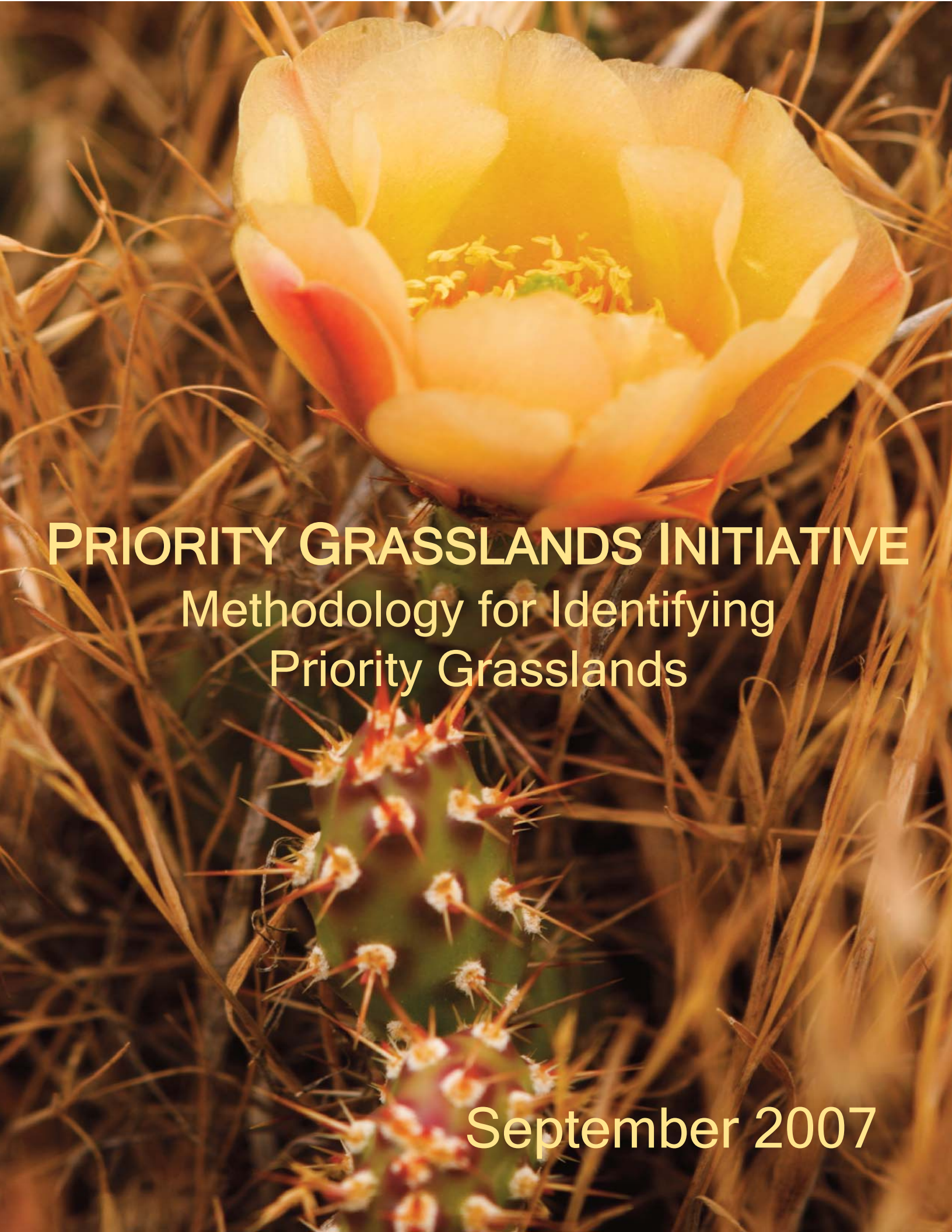

Priority Grasslands Initiative

Methodology for Identifying Priority Grasslands

September 2007

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Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

The Priority Grasslands Initiative was initiated in 2006 due to a clear recognition that the lack of knowledge, data and access to grassland information in the province poses a significant threat to grasslands in British Columbia. This initiative will delineate priority grasslands for each of the 10 grassland regions of the province, the highest priority going to grassland ecosystems that have the greatest ecological importance and are most at risk to loss and degradation. This document provides a comprehensive methodology that details the process and criteria that will be applied to identify, delineate and rank priority grasslands. The grassland values incorporated into the priority grasslands analysis include: rare and threatened grassland ecosystems, species at risk habitats, livestock and wildlife forage, recreational areas and impacts, and archaeological sites. In addition, grasslands will be assessed and ranked based on regional connectivity and contiguity, regional and provincial representation of ecosystems and threat from development and agricultural intensification.

This initiative will provide regional planners, local decision-makers, First Nations and the province with an effective scientific basis and rational for grassland conservation. The data, maps and other information generated by this process will be incorporated, where appropriate, into land use planning and decision-making processes around the province. The goal is to empower government planners and decision-makers to promote and ensure a strategic and effective approach to conservation and stewardship of BC's remaining grasslands.

The Priority Grasslands Initiative will form a basis for regional and provincial grassland status reporting that will enable regular monitoring of British Columbia's grassland and status reporting for each major region.

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Gaming Policy and Enforcement Branch

Integrated Land Management Bureau

Habitat Conservation Trust Fund

The Real Estate Foundation of British Columbia

Nature Conservancy Canada

Tula Foundation

Bullitt Foundation

Western Economic Diversification Canada / Diversification de l'économie de l'Ouest Canada

Introduction

The Priority Grasslands Initiative was launched in 2006 due to a clear recognition that the lack of knowledge, data and access to grassland information in the province poses a significant threat to grasslands in British Columbia. In many cases, grasslands are being lost to development or to alternate land uses simply because their values are unknown, undefined or unavailable. Appropriate and accessible information about grasslands and associated values is essential to achieving effective conservation and stewardship of British Columbia's grasslands.

This initiative will delineate priority grasslands for each of the 10 grassland regions of the province, the highest priority going to grassland ecosystems that have the greatest ecological importance and are most at risk to loss and degradation. The process of delineating high values in grasslands is a complex undertaking. This document provides a comprehensive methodology that details the process and the criteria that will be applied to identify, delineate and rank priority grasslands. This process includes GIS mapping and analysis but also the integration of knowledge from top-ranking local and provincial grassland experts that have on-the-ground information regarding species at risk, habitat condition and past and current land use. The compiled information will be assimilated into the analysis to assist with identification, delineation and ranking of priority grassland sites. By identifying, delineating and ranking grasslands in each region according to their ecological and economic values—as well as level of threat—the GCC will inform and extend information to local, regional, provincial and First Nations' governments. The Priority Grasslands Initiative will fill a data and information gap and will yield the necessary tools to achieve effective land use planning and decision-making within British Columbia's grassland landscape. One of the most significant results of this process will be status reporting for grasslands in each major region.

The procedures contained within this methodology were developed by GCC staff in collaboration with a provincial technical advisory committee (PTAC), and subsequently endorsed by its 25 members representing a broad spectrum of stakeholders (See list in Appendix 1).

This document is divided into two main sections: Methodology Overview and Methodology Stages. The Methodology Overview gives brief descriptions of each of the 11 stages of the methodology to explain the rationale behind each part of the analysis. This section also describes the role of regional committees and the geographic extent of the analyses. In the Methodology Stages section, details regarding the process and criteria for determining and presenting priority grassland areas are presented. Details include procedure and criteria for identifying high value grasslands using GIS information and expert input, incorporating negative recreational impacts, assessing regional connectivity and contiguity, integrating GIS analyses on grassland representation and threats, reviewing of priority grasslands by regional committees, and developing of extension products.

The summary of this methodology document presents future steps, including how information generated by the Priority Grasslands Initiative will be extended to governments and communities around the province through the Planning for Change and other initiatives.

Methodology Overview

The Priority Grasslands Initiative methodology has 11 key stages. Flexibility exists for the order in which these stages are addressed and there is overlap and ties between some stages to ensure that, whenever possible, activity completed in one may address components of another. The final outcome of this initiative will be priority grassland levels, which are determined through a series of key stages using a combination of in-house data analysis and out-of-house expert input.

Regional committees established for each grassland region and comprised of local experts and stakeholders will direct the GCC towards appropriate people for expert input, suggest modifications to the analysis to reflect regional knowledge or data availability and review priority grassland products. The GCC will establish the regional committees in conjunction with advice from the PTAC.

The initiative will focus on the 10 grassland regions identified by the GCC (GCC 2004a) which closely follow the ecosection boundaries of British Columbia's Ecoregion Classification System (Figure 1). Ecosections are areas with similar biogeoclimatic criteria such as climate, physiography, soil and vegetation (Demarchi 1996). Analysis will be conducted independently for each of the 10 regions. The following stages will guide the implementation of the priority grasslands methodology:

1. Initial GIS data gathering, preparation and analysis
2. Expert input
3. Assessment of recreational impacts
4. High value grasslands categories and ranking
5. Verification and field assessment
6. Regional connectivity and contiguity analysis
7. Representation analysis
8. Threat analyses
9. Assignment of priority levels
10. Review by regional committee
11. Digital data and portfolios

The initial procedure involves identifying and delineating high value grassland areas using existing Geographic Information System (GIS) data. Grassland values incorporated into the priority grasslands analysis include rare and threatened grassland ecosystems, species at risk habitats, livestock and wildlife forage, recreational areas and impacts and archaeological sites. Expert input will supplement the initial GIS mapping and be integrated into the GIS data layers. The goal is to engage key interest groups and individuals in the process to determine high value areas including: government agencies, ranching and other industries, landowners, urban developers and conservation groups.

Once the mapping of the various grassland values—represented as layers in the GIS—is complete, a classification and ranking scheme will be used to assign each grassland area with its combinations of grasslands values into one of several categories, each of which has a rank relating to that category's relative importance for grasslands conservation and stewardship. However, high value grassland areas that are severely degraded by recreational activities are ineligible and are not assigned a category. The rank associated with each category is part of the input for the final analysis stage – priority level assignment. Areas for some grassland values may

require further verification through field assessments, especially in cases when the accuracy of information is uncertain (e.g. areas identified through expert input).

Prior to assigning priority grasslands status to the higher grassland categories, two other stages are required: a regional connectivity and contiguity assessment and a representation analysis. These two stages will ensure that grassland areas have been assigned to the most appropriate grassland category. The connectivity and contiguity assessment includes determining if areas within lower-ranked grassland categories need to be labelled as priority grasslands in order to ensure species persistence within the higher-ranked grasslands. Representation analysis will assess if the full diversity of grassland ecosystems and seral stages are represented in the higher grassland categories.

One of the final stages includes assigning priority grassland levels based on the combination of grassland categories and threat or risk. The threat/risk assessment involves analyzing the potential for intensive agriculture and urban development threats. It identifies grassland areas at high risk of conversion. The final two stages focus on the regional committee and final products. Once the final maps of the priority grasslands areas are drafted, they are reviewed and approved by the regional committee. Following approval from the committee, regional maps and portfolios are developed. All digital products will be stored in an on-line data warehouse.

The 11 stages will be completed for each grassland region: Northern Boreal Mountains Plateaus, Muskwa Foothills-Liard Highland, Peace, Bulkley Basin, Cariboo-Chilcotin, Thompson-Pavillion, South Thompson Upland, East Kootenay Trench, Okanagan and East Vancouver Island-Gulf Islands (Figure 1). If necessary, adjustments to the methodology will be made to accommodate regional differences due to the varying degree of available data and knowledge for the province's diverse grassland ecosystems. These adjustments, if necessary, will be made by the GCC, in consultation with the respective regional committee.

The next section expands on each of the above stages, as well as, each of the grassland value groups.

Figure 1. Grassland Regions of British Columbia.

Methodology Stages

Stage 1: Initial GIS Data Gathering, Preparation and Analysis

It is first necessary to gather and assess the quality of all existing data relevant to the Priority Grasslands Initiative. GIS data availability and quality varies throughout regions of the province. Before any priority grasslands GIS analysis can be completed, an inventory of available data is conducted, as well as an assessment of how this data can be effectively used for priority grassland analysis. Data will be reviewed for availability, quality, usability and currency.

The initial GIS data gathering, preparation and analysis is described below for each of the grassland value groups. The following sub-sections describe the Stage 1 procedure for each value group.

Important Ecosystems

Important ecosystems are defined as rare and threatened grassland ecosystem elements: plant community types that occur on ecologically distinct sites. The Biogeoclimatic Ecosystem Classification Program in British Columbia (BEC) is the basis for determining plant community types (i.e. plant association or sub-associations) and ecological distinct sites (i.e. site series or site types). A combination of rarity and threat ranking—discussed further in the next section—is used to assign a level of conservation priority.

Provincial mapping of the BEC is only available to the subzone variant level, which is one level coarser than required for this methodology. Therefore, the assignment of conservation priority status and delineation of important ecosystems will fall mostly to expert input (Stage 2). Existing data collected in preparation for Stage 2 will include: GCC provincial grasslands, subzone variant BEC mapping, Vegetation Resources Inventory (VRI), Sensitive Ecosystem Inventories (SEI) and aerial photography. With the exception of the GCC grasslands base layer, the data layers will be obtained from the British Columbia Land and Resources Data Warehouse (LRDW), which is the government's central data repository. The GCC grasslands base layer —containing this initiative's "grassland areas" polygons —was compiled by the GCC in 2004 (GCC 2004a).

Species at Risk

The objective of this values group is to ensure the long-term persistence of all constituent grassland-associated species-at-risk and provide for the mix of seral plant communities and disturbances needed to maintain a variety of grassland-associated species. This value group will include important habitat and suitable habitat for a wide range of grassland dependent species at risk. Habitat definitions, determined using a combination of species occurrence records, habitat modeling and expert input, are provided below.

Species at risk are defined by the British Columbia Conservation Data Centre (CDC) as species that depend on a specific ecosystem (e.g. grasslands) for part of their life cycle and are at risk to local extinction (CDC 2007). Grassland species selected for analysis include eight mammal, 13 bird, five reptile, two amphibian, 116 vascular plant, three non-vascular plant and 13 invertebrate species (listed in Appendix 2). This list was developed by querying the online BC Species and

Ecosystems Explorer to identify red, blue and identified wildlife species that breed in the Bunchgrass Zone of the BEC (CDC 2007). Separate queries were performed for the Ponderosa Pine Zone and Interior Douglas-fir Zone, but the queries did not identify any additional grassland dependent species.

The list was evaluated by CDC staff and a regional biologist on the PTAC with species at risk expertise. The CDC identified nine additional plants that occur in the Bunchgrass Zone for the analysis, as the data source for the BC Species and Ecosystems Explorer differs slightly from the CDC element occurrence database (i.e. internal CDC species at risk database). Discussions with John Surgenor, Wildlife Biologist with the Ministry of Environment on the PTAC eliminated 19 species from the list of vertebrate species (i.e. mammals, birds, reptiles and amphibians) because the species was no longer found in British Columbia (i.e. extirpated) or the species does not require grasslands to persist.

Species at risk records from the CDC and the Species Inventory Data System (SPI) will comprise the initial base information for records to determine both important habitat and suitable habitat under the Priority Grasslands Initiative.

The CDC treats many of the important habitat features as sensitive information; therefore, maps of the species occurrence records for the expert input stage will not portray sensitive habitat features.

a. Important Habitat

Important habitat is defined as an area surrounding a feature that is essential to a critical part of a species' life cycle (e.g. nest, den or hibernation site). The feature will vary by species depending on specific limiting factors such as breeding, rearing, staging, feeding, hibernating or wintering. For further details on the important habitat areas delineation procedure see the expert input stage (Stage 2).

b. Suitable Habitat

Suitable habitat is defined as areas required for individual species' survival throughout the year, including a species' persistence on the landscape; it does not include the areas already defined as important habitat. For clarification the following information details the compilation and presentation of the initial data. As these complex habitat definitions are the basis for the expert input stage, they require clear explanations.

i. Species Occurrence Records

As the occurrence of species at risk is a central component of the priority grasslands analysis, each area needs to be assessed for the presence of such species before experts are consulted. Using species at risk records, species are extracted from a GIS coverage then analyzed in association with the polygons in the grasslands base layer (GCC 2004a). The number of times a species is found in a particular grassland polygon is summarized and displayed as a frequency category. Maps produced for the development of suitable habitat in Stage 2 will incorporate these summaries to clearly show the frequency categories and species occurring in each grassland polygon.

ii. Habitat Modeling

Predictive habitat models are developed for seven species at risk to ensure that our experts have a clear sense of potential habitat (Table 1). The model is used for all grassland regions where the species occurs. The habitat models are created in Arc Macro Language (AML) to complement the limited amount of location records to aid the panel of experts. The seven selected species represent a variety of focal habitat types, which reflects their local importance to each grassland region. See Table 1 for further details.

John Surgenor supports the models as appropriate data sources and models—based on the best information available—to assist in guiding the identification of suitable habitat.

Models are developed using existing knowledge and information that would be most relevant for predictive habitat mapping; however, it should be noted that the models may not represent habitat used throughout the species' life cycle (Appendix 3 provides more detailed descriptions of the predictive habitat models). To further assist our panel of experts, products produced for the expert input stage include maps of each model's results.

Table 1. Summary of Predictive Habitat Models for Species at Risk.

Species	**General Model Criteria**	**Species at Risk Status**		**Justification for Modeling Species**
		BC	**COSEWIC**	
American badger	Soils, proximity to water, open grasslands and slope	Red	Endangered	Badger burrows used by other species such as Burrowing owls and Gopher snakes
Great basin spadefoot toad	Small ephemeral ponds, biogeoclimatic zones and slope	Blue	Threatened	Representative species for species dependent on ephemeral water sources and friable soils
Screech owl	Aspen or Cottonwood stands based on riparian suitability and age	Red	Endangered	Indicator of healthy riparian ecosystems
Lewis's woodpecker	Aspen or Cottonwood stands based on riparian suitability and age	Red	Special Concern	Indicator of healthy riparian ecosystems
Western rattlesnake	Steep, rocky, warm and hot aspects (i.e. hibernacula)	Blue	Threatened	Requires grasslands
Sharp-tailed grouse	Riparian/moister shrubs habitats with moderate to gentle slopes	Blue	N/A	Requires grasslands
Burrowing owl	Lower elevation flatter open grasslands	Red	Endangered	Requires grasslands

Ranching: Livestock Spring Forage

Incorporating the economic importance of grasslands to ranching into the Priority Grasslands Initiative is a crucial component of the project. The use of a livestock spring forage GIS model clearly shows the importance of grasslands areas that can provide early access for domestic livestock to range forage in the spring, which reduces feeding costs and makes ranching operations more economically viable. Without spring ranges it is estimated that the additional cost to a rancher would be $35 per animal over a 15-day period.

To assess spring forage, a GIS analysis is conducted to identify flatter open grasslands that could be utilized efficiently by livestock. An economic value assessment was developed by Rick Tucker, Range Agrologist with the Ministry of Forests and Range to identify a monetary value of spring ranges to ranchers; these values have been applied to the GIS analysis to identify economic spring range value of grasslands.

More specifically, the analysis divides grasslands into ecosystem and temporal groupings (i.e. when plants are best suited for spring forage) and then selects the accessible (i.e. flatter) areas. The temporal groupings are primarily related to the BEC subzone variant (i.e. elevation), and are similar to the geographical extent to GCC's lower, middle and upper grasslands (GCC 2004b) (Table 2). Spring forage areas for the Thompson Nicola region must be less than 40 percent slope, as land beyond this gradient is less efficient for livestock grazing. During the expert input stage, experts will use this data to clearly identify appropriate BEC subzone variants and a slope gradient for the grassland region.

Table 2. Example of Livestock Spring Forage Groupings for the Thompson Nicola Region**.**

Grassland Groupings	Description	Use Period
Lower	Very Dry Hot Bunchgrass (BGxh2) and Very Dry Hot Ponderosa Pine (PPxh2)	April 15 to May 1
Middle	Very Dry Wet Bunchgrass (BGxw1)	May 1 to May 15
Upper	Very Dry Hot Interior Douglas-fir (IDFxh1a) and Dry Cold Interior Douglas-fir (IDFdk1a)	May 15 to May 30

Spring forage areas are also important forage areas for wild ungulate species (e.g. deer and bighorn sheep); however, because they use different grasslands habitats they are considered separately (see *Wildlife Habitat* below).

First Nations

First Nations have a long history of use and influence on British Columbia's grasslands. The values selected for analysis are based on archaeological sites, which are the most easily accessible data; therefore, the archeological information contained in the Remote Access to Archaeological Data (RAAD) database is the main source of GIS data for this value. RAAD is an on-line archeological database maintained by the Ministry of Tourism, Sport and the Arts (MTSA). Records relevant to First Nations values include historic places and archeological sites. Other First Nations values, such as traditional use areas, may be added to this value group but will have to be obtained from First Nations experts during Stage 2.

Recreation

Many grassland areas throughout the province are used for various forms of recreation, including off-road vehicle use, hunting, horseback riding, mountain biking and hiking. Since human value placed on specific recreational areas in grasslands is important, it is considered for determining priority grasslands; however, as there are cases where recreational use has severely degraded the grassland ecosystem beyond rehabilitation, grassland areas that have been damaged are also addressed in Stage 3 (Assessment of Recreational Impacts). To deal with the duality of grassland recreation, the initiative focuses on recreational areas that provide a positive human benefit in Stage 1 and severely degraded ecosystems in Stage 3.

The GIS data layers mapped for the expert input stage will include recreation feature inventory, provincial protected areas, invasive alien plant inventory treatment and monitoring data and protected area strategy Goal 2 areas. Goal 2 areas were identified during the 1990s and include special natural, cultural heritage and recreational features (Lewis 1994). Maps prepared for expert input will also feature landforms features such as eskers, kames and waterfalls.

Wildlife Habitat

Grasslands play a vital role in the survival of ungulates and waterfowl. As mentioned earlier, grasslands provide winter forage, early spring forage (at lower elevations) and habitat diversity for ungulates when they border adjacent forested lands. The provincial databases used for ungulates in this value group include winter range predictive models for Mule deer, Bighorn sheep and Moose. For waterfowl, wetlands and water bodies within grasslands provide important nesting and staging areas. The federal government database for assessing waterfowl habitat is the *Canada Land Inventory—Land Capability for Waterfowl*. Classes 4 and greater have a moderate to severe limitation to the production of waterfowl; therefore, only classes 1 to 3, including 3S and 3M, are used for this value group (Table 3). The chosen classes are identical to those used by Ducks Unlimited Canada for their conservation programs (Ducks Unlimited Canada 2005).

A final single GIS coverage, used in Stage 4, will portray all of the overlapping databases described above.

Table 3. Classes of the *Canada Land Inventory—Land Capability for Waterfowl* (Government of Canada 2007) used in the Wildlife Habitat Value Group.

Classes	Description
1	Lands in this class have no significant limitation to the production of waterfowl.
1S	Water areas in this special class are Class 1 areas that also serve as important migration stops.
2	Lands in this class have very slight limitations to the production of waterfowl.
2S	Water areas in this special class are Class 2 areas that also serve as important migration stops.
3	Lands in this class have slight limitations to the production of waterfowl.
3S	Water areas in this special class are Class 3 areas that also serve as important migration stops.
3M	Water areas in this special class may not be useful for waterfowl production, but are important as migration or wintering areas. This class has no subclasses.

Stage 2: Expert Input

The purpose of Stage 2 is for experts to provide input on and verify the data preparation and analysis results completed in Stage 1. Experts will include species at risk recovery team members, naturalists, First Nations, university faculty members, consultants and government staff. The following describes the Stage 2 procedure for each grassland value group.

