Terrestrial Rare Vascular Plant Field Data Collection Protocol for the Lower Athabasca Region

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ALBERTA BIODIVERSITY MONITORING INSTITUTE

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1. OVERVIEW OF DATA COLLECTION

Data Collected in Rare Vascular Plant Protocol

The EMCLA terrestrial rare vascular plant protocol is designed to be implemented by a field crew of two. Both crew members must have a strong background in identifying vascular plants.

Types of data collected:
General Habitat
- Physical characteristics (latitude, longitude, elevation, soils, ecosite)
- Photographs of the site
- Dominant canopy tree species
- Area and type of natural and human created disturbance

Vascular Plant Species List
Detailed Observations of Rare Vascular Plant Species
Soil pH measurements

Quality Control and Accounting for Observer Bias

All field staff receive classroom and field based training prior to beginning data collection. This training covers the protocol and prepares staff for the variety of habitats and field conditions they may encounter.

Data is collected using tablet computers. Tablets have drop-down menus for most fields, with a complete list of all possible options that can be entered. This insures that non-permissible codes (ex: plant codes that do not exist) are not recorded.
Data are later transferred to an electronic database and verified for accuracy and completeness.

Plant Specimen Processing

Plant specimens or specimen photographs collected during field sampling are transported from the field to the lab for processing and storage. Plant specimens that were not identified in the field will be pressed and sent to an expert for identification. Rare vascular plant identifications made by the field crew will be confirmed by experts. Specimens will be housed at the Royal Alberta Museum herbarium in Edmonton.

Protocol Objectives

This sampling protocol was designed to:

1. Collect new observations of rare vascular plants that will help refine rare plant habitat models
2. Pilot test a new rare plant monitoring protocol that complements existing Alberta Biodiversity Monitoring Institute protocols (ABMI 2008 & 2010) and incorporates Alberta Native Plant Council Guidelines (ANPC 2000 & 2012) for rare vascular plant surveys

Information Dissemination

All data collected by the EMCLA are stored and managed on the EMCLA website (http://www.emcla.ca). Data are uploaded to the web-site within 12 months of being collected. To facilitate use of the data, it can be downloaded freely by everyone. As data summaries and analyses are completed, these are also posted on the website.

2. SITE SELECTION AND ESTABLISHMENT

Choosing Sites and Target Species

Sample sites will be located in either a terrestrial upland or fen environment. Nine habitat types will be targeted: fen-graminoid-poor, fen-graminoid-rich, fen-shrub-poor, fen-shrub-rich, fen-tree-poor, fen-tree-rich, upland-conifer, upland deciduous and upland pine. No sample site will be located in open water ecosystems such as marshes or lakes. Sites will be selected using model based predicted locations of target species, assessments of disturbance and accessibility, and expert advice regarding landscape features and habitats within the study region with high probability of rare plant occurrence. A list of targeted rare species is provided (Appendix 1). The target list was compiled from the EMCLA rare plant database which consists of observations from Alberta Conservation Information Management System (ACIMS), ABMI and additional industry data (Bayne 2011). Phenological information was analysed to coincide sample times with times of highest detectability for rare species that are problematic to identify.

Each sample site will yield two plots (A and B) clustered together within a distance of 200 m to reduce travel time to sites and allow two observers to work in relatively close proximity while simultaneously sampling different plots. Plot A will be selected to be typical of the targeted habitat type, or as close to the targeted habitat type as possible. If the site was selected to target an area of disturbance then plot A will be placed so as to include as much of the disturbed area as possible. Plot B will be selected to maximize the occurrence of rare species. The clustered plots will ideally be located in different habitat types to minimize resampling of the same habitat type (i.e. issues of autocorrelation/pseudo-replication).

Additionally a meandering survey targeting distinct landscape or habitat features in the area surrounding the plots will be conducted at some sites. This survey will be completed by a technician with the experience and expertise to identify most species encountered and distinguish significant rare species.

Approximately 100-150 sites will be sampled from June-August, 2014. Relevant permission to sample sites will be obtained prior to beginning sampling (e.g. sites close to oil sands developments, or located in parks or protected areas).

