond trail, Cutline	GSP4	YES
73	PA2	Pb-Aw/willow/bluejoint		2			None	GSP1	NO
74	BE	Beaver pond and associated flooding area		10			Flood and cutting	ZWA2	NO
75	HF	Hay field	9, 35, 36, 37	13	4, 4, 4, 4	3, 3, 3, 3	Haying and Marl Pond trail	CVL1	NO
76	CL	Clearing		1			Cutting	GSP1	NO
77	HF	Hay field	11, 32, 33	13	4, 5, 6	4, 3, 3	Haying	CVL2	NO
78	SS1	Sw-Sb/dewberry/sedge/feather moss	31	6	6	4	None	CVL2,	YES
								GSP3	
79	SP4	Sw-Pb/clover	12	2	6	4	None	RVN1	YES
80	SP1	Sw-Pb/dewberry	30	3	6	4	None	RVN1	YES
81	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	RVN1	YES
82	SP2	Sw-Pb/willow-dogwood		3			None	GSP3	YES
83	PA1	Pb-Aw/dewberry		3			None	CVL2	YES

Appendix 5. (Cont'd)

PoN	MU	MUD	PIN	SS	EMR	NR	DI	SU	DT
84	FE2	Dwarf birch/sedge/moss fen		6			None	WNR1	YES
85	MP	Marl pond		10			None	ZWA1	NO
86	FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen		6			None	GSP4	YES
87	SL1	Sb-Lt/Labrador tea/feather moss		6			None	GSP4	YES
88	FE2	Dwarf birch/sedge/moss fen	27	6	9	5	None	WNR1	YES
89	MP	Marl pond		10			None	ZWA1	NO
90	SP1	Sw-Pb/dewberry		3			None	GSP4	YES
91	MP	Marl pond		10			None	ZWA1	NO
92	SS1	Sw-Sb/dewberry/sedge/feather moss		6			None	GSP4	YES
93	PA2	Pb-Aw/willow/bluejoint	24	2	7	4	Marl Pond trail	GSP5	YES
94	SP2	Sw-Pb/willow-dogwood		3			None	GSP4	YES
95	AF	Abandoned field	10, 23	11	3, 4	4, 3	Marl Pond trail	BRK1	NO
96	PA3	Pb-Aw/bluejoint-sedge	4, 22	3	6, 8	4, 4	None	GSP6	YES
97	WS	Willow/sedge-bluejoint	1, 19, 20, 21,	2	9, 7, 8, 9,	4, 4, 4, 4,	Beaver cutting	GSP8	YES
			34		8	4			
98	PA1	Pb-Aw/dewberry		3			None	GSP1	YES
99	HF	Hay field	2	13	5	3	Haying	CVL3	NO
9046	FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen	61	6	9	5	None	WNR1	YES

Vegetation Polygon Attribute Legend

Title

PoN	Polygon Number
MU	Map Unit
MUD	Map Unit Description
PlN	Plot Number
SS	Successional Status
EMR	Ecological Moisture Regime
NR	Nutrient Regime
DI	Disturbances
SU	Dominant/Co-dominant Soil Unit
DT	Dead Timber

Successional Status

1	Pioneer Seral
2	Young Seral
3	Mature Seral
5	Young Edaphic Climax
6	Mature Edaphic Climax
10	Non-vegetated
11	Old Field
13	Cultivated Pasture

Ecological Moisture Regime

3	Subxeric (moderately dry)
4	Submesic (moderately fresh)
5	Mesic (fresh)
6	Subhygric (moderately moist)
7	Hygric (moist)
8	Subhydric (moderately wet)
9	Hydric (wet)

Nutrient Regime

3	Mesotrophic (medium)
4	Permesotrophic (medium)
5	Eutrophic (rich)

Soil Unit

For soil unit legend please refer to Appendix 4.

APPENDIX 6.
Vascular and Non-vascular Plant Species Recorded During Wagner Natural Area Study

Appendix 6. Vascular and Non-vascular Plant Species Recorded During Wagner Natural Area study (for nomenclature, see section 3.3.4 of the report).

Scientific name	Common name	CODES
Vascular plants		
Acer negundo L.	Manitoba maple	ACERNEG
Achillea millefolium L. ssp. *lanulosa* (Nutt.) Piper	common yarrow	ACHIMILL
Achillea sibirica Ledeb.	northern yarrow	ACHISIB
Actaea rubra (Ait.) Willd.	red and white baneberry	ACTARUB
Adoxa moschatellina L.	moschatel	ADOXMOS
Agropyron repens (L.) Beauv.	quack grass	AGROREP
Agropyron trachycaulum (Linke) Malte	slender wheat grass	AGROTRA
Alnus tenuifolia Nutt.	river alder	ALNUTEN
Amelanchier alnifolia Nutt.	saskatoon	AMELALN
Andromeda polifolia L.	bog rosemary	ANDRPOL
Antennaria parvifolia Nutt.	small-leaved everlasting	ANTEPAR
Aralia nudicaulis L.	wild sarsaparilla	ARALNUD
Aster borealis (T. & G.) Prov.	marsh aster	ASTEBOR
Aster ciliolatus Lindl.	Lindley's aster	ASTECIL
Aster conspicuus Lindl.	showy aster	ASTECON
Aster hesperius A. Gray	western willow aster	ASTEHES
Aster puniceus L.	purple-stemmed aster	ASTEPUN
Betula neoalaskana Sargent	Alaska birch	BETUNEO
Betula pumila L. var. *glandulifera* Regal	dwarf birch	BETUPUM
Bromus ciliatus L.	fringed brome	BROMCIL
Bromus inermis Leyss.ssp. *inermis*	awnless brome	BROMINE
Calamogrostis canadensis (Michx.) Beauv.	bluejoint	CALACAN
Calamogrostis inexpansa A. Gray	northern reed grass	CALAINE
Caltha palustris L.	marsh marigold	CALTPAL
Carex aquatilis Wahlenb.	water sedge	CAREAQU
Carex atherodes Spreng.	awned sedge	CAREATH
Carex aurea Nutt.	golden sedge	CAREAUR
Carex bebbii Olney ex Fern.	Bebb's sedge	CAREBEB
Carex capillaris L.	hair-like sedge	CARECAP
Carex concinna R. Br.	beautiful sedge	CARECON
Carex deweyana Schwein.	Dewey's sedge	CAREDEW
Carex diandra Schrank	two-stamened sedge	CAREDIA
Carex disperma Dewey	two-seeded sedge	CAREDIS
Carex gynocrates Wormsk.	northern bog sedge	CAREGYN
Carex interior Bailey	inland Sedge	CAREINT
Carex leptalea Wahlenb.	bristle-stalked sedge	CARELEP
Carex limosa L.	mud sedge	CARELIM
Carex livida (Wahlenb.) Willd.	livid sedge	CARELIV
Carex norvegica Retz.	Norway sedge	CARENOR
Carex peckii Howe	Peck's sedge	CAREPEC
Carex prairea Dewey	prairie Sedge	CAREPRA
Carex sartwellii Dewey	Sartwell's sedge	CARESAR
Carex stipata Muhl. ex Willd.	awl-fruited sedge	CARESTI

Appendix 6. (Cont'd)

Carex utriculata Boott	small bottle sedge	CAREUTR
Carex vaginata Tausch	sheathed sedge	CAREVAG
Carex viridula Michx.	green sedge	CAREVIR
Cicuta maculata L.	water-hemlock	CICUMAC
Cinna latifolia (Trev.) Griesb	drooping wood reed	CINALAT
Circaea alpina L.	small enchanter's nightshade	CIRCALP
Cirsium arvense (L.) Scop.	Canada thistle	CIRSARV
Corallorhiza trifida Chatelain	pale coral-root	CORATRI
Cornus canadensis L.	bunchberry	CORNCAN
Cornus stolonifera Michx.	red-osier dogwood	CORNSTO
Crepis runcinata (James) T. & G.	scapose hawksbeard	CREPRUN
Cypripedium calceolus L.	yellow lady's -slipper	CYPRCAL
Deschampsia cespitosa (L.) Beauv.	tufted hair grass	DESCCES
Dodecatheon pulchellum (Raf.) Merr.	saline shooting-star	DODEPUL
Drosera anglica Huds.	oblong-leaved sundew	DROSANG
Drosera rotundifolia L.	round-leaved sundew	DROSROT
Dryopteris carthusiana (Vill.) H.P. Fuchs	narrow spinulose shield fern	DRYOCAR
Empetrum nigrum L.	crowberry	EMPENIG
Epilobium angustifolium L.	common fireweed	EPILANG
Epilobium ciliatum Raf.	northern willowherb	EPILCIL
Epilobium leptophyllum Raf.	narrow-leaved willowherb	EPILLET
Epilobium palustre L.	marsh willowherb	EPILPAL
Equisetum arvense L.	common horsetail	EQUIARV
Equisetum fluviatile L.	swamp horsetail	EQUIFLU
Equisetum palustre L.	marsh horsetail	EQUIPAL
Equisetum pratense Ehrh.	meadow horsetail	EQUIPRA
Equisetum scirpoides Michx.	dwarf scouring-rush	EQUISCI
Erigeron philadelphicus L.	Philadelphia fleabane	ERIGPHI
Eriophorum polystachion L.	tall cotton-grass	ERIOPOL
Festuca rubra L.	red fescue	FESTRUB
Fragaria vesca L.	woodland strawberry	FRAGVES
Fragaria virginiana Duchesne ssp. *glauca* (S. Wats.) Staudt.	wild strawberry	FRAGVIR
Galeopsis tetrahit L.	common hemp-nettle	GALETET
Galium boreale L.	northern bedstraw	GALIBOR
Galium labradoricum Wieg.	Labrador bedstraw	GALILAB
Galium trifidum L.	small bedstraw	GALITRF
Galium triflorum Michx.	sweet-scented bedstraw	GALITRI
Geocaulon lividum (Richards.) Fern.	northern bastard toadflax	GEOCLIV
Geum aleppicum Jacq.	yellow avens	GEUMALE
Geum rivale L.	purple avens	GEUMRIV
Glyceria striata (Lam.) Hitchc.	fowl manna grass	GLYCSTR
Goodyera repens (L.) R. Br.	dwarf rattlesnake plantain	GOODREP
Habenaria dilatata (Pursh) Hook.	tall white bog orchid	HABEDIL
Habenaria hyperborea (L.) R. Br.	northern green bog orchid	HABEHYP
Habenaria obtusata (Pursh) Richards.	blunt-leaved bog orchid	HABEOBT
Heracleum lanatum Michx.	cow parsnip	HERALAN
Hieracium umbellatum L.	narrow-leaved hawkweed	HIERUMB
Impatiens capensis Meerb.	spotted touch-me-not	IMPACAP
Juncus alpinoarticulatus Chaix	alpine rush	JUNCALP