Important Ecosystems

Expert opinion is required throughout the process of determining important ecosystems to help define the ecosystem elements and refine the criteria that will be used to distinguish individual element occurrences (i.e. populations) for each grassland region using the area of occupancy, range extent and number of occurrences of each ecosystem element to form the basis for determining rarity. Professional ecologists from the Ministry of Environment will determine the appropriate rarity class for each ecosystem element and ecologists at the CDC will verify their choices. Experts will also determine the severity and extent of the potential disturbances over the next 20 years. This determination will be used by the initiative to identify the rarity and threat to each ecosystem element, which can then be compared to each other to determine conservation priority. Experts will determine threats associated with each ecosystem element, which will then be compared to determine conservation priority. Ecosystem elements with mid seral plant communities may also be given a conservation priority based on their value for recruitment—through natural succession—to climax ecosystems.

Aerial photography, VRIs and when available, SEIs will all be used throughout this process to supplement expert knowledge; however if SEIs are unavailable, aerial photography and VRIs are to be used. Appendix 4 provides the complete procedure for ecosystem element and conservation priority determination.

Species at Risk

Expert input on species at risk is essential due to gaps in the existing knowledge information from the CDC. A group of selected species-specific experts will be consulted to review species sightings information and GIS models as well as to delineate known or potential species at risk habitat into core areas. Their focus will be on identifying additional species locations, delineating heavily utilized habitat areas, verifying areas around known locations and fine-tuning predictive GIS models, as well as identifying other habitat areas not reflected in the models or location data. Experts are to provide explicit details in order to determine whether new species sightings and habitat areas should be classified as important habitat; however, due to the sensitive nature of the data, maps will not portray important habitat areas identified during Stage 1. Results of the predictive habitat models may be used to help establish the boundaries of core areas; however, their limitations should be considered. Experts will provide justification for new areas delineated (e.g. known habitat area for a species based on field work experience or a suspected area that is likely to be important for the species based on known factors) and assign a reliability rating between 1 and 10—with 1 being lowest reliability and 10 being the highest—to each new species at risk area delineated. Additionally, the number of times an area is nominated by experts will strengthen the confidence in these new species at risk areas. These ratings will assist the GCC when making choices for suitable habitat areas.

The Priority Grasslands Initiative must define a single GIS layer to incorporate both expert input and Stage 1 information, as it will portray all of the species at risk locations and areas and will form the basis for delineating important habitat and suitable habitat. As mentioned in Stage 1, important habitat is an area surrounding a critical feature. The area surrounding the feature is to be sufficient in size to protect its function while it is in use and for future use if applicable. Once all of the important habitats are delineated, an important habitat GIS layer will be produced for Stage 4 (High Value Grasslands Categories and Ranking). For suitable habitat, the focus is on a species' survival throughout the year and its persistence on the landscape. Suitable habitat areas are delineated by taking into account the species occurrence records, the species frequency categories for each grassland polygon, the core areas delineated through expert input and their reliability rating and integrate knowledge of home range use and dispersal distances. The Priority Grasslands Initiative recognizes that the only way to ensure long-term species persistence of all constituent grassland-associated species at risk is to provide a mix of seral communities and disturbances needed to maintain a variety of grassland-associated species.

Once core areas have been selected, connectivity between these areas will be assessed. Connectivity is an important component for species persistence, especially in fragmented landscapes where a contiguous area is not feasible, as the establishment of corridors and linkages allow genetic flow for flora and fauna across the grassland landscape. Connectivity between priority grassland areas is to be assessed based on traveling suitability by species (e.g. barriers), fauna species' home range and dispersal distances and seed dispersal capabilities. NatureServe will be the primary source of information in regard to dispersal distances and barriers to movement.

Once all of the suitable habitats are delineated, a suitable habitat GIS layer will be produced for Stage 4 (High Value Grasslands Categories and Ranking). Each suitable habitat area will include a justification for its selection (e.g. key species captured, species at risk in the area, habitat and topographic types captured and regional significance). Species at risk habitat criteria for important habitat and suitable habitat set out in this methodology will evolve and improve as more is learned regarding species at risk habitats and types of information that experts can provide.

Ranching

As livestock spring forage is the value for this grassland value group, the appropriate BEC subzone variants associated with the grassland regions' lower, middle and upper grasslands will be determined through expert input with a professional range agrologist. The regional committee and the GCC will approve the grouping selected, including any minor modification to the model to better portray local circumstances (e.g. maximum slope at which cattle will graze). Additional ranching values may be considered if approved by the regional committee.

First Nations

Although, archaeological sites documented in RAAD are the primary source for this grassland value group, discussions will be held with tribal councils and individual bands to determine if other First Nations values in grasslands could be used for this initiative. As tribal councils are political organizations representing many of the individual bands that work on matters of common interest, discussions will focus on the preferred method of engagement for each member

band. Additional First Nations values may be considered in the determination of priority grassland areas, if approved by the regional committee. All of the data collected is to be compiled into one GIS coverage for use in Stage 4.

Recreation

Recorded recreation areas will be identified using a combination of existing mapped recreation inventories identified in Stage 1. Expert input is needed to identify new recreational areas and to provide context to existing and new recreational features (i.e. recreational uses for the area), as well as to identify grassland recreational areas that are severely degraded beyond rehabilitation. Experts include provincial government staff and may include recreationists (e.g. naturalists or organized recreation groups). The new recreational information, combined with areas identified in Stage 1, will comprise the recreation value group layer for Stage 4 (High Value Grasslands Categories and Ranking); however, a separate GIS layer of grassland areas severely degraded will be created for Stage 3.

Stage 3: Assessment of Recreational Impacts

Recreational use may severely impact grasslands beyond rehabilitation and must be integrated prior to the next stage. Severely impacted grasslands mean a condition whereas it is not physically possible or financially reasonable to restore the native grassland ecosystem. An example of severely impacted grasslands would be an area where usage has led to extensive erosion and the subsequent establishment of invasive species with no viable native seedbank. These areas are not eligible for high value ranking (Stage 4) and are to be relabeled accordingly; however, maps used in subsequent methodology stages will show these areas for reference only (e.g. Stage 6: Regional Connectivity and Contiguity Assessment).

Stage 4: High Value Grasslands Categories and Ranking

In this stage of the initiative, grassland areas will be assigned a category label based on the combined presence of grassland value groups (i.e. important ecosystems, species at risk, ranching, First Nations, recreation and wildlife habitat). The category labels are made up of two parts: a rank (number), which assigns the relative importance of a combination of grassland values and a type (letter), which provides qualitative information on how that rank was assigned.

The goal of this stage is to keep the process simple by having as few ranks as possible, but retain sufficient details of how a rank is assigned. Retaining the details of how a rank is assigned allows for the potential to make modifications to the ranking scheme at a later point in the priority mapping process if certain criteria are found to have undue influence on the number or nature of areas that receive a specific ranking. Figure 2 illustrates how categories are assigned to individual grassland areas (polygons in the GCC grasslands base layer) based on the types of grassland values (described above) contained in those areas. Table 4 provides descriptions of the criteria used in the diagram in Figure 2 and Table 5 summarizes formulas for each of the categories in Figure 2. The ranking scheme assigns ranks based on the importance of a value to grasslands conservation or vice versa. Important ecosystems and species at risk are given the highest ranking as these values are at the highest risk of disappearing. Likewise, ranching is an important

economic use of British Columbia's grasslands and is therefore given a high ranking. The other value groups (i.e. First Nations, recreation and wildlife habitat) are also important values of grasslands and are featured in the ranking scheme. The assigned ranks are used to assign priority levels in Stage 9.

A sensitivity analysis will be conducted throughout the process to evaluate the effect of parameter decisions (e.g. important ecosystem conservation priority 3 in high category versus moderate). A sensitivity analysis is used to determine how much an outcome depends on (or is sensitive to) a parameter setting used by a model (Crosetto and Tarantola 2001). By testing different scenarios that vary the parameter settings and evaluating the response, it is possible to determine how sensitive the model is to changes in assumptions.

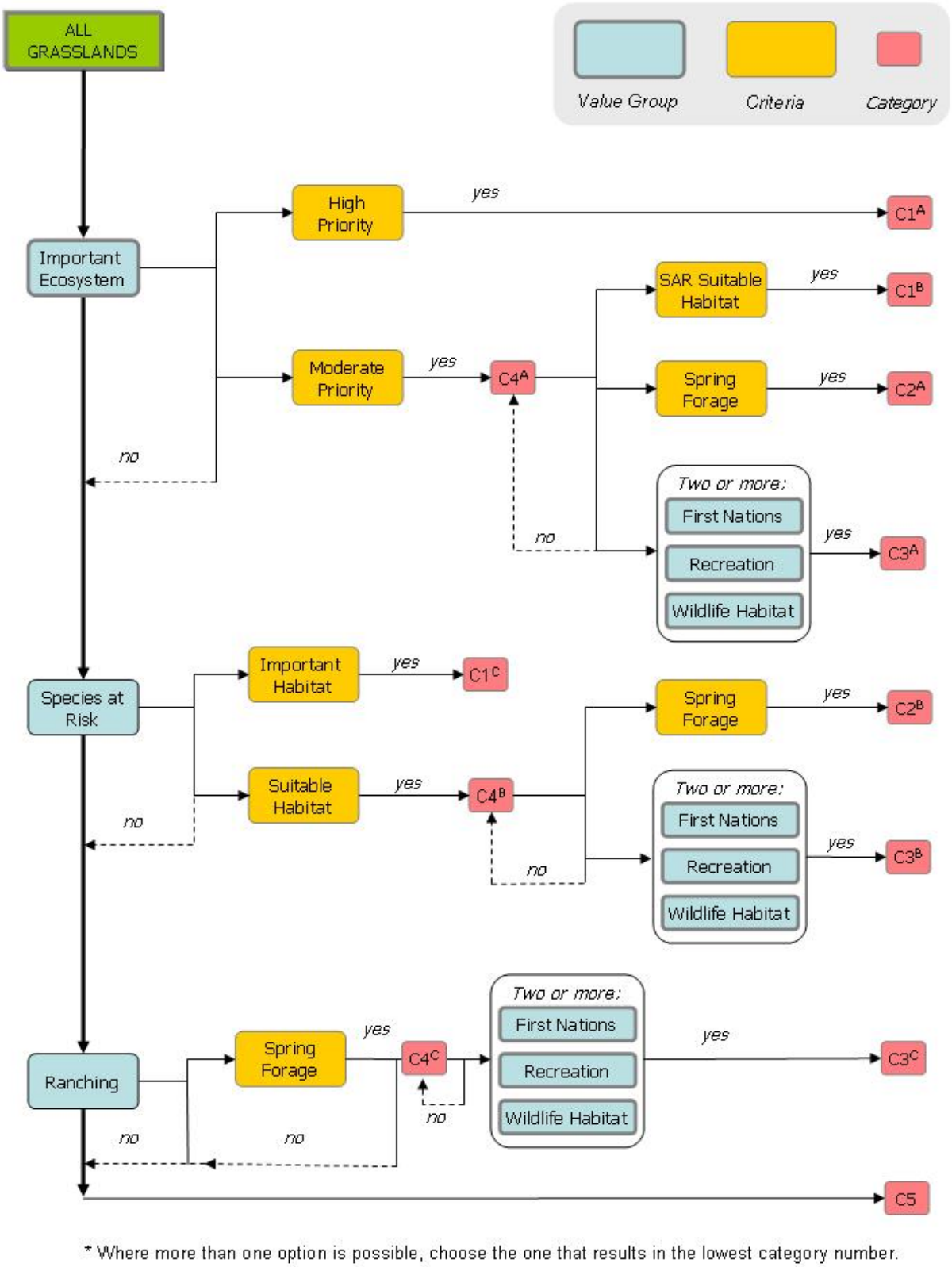

Figure 2. High Value Grasslands Categories and Ranking Procedure.

Table 4. Criteria Description for High Value Grasslands Ranking.

Value Group	Criteria	Description
Important Ecosystem	High Conservation Priority (1, 2, 1-P to 3-P)	See Appendix 4. High and moderate priority rankings are by the CDC's criteria, which are based on rarity and anticipated threat for the next 20 years (see Table 2 in Appendix 4). "P" is the abbreviation for "RP", Recruitment Priority. RP is assigned to an ecosystem with non-climax plant communities based on the ecosystems value for recruitment, through natural succession, to a climax ecosystem.
	Moderate Conservation Priority (3 to 5, 4-P, 5-P)	
Species at Risk	Important Habitat	Important habitat is an area surrounding a feature that is essential during a critical part of a species' life cycle (e.g. nest, den or hibernation site). It is comprised of available data, GIS analysis and expert input.
	Suitable Habitat	Suitable habitat is defined as areas required for individual species' survival throughout the year, including a species' persistence on the landscape. It is comprised of available data, GIS analysis and expert input.
Ranching	Spring Forage	Spring forage is grasslands associated BEC subzone variant groupings with a slope less than 40 %.
First Nations	-	This value group includes historic places and archaeological sites.
Recreation	-	This value group is a combination of government GIS databases and expert input.
Wildlife Habitat	-	This value group includes winter range predictive models for Mule deer, Bighorn sheep and Moose and land capability for waterfowl.

Table 5. Category Formulas for High Value Grasslands Ranking.

Category	Formulas
C1^{A}	Ecosystem Elements Conservation Priority 1, 2, 1-P, 2-P or 3-P
C1^{B}	Ecosystem Elements Conservation Priority 3, 4, 4-P, 5 or 5-P & Species at Risk Suitable Habitat
C1^{C}	Species at Risk Important Habitat
C2^{A}	Ecosystem Elements Conservation Priority 3, 4, 4-P, 5 or 5-P & Livestock Spring Forage
C2^{B}	Species at Risk Suitable Habitat & Livestock Spring Forage
C3^{A}	Ecosystem Elements Conservation Priority 3, 4, 4-P, 5 or 5-P & two or more high value occurrences from the following value groups: First Nations, Recreation or Wildlife Habitat.
C3^{B}	Species at Risk Suitable Habitat & two or more high value occurrences from the following value groups: First Nations, Recreation or Wildlife Habitat.
C3^{C}	Livestock Spring Forage & two or more high value occurrences from the following value groups: First Nations, Recreation or Wildlife Habitat.
C4^{A}	Ecosystem Elements Conservation Priority 3, 4, 4-P, 5 or 5-P
C4^{B}	Species at Risk Suitable Habitat
C4^{C}	Livestock Spring Forage
C5	Remaining Grasslands*

* Grasslands in this category include areas from the GCC grasslands base layer that do not meet any of the above criteria.

Stage 5: Verification and Field Assessment

Field assessments may be required to verify value group data. Whenever possible, verification will be conducted for the high value grassland areas, which may be done when the accuracy of data is uncertain, especially in regard to value groups with an expert input component (e.g. important ecosystems). The ability to perform field assessments will depend on available funding. The field methodology describes two methods for data collection: detailed ground inspection plots and visual inspection plots, which are primarily based on the Field Manual for Describing Terrestrial Ecosystems (MOE & MOF 1998). Appendix 5 provides detailed information on the field assessment procedure.

Stage 6: Regional Connectivity and Contiguity Assessment

Contiguous and connected areas of suitable habitat are required for healthy species populations[1]. This is especially true in fragmented landscapes. The goal of the connectivity assessment is to allow unencumbered species movement through the establishment of sustainable corridors and linkages among ecosystems, both within and between priority areas. As for the contiguity analysis, its goal is to ensure that contiguous grassland landscapes are as large and intact as necessary and minimize fragmentation[2] by the application of appropriate conservation, land use planning and management tools.

The Priority Grasslands Initiative contiguity and connectivity assessments focus on seven focal species at risk (those species selected for habitat modelling); however, other species with wide-ranging or specialized habitat requirements may be considered. To meet the goals for connectivity and contiguity, mapped areas of high category ranks (i.e. C1, C2 and C3) will require visual assessment and spatial analysis using the GIS. The Priority Grasslands Initiative's goal for contiguity is to extend and buffer small isolated high ranked areas with suitable lower ranked areas. Small isolated areas may be inadequate for the needs of one or many grasslands species of interest if left alone, but may be highly suitable areas if extended with lower ranked areas. Small isolated areas will retain their high rank in the high value grassland maps; however, efforts should focus on adding lower ranked areas to small isolated high ranked areas—especially if their values are similar—to create areas of sufficient size to meet a local focal grasslands species' living requirements.

The Priority Grasslands Initiative's goal for connectivity is to establish corridors and linkages to allow for the movement of flora and fauna within the grassland region. Assessment of connectivity is evaluated on the following criteria: traveling suitability by species (e.g. presence of barriers), fauna species' home range and dispersal distances, and seed dispersal capabilities. NatureServe is the primary source of information for dispersal distances and barriers to movement.

Lower category rank areas (i.e. < C3) identified in either the contiguity or connectivity assessment—as important extensions or corridors for higher ranked areas—will be further qualified with the category rank of the high ranked area(s) that it extends or connects. This will be

[1] For a definition of connectivity and contiguity with respect to habitat, please see Appendix 4.
[2] For a definition of habitat fragmentation, please see Appendix 4.

done by adding information pertaining to the rank(s) of the area(s) that it connects or extends within a separate field in the GIS database.

Stage 7: Representation Analysis

The goal of the GIS representation analysis is to ensure all principal native grassland ecosystems and seral stages are represented in priority grasslands, with emphasis given to rare ecosystems and late seral plant communities[3]. The analysis consists of comparing the high category ranks (i.e. C1, C2 and C3) to the GCC grasslands base layer based on a matrix of BEC subzone variant, aspect, slope and primary vegetation (Appendix 6). The matrix was developed as a surrogate to grassland classification due to the unavailability of a spatially referenced classification scheme. The proportions (%) of each combination in the matrix for both layers—high category ranks and grasslands base layer—are compared and if any high category rank combinations are missing or greatly lower than those in the grasslands base layer, areas from the grasslands base layer in lower ranks may be added to the higher ranked areas to correct these deficiencies.

If available for the grassland region, Predictive Ecosystem Mapping (PEM) or Terrestrial Ecosystem Mapping (TEM) data will supplement the assessment of representation, with TEM taking preference.

Stage 8: Threat Analyses

GIS predictive threat analyses are conducted for urban and intensive agriculture developments to assign priority levels in Stage 9. Both analyses compile several GIS databases to assess the risks of grassland conversion. Urban development risk is determined using the following GIS databases: GCC grasslands base layer, Agricultural Land Reserve boundaries, municipal boundaries, slope and land ownership. Intensive agricultural development risk is determined using the following GIS databases: GCC grasslands base layer, Agricultural Land Reserve boundaries, *Canada Land Inventory—Soil Capability for Agricultural*, slope and water.

All GIS data is merged together using an overlay process and grassland polygons are classified into risk categories using a matrix. Appendix 7 provides extensive details on the analyses and procedures.

Modification to procedures may be required due to the variety of agriculture surveys and GIS information that exist throughout the province and any modifications must be reviewed by the regional committee. In addition, as major threats to grasslands may differ from one grassland region to another, the regional committee may choose or develop a more appropriate threat analysis (e.g. forest encroachment).

[3] Rare ecosystems and late seral plant communities are important as they represent components most at risk of disappearing. See Appendix 4 for further details.

Stage 9: Assignment of Priority Levels

With delineated and verified high value grasslands assigned to appropriate categories, the next step is to assign the level of priority, which are based on a combination of an area's category rank (Stage 4) and threat (Stage 8). Table 6 shows the seven levels of priority grasslands, which represent a raking of the most important grasslands to conserve.

Table 6. Priority Grassland Levels.

Category Rank* **(Stage 4)**	**Risk (Stage 8)**		
	High	**Moderate**	**Low**
• High priority important ecosystems ($C1^A$) • Moderate priority important ecosystems & species at risk suitable habitat ($C1^B$) • Species at risk important habitat ($C1^C$)	**1**	**2**	**2**
• Livestock spring forage & moderate priority important ecosystems ($C2^A$) • Livestock spring forage & species at risk suitable habitat ($C2^B$)	**2**	**3**	**3**
• Moderate priority important ecosystems & two of First Nations, recreation or wildlife habitat ($C3^A$) • Species at risk suitable habitat & two of First Nations, recreation or wildlife habitat ($C3^B$) • Livestock spring forage & two of First Nations, recreation or wildlife habitat ($C3^C$)	**3**	**4**	**5**
• Moderate priority important ecosystem($C4^A$) • Species at risk suitable habitat ($C4^B$) • Livestock spring forage ($C4^C$)	**5**	**5**	**6**
• Remaining grasslands (C5)	**6**	**6**	**7**

Stage 10: Review by Regional Committee

A final draft of the priority grassland results will be presented to the regional committee, and will include regional maps with ranked priority grassland polygons, rationale for priority ranking and draft portfolios for priority grassland selections or polygons. The regional committee will review and provide feedback on the priority sites and selection. The committee is tasked to provide final approval for the priority grasslands delineation and ranking. In addition, the committee's expertise will guide the final production of regional portfolios and future extension to governments and First Nations.

Stage 11: Digital Data and Portfolios

Extension of the priority grasslands information and results is essential. The final stage describes the compilation and distribution of resulting products, including GIS coverages and attributes and

portfolios. The two types of final products that will be developed for extension and distribution purposes are:

- digital GIS coverage of priority grasslands and Microsoft Access database for data entry and tracking of priority grassland attributes; and
- site portfolio documents describing each priority grassland site or a group of sites (i.e. polygons) (Appendix 9) including maps at 1:20,000 scale depicting priority grassland areas, their regional significance and priority level (Figure 3) and regional portfolio documents providing a regional synopsis (Appendix 10) including maps at 1:100,000 scale (Figure 4).

Digital Products

Priority grasslands are spatially mapped in a GIS environment to facilitate data analyses, but this also allows easy access to a wealth of data. The following describes the development of the digital product.

Within the GIS databases, a key identifier will allow linking of priority grassland attribute data to each mapped priority grassland polygon. The development of a variety of map projections will allow easy transfer and usability of information to the end user, while also minimizing the work of the user to convert data to their required format.

The priority grassland database developed in Microsoft Access will capture all characteristics and rationale for selection of each priority site. The database was designed based on information contained within site record guidelines described below. Database records are linked directly to each mapped priority grassland polygon to allow the automatic generation of portfolio reports through report scripts contained within the database.

The provincial government's GIS data libraries as well as the GCC website[4] will house the digital data for the Priority Grassland Initiative. The uploading of source information to other GIS or web mapping applications will make the data accessible for a variety of applications or user groups. Other organizations or web applications that will include priority grassland data include:

- CDC site record database (http://www.env.gov.bc.ca/cdc/);
- LRDW and iMapBC web mapping application (http://maps.gov.bc.ca);
- Kamloops –South Thompson Sustainable Community Atlas (http://research.tru.ca/kstcmp/atlas.html); and
- Sustainable Planning for the Okanagan Environment (spOKe) (http://spoke.pyr.ec.gc.ca/).

Portfolios and Maps

In order to standardize the way priority grasslands are described and reported, the priority grassland portfolios reflect the attributes used in the site record guidelines established by NatureServe (NatureServe 2007), which provide a consistent methodology for presenting and describing scientific and ecological site information. Benefits of this reporting method allow easy

[4] http://www.bcgrasslands.org/projects/conservation/priorityinitiative.htm

transfer of priority grassland spatial data and attributes into the CDC database, which is accessible by numerous government and non-government agencies. The CDC is part of an international network of natural heritage programs that adhere to NatureServe standards and protocols; detailed descriptions of the site record guideline attributes can be found in Appendix 8. The data generated by the priority grasslands analysis will form the basis for grasslands status reporting.

Each priority grassland polygon or grouping of priority grassland polygons will be mapped on 11'' x 17'' paper sheet at a scale of 1:20,000 scale (Figure 3). Information depicted on each map will include a priority grassland boundary, Agriculture Land Reserve boundaries, municipal or regional district boundaries, biogeoclimatic zones and base mapping features such as roads, contours, water bodies and feature names. Priority grassland site specific information will be featured on the map, as well as statistics for grasslands in the region.

