British Columbia Wildlife Habitat Rating Standards

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Ministry of Environment, Lands and Parks
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Preface

In developing standards for capability and suitability ratings for all terrestrial vertebrate species in British Columbia at any of the four commonly-used scales of ecosystem mapping, many complexities arise. Our goal – and the ongoing challenge – is to formulate standards that are both relatively uncomplicated and yet flexible enough to be applicable to a multitude of species across the breadth of our very diverse province. A continuing dialogue with users of this manual is important to achieving this goal. The Wildlife Interpretations Subcommittee welcomes any comments and suggestions.

Changes from April 1998 Standards

[Note: the April 1998 Standards have been retroactively proclaimed "Version 1"]

Minimum Requirements – a statement (paragraph or table) has been added at the end of each relevant section to clarify what the minimum requirements are for all projects.

Executive Summary

Minimum requirements have been clearly identified.

1.2 Capability and Suitability Ratings Defined

Wording in definition of "capability" has been changed to clarify -- but not change -- the definition.

Wording in definition of "density" has been changed to clarify -- but not change -- the definition.

2. Rating Criteria: Rating Schemes/Life Requisites/ Rating Habitat Use:

Density is more clearly defined as: # animals *times* the unit of time *divided* by the area of habitat.

Redefine Living - Living includes all relevant life requisites; a rating for Living includes the ratings for all the life requisites important to the species during the specified season.

Table 6: Remove Denning/Roosting from list of Specific Life Requisites (because rating security/thermal habitat will cover these requirements)

Table 6: Remove Feeding on Salmon from list of Specific Life Requisites (can use spatial adjustment to cover these requirements)

Add Section 2.5: Minimum Requirements for Rating Habitat Use

Add New table: Minimum requirements for rating habitat use (life requisites and seasons) and the rating scheme to use for some commonly rated vertebrate species at two map scales (1:50,000 and 1:20,000).

3. Project Management:

Table 9: Completion of the training course for Describing Ecosystems in the Field (DEIF) is no longer required, but is preferred (and strongly recommended!).

3.4 Quality Control and Correlation

Add Table 10 (drafted by Chris Swan) on Project Review roles and times required for review

(This is for Ministry administered projects, but hopefully provides guidelines for other projects as well)

4. Procedures for Developing Wildlife habitat Ratings

4.1 Project Plan - move paragraph on 1:5,000 map scale to Appendix J

4.1.3 Select Map Scale and Survey Intensity - add Table 11 showing TEM survey intensity level and wildlife rating requirements (detailed or reconnaissance level)

4.2.3 Species Accounts

Add "Map Scale" to indicate the project map scale for which the species account is being developed.

Adjustments - remove bulleted list of potential adjustments (adjustments will be described in Mapping Procedures (under development)

Appendix A – Rating Criteria for reconnaissance level projects only:

- remove 1:5,000 scale column
- remove detailed rows from bears and ungulates
- reformat table to portrait, combine mammals to one table
- combine ungulates into one row
- revise options columns for bears & ungulates - options can be added to minimum or replace it

Appendix C - Schedule A - update to reflect 99 Standards

Appendix E – example species accounts reduced to two: Black-tailed deer and Pileated Woodpecker. (Black Bear and Keen's Long-eared Myotis omitted)

Appendix F – Preliminary Ratings Table -- reformat to appear more like Final Ratings Tables in Appendix I.

Appendix H -- Benchmarks: make corrections to the benchmarks for Mountain Caribou and Mountain goat: change SF (White Spruce-Subalpine Fir) to EF (Englemann Spruce-Subalpine Fir)

Appendix I -- Final Ratings Table—allow final ratings table to be split so that not all species need to be rated in one table. Also, add more codes (including terrain) to Table I-1.

