GUIDELINES FOR NATURAL HERITAGE INVENTORIES IN PARKS AND PROTECTED AREAS

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La Butte Creek in La Butte Creek Wildland Park
Photo by W. Nordstrom (July 2001)

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1. INTRODUCTION

Intent of the Guidelines

There are a wide variety of situations and circumstances that must be considered when conducting natural heritage inventories and it is important that there is sufficient latitude within which those inventories can be conducted and the subsequent results presented. In recognition of this, the guidelines that follow are not necessarily aimed at providing a 'cookbook' of inventory protocols. There are lots of good books, journal articles and other materials on those subjects.

The guidelines in this document are intended to provide a basic framework upon which inventories can be structured, and some of the things that need to be considered when conducting a natural heritage inventory in a provincial park or other type of protected area, either existing or proposed. Further, the guidelines are intended to provide a measure of consistency and standardization when collecting data for and providing data to the Alberta Natural Heritage Information Centre (ANHIC) and to other units or groups that collect and use natural heritage data.

One of the major purposes of a natural heritage inventory is to collect reliable data and information that will aid in the conservation, management and monitoring of lands that have valued biological, physical, historical or palaeontological features. These lands include those that are either within existing protected areas or those that are proposed for addition to the protected areas' system.

The guidelines that are described below have been developed to meet the needs of the Parks and Protected Areas Division. They are not intended to form a complete fit with other inventory protocols such as the comprehensive work of the National Ecological Framework for Canada (Marshall and Schut 1999) and the Ecological Stratification Working Group (1996). Concepts and tools from some of those protocols, however, have been incorporated into these guidelines, including (1) the different scales at which different types of inventories are conducted, and (2) 'ecological land classification' -- the fundamental and recognized basis for delineating and describing ecological units (Marshall and Schut 1999).

Why inventory?

Natural heritage inventories for protected area purposes are conducted for a wide variety of reasons and to meet a variety of needs. The ability to meet those needs is influenced by factors such as available staff and budget, timing of the project, expectations of senior managers, public pressures, etc.

Some of the most evident reasons for conducting natural heritage inventories in protected areas are:

- To collect reliable biological and physical data/information relating to broad geographical regions (e.g., Grassland Natural Region) or to smaller land units (e.g., established protected areas) that will aid in the conservation, management and monitoring of the biological and physical features of those regions or land units.
- To provide reliable biological and physical data that will enhance decision-making related to resource-use and/or land-use questions.
- To collect data that will aid in examining the state or status of an area's biodiversity (e.g., presence, distribution, status and trends of species; what and how much is at risk; impact of human activities).
- To take advantage of other resource inventory projects that are being conducted in an area, perhaps by other agencies or groups, and therefore maximizing opportunities for data gathering.

Data and information provided by natural heritage inventories is used primarily by those responsible for conservation planning initiatives within the province or for management of natural resources within protected areas. Inventory data and information is also used by those involved with documenting and evaluating an area's biodiversity, and includes government staff, external clients and members of the public.

Need for Objectives

When designing a natural heritage inventory, the objectives for that inventory should be clearly determined. If objectives are lacking or if they are unclear, then it is difficult, if not impossible, to determine the type of inventory that is required or the level of detail that is needed. Objectives should drive the inventory, not vice versa. It is important, therefore, that time and effort is allocated to developing meaningful and deliverable objectives for a particular inventory. To be deliverable, objectives must have considered the implications and constraints of budget, time and logistics. This could involve obtaining clarification from supervisors or managers in what they are expecting, particularly if direction is not clear or the situation has changed since an inventory proposal or project was first identified.

Types of inventory

Inventories involve the compilation of existing information as well as the collection of new information. In some cases it is not always necessary to conduct on-site field inventories since it may be sufficient to summarize existing data and information. The type of inventory required for a project will be dependent on the identified objectives and the amount and quality of data already available.

For purposes of these guidelines, two broad levels of inventory are recognized. The first level or **"systems-wide inventory"** is employed for identifying conservation opportunities and issues in a land unit of large areal extent such as a subregion.

The second level or **"site-specific inventory"** is employed for identifying conservation opportunities within and providing management information for existing or proposed protected areas. There are three sub-components within this level of inventory--the **"reconnaissance survey"**, the **"protected areas' ecological land classification"** and the **"single-sector inventory"**.

Using these Guidelines

Once objectives have been determined, the particular type of inventory can be selected that would best meet identified objectives. In most cases, a person would be selecting one, or perhaps a combination, of the types of inventory stated above. Further comments and guidelines for each type of inventory are presented in the pages that follow.

- Details on the **"systems-wide inventory"** are presented in Section 2 below
- Details on the **"reconnaissance survey"** are presented in Section 3.1 below
- Details on the **"protected areas' ecological land classification"** are presented in Section 3.2 below
- Details on the **"single-sector inventory"** are presented in Section 3.3 below

If a single-sector type of inventory is chosen as the one to do, not all sectors listed in Section 3.3 need be done, only those for which data and information is needed. For example, if a bird inventory is needed, it is not necessary to do a soils inventory just because 'soils' is listed as one of the sectors in Section 3.3.

This document also contains five appendices with useful information that can aid in the actual design and preparation of an inventory, and reporting of the results. Those appendices should be consulted and their reference documents, reporting forms, sampling protocols and other information used as required.

- **Appendix 1** contains a reference base for inventory, organized according to the types of inventory mentioned above. The appendix does not list all references since it is intended only to be a reference base. There is a substantial body of literature that exists on the methodology and protocols by which different types of inventory can be conducted as well as the products that result from those inventories. Published literature is invaluable when preparing for and designing an inventory. It is also invaluable for examples of how to present results.

- **Appendix 2** lists some of the nomenclature and taxonomy sources that should be consulted for guidance when naming and describing features. The use of recognized and consistent names for all natural features, be they soil types, landforms, or species' names, facilitates consistent reporting and eliminates confusion among the readers and users of data and information.

- **Appendix 3** presents a generic table of contents for a single-sector inventory report. This table of contents are presented as a guide only; actual situations and circumstances will drive what is finally presented in the report.

- **Appendix 4** discusses things to consider when sampling plant communities of conservation concern. It presents definitions, suggested sampling protocols, minimum information requirements, and how to document collected data.

- **Appendix 5** contains two data reporting forms: (1) the rare native plant form, and (2) the vertebrate and invertebrate report form. These two forms can be used to document occurrences of plant and animal species. If used for an inventory project, these forms (or copies of them) should be submitted to the ANHIC for their use.

2. THE SYSTEMS-WIDE INVENTORY

Conditions for Inventory

- The study area is of large areal extent and /or little data exists whereby conservation opportunities for protected area purposes can be identified (e.g., municipality, county, a subregion such as the Central Parkland Subregion)

Comments

- Systems-wide inventories have been used for:
  - Regional planning and modelling
  - Protected area target planning / recommendations
  - Protected area gap analyses / recommendations
  - Baseline data collection (e.g., Environmentally Significant Areas' studies)
  - Prioritizing areas for further study

- The Natural History Theme (NHT) approach as outlined in the document, "*Natural Regions, Subregions and Natural History Themes of Alberta: A Classification System for Protected Areas Management*" (Alberta Environmental Protection 1994) can form the basis of a systems-wide inventory. This approach is valuable for:
  - determining conservation needs on a provincial or regional basis
  - identifying gaps in the system of protected areas and choosing sites to fill those gaps
  - defining sites that will add to the system on a landscape scale

- If ecological land classification polygons have already been identified for an area from earlier studies and have been digitally mapped, they could be used through GIS analysis to help delineate the boundaries of Level 1 NHTs. A map of Level 1 NHTs could then be generated for that area.

- As a minimum, when preparing for and designing the inventory project, the following things should be considered:
  - the objectives to be met
  - the area to be studied
  - the map scale to use
  - the data and information that currently exists (e.g., literature, digital data, maps, airphotos, ANHIC databases)
  - the need, if any, to conduct a reconnaissance survey of the area (e.g., overflight, rapid field assessment)

Scale

- Since the area to be surveyed / inventoried is generally of large areal extent, the scale of study will usually be 1:100,000 or smaller; corresponding somewhat to the ecosection level of generalization as described in Wiken (1986)

Required Products

- A **final report** (see below) with any supporting **maps**. Depending on the inventory objectives, the report could provide direction relative to:
  - protected area and related conservation needs on a provincial or regional basis
  - current gaps in the provincial/regional protected areas' system
  - potential sites that could fill identified gaps
  - priority sites / areas for further study

- For **examples of report and map content**, refer to the following reports that focus on the Boreal Forest and Grassland Natural Region, as well as the Environmentally Significant Areas (ESA) reports.
  - Alberta Environmental Protection. March 1997. *The Grassland Natural Region of Alberta.* One of a Series of Reports Prepared for the Special Places 2000 Provincial Coordinating Committee. Recreation and Protected Areas Division. 229pp.
  - Alberta Environmental Protection. April 1998. *The Boreal Forest Natural Region of Alberta.* One of a Series of Reports Prepared for the Special Places 2000 Provincial Coordinating Committee. Recreation and Protected Areas Division. 313pp.
  - several of the ESA reports such as: Cottonwood Consultants Ltd. February 1988. *Environmentally Significant Areas in the Oldman River Region, Municipal District of Taber.* Prepared for Alberta Forestry, Lands and Wildlife, and the Oldman River Regional Planning Commission. 35pp.

- Content items for the **final report** (dependent on inventory objectives) could include the following:
  - ⇒ Executive Summary or Abstract
  - ⇒ Introduction
  - ⇒ Methodology
  - ⇒ Land ownership
  - ⇒ Existing land uses
  - ⇒ Threats to the site/area
  - ⇒ Targets for representation (e.g., NHTs)
  - ⇒ Existing gaps in representation (e.g., NHTs)
  - ⇒ Prospects for filling representation gaps
    - Descriptive summary of biological, physical and historical information per prospective site or area (e.g., geology, geomorphology, hydrology, soils, vegetation, fauna, palaeontology, archaeology)
  - ⇒ Recommendations
    - For incorporating the identified prospects into the protected areas' system of the province (e.g., boundary recommendations, new site proposals)
    - For management of sites / areas
    - For further study
  - ⇒ Supporting maps and tables
  - ⇒ Literature cited

3. THE SITE-SPECIFIC INVENTORY

Site-specific inventories include all those inventories / surveys that are done for either existing or proposed protected areas (e.g., provincial parks, wildland parks, ecological reserves, etc.). Boundaries for these protected areas exist, either legally or proposed, and the inventory / survey is usually conducted within those boundaries. The Parks and Protected Area Division maintains a website that should be used as the source for land descriptions and current boundaries of all established protected areas. The website contains a complete listing of all lands currently under the administration of Alberta Community Development — Parks & Protected Areas Division. Land descriptions and maps are provided on this website for every site established by Order-In-Council. (URL: http://www.cd.gov.ab.ca/preserving/parks/lrm/).

Site-specific inventories / surveys will generally fall into one of the following three categories:
(1) a reconnaissance survey,
(2) a protected areas' ecological land classification, or
(3) a single-sector inventory.