The production of regional priority grassland strategy maps—at 1:100,000 scale—illustrates where each priority area is and portray links and adjacencies to other priority areas as well as government jurisdictions they fall under (Figure 4).

Individual priority site portfolio documents will be developed from priority site information entered into a database. Key components of the document will contain statistics for each site, description and significance of the site, biodiversity, threats and management or conservation recommendations. A sample of the document can be found in Appendix 9.

Regional strategy maps, site portfolios maps and documents will be compiled into a single priority grassland strategy document for each grassland region.

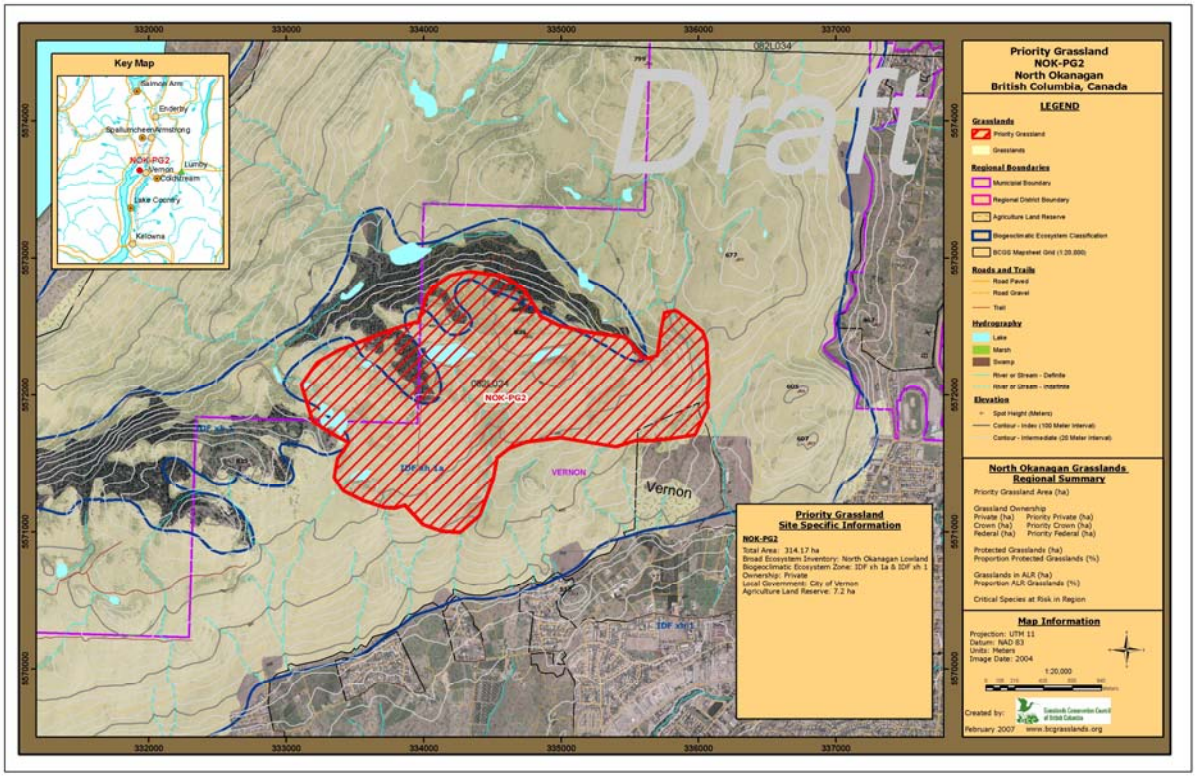

Figure 3. Sample Priority Portfolio Map for the North Okanagan.

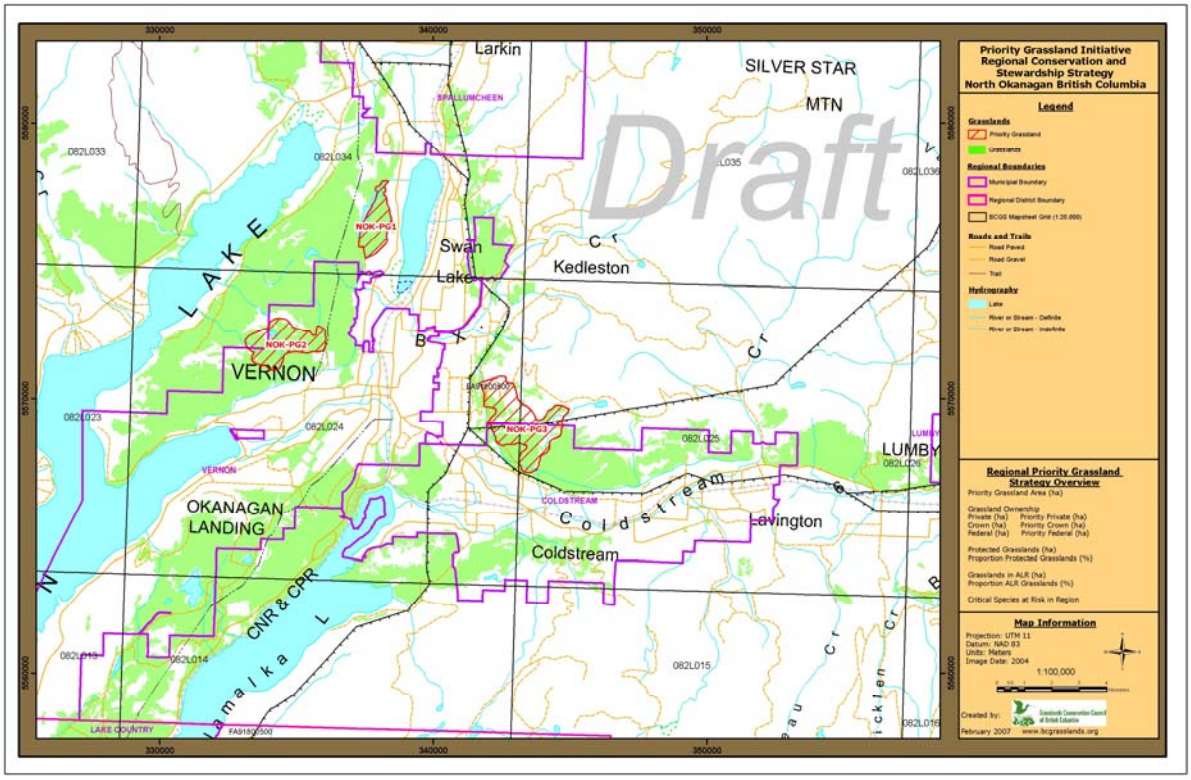

Figure 4. Sample Regional Strategy Map for the North Okanagan.

Summary

The Priority Grasslands Initiative addresses a gap and a clear need for information about British Columbia's grasslands. This initiative will provide regional planners, local decision-makers, First Nations and the province with an effective scientific basis and rational for conservation. The data, maps and other information generated by this process will be incorporated, where appropriate, into land use planning and decision-making processes around the province.

The companion *Planning for Change* Initiative will specifically focus on the extension of information, grassland portfolios and tools—such as the Green Infrastructure and Sensitive Ecosystems Bylaws Toolkit—to local, regional and First Nations governments. The goal is to empower government planners and decision-makers to promote and ensure a strategic and effective approach to conservation and stewardship of British Columbia's remaining grasslands.

Lastly, the Priority Grasslands Initiative forms a basis for regional and provincial grassland status reporting that will allow for careful monitoring of British Columbia's grassland inventory and its associated values. Status reporting will be completed on a regular basis for each major region.

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Appendix 1

Provincial Technical Advisory Committee for the Priority Grasslands Initiative

The Priority Grasslands Initiative methodology was created in collaboration with the Priority Grasslands Initiative Provincial Technical Advisory Committee. The committee, comprised of 25 members, represents the gamut of stakeholders interested in the conservation of British Columbia's grasslands. Members of the committee reviewed and fully endorsed the methodology.

Chair:

Bruno Delesalle, Executive Director, Grasslands Conservation Council of British Columbia (GCC), Kamloops

Members:

Phil Belliveau, Senior Ecosystem Biologist, BC Ministry of Environment (MOE), Kamloops
Carmen Cadrin, Program Ecologist, MOE Conservation Data Center, Victoria
Richard Doucette, Conservation Planner, GCC, Kamloops
Orville Dyer, Wildlife Biologist, MOE, Penticton
Jennifer Eastwood, Recreation Officer, BC Ministry of Forests and Range (MOFR), Kamloops
Lauchlan Fraser, Canada Research Chair in Community Ecosystem Ecology, Thompson Rivers University, Kamloops
Cindy Haddow, Range Specialist, MOE, Victoria
Jared Hobbs, Ecosystem Specialist, MOE, Victoria
Kristi Iverson, Consulting Ecologist, Iverson and Mackenzie Biological Consulting Ltd., Lac la Hache
Ted Lea, Vegetation Ecologist, MOE, Victoria
Dennis Lloyd, Regional Ecologist, MOFR, Kamloops
Terry Macdonald, Planning Officer, BC Ministry of Agriculture and Lands (MAL), Kamloops
Graham MacGregor, Regional Geomatics Analyst, MOFR, Kamloops
Ian Mackenzie, GIS Analyst, GCC, Kamloops
Nancy Mahony, Program Evaluation Biologist, Environment Canada, Canadian Wildlife Service, Delta
Larry Price, Director, Land Information BC, MAL, Kamloops
Ordell Steen, Consulting Ecologist, O.A, Steen Consulting, Williams Lake
Graham Strachan, Resource Stewardship Agrologist, MAL, Kamloops
John Surgenor, Wildlife Biologist, MOE, Kamloops
Rick Tucker, Range Reference Area Agrologist, MOFR, Kamloops
Eric Valdal, Land Information Specialist, MAL, Kamloops
Frances Vyse, Kamloops Naturalist Club, Kamloops
Phil Youwe, Range Officer, MOFR, Kamloops

Appendix 2

List of Species at Risk for the Priority Grasslands Initiative

Species at risk used in the Priority Grasslands Initiative include grassland-dependent species identified by the BC Conservation Data Centre's (CDC) online BC Species and Ecosystems Explorer as at risk of local or global extinction (i.e. red, blue and identified wildlife species that breed in the bunchgrass ecological community) (B.C. Conservation Data Centre 2007). The list includes eight mammal, 13 bird, five reptile, two amphibian, 116 vascular plant, three non-vascular plant and 13 invertebrate species. The list was evaluated by CDC staff and a regional biologist on the Priority Grasslands Initiative Provincial Technical Advisory Committee to ensure the most appropriate list of species is used.

	English Name	**Scientific Name**
Mammals	Pallid Bat	*Antrozous pallidus*
	Spotted Bat	*Euderma maculatum*
	Fringed Myotis	*Myotis thysanodes*
	Bighorn Sheep	*Ovis canadensis*
	Great Basin Pocket Mouse	*Perognathus parvus*
	Western Harvest Mouse	*Reithrodontomys megalotis*
	Nuttall's Cottontail	*Sylvilagus nuttallii*
	Badger	*Taxidea taxus*
Birds	Grasshopper Sparrow	*Ammodramus savannarum*
	Short-eared Owl	*Asio flammeus*
	Burrowing Owl	*Athene cunicularia*
	Swainson's Hawk	*Buteo swainsoni*
	Canyon Wren	*Catherpes mexicanus*
	Lark Sparrow	*Chondestes grammacus*
	Yellow-breasted Chat	*Icteria virens*
	Western Screech-Owl, *macfarlanei* subspecies	*Megascops kennicottii macfarlanei*
	Lewis's Woodpecker	*Melanerpes lewis*
	Long-billed Curlew	*Numenius americanus*
	Sage Thrasher	*Oreoscoptes montanus*
	Brewer's Sparrow, *breweri* subspecies	*Spizella breweri breweri*
	Sharp-tailed Grouse, *columbianus* subspecies	*Tympanuchus phasianellus columbianus*
Reptiles	Racer	*Coluber constrictor*
	Western Rattlesnake	*Crotalus oreganus*
	Night Snake	*Hypsiglena torquata*
	Gopher Snake, *deserticola* subspecies	*Pituophis catenifer deserticola*
	Western Painted Turtle—Intermountain—Rocky Mountain Population	*Chrysemys picta pop. 2*
Amphibians	Tiger Salamander	*Ambystoma tigrinum*
	Great Basin Spadefoot	*Spea intermontana*
Invertebrates	Mormon Metalmark	*Apodemia mormo*
	Vivid Dancer	*Argia vivida*
	Immaculate Green Hairstreak	*Callophrys affinis*

	English Name	**Scientific Name**
Invertebrates (cont.)	Arrowhead Blue	*Glaucopsyche piasus*
	Viceroy	*Limenitis archippus*
	Sonora Skipper	*Polites sonora*
	Behr's Hairstreak	*Satyrium behrii*
	California Hairstreak	*Satyrium californica*
	Sooty Hairstreak	*Satyrium fuliginosa*
	Half-moon Hairstreak	*Satyrium semiluna*
	Coral Hairstreak, *titus* subspecies	*Satyrium titus titus*
	Aphrodite Fritillary, *manitoba* subspecies	*Speyeria aphrodite manitoba*
	Great Spangled Fritillary, *pseudocarpenteri* subspecies	*Speyeria cybele pseudocarpenteri*
Vascular Plants	nettle-leaved giant-hyssop	*Agastache urticifolia*
	scarlet ammannia	*Ammannia robusta*
	western dogbane	*Apocynum* x *floribundum*
	Holboell's rockcress	*Arabis holboellii* var. *pinetorum*
	woody-branched rockcress	*Arabis lignifera*
	sickle-pod rockcress	*Arabis sparsiflora*
	short-rayed aster	*Aster frondosus*
	threadstalk milk-vetch	*Astragalus filipes*
	freckled milk-vetch	*Astragalus lentiginosus*
	The Dalles milk-vetch	*Astragalus sclerocarpus*
	silvery orache	*Atriplex argentea* ssp. *argentea*
	wedgescale orache	*Atriplex truncata*
	cut-leaved water-parsnip	*Berula erecta*
	tall beggarticks	*Bidens vulgata*
	narrow-leaved brickellia	*Brickellia oblongifolia* ssp. *oblongifolia*
	Andean evening-primrose	*Camissonia andina*
	annual paintbrush	*Castilleja minor* ssp. *minor*
	western centaury	*Centaurium exaltatum*
	American chamaerhodos	*Chamaerhodos erecta* ssp. *nuttallii*
	thyme-leaved spurge	*Chamaesyce serpyllifolia* ssp. *serpyllifolia*
	Atkinson's coreopsis	*Coreopsis tinctoria* var. *atkinsoniana*
	hairy bugseed	*Corispermum villosum*
	slender hawksbeard	*Crepis atribarba* ssp. *atribarba*
	low hawksbeard	*Crepis modocensis* ssp. *modocensis*
	western low hawksbeard	*Crepis modocensis* ssp. *rostrata*
	western hawksbeard	*Crepis occidentalis* ssp. *pumila*
	obscure cryptantha	*Cryptantha ambigua*

	English Name	Scientific Name
Vascular Plants (cont.)	cushion fleabane	*Erigeron poliospermus* var. *poliospermus*
	cockscomb cryptantha	*Cryptantha celosioides*
	Watson's cryptantha	*Cryptantha watsonii*
	Richardson's tansy mustard	*Descurainia incana* ssp. *incisa*
	Carolina draba	*Draba reptans*
	three-flowered waterwort	*Elatine rubella*
	Hall's willowherb	*Epilobium halleanum*
	smooth spike-primrose	*Epilobium pygmaeum*
	scarlet gaura	*Gaura coccinea*
	dwarf groundsmoke	*Gayophytum humile*
	hairstem groundsmoke	*Gayophytum ramosissimum*
	prairie gentian	*Gentiana affinis*
	shy gilia	*Gilia sinuata*
	spreading stickseed	*Hackelia diffusa*
	Whited's halimolobos	*Halimolobos whitedii*
	mock-pennyroyal	*Hedeoma hispida*
	mountain sneezeweed	*Helenium autumnale var. grandiflorum*
	hutchinsia	*Hutchinsia procumbens*
	poverty-weed	*Iva axillaris ssp. robustior*
	western stickseed	*Lappula occidentalis var. cupulata*
	prairie pepper-grass	*Lepidium densiflorum var. pubicarpum*
	northern linanthus	*Linanthus septentrionalis*
	false-pimpernel	*Lindernia dubia var. anagallidea*
	nine-leaved desert-parsley	*Lomatium triternatum ssp. platycarpum*
	silvery lupine	*Lupinus argenteus var. laxiflorus*
	Suksdorf's lupine	*Lupinus bingenensis var. subsaccatus*
	small-headed tarweed	*Madia minima*
	bristly mousetail	*Myosurus apetalus var. borealis*
	wild tobacco	*Nicotiana attenuata*
	pale evening-primrose	*Oenothera pallida ssp. pallida*
	flat-topped broomrape	*Orobanche corymbosa ssp. mutabilis*
	Grand Coulee owl-clover	*Orthocarpus barbatus*
	winged combseed	*Pectocarya penicillata*
	branched phacelia	*Phacelia ramosissima*
	showy phlox	*Phlox speciosa ssp. occidentalis*
	western Jacob's-ladder	*Polemonium occidentale ssp. occidentale*

	English Name	Scientific Name
Vascular Plants (cont.)	Drummond's campion	*Silene drummondii var. drummondii*
	dotted smartweed	*Polygonum punctatum*
	five-leaved cinquefoil	*Potentilla nivea var. pentaphylla*
	bushy cinquefoil	*Potentilla paradoxa*
	Columbian goldenweed	*Pyrrocoma carthamoides var. carthamoides*
	toothcup meadow-foam	*Rotala ramosior*
	peach-leaf willow	*Salix amygdaloides*
	plains butterweed	*Senecio plattensis*
	Oregon checker-mallow	*Sidalcea oregana var. procera*
	scarlet globe-mallow	*Sphaeralcea coccinea*
	Munroe's globe-mallow	*Sphaeralcea munroana*
	Okanogan fameflower	*Talinum sediforme*
	thick-leaved thelypody	*Thelypodium laciniatum var. laciniatum*
	cup clover	*Trifolium cyathiferum*
	English Name	*Scientific Name*
	blue vervain	*Verbena hastata var. scabra*
	meadow arnica	*Arnica chamissonis ssp. incana*
	field dodder	*Cuscuta campestris*
	common twinpod	*Physaria didymocarpa var. didymocarpa*
	Kellogg's knotweed	*Polygonum polygaloides ssp. kelloggii*
	hairy water-clover	*Marsilea vestita*
	Gastony's cliff-brake	*Pellaea gastonyi*
	Geyer's onion	*Allium geyeri var. tenerum*
	river bulrush	*Bolboschoenus fluviatilis*
	blue grama	*Bouteloua gracilis*
	bearded sedge	*Carex comosa*
	porcupine sedge	*Carex hystricina*
	Holm's Rocky Mountain sedge	*Carex scopulorum var. bracteosa*
	many-headed sedge	*Carex sychnocephala*
	fox sedge	*Carex vulpinoidea*
	dry-land sedge	*Carex xerantica*
	red-rooted cyperus	*Cyperus erythrorhizos*
	awned cyperus	*Cyperus squarrosus*
	purple spike-rush	*Eleocharis atropurpurea*
	Nuttall's waterweed	*Elodea nuttallii*
	giant helleborine	*Epipactis gigantea*
	tufted lovegrass	*Eragrostis pectinacea*
	slender mannagrass	*Glyceria pulchella*
	porcupinegrass	*Hesperostipa spartea*
	Colorado rush	*Juncus confusus*

	English Name	Scientific Name
Vascular Plants (cont.)	rough dropseed	*Sporobolus compositus var. compositus*
	small-flowered lipocarpha	*Lipocarpha micrantha*
	oniongrass	*Melica bulbosa var. bulbosa*
	marsh muhly	*Muhlenbergia glomerata*
	satin grass	*Muhlenbergia racemosa*
	mutton grass	*Poa fendleriana ssp. fendleriana*
	long-leaved pondweed	*Potamogeton nodosus*
	Rocky Mountain clubrush	*Schoenoplectus saximontanus*
	rivergrass	*Scolochloa festucacea*
	prairie wedgegrass	*Sphenopholis obtusata*
	hairgrass dropseed	*Sporobolus airoides*
	sheathing pondweed	*Stuckenia vaginata*
	bigleaf sedge	*Carex amplifolia*
	Howell's quillwort	*Isoetes howellii*
Nonvascular Plants	rusty cord-moss	*Entosthodon rubiginosus*
		Microbryum vlassovii
	alkaline wing-nerved moss	*Pterygoneurum kozlovii*

Appendix 3

Species at Risk Predictive Habitat Models

Predictive habitat models are developed for seven species at risk: American badger, Great basin spadefoot toad, Screech owl, Lewis's woodpecker, Western rattlesnake, Sharp-tailed grouse and Burrowing owl. The habitat models, created in Arc Macro Language (AML), complement the limited amount of location records and to aid as a tool during the expert input stage. The Ministry of Environment's *Accounts and Measures for Managing Identified Wildlife – Accounts V.* 2004 (MOE 2004) and draft rating guides were the primary source of information for these models. The species chosen to model represent a variety of focal habitat types as well as reflect their local importance to each grassland region.

Spadefoot Toad

Purpose:
To identify within a narrow range potentially important spadefoot toad habitat on grasslands based on mapped water features, biogeoclimatic ecosystem classifications, distance from water features and slope steepness.

Rating Scheme:
A three level rating scheme is applied to indicate habitat importance for grasslands.

- Primary Breeding Habitat
- Primary Terrestrial Habitat
- Secondary Terrestrial Habitat

Modeling Theme:
The model depicts important breeding and foraging habitat surrounding identified wetland or lake features on grasslands. Because migration of spadefoot toads is not extensive, only areas surrounding lakes or wetlands are assessed.

Suppressed and Unrated Values:
Breeding can occur in extremely small, ephemeral waterbodies in native habitats and anthropogenic habitats such as waterbodies in golf courses. These are unmappable and therefore are not incorporated into the model. Soils information is available for some regions of the province, however due to its large scale the data has not been used to identify important soils which may contribute to important spadefoot habitat. Forested habitats are not being assessed due the focus on grassland habitats and the need to keep modeling focused.

Other Modeling Options:
Range condition may have an effect on habitat use. It is unknown at this time how much of an effect this may be. However, it is assumed that poor range condition would have compact soils and is therefore rated down one for denning. This would need to be studied to determine if this relationship exists. It is unknown whether spadefoot toads select for warm or cool aspect slopes or if they use talus habitats for denning. Further research would need to be conducted to provide ratings for the suppressed, unrated and unknown values.

Habitat Use Assumptions

1	Biogeoclimatic Zones:	BG, PP and IDF rated Important, MS and ESSF rated as Nil.
2	Slope:	Flat to Moderate slopes (<=10%) rated as important, Steep slopes and very steep slopes rated as nil
3	Aspect:	Not applicable
4	Ecosystem Unit:	• Grasslands rated important. • Coniferous forests rated up to Moderate for Denning; riparian coniferous rated up to Low []. • Wetlands and open water habitats < 10ha rated important for Breeding • Anthropogenic habitats rated Low for Breeding; • Migration habitats occur in all ecosystem units located between Breeding and Foraging habitats; excluding very steep habitats, rock outcrops, talus slopes. • Cliffs, talus and rock outcrops rated Nil, beach and gravel bars rated up to Moderate for Denning.
5	Range Condition & Successional Stage:	Unknown effect, but compacted soils in Poor Range Condition may affect ability to burrow therefore rate down one for Denning but not less than Low. Successional stage has no effect.
6	Shrub Density:	No effect.
7	Tree Density:	Dense forests rated down one notch (Low at best) for Denning and Migration; Sparse and Moderate rated No Effect.
8	Habitat Structure:	Ecosystem units with pinegrass are rated down two for Denning due to decreased soft soil surface area.
9	Proximity Effects:	Denning habitat within 0.5 km of breeding habitat rated high, between 0.5 km and 1 km rated moderate. Since spadefoot toads will disperse in any direction from breeding habitat, migration will be modeled as occurring anywhere in the selected ecosystem units within the 1000 meter buffer around breeding habitats. Migration corridors (migration habitat directly between breeding and denning habitat) will not be modeled.
10	Terrain & Soil Effects:	Shallow and rocky soils rated down one and very shallow soils

Modeling Characteristics

Input data:

The following data sources were used to apply habitat assumptions. Not all assumptions were applied due to limitations and availability of source information

- TRIM wetlands and lakes

    - Buffered 500 meters and 1000 meters
- 25 Meter Gridded Digital Elevation Model (DEM)
    - Slopes <= 10% (Extracted from DEM)
    - Slopes <= 1% (Extracted from DEM)
    - Water Flow accumulation analysis (Analyzed from DEM)
- Grassland Mapping
- Provincial Biogeoclimatic Ecosystem Classification

Modeling Procedure:

The following modeling procedure was applied using input data.