Site Access and Establishment

GPS navigation should be used to locate the sample site (e.g. site 48). Each site will target either a terrestrial upland or a fen habitat. Details of access to the site (e.g. driving and ATV directions) will be recorded on the access datasheet. Pertinent access information (waypoint locations, route, access hazards) should be recorded on the supplied maps. Information that will assist the field crews in reaching the site (mode of travel, closest road location, direction and distance of travel, obstacles, etc.) and the amount of time the crew will require to travel from camp to the site should be recorded on the access datasheet. On arrival at the site, a meander search of the area should be conducted for a maximum of 15 minutes to locate an area that covers the targeted habitat type and has the highest potential for rare plants (variety of microsites, unusual habitat features). Upon finding an area typical of the assigned habitat type, a 50 x 50 m plot should be laid out (e.g. plot number 48A) (Figure 1). Note the GPS location of the plot centre. While one member of the field crew works in the plot, a second plot should be established by another member of the field crew in a different habitat type (e.g. plot number 48B) and in an area of high potential for rare plants (e.g. open sand, rock faces, unusual landscape features, ephemeral habitats, transition zones between habitats, old growth forest, Jack pine stands), at a maximum distance of 200 m from the first plot. If a meandering survey is to be completed at the site a third technician begins their search from plot A. The plots should not be located on roads that have an improved road surface. A foot long rebar pin is placed at the SW corner of each 0.25 ha plot to allow for future resurveying. A “witness tree” is also located and tagged (if possible) to aid in future location of the pin. The bearing and distance from tree to pin as well as the tree species is recorded on the access sheet.

3. FIELD SURVEYS

Ecological Site Type

- Ecological (ecosite) site types identify the dominant vegetative community present, or that would have been present pre-disturbance (Table 1).
- Ecosite classifications are based on soil characteristics, soil nutrients, moisture status, vegetation community and structural stage.

- The primary and secondary historical/natural ecosite classifications are determined for each plot:
    - For each plot, the historical/natural primary ecosite type is determined, and the % (in 10% increments) occupied by this ecosite type is recorded.
    - First determine whether the area is upland or lowland.
    - Then determine the moisture/nutrient category based on the understory vegetative community that is present.
    - After a moisture/nutrient category is assigned, determine the corresponding tree species modifier and structural stage.
    - The tree species modifiers listed in the table are the most common scenarios, and may not perfectly fit each scenario found in the field.
    - If the area being described has been altered by some type of human disturbance (e.g., agriculture, well pad, road, cutline, etc.) it is important to determine ecosite type based on pre-disturbance conditions. This may require looking at vegetation in adjacent areas to determine what was present originally.
    - If there is more than one ecosite type present, then determine the secondary ecosite site type and the proportion of the plot occupied by this type.
    - Secondary ecosite types must make up at least 10% of the plot (0.025 ha) otherwise they are considered part of the primary ecosite.
    - The sum of the primary and secondary ecosite types may be less than 100% if more than two ecosite types are present.
- The current ecosite type for each plot is also determined. If the site is undisturbed, this will be the same as the historical conditions (“SameHist”). If the site is disturbed, record the current ecosite type of the largest polygon within the site.