A hybrid of the systems-wide and site-specific inventories may be warranted in certain situations if resources are limited and a site-specific inventory cannot be done for the entire area.

There may be some overlap or sequencing between the three categories listed above for a particular project, depending on the needs and objectives of the project. For example, it might be necessary to conduct a reconnaissance survey prior to engaging in a detailed ecological land classification of the site.

3.1 The Reconnaissance Survey

Conditions for Inventory

- The study area is large and/or little data exists upon which to base conservation or management decisions / plans.
- The inventory budget or time frame to do the inventory is limited. In this case, only basic information about the site will be obtained, including such things as: land use issues / commitments, the general state of a site's natural features, and immediate threats to the site's integrity.
- There is no need at present to conduct a detailed single-sector inventory or ecological land classification.

Comments

- Reconnaissance surveys have been used for:
  - compiling existing information about a site or study area (i.e., reports, photos, air photos, maps, etc.). This information is also useful for designing and refining more detailed inventories (e.g., ecological land classifications, single-sector inventories) as well as providing basic information about a site.
  - ground-truthing things that are evident on air photos or documented in existing publications and materials.
  - verifying proposed classifications of vegetation types or interpreted land uses.
  - providing basic familiarity with a study site or area prior to engaging in a more detailed single-sector inventory or ecological land classification.
- Site visits are a valuable component of a reconnaissance survey and can take the form of either an overflight of the area or a rapid field assessment.
- A reconnaissance survey should, in most cases, be the initial stage of an ecological land classification or single-sector inventory since the information gathered would help to refine the protocols for those types of projects.
- Reconnaissance surveys should include visits to local land managers, local people knowledgeable about the area, natural history club members, and others who have some knowledge about the conservation and management issues associated with the site.

Scale

- Usually 1:50,000 or less.

Required Products

- an annotated compilation of existing information about the site, including reports, maps, air photos, local knowledge, etc.
- a description of relevant issues affecting the site, including: land use issues, single-sector issues (e.g., disturbances to bird nesting colonies) and other conservation or management needs.

3.2 Protected Areas' Ecological Land Classification (ELC)

Conditions for Inventory

- Resources and time are available to enable an integrated / holistic and detailed ELC to be conducted in support of various conservation / management initiatives for existing or proposed protected areas.
- Systematic data collection would support ongoing biological or physical resource monitoring or updating activities.

Comments

- A Protected Areas' ELC emphasizes separate vegetation, landform and soils maps that can be combined through application of GIS techniques into a classical ELC. This may be a somewhat different approach than the researcher has used in the past.
- Ecological land classifications have been used for:
  - Multi-purpose landscape stratification (e.g. forming a framework upon which single-sector inventories or long-term monitoring projects can be based--see section 3.3 below).
  - Documenting a site's biodiversity (e.g., representative plant communities, soils, landforms, special features).
  - Collecting baseline data and information of existing and proposed protected areas that is useful for conservation or management of those areas.
- Depending on the conservation or management objectives for a particular protected area, an ELC may be all that is needed to provide the necessary data or information. The ELC would, therefore, function as the 'baseline inventory' for the site.
- Information generated from an ELC could assist in site planning related to facilities, trails and other infrastructure developments.
- A reconnaissance survey could be a part of the ELC and the results used to refine the ELC's protocols.
- Detailed data collection relating to special features (e.g., special plant communities) or some of the sector components (e.g., birds, mammals, palaeontology), as outlined in section 3.3 below, is usually not within the scope of a typical ELC. However, since workers often observe various species, special features or other things during the course of conducting an ELC, it is requested that those observations be recorded and included in the ELC report. These observations might include:
  - incidental observations (e.g., birds, mammals, etc.),
  - any observations on special or significant features,
  - any observations on good representative features (e.g., undisturbed *Carex* wetland, unaltered sand dune system), and/or
  - any observations on suspected features of importance (e.g., sites that seem unusual or diverse and might merit more detailed study to identify "special features" or "tracked elements").
- When preparing a Terms of Reference for conducting an ELC, the template outlined in Marshall (2000) can be used as a guide and modified as necessary to suit a particular site or situation.
- The guidelines outlined in the *Ecological Land Survey Site Description Manual* (Alberta Environmental Protection 1994) should be used as a guide when conducting an ELC for an area.
- When conducting an ELC for existing protected areas, consideration should be given to including more than just the land within the protected area boundaries. This is especially true if the site is small in size or the protected area boundaries are jagged in nature. Information generated for adjacent lands could be valuable when making broader ecosystem-level or landscape-level conservation and management decisions. "Adjacent lands" of interest, their size and why they are of interest, should be clearly specified by the proponent at the outset of a project since that would have an effect on the size of the study area and the resources required to complete the project.

Scale

- Depending on the site, budget and time allotted for the ELC, the scale for the project will vary, ranging between 1:5,000 to 1:100,000; corresponding more or less to the ecosite level of generalization as described in Wiken (1986)

Required Products

- Depending on the objectives of the project, one or more of the following maps will be required:

1. a digitized <u>landform map</u>

- determine the minimum polygon size acceptable for the project.
- digitize on IRS base imagery using UTM 11 or 12 projection, NAD83.
- prepare map in _Arc/Info export format, including associated attribute fields. For examples of attribute fields that could be used, refer to:
    - documents and surficial geology maps prepared by the Alberta Geological Survey and by the Geological Survey of Canada (see section 2.2.4 in Appendix 1). Of particular note in this regard is the map prepared by the Alberta Research Council of the Quaternary Geology of Southern Alberta by Shetsen (1987).
    - The *Classification of Alberta Landforms* report (Alberta Natural Heritage Information Centre (1998).
    - the *Physical Land Classification* reports prepared through the Resource Information Branch of Alberta Forestry, Lands and Wildlife (now the Resource Data Branch of Alberta Sustainable Resource Development). Many of these reports utilized the methodology outlined in Kocaoglu (1990).
- ensure the digitized map is topologically correct and cleaned.

2. a digitized <u>vegetation map</u>

- determine the minimum polygon size acceptable for the project.
- delineate vegetation polygons for plant communities. In some cases, plant community complexes rather than individual plant communities may need to be delineated for mapping purposes.
- digitize on IRS base imagery using UTM 11 or 12 projection, NAD83.
- prepare map in _Arc/Info export format, including associated attribute fields. For examples of attribute fields that could be used, refer to:
    - the *Soil and Vegetation Inventory report for the Wagner Natural Area (*Vujnovic *et al.* 2000).
    - the *Ecological Land Classification* report for the Red Deer River Valley (Cordes and Getty 1996).
- ensure the digitized map is topologically correct and cleaned

3. a digitized <u>soils map</u>

- determine the minimum polygon size acceptable for the project.
- digitize on IRS base imagery using UTM 11 or 12 projection, NAD83.
- prepare map in _Arc/Info export format, including associated attribute fields. For examples of attribute fields that could be used, refer to:
    - the *Soil and Vegetation Inventory report for the Wagner Natural Area (*Vujnovic *et al.* 2000).
    - the *Ecological Land Classification* report for the Red Deer River Valley (Cordes and Getty 1996).
    - the *Canadian System of Soil Classification* report (Agriculture and Agri-Food Canada 1998).
    - the *Guidebook for use with Soil Survey Reports of Alberta Provincial Parks and Recreation Areas.* (Greenlee 1981).
- ensure the digitized map is topologically correct and cleaned.

4. a digitized <u>ecological land classification map</u>

- determine the minimum polygon size acceptable for the project.
- depict on IRS base imagery using UTM 11 or 12 projection, NAD83.
- prepare ELC map in _Arc/Info export format, including associated attribute fields. For examples of attribute fields that could be used, refer to:
    - the *Ecological Land Classification* report for the Red Deer River Valley (Cordes and Getty 1996).
    - the *Ecological Land Classification* report for the Beauvais Lake Provincial Park Study Area (Cornish 2001).
    - the *Ecological Land Classification* report for Brown-Lowery Provincial Park (Sutherland 2000).
    - the *Physical Land Classification Methodology* report (Kocaoglu 1990).
- ensure the integrated map is topologically correct and cleaned.

- a digital copy of the **<u>final report</u>** that describes the ELC and any incidental observations as noted above. For examples of report format and content, refer to: (1) the Big Knife Provincial Park Biophysical Inventory prepared by Karpuk and Meijer (1999), and/or (2) the Ecological Land Classification of Beauvais Lake Provincial Park Study Area (Cornish 2001). Final reports could use the formats of either of these reports, or a combination of the two.

  Suggested content items for the final report include the following:
  ⇒ Objectives
  ⇒ Introduction
  ⇒ General description of study area
  ⇒ Methodology
  ⇒ Results
    - Landforms and Topography
    - Vegetation Types / Communities
      - Include a summary table of the dominant plant species for each plant community type recognized, noting those communities that are on ANHICs tracking list or otherwise are special (see Appendix 4).
      - Include full species tables in an appendix (see the list of appendices immediately below).
      - Any relationships to similar documented plant communities should be noted.
    - Soils
    - Fauna
      - Include a summary of personal observations, noting particularly those species that are on ANHICs tracking lists. Exact locations of breeding evidence (e.g., nests, dens, etc.), particularly for tracked species, should be provided either in lat / long or UTM coordinates.
  ⇒ Project limitations (e.g., timing, site visit logistics)
  ⇒ Recommendations
    - The recommendations that are provided should be based only on the scope and type of the data collected and analyzed plus any other relevant observations.
    - Include any recommendations for further study.
  ⇒ Supporting maps (see above) and tables
  ⇒ Appendices
    - a list of <u>incidental observations</u> (e.g., birds, mammals, flora, etc.),
    - any observations on <u>special or significant features</u>
    - any observations on exemplary <u>representative features</u>
    - any observations on <u>suspected features of importance</u>
    - all <u>plot data</u>, by community type recognized
  ⇒ Literature cited

3.3 Single-sector Inventory

Conditions for Inventory

- Management / conservation planning needs or environmental issues require detailed biological or physical data for making informed decisions relative to existing or proposed protected areas.
- Previous studies (e.g., ecological land classifications, reconnaissance surveys) have recommended that a more detailed inventory be conducted.
- Systematic data collection would support ongoing natural resource monitoring or updating activities.