1. All wetlands and Lakes < 10ha are selected for analysis
2. Lake and wetland features are buffered 500 and 1000 Meters
3. Digital elevation model is analyzed for slopes < = 10% and <= 1%
4. Water flow accumulation is analyzed using DEM
5. Features are overlaid into a resultant overlay coverage
6. Resultant coverage is then calculated to identify levels of predicted habitat importance.

Habitat Output:

Primary Breeding Habitat

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Water = Wetland or lake < 10 ha; and
- Within 500 meters of grasslands

Primary Terrestrial Habitat

- Biogeoclimatic zone = BG (Bunch Grass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Water = Wetland or lake < 10 ha;
- Slope < = 10 Percent or flow accumulation = High and Slope <= 1%;
- Grassland Mapping = Grassland; and
- Proximity to water feature < 500 meters

Secondary Terrestrial Habitat

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Water = Wetland or lake < 10 ha;
- Slope < = 10 Percent;
- Grassland Mapping = Grassland; and
- Proximity to water feature < 1000 meters

Sharp-Tail Grouse

Purpose:
To identify important sharp-tail habitat on grasslands based on mapped Leks (Breeding Sites), proximity to Lek sites, riparian / moister shrub habitats and moderate to gentle slopes.

Rating Scheme:
A three level rating scheme is applied to indicate habitat importance for grasslands.

- Important grasslands within 3 km of Lek
- Important Aspen Forest within 3 km of Lek
- Important Douglas fir habitats within 3 km of Lek
- Important shrub habitat (Modeled Riparian depressions) within 3 km of Lek

Modeling Theme:
The model depicts important breeding (grasslands) and foraging (shrub/riparian) habitat within 3km proximity of Lek sites. Migration rates of sharp-tails from leks have been determined to be around 3 km.

Suppressed and Unrated Values:
Condition of riparian or grassland sites cannot be determined from available data sources.

Habitat Use Assumptions

1	Biogeoclimatic Zones:	BG, PP and IDF rated Important, MS and ESSF not rated.
2	Slope:	Steep slopes and very steep slopes are not rated
3	Aspect:	Not applicable
4	Ecosystem Unit:	• Grasslands rated important. • Coniferous forests rated important for spring forage and winter cover • Deciduous forest are rated important • Shrub thickets are rated important • Anthropogenic habitats are not rated • Migration habitats occur in all ecosystem units located between Breeding and Foraging habitats, excluding very steep habitats, rock outcrops, talus slopes.
5	Range Condition	Old seral bunchgrass grasslands with and stubble height > 25cm and close spacing are important habitat components
6	Shrub Density:	Thicker shrubs provide better cover and security for young
7	Tree Density:	Unknown

8	Habitat Structure:	A higher crown closure of forest canopies, that creates a diverse under story of shrubs is important
9	Proximity Effects:	Habitat within 3km of Lek site is important
10	Terrain & Soil Effects:	Steep terrain has a negative effect on sharp-tail habitat

Modeling Characteristics

Input data:

The following data sources were used to apply habitat assumptions. Not all assumptions were applied due to limitations and availability of source information.

- Known Lek (Breeding) sites
- 25 Meter Gridded Digital Elevation Model (DEM)
    - Moister Valley/Riparian areas (Extracted from DEM)
    - Slopes > 30% (Extracted from DEM)
- Grassland Mapping
- Provincial Biogeoclimatic Ecosystem Classification
- Vegetation Resource inventory (VRI)

Modeling Procedure:

The following modeling procedure was applied using input data.

1. Lek sites are selected from species at risk inventories
2. Lek sites are buffered in a 3 km radius
3. Digital elevation model is analyzed for valley bottom / moister areas that indicate shrub or thicket growth.
4. Features are overlaid (Lek buffers, VRI, BEC, slopes, grasslands) into a resultant overlay coverage
5. Resultant coverage is then calculated to identify types of important habitat.

Habitat Output:

Important Grasslands

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Grassland Mapping = Grassland;
- Slope < = 30 Percent; and
- Within 3000 meters of Lek site

Important coniferous forest

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Primary Vegetation Resource Inventory species = Douglas Fir; and
- Within 3000 meters of Lek site

Important deciduous forest

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Primary Vegetation Resource Inventory species = Trembling Aspen or Aspen Cotton Wood; and
- Within 3000 meters of Lek site

Important shrub habitat

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDF (Interior Douglas Fir);
- Grassland Mapping = Grassland;
- Topographic analysis = Bowl depression which corresponds to shrub habitat; and
- Within 3000 meters of Lek site

Western Rattlesnake

Purpose:
To identify potentially important rattlesnake denning and surrounding rocky gestation areas within the grassland landscape.

Rating Scheme:
A two level rating scheme is applied to indicate habitat importance for grasslands.

- Primary potential for denning and gestation sites
- Secondary potential for denning and gestation sites
- Foraging habitat surrounding denning sites within 1km radius

Modeling Theme:
The model depicts important hibernacula and gestation habitat within steep rocky slopes that receive high levels of solar radiation. Open forest foraging habitat around denning sites is also identified.

Suppressed and Unrated Values:
Due to limited knowledge Foraging habitat use around hibernacula is limited to open pine forests.

Other Modeling Options:
More research is required to further define the habitat of this species and in particular; migration corridors.

Habitat Use Assumptions

1	Biogeoclimatic Zones:	BG, PP, IDF xh rated Important, IDF, MS and ESSF not rated.
2	Slope:	Steep slopes and very steep slopes are rated high
3	Aspect:	Hotter south facing aspects rated high
4	Ecosystem Unit:	• Grasslands rated high. • Steep rocky grassland habitats, rock outcrops, talus slopes rated high. • Areas receiving high solar radiation rated high.
5	Range Condition	Poor condition will reduce rodent populations and decrease foraging habitat
6	Shrub Density:	No Effect (unknown).
7	Tree Density:	No Effect (unknown).
8	Habitat Structure:	No Effect (unknown).
9	Proximity Effects:	Forage habit is rated high if within 1km and moderate between 1km and 1.5km

10 Terrain & Soil Effects: Steeper rocky terrain is rated high.

Modeling Characteristics

Input data:

The following data sources were used to apply habitat assumptions. Not all assumptions were applied due to limitations and availability of source information

- Known rattlesnake denning sites
- 25 Meter Gridded Digital Elevation Model (DEM)
    - Identification of rugged areas that have high variance in topographic relief (Extracted from DEM)
    - Slopes between 50% and 80% (Extracted from DEM)
- Solar Radiation Modeling
- Grassland Mapping
- Provincial Biogeoclimatic Ecosystem Classification
- Vegetation Resource inventory (VRI)

Modeling Procedure:

The following modeling procedure was applied using input data.

1. Buffer known denning sites 1 km
2. Analyze the DEM and identify areas that receive high values of solar radiation and divide into three classes. (High Moderate, Low)
3. Analyze the DEM to identify with high relief differences which would indicate rocky or talus slopes.
4. Analyze DEM to identify slopes between 50% and 80%.
5. Extract out of the VRI Pine and Douglas Fir forests that have crown closure between 10% and 30%
6. Using the GIS, overlay all previously created coverage's to create resultant overlay coverage.

Habitat Output:

Primary Habitat Potential

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDFxh1 (Interior Douglas Fir);
- Grassland Mapping = Grassland;
- High degree of ruggedness; and
- High level of solar radiation

Secondary Habitat Potential

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDFxh1 (Interior Douglas Fir);
- Grassland Mapping = Grassland;
- Moderate degree of ruggedness or slope 50 to 80%; and
- High level of solar radiation

Surrounding foraging habitat

- Biogeoclimatic zone = BG (Bunchgrass) or PP (Ponderosa Pine) or IDFxh1 (Interior Douglas Fir);
- Within 1 km of known den habitat;
- Primary VRI Species = Ponderosa Pine or Douglas Fir; and
- High level of solar radiation

American Badger

Purpose:
To identify important badger denning and foraging habitat within the grassland landscape.

Rating Scheme:
A three level rating scheme is applied to indicate habitat importance of grasslands. Each input value is ranked according to a weighted importance for badger habitat then summed into a final habitat significance rating.

- Very High significance for Badger
- High significance for Badger
- Moderate Significance for Badger

Modeling Theme:
The model depicts habitat importance for badger throughout the grassland landscape with a focus on breeding and denning habitat within the grassland landscape. Due to the variety of habitat that Badgers utilize only a broad habitat importance model was created.

Suppressed and Unrated Values:
Due to limited knowledge and lack of ecosystem or habitat data a detailed habitat analysis will not be represented. Succession and range condition have not been assessed.

Other Modeling Options:
More research is required regarding habitats utilized by this species.

Habitat Use Assumptions

1	Biogeoclimatic Zones:	BG, PP and IDF rated High. MS rated Moderate and ESSF not rated.
2	Slope:	Moderate and gentler slopes are rated High, Steep slopes and very steep slopes are rated low
3	Aspect:	No Effect
4	Ecosystem Unit:	• Grasslands /shrub steppe rated high. • Coniferous habitats rated high for foraging and breeding • Deciduous habitat rated moderate for foraging • Other ecosystems not rated
5	Range Condition	Poorer range condition rated lower. Higher succession stage for grassland ecosystem rated higher for breeding and foraging.
6	Shrub Density:	No Effect (unknown).
7	Tree Density:	Higher density forest rated lower. Open forest rated higher
8	Habitat Structure:	No Effect (unknown).

9 Proximity Effects: Proximity to water sources rated higher

10 Terrain & Soil Effects: Foraging and breeding rated high within friable soils

Modeling Characteristics

Input data:

The following data sources were used to apply habitat assumptions.

- TRIM water mapping
  - Analyze distance of grasslands from known water sources. 4 distance categories (100 m, 250 m, 500 m, & 1000 m)
- 25 Meter Grid Digital Elevation Model (DEM)
  - Analyze for slopes < 30%
- Provincial soil studies
  - Assess soils information and identify loose friable soils
- Grasslands mapping
  - Assess and identify open grasslands and open forest grasslands
- VRI
  - Analyze for open forests with a crown closure < 30% and forest age categories

Modeling Procedure:

The following modeling procedure was applied using input data.

1. TRIM water is analyzed at 4 specified distances and weighted values applied.
   - 0-100m = score 40; 101-250 = score 30; 250-500 = score 20; 500-1000; score 10
2. DEM is analyzed for slope < 30% and weighted values applied
   - Slope 1-15% = score 50; 16-30% = score 25
3. Open pine and fir forest are identified in VRI and weighted values applied
   - < 20 and > 10 crown closure = score 30; < 30 and > 20 crown closure = score 20
4. Forest ages are identified in VRI and weighted score applied
   - < 60 years = score 30; <120 and > 60 = score 20; > 120 = score 10
5. Identify open grasslands and open forests in grasslands mapping and apply weighted scores
   - Open grasslands = score 100; open forest grasslands = score 50
6. Soils data is assessed and scored based on friability (How diggable they are).
   - Stone free (Fluvial, Lacustrine) = Score 100; Moderate stony (Glaciofluvial) = Score 50; Stony Glaciofluvial = score 30
7. Scored layers are combined and weighted score summed
8. Categories of badger habitat are classified based on summed weighting.
   - Very low = 0; Low = 1 – 50; Moderate = 50 to 100; High = 100 to 150; Very High = > 150

Habitat Output:

Badger Habitat Importance

- Very low habitat importance = 0
- Low habitat importance = 1 to 50
- Moderate habitat importance = 50 to 100
- High habitat importance = 100 to 150
- Very High habitat importance = > 150

Lewis's Woodpecker / Screech Owl

Rating Scheme:
A four class rating scheme is used due to the intermediate level of knowledge of habitat use of this species (Demarchi 1995).

Modeling Theme:
The model will depict breeding and foraging habitats, where breeding is equal to foraging. Temporal (seasonal) differentiations will not be modeled. Habitat capability will be adjusted depending on ecosection. The capability rating will be the highest value given for an ecosystem unit in the Rating Table. Habitat suitability will be adjusted depending on ecosection, successional stage and tree density. The migration life requisite will not be modeled.

Suppressed and Unrated Values:
There may be habitats which have been suppressed due to lack of evidence on habitat use of these ecosystem units according to the available research on this species. When more information has been collected, the model may need revision.

Other Modeling Options:
When wildlife trees can be identified by UTM coordinates and overlaid on the map, a more accurate model could be developed.

Hierarchy of Life Requisites and/or Seasonal Use Patterns:[5]
1. Breeding (b). Eggs and nestlings are found from April to June (Siddle and Davidson 1991).
2. Foraging (f) occurs from late April to late September (Siddle and Davidson 1991).
3. Migration is not rated in the Rating Table. Spring arrival occurs from late April to mid-May and fall migration begins in August and is completed by late September (Siddle and Davidson 1991). Although the majority of birds migrate during the winter, some remain in the Okanagan as residents (Cannings et al. 1987, Siddle and Davidson 1991).

Habitat Use Assumptions

#	Topic	Description
1	Ecosection:	SOB, NOB, SOH and OKR rated High.
2	Biogeoclimatic Zones:	BG and PP rated High, IDFxh1 rated Moderate
3	Slope:	No effect.
4	Aspect:	No effect.
5	Ecosystem Unit:	• Shrub steppe habitats rated up to Low. Requires open country with tall scattered trees, snags and stubs for perches while foraging and for nesting sites.

[5] Section "A" of the Ratings Adjustment Table.

		• Coniferous forest habitats rated up to High. Nest in open ponderosa pine and Douglas fir forests. • Deciduous forests of black cottonwood rated Moderate. Nest in groves of black cottonwoods near lakes or streams. • Wetlands and water not rated. • Agricultural habitats rated Low. Forage in cultivated fields, pastures and orchards. • Urban habitats rated Low. Provides winter and summer forage and areas with tall trees can be used for nesting. • Rock outcrops and talus slopes rated up to Moderate due to presence of sparse trees. • All other ecosystem units not rated.
6	Range Condition & Successional Stage:	Range condition has No effect (unknown). Successional stages 1, 2 and 3 rated up to Low, stage 4 rated up to Moderate and stage 5 rated up to High.
7	Shrub Density:	No effect.
8	Tree Density:	Affects coniferous forests only. Sparse density has no effect; Moderate density rated lower; Dense not rated.
9	Habitat Structure:	No effect.
10	Proximity Effects:	No effect, however foraging occurs within and in close proximity to the breeding grounds.
11	Terrain & Soil Effects:	No effect.

Modeling Characteristics

Input data:

The following data sources were used to apply habitat assumptions.

1) Buffer lakes and wetlands 500 Meters

2) Analysis for stream density calculation. Length of stream per hectare for each VRI polygon.

3) Overlay ruggedness calculation from rattlesnake, water buffers, stream density, VRI and Grasslands.

4) Riparian calculation groupings. (length per hectare)

{0->30} 'Very Low'	{30->60} 'Low'	{60->90} 'Moderate'	{90->120} 'Good'	> 120 'Very Good’

5) Calculate aspen groupings

spc_pct_1 stems_ha > 50 'First Rank Aspen stand'	species_cd_2 stems_ha > 50 'Second Rank Aspen stand'	species_cd_3 stems_ha > 50 'Third Rank Aspen stand'

	Riparian							
	[Age]	No	Unknown	Very Low	Low	Moderate	Good	Very Good
1st rank Aspen Cottonwood	<80	unsuitable	unsuitable	unsuitable	L. = Mod. 5 S. = Mod. 5	L. = Mod. 5 S. = Mod. 5	L. = Good 4 S. = Good 4	L. = Good 4 S. = Good 4
	> 80	unsuitable	unsuitable	unsuitable	L. = Good 4 S. = Good 4	L. = Good 4 S. = Good 4	L. = V.Good 2 S. = V.Good 2	L. = V.Good 2 S. = V.Good 2
	> 120	unsuitable	unsuitable	unsuitable	L. = Good 3 S. = Good 3	L. = Good 3 S. = Good 3	L. = V.Good 1 S. = V. Good 1	L. = V.Good 1 S. = V. Good 1
2nd rank Aspen Cottonwood		unsuitable	L. = Mod. 6 S. = Mod. 6	unsuitable	L. = Mod. 6 S. = Mod. 6	L. = Mod. 6 S. = Mod. 6	L. = Mod. 5 S. = Mod. 5	L. = Mod. 5 S. = Mod. 5
Old Conifer	> 120	L. = Mod 8 S. = Mod. 8	unsuitable	unsuitable	unsuitable	unsuitable	L. = Good 4 S. = Good 4	L. = Good 4 S. = Good 4
	> 160	L. = Mod 7 S. = Mod. 7	unsuitable	unsuitable	unsuitable	unsuitable	L. = Good 2 S. = Good 2	L. = Good 2 S. = Good 2

6) Calculation based on data is then used to assess the sites.

Modeling Procedure L. = Lewis's woodpecker S. = Screech owl

Burrowing Owl

Rating Scheme:
A four class rating scheme is used due to the intermediate level of knowledge of habitat use of this species (Demarchi 1995).

Modeling Theme:
The model will depict breeding habitats and foraging habitats. Foraging occurs in the same polygon as breeding but can also occur outside of breeding habitats. In the model, breeding habitats will overlay (or hide) the foraging habitats that occur in the same polygons. Temporal (seasonal) differentiations are not modeled. Habitat capability will be adjusted depending on proximity of foraging habitats to breeding habitats. The capability rating will be the highest value given for an ecosystem unit in the Rating Table. Habitat suitability will be adjusted according to range condition, shrub and tree density and proximity of foraging to breeding habitats. Life requisites, such as migration, will not be modeled. Some values will be suppressed, such as certain Ecosystem Units, due to the limited knowledge of habitat use in these areas.

Suppressed and Unrated Values:
Warm talus, sumac-ocean spray talus and rock outcrop slopes are not rated due to the lack of knowledge about habitat use of the habitats. There may be habitats which have been suppressed or unrated due to lack of evidence on habitat use of these ecosystem units according to the available research on this species. When more information has been collected, the model may need revision.

Other Modeling Options:
Warm talus slopes and rock outcrops may provide breeding and foraging habitat. Further research must be conducted to determine the rating for these unrated values.

Hierarchy of Life Requisites and/or Seasonal Use Patterns:[6]
1. Breeding from March to August (b).
2. Foraging from April to October (f).
3. Migration arrival in April and depart between July and October (not rated in the Rating Table).

Habitat Use Assumptions

Two habitat uses are rated: Breeding (b) and Foraging (f).

#	Topic	Description
1	Ecosection:[7]	No effect. (SOB, NOB, OKR, NOH and SOH).
2	Biogeoclimatic Zones:	BG, PP and IDFxh1 rated up to High; IDFdk, IDFdm, MS and ESSF rated Nil.
3	Slope:[8]	Not an adjustment. Selection against steep slopes which is rated using warm and cool aspect modifiers (>25% slope). Very steep

[6] Section "A" of the Rating Adjustments Table.

[7] Section "E" of the Rating Adjustments Table.

slopes rated Nil. Gullies rated down one for Breeding and No effect for Foraging (Sarell 1996 pers. comm.).

4 Aspect:[9] Not an adjustment. Warm and cool aspects rated down one in all biogeoclimatic zones, cool aspects rated down two in the PP and IDFxh zones.

5 Ecosystem Unit:
- Shrub-steppe habitats rated up to High for breeding and foraging.
- Coniferous forest habitats rated Nil, except for suitable sparse shrub-herb successional stages (i.e. excluding SP, PB, RM) then rated up to Low for Breeding and Foraging.
- Dry pastures, cultivated fields and vineyards rated up to Low, moist pastures are rated up to High for Foraging, rated up to Low for Breeding.
- Wetlands consisting of CB, SB, SE and WR rated up to Moderate for Foraging. All others are rated Nil.
- All other ecosystem units rated Nil.

6 Range Condition & Successional Stage: Shrub-herb successional stages of coniferous forests are rated up to Low for Breeding and Foraging since they have similar characteristics of shrub-steppe ecosystem units. Stages >1 rated Nil.

Complex Rating Matrix for Range Condition

Rating Considerations	Range Condition			
	POOR	FAIR	GOOD	EXCELLENT
Grass Cover	High	Moderate	Low	Moderate
Forage Availability	Low	Moderate	High	High
Resultant Forage Rating	**Moderate**	**Moderate**	**Moderate**	**High**
AND BURROWS IN: Morainal/Lacustrine/Coarse Soils	Low	Moderate	High	High
Resultant Breeding Rating	**Low**	**Moderate**	**Moderate**	**High**
OR BURROWS IN: Sandy Soils	Nil	Low	Moderate	High
Resultant Breeding Rating	**Nil**	**Moderate**	**Moderate**	**High**

7 Shrub Density:[10] Dense rated down two notches, moderate rated down one notch and sparse density rated no effect for Breeding and Foraging. Prey

[8] Section "E" of the Rating Adjustments Table.

[9] Section "E" of the Rating Adjustments Table.

[10] Section "B" of the Rating Adjustments Table.

		detection and capture is reduced in dense shrub communities because of a cluttered foraging environment.
8	Tree Density:[11]	Sparse rated Low at best, Dense and Moderate rated Nil for Breeding and Foraging.
9	Habitat Structure:	Preferred foraging habitats are open and uncluttered to permit effective detection and capture of prey.
10	Proximity Effects:[12]	Forage habitats within 500 meters of High and Moderate Breeding habitats rated no effect. Forage habitats within 500 to 1000 meters of High and Moderate Breeding habitats rated down one. Forage habitats within 1000 meters of Low Breeding habitat rated up to Low for Foraging. Forage habitats greater than 1000 meters from Breeding habitat rated Nil.
11	Terrain & Soil Effects:	Ecosystem Units with loose sandy soils cannot support burrows under intense grazing conditions []. Soils on fans and of morainal origin are rated down for Breeding (addressed in the Complex Rating Matrix Table), rated no effect for Foraging. Shallow soils rated down one notch, very shallow soils rated Nil for Breeding, rated no effect for Foraging.
12	Moisture Regime:	In mesic ecosystem units the ratings for range condition are different than in xeric sites. Rate Poor Range Condition up to High, Fair and Good up to Moderate and Excellent Range Condition up to Low for Forage. Rate Breeding up to Low, Range Condition has no effect. Floodplains rated down one for Breeding and No effect for Foraging (Sarell 1996 pers. comm.).

Modeling Characteristics

1) Create grid coverage of 0 to 10 percent slope.
2) Buffer wetlands and lake by 500 and 1000 meters.
3) Overlay (grasslands, slope and water buffers)
4) Candidate areas are the calculated as follows.

'BG Grasslands < 20 % slope not near forest edge'
'BG Grasslands < 20% slope not near forest edge in 1000 m wet buffer'
'BG Grasslands < 20% slope near forest edge in 1000 m wet buffer'
'BG Grasslands < 20% slope not near forest edge in 500 m wet buffer'
'BG Grasslands < 20% slope near forest edge in 500 m wet buffer'

[11] Section "C" of the Rating Adjustments Table.