Table 1. Ecosite categories based on a simplified forest classification

Dominant Shrub/Herb/Ground Cover	Nutr./ Moist. Code [1]	Tree Species Modifier	Tree Species Composition [2] (In an area without human disturbance)	Structural Stage [3]
Upland Vegetation Communities				
Bearberry/Lichen Bog Cranberry common at some sites	1 - **PX**	1a **Pine**	Pj + Fd > 80%	**A. Tree Dominated Ecosites** *(Trees ≥10% cover)* – Add 4-letter code combining tree height, density, and arrangement. Tree Height **(TS) Short** – ≥50% of canopy cover <10 m tall. **(TT) Tall** – >50% of canopy cover ≥10 m tall. Tree Density **(D) Dense** – Trees ≥1.3 m tall are ≤2 m apart. **(S) Sparse** – Trees ≥1.3 m tall are >2 m apart. Tree Arrangement **(C) Complex (Spatially)** – Tallest trees ≥10 m apart, with smaller trees (~ ½ height) between that receive direct sunlight from above. **(N) Non-complex (Spatially)** – Tallest trees <10 m apart, with few or no smaller trees (~ ½ height) between, that receive direct light from above. **B. Non-Tree Dominated Ecosites** *(Trees <10% cover)* **Non-Vegetated** *(<10% Vegetation Cover)* – Add 2-letter code describing dominant substrate type. **(NR) –** Bedrock, cliff, talus, bolder **(NS) –** Sand bar in river/stream (cobble, gravel, sand) **(NB)** – Beach at edge of a lake or wetland **(NM) –** Mineral soil any other reason **(NO) –** Organic soil any other reason **Note:** If standing water is present, refer to Open Water Communities **Only Ground Vegetation Present** *(Shrubs <10%; Trees <10%; Other Vasc. >10%)* – Add 3-letter code combining dominant vegetation type and density Vegetation Type **(GB) Bryoid/Lichen** – Bryophyte and lichen **(GF) Forb** – Non-graminoid herbs and ferns **(GG) Graminoid** – grasses, sedges **(GR) Marsh** – reeds, and rushes Vegetation Density **(D) Dense** – Cover >75% **(M) Moderate** – Cover 25-75% **(S) Sparse** – Cover <25% **Shrubs Present** *(Shrubs >10%; Trees <10%)* – Add 3 letter code combining shrub height and density. Shrub Height **(SL) Low** – Shrubby vegetation <2 m tall **(ST) Tall** – Shrubby vegetation >2 m tall Shrub Density **(D) Dense** – Shrubs cover >75% **(M) Moderate** – Shrubs cover 25-75% **(S) Sparse** – Shrubs cover <25%
Labrador Tea / Feather Moss Bog Cranberry, Bilberry, Grouse-berry common at some sites	2 - **PM**	2a **Pine**	Pj + Pl > 50%	
		2b **Other**	Aw + Sw + Se +Fa +Pw > 50%	
		2c **Sb**	Sb > 50%	
Hairy Wild Rye Bearberry, Canada Buffalo-berry, Feather Moss common at some sites	3 - **MX**	3a **None**	No Trees	
		3b **Pine**	Pj + Pl > 50%	
		3c **AwMix**	Aw > 20%	
		3d **Spruce**	Sw + Se + La >50%	
Low-bush Cranberry / Canada Buffalo-berry Blueberry, Rose, Alder, Labrador Tea, Bearberry, Thimbleberry, Bog Cranberry, Feather Moss common at some sites	4 -**MM**	4a **Pine**	Pj + Pl + Fa >50%	
		4b **PjMix**	Aw + Bp + Sw >20%, AND Pj >20%	
		4c **Aw**	Aw > 50%	
		4d **AwMix**	Aw >20% AND Sw + Sb + Pl > 20%	
		4e **Spruce**	Sw > 50%	
Horsetail Dogwood, Rose, Willow, Feather Moss common at some sites	5 - **MG**	5a **Poplar**	Pb + Aw > 50%	
		5b **Spruce**	Sw + Se > 50%	
		5c **Sb**	Sb > 50%	
Dogwood / Fern / Feather Moss Rose, Alder, Bracted Honeysuckle, Devil‟s Club Fir common at some sites	6 - **RG**	6a **Pine**	Pl > 50%	
		6b **Poplar**	Pb + Aw > 50%	
		6c **Spruce**	Sw + Se + Fa > 50%	
Not Treed	7 - **NT**	7a **Alpine**	Elevation above tree line	
		7b **Flood**	Site disturbed frequently by Flooding	
		7c **Ice**	Site disturbed frequently by ice or snow	
		7d Dry	Site in prairies/parkland and receives little precipitation	
		7e **Geo**	Geological features not suitable for tree growth	
		7f **Human**[4]	Site disturbed recently by Humans	
Aw - trembling aspen, Pb - balsam poplar, Bp - paper birch, Pl - lodgepole pine, Pj - jack pine, Pw – white pine, Lt – larch		Sw - white spruce, Sb - black spruce, Se - Engelmann spruce, Fa - subalpine fir, Fd - Douglas fir, Fb - balsam fir, and		