Appendix 6. (Cont'd)

Juncus balticus Willd.	wire rush	JUNCBAL
Juncus tenuis Willd. var. *dudleyi* (Wieg.) Hermann	Dudley's slender rush	JUNCTEN
(Specimen sent for identification)		KBOOOO
Larix laricina (DuRoi) K. Koch	tamarack	LARILAR
Lathyrus ochroleucus Hook.	cream-colored vetchling	LATHOCH
Ledum groenlandicum Oeder	common Labrador tea	LEDUGRO
Lemna minor L.	common duckweed	LEMNMIN
Lilium philadelphicum L. var *andinum (Nutt.) Ker*	western wood lily	LILIPHI
Linnaea borealis L. ssp. *americana* (Forbes) Hult.	twin-flower	LINNBOR
Listera cordata (L.) R. Br.	heart-leaved twayblade	LISTCOR
Lobelia kalmii L.	Kalm's lobelia	LOBEKAL
Lonicera dioica L.	twining honeysuckle	LONIDIO
Lonicera involucrata (Richards.) Banks	bracted honeysuckle	LONIINV
Lysimachia thyrsiflora L.	tufted loosestrife	LYSITHY
Maianthemum canadense Desf. var. *interius* Fern	wild lily-of-the-valley	MAIACAN
Malaxis monophylla (L.) Sw.	white adder's-mouth	MALAMON
Medicago sativa L.	alfalfa	MEDISAT
Melilotus alba Desr.	white sweet clover	MELIALB
Mentha arvensis L.	wild mint	MENTARV
Mertensia paniculata (Ait.) G. Don	tall lungwort	MERTPAN
Mitella nuda L.	bishop's-cap	MITENUD
Moehringia lateriflora (L.) Fenzl.	blunt-leaved sandwort	MOEHLAT
Moneses uniflora (L.) A. Gray	one-flowered wintergreen	MONEUNI
Muhlenbergia glomerata (Willd.) Trin.	bog muhly	MUHLGLO
Orchis rotundifolia Banks ex Pursh	round-leaved orchid	ORCHROT
Orthilia secunda (L.) House	one-sided wintergreen	ORTHSEC
Oxycoccus microcarpus Turcz.	small bog cranberry	OXYCMIC
Oxycoccus quadripetalus Gilib.	small bog cranberry	OXYCQUA
Parnassia palustris L. var. *neogaea* Fern.	northern grass-of-Parnassus	PARNPAL
Pedicularis groenlandica Retz.	Elephant's-head	PEDIGRO
Petasites palmatus (Ait.) A. Gray	palmate-leaved coltsfoot	PETAPAL
Petasites sagittatus (Pursh) A. Gray	arrow-leaved coltsfoot	PETASAG
Phalaris arundinacea L.	reed canary grass	PHALARU
Phleum pratense L.	timothy	PHLEPRA
Picea glauca (Moench) Voss	white spruce	PICEGLA
Picea mariana (Mill.) BSP	black spruce	PICEMAR
Pinguicula vulgaris L.	common butterwort	PINGVUL
Poa interior Rydb.	inland bluegrass	POAINTE
Poa palustris L.	fowl bluegrass	POAPALU
Poa pratensis L.	Kentucky bluegrass	POAPRAT
Populus balsamifera L.	balsam poplar	POPUBAL
Populus tremuloides Michx.	aspen	POPUTRE
Potentilla anserina L.	silverweed	POTEANS
Pyrola asarifolia Michx.	common pink wintergreen	PYROASA
Ranunculus cymbalaria Pursh	seaside buttercup	RANUCYM
Ranunculus gmelini DC.	yellow water crowfoot	RANUGME
Ranunculus lapponicus L.	Lapland buttercup	RANULAP
Ranunculus sceleratus L.	celery-leaved buttercup	RANUSCE
Ribes americanum Mill.	wild black currant	RIBEAME
Ribes glandulosum Grauer	skunk currant	RIBEGLA

Appendix 6. (Cont'd)

Ribes hudsonianum Richards.	northern black currant	RIBEHUD
Ribes lacustre (Pers.) Poir.	bristly black currant	RIBELAC
Ribes oxyacanthoides L.	northern gooseberry	RIBEOXY
Ribes triste Pall.	wild red currant	RIBETRI
Rorippa palustris (L.) Basser ssp. p*alustris*	marsh yellow cress	RORIPAL
Rosa acicularis Lindl.	prickly rose	ROSAACI
Rosa woodsii Lindl.	common wild rose	ROSAWOO
Rubus arcticus L. ssp *acaulis* (Michx.) Focke	dwarf raspberry	RUBUARC
Rubus idaeus L.	wild red raspberry	RUBUIDE
Rubus pubescens Raf.	dewberry	RUBUPUB
Rumex occidentalis S. Wats.	western dock	RUMEOCC
Salix athabascensis Raup	Athabasca willow	SALIATH
Salix bebbiana Sarg.	beaked willow	SALIBEB
Salix candida Fluegge ex Willd.	hoary willow	SALICAN
Salix discolor Muhl.	pussy willow	SALIDIS
Salix lucida Muhl.	shinning willow	SALILUC
Salix maccalliana Rowlee	velvet-fruited willow	SALIMAC
Salix myrtillifolia Anderss.	myrtle-leaved willow	SALIMYR
Salix petiolaris J. E. Smith	basket willow	SALIPET
Salix planifolia Pursh	flat-leaved willow	SALIPLA
Salix pseudomonticola Ball	false mountain willow	SALIPSE
Salix pyrifolia Anderss.	balsam willow	SALIPYR
Salix spp.	willows	SALISPP
Schizachne purpurascens (Torr.) Swallen	purple oat grass	SCHIPUR
Scirpus acutus Muhl. ex Bigel.	great bulrush	SCIRACU
Scirpus cespitosus L. var. *callosus* Bigel.	tufted bulrush	SCIRCES
Scirpus pungens Vahl ssp. *pungens*	three-square bulrush	SCIRPUN
Scutellaria galericulata L.	marsh skullcap	SCUTGAL
Senecio eremophilus Richards.	cut-leaved ragwort	SENEERE
Senecio pauperculus Michx.	balsam groundsel	SENEPAP
Shepherdia canadensis (L.) Nutt.	Canada buffaloberry	SHEPCAN
Smilacina stellata (L.) Desf.	star-flowered Solomon's-seal	SMILSTE
Smilacina trifolia (L.) Desf.	three-leaved Solomon's-seal	SMILTRI
Solidago canadensis L.	Canada goldenrod	SOLICAN
Solidago gigantea Ait.	late goldenrod	SOLIGIG
Sonchus uliginosus Bieb.	smooth perennial sow-thistle	SONCULI
Sorbus aucuparia L.	European mountain-ash	SORBAUC
Sphenopholis intermedia (Rydb.) Rydb.	slender wedge grass	SPHEINT
Stellaria longifolia Muhl.	long-leaved chickweed	STELLON
Stellaria media (L.) Cyrill.	common chickweed	STELMED
Symphoricarpos albus (L.) Blake	snowberry	SYMPALB
Symphoricarpos occidentalis Hook.	buckbrush	SYMPOCC
Taraxacum officinale Weber	common dandelion	TARAOFF
Tofieldia glutinosa (Michx.) Pers.	sticky false asphodel	TOFIGLU
Trifolium hybridum L.	alsike clover	TRIFHYB
Trifolium pratense L.	red clover	TRIFPRA
Trifolium repens L.	white clover	TRIFREP
Triglochin maritima L.	seaside arrow-grass	TRIGMAR
Triglochin palustris L.	slender arrow-grass	TRIGPAL
Typha latifolia L.	common cattail	TYPHLAT

Appendix 6. (Cont'd)

Urtica dioica L. ssp. *gracilis* (Ait.) Selander	common nettle	URTIDIO
Utricularia intermedia Hayne	flat-leaved bladderwort	UTRIINT
Vaccinium myrtilloides Michx.	blueberry	VACCMYR
Vaccinium vitis-idaea L. ssp. *minus* (Lodd.) Hult	bog cranberry	VACCVIT
Valeriana dioica L. ssp. *sylvatica* (Rich.) F.G. Mey.	northern valerian	VALEDIO
Viburnum edule (Michx.) Raf.	low -bush cranberry	VIBUEDU
Vicia americana Muhl.	wild vetch	VICIAME
Viola canadensis L. var. *rugulosa* (Greene) C.L. Hitchc.	western Canada violet	VIOLCAN
Viola nephrophylla Greene	bog violet	VIOLNEP
Viola renifolia A. Gray	kidney-leaved violet	VIOLREN
Viola selkirkii Pursh	great-spurred violet	VIOLSEL

Mosses

Aulacomnium palustre (Hedw.) Schwaegr.	tufted moss	AULAPAL
Brachythecium campestre (C. Mull.) B.S.G.		BRACCAM
Brachythecium mildeanum (Schimp.) Schimp. in Milde		BRACMIL
Brachythecium salebrosum (Web. & Mohr) B.S.G.		BRACSAL
Brachythecium spp.		BRACSPP
Brachythecium starkei (Brid.) Schimp. *in* B.S.G.		BRACSTA
Brachythecium turgidum (C.J. Hartm.) Kindb.		BRACTUR
Bryum pseudotriquetrum (Hedw.) Gartn.		BRYUPSE
Calliergon giganteum (Schimp.) Kindb.		CALLGIG
Campylium stellatum (Hedw.) C. Jens.		CAMPSTE
Catoscopium nigritum (Hedw.) Brid.		CATONIG
Dicranum elongatum Schleich	long forked moss	DICRELO
Dicranum fragilifolium Lindb.	cushion moss	DICRFRA
Dicranum polysetum Sw.	wavy dicranum	DICRPOL
Dicranum undulatum Brid.	wavy dicranum	DICRUND
Drepanocladus aduncus (Hedw.) Warnst.	brown moss	DREPADU
Drepanocladus revolvens (Sw.) Warnst.	brown moss	DREPREV
Drepanocladus vernicosus (Lindb. ex C. hartm.) Warnst.	brown moss	DREPVER
Eurhynchium pulchellum (Hedw.) Jenn.		EURHPUL
Helodium blandowii (Web. and Mohr) Warnst.		HELOBLA
Hylocomium splendens (Hedw.) B.S.G.	stair-step moss	HYLOSPL
Hypnum lindbergii Mitt.		HYPNLIN
Meesia triquetra (Risht.) Angstr.		MEESTRI
Mnium spinulosum B.S.G.		MNIUSPI
Plagiomnium cuspidatum (Hedw.) Kop.		PLAGCUS
Plagiomnium ellipticum (Brid.) Kop.		PLAGELL
Pleurozium schreberi (Brid.) Mitt.	Schreber's moss	PLEUSCH
Polytrichum strictum Brid.	slender hair-cap	POLYSTR
Ptilium crista-castrensis (Hedw.) De Not.	knight's plume moss	PTILCRI
Rhizomnium pseudopunctatum (Bruch and Schimp.) Kop.		RHIZPSE
Rhytidiadelphus triquetrus (Hedw.) Warnst.	red-stemmed pipecleaner	RHYTTRI
Scorpidium scorpioides (Hedw.) Limpr.		SCORSCO
Scorpidium turgescens (T. Jens.) Loeske		SCORTUR
Sphagnum capillifolium (Ehrh.) Hedw.	acute-leaved peat moss	SPHACAP
Sphagnum fuscum (Schimp.) Klinggr.	rusty peat moss	SPHAFUS
Sphagnum warnstorfii Russ.	peat moss	SPHAWAR