[12] Section "D" of the Rating Adjustments Table.

Appendix 4

Determining Conservation Priorities for Grasslands and Associated Ecosystem Elements in British Columbia[13]

Introduction

The objective of the following approach is to provide local, regional and provincial land-use planners with a simple tool to assess conservation priority of British Columbia grasslands and associated ecosystem elements using a standardized, repeatable approach. This approach considers basic conservation biology principles and draws upon methods used by B.C.'s Conservation Data Centre (CDC) and NatureServe. We start by defining an ecosystem element and the criteria for distinguishing individual occurrences. The aerial extent and number of occurrences of each element forms the basis for determining rarity. The severity and extent of the potential disturbances over the next 20 years forms the basis for identifying the threat to each ecosystem element. Rarity and threat to each ecosystem element are then compared to determine conservation priority. Ecosystem elements with non-climax plant communities may also be given a conservation priority based on their value for recruitment, through natural succession, to climax ecosystems.

Ecosystem Element Definition

For purposes of the GCC Priority Grasslands Initiative, an ecosystem element is a defined plant community type that occurs on ecologically distinct sites.

- The plant community may be:
    - a plant association or subassociation formally recognized by the British Columbia Biogeoclimatic Ecosystem Classification (BEC) program; or
    - another plant community type that is not yet formally recognized by the BEC program. These may be equivalent to individual associations or subassociations of the BEC program or may be seral stages (i.e. early, mid, late) that represent groups of associations that occur on sites with the same environmental conditions. Grassland seral stage criteria will be consistent with Ministry of Forests and Range guidelines.

    Vegetation units other than those formally recognized by the BEC program, must be approved by a scientific committee whose membership includes the MOFR regional ecologist for the area of interest. Additional membership is yet to be identified but may include appropriate CDC, university and local experts.

- Ecologically distinct sites may be:
    - a site series[14] or site type[15] formally recognized by the BEC program; or
    - any other group of sites conceptually equivalent to a site series or site type but not yet formally recognized by the BEC program. These sites have a defined

[13] This approach was specifically developed for GCC's priority grasslands initiative.

[14] A site series is a group of sites within a biogeoclimatic subzone variant that potentially supports the same climax plant association.

[15] A site type is a subset of sites within a site series. A site type has distinct site or soil features, resulting in different ecosystem or management implications compared to other sites within the site series.

climax or long-persistent potential plant community type (plant association, subassociation, or equivalent).

It is important to note that site series and site types, as defined by the B.C. BEC program, occur within only one biogeoclimatic subzone variant. As a result, ecosystem elements, as defined here, also occur within only one biogeoclimatic subzone variant. Consequently, the ecosystem element assessment described here is a regional (local) approach, approved in principal by the CDC, which departs from the provincial, national and international approach most often used by the CDC. In the provincial approach of the CDC, ecosystem elements are plant associations that may occur in two or more biogeoclimatic subzone variants and therefore represent more than one site series.

The GCC approach (described in bullets above) has been chosen because each biogeoclimatic unit has a distinct climate and, as a result, the same plant association in different biogeoclimatic units may support different organisms and ecological processes. For example, insects and other wildlife of a cattail marsh association in a dry grassland climate such as the BGxh2 likely differ significantly from insects and other wildlife of the same cattail association within in a wet forest climate such as the Interior Cedar Hemlock (ICH) zone.

Site units other than those formally recognized by the BEC program, must be approved by a scientific committee whose membership includes the MOFR regional ecologist for the area of interest. Additional membership is yet to be identified, but may include appropriate CDC, university and local experts.

- As described above, the context for assessing rarity or representation of an ecosystem element is the biogeoclimatic subzone variant. That is, an ecosystem element that meets criteria for rare or representation within a subzone variant will be considered rare or represented in that subzone variant regardless of the occurrence in other subzone variants of ecosystem elements with the same plant association.

Ecosystem Element Occurrence

An ecosystem element occurrence (EEO) is an ecosystem element or a complex of spatially integrated ecosystem elements on a defined area of land or water that meets minimum requirements for contiguous area and separation. Separation requirements differ among landscape distribution pattern categories (i.e. matrix, large patch, small patch and linear).

Landscape distribution pattern categories are based on pre-European distributions as follows:

- Matrix ecosystems form (or formed) extensive and often contiguous cover on the most extensive landforms. Historical occurrences were commonly > 2000 ha. In typical grassland subzone variants, the aggregate of matrix ecosystems often occupy (or occupied) > 50% of the landscape. The mapped boundaries of a matrix ecosystem may incorporate up to 10% other ecosystems as small inclusions that cannot reasonably be mapped separately or are considered part of an integrated complex dominated by the matrix ecosystem. Examples of matrix ecosystems include many "/01" ecosystems within the BEC system.
- Large patch ecosystems form large (historical occurrences were typically 20 – 2000 ha) uninterrupted cover associated with environmental conditions and landforms that are

less extensive than those of matrix communities. Examples of large patch ecosystems within the grasslands include coniferous forest ecosystems, north aspect fescue grasslands in the BGxh2 and some subhygric valley bottom ecosystems.

- Small patch ecosystems occupy small (≤ 20 ha and most often < 5 ha), discreet areas. Small patch ecosystems are typically associated with very specific site conditions or microsites that are only very locally present on the landscape. Examples of small patch ecosystems include saline meadow, rock outcrop and sand dune ecosystems. Some small patch ecosystems form bands around the base of wet or saline depressions. Although these ecosystems have linear characteristics, they are considered small patch ecosystems if the depression is ≤ 20 ha.
- Linear ecosystems consistently form linear strips associated with site features or landforms that are consistently linear. Linear ecosystems may form bands around the base of large depressions such as lakes > 20 ha. Examples of linear ecosystems within the BG zone include streamside riparian ecosystems, lakeshore riparian ecosystem bands and eskers.

The classification of an ecosystem element as matrix, large patch, small patch, or linear refers to 'natural' occurrences, prior to European contact, unless the ecosystem occurs as a result of post-contact, human disturbance.

- Minimum contiguous area for an EEO:
  - 2 ha for matrix ecosystems;
  - 0.4 ha for large patch ecosystems; or
  - 0.05 ha for small patch or linear ecosystems
- Minimum required separation from other occurrences of same ecosystem element:
  - Matrix ecosystems:
    - ≥ 1 km when intervening ecosystem(s) is (are) entirely natural or semi-natural;
    - ≥ 0.5 km when intervening ecosystem(s) is (are) cultural but does not severely restrict movement of individuals and genes; or
    - Any distance when intervening area severely restricts movement of individuals and genes, such as major highways, housing developments and industrial areas.
  - Large patch ecosystems:
    - ≥ 500 m when intervening ecosystem(s) is (are) entirely natural or semi-natural;
    - ≥ 250 m when intervening ecosystem(s) is (are) cultural but do not severely restrict movement of individuals or genes; or
    - Any distance when intervening area severely restricts movement of individuals and genes, such as major highways, housing developments and industrial areas.
  - Small patch ecosystems:
    - ≥ 250 m when intervening ecosystem(s) is (are) entirely natural or semi-natural or is cultural but does not severely restrict movement of individuals and genes; or
    - Any distance when intervening area severely restricts movement of individuals and genes, such as major highways, housing developments and industrial areas.
  - Linear ecosystems:

  - ≥ 500 m when intervening ecosystem(s) is (are) entirely natural or semi-natural or is cultural but does not severely restrict movement of individuals and genes; or
  - Any distance when intervening area severely restricts movement of individuals and genes, such as major highways, housing developments and industrial areas.
- Some ecosystems created by human activity **may** be considered an EEO if they contribute significant biodiversity conservation function, such as habitat for species of concern. Examples may include wetlands created by excavation or damming of drainage channels.

Ecosystem Element Rarity

For purposes of the GCC Priority Grasslands Initiative, rarity of an ecosystem element is assessed by its:

- Area of occupancy: The total accumulated area of all occurrences of the ecosystem element within the subzone variant.
- Occurrences: Number of occurrences of the ecosystem element within the subzone variant.
- Range extent: The current distributional range of the ecosystem element within a subzone variant, expressed in hectares. It is the circumscribed area that encompasses all occurrences of the ecosystem element within the subzone variant.

Area of occupancy is the total area of each EEO based on the following classes:

A. Extremely small: < 40 ha
B. Very small: 41 – 400 ha
C. Small: 401 – 2000 ha
D. Medium: 2001 – 7000 ha
E. Large: > 7000 ha

Number of occurrences is base on the following classes:

A. Extremely few: 1 - 5
B. Very few: 6 - 20
C. Few: 21 – 80
D. Some: 81 – 300
E. Many: > 300

Range extent is described by three classes:

A. Restricted: < 25,000 ha
B. Widespread: 25,000 – 100,000 ha
C. Extensive: > 100,000 ha

Five classes of ecosystem element rarity are identified (Table 1). Primary determinants of rarity are Area of Occupancy and Number of Occurrences. Range Extent modifies the rarity designation by up to one class.

Table 1. Ecosystem element rarity classes.

			RANGE EXTENT														
			< 25,000 ha					25,000 - 100,000 ha					>100,000 ha				
			Area of Occupancy														
			A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
			<40 ha	41-400 ha	401 - 2000 ha	2001-7000 ha	>7000 ha	<40 ha	41-400 ha	401 - 2000 ha	2001-7000 ha	>7000 ha	<40 ha	41-400 ha	401 - 2000 ha	2001-7000 ha	>7000 ha
Number of Occurrences	A	1-5	1	1	1	2	2	1	1	2	2	3	1	2	2	3	3
	B	6-20	1	2	2	2	3	1	2	2	3	4	2	2	3	3	4
	C	21-80	1	2	2	3	4	2	2	3	4	5	2	3	3	4	5
	D	81-300	2	3	3	4	5	3	3	4	4	5	3	4	4	4	5
	E	>300	3	3	4	5	5	4	4	5	5	5	4	5	5	5	5

Rarity Classes:

- 1. Extremely rare
- 2. Rare
- 3. Few
- 4. Abundant
- 5. Very abundant

Threat to Ecosystem Elements

Threat rating for an ecosystem element is determined from the **anticipated scope** (% of area of occupancy of ecosystem element) of each of four **threat severity classes** within the next 20 year period. In cases where the anticipated scope of severity classes differs from trends during the previous 20 years, the difference will be rationalized. All threat severity classes except "Minor" assumes degradation or loss ecosystem elements. Because anticipated threat is based on a relatively short term (< 20 years) assessment, it must be reassessed at regular (5 – 10 year) intervals.

Threat Severity Classes:

Destroyed: Ecosystem element occurrence(s) is (are) irreversibly destroyed without any expectation of recovery of vegetation composition and structure and ecosystem function. Examples include conversion of grassland to agricultural cropland, housing developments, highways and industrial areas.

Degraded: Ecosystem element occurrence(s) is (are) extremely impacted, requiring a long term (>50 years) for recovery of vegetation composition and structure and ecosystem function. Examples include severe livestock grazing, resulting in loss of most mid and tall grasses of the natural grassland and high impact vehicle traffic that results in soil physical damage and replacement of natural grassland species with weeds over more than half of the ecosystem element occurrence.

Modified: Ecosystem element occurrence(s) is (are) impacted sufficiently to require 5 to 50 years for recovery of vegetation composition and structure and ecosystem function. Examples include moderate intensity livestock grazing, resulting in replacement of late seral – climax vegetation with mid seral vegetation (as defined by the B.C. Ministry of

Forests and Range) and moderate physical disturbance (such as vehicle traffic) resulting in substantial inclusion of weeds within the native grassland vegetation. Soils are not severely compacted or eroded.

Minor: Ecosystem element occurrence(s) is (are) only slightly affected so that either < 5 years is required for recovery from impacts or only a very small proportion (< 5%) of an occurrence is impacted. Impacts are sufficiently light that natural ecosystem functions are mostly uninterrupted.

Insignificant: The ecosystem element(s) is (are) impacted in a manner which is so small that it does not significantly influence the overall composition and functional ecological processes**.**

Severity classes in Table 2 are based on anticipated detrimental threats. However, an ecosystem element may also be improving. For example, improved range management practices may be anticipated to result in an increase in the area of late seral ecosystem through natural succession. In these cases, threat class is not determined from Table 2 and is considered improving when calculating conservation priority.

Anticipated threat to an ecosystem element is rarely of a single severity class. Rather, threats often include an array of severity classes, each affecting a different percentage (scope) of the ecosystem element occurrence's area. To determine the overall threat class, the anticipated scope of each severity classes must be determined. This information is then used in Table 2. It must be noted that the "degraded" severity class is not assessed independently but rather in combination with "destroyed".

Table 2. Anticipated threat class key. Threat class is determined by starting under "Total % impacted" and following through the key to arrive at a "Threat class".

Anticipated percent of area detrimentally affected within 20 years Values in parentheses are not required for determination of threat class but are added for clarity						
Total % Impacted	% Destroyed	% Destroyed and/or Degraded	% Modified	% Minor		Threat Class
>60	> 40	*(41 - 100)*	*(0 - 59)*		=	Destructive
	≤ 40	> 60	*(0 - 39)*		=	Destructive
		20 - 59	*(2 - 80)*		=	Major
		5 - 19	≥40	*(0 - 55)*	=	Major
			<40	*(42 - 95)*	=	Moderate
		< 5	≥ 60	*(0 - 39)*	=	Major
			<60	*(0 - 100)*	=	Moderate
20 - 60	> 40	*(41 - 60)*	*(0 - 19)*		=	Destructive
	≤ 40	20 - 59	*(0 - 40)*		=	Major
		5 - 19	(0 - 55)		=	Moderate
		< 5	20 - 59	*(0 - 40)*	=	Moderate
			< 20	*(0 - 60)*	=	Minor
< 20		5 - 19	*(0 - 14)*		=	Moderate
		< 5	5 - 19	*(0 - 14)*	=	Minor
			< 5	*(0 - 19)*	=	Insignificant

Categories of Anticipated Threat (within 20 years):

1. **Destructive Threat**: Current and anticipated threats indicate that:
   - >40% of the total area of the ecosystem element will be destroyed; or
   - 60% will be destroyed and/or degraded over the next 20 years if no new action is taken to mitigate or remove threats.
2. **Major Threat**: Current and anticipated threats indicate that:
   - 20 – 59% of the total area of the ecosystem element will be destroyed and/or degraded; or
   - 5 – 19% will be destroyed and/or degraded and ≥ 40% of the total area will be modified; or
   - < 5% will be destroyed and/or degraded and ≥ 60% or more will be modified over the next 20 years if no action is taken to mitigate or remove threats.
3. **Moderate Threat**: Current and anticipated threats indicate that:
   - > 60% of total area of ecosystem element will experience minor or greater impacts, 5 – 19% will be destroyed and/or degraded and < 40% will be modified; or
   - > 60% of total area of ecosystem element will experience minor or greater impacts, < 5% will be destroyed and/or degraded and < 60% will be modified; or
   - 20 – 60% of total area of ecosystem element will experience minor or greater impacts and 5 – 19% will be destroyed and/or degraded; or
   - 20 – 60% of total area of ecosystem element will experience minor or greater impacts, < 5% will be destroyed and/or degraded and ≥ 20% will be modified; or
   - < 20% of total area of ecosystem element will experience minor or greater impacts and ≥ 5% will be destroyed and/or degraded over the next 20 years if no action is taken to mitigate or remove threats.
4: **Minor Threat**: Current and anticipated threats indicate that:
   - 20 – 60% of the total area of the ecosystem element will experience minor or greater impacts, < 5% will be destroyed and/or degraded and < 20% will be modified; or
   - < 20% of the total area of the ecosystem element will experience minor or greater impacts, < 5% will be destroyed and/or degraded and ≥ 5% will be modified over the 20 years if no action is taken to mitigate or remove threats.
5: **Insignificant threat**: Current and anticipated threats indicate that:
   - < 20% of the total area of the ecosystem element will experience minor impacts and < 5% will be destroyed and/or degraded and < 5% will be modified over the next 20 years if no action is taken to mitigate or remove threats.

Prioritization of Ecosystem Elements

Ecosystem element prioritization for conservation management is based on:

1. ecosystem element rarity and anticipated threat during next 20 years
2. ecosystem element importance for recruitment to other elements that have experienced substantial long term declines

Priority based on rarity and anticipated threat

If threats to the ecosystem element are decreasing and the overall condition is improving, the conservation priority will be reduced by one class to; 2, 3, 5, 5 and 5, respectively for ecosystem elements that are extremely rare, rare, few, abundant and very abundant (Table 3). For these ecosystem elements, a notation will be made that anticipated threat class is improving.

Ecosystem element conservation priority classes based on rarity and threat (except improving) are:

1. **Critically imperilled**. Includes ecosystem elements that are:
   - extremely rare with any anticipated threat other than insignificant;
   - rare with destructive, major, or moderate anticipated threat; or
   - few with destructive anticipated threat.
2. **Imperilled:** includes ecosystem elements that are:
   - extremely rare with insignificant anticipated threat;
   - rare with minor anticipated threat;
   - few with major anticipated threat; or
   - abundant with destructive anticipated threat.
3. **Vulnerable:** includes ecosystem elements that are:
   - rare with insignificant anticipated threat;
   - few with moderate or minor anticipated threat;
   - abundant with major anticipated threat; or
   - very abundant with destructive anticipated threat.
4. **Apparently secure:** includes ecosystem elements that are:
   - few with insignificant anticipated threat;
   - abundant with moderate or minor anticipated threat; or
   - very abundant with major anticipated threat.
5. **Secure:** includes ecosystem elements that are:
   - abundant with insignificant threat; or
   - very abundant with moderate, minor, or insignificant threat.

Table 3. Ecosystem Elements Conservation Priority.

			Anticipated Threat for next 20 years				
			1 Destructive	2 Major	3 Moderate	4 Minor	5 Insignificant
Rarity	1	Extremely Rare	**1**	**1**	**1**	**1**	**2**
	2	Rare	**1**	**1**	**1**	**2**	**3**
	3	Few	**1**	**2**	**2-3****	**3**	**4**
	4	Abundant	**2**	**3**	**4**	**4**	**5**
	5	Very Abundant	**3**	**4**	**5**	**5**	**5**

Assign priority 2 if threat is considered at upper end of moderate **or rarity is high (number of occurrences is <40)
priority 3 if threat is considered at lower end of moderate and rarity is not high (number of occurrences is >40)

Priority based on Recruitment Importance

Recruitment importance is assigned to ecosystem elements that currently support seral plant communities (as defined by the Ministry of Forests and Range) and need to be protected or

managed for recruitment to a later successional stage on the same ecological site unit (site series, site type, or equivalent). This priority is assigned to elements where late seral or climax vegetation on the same site unit is considered critically imperilled, imperilled, or vulnerable. It is expected that mid and late seral plant communities will develop through natural succession to late seral and climax communities respectively when the current disturbances preventing succession to late seral or climax vegetation are mitigated or removed.

Recruitment to climax plant communities can be achieved most quickly by protection or appropriate management of late seral communities. However, if the available area of late seral communities is insufficient to meet goals for climax communities, mid seral communities on the same site series can provide additional sites for recruitment. Similarly, recruitment to late seral communities can be most quickly achieved by protection or management of mid seral communities.

An ecosystem element with a recruitment priority is designated by an "-R**P**" following its conservation priority based on rarity and threat. Ecosystem elements designated as having recruitment priority are, like those based on rarity and threat, considered priority ecosystems for conservation.

Confidence in the Conservation Priority Assessment

When the forgoing procedures are followed, assessments may be made by individuals with varying levels of expertise and knowledge and data about individual ecosystem elements within the full range of the subzone variant under review. In a few cases detailed mapping may be available but in most instances the assessment will be based on expert opinion. Three classes are used to capture the level of confidence placed on each assessment.

1. **High:** Detailed ecological mapping (including TEM and PEM) of site series and their successional status is available for >50% of the subzone variant and the assessment has been completed by an expert who has detailed familiarity with ecosystem distribution and extent on >50% of the mapped as well as the unmapped portions of the subzone variant. In addition, there is detailed land-use planning and a subzone variant – wide description of anticipated land-use practices during the next 20 years.
2. **Moderate:** The assessment has been completed without detailed ecological mapping of >50% of the subzone variant or the assessment has been completed by an ecosystems expert who does not have familiarity with ecosystem distribution and extent on >50% of the mapped and unmapped portions of the subzone variant or the assessment has been completed without local or regional knowledge of land-use practices anticipated over the next 20 years. The expert completing the assessment must have detailed familiarity with ecosystem distribution and extent on >25% the subzone variant. It is anticipated that this will be the most commonly applied level of confidence placed on conservation priority assessments.
3. **Low:** The assessment is a "best guess" made by someone who is not an ecosystems expert with familiarity of ecosystem distribution and extent in >25% of the subzone variant or who has little knowledge of anticipated future land-use practices. The assessment has been completed by someone with limited personal knowledge of the distribution and extent of ecosystem elements throughout the subzone variant or who has little basis for accurately and broadly anticipating future land-use activities.

Connectivity Definition

Connectivity is the capacity of landscape features to impede or facilitate the movement of individuals of a species within and between the habitats that they require for survival (Metzger and Decamps 1997, Taylor et al., 1993). Movement between patches of suitable habitat is crucial to the survival of individuals and populations of a species (Merriam 1984; Baudry and Merriam 1988; Merriam 1991). The general agreement among conservation biologists is that landscape connectivity enhances population viability for many species and that human impacts have created fragmented landscapes in areas where species are used to intact environments (Beier and Noss1998; Gilpin & Soule 1986; Noss 1987; Primack 1993; Noss & Cooperrider 1994; Hunter 1996; Meffe & Carroll 1997).

Contiguity Definition

Contiguity in landscape ecology and remote sensing (Hargis et al. 1998, Rutledge 2003) refers to objects (cells or polygons) that are physically adjacent or touching. With respect to conservation biology, a contiguous landscape is one consisting of interconnected suitable habitat for the species in question. This does not, however, mean that a contiguous landscape is necessarily environmentally homogeneous as suitable habitat for a species may include a variety of different terrain/environment types. A non-contiguous landscape is fragmented by unsuitable habitat, e.g., roads and urban development. In this case, the nature of the connectivity of the remaining suitable habitat patches becomes a priority for conservation.

Habitat Fragmentation Definition

Habitat fragmentation alters population viability by decreasing available habitat and increasing the isolation of remaining patches of suitable habitat (Joly, Moran, and Cohas 2003). Less habitat means smaller population size (Shaffer 1987) while isolation affects viability by reducing immigration from other populations (Brown and Kodric-Brown 1977, Hanski 1999). Consequently a species' genetic diversity and fitness are negatively impacted by genetic drift and inbreeding associated with smaller populations (Frankham, Ballou and Briscoe 2002). Suitable habitat may be too small to support a breeding pair or a functional social group (Lambeck, 1997), whereas species with low dispersal capacity are unable to recolonize the habitat patches following the extinction of their local populations (Collinge 1996). Currently, the main cause of habitat fragmentation – loss of original habitat, reduction in habitat patch size, and isolation of patches is due to human impact (e.g. urban development, agriculture, forestry, mining, etc.) (Nikolakaki 2004, Andren 1994).

Appendix 5

Field Assessment Methodology

The following describes the verification procedure for the high value grassland areas. Field assessments may be done when the accuracy of data is uncertain, especially in regard to value groups with an expert input component (e.g. important ecosystems). The field assessment methodology describes two methods for data collection, detailed ground inspection plots and visual inspection plots, which is primarily based on the Field Manual for Describing Terrestrial Ecosystems (MOE & MOF 1998).

Objectives

The objectives of a focused grassland field assessment are to identify old seral, good condition or rare grasslands in relation to existing grassland mapping in British Columbia. The methodology is not intended to be a complete assessment of all grassland areas, but is intended to provide qualitative information on where critical grassland ecosystems exist and information to why their characteristics are important on the grassland landscape.