Dominant Shrub/Herb/Ground Cover	Nutr./ Moist. Code [1]	Tree Species Modifier	Tree Species Composition [2] (In an area without human disturbance)	Structural Stage [3]
Lowland/Wetland Vegetation Communities				
Bog - Labrador Tea / Peat Moss / Lichen Bog cranberry and cloudberry may also be present (Soil saturated for part or all the year)	**8 - PD**	**8a SbLt**	≥10% tree cover (may only be in shrub/ground strata) Sb + Lt > 50%	**C. Open Water Dominated Communities** *(Emergent Vegetation <10%)* – Add 4-letter code combining dominant vegetation type, height and density Vegetation Type **(OV) Vegetated** – Floating or submerged plants ≥ 10% cover **(ON) Non-Vegetated** – Floating or submerged plants < 10% cover (note that only a 2-letter code is used for this category → vegetation height and density are not added to the code) Vegetation Height **(S) Short Submerged** – ≥50% of vegetation extending 0.0 – <0.3 m above the substrate **(M) Medium Submerged** – ≥50% of vegetation extending 0.3 – 1.3 m above the substrate **(T) Tall Submerged** – ≥50% of vegetation extending >1.3 m above the substrate **(F) Floating** – ≥50% of vegetation with floating leaves on the water surface. Vegetation Density **(D) Dense** – Aquatic vegetation covering >75% of the substrate. **(M) Moderate** – Aquatic vegetation covering 25-75% of the substrate. **(S) Sparse** – Aquatic vegetation covering <25% of the substrate.
		8b Shrub	<10% tree cover	
Poor Fen - Labrador Tea / Peat Moss / Sedge Bog cranberry, dwarf birch and river alder may also be present (Soil saturated for part or all the year)	**9 - MD**	**9a SbLt**	≥10% tree cover (may only be in shrub/ground strata) Sb + Lt > 50%	
		9b Shrub	<10% tree cover	
Rich Fen - Dwarf Birch / Willow / Sedge / Grass / Moss (Soil saturated for part or all the year; includes floating mats of vegetation)	**10-RD**	**10a SbLt**	≥10% tree cover (may only be in shrub/ground strata) Sb + Lt ≥ 50%	
		10b Shrub	<10% tree cover AND ≥10% shrub cover	
		10c None	<10% tree cover AND <10% shrub cover	
Swamp Conductivity <15 mS/cm, trees and shrubs present, (Water is above the rooting zone for some of the year)	**11-SD**	**11a Tree**	>10% tree cover	
		11b Shrub	<10% tree cover	
Marsh – Cattail / Rush /Reed Conductivity <15 mS/cm, sedge and grass may also be present (Water is above the rooting zone for most or all of the year)	**12-VD**	**12a None**	usually along a water body edge ≥10% emergent vegetation cover <10% tree cover	
Alkali Conductivity >15 mS/cm, white salt flats at water"s edge, saltwater widgeon grass dominates (Water is above the rooting zone for most or all of the year)	**13-AD**	**13a None**	<10% shrub/tree cover	
Open Water	**14-OW**	**14a Lake**	In standing water <10% emergent vegetation cover	
		14b River	In flowing water <10% emergent vegetation cover	

Physical Characteristics

- Slope (in degrees) is determined using a compass from the centre of each plot and at each rare vascular plant location. A description of the slope is also recorded:
    - C = Crest – situated in a relatively level area on the top of a hill
    - S = Slope – situated on the side of a hill
    - T = Toe – situated at the bottom of a hill where the ground surface transitions from a slope to level
    - L = Level – situated on an area with <2° slope
    - D = Depression – situated in an area that accumulates water after rains
- Aspect (direction in degrees when looking down-hill) is determined using a compass from the centre of each plot.
- Identify the dominant canopy tree species. Canopy trees have well developed crowns extending to the general level of surrounding trees.
- Record the percentage of the plot that is covered by bare ground and water. Bare ground is any substrate which cannot support **or** does not presently have vegetation. Record both bare ground and water % area as 0%, <1%, or 5% increments (e.g., 5, 10, 15, etc.).