Comments

- Single-sector inventories have been used for:
  - site conservation initiatives (e.g., special features, rare plants and animals, wildlife habitats)
  - management planning needs, including both site-based and ecosystem-based needs (e.g., rangeland and browse issues, brush encroachment issues, forest fuels and "old growth" questions, trail planning and maintenance issues)
  - environmental impact needs (e.g., trails, erosion, access)
  - documenting a site's overall biological or physical diversity (e.g., soils, hydrology, vegetation, landforms, fauna, fossils). Generation of lists of birds, insects, mammals, plants, etc. found within a site would be one component of this type of inventory. Identification of areas of high biodiversity within an existing or proposed protected area would be another component.
  - obtaining data in support of short or long term monitoring projects.
- Depending on the objectives of the project and the budget and time allotted, single-sector inventories can range from detailed to general, or a combination of the two. Both detailed and general inventories may include only one or a combination of the sectors described below.
- "General inventories" may only involve consolidation of information from other sources (e.g., literature reviews), with little on-site fieldwork except to verify interpreted airphotos, other map products (e.g., soils maps, surficial geology maps, hydrogeology maps) or statements made in the literature (both published and non-published).
- Data obtained through a single-sector inventory can be stratified on the basis of the landform, soils, or vegetation polygons, or integrations of those polygons, as generated by the ecological land classification.
- A reconnaissance survey should, in most cases, be a part of the single-sector inventory. The results from reconnaissance could be used to refine the protocols of the single-sector inventory.
- Single-sector inventories should not be confused with detailed scientific studies developed specifically for wildlife, forests, geology, soils, hydrology, etc. that follow strict and rigorous sampling protocols. A single-sector inventory, however, could be designed and implemented using some of those protocols if they are needed to meet the objectives of the inventory project.

Scale

- the scale for single-sector inventories is highly variable and the scale chosen will depend on the objectives of the project.

Inventory or survey intensity

There are three broad levels of intensity at which single-sector inventories can be conducted, these being: presence / not detected, relative abundance, and absolute abundance. The selection of a level of intensity will depend on the survey objectives.

Level 1: Presence / not detected (possible)

- Designed to determine the presence of biological or physical features in an area, including: plant or animal species, plant communities, landforms, special features and/or species/habitat associations.

Level 2: Relative abundance

- Provides indices of population sizes (e.g., number of animals or their sign seen per unit of time, number of animals or their sign seen per linear distance, number of animals trapped per 24 hours, number of animal calls heard per hour)
- Results can provide comparable estimates of abundance between localities and species, or within species over time

Level 3: Absolute abundance

- Refers to the total numbers or density of a species in a specified area
- Usually more costly and difficult to measure than relative abundance

Sectors for Inventory / Survey

Choose one, several or all of the following **eight sectors or components within those sectors** for detailed inventory or survey, dependent on the objectives of the project. The sectors or the components that are chosen for detailed study should be based on identified needs. These may include:

- known or anticipated management or conservation issues
- known or anticipated presence of valued biological or physical features (e.g., rare species, plant communities, landforms) that need to be documented for consideration in conservation initiatives and/or management planning
- lack of data or information upon which to base conservation or management decisions

(a) Hydrology Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., digital elevation files and other GIS coverages, topographic maps, hydrological maps, airphotos, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Drainage basin characteristics
  - Drainage basin borders
  - Size of drainage basins
  - General physical characteristics of the drainage basin (e.g., bedrock, surficial deposits, soils, land use)
- Lake basin characteristics
  - Lake basin morphology (i.e., size, shape, bottom form, depth)
  - Lake bed characteristics
  - Water levels
- Stream / River characteristics
  - River morphology (e.g., stream order, gradient, drainage pattern, valley type, waterfalls, rapids, channel geometry)
  - Streamflow volumes & seasonal variations
  - River size (length, channel width, depth)
- Water Quality (lakes, rivers)
  - Salinity
  - pH
  - Buffering capacity and hardness
  - Major ions
  - Temperature
  - Oxygen
  - Nutrients
  - Transparency
  - Trophic status
  - Fecal coliforms, pesticides, and other contaminants
- Special hydrological features (e.g., waterfalls, rapids, springs, etc.)

Guidelines

- Describe the 'characteristics of the drainage basin' within which the site is located. For examples of the types of information and maps to include on this topic, refer to the *Atlas of Alberta Lakes* by Mitchell and

Prepas (1990). In most cases, information related to drainage basin characteristics can be generated from digital elevation files, topographic maps, airphotos and other available sources.

- Describe the 'characteristics of the lake basins' found within the site. For examples of the types of information and maps to include on this topic, refer to the *Atlas of Alberta Lakes* by Mitchell and Prepas (1990). Refer also to Mitchell and Prepas (1990, pp16-17) for details on conducting bathymetric surveys. In many cases, details related to lake basin characteristics can be generated from existing information.

- Describe the 'characteristics of streams and rivers' found within the site. For examples of the types of information to include on this topic, refer to *A Framework for the Natural Values of Canadian Heritage Rivers* by Coomber (1998). Some information related to stream/river characteristics can be generated from digital elevation files, topographic maps, airphotos and other published sources. Streamflow data obtained from river flow gauging stations is available through Alberta Environment.

- Describe the 'water quality' of lakes within the site. For examples of the types of information to include on this topic, refer to the *Atlas of Alberta Lakes* by Mitchell and Prepas (1990) and the report *Water Quality Management in Lac Ste. Anne and Lake Isle* by Mitchell (1999). The US Geological Survey's *Field Manual for the Collection of Water-Quality Data* (see Appendix 1 for reference) should be consulted for useful techniques as well as the *Lake Sampling Procedures Manual* (Alberta Environmental Protection 1995). Alberta Environment's water quality database should be consulted for any available data relating to lakes and streams.

- Describe the 'special hydrological features' found within the site. For evaluation of those features in terms of their significance for conservation purposes, refer to section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998)

(b) Soils Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., GIS coverages, topographic maps, soils maps, airphotos, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Soil characteristics
  - refer to the *Ecological Land Survey Site Description Manual* (Alberta Environmental Protection 1994) and the *Guidebook for use with Soil Survey Reports of Alberta Provincial Parks and Recreation Areas* (Greenlee 1981).
- Restricted soil types (e.g., soil types of limited occurrence in Alberta such as Vertisolic soils)
- Special soil features (e.g., structural soil features such as fragipans, round top columnar structures in solonetzic soils, cryoturbated horizons)

Guidelines

- Use the Soil Description Form (current revision) to record soil data according to guidelines outlined in the *Ecological Land Survey Site Description Manual* (Alberta Environmental Protection 1994).

- Describe the 'soil characteristics' of the site. For examples of the types of information and maps to include on this topic, refer to the report *Soil Survey of Cypress Hills, Alberta and Interpretation for Recreational Use (*Greenlee 1981).

- Consult the following two reports for guidance in terms of soil classification and describing soils in the field:
  - Agriculture and Agri-Food Canada. 1998. *The Canadian System of Soil Classification. 3rd edition.* Soil Classification Working Group. Publication #1646.
  - Land Resource Research Institute. 1993. *The Canadian Soil Information System (CanSIS): Manual for Describing Soils in the Field.* J.H. Day (ed.). LRRI Contrib. No. 82-52. Agriculture Canada. Ottawa, Ont.

- Describe any 'special soil features' or 'restricted soil types' found within the site. For evaluation of those features in terms of their significance for conservation purposes, refer to section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998)

(c) Geology Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., GIS coverages, airphotos, geologic maps, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Stratigraphy / Formation descriptions
- Bedrock topography
- Geological framework
- Special geologic features (e.g., formation exposures, erratics, unusual stratigraphy)

Guidelines

- Describe the 'stratigraphy', 'bedrock topography', and 'geological framework' of the site. For examples of the types of information and maps to include on these topics, refer to:
    - the *Geological Atlas of the Western Canada Sedimentary Basin* (Alberta Geological Survey 1994). URL: http://www.ags.gov.ab.ca/AGS_PUB/ATLAS_WWW/ATLAS.HTM, and
    - the report *Quaternary stratigraphy and surficial geology of the Sand River area 73L* (Andriashek and Fenton1989).

  In many cases, details related to geology for a particular area can be generated from existing information such as the geology reports and maps of the Alberta Geological Survey.

- Describe the 'special geological features' of the site. For evaluation of those features in terms of their significance for conservation purposes, refer to:
    - section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998), and/or
    - Nelson, Marilyn J. 2000. *A Method for Assessment of the Significance of Geological Sites.* The Provincial Museum of Alberta, Alberta Community Development. URL: http://www.pma.edmonton.ab.ca/vpub/geology/english/home.htm.

(d) Geomorphology Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., GIS coverages, topographic maps, surficial geology maps, airphotos, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Running water landforms
- Lake wave & current landforms
- Glacial ice & meltwater landforms
- Glaciotectonic landforms
- Wind landforms
- Karst / Spring / Geothermal landforms
- Gravity / Mass movement landforms
- Weathering & differential erosion landforms
- Frozen ground & Snow landforms
- Movements of the earth's crust landforms

- Volcanism landforms
- Peat accumulation -- non-permafrost landforms
- Peat accumulation -- permafrost landforms
- Special landform features (e.g., rare or unique landforms, landforms of restricted distribution)

Guidelines

- Describe the 'landforms' of the site
  - For methodology and examples of the types of information and maps to consider on this topic, refer to documents prepared by the Alberta Geological Survey and the Geological Survey of Canada (see section 2.2.4 in Appendix 1 for some examples).
  - In many cases, details related to geomorphology for a particular area can be generated from existing information such as the surficial geology reports and maps of the Alberta Geological Survey or the Geological Survey of Canada.
  - For an example of the types of information to include on 'surface karst' and 'cave features' of a site, refer to the document *Whitehorse Wildland Park Karst Management Report* prepared by Alberta Cave and Karst Consulting *(*March 2002).

- Descriptions of landform features can be organized according to the classification presented in the report *Classification of Alberta Landforms* (Alberta Environmental Protection 1998).

- Refer to the report *Peatland Inventory of Alberta* (Vitt *et al.* 1988) as the basis for peatland classification.

- Describe the 'special landform features' of the site. For evaluation of those features in terms of their significance for conservation purposes, refer to:
  - section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998), and/or
  - Nelson, Marilyn J. 2000. *A Method for Assessment of the Significance of Geological Sites.* The Provincial Museum of Alberta, Alberta Community Development. URL: http://www.pma.edmonton.ab.ca/vpub/geology/english/home.htm.

(e) Vegetation Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., GIS coverages, airphotos, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Vascular plants
- Non-vascular plants
  - Mosses
  - Liverworts
  - Hornworts
- Lichens
- Fungi
- Plant communities
  - Uplands
  - Wetlands
  - Aquatic
- Special plant & plant community features (e.g., rare species / communities, unusual plant / community assemblages, etc.)

Guidelines

- Describe the rare flora of the site (i.e., for those components listed above). Rare plant surveys should be conducted according to the guidelines outlined by the Alberta Native Plant Council (March 2000). URL: http://www.anpc.ab.ca/rareplant.pdf.

- Describe the special plant communities of the site. Special plant communities should be sampled according to the guidelines outlined in Appendix 4. Representative plant communities will have been documented as part of the ecological land classification (see Section 3.2 above). For evaluation of special plant communities in terms of their significance for conservation purposes, refer to section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998).

- Use the references listed in Appendix 2 as the taxonomic authorities for scientific and common names of plant species

(f) Fauna Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., internet webpages, published reports, etc.) is likely sufficient.

Components to consider for inventory

- Mammals
- Birds
- Reptiles
- Amphibians
- Fish
- Invertebrates
  - Butterflies
  - Odonates
  - Molluscs
  - Tiger beetles
- Special faunal features (e.g., biodiversity 'hotspots', rare species, critical breeding/nesting sites, etc.)