Selection of Grassland Sites for Inspection

a) Three methods will be used for site selection of grasslands and will need to be based on available information, development risk and suspected important grasslands. Selection will also have to be based on grassland accessibility due to land ownership as well as road access, walking distance and topographic limitations to access grasslands.
b) The three site selection criteria are as follows:
   - Site selection based on provided expert input: ecosystem verification and attribute or location refinement of sites already provided by range agrologists, ecologists or other expert input.
   - Site selection based on development risk to Grasslands: grasslands around municipalities and key regions within a regional district should be assessed to provide an appropriate level of information to regional governments to mitigate development of priority grasslands that may exist in their vicinity.
   - Site selection based on additional areas that may play an important role in priority grassland recommendations: additional grassland areas suspected to be in good condition or important corridors between parks, wildlife habitat areas and different types of land ownership.
c) The GCC GIS Analyst and the GCC Conservation Planner will create an initial selection of grassland candidates for inspection. This selection will then be reviewed by a sub-committee of the Provincial Technical Advisory Committee for confirmation or revision of selected sites.
d) If specific sites are difficult to determine for inspection, then a regional visual assessment and selection of appropriate sites in the field may play a greater role. An ecologist would reconnaissance specific regions on the fly and make decisions on which sites required further inspection.

Field Inspection Types

a) Two types of ground inspection plots are possible and provide differing levels of field detail and time efficiencies. A 50% split between the two types of plots will be required to collect enough detailed ground information while also covering

enough grassland area that requires some level of assessment. While in the field, a visual assessment of grasslands may warrant further detailed ground inspection plots.

b) GPS points or hand drawn map polygon delineation will be collected or digitized, providing spatial GIS information as a point or polygonal area for each ground inspection form (GIF) form entry. GIF form information will then be entered into an Excel or access database (e.g. Graviti) and joined to corresponding information:
   - Detailed Ground Inspection Plot. Using the GIF to collect an appropriate level of information to describe grassland sites characteristics and subsequently define rarity or condition.
   - Visual Inspection Plot. Partial or visual inspections can also be entered into a GIF form representing a faster less detailed assessment based on condition and general species composition of grasslands. This plot type will need to be assessed for its effectiveness and accuracy and may need to be limited if it is too difficult for the ecologist to make such an assessment.

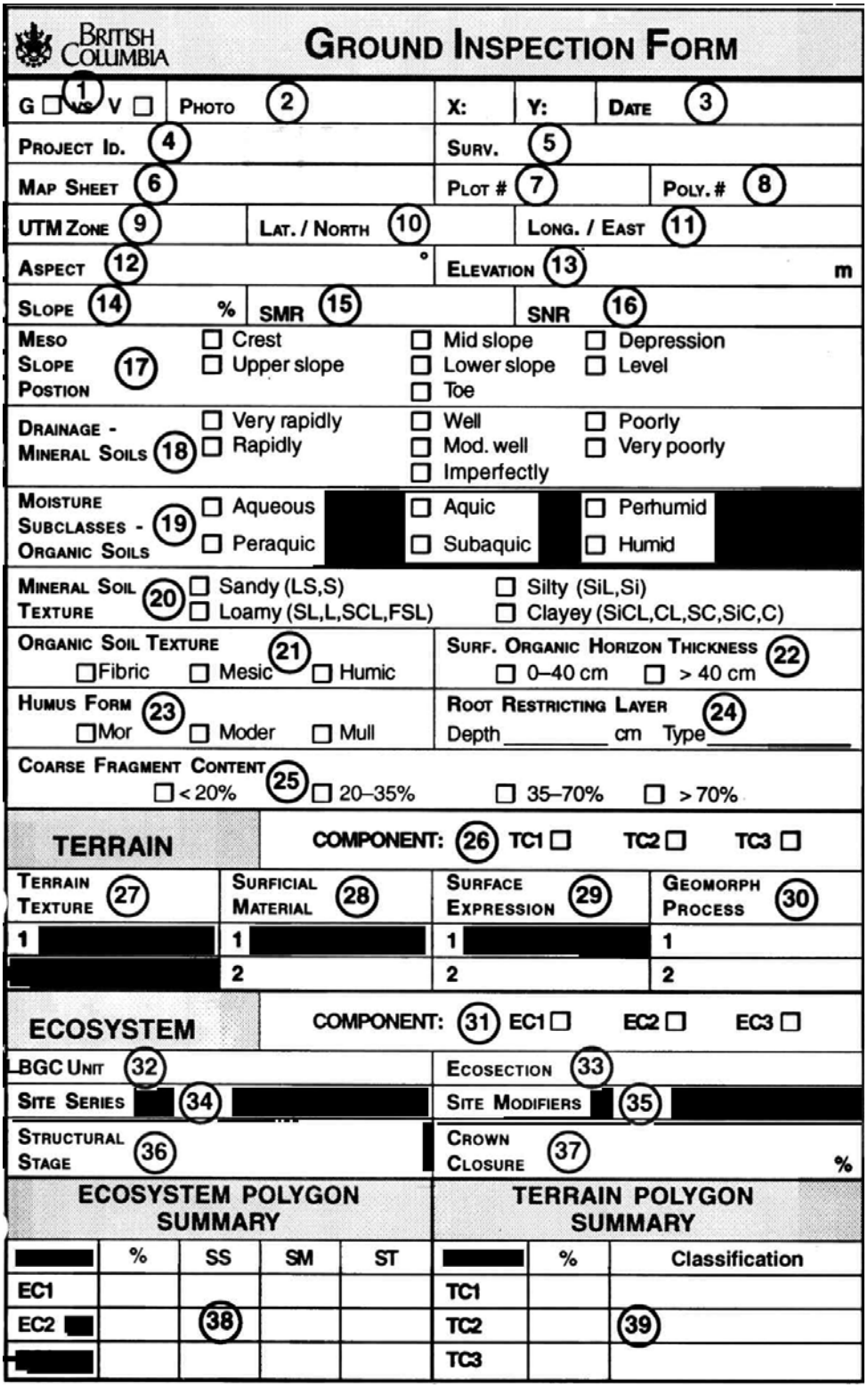
Ground Inspection Form (Data Collection)

The Field Manual for Describing Terrestrial Ecosystems (MOE and MOF 1998) will form the basis on which grassland information is collected. Ground inspection form cards will be used for all field assessments and provides a methodology already used within the province of British Columbia. GIFs provide enough detail and flexibility for the inspecting ecologist to collect an appropriate level of information to describe the grassland site and the ability to reassess or verify field information for rarity or BEC site series classification. Additional fields will be added to the form to provide comments that an ecologist may require when assessing the grassland.

a) The following are proposed additional fields to be added to the GIF form:
   - Ecosystem Comments: A comments section for BEC site series and structural stage descriptions and assessment of rare ecosystems outside the BEC classification.
   - Wildlife Comments: A general wildlife species comment section to describe important wildlife habitat or existence of species found on or near the site.
   - Disturbance comments: To point out any of the following concerns occurring on grassland: recreational vehicles, weeds, range management.
   - Location comments: Descriptive comments on the location of the grassland site.
   - Photo Number: A unique number input for each photo taken of a grassland site.

Sample Ground Inspection Form

a) Page 1 of GIF form



BRITISH COLUMBIA

GROUND INSPECTION FORM

G ☐ (1) V ☐	PHOTO (2)	X:	Y:	DATE (3)
PROJECT ID. (4)		SURV. (5)		
MAP SHEET (6)		PLOT # (7)		POLY. # (8)
UTM ZONE (9)	LAT. / NORTH (10)		LONG. / EAST (11)	
ASPECT (12) °		ELEVATION (13)		m
SLOPE (14) %	SMR (15)		SNR (16)	

MESO SLOPE POSTION (17)	☐ Crest	☐ Upper slope	☐ Mid slope	☐ Lower slope
	☐ Toe	☐ Depression	☐ Level	
DRAINAGE - MINERAL SOILS (18)	☐ Very rapidly	☐ Rapidly	☐ Well	☐ Mod. well
	☐ Imperfectly	☐ Poorly	☐ Very poorly	
MOISTURE SUBCLASSES - ORGANIC SOILS (19)	☐ Aqueous	☐ Peraquic	☐ Aquic	☐ Subaquic
	☐ Perhumid	☐ Humid		
MINERAL SOIL TEXTURE (20)	☐ Sandy (LS,S)	☐ Loamy (SL,L,SCL,FSL)	☐ Silty (SiL,Si)	☐ Clayey (SiCL,CL,SC,SiC,C)

ORGANIC SOIL TEXTURE (21) ☐ Fibric ☐ Mesic ☐ Humic	SURF. ORGANIC HORIZON THICKNESS (22) ☐ 0–40 cm ☐ > 40 cm
HUMUS FORM (23) ☐ Mor ☐ Moder ☐ Mull	ROOT RESTRICTING LAYER (24) Depth _____ cm Type _____
COARSE FRAGMENT CONTENT (25) ☐ < 20% ☐ 20–35% ☐ 35–70% ☐ > 70%	

TERRAIN COMPONENT: (26) TC1 ☐ TC2 ☐ TC3 ☐

TERRAIN TEXTURE (27)	SURFICIAL MATERIAL (28)	SURFACE EXPRESSION (29)	GEOMORPH PROCESS (30)
1	1	1	1
	2	2	2

ECOSYSTEM COMPONENT: (31) EC1 ☐ EC2 ☐ EC3 ☐

BGC UNIT (32)	ECOSECTION (33)
SITE SERIES (34)	SITE MODIFIERS (35)
STRUCTURAL STAGE (36)	CROWN CLOSURE (37) %

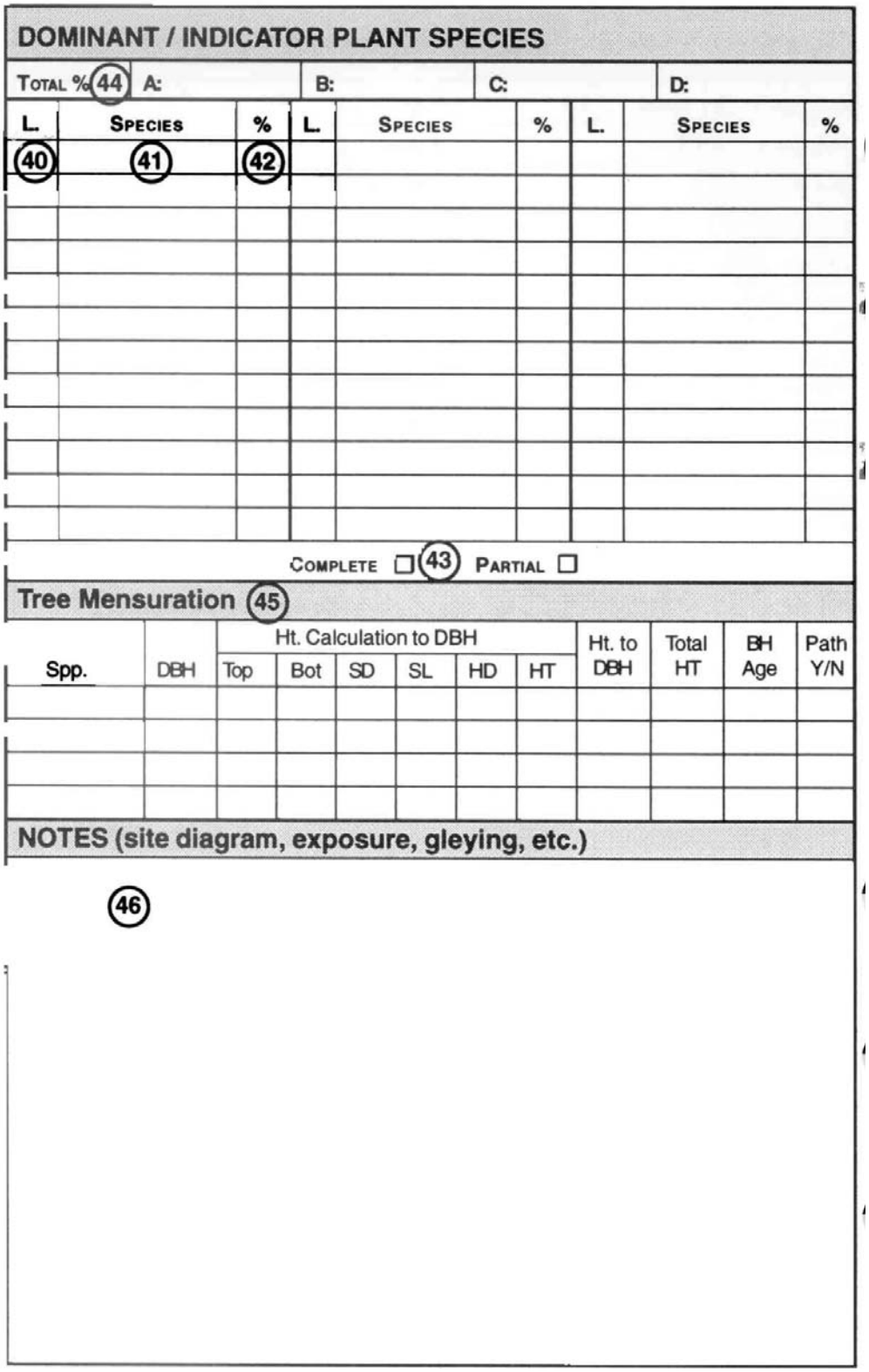
ECOSYSTEM POLYGON SUMMARY

	%	SS	SM	ST
EC1				
EC2		(38)		

TERRAIN POLYGON SUMMARY

	%	Classification
TC1		
TC2		(39)
TC3		

b) Page 2 of GIF form



DOMINANT / INDICATOR PLANT SPECIES

TOTAL % (44)	A:	B:	C:	D:

L.	SPECIES	%	L.	SPECIES	%	L.	SPECIES	%
(40)	(41)	(42)						

COMPLETE ☐ (43) PARTIAL ☐

Tree Mensuration (45)

Spp.	DBH	Ht. Calculation to DBH						Ht. to DBH	Total HT	BH Age	Path Y/N
		Top	Bot	SD	SL	HD	HT				

NOTES (site diagram, exposure, gleying, etc.)

(46)

Proposed additional attributes to be added to GIF form:

- **Assessment of field data for defining rare or good condition grasslands**
  a) When field data is collected, the ecologist will have to train themselves in defining what truly is a good condition or rare grassland. After visiting enough sites, they will begin seeing a pattern in how grasslands are defined by species composition, structure, topography and disturbance. A vetting process or realignment of GIF information will most likely be required to better define and classify what was described in the field.

- **Additional GIF data collection explanations**
  a) Much of the data fields in the GIF form already have defined codes or descriptions that will be sufficient for grassland data collection. Some however may need to be modified or refined to an effective methodology for this particular grassland assessment. The following are a list of suggestions of how the data may be input:
    - GPS Coordinates
      - Projection (UTM 11 or 10 NAD83). Other projections can be automatically calculated.
      - Easting (Six Digit)
      - Northing (Seven Digit)
    - Unique Ecosystem Classification (Not within BEC classification or further site description needed)
      - If the assessed grassland has not previously described or clearly fall under an existing BEC classification system, a best fit BEC/Site series classification with good site comments should be given to describe the grassland. The comments will provide a critical reference for the field ecologist to revise or reclassify what was observed in the field and make a second judgement to correctly classify similar type grasslands based on all information on the form. An asterisk would be entered in the ecosystem section of the form, signifying additional comment information for site series or structural stage fields that will play an important role in further defining grasslands when the field work is completed.
      - After field work has been reviewed and spatially digitized, the field ecologist will then sign off on the final interpretation of site series or structural stage classifications with adjusted classifications reflected on the GIF form as well as in the database.
    - Example: BGC Unit = BGxh2; Site series = *85 signifying a proposed initial classification of site series, but with descriptive comments that will effectively let the ecologist adjust their classification when comparing many grassland sites with a similar characteristics or site series.
    - Ecosystem Comments
      - Descriptive comments by the ecologist to provide additional site information and also to revise or improve their initial grassland classification.
    - Disturbance Comments

    - General comments on disturbance. (motorized vehicles , weeds ,range management)
- Wildlife Species Comments
    - General comments regarding species potential or existence. (e.g. Old seral Bluebunch wheatgrass with minimal Big Sagebrush is good for sharp-tail grouse or a badger den was observed on the site).
- Location Comments
    - A descriptive comment on the location of the grassland site is also important if spatial information is not readily available.
- Photo Number
    - Unique number of photo taken at the grassland site and entered on GIF form. The photo number will be entered as (Plot#_Photo Number) to make a unique identifier if multiple photos are taken at each site. Photo numbers will be placed in a separate look up table to link multiple photos to single field plots (e.g. If two photos are taken at a particular site then the photo number could be entered as F558_2 and F558_3).

- **Final Comments**

a) A field ecologist with some experience in grassland ecosystem inspection and the BEC classification should be hired to effectively assess grasslands and to appropriately classify their importance or rarity as well as condition on the landscape.
b) The time schedule for the initial field work should be in the early spring.
c) It will be necessary for an ecologist to visit a number of similar sites before they can gain an understanding of what type of grassland ecosystem they are assessing and what rarity or condition category it might fall under. As more field work is completed they will become faster and more effective at delineating such ecosystems.

Appendix 6

Representation Analysis

Representation of the diversity of grasslands ecosystems is the key goal of this GIS grid analysis. The analysis consists of comparing the high category ranks (i.e. C1, C2 and C3) to the GCC grasslands base layer based on a matrix of BEC subzone variant, aspect, slope and primary vegetation (i.e. topographic and Vegetation Resource Inventory information) using a series of 25m resolution grid coverages in a GIS raster analysis. The resolution chosen provides adequate precision given the data that will be analysed. In addition, digital elevation models, which use slope and aspect, use a 25 m resolution. Using a GIS raster methodology, the coverages will be developed for the following information.

- **Grasslands – Mapping Project**
  - Represented by BEC Subzone Variant
- **Grasslands – Priority Initiative**
  - Representing by BEC Subzone Variant
- **Slope** – divided into five categories:
  - Level (0-5 percent)
  - Low (5-15)
  - Moderate (16-35)
  - Steep (36-70)
  - Very Steep (>70)
- **Thermal gradients --** divided into three categories of aspect:
  - Cold (336 to 45 degrees)
  - Hot (155 to 290 degrees)
  - Neutral (46 to 154 & 291 to 335 degrees)
- **Primary Vegetation** – Resource Inventory Types (Vegetation Resource Inventory):
  - Aspen Cottonwood
  - Trembling Aspen
  - Ponderosa Pine
  - Lodgepole Pine
  - Spruce
  - Douglas Fir
  - Wetlands (i.e. Marsh, swamp and fens)
  - Rock outcrops
  - Talus
  - Others

Grid coverages would be merged or individually analyzed to determine representation. Percentages for slope, aspect and primary vegetation would be calculated for grasslands from the GCC grassland layer and high category ranked areas. Representation would be evaluated based on comparing the percentage levels.

The above-noted assessment of representation may be supplemented with Predictive Ecosystem Mapping (PEM) or Terrestrial Ecosystem Mapping (TEM) information when available.

Appendix 7

Urban Development and Intensive Agriculture Risk Assessments

GIS predictive threat analyses are conducted for urban and intensive agriculture developments to assign priority levels in stage nine. Both analyses compile several GIS databases to assess the risks of grassland conversion.

Methodologies developed only reflect available agriculture information encountered within the Thompson-Nicola region. Modification to procedures may be required due to the variety of agriculture surveys and GIS information that exist throughout the province.

Urban Development Risk

To determine urban development risk, GIS data and analysis products were compiled for the following features:

- Agriculture Land Reserve GIS boundaries;
- Grasslands GIS data;
- Municipal GIS boundaries;
- City influence boundaries (Areas determined to be influenced by commuters or acreage development outside city boundaries);
- GIS coverage of slopes > 20 percent; and
- Land ownership types

All GIS data is then merged together using an overlay process and consequently all spatial and attribute information is contained in one layer that can be queried on different criteria. Slopes greater than 20 percent are classified as not developable and the remaining attributes are classified into the risk categories stated below. Because risk is dependent on land type, three categories of land ownership were created and appropriate risk ratings developed. Generally private land ownership has a higher risk of development, with federal crown lands at a lower level of risk and provincial crown lands having the lowest level of development risk. Risk is ranked on a scale of 10, with 10 being the highest level of risk and 1 as the lowest level of risk.

Development Risk Categories:

- Private Land
  - Within City Boundary Private grassland not in ALR (Very High Risk) 10
  - Within City Boundary Private grassland in ALR (Moderate Risk) 7
  - 1000 M from Municipal Boundary Private grassland in ALR (Moderate Risk) 6
  - 1000 M from Municipal Boundary Private grassland not in ALR (High Risk) 8
  - 2000 M from Municipal Boundary Private grassland in ALR (Lower Risk) 5
  - 2000 M from Municipal Boundary Private grassland not in ALR (High Risk) 7
  - City Influence from Municipal Private grassland in ALR (Lower Risk) 3
  - City Influence Private grassland not in ALR (High Risk) 7

- Provincial Crown Land
  - Municipal Provincial Crown grassland not in ALR (Very High Risk) 8
  - Municipal Provincial Crown grassland in ALR (Moderate Risk) 5

  - 1000 M from Municipal Boundary Provincial Crown grassland in ALR (Moderate Risk) 4
  - 1000 M from Municipal Boundary Provincial Crown grassland not in ALR (Moderate Risk) 6
  - 2000 M from Municipal Boundary Provincial Crown grassland in ALR (Lower Risk) 3
  - 2000 M from Municipal Boundary Provincial Crown grassland not in ALR (Moderate Risk) 5
  - City Influence from Municipal Provincial Crown grassland in ALR (Lower Risk) 3
  - City Influence from Municipal Provincial Crown grassland not in ALR (Moderate Risk) 4

- Federal Crown Land
  - Within City Boundary Federal Crown grassland not in ALR (Very High Risk) 10
  - Within City Boundary Federal Crown grassland in ALR (Moderate Risk) 6
  - 1000 M from Municipal Boundary Federal Crown grassland in ALR (Moderate Risk) 6
  - 1000 M from Municipal Boundary Federal Crown grassland not in ALR (High Risk) 9
  - 2000 M from Municipal Boundary Federal Crown grassland in ALR (Lower Risk) 6
  - 2000 M from Municipal Boundary Federal Crown grassland not in ALR (High Risk) 8
  - City Influence from Municipal Provincial Crown grassland in ALR (Lower Risk) 5
  - City Influence from Municipal Provincial Crown grassland not in ALR (Moderate Risk) 7

Intensive Agriculture Development Risk

To assess intensive agriculture development risk, the priority grassland initiative used key available GIS data sources to develop a risk rating that could be applied to grasslands. Data used in the analysis included:

- Slope categories of less than 15 percent that are conducive to agriculture and slopes greater than 15 percent where agriculture development is difficult;
- Agriculture Land Reserve data which maintains lands for agriculture purposes and tends to be lands that have agriculture capability; and
- Canada Land Inventory (CLI) Agriculture capability ratings. This includes ratings for grasslands in their natural state and the potential of those grasslands for agriculture if water or other improvement was applied.

CLI agriculture capability ranges from 6 being the poorest agriculture sites, to 1 being the best sites for agriculture. For this analysis 1 and 2 were classified as very good agriculture potential, 3 and 4 as good agriculture potential and 5 or 6 as having no agriculture potential. Results from the analysis were as follows:

- Flat grassland < 15 percent slope in ALR and very good CLI potential = Very high agriculture potential;
- Flat grassland < 15 percent slope in the ALR and good CLI potential = High agriculture potential;
- Flat grassland < 15 percent slope not in ALR and very good CLI potential = High Agriculture potential;
- Flat grassland < 15 percent slope not in the ALR and good CLI potential = Moderate Potential;

- Flat grassland < 15 percent slope in the ALR and no agriculture potential = Moderate to Low Agriculture potential;
- Flat grassland < 15 percent slope not in the ALR and no agriculture potential = Low agriculture potential; and
- Steep grassland > 15 percent slope in ALR = No intensive agriculture potential.