Human Disturbance

- Human disturbance is recorded in each plot and at each rare plant location. The type and % (as 0, <1% or in 5% increments) of the area affected by human caused disturbances is recorded.
- Multiple disturbance types, if present, are recorded in order of decreasing % cover.
- Categories of human disturbance include:

    NONE – No human caused disturbance present
    HARV – Any type of forest harvesting (i.e., clear-cut, partial-cut, understory retention, etc.) <30 years old) PIPE – Pipeline
    POWER – Power line
    SEIS – Any type of cutline or seismic line
    RAIL – Railway
    WELL – Any type of area cleared for oil/gas/coal-bed-methane including pump jacks or well heads
    ROADP – Any type of road with paved surface
    ROADG – Any type of road with gravel surface
    TRAIL – Any type of truck or ATV trail with an unimproved surface
    CULT – Any type of cultivated field that is used to grow agriculture crops including forage
    PAST – Any type of uncultivated pasture (tame or native) with grazing
    RES – Any type of residential dwelling, farm building, or farm yard in a rural or acreage setting
    URB – Any type of human dwelling, associated building, or yard/driveway/road in an

urban setting
IND – Any type of building, roadway, yard, etc. associated with industrial development
BARE – Human caused bare ground for which the cause cannot be determined
OTHER – Please specify

Natural Disturbance

- Record the type and % (0%, <1% or in 5% increments) of the area affected by natural disturbances in each plot and at each rare plant location.
- Multiple disturbance types, if present, are recorded in order of % cover.
- Categories of natural disturbance include:

None – No natural disturbance present

Fire – Any evidence of scarring or burning (may be human caused); may coincide with salvage-harvesting

Wind – Evidence of wind throw (i.e., many trees up-rooted and laying on the ground and/or snapped along the bole); often occurring along canopy openings, cutblocks, roads; potentially human induced

Erosion – Evidence of soil removal by precipitation or wind; potentially human induced; examples include:
side of a hill has eroded from rain (natural), culvert under logging haul road is plugged causing run-off through low lying areas undercutting trees

Flooding – Evidence of high water mark, dead trees, etc.; potentially human induced; examples include:
stream overflows its banks in spring and fills in forest depressions and/or "historic" flood plain (natural) evident by standing dead trees, grass and debris build up; road is built through spruce bog not allowing proper water transfer (human) evident by standing water and large stands of dead trees

Snow/Ice – Evidence of vegetation breakage caused by snow or ice

Insect – Any evidence of vegetation experiencing insect; it can take several years of defoliation to do permanent damage to the vegetation; identifying „notable" insect damage is difficult to the untrained eye

<u>Conifer Stand</u>: budworms, moths, sawflies, needleminers, spider mites,bark/boring beetles, etc.

Symptoms – tree die off, brown/dead terminal ends and branches; frass at base of trees, larvae galleries on trunk and branches, evidence of woodpecker flaking

Confirmation – larvae and/or adults on needles, branches, or bark depending on life cycle, evidence of silken webbing or cocoons

<u>Deciduous Stand</u>: tent caterpillars, moths, leafminers, mites, aphids, etc; significant damage to deciduous trees may not be noticeable at all times

of the year

Symptoms – complete defoliation, brown or yellow/dying leaves and trees, tree dye-off

Confirmation – larvae and/or adults on leaves and branches, silken webbing, cocoons, leaf deformity and/or galls

Disease – Any evidence of vegetation experiencing disease outbreak; it may sometimes be difficult to distinguish between disease and insect damage, especially depending on time of year

Conifer Stand: mistletoe, witches-broom, burls, blister rust, root rot, etc.

Symptoms – erratic growth forms (bushy growth) on branches and/or stem (mistletoe/witches broom), trunk deformities (burls), white/yellow/orange fungus growing on trunk/branches, brown needles and/or tree dye-off (especially young trees; root rot)

Confirmation – check for absence of insect damage and describe scenario in comments; tree dye off could be naturally caused by winter-kill and/or drought (especially in young trees)

Deciduous Stand: leaf spot, leaf and twig blight, leaf rust, etc.

Symptoms – colored leaves; round or angular brown spots on leaves (leaf spot), blackening and wilting of young shoots; tips bending back (blight), powdery golden-yellow pustules on leaves; yellow spots (rust)

Confirmation – check for absence of insect damage and describe scenario in comments; can be difficult to assess according to season

Beaver – any evidence of beaver activity altering landscape or vegetation

Other – please describe any other type of disturbance

Unknown – If a crew member cannot decipher what type of disturbance has taken place and it is evident that something has changed the plot area in some way, describe what is observed.