Guidelines

- Consult the report *Nature in Focus: Rapid Ecological Assessment* (Sayre *et al.* 2000) for guidance relative to issues that are central to planning and executing an animal survey (e.g., target species, survey design, data management, collections).

- Consult the inventory methods as prepared by the Resources Inventory Committee of British Columbia (URL: http://www.for.gov.bc.ca/ric/pubs/TEBIODIV/ and URL: http://www.for.gov.bc.ca/ric/Pubs/Aquatic/index.htm) for guidance relative to determining inventory protocols for various taxa and apply those protocols, as applicable, when conducting inventories of Alberta taxa. For other inventory protocols, also consult Appendix 1 (section 2.2.6) of this report.

- Consult the publication *Collecting and Preserving Insects and Mites: Techniques and Tools.* by M.E. Schauff for guidance relative to protocols for collecting and preserving insects. (URL: http://www2.sel.barc.usda.gov/selhome/collpres.htm)

- As a minimum, conduct animal surveys to the 'presence/not detected' intensity level (i.e., Level 1) and, if budgets and time permit, to the 'relative abundance' intensity level (i.e., Level 2). For those species on ANHIC's tracking lists, data should be obtained on their relative abundance, if possible, as well as on their important habitats and distribution at a site.

- Use the Vertebrate & Invertebrate Report Form (downloadable on URL: http://www.gov.ab.ca/env/parks/anhic/animalreport.pdf) and the Alberta Birdlist Form (downloadable on URL: http://fanweb.ca/download/birdlist.pdf) to record faunal data, or other suitable forms that are appropriate for recording faunal data. Field notebooks can be used for recording data but information related to species on the tracking lists should be transposed to the Vertebrate & Invertebrate Report Form.

- Describe the fauna of the site (i.e., for those components listed above), stratified on the basis of ELC units or other appropriate units. This will include presence or absence, distribution, relative abundance (if known), species/habitat associations, species richness, important biological features, etc. Annotated species lists should be provided in either the body or appendix of the report. Maps should depict locations of target species (e.g., ANHIC tracked species), and other important biological features (e.g., breeding ponds, colonial nesting sites, staging areas, dens, etc.).

- Describe the 'special faunal features' of the site. For evaluation of those features in terms of their significance for conservation purposes, refer to section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998).

- Use the references listed in Appendix 2 as the taxonomic authorities for scientific and common names of animal species. Those references should also be used as the source for accepted terms for various sub-components (e.g., rodents, carnivores, falcons, wood warblers).

(g) Prehistory / History Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., internet webpages, published reports, photographs, etc.) is likely sufficient.

Components to consider for inventory
- Standing structures (e.g., buildings, dams, canals, bridges, fortifications)
  - individual structures
  - group structures
- Buried or archaeological sites
- Cultural landscapes (e.g., gardens, field patterns, mining landscapes)
- Sites of historical significance (e.g., trails, battlefields, landing sites, portages)

Guidelines
- Consult the report *Master Plan: Prehistoric and Historic Resources* (Alberta Culture n.d.) for guidance relative to the framework within which prehistoric and historic data can be presented as well as the criteria by which the significance of prehistoric and historic features can be evaluated.

- Consult the manual *Guidelines for Archaeological Permit Holders in Alberta* (Archaeological Survey of Alberta 1989) for guidance relative to conducting archaeological fieldwork, submitting collections and reporting of results.

- Describe the 'standing structures', 'archaeological sites', 'cultural landscapes', and 'sites of historical significance' that are found in the site. For examples of the types of information to include on these topics, refer to the publications listed in Appendix 1 (section 2.2.7).

(h) Palaeontology Sector

One or more of the components listed below should be considered for detailed inventory when there is an identified need (e.g., help to solve management issues, provide valued information for conservation planning, etc.). Detailed inventories can be conducted according to the general guidelines listed below. Where there are no identified needs or the needs are obscure, summarized information generated from existing sources (e.g., internet webpages, published reports, collections, etc.) is likely sufficient.

Components to consider for inventory
- the plants and animals
- the single-celled organisms
- the mushrooms and fungi

- the bacteria and blue-green algae
- Special palaeontology features (e.g., unique fossils, valuable sites)

Guidelines

- Consult the *Alberta Historical Resources Act* (1978) for guidance relative to the collection, ownership and removal of palaeontological resources in Alberta. Under the act, all fossils in the province are the property of the Government of Alberta.

- Describe the 'palaeontologic features' that are found in the site. For examples of the methodologies and types of information to include on these topics, refer to the publications listed in Appendix 1 (section 2.2.8).

- Describe the 'special palaeontologic features' of the site. For evaluation of those features in terms of their significance for conservation purposes, refer to section 4.0 of the report *Special Features in Alberta* (Alberta Environmental Protection 1998).

4. DATA MANAGEMENT AND REPORTING

Careful data management and reporting by qualified personnel is a crucial aspect of a successful project. Misplaced, forgotten or unusable data (e.g., damaged or obscure data sheets) is of little or no value. Field data should be collected with the intent that it becomes included within the datafiles of a data repository, such as the Alberta Natural Heritage Information Centre or an appropriate database such as those listed in Section 3 of Appendix 1 (e.g., ESIS). One of the most important products of an inventory project is the set of field data (annotated airphotos, field notes, working maps, field photos, etc.). When applicable, datasheets should be accompanied by a set of field survey maps or airphotos that show the location of the project boundary, survey strata used, sample units and any other appropriate data.

Dataforms

Project professionals (e.g., biologists, resource specialists) should ensure that dataforms (either hardcopy or digital) are properly filled out. This will help increase the 'life' and quality of the data. Each inventory project will require the use of one or a combination of the following dataforms:

- For **ecological land classification**
  - Site Description Form (current revision)
  - Soil Description Form plus Supplementary Soil Description Form (current revision)
  - Vegetation Description Form (current revision)
- For **rare plants and lichens**
  - Rare Native Plant Report Form
- For **animal species**
  - Vertebrate & Invertebrate Report Form (use for species on ANHICs tracking lists)
  - Alberta Birdlist Form
- For **plant communities**
  - as a minimum, use the ELC *Site Description Form* (current revision) and the *Vegetation Description Form* (current revision) to document occurrences of plant communities that are on ANHICs tracking list or that are recommended for addition to that list. A completed *Soil Description Form* (current revision) would also be useful.
  - the *Vegetation Inventory Form* (current revision), used for range surveys, can be used where transects are employed as the survey technique (e.g., in grassland communities, alpine communities, etc.) (see the 1990 Range Survey Manual of the Alberta Forest Service for guidelines).

Data Entry and Storage

It is the responsibility of the proponent of an inventory project to ensure that copies of final reports and associated data are forwarded to the appropriate agency, organization or group that is responsible for or has a direct interest in the results of that inventory. Original reports, related data, field forms and other field support materials should remain with the proponent.

- Staff of the Alberta Natural Heritage Information Centre of Parks and Protected Areas Division should be forwarded data and reports, hardcopy and/or digital, relating to **tracked species, tracked plant communities** and **special landforms**. They will be responsible for entry and storage of such data into the datafiles of ANHIC. In addition, photos (either originals or duplicates) of tracked species, tracked plant communities or special landforms should be submitted to ANHIC.
- Staff of the Fisheries and Wildlife Management Division (either Regional or Edmonton office staff) who have access to BSOD's datafiles should be forwarded data relating to **animal species**. They will be responsible for entry and storage of such data into BSOD.
- Staff of the Resource Data Division of Alberta Sustainable Resource Development should be forwarded data and reports relating to **ecological sites**. They will be responsible for entry and storage of such data into the ESIS datafiles.
- The Resource Data Division will function as a **repository** and **archive** for **copies of Ecological Land Classification reports**, and the field forms and other field support materials related to those reports (e.g., annotated airphotos, field notes, working maps, field photos, etc.).

Reporting and Maps

- As a minimum, every single-sector inventory project should produce a **final report** in digital form along with any supporting maps. Depending on the objectives of the project, the final report can be prepared as: (a) a stand-alone single-sector report, or (b) a report that consolidates all inventoried sectors into one document.
- Maps that are digitized should be topologically correct and cleaned. If possible, maps should be prepared using IRS base imagery. When IRS base imagery is used for digital mapping, it should be in UTM 12 projection, NAD83. Maps should be prepared in _Arc/Info export format, including associated attribute fields.
- Appendix 3 outlines the suggested format for a single-sector inventory report.

5. VOUCHER SPECIMENS

- Within Alberta's protected areas, and dependent on the objectives of the inventory, voucher specimens currently will **only be collected** for the following taxonomic groups and/or where positive identification is required:
  - Small mammals (e.g., shrews, voles, mice, bats)
  - Fish (i.e., only those on ANHICs tracking list)
  - Arthropods (e.g., butterflies, moths, beetles, dragonflies, etc.)
  - Molluscs (i.e., bivalves and gastropods)

- Voucher specimens will normally not be collected for geological, archaeological or palaeontological elements unless part of a recognized research project.

- For plants, vouchers should be collected for those species where positive identification is required. Vouchers may be beneficial for those taxa that are of interest due to significant range extensions, new records for the province etc. Generally, do not collect from populations with fewer than 50 plants (see Alberta Native Plant Council 2000).

- Collecting of voucher specimens in existing protected areas may require a Research and Collection Permit or "letter of authorization". For a specific protected area, the appropriate district or regional office of the Parks and Protected Areas Division should be consulted to obtain these permits or letters of authorization.

- Voucher specimens should be identified by recognized experts, and be prepared and labelled for deposition in recognized institutions, primarily universities and museums
  - Rare plant specimens should be submitted to ANHIC
  - Small mammals, fish, arthropods and molluscs should be submitted to a recognized institution for deposition
  - All data associated with voucher specimens should be submitted to ANHIC

- It is critical that institutions know in advance when to expect a collection and the size of the collection so that they can be ready to process the incoming specimens. Specimens should be appropriately labelled prior to submission to an institution. A copy of any written reports and field notes associated with the voucher specimens should accompany the collection.

- Project proposals should identify costs associated with specimen identification, preparation and deposition, and have those costs included in the project budget.

- The following documents should be consulted for protocols in terms of the collection, preparation, identification and storage of voucher specimens, and applied, as appropriate, to the Alberta situation.

  - Brayshaw, T. C. 1996. *Plant Collecting for the Amateur.* Royal British Columbia Museum, Victoria, BC, 44 pp.

  - Fabijan, D. 1999. *Herbarium handbook.* Department of Biological Sciences, University of Alberta, Edmonton, AB.

  - Ministry of Environment, Lands and Parks. June 1999. *Voucher Specimen Collection, Preparation, Identification and Storage Protocol: Animals. Standards for Components of British Columbia's Biodiversity No. 4a.* Resources Inventory Branch. 47pp. (URL: http://www.for.gov.bc.ca/ric/Pubs/teBioDiv/voucher/index.htm)

  - Ministry of Environment, Lands and Parks. June 1999. *Voucher Specimen Collection, Preparation, Identification and Storage Protocol: Plants and Fungi. Standards for Components of British Columbia's Biodiversity No. 4b.* Resources Inventory Branch. 37pp. (URL: http://www.for.gov.bc.ca/ric/Pubs/teBioDiv/voucherb/index.htm)

  - Schauff, M. E. (ed.). *Collecting and preserving insects and mites: techniques and tools.* Systematic Entomology Laboratory, USDA National Museum of Natural History, NHB 168. Washington, D.C. 20560. URL: http://www2.sel.barc.usda.gov/selhome/collprev.pdf.