Appendix J (Example VENUS report) – omit this altogether

Appendix J – now becomes "Guidelines for Detailed Projects"

Abstract

This manual provides the minimum provincial standards required for wildlife habitat assessment data collection and for the development and application of wildlife habitat capability and suitability ratings to ecological mapping at scales from 1:250,000 to 1:20,000. Habitat capability and suitability maps are a planning tool for land management decision making. Capability is defined as the ability of the habitat, under the optimal natural (seral) conditions for a species to provide its life requisites, irrespective of the current condition of the habitat. Suitability is defined as the ability of the habitat in its current condition to provide the life requisites of a species. Ratings indicate the value of a habitat to support a particular wildlife species for a specified habitat use compared to the best habitat in the province (the provincial benchmark). Rating criteria are defined for different map scales and different levels of detail. Three rating schemes are presented to address the variable level of knowledge that exists on the habitat requirements of different wildlife species. The level of detail for describing a species' life requisites and seasons of habitat use have also been defined and standardized. A wildlife habitat capability and suitability assessment project requires development of species-habitat models that are ground-truthed and refined through field sampling. Guidelines for developing a final ratings table are provided and standards for coding and formatting these tables are also identified.

Executive Summary

This manual provides provincial standards and procedures for developing wildlife habitat capability and suitability ratings to be applied at a reconnaissance level to ecological mapping at scales from 1:250,000 to 1:20,000. Minimum requirements are presented for habitat rating and field data collection. Capability and suitability ratings define the relative importance of various mapped ecological units to wildlife populations for the purpose of making land management decisions. Capability is defined as the ability of the habitat, under the optimal natural (seral) conditions for a species to provide its life requisites, irrespective of the current condition of the habitat. Suitability is the ability of the habitat, in its current condition, to provide the life requisites of a species.

Rating Criteria

A rating is defined as the value assigned to a habitat for its potential to support a particular species for a specified season and life requisite compared to the best habitat in the province (used by that species for the same season and life requisite). Thus, the provincial benchmark is the highest capability habitat for a particular species in the province, against which all other habitats for that species are rated. This ensures the habitat for any given species is rated consistently and uniformly from ecosystem to ecosystem and area to area across the province

Capability and suitability ratings reflect expected use of the habitat by the species of concern and are based on a measure of density (number of animals times unit of time divided by area of habitat). The animal density measures are primarily used as a conceptual framework for evaluating the value of a habitat (i.e., its potential use by animals) rather than actual numbers of animals.

Three rating schemes reflect the knowledge of a given species' habitat use and the scale at which that knowledge is applied:

The six-class scheme uses ratings of high (1), moderately high (2), moderate (3), low (4), very low (5) and nil (6) for defined seasons and habitat uses and is used for species for which there is a detailed knowledge level;

The four-class scheme uses high (H), moderate (M), low (L) and nil (N) ratings for defined seasons and habitat uses and is used for species for which there is an intermediate knowledge level;

The two-class scheme uses ratings of "habitat useable" (U) or "likely no value" (X) and is used for species for which there is a limited knowledge level.

How an animal uses habitat is closely associated with the season or time of year and the specific activity or life requisite. A habitat is therefore rated for a specified season and life requisite.

An ecological approach has been developed for describing seasons of habitat use. The Chart of Seasons by Ecoprovince (Appendix B) indicates the months in which Winter, Spring, Fall and Summer occurs in each Ecoprovince of British Columbia as represented by generalized

lower elevation sites. Seasons can be described at four levels of detail: one-season (All), two-season (Winter and Growing), four-season (Winter, Spring, Summer and Fall), and 6-season (Early Winter, Late Winter, Early Spring, Late Spring, Summer and Fall, which is used for bears and ungulates only).

Life requisites are the special requirements of an animal for sustaining and perpetuating the species. These requirements are supplied by the species' habitat and include food/ cover and specific life requisites. Life requisites can also be rated at various levels of detail. Habitat can be rated for its general value as "Living" (this is the default), for food/cover life requisites (food, security, thermal and security/thermal) or for specific life requisites (courtship, hibernating, migrating, reproducing and staging).

The combination of seasons and life requisites used for capability and suitability ratings, as well as the detail at which they are applied, will vary depending on: 1) the particular requirements of each animal species, 2) the map scale, and 3) the objectives of the habitat mapping project. For most species, the minimum required life requisite to rate is "living." The exception is for birds that breed in the province when "reproducing" must also be rated. Also, for most species only one or two seasons need to be rated as a minimum. Table 8 provides the minimum requirements for some wildlife species for which capability and suitability mapping is most often required. For minimum requirements and additional options for more vertebrate species, refer to Appendix A.