Appendix 6. (Cont'd)

Thuidium recognitum (Hedw.) Lindb.		THUIREC
Tomenthypnum nitens (Hedw.) Loeske	golden moss	TOMENIT

Liverworts

Marchantia polymorpha L.	liverwort	MARCPOL
Plagiochila asplenoides (L.) Dum	liverwort	PLAGASP

Lichens

Cladina arbuscula (Wallr.) Hale & W. Culb.	reindeer lichen	CLADARB
Cladina mitis (Sandst.) Hale & W. Culb.	reindeer lichen	CLADMIT
Cladina rangiferina (L.) Harm.	reindeer lichen	CLADRAN
Cladonia chlorophaea (Floerke ex Somm.) Spreng.		CLADCHL
Cladonia coniocraea (Floerke) Spreng.		CLADCON
Cladonia cornuta (L.) Hoffm.		CLADCOR
Cladonia crispata (Ach.) Flot.		CLADCRI
Cladonia furcata (Huds.) Schrad.		CLADFUR
Cladonia gracilis (L.) Willd.		CLADGRA
Cladonia pleurota (Florke) Schaer.		CLADPLE
Cladonia scabriuscula (Del. ex Duby) Nyl.		CLADSCA
Peltigera aphthosa L. Willd.	studded leather lichen	PELTAPH
Peltigera canina (L.) Willd.	dog lichen	PELTCAN

APPENDIX 7
Wagner Natural Area: Vascular Plant List

Appendix 7: Wagner Natural Area: Vascular Plant List

(based on a compilation by Julie O. Hrapko in "Natural History Information No. 88. December 1991. Alberta Culture and Multiculturalism, Provincial Museum of Alberta, Edmonton)

Key to columns:
Column 1. Scientific name and authority: Nomenclature is largely according to E.H. Moss, 1983, Flora of Alberta, 2d ed., rev. by J.G. Packer, University of Toronto Press.

R= rare species in Alberta
X= extirpated (extinct at site) or no record in at least 15 years
I= Introduced (not native to Alberta)
G= garden or landscaping plant escaped from cultivation
?= incomplete information for the species

Column 2. Common names are according to Ealey, D. 1992. Alberta plants and fungi–master species list and species group checklists, Alberta Energy, Forestry, Lands & Wildlife, Edmonton.

Column 3. Flowering times. Based on Wagner Natural Area Society's knowledge of the site's flora, as compiled by Pat McIsaac and Chel Macdonald (with assistance from Alberta Culture and Multiculturalism) for Alberta's Watchable Wildlife Checklist Series: Wagner Natural Area - Plants. (N.D.)
1. early spring (late March to early May) 2. late spring (mid-May to end of June)
3. summer (July) 4. late summer (August to killing frost)
NA= plant does not produce flowers/seeds (e.g. ferns)

Column 4. Abundance at the Site. Coding developed for Alberta's Watchable Wildlife Checklist Series by Pat McIsaac and Chel Macdonald and assigned according to Wagner Natural Area Society's knowledge of the flora.

C common (usually present in most identified habitats)
U uncommon (seldom present in identified habitats)
0 occasional (almost never present in the identified habitats)
P present in unknown numbers

Column 5. Habitat. Coding developed for Alberta's Watchable Wildlife Checklist Series by Pat McIsaac and Chel Macdonald and assigned (with slight modifications) according to Wagner Natural Area Society's knowledge of the flora.
Pea= peatland (marl ponds; peat/brown mosses dominate)
Wet= wet areas other than peatland
Gra= grassland (forbs and grasslike plants dominate)
Shr= shrubland (tall shrubs [> 0.5 m] dominate)
Con= coniferous (needle-leaved) tree forest
Brl= broad-leaved tree forest
Mix= mixedwood (mixed coniferous & broad-leaved forest)
For= forest (present in most or all of the forest types)
Dis= disturbed (bare soil dominates)
Pea= peatland (marl ponds; peat/brown mosses dominate)
Wet= wet areas other than peatland
Gra= grassland (forbs and grasslike plants dominate)
Shr= shrubland (tall shrubs [> 0.5 m] dominate)
Con= coniferous (needle-leaved) tree forest
Brl= broad-leaved tree forest
Mix= mixedwood (mixed coniferous & broad-leaved forest)
For= forest (present in most or all of the forest types)
Dis disturbed (bare soil dominates)
Various= present in various habitats except open water

Scientific name & authority	Common name	Flowering Period	Abundance	Habitat
LYCOPODIACEAE	**Club-moss Family**			
Lycopodium annotinum L.	stiff club-moss	NA	O	Con
EQUISETACEAE	**Horsetail Family**			
Equisetum arvense L.	common horsetail	NA	C	Various
E. fluviatile L.	swamp horsetail	NA	U	Wet
E. palustre L.	marsh horsetail	NA	U	Wet
E. pratense Ehrh.	meadow horsetail	NA	C	For
E. scirpoides Michx.	dwarf scouring-rush	NA	C	Con
E. variegatum Schleich.	variegated horsetail	NA	P	Wet
OPHIOGLOSSACEAE	**Adder's-tongue Family**			
Botrychium virginianum (L.) Sw.	Virginia grape fern	NA	U	Mix; /
POLYPODIACEAE	**Fern Family**			
Dryopteris carthusiana (Vill.) H.P. Fuchs	narrow spinulose shield fern	NA	U	For
Gymnocarpium dryopteris (L.) Newm.	oak fern	NA	C	For
PINACEAE	**Pine Family**			
Larix laricina (DuRoi) K. Koch	tamarack, American larch	2	C	Pea; Con
Picea glauca (Moench) Voss	white spruce	2	C	Con; Mix
P. mariana (Mill.) BSP	black spruce	2		Pea; Con
TYPHACEAE	**Cattail Family**			
Typha latifolia L.	common cattail	2-3	C	Wet; Pea
SPARGANIACEAE	Bur-reed Family			
Sparganium angustifolium Michx.	narrow-leaved bur-reed	3-4	U	Wet
POTAMOGETONACEAE	**Pondweed Family**			
Potamogeton filiformis Pers.	thread-leaved pondweed	3	C	Wet
JUNCAGINACEAE	**Arrow-grass Family**			
Triglochin maritima L.	seaside arrow-grass	2-4	C	Pea; Wet
T. palustris L.	slender arrow-grass	2-3	C	Pea; Wet
ALISMATACEAE	**Water-plantain Family**			
Alisma plantago-aquatica L.	broad-leaved water plantain	3	O	Wet
GRAMINEAE (POACEAE)	**Grass Family**			
Agropyron repens (L.) Beauv. I	quack grass	2-3	C	Gra; Dis
A. trachycaulum (Linke) Malte	slender wheat grass	2-3	C	For; Gra
Agrostis scabra Willd.	hair grass, tickle grass	2-3	U	Pea; Wet
A. stolonifera L. I	redtop	2-3	U	Wet-Dis

Avena fatua L.	XI?	wild oat	2	P	Gra-Dis
Beckmannia syzigachne (Steud.) Fern.		slough grass	2-3	C	Wet
Bromus ciliatus L.		fringed brome	2-3	C	Brl
B. inermis Leyss. ssp. *inermis*	I	awnless brome	2-3	C	Gra; Dis
B. inermis ssp. pumpellianus (Scribn.) Wagnon		northern awnless brome	2-3	P	?
Calamagrostis canadensis (Michx.) Beauv.		bluejoint; marsh reed grass	2	C	For; /; Pea
C. inexpansa A. Gray		northern reed grass	2-3	C	Pea
Festuca rubra L.	I	red fescue	2-3	U	Gra
Glyceria grandis S. Wats. *ex* Gray		common tall manna grass	3	U	Wet
G. striata (Lam.) Hitchc.		fowl manna grass	3	C	Pea; Wet; Wet-For
Hierochloe odorata (L.) Beauv.		sweet grass	1-2	C	Gra; Dis
Koeleria macrantha (Ledeb.) J.A. Schultes f.		june grass	2-3	P	Gra
Muhlenbergia glomerata (Willd.) Trin.		bog muhly	3	C	Pea
Phalaris arundinacea L.		reed canary grass	3	U	Wet; Wet-Dis
Phleum pratense L.	I	timothy	2-3	C	Gra; Dis
Poa interior Rydb.	?	inland bluegrass	2-3	P	Gra; For/
P. palustris L.		fowl bluegrass	2-3	C	For; Wet; Pea
P. pratensis L.	I?	Kentucky bluegrass	2-3	C	Gra; Dis
Puccinellia distans (L.) Parl.	I	slender salt-meadow grass	2-4	P	Wet-Dis
Schizachne purpurascens (Torr.) Swallen		purple oat grass	2-3	C	For
Scolochloa festucacea (Willd.) Link		spangletop	3	U	Wet
Sphenopholis intermedia (Rydb.) Rydb.		slender wedge grass	3	P	Wet-Gra
CYPERACEAE		**Sedge Family**			
Carex aquatilis Wahlenb.		water sedge	2-3	C	Wet
C. atherodes Spreng.		awned sedge	2-3	C	Wet
C. aurea Nutt.		golden sedge	1-2	U	Wet/; Pea
C. bebbii Olney *ex* Fern.		Bebb's sedge	2	U	Wet
C. brunnescens (Pers.) Poir.	?	brownish sedge	2	P	Pea; Con
C. capillaris L.		hair-like sedge	1-2	C	Mix/; Pea
C. concinna R.Br.		beautiful sedge	1-2	C	Con; Mix; Pea
C. deweyana Schwein.		Dewey's sedge	1-2	U	Mix
C. diandra Schrank		two-stamened sedge	1-2	C	Pea
C. disperma Dewey		two-seeded sedge	1-2	C	Con
C. gynocrates Wormsk.		Northern bog sedge	1-2	C	Con; Pea
C. interior Bailey		inland sedge	2	C	Pea
C. lasiocarpa Ehrh. ssp. *americana* D. Löve & Bernard		hairy-fruited sedge	2	U	Pea; Wet
C. leptalea Wahlenb.		bristle-stalked sedge	1-2	C	Con
C. limosa L.		mud sedge	1-2	C	Pea
C. livida (Wahlenb.) Willd.		livid sedge	1-2	C	Pea
C. microptera Mack.		small-winged sedge	2	U	For/