Soil pH

A portable Hellige-Truog pH kit will be used determine soil pH at site centre.

- pH will only be measured in mineral soil. At sites where no mineral soil is present, a pH measurement is not taken.
- pH measurements will be taken in the field.
- To collect soil for pH measurements, dig past the layer of organic soil using a trowel until mineral soil is reached.
- Determining the organic/mineral horizon is usually straight forward based on the color and texture of the soil and resistance of the soil corer to penetrate far into the mineral layer. The organic layer is typically dark in color, coarse and fibrous (containing rooting systems)

whereas the mineral soil is typically lighter in color, finely particulate, and lacking most roots.
- Take 5cm core of mineral soil using the trowel and conduct a pH test at 3 spots along the length of this core.

Site Photographs

- Six photographs are taken using a digital camera with a 35 mm focal length and a quality setting of approximately 3 Mega-pixels.
    - Subordinal Photos – From site centre, landscape photographs are taken at eye level in each of the four sub-ordinal directions.
    - Representative Site Photo – From anywhere within the 0.25 ha plot; a single photograph is taken that best represents the physical and vegetation characteristics of the site.
    - Canopy Photo – Standing at site centre, a photograph of the canopy is taken while looking directly overhead.
- Except for the canopy photo, a back pack is included approximately 5 m from the camera for scale.
- Check the quality of the photos and re-take if they are blurry.

Vascular Plant Surveys

<u>Plot Survey</u>

Both plots (A and B plots at each site) at all sites will be surveyed by at least one observer using a time-unlimited survey method:

- Each observer will conduct a vascular plant survey in a 0.25 ha (50m x 50m) plot.
- The SW corner of each plot will be marked with a permanent marker (i.e. rebar and associated witness tree) for the purposes of revisiting
- Technicians begin their time-unlimited survey at a corner of the plot. The tablet stopwatch is engaged and the technician begins walking in a pattern that mimics following parallel 50 m transects, scanning a width of about 1-2 m on each side of the transect (Figure 1).
- Each new species encountered is recorded in the tablet. A detection time is automatically recorded. Species are arranged alphabetically in the tablet by plant code. Species can be searched by common name, scientific name, or code. Note that a separate index is available for searching species synonyms.
- Excessive time should not be spent identifying unknown species while the stop watch is running. Unknowns can be flagged and revisited later or quickly collected. The stopwatch should be stopped during any significant break from surveying.

- Detailed rare plant observation data should be collected outside of this search time. Note down rare plant occurrences and time the species was first found, then quickly flag the rare plant and return to it later. Remove all flagging material from the site before leaving.
- Observers should take as much time as they require ensuring a thorough search of the plot for rare species.
- Place "unknown" specimens in a plant press and take them to camp for identification during the evening or by experts. Specimens should be given a unique identification label following the format: UIS-plot number-sample number (e.g. UIS-10A-4). If an unknown specimen is suspected to be a rare species (S1, S2, S3), it should be treated as a rare species (collect a sample and fill out a detailed rare species sheet).
- Ensure that identification numbers for unknown specimens are not repeated for the site.
- To account for observer biases in detectability, technicians will switch and survey both plots whenever time allows.