Managing a Wildlife Habitat Assessment Project

This section provides some guidelines for managing a wildlife habitat assessment project. The key ingredients for a successful project are coordination, communication, ongoing review and quality assurance of the deliverables. Wildlife habitat assessments should be planned and integrated with of the rest of the ecological mapping team: the surficial geologist, the plant ecologist and the GIS specialist.

Project deliverables include: preliminary species-habitat models (species accounts plus preliminary ratings tables), habitat assessment field sampling plan, field data, final species-habitat models, draft maps and reports, and final maps and reports.

Minimum qualifications for wildlife personnel on a wildlife habitat mapping project are provided in Table 9. A pre-field work project coordination meeting with the project manager, soils/terrain specialist, plant ecologist and wildlife biologist is required to discuss the items described in Section 3.3. Draft project deliverables must be submitted for review and correlation as stated in the contract and agreed to in the coordination meeting.

Procedures for Developing Wildlife Habitat Ratings

This section describes the procedures for applying the habitat rating criteria to ecosystem map units through development of species accounts and ratings tables.

All projects require a project plan which identifies the overall approach and level of detail for a habitat mapping project. A wildlife habitat assessment project plan includes: statement of purpose, description of the project area, map scale and survey intensity, mapping methodology, list of wildlife species, timing and duration of the project components, final products required and a budget.

Every project must have a written Species-Habitat Model for each of the wildlife species in the project. The detail in the model depends on the degree of knowledge on the species and the scale at which it is being mapped (the larger the map scale, the greater the detail). The preliminary species-habitat model is developed prior to field sampling and provides the framework for data collection (both for the sampling plan and at the sample plot). It includes a species account and the preliminary ratings for the project area. The species account is a written description of an animal species' life requisites and seasonal habitat requirements which are relevant to the project area. It includes the following information on each of the project species: name, status, ecology and habitat requirements, habitat use (life requisites and seasons to be rated) and ecosystem attributes required. This information leads to the development of the preliminary habitat capability and suitability ratings for the species. The provincial benchmark and appropriate rating scheme for the species are identified. The ratings assumptions are documented to provide the basic concepts and the reasoning behind the values that appear in the preliminary ratings table. The preliminary ratings table is then developed based on the ecosystem mapping database.

Before field sampling begins a sampling plan must be approved. It includes: location of sample plots, rationale for selection of plot sites, dates planned for field work, number and composition of field crews, and field data forms to be completed. Standards for field sampling are provided in *Field Manual for Describing Terrestrial Ecosystems* (RIC 1998b) which includes the instructions for completing the Wildlife Habitat Assessment field form as well as the rest of the Ecosystem Field Forms. Data from the completed field forms must be entered into the VENUS database.

The final ratings table is developed from the additional data on species-habitat relationships collected during field sampling and reflects the detailed ecosystems that have been mapped for the project area. Preliminary ratings tables as revised from field sampling, field data as summarized in VENUS reports, and the expanded ecosystem mapping legend all contribute to creation of the final ratings table. The final ratings table must include ratings for structural stages two through seven for each unique ecosystem in the project: Ecosection, Biogeoclimatic Zone, Subzone, Variant, Phase, Site Series, and Site Modifiers. Coding for the ecosystems must follow the standards (Resources Inventory Committee,1998c). Format for the final ratings table and coding for seasons, life requisites and wildlife species must follow the codes and definitions used in this manual (refer to the guidelines for formatting a final ratings table in Appendix I) and in Resources Inventory Committee (In Prep.).

The final report ties together the entire project in a written format. It includes: the project plan and/or a copy of the contract Schedule A, the final species-habitat models, a qualitative discussion of the habitats requirements (in relation to the project area) of each of the project species, and, if required in the contract, habitat management recommendations.

Acknowledgments

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The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments as well as from First Nations peoples. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report "The Future of our Forests".