  - The Dragonfly Society of the Americas. Last updated 13 April 1996. *Statement of Committee on collecting Policy (pending final approval).* URL: http://www.afn.org/~iori/oincolgl.html

  - Wheeler, T.A., J.T. Huber and D.C. Currie. 2001. *Label Data Standards for Terrestrial Arthropods.* A brief prepared by the Biological Survey of Canada (Terrestrial Arthropods). Document Series No.8. URL: http://www.biology.ualberta.ca/bsc/bschome.htm

6. INVENTORY PROJECT AND SURVEY DESIGN

A natural heritage inventory or survey has at least two phases that must be considered when it is being designed. These include:

Project Design

Each project will have a boundary that is usually identified by the proponent and is based on some conservation or environmental concern. If a project will include adjacent areas of interest, those boundaries need to be defined and the rationale for including adjacent areas need to be explained at the outset of a project. The project boundaries will act as the area to which the results of the inventory are applied or extrapolated. A project may occur over more than one year, and may be composed of a number of surveys, each with a different focus, objectives, start and end dates, and protocols. Components to consider in a project design include:

- Project name
- Project boundary
    - for projects that focus on existing protected areas, the Parks and Protected Area Division's website (URL: http://www.cd.gov.ab.ca/preserving/parks/lrm/) should be used as the source for land descriptions and current boundaries of those sites. The website contains a complete listing of all lands currently under the administration of Alberta Community Development — Parks & Protected Areas Division. Land descriptions are provided for every site established by Order-In-Council.
- Project objectives (i.e., overall project-specific objectives)
- Project agency (i.e., agency that is implementing the project)
- Project coordinator(s)
- Start date (i.e., the date when the project will begin)
- End date (i.e., the date on which project completion is expected)
- Funding sources

Survey Design

Thorough preparation is a key to a successful field survey. Prior to the survey, existing information about the area should be obtained that might have a bearing on or be of relevance to the survey. This information may be in the form of maps and airphotos, reports and articles, personal contact, or unprocessed data (e.g., digital GIS coverages, plant and animal databases, etc.). Data housed within the ANHIC is a valuable resource and its datafiles should be checked to determine what data is available relative to the area(s) being surveyed (e.g., locations of rare or uncommon species).

An individual survey or inventory is designed to obtain data about a particular sector of the biological or physical diversity of the project area over a meaningful period of time. Components to consider in a survey design include:

- **Project name**
    - use the same name as for the Project Design phase

- **Survey name**
    - provide a name to reflect what is being surveyed, the geographic area involved, and the calendar year in which the survey is to be conducted; in some cases the Survey Name might be the same as the Project Name

- **Survey objectives**
    - determine objectives for the survey

- **Survey coordinator**
    - provide the name of the survey coordinator

- **Surveyor's names**
  - provide the name(s) of all persons directly involved in the field survey

- **Survey period (start/end date)**
  - identify the start and expected end dates of the survey

- **Survey type**
  - determine the survey method to be used, e.g., point counts, line transects, area-based samples

- **Survey intensity**
  - indicate level of intensity to be used; i.e., presence / not detected, relative abundance, absolute abundance

- **Target taxa or sector / sector component**
  - identify the taxon / sector being surveyed

- **Study site(s)**
  - identify sites within the project boundary where sampling is to occur and for which conclusions will be made about the larger project area; study sites may be identified on the basis of ELC polygons

- **Data management**
  - identify the tools by which data will be recorded during the survey (e.g., hardcopy dataforms, digital datafiles, field notebooks, etc.)
  - identify the arrangements that will be made to ensure that the data is entered and stored once the survey is complete

- **Voucher specimens**
  - outline the arrangements that will be made for the collection, preparation, identification and storage of voucher specimens, if applicable,

- **Equipment and Supplies**
  - identify what equipment and supplies are necessary to conduct the inventory (e.g., natural history field guides, camera, binoculars, plant press, nets, field notebooks, safety equipment, GPS units, laptop computer, compass, etc.).

APPENDIX 1. REFERENCE BASE FOR NATURAL HERITAGE INVENTORY AND EVALUATION

1. THE SYSTEMS-WIDE INVENTORY

- Alberta Environmental Protection. February 1994. *Ecological Land Survey Site Description Manual.* Canadian Forest Service and Alberta Land and Forest Services. 165pp.
- Alberta Environmental Protection. 1994. *Natural Regions, Subregions and Natural History Themes of Alberta: A Classification System for Protected Areas Management*. Report 2. Recreation and Protected Areas Division.
- Alberta Environmental Protection. March 1997. *The Grassland Natural Region of Alberta.* One of a Series of Reports Prepared for the Special Places 2000 Provincial Coordinating Committee. Recreation and Protected Areas Division. 229pp.
- Alberta Environmental Protection. April 1998. *The Boreal Forest Natural Region of Alberta.* One of a Series of Reports Prepared for the Special Places 2000 Provincial Coordinating Committee. Recreation and Protected Areas Division. 313pp.
- The Nature Conservancy. 1997. *Designing a Geography of Hope: Guidelines for Ecoregion-Based Conservation in the Nature Conservancy*. 84pp.
- several of the ESA reports such as: Cottonwood Consultants Ltd. February 1988. *Environmentally Significant Areas in the Oldman River Region, Municipal District of Taber.* Prepared for Alberta Forestry, Lands and Wildlife, and the Oldman River Regional Planning Commission. 35pp.

2. THE SITE-SPECIFIC INVENTORY

2.1 Ecological Land Classification

- Alberta Environmental Protection. February 1994. *Ecological Land Survey Site Description Manual.* Canadian Forest Service and Alberta Land and Forest Services. 165pp.
- Alberta Environmental Protection. July 1998. *Special Features in Alberta: Proposed Framework for Site Identification and Initial Evaluation of Potential Special Feature Sites.* Prepared for the Special Places Provincial Co-ordinating Committee.
- Alberta Natural Heritage Information Centre. March 1998. *Classification of Alberta Landforms.* Prepared for Recreation and Protected Areas Division, Alberta Environmental Protection.
- Cordes, L.D. and M.A. Getty. *An Ecological Land Classification of the Red Deer Valley from Dry Island Buffalo Jump Provincial Park south to Tolman Bridge.* Department of Geography, University of Calgary, Calgary, Alberta. 124pp + appendices.
- Cornish, B. 2001. *Ecological Land Classification of Beauvais Lake Provincial Park Study Area.* Prepared for Resource Data Division, Alberta Environment. RIB #797. 71pp. URL: http://142.94.104.14/publications/eco_pub/ELC_Beauvais.pdf
- Ecological Stratification Working Group. 1996. *A National Ecological Framework for Canada.* Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of Environment Directorate, Ottawa/Hull. 125pp. And Map at scale 1:7.5 million. http://www.ec.gc.ca/soer-ree/English/Framework/framework.cfm. Pdf copy available from http://sis.agr.gc.ca/cansis/publications/ecostrat/intro.html
- Grossman, D.H. et al. 1998. *International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Volume 1. The National Vegetation Classification System: Development, Status and Applications*.. The Nature Conservancy. Arlington, Virginia, USA.
- Ironside, G.R. 1991. *Ecological land survey: Background and general approach*. *In* H.A. Stelfox, G.R. Ironside, and J.L. Kansas (eds.) *Guidelines for the integration of wildlife and habitat evaluations with ecological land survey.* Wildlife Habitat Canada and Canadian Wildlife Service, Environment Canada, Ottawa, Ont. 107 pp.
- Karpuk, E. and M. Meijer. December 1999. *Big Knife Provincial Park Biophysical Inventory.* Prepared for Natural Resources Service, Parkland Region, Alberta Environment

- Kocaoglu, S.S. 1990. *Physical Land Classification Methodology.* Alberta Forestry, Lands and Wildlife, Land Information Branch, Resource Inventory Section. 41pp.
- Marshall, E. 2000. *Terms of Reference for an Ecological Land Classification.* Land and Forest Service, Alberta Environment.
- Marshall, I. B. and P. H. Schut. 1999. *A National Ecological Framework for Canada .* Ecosystems Science Directorate, Environment Canada and Research Branch, Agriculture and Agri-Food Canada . URL: http://sis.agr.gc.ca/cansis/nsdb/ecostrat/intro.html
- Meijer, M. and E. Karpuk. December 1999. *Dillberry Lake Provincial Park Biophysical Inventory.* Prepared for Natural Resources Service, Parkland Region, Alberta Environment.
- Sayre, R. et al. 2000. *Nature in Focus: Rapid Ecological Assessment.* The Nature Conservancy, USA. 182pp.
- Sutherland, I. July 2000. *Ecological Land Classification for Brown-Lowery Provincial Park.* Prepared for Natural Resources Service, Alberta Environment. 59pp.
- Vujnovic, K., L. Nikiforuk, J. Bentz and P. Beaudette. March 2000. *Soil and Vegetation Inventory of Wagner Natural Area, Alberta.* Prepared for Alberta Environment, Resource Data Division by Geowest Environmental Consultants Ltd. And Soil-Info Ltd.
- Wiken, E.B. (compiler). 1986. *Terrestrial ecozones of Canada.* Ecological Land Classification Series No. 19. Environment Canada, Hull, Que. 26 pp. + map.