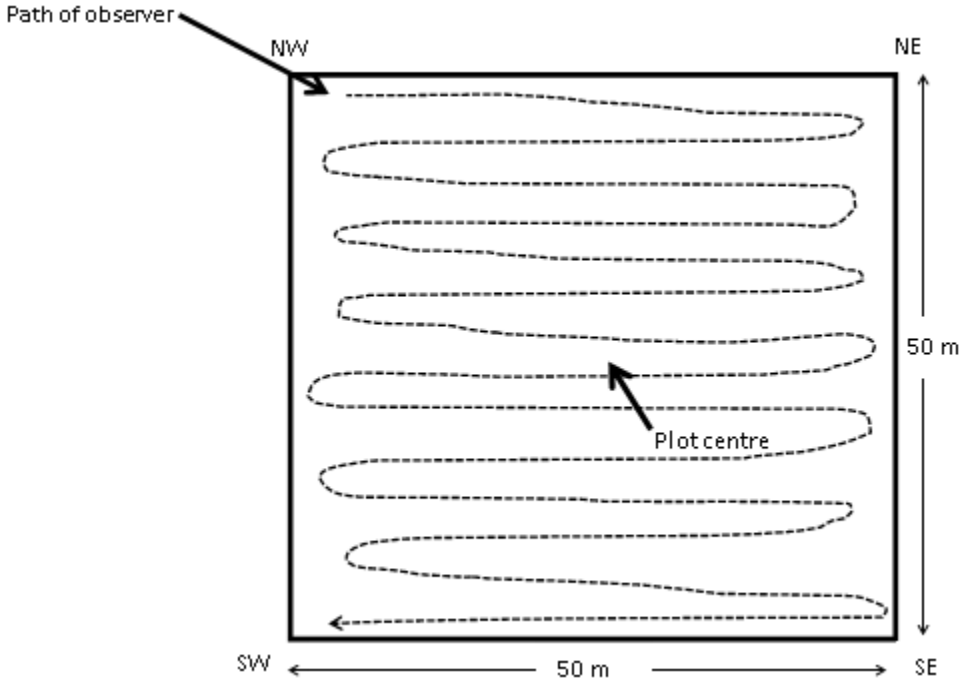

Figure 1. Path of quasi-parallel belt transect survey to be conducted by the observer after the first 20 minutes of the survey (EMCLA portion).

<u>Meandering Survey</u>

- In addition to establishing and surveying 50 x 50 m plots a third meandering survey will be completed at some sites. This survey will be completed by a third technician with the

experience and expertise to identify nearly all species encountered. The goal of the meandering survey is to maximize collection of new rare species records. Non-rare species records are not collected in this survey.

- Interesting landscape features will be identified using satellite imagery and first-hand observation during site access. Most survey effort will be concentrated in these areas.
- The technician must remain within 500 m of the plots and their coworkers (for safety reasons) but is free to search anywhere within this area. Attention will be paid to not covering the same ground multiple times.
- Search time is dependent on the time it takes for the technicians surveying plots to complete their work.

Detailed Observations of Rare Vascular Plants

- When a rare species is found (rare species are those on the target species list [Appendix 1] or other vascular S1, S2 and S3 species not on the target list), an ACIMS Rare Plant Field Data Sheet should be completed including the survey details, documentation taken, location and population information and site/habitat description. An estimate of the population size should be made (0-10, 11-100, 101-1000, 1001-5000, >5001 individuals [ramets/genets]) and the extent of population should be estimated in m^2. For species that grow in clumps, count each clump as an individual (ANPC 2006).
- Population size is also estimated or measured within the plot.. Using a grid of 25 10x10m squares which cover the extent of the 50x50m plot, technicians will indicate squares in which a rare species is present by crossing off occupied squares. Note this is done on a species by species basis on the backside of the ACIMS datasheet
- For vascular plants on the target species list or any vascular plant categorized as S1, S2 or S3 by ACIMS, collect a specimen if species is common enough (see below) so its identity can be confirmed by experts.
- Specimens will be deposited at a herbarium. Where specimens are not collected, photographs of the plant including its distinguishing features should be taken for confirmation by experts.
- Specimens should be given a unique identification label following the format: RPV-10A-sample number (e.g. RPV-10A-4). Sample numbers must not be repeated for unknown specimens or rare plant specimens.
- Specimens of rare plants should be collected using the following guidelines:
    - If a population of rare plants consists of ≥ 20 individuals and the population appears healthy with sufficient flowering and/or fruiting individuals, a voucher specimen should be collected (Plant Conservation Roundtable 1986). Collect the entire plant including as much root material as possible.

    - For < 20 individuals, a voucher specimen of only the diagnostic features of the plant, and photographs depicting a close-up of the diagnostic features and entire plant should be taken. Photographs should show the plant along with its label and include ruler for scale. Photos should be checked to ensure the plant is clearly visible and the label is clearly legible.
    - If only one or close to one individual exists, only photographs should be taken. Never collect the only plant in an area.
- At the end of the field shift, take the plant press with unknown plants and rare species vouchers to the laboratory, accompanied by a list of the plant press contents. These unknown specimens will be identified by an expert.