For further information about the Resources Inventory Committee and its various Task Forces, please access the Resources Inventory Committee Website at: http://www.for.gov.bc.ca/ric.

Terrestrial Ecosystems Task Force

This report was developed by the Wildlife Interpretations Subcommittee, part of the Terrestrial Ecosystem Task Force, Resources Inventory Committee and consists of the following members: Dennis Demarchi (Chair), Lynne Bonner, Marvin Eng, Tony Hamilton, Chris Swan, Ted Lea, James Quayle, Mike Sarell, Keith Simpson, Andy Stewart, John Surgenor and Calvin Tolkamp.

Substantial contributions for this manual have been provided by Dennis Demarchi, Lynne Bonner, Calvin Tolkamp and Sal Rasheed. Members of the Wildlife Interpretations Subcommittee as well as the participants of the two workshops held in 1996 are gratefully acknowleged for their input to the development of this manual.

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1. Introduction

1.1 Purpose and Scope of this Manual

In British Columbia wildlife managers and planners are responsible for protecting, managing and enhancing a remarkable diversity of wildlife species within a sustainable resource-based economy. The province has a wide variety of animal species that occur from ocean to mountain tops; an estimated 20 species of amphibians, 19 reptiles, 143 mammals, 451 fish and 448 birds (Cannings and Harcombe, 1990). Maintaining an inventory of all these species to determine their distribution, relative numbers and important habitat areas is a difficult task which is only practical if consistent standards, methodologies and data bases are used.

The purpose of this manual is to provide wildlife habitat rating criteria and procedures for developing ratings for particular wildlife species based on the standard ecosystem mapping techniques developed by the Province. Specific methodologies for mapping are discussed in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC, 1998a) and other ecosystem mapping methodologies that are currently being developed. The intention is to define a standardized framework and methods for assigning capability/suitability ratings that should be generally applicable to all terrestrial vertebrate species in the province. The provincial context of the capability/suitability ratings provides consistency from area to area and region to region within the province.

This manual is primarily aimed at wildlife interpretations of Terrestrial Ecosystem Mapping at medium to large scales. The rating criteria and procedures for developing the wildlife habitat ratings are also applicable to smaller scale mapping (e.g. Broad Ecosystem Inventory at 1:250,000) and other mapping methodologies (see Section 4.1.4. for a description of these other methods). However, differences occur in the mapping process for methods such as the Vegetation Resources Inventory (VRI) and Predictive Ecosystem Mapping (using forest cover), due to different attributes in the inventory and the different spatial data layers available for analysis. The procedures for mapping wildlife capability and suitability values using these inventories are currently under development.

It is beyond the scope of this manual to define habitat relationships and ratings for the approximately one thousand vertebrate species currently identified in the province. The habitat capability and suitability rating standards presented are not meant to deal with all classes of wildlife as currently defined by the Wildlife Act, the Forest Practices Code, or the Canadian Wildlife Policy (Wildlife Ministers' Council of Canada). Instead this manual is intended for terrestrial vertebrates, including amphibians, but excluding fish and marine mammals. The focus will be on species in *Species and Plant Community Accounts for Identified Wildlife* (Province of British Columbia, 1997).It could, however, be used to rate habitat for arthropods, plants or other species.

Minimum requirements for reconnaissance-level habitat mapping projects are outlined at the end of each relevant section in this document. These are the basic requirements for all projects. Additional information and more detailed ratings can be added to the minimum requirements when necessary for meeting the project objectives.

1.2 Capability and Suitability Ratings Defined

Capability is defined as the ability of the habitat, under the optimal natural (seral) conditions for a species to provide its life requisites, irrespective of the current condition of the habitat. It is an estimate of the highest potential value of a particular habitat for a particular species and is useful in providing predictive scenarios for various habitat management options. Capability assumes non-intensive management and does not apply where the inherent soil characteristics and productivity have been artificially enhanced, as commonly occurs with irrigation or fertilization. The capability classification of these areas are based on what the ecosystems would be like if they reverted from their present state back to a non-intensive management state.

Suitability is defined as the ability of the habitat in its current condition to provide the life requisites of a species. It is an estimate of how well current habitat conditions provide the specified life requisite(s) of the species being considered. The suitability of the land is frequently less than the capability because of unfavourable seral conditions.