Water availability also plays a key role if intensive agriculture is feasible on grasslands. Using GIS analysis, major water sources were manually selected from TRIM data, then assessed in relation to the surrounding terrain elevation. The results of this assessment identified the elevation in meters required to pump water to a specific area of grassland. Elevations were then classified into the following elevation categories:

- 0 to 50 Meters = Very Good water access;
- 50 to 100 Meters = Good water access;
- 100 to 150 Meters = Moderate water access; and
- > 150 Meters = Poor Water access

Maps are then produced for a regional agrologist to review the results of the analysis. Using the analysis information, the agrologist then manually interprets and adjusts the true agriculture potential of individual grassland areas. Interpretation increases, decreases or verifies agriculture potential based on knowledge of the area and water access.

Appendix 8

NatureServe Site Record Guidelines Adapted for the Priority Grasslands Initiative

The priority grassland portfolio template, in Appendix 9, reflects the attributes used in the site record guidelines established by NatureServe (NatureServe 2007). Utilizing these attributes allows a standardized way of describing and reporting priority grasslands as the NatureServe guidelines provide a consistent methodology for presenting and describing scientific and ecological site information. Benefits of this reporting method allow easy transfer of priority grassland spatial data and attributes into the CDC database, which is accessible by numerous government and non-government agencies.

There are terms in this appendix that are repeated in order to follow the format of the portfolio; some fields in the portfolio occur twice, first in the summary page and then again in the Site Comments pages, the latter being the more detailed descriptive section of the portfolio. Appendix 8.1 describes the standards for abbreviations and symbols. The text with a double underline are headings used for the grasslands site portfolio that are not described in the site record guidelines and are therefore left blank.

Summary Page(s)

Site Name: Unique, official full name assigned to a Site.

Data entry details:

Enter the official full name for the Site. Each Site should be assigned a unique name. Once assigned, the value in the Site Name field should not change unless absolutely necessary.

Enter unofficial names, or a previous Site name that was modified, into the Site Alias field (see below).

Use the Standards for Naming Sites outlined in Appendix 8.2.

Mapped Date: Date on which a Site design map was completed.

The date should be typed into the field using the format yyyy-mm-dd, for example, 2003-01-21.

Priority Ranking:

Site Specifications

Total Area: Called "Primary Area" by the CDC. Estimate of the total area of the Site (acres or hectares) that occurs within the ecological boundaries of the Site. The CDC defines this as the area required to protect the Site's ecological integrity and processes.

Grassland Region:

Broad Ecosystem Inventory:

Biogeoclimatic Ecosystem Zone:

Ownership:

Local Jurisdiction: Local jurisdiction(s) within which the Site is located. The CDC uses the municipality in this field.

Agriculture Land Reserve:

BCGS Mapsheet: Information related to map(s) on which the Site is located

Latitude and Longitude: The latitude/longitude of the centre of the Site.

Minimum Elevation: The lowest altitude in meters or feet, above or below sea level, at which the Site is found.

Data entry details:
If the Site is located on flat terrain, then the uniform elevation should be entered in this field and the Maximum Elevation field left blank.

Maximum Elevation: The highest altitude in meters or feet, above or below sea level, at which the Site is found.

Data entry details:
If the Site is located on flat terrain, then this field should be left blank and the uniform elevation entered in the Minimum Elevation field instead.

Site Ratings Summary

Biodiversity Significance Rating that best describes the significance of the Site in terms of its biological diversity.

Data entry details:
Select the appropriate code. Domain values for Biodiversity Significance are:

- **B1** Outstanding
- **B2** Very high
- **B3** High
- **B4** Moderate
- **B5** General interest/open space
- **B?** Unknown
- **(null)** Not assessed

For a detailed description of each of the above Biodiversity Significance values and how to assign them, see Appendix 8.3.

Connectivity: Rating that best describes the connectivity of the Site to other natural areas.

Data entry details:
Select the appropriate code. Domain values for Connectivity Rating are:

- **C1** The Site provides a high level of connectivity to other natural areas.
- **C2** The Site provides good connectivity to other natural areas.
- **C3** The Site provides a moderate amount of connectivity to other natural areas.
- **C4** The Site provided minimal connectivity to other natural areas.
- **C5** The Site is isolated or surrounded by disturbance and provides no connectivity to other natural areas.
- **(null)** Not assessed

Representation: Rating that best describes how representative the Site is of the ecological communities found within the biogeoclimatic unit.

Data entry details:
Select the appropriate code. Domain values for Representativeness Rating are:

- **R1** is highly representative of the ecological communities found within the biogeoclimatic unit.
- **R2** is fairly representative of the ecological communities found within the biogeoclimatic unit.
- **R3** is somewhat representative of the ecological communities found within the biogeoclimatic unit.
- **R4** is minimally representative of the ecological communities found within the biogeoclimatic unit.
- **R5** is not representative of the ecological communities found within the biogeoclimatic unit.

Cultural: Rating that best describes the cultural significance of the Site.

Data entry details:
Select the appropriate code. Domain values for Cultural Rating are:

- **H1** Outstanding values. The Site has great cultural and/or heritage values.
- **H2** High values.
- **H3** Moderate values.
- **H4** Cultural/heritage values absent or incompatible with land conservation.
- **HU** No important values discernible or known.
- **(null)** Not assessed

Other Values: Rating that best describes the significance of the Site in terms of its aesthetic, recreational, open space and other ecological values; this includes its role in maintaining ecosystem health (e.g., by providing game and wildlife habitat, aquifer recharge functions, erosion control).

Data entry details:
Select the appropriate code. Domain values for Other Values are:

- **V1** Outstanding values [*Such values are generally recognized and a high amount of interest exists in the Site's protection.]*
- **V2** High values

V3 Moderate values
V4 No known values
V5 Negative or counter values [*and/or the Site's other values are incompatible with land conservation.*]
V? Unknown
(null) Not assessed

Protection Urgency: Rating that best describes the urgency to protect the Site.

Data entry details:
Select the appropriate code. Domain values for Protection Urgency are:

P1 Immediately threatened
P2 Threat within 5 years
P3 Definable threat, but not within 5 years
P4 No threat
P5 No action to be taken on this Site
P? Unknown
(**null**) Not assessed

The urgency for protection action (not to be confused with the urgency for management action) generally increases with impending threats to the Site until legal, political, or other administrative measures are taken.

Threats that may require a protection action include:

1. anthropogenic forces that threaten the existence of one or more Element Occurrences at the Site, including:
    a. development that would destroy, degrade, or seriously compromise the long-term viability of an Element Occurrence; and
    b. timber, range, recreational, or hydrologic management that is incompatible with an Element Occurrence's existence);
2. the inability to undertake a management action in the absence of a protection action (e.g., obtaining a management agreement); and
3. in extraordinary circumstances, a prospective change in ownership or management that will make future protection actions much more difficult.

Management Urgency: Rating that best describes the urgency to manage one or more Elements at the Site.

Data entry details:
Select the appropriate code. Domain values for Management Urgency are:

M1 Essential within 1 year to prevent loss
M2 Essential within 5 years to prevent loss
M3 Needed within 5 years to maintain quality
M4 Not needed now; no current threats; may need in future
M5 Not needed; no threats anticipated
M? Unknown
(null) Not assessed

The urgency for management action (not to be confused with the urgency for legal protection action) requires stewardship intervention in order to maintain Element Occurrences (EOs) at the Site.

A management action may include biological management (e.g., prescribed burning, removal of exotics, mowing, etc.) or people and Site management (e.g., building barriers to prevent motorized vehicle use, rerouting trails, patrolling for collectors, hunters or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a Site.

M1 Essential within 1 year to prevent loss

- New management action required immediately or Element Occurrences could be lost or irretrievably degraded within 1 year.
- Ongoing annual management action must continue or Element Occurrences could be lost or irretrievably degraded within 1 year.

M2 Essential within 5 years to prevent loss

- New management action will be needed within 5 years to prevent loss of Element Occurrences.
- Ongoing, recurring management action must continue within 5 years to prevent loss of Element Occurrences.

M3 Needed within 5 years to maintain quality

- New management action will be needed within 5 years to maintain current quality of Element Occurrences.
- Ongoing, recurrent management action must continue within 5 years to maintain current quality of Element Occurrences.

M4 Although not currently threatened, management may be needed in the future to maintain current quality of Element Occurrences

M5 No serious management needs known or anticipated at Site.

Description

Site Description: A short, general visual description (or word picture) of the principal physical and natural features on the Site. The CDC also includes relevant anthropogenic features and uses this field, together with information in the Site Comments, as an Executive Summary.

Data entry details:
The description may include a brief account of the substrate (geologic formations, bedrock), soil types, hydrology (xeric, mesic, hydric and hydrologic regimes) and general topography (mountains, valleys, relief, etc.), noteworthy fauna, dominant vegetation with percent cover and wetland class. Other features may also include a summary of information identified in the Land Use Comments or Offsite fields such as rural residential properties, adjacent recreational development, regional parks, etc.).

Comments about the significance of the Site and its features should be entered in other fields (e.g. Biodiversity Significance Comments, Other Values Comments, etc).

Example:
The Site contains dry Coastal Douglas-fir forest, Garry oak meadows and areas of extremely shallow soils and/or exposed bedrock. Topography is characterized by rolling hills and depressions. Rural residential development is scattered throughout the area and typically consists of a mixture of cleared land, forests and/or woodland.

Location Description:

Key Environmental Factors: Description of the driving factors or key environmental variables that are known to exert a major influence on the biota at the Site.

Data entry details:
Examples include seasonal flooding, wind, soil type, spring seepage, currents, tides, proximity to the ocean, etc.

Example:
The warm, southern aspect and relatively shallow, well-drained soils are key to the presence of *Quercus garryana* communities on the southern slopes of the Site. These ecosystems are also found on the east side where rock outcrops and shallow soils are present. Summer drought conditions are common on the shallow to bedrock areas. Seepage, solar insulation and drying winds are other key factors.

Significance

Boundary justification (Priority Grassland Rationale): Explanation of the biological rationale used to determine the location of the Site boundary.

Data entry details:
The explanation should clearly justify why the Site boundaries were drawn at that location rather than simply describing the boundaries or any coincidental property lines. Include references to any source of information (e.g., field work, maps, etc.) on which boundary decisions were based.

Example:
The boundary captures the area's open, rock and grass-dominated communities known to support Garry oak woodland communities.

Site Comments

Biodiversity

Biodiversity Significance Rating: *see same heading under "Site Summary"*

Biodiversity Significance Comments: Comments that justify the rating assigned for the Site in the Biodiversity Significance field.

Data entry details:
A word summary that supports the rating and identifies why it was assigned. Do not list all the mapped Elements present and their ranks (these are reported from an automatically updateable table and are subject to change). Vegetation summaries for the Site can be captured in the Biological Information field on the Site Opt. (BC) tab. *(Note: only the species used to assign or support the rating are identified in the Comments field.)*

Examples:
Harling Point Site contains the following plant species: *Limnanthes macounii, Microseris bigelovii, Sanicula arctopoides* and *Triphysaria versicolor* ssp. *versicolor.* These species, considered globally and/or provincially "at-risk", are in populations of acceptable size and condition to be of high biodiversity significance.

OR

The biodiversity significance rating will be changed once the provincially "at risk" *Pseudotsuga menziesii – Arbutus menziesii* (Douglas-fir – arbutus) community type has been ranked by the BC CDC.

Additional Biological Information

Species at Risk

Number of Records of Species at Risk:

Species at Risk List:

Species at Risk Habitat Modeling:

Ecosystem Elements

List of elements:

Element Rarity Class:

Element Area of occupancy:

Element Number of occurrences:

Element Range extent:

Element Condition:

Element Recruitment:

Connectivity

Connectivity Rating: *see same heading under "Site Summary"*

Connectivity Comments: Comments that justify the rating assigned for the Site in the Connectivity Rating field.

Data entry details:
This is a brief word summary that supports the rating and identifies why the rating was assigned. Consider whether the Site provides connectivity to other natural areas. The Site may act as a buffer around, or be adjacent to, other areas that are protected or that are of high conservation value. It may also prove a natural corridor for migration or travel.

Example:
The Site offers high connectivity values. It is bisected by property acquired by the CRD Parks in 2003, to act as a link between Mount Work Regional Park and Thetis Lake Regional Park. Plans to create a pathway connecting the two regional parks are underway and are expected to be completed by 2005 (CRD Parks 2004).

Representation

Representativeness Rating: *see same heading under "Site Summary"*

Representativeness Comments: Comments that justify the Representativeness Rating for the Site.

Data entry details:
A word summary that supports the rating and identifies why it was assigned. Consider the adequate representation of all ecosystem types, even relatively common ones, in the Site and how well the overall biogeoclimatic unit is represented within the Site boundaries. Unusual or uncommon ecological communities can also be identified in this field.

Example:
The Site is fairly representative of the coastal bluff and meadow ecosystems found in the moist maritime subzone of the Coastal Douglas-fir (CDFmm) biogeoclimatic zone. Given the small size of the Harling Point Site, the overall representation of the ecological communities expected within the CDFmm is minimal.

OR

Although the variety of ecosystem types usually found within the biogeoclimatic zone is limited, the Site contains an excellent example of the Douglas-fir / Alaska oniongrass community type. Both this and the *Quercus garryana / Bromus carinatus* (Garry oak / California brome) communities are well represented here.

Cultural

Cultural Rating: *see same heading under "Site Summary"*

Cultural Comments: Comments that justify the Cultural Rating for the Site.

Data entry details:
A brief word summary concerning the cultural significance of the Site and/or any historic, cultural or archaeological features found (e.g., burial mounds, prehistoric artifacts, historic sites, abandoned village sites, bridges, cairns, cemeteries, traditional harvesting sites, shell middens, pictographs, petroglyphs, shipwrecks, etc.).

Example:
Much of the Site is of very significant heritage and cultural value. It is contained within the Chinese Cemetery, established in 1903 and is designated a National Historic Site by Parks Canada.

Other Information

Other Values Rating: *see same heading under "Site Summary"*

Other Values Comments: Comments that justify the rating assigned for the Site in the Other Values field.

Data entry details:
A word summary that supports the rating and identifies why it was assigned.

Example:
The area has high aesthetic, wildlife and recreational values. Panoramic and scenic views exist over Satellite Channel and Cowichan Bay and the Site is well used for hiking and birdwatching. The Site is regularly used by raptors making use of the thermal currents generated by the adjacent bluffs. Caves and dead wildlife trees (snags) can be found in a number of locations throughout the area.

Land–use History: Comments about past land uses on this Site.

Data entry details:
Examples include mining, logging, shifting cultivation, etc.

Comments about current land uses should be entered in the Land Use Comments field.

Example:
The majority of the land is owned by the Municipality of North Cowichan and has been included in the Municipal Forest Reserve (MFR) since 1946. Springboard stumps were observed indicating past logging activities.

Ranching:
First Nations:

Land-use Comments: Description of current and/or recent land use, disturbances, improvements and structures on the Site.

Data entry details:
Describe how the land is currently being used (e.g., agriculture, recreational use by all-terrain vehicles, mining, dumping, hydrological implications, hazardous or toxic waste disposal, etc.). Identify why these activities may or may not be a problem on the Site as well as the stewardship implications of this use, if applicable.

Example:
This area is protected to a degree by the park's management plan (CRD Parks 2000). Designated as a "Regional Conservation Area", management priorities are based on environmental consideration with the prevention of further disturbance to natural areas clearly identified. However, a multi-use pathway (for cyclists, pedestrians and horses) is being extended into the newly acquired corridor between the two regional parks. Although cyclists and riders are to stay on designated trails, there is no enforcement of these regulations. The balance of the Site is located within private lands.

Official Designation:
Agricultural Land Commission:
Recreation:

Invasive Comments: Called Exotic Comments by the CDC.

Description of potentially damaging exotic (i.e., introduced) flora and fauna on the Site.

Data entry details:
Include information on the location and abundance of the exotics, as well as their effect on the viability of endangered Elements and/or the condition of the Site. Where identified, methods that could be uses to manage or control exotic species and whether local ordinances require such control, should also be noted. Examples of exotics may include Scotch broom (*Cytisus scoparius*), purple loosestrife (*Lythrum salicaria*), periwinkle (*Vinca* spp), English ivy (*Hedera helix*), feral goats, etc.

Example:
The southern slopes are heavily impacted by *Cytisus scoparius*, although by lesser amounts on the eastern slopes. Extensive dieback of the shrub was observed in 2003 and is thought to be a result of natural causes. Invasive grasses are prominent, particularly on the southern slopes and include: *Vulpia bromoides* (barren fescue), *Aira praecox* (early hairgrass) and *Cynosurus echinatus* (hedgehog dogtail).

Threats

Protection Urgency Rating: *see same heading under "Site Summary"*

Protection Urgency Comments: Comments that justify the rating assigned for the Site in the Protection Urgency field.

Data entry details:
A word summary that supports the rating and identifies why it was assigned.

Example:
Subdivision developments continue on much of the lower slopes. Significant pressures exist along the western and northern boundary for increased subdivision and recreational development. Comparison of air photos (1995 and 2005) also indicates a substantial increase in residential properties along the northern boundary.

OR

Although no apparent threat exists for this Site, there is no formal level of protection for the property.

Anticipated Threats:
Threat Severity:
Threat Scope:

Management

Management Urgency Rating: *see same heading under "Site Summary"*

Management Urgency Comments: Comments that identify current management practices and justify the rating assigned for the Site in the Management Urgency field.

Data entry details:
Do not describe general Site management needs in this field. Address only those needs that are urgent or specific to maintaining Element Occurrences (EOs) on the Site. Routine management needs that apply to the Site as a whole (i.e., general Site management) should be described in the Management Needs field (Management tab) instead.

Example:
The stickleback populations are threatened by shoreline development and the decline in water quality. Another threat is thought to be the result of the introduced crayfish (*Pacifastacus leniusculus*), now present in significant numbers, which are eating the stickleback eggs and are also thought to be responsible in part for the increased water turbidity. The extinction of the Hadley Lake sticklebacks on Lasqueti Island was a result of exotic fish species introduced to the lake (COSEWIC 2002d). Introduced species have the potential to result in a similar extinction at Enos Lake if not managed.

Management Needs: Summary of the expected management needs for the Site and the Elements on it.

Data entry details:
Include routine items such as the need for fencing, restricting use, grazing, control of exotics, burning, etc.

Urgent management actions specific to maintaining EOs on the Site should be listed separately in the Management Urgency Comments field of the Site Significance tab.

Comments concerning a managed area currently overlying the Site should be entered in the Managed Area record.

Example:
General management recommendations for areas within the Site that have been identified in the Sensitive Ecosystems Inventory have been reported in McPhee *et al.* (2000).
OR
Access to areas within the Site that have identified as particularly sensitive to disturbance should be restricted or discouraged. Stewardship agreements or covenants should be pursued with landowners of properties where the "at risk" species have been identified.

Additional Information Needs:
Summary of information that is still needed in order to effectively manage the Site and Elements on it.

Data entry details:
Include such items as the need for baseline information or monitoring, research on management techniques or a more detailed land use history.

Example:
Because of the development of trails, baseline information is required to determine the impact on the area by increased recreational use, particularly in areas sensitive to disturbance (e.g., the impact on mountain-bike use on sparsely vegetated rock outcrops). Overall recreational use through the park "corridor" should be monitored to determine if increased use is having a significant detrimental effect on the Site's condition.

The BC CDC (2005) has records of various species "at risk" occurring in the immediate vicinity of the Site. Further study is required to determine if these species also exist within the Site boundary.

Sources

Digital Mapping by:

Mapping Date: Date on which a Site design map was completed.

Data entry details:
The date should be typed into the field using the format yyyy-mm-dd, for example, 2003-01-21.

Creator: Person that designed the Site and determined its boundaries.

Data entry details: Use standard scientific bibliographic format (i.e., last name, first initial[s] for the first author and then first initial[s], last name for any additional authors).

Examples:
- Oliver, L.

Oliver, L. and K. Maybury

Mapping Method:
Mapping Accuracy:
Literature cited: Any references cited in the Site Record and/or having information on the Site.

Appendix 8.1: Abbreviations and Symbols

The following is derived from *Guidelines for Technical Publications of the Wildlife Program:*

Use only widely accepted forms for abbreviations [see Table 1]. If the abbreviation is not widely used, the term should be written out at first mention with the abbreviation in parentheses:

International Standard Serial Numbers (ISSN) appear in the upper right corner.

Abbreviate the name of a state, territory, province, or district only when it is preceded by the name of a city or town:

Cranbrook is in southeastern British Columbia.
The study area is 50 km north of Cranbrook, B.C.

Do not letterspace between capital-letter abbreviations (acronyms) and do not use periods except when referring to nations, states, provinces and cities in body text [follow Table 10 for state and province abbreviations]:

DNA FAP N.J. P.E.

Spell out the names of countries in the text, with the exception of USA (or U.S. when used as an adjective).

In the reference section of the manuscript, the **place of publishing** (e.g., state, province) may be abbreviated according to the U.S. and Canada postal format [see Table 2]:

B.C. Minist. For., Res. Branch, Victoria, BC.

BC **not** B.C.
AB **not** Alta.

Do not abbreviate the name of a division of the earth's surface, a continent, region, mountain or mountain range, ocean, sea, lake or river, or such words as County, Fort, Point, Port, or Mount when they are part of a proper name:

Arctic Circle	Pacific Ocean	Africa	Fort St. John
Fraser River	Cultus Lake	Mount Currie	

Spell out the genus name in a title and on first mention in text; thereafter, it may be abbreviated if the content makes it clear:

Myotis keenii
M. keenii

Table 1. Word or phrase abbreviations for titles of publications (an * indicates a frequently misabbreviated word; a blank means do not abbreviate) (from Ratti and Ratti 1988).

Word/root or phrase	Abbreviation	Word/root or phrase	Abbreviation
Abstract	Abstr.	Circu-	Circ.
Academ-	Acad.	Clini-	Clin.
Acta		College(i)-	Coll.
Administr-	Adm.	Commerc-	Commer.
Advanc-	Adv.	Commission-	Comm.
Aeronauti-	Aeronaut.	Committee	Comm.
Affair-	Aff.	Commonwealth	Commonw.
Afri-	Afr.	Commonw. Sci. and Ind.	C.S.I.R.O.
Agency		Res. Organ	
Agricult- *	Agric.	Communications	Commun.
Agronom-	Agron.	Company(ies)	Co.
Ameri- *	Am.	Compar-	Comp.
Anali(y)-	Anal.	Completion	
Anals	An.	Comptes Rendus	C.R.
Anatomical	Anat.	Comput-	Comput.
Animal-	Anim.	Confer-	Conf.
Annal-	Ann.	Congres-	Congr.
Annu- *	Annu.	Conserva-*	Conserv.
Antarcti-	Antarct.	Contamina-	Contam.
Appli-	Appl.	Catalogue	Cat.
Archaeology	Archaeol.	Contrib-	Contrib.
Archiv-	Arch.	Coopera-	Coop.
Arctic	Arct.	Coordinator	Coord.
Assistance	Assist.	Council-	Counc.
Associ-	Assoc.	Corporation	Corp.
Atlanti-	Atl.	Cultur-	Cult.
Atmos-	Atmos.	Current	Curr.
Atomi-	At.	Depart-*	Dep.
Australi-	Aust.	Develop-	Dev.
Avian		Disease-	Dis.
Bac(k)teriolog-	Bac(k)teriol.	Disserta-	Diss.
Behavio(u)r-	Behav.	District	Dist.
Beobacht-	Beob.	Divis-	Div.
Bibliogra-	Bibliogr.	Doctor of Philosophy	Ph.D.
Biennial	Bienn.	East*	
Biochem-	Biochem.	Eastern*	East.
Biolo-	Biol.	Ecolog-	Ecol.
Biometri-	Biom.	Econom-	Econ.
Board		Edic(t)(z)-	Ed.
Botan-	Bot.	Education(al)	Educ.
Branch		Electric(q)-	Electr.
Breeder		Endocrinolog-	Endocrinol.
British *	Br.	Energy	
Bulet-	Bul.	Engineer-	Eng.
Bullet-	Bull.	Engl-	Engl.
Bureau-	Bur.	Entomolog-	Entomol.
Canad-	Can.	Environment-*	Environ.