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Appendix 1. Naming conventions

Site and plot names

Site 1
Plot 1A (representative plot)
Plot 1B (plot placed in a different habitat from plot A)
Plot 1A - 1 (first survey of the representative plot)
Plot 1B - 1 (first survey of the plot placed in a different habitat from plot A)

Vouchers

Components of the voucher name:
-UIS (stands for unidentified species) or RPV (stands for rare plant voucher)
-Plot number (ex: 1A)
-Whether this was the first or second (repeat) survey of this plot (1 or 2)
-The voucher number from that site

Examples:
UIS - 1A - 2 - 5 (fifth indentified species from the second survey of plot 1A)
RPV - 1B - 1 - 2 (second rare plant species collected from the first survey of plot 1B)

Access

First truck point for site 455: 455-T1
First quad point for site 455: 455-Q1
First walk point for site 455: 455-W1

Appendix 2. Target species list

Vascular species	S rank	Flowering time	Highest Detectability	Pervious collections by month (%)		Identified vegetatively	Habitat	Comments
				July	Aug.			
Carex houghtoniana	S3S4	June-July	June-July	17	42	No	dry	Fire beneficial; dry acidic sandy soils; often with pine
Carex supina			July	100		No	dry	Dry sandy gravelly habitats, eroding slopes
Carex umbellata	S2	April-July	July	89	0	No	Dry-mesic	sandy habitats in the boreal, especially disturbed areas, open woods particularly pine.
Potentilla multifida	S1	July	July	73	9	Yes	dry	sandy areas, often in slightly disturbed areas
Spiranthes lacera	S1	mid-July to August	mid-July to August	43	57	No	dry	dry woodlands and grasslands; often with *Vaccinium myrtilloides*
Stellaria arenicola	S1	July to August	Summer	0	22	No	dry	sandy areas only
Tanacetum bipinnatum huronense	S2	May-July	Summer			Yes	dry	gravely or sandy areas
Carex backii	S3	May-July	Early Summer	38	25	No	both	dry (to moist) shady woods. Elsewhere in riparian woodland. Assoc. with disturbance-fire
Chrysosplenium tetrandrum	S3S4	May-July	May-July			Yes	both	rock crevices, wet conifer forests
Artemisia tilesii spp. elatior	S3	July-Sept; fruits late summer and fall	Summer	17	50	Probably	both	woodlands, river flats and alpine slopes
Cypripedium acaule	S3	Late June and July	June-July	23	16	Probably	both	Wetlands, woods, and overgrown sand dunes; deceptive orchid- poor pollination
Malaxis paludosa	S1	June-August		40	60	No	wet	wet bogs, in sphagnum moss
Cardamine pratensis	S3	May-June	Summer	11	0	Probably not (Other similar Cardamine)	wet	along creeks, in swamps; high water table
Carex capitata	S3	June-August	Summer	42	32	No	wet	wet areas, calcareous fens
Carex oligosperma	S3?	Late June and July	Summer	21	56	No	wet	wet meadows and bogs
Carex retrorsa	S3	May-	Late spring to early	45	27	No	wet	swamps and wet meadows

		September	fall					
Chrysosplenium iowense	S3?	May-July	May-July			Yes	wet	shady moist to wet stream banks and marshes in montane areas
Drosera linearis	S3	mid June to early July	Summer			Yes	wet	marl fens, either in shallow water or on soil hummocks
Eupatorium maculatum	S1S2	Late July to early September	Summer			Yes	wet	wet to moist meadows and open woods
Hypericum majus	S2	Late June to September	Summer	75	5	Unsure	wet	wet sites in the boreal forest
Juncus brevicaudatus	S2	July to August (fruits)	Summer	64	7	No	wet	very moist to wet substrate; lake shores and marshes
Sarracenia purpurea	S3	spring flower; pitcher in late spring/summer; fruits summer	Summer			Yes	wet	Bogs, fens, wet meadows
Carex heleonastes	S2	June -August		50	0	No	wet	Wet open calcareous sites on fens and marshes. Also in bogs, muskegs, lake shores, swamps, wet sandy roadsides, seeps
Panicum acuminatum	SU			0	13	Probably	wet	Moist sandy soils at woodland edges, marshy places, around hot springs
Lycopodiella inundata	S2					Yes	wet	Sphagnum bogs; elsewhere on sand shores and in marshes and other wet sites