In Terrestrial Ecosystem Mapping, a suitability rating is given to each structural stage of each unique ecosystem in a project area. The structural stage with the highest suitability rating is the capability for that ecosystem.

A rating is the value assigned to a habitat for its potential to support a particular species for a specified season and activity compared to the best habitat in the province used by that species for the same season and activity. It is expressed as a percentage of the best habitat in the province and it reflects the expected use of a habitat by the species. Expected use is based on a measure of density. *Density is defined as the number of animals times a unit of time divided by the area of habitat.*

1.3 Ecological Mapping: the Framework for Habitat Evaluations

The biophysical method of land evaluation applied in British Columbia was developed from the Canada Land Inventory Program in the late 1960's and early 1970's (Lacate, 1969; Walmsley, 1976; Demarchi *et al*., 1983). It had its foundation in the ecological formulation presented by Jenny (1941) and Major (1951), who postulated that both soils and vegetation were a function of climate, geologic parent material, relief, organisms and time. When that concept is applied to the ecosystem concept to study the processes and products of production (Hills et al., 1973), each physical or biological factor can be analyzed or determined and its contribution to the functioning whole can be evaluated. This approach to land classification and evaluation for wildlife and habitat is widely accepted for resource planning in British Columbia.

Since 1992, resource inventory specialists working for the provincial and federal governments in British Columbia, in cooperation with universities, technical institutions and private consultants, have been working to develop integrated and compatible resource inventories. As a result, timber and ecosystem inventories are being made compatible with each other (Resources Inventory Committee, 1996). Similarly, ecosystem classification and inventory conducted by the Wildlife Branch and the Ministry of Forests' Research Branch have been integrated (Resources Inventory Committee, 1995, 1998a and 1998b).

The emphasis in ecosystem mapping has been on delineating "permanent" ecological units from air photo interpretation that are relatively homogeneous at the scale of mapping, based on vegetation and site features (including surficial material and other terrain features, topography, moisture regime, and nutrient regime). All ecosystem units are identified and mapped within the framework of Ecoregions and Biogeoclimatic units (Mah et al., 1996). The landscape is thus progressively stratified from broad subcontinental ecosystems (ecodomain) down to habitat specific elements (site series) (Table 1). The physical and biological processes considered at three different ecosystem classification scales commonly used for wildlife interpretations are outlined in Table 2.

Table 1. The hierarchical structure of the Ecoregional and Biogeoclimatic Ecosystem classification used for ecological mapping in British Columbia

Map Scale	Ecoregion Units	Biogeoclimatic Units	Ecosystem Units
1:30,000,000	Ecodomain		
1:7,000,000	Ecodivision		
1:2,000,000	Ecoregion		
1:2,000,000	Ecosection	Zone	
1:250,000		Subzone	
1:250,000		Variant	Broad Ecosystem Units (Site Series Groups)
1:250,000		Phase	Broad Ecosystem Units (Site Series Groups)
1:50,000			Site Series, site modifiers, structural stages
1:20,000			Site Series, site modifiers, structural stages

(modified from Resources Inventory Committee, 1995)

Table 2. Physical and biological processes or parameters considered when defining ecosystems at three different ecosystem classification scales in British Columbia.

Classification Level & Map Scale	Parameters Used to Define Ecosystem Units				
	Climate	**Landforms**	**Soils**	**Vegetation**	**Wildlife**
Ecoregion and Biogeoclimatic Units 1:250,000	Climatic regimes macro-climates	Subdivision of regional physiography to represent groups of local landforms	Soil Great Groups	climatic climax communities	Faunal communities with belts of seasonal habitat use by migratory species
Broad Ecosystem Units 1:250,000	General level meso-climates	General landforms, including topography (slope, aspect)	Soil Great Groups	Broad plant communities (potential structural stages, including climax)	Broad units of potential and current habitat use
General Ecosystem Units 1:50,000 - 1:100,000	Detailed level meso-climates	Local landforms including topography (slope, aspect) and parent materials	Soil subgroups few classes	Plant communities (succession, physiognomy, stand structure)	Units of potential and current habitat use
Specific Ecosystem Units 1:5,000 - 1:20,000	Specific microclimates	Specific landforms and parent materials	Soil series many classes	Plant communities (succession, physiognomy, stand structure)	The influence of social behaviour on distribution and specific habitat use