C. norvegica Retz.	Norway sedge	2	U	For/
C. paupercula Michx.	bog sedge	1-2	U	Wet-Con
C. peckii Howe	Peck's sedge	1-2	U	Brl
C. prairea Dewey	prairie sedge	1-2	C	Pea; Wet
C. sartwellii Dewey	Sartwell's sedge	2	C	Wet; Wet-Shr
C. siccata Dewey	hay sedge	1-2	U	Gra/; For/
C. stipata Muhl. *ex* Willd.	awl-fruited sedge	2	U	Wet/
C. vaginata Tausch	sheathed sedge	1-2	C	Con; Mix
C. viridula Michx.	green sedge	2	C	Pea
C. utriculata Boott	small bottle sedge	2	C	Wet; Pea
Eleocharis tenuis (Willd.) Schultes R	slender spike-rush	2	U	Pea
E. palustris (L.) R. & S.	creeping spike-rush	2	C	Pea; Wet
E. quinqueflora (F.X. Hartm.)O. Schwarz	few-flowered spike-rush	2	C	Pea
Eriophorum polystachion L.	tall cotton-grass	1-2	C	Pea
E. viridi-carinatum (Engelm.) Fern.	thin-leaved cotton-grass	1-2	C	Pea
Rhynchospora capillacea Torr. R	slender beak-rush	3-4	U	Pea
Scirpus acutus Muhl. *ex* Bigel.	great bulrush	2-3	P	Wet
S. caespitosus L. var. *callosus* Bigel.	tufted bulrush	1-2	C	Pea
S. hudsonianus (Michx.) Fern.	Hudson Bay bulrush	2	C	Pea
S. microcarpus Presl	small-fruited bulrush	2-3	U	Wet
S. pungens Vahl ssp. *pungens*	three-square bulrush	2	U	Pea; Wet
S. validus Vahl	common great bulrush	2-3	C	Wet
JUNCACEAE	**Rush Family**			
Juncus alpinoarticulatus Chaix	alpine rush	2-3	C	Pea; Wet
J. balticus Willd.	wire rush	2-3	C	Pea; Wet-Gra
J. bufonius L.	toad rush	2-3	C	Wet-Dis
J. longistylis Torr.	long-styled rush	2-3	U	Pea
J. nodosus L.	knotted rush	2-3	C	Pea; Wet
J. tenuis Willd. *var. dudleyi* (Wieg.) J. Hermann	Dudley's slender rush	2-3	U	Pea
LILIACEAE	**Lily Family**			
Disporum trachycarpum (S. Wats.) B. & H.	fairybells	1-2	U	Brl; Mix
Lilium philadelphicum L. *var. andinum* (Nutt.) Ker	western wood lily	2-3	C	For; Pea; Gra
Maianthemum canadense Desf. var. *interius* Fern.	wild lily-of-the-valley	2-3	C	Mix
Smilacina stellata (L.) Desf.	star-flowered Solomon's-seal	2-3	C	Mix; Pea
S. trifolia (L.) Desf.	three-leaved Solomon's-seal	2-3	C	Pea; Con
Tofieldia glutinosa (Michx.) Pers.	sticky false asphodel	3	C	Pea
IRIDACEAE	**Iris Family**			
Sisyrinchium montanum Greene	common blue-eyed grass	2-3	U	Gra

ORCHIDACEAE		**Orchid Family**			
Calypso bulbosa (L.) Oakes	X?	Venus'-slipper	2	P	Mix
Corallorhiza maculata Raf.		spotted coral-root	2-3	O	Mix
C. trifida Chatelain		pale coral-root	2-3	C	Brl; Mix
Cypripedium calceolus L. var. *parviflorum* (Salisb.) Fern.		small yellow lady's-slipper	2-3	C	For; Pea
C. passerinum Richards.		sparrow's-egg lady's-slipper	2-3	C	Brl; Mix
Goodyera repens (L.) R.Br.		lesser rattlesnake plantain	3-4	O	Con
Habenaria dilatata (Pursh) Hook.		tall white bog orchid	3	U	Pea
H. hyperborea (L.) R. Br.		northern green bog orchid	2-3	C	Gra; For; Pea
H. obtusata (Pursh) Richards.		blunt-leaved bog orchid	2-3	C	Con; Pea
H. orbiculata (Pursh) Torr.		round-leaved bog orchid	3	O	Mix
H. viridis (L.) R.Br.		bracted bog orchid	2-3	O	Mix
Listera cordata (L.) R.Br.		heart-leaved twayblade	2-3	U	Con; For/
Malaxis monophylla (L.) Sw.	R	white adder's-mouth	3	U	Pea/; For/
M. paludosa (L.) Sw.	R	bog adder's-mouth	3-4	O	Pea
Orchis rotundifolia Banks *ex* Pursh		round-leaved orchid	2-3	C	Con; Pea
Spiranthes romanzoffiana Cham. & Schlecht.		hooded ladies'-tresses	3-4	C	Pea
SALICACEAE		**Willow Family**			
Populus balsamifera L.		balsam poplar	1	C	Brl; Mix
P. tremuloides Michx.		aspen	1	C	Brl; Mix
Salix athabascensis Raup		Athabasca willow	1	C	Pea
S. bebbiana Sarg.		beaked willow	1-2	C	Shr; Brl
S. brachycarpa Nutt.	X?	short-capsuled willow	1	P	Pea
S. candida Fluegge *ex* Willd.		hoary willow	1	C	Pea
S. discolor Muhl.		pussy willow	1	U	For/
S. exigua Nutt.		sandbar willow	2	U	Shr; For/
S. lucida Muhl.		shining willow	1-2	C	Shr-Wet
S. maccalliana Rowlee		velvet-fruited willow	1-2	C	Shr-Wet
S. myrtillifolia Anderss.		myrtle-leaved willow	1	O	Pea
S. myrtillifolia Anderss. var. *cordata* (Anderss.) Dorn		myrtle-leaved willow	1	O	Pea; Con; Gra
S. petiolaris J.E. Smith		basket willow	1	C	Shr
S. planifolia Pursh		flat-leaved willow	1	C	Shr-Wet
S. pseudomonticola Ball		false mountain willow	1	C	Shr; For/
S. pyrifolia Anderss.	?	balsam willow	1	P	Shr-Wet
S. serissima (Bailey) Fern.		autumn willow	2	C	Shr-Wet
BETULACEAE		**Birch Family**			
Alnus tenuifolia Nutt.		river alder	1	C	Wet/
Betula neoalaskana Sarg.		Alaska birch	1	C	Mix; Brl
B. pumila L. var. *glandulifera* Regel		dwarf birch	2	C	Pea
URTICACEAE		**Nettle Family**			
Urtica dioica L. ssp. *gracilis* (Ait.) Selander		common nettle	2-3	C	Brl; Dis

SANTALACEAE		**Sandalwood Family**			
Geocaulon lividum (Richards.) Fern.		northern bastard toadflax	2-3	C	Con
POLYGONACEAE		**Buckwheat Family**			
Polygonum erectum L.		striate knotweed	2-4	U	Dis
Rheum rhaponticum L.	IG	rhubarb	2	O	Brl
Rumex maritimus L.		golden dock	2-3	U	Wet-Dis; Wet-Gra
R. occidentalis S. Wats.		western dock	2-3	U	Wet
R. triangulivalvis (Dans.) Rech. f.		narrow-leaved dock	2-3	U	Wet
CHENOPODIACEAE		**Goosefoot Family**			
Chenopodium album L.	I	lamb's-quarters	2	U	Gra-Dis
C. capitatum (L.) Aschers.		strawberry blite	2	O	Mix-Dis
CARYOPHYLLACEAE		**Pink Family**			
Cerastium arvense L.		field mouse-ear chickweed	2	U	Gra
C. vulgatum L.	I	common mouse-ear chickweed	2	O	Wet-Dis
Moehringia lateriflora (L.) Fenzl.		blunt-leaved sandwort	2	C	Brl; Mix
Stellaria calycantha (Ledeb.) Bong.	?	northern stitchwort	2	P	Wet
S. crassifolia Ehrh.		fleshy stitchwort	2	P	Wet
S. longifolia Muhl.		long-leaved chickweed	2-3	C	Wet; Pea
S. longipes Goldie		long-stalked chickweed	2-3	U	Brl; Gra
S. media (L.) Cyrill.	I	common chickweed	2-4	O	Dis
RANUNCULACEAE		**Crowfoot Family**			
Actaea rubra (Ait.) Willd.		red and white baneberry	2	C	Brl; Mix
Anemone canadensis L.		Canada anemone	2-3	C	/; Shr; Brl
A. riparia Fern.	?	tall anemone	2-3	P	For/
Caltha palustris L.		marsh marigold	1-2	C	Wet
Delphinium glaucum S. Wats.		tall larkspur	3	O	Brl; Mix
Ranunculus aquatilis L.		white water crowfoot	2-4	U	Wet
R. cymbalaria Pursh		creeping buttercup	2-3	C	Wet
R. gmelinii DC.		yellow water crowfoot	2-4	C	Wet
R. lapponicus L.		Lapland buttercup	2	U	Pea
R. macounii Britt.		Macoun's buttercup	2-3	U	Wet; Brl
R. sceleratus L.		celery-leaved buttercup	2-3	C	Wet
Thalictrum dasycarpum Fisch. & Ave.-Lall.	R	tall meadow rue	2-3	C	/; Brl
T. venulosum Trel.		veiny meadow rue	2-3	C	/; Gra
FUMARIACEAE		**Fumitory Family**			
Corydalis aurea Willd.		golden corydalis	I 2-3	U	Dis
CRUCIFERAE (BRASSICACEAE)		**Mustard Family**			
Arabis hirsuta (L.) Scop.		hairy rock cress	2-3	O	/
Armoracia rusticana Gaertn.	IG	horse-radish	2	P	Mix/; Dis
Capsella bursa-pastoris (L.) Medic.	I	shepherd's-purse	2-4	U	Dis