2.2 Single-sector Inventory

2.2.1 Hydrology

- Alberta Environmental Protection. January 1995. *Lake Sampling Procedures Manual.* Water Monitoring Branch and Water Sciences Branch, Edmonton.
- Alberta Environmental Protection. July 1998. *Special Features in Alberta: Proposed Framework for Site Identification and Initial Evaluation of Potential Special Feature Sites.* Prepared for the Special Places Provincial Co-ordinating Committee.
- Alberta Environment. November 1999. *Surface Water Quality Guidelines for Use in Alberta.* Environmental Services Division and Water Management Division. 20pp.
- Alberta Environment. Maps that depict the physical characteristics of various lakes are available at Alberta Environment's records centre on the 9th floor in Oxbridge Place, 9820 - 106 St., Edmonton, Alberta.
- Coomber, N. March 1998. *A Framework for the Natural Values of Canadian Heritage Rivers.* Canadian Heritage River System.
- Garven, G. 1982. *Groundwater Hydrology of the Pine Lakes Research Basin, Alberta : A Preliminary Analysis.* Alberta Geological Survey.
- Mitchell, P. and E. Prepas (eds.). 1990. *Atlas of Alberta Lakes.* The University of Alberta Press. 675pp.
- Mitchell, P. 1999. *Water Quality Management in Lac Ste. Anne and Lake Isle: A Diagnostic Study.* Water Management Division, Alberta Environment. 44pp.
- US Geological Survey. nd. *National Field Manual for the Collection of Water-Quality Data. Techniques of Water-Resources Investigations.* Book 9. Water Resources Division, USGS, Denver. URL: http://water.usgs.gov/owq/FieldManual/index.html

2.2.2 Soils

- Agriculture and Agri-Food Canada. 1998. *The Canadian System of Soil Classification. 3rd edition.* Soil Classification Working Group. Publication #1646.
- Alberta Environmental Protection. February 1994. *Ecological Land Survey Site Description Manual.* Canadian Forest Service and Alberta Land and Forest Services. 165pp.
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3. DATABASES AND RELATED INFORMATION

- **The Alberta Natural Heritage Information Centre (ANHIC).** The Centre, one of over 80 centres in an international Natural Heritage Network, was established in 1996. ANHIC provides accurate and accessible biodiversity information necessary for making informed decisions concerning conservation, natural resource management, and development planning. The centre collects, continually updates, analyzes and disseminates information about the location, condition, status, and trends of selected elements, including species and plant communities. Information is tracked at several levels. Species information in the system for selected taxa includes the scientific name, taxonomy, geographic range, confirmed locations, population size and condition, global and subnational status, and autecology. Community information for selected communities includes classification, species composition, geographic range and location, endangerment status, and condition. Site information includes ownership, size, boundaries, use classification, management status, and species and community occurrences. The databases are linked to a common bibliographic database and can be tied to a computerized Geographic Information System (GIS) for spatial display and analysis.
  URL: http://www.cd.gov.ab.ca/preserving/parks/anhic/index.asp

- **Native Prairie Vegetation Baseline Inventory.** The Native Prairie Vegetation Baseline Inventory is a reconnaissance level inventory that has classified and mapped native vegetation in the Grassland Natural Region of Alberta. The classification was completed to a quarter section (160 acre) resolution. Native vegetation was classified in one of six cover classes: tree, shrub, graminoid, riparian, lake or wetland. The percentage of each cover class was estimated to the nearest five percent of each quarter section. The inventory was undertaken using mostly 1991 - 1993, 1:30,000 aerial photography. The spatial data

base is in Arc/Info EXPORT (.e00) format and has been compiled with mapped data including Crown ownership and grazing disposition on CD (March 1999). Various mapped products showing different percentages of native vegetation superimposed on land standings have been produced. The inventory was undertaken by Alberta Environment for the Prairie Conservation Forum to follow-up on an objective in the Alberta Prairie Conservation Action Plan, 1996-2000 to complete identification of native prairie. URL: http://www.albertapcf.ab.ca/background.htm.

- **Environmentally Significant Areas Inventories.** ESAs are reconnaissance level inventories identifying Alberta's significant, rare, sensitive and unique natural features. ESA inventories have been undertaken for all rural municipalities in prairie and parkland Alberta. ESA inventories identify important ecosystems or ecosystem segments having natural characteristics and processes. They document 'significant' natural features and rate their significance: regionally, provincially, nationally, and internationally. URL: http://www.albertapcf.ab.ca/esaIntro.htm.

- **Base Features Spatial Data.** These data provide a standard reference for provincial land based information and is considered key to efficient, effective integrated resource management. The spatial data collectively referred to as Base Features is comprised of six data themes: Alberta Township System (ATS), Hydrography, Hypsography (DEM), Access, Geoadministrative Areas and Facilities. Base Features spatial data provides seamless provincial coverage that is scale independent in a GIS ready format suitable for direct use by decision makers, and in departmental business systems. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Alberta Geographical Names System**. This system was created to provide an accurate, consolidated and current database of all named geographic features that exist within the Province of Alberta. GNS is the definitive source for all Base Features naming. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Ecological Site Information System (ESIS).** The Alberta Government has gathered ecological site data over a significant time period to support its mandate towards managing renewable resource activities in the Province. Data accessibility has, however, been a concern as the information was stored in various formats by different agencies with resource management responsibilities. In 1993, the Alberta and Canadian governments joined efforts to standardize the storage of this data in a single electronic database known as the Ecological Site Information System (ESIS). The main objective of developing this system was to facilitate the input, storage, retrieval and analysis of ecological site data. The database stores over 15,000 point records from various sources including permanent sample plots, stand dynamics studies and ecological land classification projects and includes data collected as early as 1975. ESIS data is available to support local and regional resource management and planning activities as well as research initiatives where historical site data at a province-wide scale is required. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Physical Land Classification Projects (PLC).** In 1977 the Land Classification Group (Resource Inventory Section) and Alberta Energy and Natural Resources adopted a physical land classification methodology to meet the needs and requirements of resource planning and management agencies. The Physical Land Classification (PLC) projects involve classifying and mapping the physical features of landscape (landform, surficial geology and soils). PLCs have frequently provided the first level of abstraction from which subsequent ecological land classifications and integrated resource inventories have been generated. PLCs have been carried out primarily at the scales of 1:15,000, 1:20,000, 1:50,000 and 1:1,000,000 for selected areas of crown land in the province. Over the past five years large scale PLCs have also been collected as a basis for future vegetation inventories in grazing dispositions administered by the Land and Forest Service and Public Lands. A series of maps with accompanying reports display genetic composition (landform and parent geological material), surface expression, texture, slope and aspect with the integration of soil classification and drainage based on the Canada System of Soil Classification (CSSC). The maps provide a physical land resource database for resource management and planning. The reports provide interpretation of the maps. The Physical Land Classification reports and maps are available in hardcopy only. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Alberta Ground Cover Classification Project (AGCC).** The Alberta Ground Cover Classification Project (AGCC) was initiated to acquire vegetation information for regions of Alberta where Alberta Vegetation Inventory (AVI) information was not available. As a satellite based classification, this type and scale of resource information is intended for reconnaissance level management. Primary interest to acquire ground cover information was driven by the Forest Protection Division. Their need for ground cover data becomes an integral component to a fire prediction model for predicting forest fire risk and assessing pre-emptive strategies. Other applications of AGCC data may relate well to wildlife habitat inventories. Land cover classifications were derived from geo-referenced LANDSAT TM data from a single date. The AGCC legend addresses 59 potential classes throughout north and north-central Alberta. Overall classification accuracy is greater than 80% with no individual classification less than 65%. Post classification filtering reduced the number of small areas to those greater than 3 ha before conversion and export to ArcInfo. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Alberta Vegetation Inventory (AVI).** The Alberta Vegetation Inventory (AVI) provides detailed vegetation information necessary for forest management planning, wildlife habitat classification and integrated resource management activities. Alberta Vegetation Inventory occurs on land managed by the Crown and land managed under a Forest Management Agreement (FMA). Cutblock information for Crown-managed AVI is available for selected townships in the Green Area only. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Alberta Woodlot Inventory.** Forest Cover Inventories provide an assessment of tree species composition, their heights and densities for their potential value to the Timber Industry. These inventories also provide information about the growing conditions and losses a forest may have sustained. Historically, these forest inventories have been focused in regions of Crown Land (Green Zone) associated with the Forest Management Agreements. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **Reconnaissance Vegetation Inventory.** This series of reports and hardcopy maps provides a broad vegetation inventory for the Green Area and White Area. The maps depict both forestry and agricultural based species including those native and introduced to the province, as well as height, and density. In some cases non-vegetated areas are included in the inventory. The hardcopy maps are intended for wildlife habitat evaluation. For more information contact the Resource Data Branch of Alberta Sustainable Resource Development.

- **The Fisheries Management Information System (FMIS).** This system was developed and implemented in the fall of 1998 in order to meet the data storage and data retrieval requirements of Fisheries staff throughout the province. As a result of the dedication of Fisheries managers, FMIS has become one of the most comprehensive sources of fisheries information in Alberta.
  URL: http://www.env.gov.ab.ca/dept/fws/fwmd/index.html

- **Production Fur Trapping System.** This trapping system contains data regarding fur affidavits, registrations and the registered fur management areas. URL: http://edmgwb3f/home/trapping.htm

- **Biodiversity/Species Observation Database (BSOD).** The B/SOD project was initiated in early 1995 to provide a long-term, standardized data collection, storage, and retrieval system for species observation data routinely collected by professional biologists and amateur naturalists. Initial priority has been given to species that may be at risk of serious decline or may be of uncertain population status, but the database is being used for a variety of data storage tasks. The primary functions of BSOD are to: (1) support the monitoring of population status and trends of species at risk of long term permanent declines as mandated by the government's commitment to assessing the status of all wildlife species in the province every 5 years, (2) provide input during the land-use referral process involving public lands and proposed development activities that might adversely impact wildlife species, (3) provide a standardized and widely available data management system for the convenient storage and retrieval of all kinds of species observation data, (4) provide a data source for a wide variety of purposes including conservation initiatives, research, and for consultants and others with a need for species observational data.
  URL: http://www.env.gov.ab.ca/dept/fws/fwmd/index.html

- **Historical Wildfire Information.** The Alberta historical wildfire incidence data is available through the Forest Protection Division for the convenience and personal use by government staff, resource users and public. There are three different sets of data that are available: a ten-year statistical summary of wildfires in Alberta, the historical wildfire database, and wildfire polygons. Earlier years, 1961 - 1995, will typically just have Class E wildfires, which are defined as wildfires that reach a size greater than 200 hectares. URL: http://edmgwb1g/forprot/hwi_1.html

- **NatureServe Explorer.** This website is a source for authoritative conservation status, taxonomic, and distribution information on more than 50,000 plants, animals, and ecological communities of the United States and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network. URL: http://www.natureserve.org/explorer/

- **Agricultural Region of Alberta Soil Inventory Database (**AGRASID). This database describes the spatial distribution of soils and associated landscapes within the agricultural region of Alberta (an area of approximately 26M ha.). Soil landscape information compiled and published over the past 75 years provided the basis for the development of this relational database. The graphic soil landscape polygons in AGRASID are intended to be represented at a scale of 1:100 000, and the associated soil landscape information are described in a standard format for the entire agricultural region. URL: http://www.agric.gov.ab.ca/soil/agrasid/agrasidmainpage.html

- **The North American Breeding Bird Survey (BBS).** The BBS is a source of information about distributions and population changes of North American birds. It is also a tool for learning about birds, with connections to the ID tips with pictures of common North American birds and quizzes on bird distribution and identification. The BBS is a large-scale survey of North American birds. It is a roadside survey, primarily covering the continental United States and southern Canada, although survey routes have recently been initiated in Alaska and northern Mexico. The BBS was started in 1966, and the over 3,500 routes are surveyed in June by experienced birders. The primary objective of the BBS has been the estimation of population change for songbirds. However, the data have many potential uses, and investigators have used the data to address a variety of research and management objectives. URL: http://www.mbr.nbs.gov/bbs/

- **The Canada Land Inventory (CLI).** CLI is a comprehensive multi-disciplinary land inventory of rural Canada, covering over 2.5 million square kilometers of land and water . Land capability for agriculture, forestry, wildlife, recreation, wildlife (ungulates and waterfowl) was mapped. Over 1000 mapsheets at the 1:250,000 scale are available on their website for on-line map making and download of desktop publishing, or GIS formats. URL: http://geogratis.cgdi.gc.ca/CLI/frames.html

- **Alberta Archaeological Inventory.** This database contains information on about 27,000 archaeological sites within Alberta -- their location, who was involved, what was found at those sites and other details relating to the site / project. The database is maintained by the Alberta Archaeological Survey within the Heritage Resource Management Branch of Alberta Community Development. The database is not on-line and requests for information must be made through the Alberta Archaeological Survey. Clients are usually e-mailed the pertinent data relating to a particular request.