(modified from Demarchi and Lea, 1989)

For large-scale mapping projects there are standardized terrestrial ecosystem classification and inventory methods used to prepare ecosystem map information from which wildlife interpretation can be derived. These are:

- Terrestrial Ecosystem Mapping (TEM) (RIC, 1998a);
- Estimated Site Series (under development) derived from the Vegetation Resources Inventory (RIC, 1996);
- Predictive Ecosystem Mapping (under development) from existing sources (e.g., forest cover, digital topography, soils/terrain maps).

For small-scale mapping projects the classifications for making wildlife interpretations are:

- Broad Ecosystem Inventory (BEI) (RIC, 1997);
- a combination of both Ecoregion map units (Demarchi, 1995) and Biogeoclimatic map units (Meidinger and Pojar, 1991).

These ecological mapping methodologies provide the basic descriptions of wildlife habitat in the province. The value of the habitat to particular wildlife species can then be evaluated through application of the habitat capability and suitability ratings.

1.4 Capability and Suitability Ratings: Limitations and Alternatives

Habitat ratings are a product of knowledge and assumptions. Thus, they are limited by the extent of knowledge about a species and ecosystems within an area, the accuracy of the assumption made about a species' use of habitat and the limited amount of animal inventory and census data underlying the ratings. Factors other than habitat quality also affect animal density (Van Horne, 1983) and amount of use, but are generally excluded in assigning ratings (Demarchi *et al*., 1983). Some of these non-habitat factors include:

- Annual variability: variability in local population densities over time may reflect recent past or temporary present conditions, rather than long-term habitat quality.
- Social interactions: for some species, social interactions may cause subdominant individuals to inhabit lower quality habitats (Van Horne, 1983). In years of high production the densities in lower quality habitats may be higher than densities in higher quality habitats. When rating habitats for these species, the effect of social interactions on the suitability ratings should be clearly documented.
- Predation: existing ratings generally do not include impacts of predation on a population, but the assumption when assigning ratings is that there is a low level of predation.
- Disease: habitat ratings generally do not reflect impacts of disease on a population.
- Human Disturbance: some human activities (recreational or industrial) can isolate otherwise high quality habitats from potential use.

While acknowledging the limitations and complexities associated with any method of habitat evaluation, it is generally accepted that wildlife habitat capability and suitability ratings continue to be a useful tool for analyzing habitat values and making land management decisions across the province.

Most other methods for mapping wildlife habitat values require detailed information on species-habitat relationships and many interpret ecosystem attributes on a site-specific basis. Some of these alternatives are:

- A 'species at risk' indicator of habitat value may be used to produce a 'species at risk' map (such maps identify the number of species at risk that each mapped ecosystem unit might support).
- Habitat Suitability Index (HSI) models are based on measurements of ecosystem attributes and are used for the Habitat Evaluation Procedures (HEP), a standardized procedure for use in impact assessment and project planning (US Fish and Wildlife Service, 1981).
- Habitat data analysis using ecosystem function and habitat attributes rather than a species rating scheme.
- Regionally based habitat values using professional judgment in an area by area assessment.

These methods are suitable for assessing site-specific projects but they do not use a standardized habitat base, such as terrestrial ecosystem mapping. Therefore, they are less useful than the capability and suitability ratings for applying values to the large areas of wildlife habitat that are being evaluated and managed in British Columbia.

1.5 Using Wildlife Capability and Suitability Ratings for Habitat Evaluation

The objective of assigning wildlife habitat capability and suitability ratings is to define the relative importance of various ecological units to wildlife populations and provide information on how various management activities may affect those populations. Ecosystem mapping stratifies the land base into map units which are displayed as polygons and the data (attributes) associated with each polygon. A geographic information system (GIS) is used to produce a digital map from all the associated databases. Interpretive products (such as habitat capability and suitability maps) use ecosystem attributes for assigning values to a polygon.