Cardamine pensylvanica Muhl.	bitter cress	2-3	U	Wet
Draba nemorosa L. I	annual whitlow-grass	2	U	Dis-Gra
Erysimum cheiranthoides L.	wormseed mustard	2-3	U	For/
Rorippa palustris (L.) Besser ssp. *palustris*	yellow cress	2-4	C	Wet
DROSERACEAE	**Sundew Family**			
Drosera anglica Huds.	oblong-leaved sundew	3	C	Pea
D. rotundifolia L.	round-leaved sundew	3	C	Pea
SAXIFRAGACEAE	**Saxifrage Family**			
Chrysosplenium iowense Rydb.	golden saxifrage	2	U	Wet-For
Mitella nuda L.	bishop's-cap	2-3	C	For
PARNASSIACEAE	**Grass-of-Parnassus Family**			
Parnassia palustris L. var. *neogaea* Fern.	northern grass-of-Parnassus	3-4	C	Wet;Pea
GROSSULARIACEAE	**Currant & Gooseberry Family**			
Ribes americanum Mill.	wild black currant	2	C	Brl; Mix
R. glandulosum Grauer	skunk currant	1-2	C	Con-Wet; Brl-Wet
R. hirtellum Michx.	wild gooseberry	1-2	U	For/
R. hudsonianum Richards.	northern black currant	1-2	C	For-Wet
R. lacustre (Pers.) Poir.	bristly black currant	1-2	U	Con; Mix
R. oxyacanthoides L.	northern gooseberry	1-2	C	Brl; Brl/
R. triste Pall.	wild red currant	1-2	C	For
ROSACEAE	**Rose Family**			
Agrimonia striata Michx.	agrimony	3-4	C	Brl; /
Amelanchier alnifolia Nutt.	saskatoon	2	U	Brl/; Pea/
Cotoneaster sp. IG	cotoneaster	2	U	Mix
Fragaria vesca L.	woodland strawberry	2-3	C	For
F. virginiana Duchesne ssp. *glauca* (S. Wats.) Staudt.	wild strawberry	2-3	C	For
Geum aleppicum Jacq.	yellow avens	2-4	C	Wet-Brl; /
G. macrophyllum Willd. ssp. *perincisum* (Rydb.) Hult.	large-leaved avens	2-4	P	Brl
G. rivale L.	purple avens	2-3	U	Wet-For
Malus baccata Borkh. var. *mandshurica* Schneid. IG	crabapple	1-2	O	/
Potentilla anserina L.	silverweed	2-4	U	Gra; Dis
P. arguta Pursh	white cinquefoil	2-4	U	Gra; Shr
P. palustris (L.) Scop. ?	marsh cinquefoil	2-3	P	Pea; Wet
Prunus virginiana L.	choke cherry	2	U	Brl/
Rosa acicularis Lindl.	prickly wild rose	2-3	C	For; Shr
R. woodsii Lindl.	common wild rose	2-3	U	Shr; Brl
Rubus arcticus L. ssp. *acaulis* (Michx.) Focke	dwarf raspberry	2	C	Mix; Pea
R. idaeus L.	wild red raspberry	2-3	C	Brl; Brl/
R. pubescens Raf.	dewberry	2	C	For

Sorbus aucuparia L.	IG	mountain ash	2	U	Mix
LEGUMINOSAE (FABACEAE)		**Pea Family**			
Lathyrus ochroleucus Hook.		cream-colored vetchling	2-3	C	Brl; Shr
Medicago falcata L.	I	yellow lucerne	2-4	C	Gra; Dis
M. lupulina L.	I	black medick	2-4	C	Gra; Dis
M. sativa L.	I	alfalfa	2-4	C	Gra
Melilotus alba Desr.	I	white sweet clover	2-4	C	Gra; Dis
M. officinalis (L.) Lam.	I	yellow sweet clover	2-4	C	Gra; Dis
Trifolium hybridum L.	I	alsike clover	2-4	C	Gra; Dis
T. pratense L.	I	red clover	2-4	C	Gra; Dis
T. repens L.	I	white clover	2-4	C	Gra; Dis
GERANIACEAE		**Geranium Family**			
Geranium bicknellii Britt.	I?	Bicknell's geranium	2-3	P	Dis
G. richardsonii Fisch. & Trautv.		wild white geranium	2-3	U	Brl; Mix
EMPETRACEAE		**Crowberry Family**			
Empetrum nigrum L.		crowberry	1	C	Pea
ACERACEAE		**Maple Family**			
Acer negundo L.	I	Manitoba maple	1	U	Brl; Brl/
BALSAMINACEAE		**Touch-me-not Family**			
Impatiens capensis Meerb.		spotted touch-me-not	3-4	C	Wet
VIOLACEAE		**Violet Family**			
Viola adunca J.E. Smith		early blue violet	1-3	U	Gra; /
V. canadensis L. var. *rugulosa* (Greene) C.L. Hitchc.		western Canada violet	2-3	C	Brl; /
V. nephrophylla Greene		bog violet	2-4	C	Pea; Wet
V. palustris L.		marsh violet	1-2	U	Wet-For
V. renifolia A. Gray		kidney-leaved violet	1-2	C	Con; Mix
V. selkirkii Pursh		great-spurred violet	1	O	Con
ELAEAGNACEAE		**Oleaster Family**			
Shepherdia canadensis (L.) Nutt.		Canadian buffalo-berry	1	C	For
ONAGRACEAE		**Evening Primrose Family**			
Circaea alpina L.		enchanter's-nightshade	3	C	Con; Mix
Epilobium angustifolium L.		common fireweed	2-4	C	For; /
E. ciliatum Raf. ssp. *glandulosum* (Lehm.) Hoch & Raven		northern willowherb	2-4	C	Wet
E. leptophyllm Raf.		marsh willowherb	2-4	C	Pea
HIPPURIDACEAE		**Mare's-tail Family**			
Hippuris vulgaris L.		common mare's-tail	2-3	C	Wet

ARALIACEAE	**Ginseng Family**			
Aralia nudicaulis L.	wild sarsaparilla	2	C	For
UMBELLIFERAE (APIACEAE)	**Carrot Family**			
Cicuta maculata L. var. *angustifolia* Hook.	water-hemlock	3-4	C	Wet
Heracleum lanatum Michx**.**	cow parsnip	2-4	C	Brl/
Sanicula marilandica L.	snake-root	2-3	C	Brl; Mix
CORNACEAE	**Dogwood Family**			
Cornus canadensis L.	bunchberry	2-3	C	For
C. stolonifera Michx.	red-osier dogwood	2-3	C	For; For/
PYROLACEAE	**Wintergreen Family**			
Moneses uniflora (L.) A. Gray	one-flowered wintergreen	3	U	Con
Orthilia secunda (L.) House	one-sided wintergreen	2-3	U	Con; Mix
Pyrola asarifolia Michx.	common pink wintergreen	2-3	C	For; Pea
P. chlorantha Sw.	greenish-flowered wintergreen	2-3	U	For
MONOTROPACEAE	**Indian Pipe Family**			
Monotropa uniflora L.	Indian pipe	3	U	Mix; Brl
ERICACEAE	**Heath Family**			
Andromeda polifolia L.	bog rosemary	2	C	Pea
Arctostaphylos uva-ursi (L.) Spreng.	common bearberry	1	U	Pea
Ledum groenlandicum Oeder	common Labrador tea	2-3	C	Con; Pea; Mix
Oxycoccus microcarpus Turcz.	small bog cranberry	2	C	Pea
O. quadripetalus Gilib.	bog cranberry	2	U	Pea
Vaccinium myrtilloides Michx.	common blueberry	2	O	Con
V. vitis-idaea L. ssp. *minus* (Lodd.) Hult.	bog cranberry	2	C	Pea
PRIMULACEAE	**Primrose Family**			
Dodecatheon pulchellum (Raf.) Merr.	saline shooting-star	2-3	C	Wet; Pea
Lysimachia thyrsiflora L.	tufted loosestrife	3-4	U	Wet; Pea
Primula incana M.E. Jones	mealy primrose	2-3	C	Wet; Pea
GENTIANACEAE	**Gentian Family**			
Gentianella amarella (L.) Borner ssp. *acuta (*Michx.) Gillett	felwort	3-4	C	For; Gra
G. crinita (Froel.) G. Don ssp. *macounii* (Holm) Gillett	fringed gentian	3-4	C	
Halenia deflexa (Sm.) Griseb.	spurred gentian	3-4	C	For
MENYANTHACEAE	**Buck-bean Family**			
Menyanthes trifoliata L.	buck-bean	2-3	U	Wet; Pea

BORAGINACEAE		**Borage Family**			
Mertensia paniculata (Ait.) G. Don		tall lungwort	2-3	C	For; Shr
LABIATAE (LAMIACEAE)		**Mint Family**			
Agastache foeniculum (Pursh) Ktze.		giant hyssop	3-4	U	Brl; Shr
Galeopsis speciosa Mill.	IX	yellow hemp-nettle	3-4	O	Dis
G. tetrahit L.	I	common hemp-nettle	3-4	C	Dis; For
Mentha arvensis L.		wild mint	2-4	C	Wet
Scutellaria galericulata L.		common skullcap	3-4	C	Wet
Stachys palustris L. ssp. *pilosa* (Nutt.) Epling		marsh hedge-nettle	3-4	C	Wet; Brl
SCROPHULARIACEAE		**Figwort Family**			
Castilleja miniata Dougl. *ex* Hook.		common red paintbrush	2-4	U	Gra; Shr; /
Limosella aquatica L.		mudwort	4	O	Wet
Pedicularis groenlandica Retz.		elephant's-head	2-3	C	Pea; Wet
Veronica americana (Raf.) Schw.		American brooklime	2-4	C	Wet
LENTIBULARIACEAE		**Bladderwort Family**			
Pinguicula vulgaris L.		common butterwort	2-3	C	Pea
Utricularia intermedia Hayne		flat-leaved bladderwort	2-	c	Wet
U. minor L.		small bladderwort	3	U	Wet
U. vulgaris L. ssp. *Macrorhiza* (Le Conte) Clausen		common bladderwort	2-3	C	Pea
PLANTAGINACEAE		**Plantain Family**			
Plantago major L.	I	common plantain	2-4	C	Dis
RUBIACEAE		**Madder Family**			
Galium boreale L.		northern bedstraw	2-4	C	Gra; Shr; /; Pea
G. labradoricum Wieg.		Labrador bedstraw	2-3	C	Pea
G. trifidum L.		small bedstraw	2-3	U	Pea; Wet
G. triflorum Michx.		sweet-scented bedstraw	2-3	C	Brl; Mix
CAPRIFOLIACEAE		**Honeysuckle Family**			
Linnaea borealis L. ssp. *americana* (Forbes) Hult.		twinflower	2-3	C	For
Lonicera dioica L.		twining honeysuckle	2-3	C	Brl; Mix; Pea/
L. involucrata (Richards.) Banks		bracted honeysuckle	2	C	For; Pea/
Symphoricarpos albus (L.) Blake		snowberry	2-3	C	Brl; Mix
S. occidentalis Hook.		buckbrush	2-4	C	Shr; Brl/
Viburnum edule (Michx.) Raf.		low bush-cranberry	2-3	C	Brl; Mix
ADOXACEAE		**Moschatel Family**			
Adoxa moschatellina L.		moschatel	2	C	Mix; Brl