- **Heritage Inventory Program**. The primary activity of the Heritage Inventory Program is the maintenance of a database of over 70,000 records relating to heritage resources in Alberta. This involves the collection, data entry and updating of information, as well as providing analysis and responding to enquiries. The Inventory contains information gathered as early as 1971, and has been continuously added to since then. A wide variety of site types is represented, from geological and natural features, to houses, grain elevators, train stations, and barns. The main emphasis of the inventory is historic buildings and other structures, usually more than 50 years of age. Information on file includes details of architectural characteristics, history, designation status, location, and photographs. The Inventory provides a base of knowledge upon which informed decisions relating to Alberta's heritage resources can be made. Currently, the hard copy of the information can be accessed by anyone who makes an appointment to come in and see it. The electronic database is in the process of being migrated from a stand-alone to an intranet situation, with a view to eventually having at least a portion of it available via

the internet. Almost all data entry is done in-house, although there have been projects in the past which have included data entry as part of the data gathering process. Maintenance of the database is the responsibility of the Heritage Inventory Program within the Heritage Resource Management Branch of Alberta Community Development.

- **Provincial Museum of Alberta Paleontological Database.** The Provincial Museum in Edmonton maintains a database of the palaeontological material that is housed within the museum. About 35,000 specimens are in the collection and most of those specimens are from Alberta. Data records for each specimen includes things such as location of find, common name, scientific name, geologic period, description of specimen, collector and storage location.

- **The Royal Tyrell Museum Paleontological Database.** The Tyrell Museum in Drumheller, Alberta maintains a database of the palaeontological material that is housed within the museum. The database currently has about 120,000 records relating to about 250,000 objects in the museum. Data is recorded on parameters such as locality / date of collection, scientific classification (order, family, genus, species), description of specimen, collector, publications about the specimen, and storage location.

- **Water Data System (WDS).** Lake chemistry data are stored in this database, a module of Alberta Environment's EMS (Environmental Management System). Data has been collected on lakes since the 1970's. Some lakes have intensive periods of record, while others may only have one or two samples. Lake samples usually consist of composite samples collected several times during the open water season and once during the winter. Parameters include phosphorus and nitrogen fractions, chlorophyll, ions/anions, total dissolved solids and sometimes metals and organics. A profile for dissolved oxygen, temperature, pH and conductivity is also collected with each composite, in the deepest area of the lake. Lake data, in Excel spreadsheet format, can be requested by contacting Ron Tchir (ron.tchir@gov.ab.ca, 780-427-1933) in Alberta Environment.

- **Lake level database.** Data on lake levels is captured by four regional offices and appended twice per week on a provincial DBF application. Approval of data for the previous year is finalized in April of the current year. Alberta Environment currently monitors in the order of 300 stations, some more active than others. For data requests, contact Otto Mahler of the Monitoring Division (Water Data Group) of Alberta Environment. They are able to provide a self service option for accessing data by arranging an application for clients that operates from a short-cut on their personal desktop computers.

- **Near Real-Time Hydrometeorological Data.** Alberta Environment's Water Management Division routinely collects near real-time hydrometeorological data from meteorological and stream gauges within Alberta's river basins using telephone and communications satellites to support its water resources management activities. These gauges are owned and operated by Transalta Utilities, Water Survey of Canada, Atmospheric Environment Services, BC Hydro, US Department of Agriculture and the Alberta Government. URL: http://www3.gov.ab.ca/env/water/WS/Newleaf/

APPENDIX 2. NOMENCLATURE AND TAXONOMY SOURCES

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APPENDIX 3. GENERIC TABLE OF CONTENTS FOR A SINGLE-SECTOR INVENTORY REPORT

1. Title
2. Executive Summary or Abstract
3. Table of Contents
4. Introduction
   - Objectives
5. Project and Study Sites
6. Methods
   - Scales and mapping
   - ELC analysis (if applicable)
   - Sector of study (i.e., one or more of hydrology, geology, geomorphology, soils, vegetation analysis, floristic surveys, faunal surveys, archaeology, palaeontology)
7. Results
   - Summary of existing information
   - Description and analysis
     - Ecological land classification (when applicable)
     - For each sector addressed (i.e., one or more of hydrology, geology, geomorphology, soils, vegetation analysis, floristic surveys, faunal surveys, archaeology, and/or palaeontology)
       - Results
       - Discussion
     - Special features for each sector addressed
       - Results
       - Discussion
8. Discussion
   - Overall evaluation of site
   - Critique of inventory protocols
   - Project limitations
9. Recommendations
   - For further study
   - For conservation / management / operation / mitigation
   - For monitoring
     - Species
     - Populations
     - Plant communities
     - Other
   - Other recommendations
10. Conclusion
11. Literature Cited
12. Maps
    - Supporting maps in digital form (e.g., sector maps, base maps, ELC maps, etc.). Digital maps on IRS imagery are preferred, if possible. One or more of the maps should show the project boundary, study sites and sampling units used.

APPENDIX 4. SAMPLING SPECIAL PLANT COMMUNITIES

1. Introduction

A **plant community** is defined as a distinct assemblage of plant species that can often be associated with particular environmental conditions and given the right conditions, reoccurs predictably. Plant communities can be separated into three major types: terrestrial, wetland and aquatic.

Special plant communities would include, but not be limited to, communities on the Preliminary Plant Community Tracking and Watch List. These are community types that have been described as unusual, uncommon, of limited extent or encountered infrequently. They also include community types that have been described by vegetation experts as in decline or threatened. All are considered as significant at the provincial scale. Some may be nationally or globally significant. Within a given study area, there may be communities of provincial or greater significance that have not yet been included on the tracking and watch lists, as the lists are currently in the developmental stages.

The tracking and watch lists have been developed through a review process, and continue to be refined as new community types are proposed and as more information is gathered on types already on the list.

Through the course of a study, **locally significant plant communities** might be documented. Locally significant plant communities contribute significantly to local biodiversity. These may be communities at the edge of their known distribution, an extension of the known range of a specific community, mature or old growth forests or communities that are rare or uncommon in the local context. All of these should be considered special plant communities.

A special plant community **may or may not** include individual plant **species** of conservation concern. It is the grouping, **the community itself**, that is the element of interest. Plant communities are “not just containers for species but complex, dynamic systems in themselves" (Anderson *et al*. 1999).

A **special plant community** is:

- on the tracking or watch list, and hence already considered significant at the provincial or greater level
- a community that is unusual, uncommon or of limited extent and so could be considered for addition to the tracking or watch list
- one that is locally significant

A special plant community may be a terrestrial, wetland or aquatic community, or other.

There are many different kinds of plant communities, ranging from those that are natural, to those that are dominated by cultivated species. Only natural and near-natural or some modified/managed communities are considered of conservation concern from the plant community perspective. For example, communities that have formed in roadside ditches or those that have been planted or substantively altered by cultivation may well provide habitat for **species** of conservation concern, and hence be significant for other reasons, but they would **not** be considered **special communities**.

2. Sampling the community

Work to characterise the vegetation of a study area generally concentrates on **matrix** and **large patch** communities as the representative types that are common or spread over large areas. **Small patch communities** are often overlooked specifically because they are not extensive enough to be considered representative. However, small patch communities may add significantly to the biodiversity of a site.

Documenting small patch plant communities is important in documenting the biodiversity of a study area. Both as elements of biodiversity themselves that may be rare or unusual, and as specialised habitats that potentially harbour species not yet documented. Although special plant communities will often be small patch communities, some communities that form large patches or even matrix types in a particular study area would be considered special if they are rare in the provincial or greater context.

Matrix communities are widespread and cover large areas across the landscape. "**Large patch" communities** are less extensive and cover less of the landscape, but overall may still form large, uninterrupted patches. Together, matrix and large patch communities usually make up the main, representative vegetation of an area.

Identifying and documenting special plant communities is in many ways a "special features" study, and is done differently than an inventory to document representative vegetation. It requires a thorough knowledge of the vegetation types typical of the study area, and the ability to recognize those that are in some way special. This requires a review of the available literature that covers both the study area and other areas that are reasonably similar.

Small patch communities form small, discrete areas, usually associated with specific, specialised habitats, such as cliff faces or saline seepages. They may "contain a disproportionately large percentage of the total flora, and also support a specific and restricted set of associated fauna (*e.g.* invertebrates or herpetofauna) dependent on specialized conditions" (Anderson *et al*. 1999).

Prior to fieldwork, the researcher should:

- Note any community types in the literature reviewed that the authors consider unusual, diverse, restricted etc.
- Note any community types on the ANHIC tracking list that might occur in the study area.
- Examine aerial photographs or Satellite imagery to identify potential locations of special communities.

During the field program, the researchers would attempt to locate occurrences of the special types identified through the literature review. They would also inspect areas identified through the examination of aerial photographs or Satellite imagery that look to be unusual or that may be small patch communities of interest.

If a community is located that may be of interest, it should be adequately sampled.

- The purpose of sampling a special plant community is to document the composition and condition of stands, as they are located. With this emphasis, a "relevé" approach is appropriate (for details on this approach see Mueller–Dombios and Ellenberg 1974).
- The size of each relevé will depend on the structure and size of the community type being sampled.
- The standards used in Alberta for forested sites are:
  - a 20 X 20 m plot to document species and cover value of trees
  - a 10 X 10 m plots for shrubs and understory species, nested within the larger plot (see AEP 1994 for additional information)
  - If there is a diverse non-vascular species layer, 1m x 1m nested relevés should be considered.
- Smaller plots may be used for grasslands or alpine communities, generally 5 X 5 m.
- A series of smaller plots along a transect may be appropriate for some community types.
- Plot shape should be tailored to the stand being sampled. For example a rectangular plot that follows the contour lines may be more appropriate than a square plot community on a hillside
- Sampling aquatic communities presents special challenges. Often a 5x5 m relevé or a series of smaller relevés (1x1 m) along a transect will work for areas near the shoreline, but a boat may be required for sampling of some less accessible aquatic plant communities.

Ideally, all known stands of each special community type should be sampled within the study area. This will allow compilation of data on the composition of the community throughout its known locations in the study area. In addition, for those types on or added to the tracking list, the sample data will be tied to the ANHIC database of element occurrences.

- Doing replicate relevés in large stands will be helpful in documenting their composition.
- Many occurrences of special communities will be too limited in extent to permit replicate sampling.
- For special communities that are large patch or matrix communities, it may be necessary to subjectively select a few representative stands for sampling.

3. Naming plant communities

Plant communities should be named using dominant and diagnostic species. Species within the same stratum should be separated by a hyphen (-), species in different strata separated by a slash (/). The name should be carefully chosen to include important species that identify the community, but not to be so all inclusive as to be unwieldy. The following additional guidelines are from Grossman et. al., 1998.