A species-habitat model describes the habitat requirements of a species and the ecosystem attributes that provide these requirements. The model is a documentation of the assumptions behind the ratings as well as providing the ratings for each ecosystem in the project area (i.e. the ratings table).

Ratings reflect the habitat's potential to support a particular species and provide a means to compare habitat (such as an Ecosection, Biogeoclimatic unit or ecosystem unit) to the best available for that species in the province. Species capability and suitability ratings are based on a standard measure: number of animals times a unit of time divided by the area of habitat.

Temporal effects are also recognized in the ratings since duration of use provides a measure of the relative importance of each habitat to each species. Thus, for any particular species and season, the best habitat in the province (which has the highest density of animals or the greatest amount of animal use) is the benchmark against which all other habitats are rated.

Capability values reflect on the inherent ability of the land unit to support a species without any substantial human intervention. Only non-intensive habitat management options should be considered in defining capability such as: prescribed burning or fire protection, prescribed grazing by livestock or livestock removal, prescribed logging, silviculture or preservation. In addition, animal harvests, protection, disease or predation are not considered to affect the ability of the habitat to support a wildlife species. Management activities function largely to maintain the native vegetation community at its optimal structural stage for the target species and such prescribed measures should not degrade the land base for long-term habitat viability (Demarchi *et al*., 1983). Intensive agricultural activities may increase suitability for some species above the inherent capability. In such cases, the anthropogenic effects can be reflected in the ratings.

While recognizing the limitations of capability and suitability mapping and the range of alternative methods as described previously, capability and suitability ratings remain the most widely-applicable method of wildlife habitat assessment in British Columbia.

Because capability and suitability mapping is based on a standardized ecosystem classification it has the following advantages:

- it is predictive;
- the methodology is consistent across the province;
- large areas can be covered;
- it is flexible and can be applied to a range of: map scales, wildlife species, and general to detailed habitat assessments;
- it provides strategic planning for habitat management (e.g. priority setting for land acquisition);
- it ties the wildlife resource to other resource uses (forestry, grazing, recreation, corridor analyses).

2. Wildlife Habitat Rating Criteria

Capability and suitability ratings are the values assigned to a habitat for its potential to support a particular species (for a particular season and life requisite) compared to the best habitat in the province used by that species (for the same season and life requisite). The best habitat in the province is the provincial benchmark. Ratings reflect expected use of the habitat by the species of concern and are based on a measure of density (number of animals times a unit of time divided by the area of habitat). There are three rating schemes that reflect the knowledge of a given species' habitat use and the scale at which that knowledge is applied. Similarly, there are also several levels of detail for the seasons of habitat use and the life requisites associated with that use.

2.1 Provincial Benchmarks

The benchmark is the highest capability habitat for the species in the province, against which all other habitats for that species are rated. It is used to calibrate the capability and suitability ratings by providing 'the standard' for comparing and rating each habitat or ecosystem unit. The benchmark is an actual location, not a theoretical habitat. It is analogous to the "type specimen" in taxonomy -- all species are defined around that type. So all habitats used by a wildlife species for a particular season and life requisite are defined around the provincial benchmark.

A standard provincial benchmark ensures the habitat for any given species is rated consistently and uniformly from ecosystem to ecosystem and area to area across the province. The best ecosystems for each species is idealized in a provincial benchmark.

In order to aid regional habitat assessment projects, regional ecosystem benchmarks will be set (Appendix H), where the regional ecosystems are compared against the provincial standard. In many areas the regional ecosystem benchmark may be equal to the provincial benchmark; however, in cases where the best regional ecosystems are lower than the provincial benchmark, those regional ecosystems must not be elevated. Doing so would affect the uniformity of the standards across the province.

Provincial benchmarks are used instead of a North American or "World" benchmark because it is not feasible to examine the ecosystems throughout a species' range. Nor are ecosystem classifications in other jurisdictions comparable to the British Columbia standards. And finally, the Provincial Wildlife Program's mandate is to manage the native species' habitats here in British Columbia, based on the value of those habitats to wildlife populations within the province.