VALERIANACEAE	**Valerian Family**			
Valeriana dioica L. ssp. *sylvatica* (Rich.) F.G. Mey.	northern valerian	2-3	U	Wet/; Mix
CAMPANULACEAE	**Bluebell Family**			
Campanula rotundifolia L.	harebell	3-4	U	Gra; Pea
LOBELIACEAE	**Lobelia Family**			
Lobelia kalmii L.	Kalm's lobelia	3-4	C	Pea
COMPOSITAE (ASTERACEAE)	**Composite/Daisy Family**			
Achillea millefolium L. ssp. *lanulosa* (Nutt.) Piper	common yarrow	3-4	C	Various
A. sibirica Ledeb.	many-flowered yarrow	3-4	C	Wet
Antennaria parvifolia Nutt.	small-leaved everlasting	2	U	Gra
Arnica chamissonis Less. ?	leafy arnica	3-4	O	For/
Aster borealis (T. & G.) Prov.	rush aster	3-4	C	Wet; Pea
A. brachyactis Blake	rayless aster	3-4	U	Dis
A. ciliolatus Lindl.	Lindley's aster	3-4	C	For
A. conspicuus Lindl.	showy aster	3-4	C	For; For/
A. hesperius A. Gray	western willow aster	3-4	C	Wet
A. laevis L.	smooth aster	3-4	C	Gra
A. modestus Lindl.	large northern aster	4	U	/
A. puniceus L.	purple-stemmed aster	3-4	C	Wet; Con/
A. umbellatus Mill. var. *pubens* Gray R	flat-topped white aster	4	U	Brl; Pea
Bidens cernua L.	nodding beggar-ticks	3-4	C	Wet
Cirsium arvense (L.) Scop. I	Canada thistle	3-4	C	Dis; Brl
C. arvense forma *albiflorum* (Rand & Redf.) R. Hoffman	white Canada thistle	3-4	P	Dis
Crepis runcinata (James) T. & G.	scapose hawksbeard	3-4	U	Wet
C. tectorum L. I	annual hawksbeard	2-4	C	Dis
Erigeron acris L.	northern daisy fleabane	3	U	Gra; /
E. philadelphicus L.	Philadelphia fleabane	2-3	C	Wet; Pea
Eupatorium maculatum L. R	spotted Joe-Pye weed	4	O	Wet
Hieracium aurantiacum L. I	orange hawkweed	3	O	Brl
H. umbellatum L.	narrow-leaved hawkweed	3-4	C	For
Matricaria matricarioides (Less.) Porter I	pineappleweed	2-4	C	Dis
M. perforata Merat I	scentless chamomile	1-4	O	Dis
Petasites palmatus (Ait.) A. Gray	palmate-leaved coltsfoot	1	C	Wet; For
P. sagittatus (Pursh) A. Gray	arrow-leaved coltsfoot	1	C	Wet
P. vitifolius Greene	vine-leaved coltsfoot	1	C	Wet; For
Senecio congestus (R. Br.) DC.	marsh ragwort	2	O	Pea
S. eremophilus Richards.	cut-leaved ragwort	3-4	O	For
S. pauperculus Michx.	balsam groundsel	3	U	For/
Solidago canadensis L.	Canada goldenrod	3-4	C	Gra; /
Sonchus uliginosus Bieb. I	smooth perennial sow thistle	3-4	C	Dis
Tanacetum vulgare L. I	common tansy	3-4	U	Dis
Taraxacum officinale Weber I	common dandelion	1-4	C	Various

APPENDIX 8
Bryophytes, Lichens and Fungi of Wagner Natural Area

Appendix 8. Bryophytes, Lichens and Fungi of Wagner Natural Area

(from Wagner Natural Area Plant Checklist, Natural History Information No. 88, December 1991; Alberta Culture and Multiculturalism, Provincial Museum of Alberta, Edmonton. Prepared and edited by Julia O. Hrapko.)

Contributors to this list: Dale H. Vitt, Christopher Miller, J. Derek Johnson, Alice Hendry.

Species Name	**Common Name**	**Habitat**	**Abundance**
Mosses			
Amblyodon dealbatus (Hedw.) B.S.G.	pale-leaved thread moss	Pea	P
Amblystegium serpens (Hedw.) B.S.G.		For	C
Amblystegium varium (Hedw.) Lindb.		For	P
Aulacomnium palustre (Hedw.) Schwaegr.	tufted moss	Wet; Con	C
Brachythecium campestre (C. Mull.) B.S.G.	field verdant moss	For	P
Brachythecium mildeanum (Schimp.) Schimp. *in* Milde	clay grass moss	Pea; Wet	U
Brachythecium salebrosum (Web. & Mohr) B.S.G.	golden ragged moss	For	C
Brachythecium starkei (Brid.) Schimp. *in* B.S.G.	woodland verdant moss	For	U
Brachythecium turgidum (C.J. Hartm.) Kindb.	thick ragged moss	Pea	U
Bryoerythrophyllum recurvirostrum (Hedw.) Chen	red leaf moss	For; Dis	P
Bryum pseudotriquetrum (Hedw.) Gaertn., Meyer & Scherb.	tall clustered thread moss	Pea; Wet	C
Calliergon giganteum (Schimp.) Kindb.	giant water moss	Pea; Wet	U
Campylium hispidulum (Brid.) Mitt.	star moss	For	C
Campylium radicale (P. Beauv.) Grout	star moss	For	P
Campylium stellatum (Hedw.) C. Jens.	yellow star moss	Pea	C
Catoscopium nigritum (Hedw.) Brid.	golf club moss	Pea	O
Ceratodon purpureus (Hedw.) Brid.	purple horn-toothed moss	Dis	C
Cinclidium stygium Sw.	common northern lantern moss	Pea	O
Climacium dendroides (Hedw.) Web. & Mohr	common tree moss	Wet	U
Desmatodon cernuus (Hub.) B.S.G.	narrow-leafed chain-teeth moss	Dis	P
Dicranum elongatum Schleich.	long forked moss	For?	P
Dicranum fragilifolium Lindb.	cushion moss	For	U
Dicranum polysetum Sw.	wavy dicranum	Con	O
Dicranum undulatum Brid.	wavy dicranum	Wet; Con	C
Distichium capillaceum (Hedw.) B.S.G.	hair-like opposite-leafed moss	Dis; For	U
Distichium inclinatum (Hedw.) B.S.G.	inclined-fruited opposite-leafed moss	Dis; For	O
Drepanocladus aduncus (Hedw.) Warnst.	common hook moss	Pea; Wet	U
Drepanocladus crassicostatus Janssens	hook moss	Pea	P
Limprichtia revolvens (Sw.) Loeske	red hook moss	Pea	C
Sanionia uncinata (Hedw.) Loeske	sickle moss	Wet; For	C
Hamatocaulis vernicosus (Mitt.) Hedenas	hook moss	Pea; Wet	U
Eurhynchium pulchellum (Hedw.) Jenn.	common beaked moss	For	C
Funaria hygrometrica Hedw.	cord moss	Dis	U
Bryohaplocladium microphyllum (Hedw.) Wat. & Iwats.		Brl; Mix	O

Helodium blandowii (Web. & Mohr) Warnst.	Blandow's feather moss	Pea	U
Hylocomium splendens (Hedw.) B.S.G.	stair-step moss	For	C
Hypnum lindbergii Mitt.	clay pigtail moss	Wet	U
Hypnum pratense Koch *ex* Brid.	meadow pigtail moss	Pea	U
Leptobryum pyriforme (Hedw.) Wils.	long-necked bryum	Dis; For	C
Meesia triquetra (Richt.) Angstr.	three-angled thread moss	Pea	U
Meesia uliginosa Hedw.	capillary thread moss	Wet	U
Mnium spinulosum B.S.G.	red-mouthed mnium	For	U
Myurella julacea (Schwaegr.) B.S.G.	small mouse-tail moss	Con	O
Onchophorus wahlenbergii Brid.	mountain curved-back moss	For	C
Orthotrichum obtusifolium Brid.	blunt-leaved bristle moss	Brl; Mix	C
Orthotrichum speciosum Nees *ex* Sturm	showy bristle moss	Brl; Mix	C
Paludella squarrosa (Hedw.) Brid.	squarrose thread moss	Pea	O
Plagiomnium cuspidatum (Hedw.) Kop.	woodsy mnium	Brl; Mix	C
Plagiomnium ellipticum (Brid.) Kop.	marsh magnificent moss	Wet	C
Platygyrium repens (Brid.) B.S.G.		Brl; Mix	P
Pleurozium schreberi (Brid.) Mitt.	big red stem	For	C
Pohlia nutans (Hedw.) Lindb.	copper wire moss	Dis; For	C
Polytrichum commune Hedw.	common hair-cap	Con	O
Polytrichum strictum Brid.	slender hair-cap	Pea; Con	C
Pseudocalliergon turgescens (T. Jens.) Loeske	yellow sausage moss	Pea	P P
Ptilium crista-castrensis (Hedw.) De Not.	knight's plume moss	For	C
Pylaisiella polyantha (Hedw.) Grout	stocking moss	Brl; Mix	C
Rhizomnium gracile Kop.	small round moss	Wet	U
Rhizomnium pseudopunctatum (Bruch & Schimp.) Kop.	large round moss	Wet	U
Rhytidiadelphus triquetrus (Hedw.) Warnst.	electrified cat's tail moss	Con	O
Scorpidium scorpioides (Hedw.) Limpr.	sausage moss	Pea	C
Sphagnum angustifolium (Russ.) C. Jens.	poor fen peat moss	Pea	U
*Sphagnum fuscum (*Schimp.) Klinggr.	rusty peat moss	Pea	C
Sphagnum capillifolium (Ehrh.) Hedw.	acute-leaved peat moss	Con	O
Sphagnum warnstorfii Russ.	Warnstorf's peat moss	Pea	C
Tetraphis pellucida Hedw.	common four-tooth moss	For	P
Tetraplodon angustatus (Hedw.) B.S.G.	narrow-leaved splachnum	Con	P
Thuidium recognitum (Hedw.) Lindb.	hook-leaf fern moss	For	U
Tomenthypnum nitens (Hedw.) Loeske	golden moss	Pea	C
Tortella tortuosa (Hedw.) Limpr.	twisted moss	Dis	P