- species within the uppermost strata are named first, followed successively by species in the next lower strata
- species from the same strata are listed in order of dominance, constancy or indicator value
- species deemed important in the overall community type but not consistently present in each individual stand are enclosed in parenthesis
- the lowest number of species possible should be used in the name, however enough information needs to be included to help the reader have a clear picture of the community type being discussed.
- generally, there should be no more than six species in a name. This is only necessary for a community type that is very diverse, with even dominance and variable composition.

The field name given a plant community will reflect the information collected from the site being studied. It should reflect the species dominance, constancy and indicators as noted during the field study. During report write-up, a community type noted during the fieldwork should be critically assessed and grouped under community types already documented, when there is a clear fit or there are only minor differences. Any differences should, however, be noted. If no similar types are found in the literature, that too should be noted. Much work has been done to document Alberta's plant communities, but new types not yet documented will still be found. Field types should be related to documented types where possible, but should not be forced to fit those types.

4. Minimum information requirements

To document the occurrence of a special plant community, a minimum amount of information on the community composition and its location is required. Additional information is, of course, always welcomed.

- As exact a location of the plant community as possible, ideally a GPS reading supported by a polygon marked on an aerial photograph and a location on a map.
- Date and name of surveyor(s)
- Aspect, slope, moisture regime (e.g. xeric, mesic etc.) and drainage
- Whenever possible a full species list should be supplied including cover estimates. For species that are unknown or difficult to identify in the field, specimens should be collected and identification to the species level confirmed.
- The system used for cover estimates should be noted (e.g. percent cover, Braun-Blanquet cover abundance scale, Daubenmire cover scale or other)
- The type and size of plot used should be noted
- An estimate of the size of the occurrence (or a polygon mapped on an aerial photograph)
- A written description of the community is often helpful, including a discussion on appearance, disturbance, invasive species and any other management concerns.

5. Suggested Information

- The data sheets developed by Alberta Sustainable Resource Development (site description form and vegetation description form) could be used as the basis for documenting an occurrence of a special plant community.
- Soils information should also be collected when possible (a soil description form from Alberta Sustainable Resource Development is also available)

6. References Cited

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APPENDIX 5. DATA REPORTING FORMS

This appendix contains two data reporting forms:

(1) the **RARE NATIVE PLANT FORM**, and
(2) the **VERTEBRATE AND INVERTEBRATE REPORT FORM**.

These two forms can be used to document occurrences of plant and animal species. If used for an inventory project, these forms (or copies of them) should be submitted to the Alberta Natural Heritage Information Centre for their use.

RARE NATIVE PLANT REPORT FORM

Please enter all information available to you and attach a detailed sketch or map showing the location of the population.

SCIENTIFIC NAME: _____
COMMON NAME: _____
OBSERVER NAME, ADDRESS AND TELEPHONE NUMBER: _____
_____
_____
_____
OBSERVATION DATE(S): _____
PHOTOGRAPH TAKEN: Y / N
SPECIMEN COLLECTED: Y / N **COLLECTION NUMBER**: _____
IF YES, NAME HERBARIUM WHERE DEPOSITED: _____

LOCATION INFORMATION:
SITE NAME: _____
_____
TOPOGRAPHIC MAP NUMBER: _____
DIRECTIONS TO POPULATION (*include descriptions of landmarks and distances if possible*):
_____
_____
_____
ELEVATION (*Please do not use elevation from GPS unit*): _____ ft/m (*circle one*)

(*Complete one of the following and accompany with map or sketch*)
UTM EASTING: _____ UTM NORTHING: _____ GRID ZONE: _____
NORTH AMERICAN DATUM: 27 / 83 (*circle one*)

LEGAL: TWP: _____ RGE: _____ W:_____ M SECTION: ____ LSD: _____

LATITUDE: _____ LONGITUDE: _____
Was the location determined using a GPS? Y / N

POPULATION INFORMATION (*include information on extent in cm^2/m^2 (circle one), number of individuals*):
_____
_____
_____
_____
PHENOLOGY (*based on average development phase of population--see over*):
____ vegetative; _____reproductive (*E.G. V6. R7 for a species with leaves fully unfolded and in full bloom*)
_____
_____
SITE/HABITAT DESCRIPTION (*include information on habitat [alpine, aquatic, cliff, forest, grassland, peatland], plant communities / dominant species / associated species / other rare species / substrate / soils / phenology of dominant species*):
_____
_____
_____
_____
ASPECT: _____SLOPE: _____ MOISTURE: _____
OWNERSHIP (*if known. Include name/address/phone number*): _____
_____
_____
CURRENT LAND USE: _____
_____
_____
HABITAT THREATS/MANAGEMENT CONCERNS: _____
_____
_____
_____

Return to: *Alberta Natural Heritage Information Centre, 2nd Floor, 9820 106 Street, Edmonton, AB T5K 2J6 (780) 427-5209. Thank You.*

Phenology Codes (after Dierschke, 1972)

VEGETATIVE		*REPRODUCTIVE*
Deciduous Tree or Shrub	*Conifer*	
0 Closed Bud	0 Closed Bud	0 Without blossom buds
1 Buds with green tips	1 Swollen bud	1 Blossom buds recognizable
2 Green leaf out but not unfolded	2 Split bud	2 Blossom buds strongly swollen
3 Leaf unfolding up to 25%	3 Shoot capped	3 Shortly before flowering
4 Leaf unfolding up to 50%	4 Shoot elongate	4 Beginning flowering
5 Leaf unfolding up to 75%	5 Shoot full length, lighter green	5 In bloom up to 25%
6 Full leaf unfolding	6 Shoot mature, equally green	6 In bloom up to 50%
7 First leaves turned yellow		7 Full bloom
8 Leaf yellowing up to 50%		8 Fading
9 Leaf yellowing over 50%		9 Completely faded
10 Bare		10 Bearing green fruit
		11 Bearing ripe fruit
		12 Bearing overripe fruit
		13 Fruit or seed dispersal
Herbs		
0 Without shoots above ground		0 Without blossom buds
1 Shoots without unfolded leaves		1 Blossom buds recognizable
2 First leaf unfolds		2 Blossom buds strongly swollen
3 2 or 3 leaves unfolded		3 Shortly before flowering
4 Several leaves unfolded		4 Beginning bloom
5 Almost all leaves unfolded		5 Up to 25% in blossom
6 Plant fully developed		6 Up to 50% in blossom
7 Stem and/or first leaves fading		7 Full bloom
8 Yellowing up to 50%		8 Fading
9 Yellowing over 50%		9 Completely faded
10 Dead		10 Bearing green fruit
		11 Bearing ripe fruit
		12 Bearing overripe fruit
		13 Fruit or seed dispersal
Grasses		
0 Without shoots above ground		0 Without recognizable inflorescence
1 Shoots without unfolded leaves		1 Inflorescence recognizable, closed
2 First leaf unfolded		2 Inflorescence partly visible
3 2 or 3 leaves unfolded		3 Inflorescence fully visible, not unfolded
4 Beginning development of blades of grass		4 Inflorescence unfolded
5 Blades partly formed		5 First blooms pollenizing
6 Plant fully developed		6 Up to 50% pollenized
7 Blades and/or first leaves turning yellow		7 Full bloom
8 Yellowing up to 50%		8 Fading
9 Yellowing over 50%		9 Fully faded
10 Dead		10 Bearing fruit
		11 Fruit or seed dispersal
Ferns		
0 Without shoots above ground		0 sori absent
1 Rolled fronds above ground		1 sori green, forming
2 First frond unfolds		2 sori mature, darker, drier
3 2 or 3 fronds unfold		3 sori depressing, strobili forming in lycopodium
4 Several fronds unfolded		
5 Almost all fronds unfolded		
6 Plant fully developed		
7 First fronds fading		
8 Yellowing up to 50%		
9 Yellowing over 50%		
10 Dead		

VERTEBRATE & INVERTEBRATE REPORT FORM

Please enter all information available to you and include a sketch or map showing the location of the species or population.
Use the form for reporting occurrences of tracked animal species only.

SURVEY DATE: (yyyy) _____ (mm) _____(dd) _____

SCIENTIFIC NAME: _____ **COMMON NAME**: _____

OBSERVER(S): _____

PHONE: (_____) _____ **PHONE: (_____)** _____

ADDRESS: _____

E-MAIL: _____

LOCATION INFORMATION:

SITE NAME: _____

NTS MAPSHEET NUMBER: _____

DIRECTIONS TO ELEMENT OCCURRENCE (include descriptions of landmarks and distances if possible):

_____

_____

_____

PRECISION OF OCCURRENCE (choose one): S (<250 m radius) ____ M (<2.5 km radius) _____ G (<8 km radius) _____

ELEVATION (do not use elevation from GPS unit): _____ feet / meters (circle one)

(Complete **one** of the following three location types):

1. UTM EASTING: _____ UTM NORTHING: _____ GRID ZONE: _____
2. LEGAL: LSD:_____ SECTION: _____ TWP: _____ RGE: _____ W: _____ Meridian
3. LATITUDE: _____ LONGITUDE: _____

NORTH AMERICAN DATUM USED: 27 / 83 (circle one) (***datum number is found below the contour interval scale on NTS map)***

WAS THE LOCATION DETERMINED USING A GPS UNIT? Y ____ N ____

NUMBER / AGE OF INDIVIDUALS (estimated): # adult males ____ # juvenile / immature males ____ # adult females _____

juvenile / immature females _____ # unknown adults _____ # unknown juveniles / immatures _____

SIZE OF AREA OCCUPIED: _____ acres / hectares / sq. meters (circle one)

EVIDENCE OF BREEDING: none _____ courtship behavior _____ mating observed _____ occupied nest _____

eggs present ___ young present ___ larva / pupa / tenerals found _____ other _____

HABITAT FEATURE: nest ___ hibernaculum ___ colony ___ den ____ breeding pond ____ other_____

SPECIMEN COLLECTED: Y____ N ____ **COLLECTION DATE**: (yyyy) _____ (mm) _____ (dd) _____

COLLECTOR NAME: _____ **FIELD COLLECTION NUMBER**: _____

AGE : adult _____ **immature** _____ **SEX: male** _____ **female** _____

LOCATION WHERE SPECIMEN DEPOSITED: _____

PHOTOS TAKEN: Y_____ N ____ **IF YES, WHERE ARE THE PHOTOS:** _____

ID DETERMINATION (list references used or expert consulted; comment on any ID concerns)

_____

over…

SITE / HABITAT DESCRIPTION
(e.g., water conditions, water quality, dominant plants, landform type, etc.) _____

ASPECT: _____ **SLOPE (%)**: _____ **MOISTURE** (e.g., wet, dry, ephemeral): _____

LAND OWNERSHIP (If known, include name/address/phone number):_____

CURRENT LAND USE:_____

HABITAT THREATS / MANAGEMENT CONCERNS: _____

FURTHER COMMENTS (e.g., weather conditions--wind, cloud cover, precipitation, temperature; species ID questions; hand-drawn location maps; etc.)