Table 1. (continued)

Word/root or phrase	Abbreviation	Word/root or phrase	Abbreviation
Center-	Cent.	Europ-	Eur.
Central	Cent.	Evol-	Evol.
Chapter *	Chap.	Experiment-	Exp.
Chemic-	Chem.	Fauna	
Chimie	Chim.	Federa-	Fed.
Chronicle	Chron.	Fenni-	Fenn.
Fertility	Fertil.	Memorial	Mem.
Fertiliz-	Fert.	Metaboli-	Metab.
Field-Naturalist	Field-Nat.	Meteorolog-	Meteorol.
Finni-	Finn.	Method(s)	
Fishery(ies)	Fish.	Mex-	Mex.
Forest-	For.	Microbiolog-	Microbiol.
Foundation-	Found.	Midland	Midl.
Franc-	Fr.	Midwestern	Midwest.
French	Fr.	Migratory	Migr.
Gazette	Gaz.	Mimeograph-*	Mimeogr.
Genera-	Gen.	Minist-	Minist.
Genet-	Genet.	Miscel-	Misc.
Geogr-	Geogr.	Monitoring	Monit.
Geolog-	Geol.	Monogr-*	Monogr.
German-	Ger.	Month-	Mon.
Gesellschaft	Ges.	Morf(ph)olog-	Morf(ph)ol.
Go(u)vernment-	Gov.	Mountain	Mt.
Handb-	Handb.	Muse-	Mus.
Helmintholog-	Helminthol.	National-*	Natl.
Heredi-	Hered.	National Academy of	Natl. Acad. Sci.
Herpetolog-	Herpetol.	Science	
Histo(i)r-	Hist.	National Research Council	Natl. Res. Counc.
Human	Hum.	National Aeronautics and	Natl. Aeronaut. and
Hygien-	Hyg.	Space Administrations	Space Adm.
Ichthyolog-	Ichthyol.	National Oceanic and	Natl. Oceanic and
Immunolog-	Immunol.	Atmospheric Administration	Atmos. Adm.
Infecti-	Infect.	Nature (al-b)(el-)	Nat.
Information	Inf.	Newsletter	Newsl.
Inland		Nomenclat-	Nomencl.
Instit-	Inst.	North*	
Interi-	Inter.	Northeast*	
Internal	Intern.	Northeastern*	Northeast.
Internat(z)- *	Int.	Northern*	North.
Investiga-	Invest.	Northwest*	
Japan-	Jap.	Northwestern*	Northwest.
Journal	J.	Norwegian	Norw.
Laborato-	Lab.	Note(s)	
Leaflet-	Leafl.	Nuclear-	Nucl.
Libra-	Libr.	Nutri-	Nutr.
Linn-	Linn.	Occasion-	Occas.
Livestock	Livest.	Offi-	Off.
Magas(z)i-	Mag.	Organic(q)	Org.
Mammalia-	Mamm.	Organis(z)a-	Organ.
Mammalog- *	Mammal.	Ornit(h)olog-	Ornit(h)ol.

Table 1. (continued)

Management *	Manage.	Outdoor-	
Manua(e)l	Man.	Pacific	Pac.
Manufacturing	Mfg.	Pamf(ph)let-	Pam.
Marin-	Mar.	Paper-	Pap.
Master of Science	MSc.	Parasitolog-	Parasitol.
Mathemat-	Math.	Patholog-	Pathol.
Medi(e)ca(h)(i)-	Med.	Performance	Perf.
Meeting	Meet.	Pesticide-	Pestic.
Memoir-	Mem.	Perspectives	Perspect.
Memorand-	Memo.	Pharmacolog-	Pharmacol.
Philosoph-	Philos.	Scien-	Sci.
Physica-	Phys.	Secti-	Sect.
Physiolog-	Physiol.	Seminar	Semin.
Pittman-Robertson*		Serie-	Ser.
Polish	Pol.	Ser(i)olog-	Ser(i)ol.
Pollution	Pollut.	Servi-*	Serv.
Poultry	Poult.	Society	Soc.
Press		Southeastern	Southeast.
Printer		Special	Spec.
Proceedings	Proc.	Station*	Stn.
Professional	Prof.	Statistical	Stat.
Program		Study(ies)	Stud.
Progres-	Prog.	Supplement	Suppl.
Project-	Proj.	Survey	Surv.
Protection	Prot.	Symposium	Symp.
Provincial	Prov.	Systematic	Syst.
Psycholog-	Psychol.	Technical	Tech.
Public		Technology	Technol.
Publica-	Publ.	Telemetry	Telem.
Publishing Company	Publ. Co.	Therap-	Ther.
Quantit-	Quant.	Toxicology	Toxicol.
Quarterly*	Q.	Transactions	Trans.
Radiati-	Radiat.	Transportation	Transp.
Radio		Vertebrat-	Vertebr.
Range		Veterinari-(y)	Vet.
Raptor		Volum-	Vol.
Record-	Rec.	Volunteer	
Region-	Reg.	West*	
Regulation	Regul.	Western*	West.
Report-	Rep.	Wildfowl	
Reproduction	Reprod.	Wild Life	
Research-	Res.	Wildlife	Wildl.
Resource-*	Resour.	Workshop	
Restoration	Restor.	Yearbook-	Yearb.
Revi(u)-	Rev.	Yearly	Yrly.
Royal-	R.	Zeitschrift-	Z.
Russi(k)-	Russ.	Zoolog-	Zool.
Sanitar(t)-	Sanit.		

a No 3-letter and practically no 4-letter words are abbreviated. Words or roots followed by a hyphen encompass >1 word derived from the same root. Letters in brackets can substitute for the letter preceding the bracket(s).
b Abbreviate Naturaliste Canadien as Nat. Can. (Que.) and Nature Canada as Nat. Can. (Ottawa).

Table 2. Abbreviations for U.S. and Canadian political units to be used for place of publication in bibliographic section: references, references cited, or literature cited.

U.S.A.			
Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Colorado	CO	New Mexico	NM
Connecticut	CT	New York	NY
Delaware	DE	North Carolina	NC
Florida	FL	North Dakota	ND
Georgia	GA	Ohio	OH
Hawaii	HI	Oklahoma	OK
Idaho	ID	Oregon	OR
Illinois	IL	Pennsylvania	PA
Indiana	IN	Rhode Island	RI
Iowa	IA	South Carolina	SC
Kansas	KS	South Dakota	SD
Kentucky	KY	Tennessee	TN
Louisiana	LA	Texas	TX
Maine	ME	Utah	UT
Maryland	MD	Vermont	VT
Massachusetts	MA	Virginia	VA
Michigan	MI	Washington	WA
Minnesota	MN	West Virginia	WV
Mississippi	MS	Wisconsin	WI
Missouri	MO	Wyoming	WY
CANADA			
Alberta	AB	Nova Scotia	NS
British Columbia	BC	Ontario	ON
Manitoba	MB	Prince Edward Island	PE
New Brunswick	NB	Quebec	PQ
Newfoundland	NF	Saskatchewan	SK
Northwest Terr.	NT	Yukon	YT

Appendix 8.2: Standards for naming Sites

DO:

1 Use local place names when available. Although these names may not be found on topographic maps, botanists, ecologists, hunters and others may refer to certain places by commonly used names. Examples: "Hamilton Swamp", "Brooks' Point".

2 Use names of features on topographic maps when local names do not exist. Examples: "Winchelsea Island" "Owl Canyon"

3 Use the town or municipality name with a generic natural community descriptor when no local place name or topographic feature name exists. Example: "Quamichan Garry Oak Meadow"

4 Use the centrum town or municipality name with a site descriptor when no community is present. To distinguish between nearby Sites, use some other additional designation such as "Swamp" or "Woods". Use a direction, (North, South, East, West), or Roman numerals, but only if absolutely necessary. Examples: Bellingham Powerline Site, Bellingham Powerline Woods, Western Prairie North, Western Prairie South, Dugan Creek I, Dugan Creek II.

5 Add the word "Site", for clarity, to the following:
- Standard Site names ending with a descriptive term for a human-made feature (e.g., "Ranch", "Canal", etc.)
- One-word Site names denoting a jurisdiction.
- Site names that are the same as the managed area name.

DO NOT:

1 To avoid attracting collectors, do not use Element names in the Site name. Example: "Orchid Meadow" could attract orchid collectors.

2 Do not use the same name more than once within the province. When a particular local place name or feature name is very common, add the town or municipality name before or after the common name to distinguish between Sites.

3 Do not combine Site names with protection status, such as "Great Woods Easement". A Site is defined by an ecological boundary, not ownership boundaries.

4 Do not name a Site after the tract owner. Example: the Jones Tract may encompass an entire Site, but if Smith buys it, the name "Jones Site" becomes meaningless.

5 Do not add parentheses, hyphens, or slashes in a Site name unless it is actually part of the name.

Appendix 8.3: Descriptions of Biodiversity Significance rating values

B1 **Outstanding** significance, such as:

- the only known occurrence of any Element,
- the best or an excellent (A-ranked) occurrence of a G1 Element; or
- a concentration (4 or more) of high-ranked (A- or B-ranked) occurrences of G1 or G2 Elements.

Site should be viable and defensible for targeted Elements and ecological processes contained.

B2 **Very high** significance, such as:

- one of the most outstanding occurrences of any community Element (regardless of its Element rank).

Also includes:

- areas containing any other (B-, C- or D-ranked) occurrence of a G1 Element;
- a good (A- or B-ranked) occurrence of a G2 Element;
- an excellent (A-ranked) occurrence of a G3 Element; or
- a concentration (4+) of B-ranked G3 or C-ranked G2 Elements.

B3 **High** significance, such as:

- any other (C- or D-ranked) occurrence of a G2 Element;
- a B-ranked occurrence of a G3 Element;
- an A-ranked occurrence of any community; or
- a concentration (4+) of A- or B-ranked occurrences of (G4 or G5) S1 Elements.

B4 **Moderate** significance, such as:

- a C-ranked occurrence of a G3 Element;
- a B-ranked occurrence of any community;
- an A- or B-ranked or only state (but at least C-ranked) occurrence of a G4 or G5) S1 Element;
- an A-ranked occurrence of an S2 Element; or
- a concentration (4+) of good (B-ranked) S2 or excellent (A-ranked) S3 Elements.

B5 Of **general** biodiversity interest or open space.

Additional Notes:

For purposes of assigning Biodiversity Significance ratings to Sites:

- Elements with range ranks spanning two levels (e.g., G2G3) should be treated as if they had the higher (G2) of the two ranks;
- Elements with range ranks spanning three levels (e.g., G3G5) should be treated at the middle rank (e.g., G4);
- Elements with ranks such as G3? should be treated as if there were no question mark;
- Elements with a GU rank should be treated as if it were G4; Elements with "Q"s attached to their global ranks (i.e., questionable taxa) should be treated at the next lower G rank (e.g., treat a G3Q as if it were a G4);
- Elements with "T"s attached to their global ranks (i.e., subspecific taxa should be treated at the next lower G rank (e.g., treat a G4T1 as if it were a G2; a G5T2 as a G3);

- Element Occurrences with range ranks (e.g., AB) should be treated as if they were ranked at the lower of the two levels (e.g., B); and
- Element Occurrences that are not yet ranked should be treated as if they were C-ranked.

Appendix 9

Sample Grasslands Site Portfolio for the Thompson Nicola Grassland Region

This sample will be used a template for priority grassland site portfolios. Most of the attributes used reflect those in NatureServe's site record guidelines (NatureServe 2007). Utilizing these attributes allows a standardized way of describing and reporting priority grasslands as the NatureServe guidelines provide a consistent methodology for presenting and describing scientific and ecological site information.

Site Name: Valleyview Silt Bluffs
Mapped Date: March 2007-05-08
Priority Ranking: 1

Site Specifications

Total Area: 578 ha
Grassland Region: Thompson Nicola
Broad Ecosystem Inventory: Thompson Basin
Biogeoclimatic Ecosystem Zone: BGxh2 and PPxh2a
Ownership: Private and Provincial Crown

Local Jurisdiction: City of Kamloops
Agriculture Land Reserve: 0 ha
BCGS Mapsheet: 092I069
Latitude: 50 40' 4"
Longitude: 120 15' 49"
Minimum Elevation: 350 m
Maximum Elevation: 570m

Site Ratings Summary

Biodiversity Significance: High
Connectivity: High
Representation: Highly Representative
Cultural: Moderate

Other Values: High Values
Protection Urgency: Threat within 5 years
Management Urgency: Unknown

Description

Site Description: The site is a series of provincially significant low elevation silt bluffs in the southeast of Kamloops. Most of the site is within the BGxh2 (very dry hot bunchgrass variant) ecosystem zone of the Biogeoclimatic Ecosystem Classification, but the southern portion of the site, approximately 60 ha is PPxh2a (very dry hot ponderosa pine variant – grassland phase). The BGxh2 occurs in the valley bottoms along the Thompson River from Pritchard to Spences Bridge, with PPxh2a mostly occurring at higher elevations above BGxh2.

Location Description: The site is located at the south side of the South Thompson River in the neighbourhood of Juniper Ridge of Kamloops. More specifically, the site is east of Rose hill Rd and south of Valleyview Dr. to approximately the most easterly of Valleyview Dr. and Qu'Appelle Blvd. The site is located in the Thompson River Basin of the intermountain region.

Key Environmental Factors: The ecological communities and species at risk, in combination with the light grazing history, on this site make it a provincially significant. This grassland site is predominantly part of BGxh2 ecosystem zone, which occurs at lower elevations in the Thompson Basin. This ecosystem zone has suffered significant losses in the Thompson Basin. Lack of moisture is the primary reason for grasslands existence in the region, with long growing seasons and moisture deficiencies in the summer. The site was designated in 1991 as an Endangered Space during a workshop lead by the Kamloops Naturalist Club (Kamloops Naturalist Club 1992). This designation prompted the City of Kamloops to designate the site as an Environmental Sensitive Area in their current official community plan, Kamplan 2004 (City of Kamloops 2004). The site provides an initial component to conserving one of the more ecologically important areas in the Thompson Basin (Kamloops Naturalist Club 1992).

Significance

Boundary justification (Priority Grassland Rationale): The site boundary was predominantly dictated by the geographic extent of the bluffs and adjacent urban development.

Site Comments

Biodiversity

Biodiversity Significance Rating: B3 (High)
Biodiversity Significance Comments: The Biodiversity Significance rating is assigned based on the element occurrence rank and the ecosystem community global rank. A high ranking was assigned to the site because the site has A-ranked occurrences for three ecological communities; big sage/bluebunch wheatgrass (BGxh2/01), rough fescue/bluebunch wheatgrass (BGxh2/06) and ponderosa pine/bluebunch wheatgrass/rough fescue (PPxh2/01). A-ranked occurrences are only assigned to sites with excellent viability.

Additional Biological Information

The following describes additional species at risk and/or ecological communities that are also globally and/or provincially "at risk" but do not satisfy the criteria for the Biodiversity Significance Rating.

Species at Risk
Number of Records of Species at Risk: 9

Species at Risk List: Gopher Snake, American Badger and Lewis's Woodpecker.

Species at Risk Habitat Modeling:

- Most of the site has a very high potential for American Badger (i.e. denning sites).
- Portions of the site have moderate potential for Western Rattlesnake (i.e. hibernation and gestation sites); however, sightings on the south side of the South Thompson River are extremely rare.
- Portions of the site are considered tertiary habitat for Spadefoot toad.

Ecosystem Elements
List of elements: To be determined.
The ecosystem elements for the Thompson Nicola have not yet been determined. However, the red and blue listed ecological communities found on the site, big sage/ bluebunch wheatgrass (BGxh2/01), rough fescue/bluebunch wheatgrass (BGxh2/06) and ponderosa pine/bluebunch wheatgrass/rough fescue (PPxh2/01), would most likely be designated as ecosystem elements. A site assessment would need to be performed to determine site specific information.

Element Rarity Class: To be determined
Element Area of occupancy: Not available
Element Number of occurrences: Not available

Element Range extent: Not available

Element Condition: To be determined
Element Recruitment: To be determined

Connectivity

Connectivity Rating: C1 (High)
Connectivity Comments: The site is on the west end of a series of grassland silt bluffs running in an east-west direction on the south side of the South Thompson River. The site provides an important link the more easterly bluffs. The site also serves as buffer from the negative influences of the adjacent urban developments.

Representation

Representativeness Rating: R1 (Highly Representative)

Representativeness Comments: The rare ecological communities that occur of within the site are highly representative of low elevation very dry hot subzone of the bunchgrass and ponderosa pine biogeoclimatic zones in the Thompson Basin.

Cultural

Cultural Rating: H3 (Moderate)
Cultural Comments: There are no known archaeological values. However, due to the proximity to a significant waterbody and the lands of the Kamloops Indian Band, a moderate value was assigned.

Other Information

Other Values Rating: V2 (High Values)
Other Values Comments: The site definitively has recreational and natural heritage values and has the potentially for ranching and First Nations values. For example, the site contains aesthetic scenic values for residents that live in the Valleyview and Juniper Ridge neighbourhoods of Kamloops.

Land–use History:

Ranching: The site has been lightly grazed on two separate occasions.
First Nations: The Kamloops Indian Band may have traditionally used the site.

Land-use Comments:

Official Designation: The site is an Environmental Sensitive Area in Kamloops' official community plan; Kamplan 2004 (City of Kamloops 2004).
Agricultural Land Commission: None of the site is designated as Agricultural Land Reserve.
Recreation: The site contains trails that are used by local residents. The city of Kamloops operates a mountain biking park on a portion of the bluffs.

Invasive Comments: Provincial weed inventories indicate the occurrence of Diffuse Knapweed (3 locations), Hound's–tongue (2 locations), Russian Knapweed (1 location) and Spotted Knapweed (1 location).

Threats

Protection Urgency Rating: (P2) (Threat within 5 years)
Protection Urgency Comments: The site is at great risk to development within the next 5 years. It is a combination of privately and provincially Crown owned lands and is not designated as Agricultural Land Reserve. The site was not assigned a P1 (Immediately threatened) rating due to its Environmental Sensitive Area designation under Kamplan 2004 (City of Kamloops 2004).

Anticipated Threats: Urban or Acreage Development
Threat Severity: To be determined
Threat Scope: To be determined

Management

Management Urgency Rating: (M?) (Unknown)
Management Urgency Comments: The threat of invasive species on the viability of the ecosystem elements is unknown.

Management Needs: Effects of recreational uses, such as biking and walking, in relation to the spread of invasive species, need to be determined.

Additional Information Needs: Ecosystem and species at risk inventories, regional expert input to help identify additional ecosystem elements, species at risk and landscape features.

Sources

Digital Mapping by: Richard Doucette, Conservation Planner, GCC
Mapping Date: May 8, 2007
Creator: Grasslands Conservation Council of BC
Mapping Method: Not applicable
Mapping Accuracy: 100 Meters
Literature cited:

Kamloops Naturalist Club. 1992. Endangered Spaces Project: Land for Nature in the Kamloops Area.

City of Kamloops. 2004. Kamplan 2004.

Appendix 10

Sample Regional Portfolio Synopsis for the North Okanagan Grassland Region

This sample will be used a template for priority grassland regional portfolios. The template was not only developed to summarize the full gamut of analysis results, but was also compiled to address the needs of GCC's Planning for Change Initiative. The Planning for Change Initiative focuses on delivering results to regional districts, municipalities, First Nations and the provincial government. This synopsis may form the basis for grassland status reporting.

Brief Description

"Grasslands in the Northern Okanagan Basin are transitional between the Rough fescue −Bluebunch wheatgrass communities of the Upper Grasslands in the Thompson-Pavilion region and the south Okanagan, but there is little vertical zonation of plant communities compared to those in the south Okanagan. Most of the grasslands from Kelowna to Armstrong and in the Coldstream Valley, are classified as part of the Interior Douglas-fir zone, even at the lowest elevations. Limited areas of subalpine and alpine grasslands are present north of the Shuswap River on the Hunters Range at elevations up to 2240 m." (Wikeem & Wikeem 2004)

Table 1. Regional Summary of Priority Grasslands for the North Okanagan Grassland Region.

		Priority Grasslands		Regional Grasslands
		Area (ha)	Proportion of region (%)	Total Area (ha)
Ownership*				
	Crown			
	Private			
	Federal			
Local Government				
	Central Okanagan Regional District			

	City of Kelowna			
	District of Lake Country			
	District of Peachland			
	North Okanagan Regional District			
	City of Armstrong			
	District of Coldstream			
	City of Enderby			
	Village of Lumby			
	Township of Spallumcheen			
	City of Vernon			
Protected Areas				
Agricultural Land Reserve				
Non-agricultural Land Reserve				
Total				

* Ownership designation was not considered during the delineation process

Table 2. Ecosystem Element Summary for the North Okanagan Grassland Region.

		Priority Grasslands		Regional Grasslands
		Total Area (ha)	Proportion of region (%)	Total Area (ha)
Ecosystem Elements				
	Okanagan Very Dry Hot Bunchgrass Variant (BGxh1)			
	Okanagan Very Dry Hot Ponderosa Pine Variant (PPxh1)			
	The Kettle Dry Hot Ponderosa Pine Variant (PPdh1)			
	Okanagan Very Dry Hot Interior Douglas-fir Variant (IDFxh1)			
	Kettle Dry Mild Interior Douglas-fir Variant (IDFdm1)			
	Other			

Table 3. Species at Risk Summary for the North Okanagan Grassland Region.

		Priority Grasslands				Regional Grasslands		
		# of Areas with Record (s)	# of Areas from Models	Proportion of Region (%) for Records	Proportion of Region (%) for Models	Total # of Areas	Total # of Areas for Records	Total # of Areas for Models
Species								
	Great basin spadefoot toad							
	Western rattlesnake							
	Gopher snake		N/A					
	Racer		N/A					
	Painted turtle		N/A					
	Night snake		N/A					
	Tiger salamander		N/A					
	Long-billed curlew		N/A					
	Short-eared owl		N/A					
	Screech owl							
	Lewis's woodpecker							
	Grasshopper sparrow		N/A					
	Brewers sparrow		N/A					
	American badger							
	Great basin pocket mouse		N/A					
	Western harvest mouse		N/A					
	Spotted bat		N/A					
	Pallid bat		N/A					

Table 4. Species at Risk Summary for the North Okanagan Grassland Region.

	Total # of Species	Proportion of Region (%)	Total # of Records
Priority Grasslands			
Total Grasslands			

Table 5. Value Groups for the North Okanagan Grassland Region.

		Priority Grasslands			Regional Grasslands	
		Area (ha)	# of Areas with Record (s)	Proportion of Region (%)	Total Area (ha)	Total #
Connectivity						
			N/A	N/A	N/A	N/A
Wildlife						
	Mule deer - Winter Forage		N/A			N/A
	Mule deer - Summer Forage		N/A			N/A
	Moose		N/A			N/A
	Bighorn Sheep - Winter Forage		N/A			N/A
Recreation						
	Recreational Sites	N/A			N/A	
Disturbance						
	Weeds					
Ranching						
	Spring Forage					
First Nations						
	Traditional Areas	N/A			N/A	
	Archaeological Sites	N/A			N/A	
Development Risk						
	Agriculture		N/A			N/A
	Municipal		N/A			N/A