Liverworts

Aneura pinguis (L.) Dum.		Pea	C
Blepharostoma trichophyllum (L.) Dum.		For	C
Conocephalum conicum (L.) Lindb.	spicy conehead	Con	O
Geocalyx graveolens (Schrad.) Nees		For	P
Jamesoniella autumnalis (DC.) Steph.	Jameson's liverwort	For	U
Lepidozia reptans (L.) Dum.	little hands liverwort	For	C
Marchantia polymorpha L.	green-tongue liverwort	Wet	O
Mylia anomala (Hook.) S.F.Gray	hard scale liverwort	Pea	C
Plagiochila asplenioides (L.) Dum.	cedar-shake liverwort	Pea	U
Preissia quadrata (Scop.) Nees		Con	O
Ptilidium ciliare (L.) Hampe	northern naugehyde liverwort	Con	P
Ptilidium pulcherrimum (G. Web.) Hampe	naugehyde liverwort	For	C

Lichens of Wagner Natural Area (Contributors to this list: Janet Marsh & J. Derek Johnson)

Arthonia patellulata Nyl.	aspen comma	Brl; Mix	U
Biatora vernalis (L.) Fr.		For	C
Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw.	speckled horsehair	Con	O
Buellia triphragmioides Anzi	button lichen	For	P
Caloplaca cerina (Ehrh.) Th. Fr.	crusted orange lichen	Brl; Mix	C
Caloplaca holocarpa (Hoffm.) Wade	orange lichen	Brl; Mix	C
Caloplaca ulmorum (Fink) Fink	orange lichen	Brl; Mix	P
Candelaria concolor (Dicks.) B. Stein var. *effusa* (Tuck.) Burnh.	lemon lichen	Con	C
Candelariella vitellina (Ehrh.) Mull. Arg.	egg lichen	Con	P
Cladina arbuscula (Wallr.) Hale & W. Culb	greater green reindeer lichen	Con	P
Cladina mitis (Sandst.) Hale & W. Culb.	lesser green reindeer lichen	Con	C
Cladina rangiferina (L.) Harm.	grey reindeer lichen	Con	U
Cladonia bacillaris (Ach.) Nyl.	lipstick powderhorn	Con	U
Cladonia botrytes (Hag.) Willd.	stump soldiers	Con	O
Cladonia cenotea (Ach.) Schaer.	miner's funnel	Con	U
Cladonia chlorophaea (Floerke *ex* Somm.) Spreng.	mealy pixie-cup	Con	C
Cladonia borealis S. Stenroos	boreal pixie-cup	Con	O
Cladonia coniocraea (Floerke) Spreng.	lesser powderhorn	Con	C
Cladonia cornuta (L.) Hoffm.	common bighorn	Con	C
Cladonia crispata (Ach.) Flot.	greater organpipe	Con	U
Cladonia cristatella Tuck.	British soldiers	Con	P
Cladonia deformis (L.) Hoffm.	lesser sulphur-cup	Con	U
Cladonia fimbriata (L.) Fr.	powdered trumpet	Con	U
Cladonia furcata (Huds.) Schrad.	many-forked cladonia	Con	O
Cladonia gracilis ssp. *turbinata* (Ach.) Ahti	bronzed pixie-cup	Con	C
Cladonia multiformis Merr.	slotted cladonia	Con	U
Cladonia pleurota (Florke) Schaerer	mind-altering pixie-cup	Con	P
Cladonia pyxidata (L.) Hoffm.	pebbled pixie-cup	Con	U
Cladonia scabriuscula (Del. *ex* Duby) Nyl.	many-winged cladonia	Con	O
Cladonia subulata (L.) Wigg.	antlered powderhorn	Con	O
Cladonia uncialis (L.) Wigg.	thorn cladonia	Con	P
Evernia mesomorpha Nyl.	boreal oakmoss	Mix; Con	C
Flavopunctelia flaventior (Stirton) Hale	green speckleback	For	C
Hypogymnia physodes (L.) W. Wats.	monk's-hood	For	C
Imshaugia aleurites (Ach.) S.F. Meyer	salted starburst	Con	O
Lecania dubitans (Nyl.) A.L. Sm.		For	P
Lecanora caesiorubella Ach. ssp. *saximontana* Imsh. & Brodo		For	P
Lecanora circumborealis Brodo & Vitik.		For	C
Lecanora meridionalis Magnusson		For	P
? *Lecanora pseudochlarotera* Brodo		For	P
Lecanora pulicaris (Pers.) Ach.		For	P
Lecanora symmicta (Ach.) Ach.		For	P
Lecidella euphorea (Florke) Hertel		For	U
Melanelia exasperatula (Nyl.) Essl.	lustrous brown	Con	U
Melanelia septentrionalis (Lynge) Essl.	northern brown	Shr, Con	O
Melanelia subaurifera (Nyl.) Essl.	abraded brown	Con	C
Ochrolechia arborea (Kreyer) Almb.		For	U
Punctelia subrudecta (Nyl.) Krog	forest speckleback	For	U
Parmelia sulcata Tayl.	powdered shield	For	C

Parmeliopsis ambigua (Wulf.) Nyl.	Green starburst	Con	C
Parmeliopsis hyperopta (Ach.) Arn.	grey starburst	Con	C
Peltigera aphthosa (L.) Willd.	freckle pelt	Con	C
Peltigera canina (L.) Willd.	dog pelt	Con	C
Peltigera elisabethae Gyeln.	concentric pelt	Con	O
Phaeophyscia orbicularis (Neck.) Moberg	granulated shadow	Brl; Mix	U
Physcia adscendens (Th. Fr.) Oliv.	hooded rosette	For	C
Physcia aipolia (Ehrh.) Hampe	grey-eyed rosette	For	C
Phaeophyscia hispidula (Ach.) Essl.	whiskered shadow	For	P
Physcia stellaris (L.) Nyl.	black-eyed rosette	For	U
Physconia detersa (Nyl.) Poelt	bottlebrush frost	Brl; Mix	O
Ramalina farinacea (L.) Ach.	the dotted line	Con	U
Ramalina americana Hale	bush	Con	U
Ramalina roesleri (Hochst. *ex* Schaer.) Hue	frayed bush	Con	P
Rinodina dakotensis Magn.		For	P
Rinodina exigua (Ach.) S. Gray		For	P
Trapeliopsis flexuosa (Fr.) Coppins & P. James		For	P
Trapeliopsis granulosa (Hoffm.) Lumbsch		For	P
Tuckermannopsis americana (Sprengel) Hale	fringed ruffle	Con	U
Usnea cavernosa Tuck.	pitted beard	Con	O
Usnea hirta (L.) Wigg.	bristly beard	Con	U
Usnea lapponica Vainio	powdered beard	Con	C
Vulpicida pinastri (Scop.) J.-E. Mattsson & M.J. Lai	powdered sunshine	Con	C
Xanthoria fallax (Hepp.) Arn.	powdered orange	Brl; Mix	C
Xanthoria polycarpa (Ehrh.) Oliv.	pincushion orange	Brl; Mix	C
Xylographa parallela (Ach.:Fr.) Behlen & Desberg	script lichen	Brl; Mix	P

Fungi of Wagner Natural Area (based on collections by Andrew Hendry, and identifications by Randy Currah and Sean Abbott, University of Alberta Devonian Botanic Garden.)

Agaricus micromegathus Peck	
Agaricus silvicola (Vitt.) Sacc.	woodland Agaricus
**Armillaria* sp.	
Auriscalpium vulgare S.F.Gray	earspoon fungus
Bjerkandera adusta (Fr.) Karst	smoky polypore
Calocera cornea (Batsch: Fr.) Fr.	staghorn jelly fungus
Cantharellus tubaeformis Fr.	trumpet chanterelle
Cerrena unicolor (Fr.) Murr.	grey polypore
Chlorociboria aeruginascens (Nyl.) Kan. *ex* Ram., Korf & Batra	green cups
Chroogomphus rutilus (Fr.) O.K. Miller	pegtop
Clavariadelphus ligula (Fr.) Donk	pestle fungus
Collybia dryophila (Bull.: Fr.) Kummer	June mushroom
Coltricia perennis (L. : Fr.) Murr.	fairy stool
Coprinus atramentarius (Bull. : Fr.) Murr.	smooth inky cap
Cortinarius amoenolens Henry *ex* Horton	
Cortinarius collinitus Fr.	
Cortinarius pholideus (Fr.) Fr.	
Crepidotus applanatus (Pers.) Kummer	flat Crepidotus
Crepidotus variabilis (Pers.: Fr.) Kummer	
Cystoderma amiantinum (Scop. :Fr.) Fayod	unspotted Cystoderma

Cystoderma cinnabarinum (Secr.) Fayod	vermilion Cystoderma
Cystoderma fallax Smith and Singer	conifer Cystoderma
Dacryopinax sp.	
Daedaleopsis confragosa (Bolt. : Fr.) Schruet.	
Dentinum repandum (L. : Fr.) S.F. Gray	spreading hedgehog mushroom
Dermocybe cinnamomea (L. Fr.) Ricken.	
Entoloma lividum Fr.	
Favolus alveolaris (DC.: Fr.) Wuel.	
Fomitopsis pinicola (Fr.) Kasts.	red belt fungus
Fuscoboletinus aeruginascens (Secr.) Pomerleau and Smith	greyish larch bolete
Fuscoboletinus spectabilis (Peck) Pomerleau and Smith	admirable bolete
Galerina mycenopsis (Fr. : Fr.) Kuehn.	
Geastrum saccatum Fr.	rounded earthstar
Geastrum triplex Jungh.	collared earthstar
Hebeloma crustuliniforme (Bull. *ex* Saint-Amans) Quel.	poison pie
Hirschioporus pargamenus	
Hypomyces hyalinus (Schw.: Fr.) Tul.	
Hypomyces luteovirens (Fr.) Tul.	yellow-green Hypomyces
Inocybe fastigiata (Schaeff. : Fr.) Quel.	deadly Inocybe
Inocybe leucoblema Kuehn.	fibrehead
Irpex lactea (Fr. : Fr.) Fr.	
Laccaria laccata (Fr.) Berk, & Br.	orange Laccaria
Lactarius deliciosus (L. :Fr.) Gray	delicious milkcap
Lactarius scrobiculatus (Scop. : Fr.) Fr.	pitted milkcap
Lactarius torminosus (Schaeff. : Fr.) S.F. Gray	woolly milkcap
Leccinum scabrum (Bull.: Fr.) S.F. Gray	birch bolete
Lentinellus cochleatus (Fr.) Karst.	
Lenzites betulina (L. : Fr.) Fr.	white-gilled polypore
Leocarpus fragilis (Dicks.) Rost.	
Lepiota clypeolaria (Bull. *ex* Fr.) Kummer	shaggy-stalked parasol
Lepiota cristata (A. & S. *ex* Fr.) Kummer	
Marasmius androsaceus (L.) Fr.	pinwheel
Mycena pura (Pers. : Fr.) Kummer	pink Mycena
Otidea leporina (Fr.) Fuckel	donkey's ears
Panus rudis Fr.	
Peniophora rufa (Fr.) Boid.	
Peziza repanda Pers.	brown cup
Phellinus punctatus (Fr.) Pilat	
Pleurotus porrigens (Pers. *ex* Fr.) Singer	
Polyporus elegans Bull. : Fr.	elegant polypore
Rhytisma andromedae Fr.	
Rhytisma salicinum Fr.	
Schizophyllum commune Fr.	split-gill
Scutellinia scutellata (L. : Fr.) Lambotte	red eyelash cup

Spathularia flavida Pers. : Fr.	yellow earth tongue
Suillus grevillei (Kl.) Singer	tamarack Jack
Suillus tomentosus (Kauf.) Snell, Singer & Dick	woolly pine bolete
Tricholoma vaccinum (Pers. *ex* Fr.) Kummer	scaly Tricholoma
Trogia crispa Fr.	

Formerly *Armillaria mellea* was thought to occur in Wagner; now this species is not believed to occur in Alberta. The two species of *Armillaria* now reported for Alberta are *A. ostoyae* (Romagn.) Herink and *A. sinapina* Berube & Dessureault. It is not yet know which one occurs, or whether both occur, in Wagner.

Please note: Key for habitat and abundance abbreviations is the same as for vascular plants
(see Appendix 7)

APPENDIX 9

Alberta Natural Heritage Information Centre Definitions

Appendix 9: Alberta Natural Heritage Information Centre Definitions (from ANHIC 2000).

Last Updated January 27, 2000

Explanation of ranks: G=Global; S=Alberta

Rank	Frequency/Distribution	Concerns/Comments
S1/G1	5 or fewer occurrences or only a few remaining individuals	May be especially vulnerable to extirpation because of some factor of its biology
S2/G2	6-20 or fewer occurrences or with many individuals in fewer locations	May be especially vulnerable to extirpation because of some factor of its biology
S3/G3	21-100 occurrences, may be rare and local throughout it's range, or in a restricted range (may be abundant in some locations)	May be susceptible to extirpation because of large scale disturbances
S4/G4	Typically >100 occurrences	Apparently secure
S5/G5	Typically >100 occurrences	Demonstrably secure

A NUMBER OF OTHER CODES ARE USED TO CLARIFY THE STATUS OF AN ELEMENT

- **A**- Accidental or casual in the province, includes species (usually birds or butterflies) recorded very infrequently, commonly far outside their usual range.
- **B** - A rank modifier indicating breeding status for a migratory species.
- **C** - Element is presently existing in the province only in captivity or cultivation.
- **E** - Exotic species established in province, may be native to nearby regions.
- **H** - Historically known, may be relocated in future.
- **HYB** - Hybrid taxon that is recurrent in the landscape.
- **N** -A rank modifier indicating non-breeding status for a migratory species.
- **P** - Potentially exists in province but no occurrences reported.
- **Q** - Taxonomic problems involved, more information needed.
- **R** - Reported for Alberta but lacking documentation which would provide a basis for either accepting or rejecting the report (e.g. misidentified specimen).
- **RD** - Report dubious
- **RF** - Falsely reported for Alberta but this error persists in the literature.
- **SYN** - Synonym; element reported as occurring in Alberta, but province does not recognize the taxon.
- **T** - Rank for subspecific taxon (subspecies or variety).
- **U** - Status uncertain often because of low search effort or cryptic nature of the element, possibly in peril, unrankable, more information needed.
- **X** - Believed to be extinct or extirpated, historical records only.
- **Z** - Ranking not applicable (e.g. migrants only).
- **_?** - Rank questionable
- **?** - Not yet ranked in Alberta or rank tentatively assigned.

Soils of Wagner Natural Area

Soils of Wagner Natural Area					
Moderately Well Drained Soils					
Soil Unit	Landscape Model	Parent Material	Dominant (>70%) or Co-dominant (30-60%) Soils	Significant (<15%) Soils	Soil Polygon Numbers
BRK1	U11	Glaciofluvial	Dark Gray Luvisols		36
CVL1	U11	Glaciofluvial	Dark Gray Luvisols (CVL)	Dark Gray Luvisols (BRK)	40
CVL2	U11	Glaciofluvial	carbonated Gleyed Dark Gray Luvisols	carbonated peaty Orthic Humic Gleysols	16, 25, 46
CVL3	U11	Glaciofluvial	Calcareous Dark Gray Chernozems		44
Poorly and Very Poorly Drained Soils					
GSP1	O1	Fen peat	carbonated Terric Mesisols		12, 14, 23, 43
GSP2	SC11	Fen peat	carbonated Terric Mesisols		24
GSP3	O1	Fen peat	carbonated Terric Mesisols and carbonated Terric Humisols	carbonated Typic Mesisols	4, 22
GSP4	O1	Fen peat	carbonated Terric Mesic Humisols	carbonated Typic Mesisols, carbonated Fibric Mesisols and carbonated Humic Mesisols	31, 35
GSP5	O1	Fen peat	carbonated Terric Humisols	carbonated Typic Mesisols	13, 38
GSP6	O1	Fen peat	carbonated Terric Humic Mesisols	carbonated Typic Mesisols	37
GSP7	O1	Fen peat	Typic Humisols	Typic Mesisols	1, 45
GSP8	O1	Forest peat	carbonated Typic Mesisols	Limnic Mesisols and carbonated Mesic Humisols	15, 39
RVN1	L1	Glaciolacustrine	carbonated peaty Orthic Humic Gleysols	carbonated Terric Mesisols	26, 27
	IU1				9
WNR1	O1	Marl	carbonated Rego Gleysols	Water	3, 5, 8, 11, 18, 20, 28, 33
WNR2	O1	Marl	carbonated Rego Gleysols	carbonated Terric Mesisols	6, 7
Standing Water					
ZWA1	W3	Water	Standing water		2, 10, 17, 19, 21, 29, 30, 32, 34
ZWA2	W3	Water	Standing water	carbonated Terric Mesisols	42

Map Features

- Soils Polygon Line
- Study Area Boundary
- Wagner Natural Area Boundary
- Alberta Township System Section Lines
- Alberta Township System Quarter Section Lines
- Highway
- 39 Polygon Number
- 72 Reconnaissance Sample Site
- 9 Detailed Sample Site

0 100 200 300 400 500
Meters

Map scale: 1:5,000

N

GEOWEST ENVIRONMENTAL CONSULTANTS LTD.
and
SOIL-INFO LTD.

Plot Date: March 9, 2000

Vegetation Communities of Wagner Natural Area

Vegetation Community Types/Subtypes and Miscellaneous Cover Types within Wagner Natural Area

Map Unit	Description	Successional Status	Moisture Regime	Nutrient Regime	Soil Unit
	Alaska Birch - Balsam Poplar Community Subtypes				
BP1	Bw-Pb/dewberry/sedge	Mature seral	subhygric	permesotrophic-mesotrophic	RVN1: GSP3
BP2	Bw-Pb/bunchberry	Mature seral	subhygric-hygric	permesotrophic	WNR2
	Fen Community Subtypes				
FE1	bulrush-sedge/moss fen	Mature edaphic climax	subhydric-hydric	eutrophic	WNR1
FE2	dwarf birch/sedge/moss fen	Mature edaphic climax	subhydric-hydric	eutrophic-permesotrophic	WNR1
FE3	Lt-Sb/dwarf birch-willow/sedge/moss fen	Mature edaphic climax	hygric-hydric	permesotrophic-eutrophic	WNR1: GSP4
	Balsam Poplar - Aspen Community Subtypes				
PA1	Pb-Aw/dewberry	Mature seral	subhygric-mesic	mesotrophic-permesotrophic	CVL2: GSP1: GSP2: GSP3: GSP5
PA2	Pb-Aw/willow/bluejoint	Young seral	subhygric-hygric	permesotrophic	GSP1: GSP5
PA3	Pb-Aw/bluejoint-sedge	Mature seral	subhygric-subhydric	permesotrophic	GSP6
PA4	Pb-Aw/dogwood	Mature seral	subhygric-hygric	permesotrophic-mesotrophic	GSP1: GSP4: GSP8
	Black Spruce - Tamarack Community Subtypes				
SL1	Sb-Lt/Labrador tea/feather moss	Mature edaphic climax	hygric-subhydric	permesotrophic	GSP7: GSP3: GSP4: WNR1: WNR2
SL2	Sb-Lt/Labrador tea/feather moss-peat moss	Mature edaphic climax	hygric	permesotrophic	GSP4
	White Spruce - Balsam Poplar Community Subtypes				
SP1	Sw-Pb/dewberry	Mature seral	subhygric	permesotrophic	RVN1: GSP3: WNR2: GSP2: GSP4
SP2	Sw-Pb/willow-dogwood	Mature seral	hygric-subhydric	permesotrophic	GSP4: GSP3
SP3	Sw-Pb/bunchberry/horsetail	Mature seral	hygric	permesotrophic	RVN1
SP4	Sw-Pb/clover	Young seral	subhygric	permesotrophic	RVN1
SP5	Sw-Pb/moss	Mature seral	subhygric	permesotrophic	RVN1
	White Spruce - Black Spruce Community Subtypes				
SS1	Sw-Sb/dewberry/sedge/feather moss	Mature edaphic climax	subhygric-hygric	permesotrophic	GSP3: GSP4: WNR2: CVL2: RVN1
SS2	Sw-Sb/horsetail	Mature edaphic climax	hygric-subhydric	mesotrophic-permesotrophic	GSP3
	White Spruce Community Type				
SW	Sw/bunchberry/feather moss	Mature edaphic climax (Young edaphic climax)	mesic-subhygric	mesotrophic-permesotrophic	WNR2: CVL2: GSP3: GSP1
	Willow Community Type				
WS	willow/sedge-bluejoint	Young seral	hydric-hygric	permesotrophic	GSP8
	Miscellaneous Cover Types				
AF	Abandoned field	Old field	subxeric-submesic	mesotrophic-permesotrophic	BRK1
BE	Beaver pond and associated flooding area	Pioneer seral	-	-	GSP1: ZWA2
CL	Clearing	Pioneer seral	-	-	GSP7: GSP1: WNR1: WNR2
HF	Hay field	Cultivated pasture	submesic-mesic	mesotrophic	CVL1: CVL2: CVL3
MP	Marl pond	Non vegetated	-	-	ZWA1

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- Highway
- 39 Polygon Number
- 72 Reconnaissance Sample Site
- 9 Detailed Sample Site
- SP1 Map Unit / Community subtype / Community type

N

Meters 0 100 200 300 400 500

Map scale: 1:5,000

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