2.2 Density Assessment as a Basis for the Ratings

Other wildlife researchers have described density or absolute density as the measure of the number of animals of a given species in a specified area (Seber, 1982), while carrying capacity has been described as the measure of the amount of forage that an area has to support a given number of a species without affecting the long-term forage supply (Boyd *et*

al., 1986; Caughley, 1979). Both measurements are used for small and medium scale geographical areas, e.g. "winter ranges." Neither measurement, however, includes a calculation on the amount of time spent in those areas, neither total days or duration, nor time as hours in a day. However, by including time in the definition of density, the wildlife habitat capability and suitability ratings become more meaningful for a range of species and map scales. Thus, the definition for density as applied to the habitat capability and suitability ratings is the number of animals x unit of time/area of habitat.

To paraphrase Boyd *et al.* (1984), biologists tend to get bogged down in semantics when trying to describe the value of a given habitat for supporting a species. In fact, no term has yet been created that adequately describes habitat use, habitat value and the number of animals that use a habitat. Thus, we face the choice in setting standards for habitat capability and suitability ratings to either: 1) remain with the existing term despite its short-comings in wildlife habitat analysis or, 2) redefine the term for density to better suit our needs. The second option has been chosen in the hopes that it will allow greater flexibility in evaluating habitats for the broad array of animal species managed in British Columbia.

In previous wildlife habitat capability and suitability rating procedures applied in British Columbia over the past 25 years (see Demarchi *et al*., 1983; Fuhr and Demarchi, 1990), the ratings were based on animal densities, (number of animals/km^2/month). The working premise was that the highest density of animals is found in the best habitat for that species in the province. All other habitats were thus rated for the ability to support densities in comparison to the densities supported in the best habitat in British Columbia.

However, when evaluating ecosystem units at large map scales, capability and suitability ratings may be related more to how individual animals might respond to a habitat, rather than how a population of animals uses the habitat over time. Thus, the density measurement has been refined by describing the amount of time an animal may spend in the habitat within the season of use being evaluated. The unit of measure, therefore, is the amount of time an animal could spend in a habitat (number of animals x unit of time/area of habitat).

It is important to understand the relationship between the mobility of an animal and the size of the mapped habitat or polygon. For example, at a very large map scale (1:5,000), a grizzly bear will move among many polygons during the course of a day or several days in any given season, whereas the more sedentary salamander may spend most of its life in only one or two polygons. The mobility of the species and the map scale also influence the units of time and area that are considered in the density measure. The larger scales and more wide-ranging species require smaller units of time (months, days or hours) and area (square kilometres or hectares). Table 3 outlines these relationships and provides some general guidelines on which units of time and area should be used. The table identifies three categories of wildlife, based on the mobility of a species or the range of habitats it uses during the course of a day or several days. For these categories then, the wide-ranging species are defined as those whose daily movement among two or more habitats (map polygons) is substantial; for medium-ranging species, daily movement among two or more habitats is moderate; and for narrow-ranging species, daily movement among two or more habitats is limited or nil. Migratory species are wide-ranging during their migration, but have more medium-ranging habitat use during their staging and breeding periods.

Table 3. Relationship between mobility of an animal, size of the mapped habitat (polygon) and the units used for density measures.

Map Scale	General home range or territory size of the species		
	Narrow-ranging (E.g., Frogs, salamanders, marmots)	Medium-ranging (E.g., Snakes, bats, fur-bearers)	Wide-ranging (E.g., Bears, ungulates)
1:250,000 Ecoregion Biogeoclimatic Units	response* - population mobility - nil time unit - year area unit - km^2	response - population mobility - moderate time unit - year area unit - km^2	response - population mobility - moderate time unit - month area unit - km^2
1:250,000 Broad Ecosystem Units	response - population mobility - nil time unit - month area unit - km^2	response - population mobility - moderate time unit - month area unit - km^2	response - population mobility - moderate time unit - month area unit - km^2
1:50,000 General Ecosystem Units	response - population mobility - nil time unit - month area unit - km^2	response - population mobility - moderate time unit - month area unit - km^2	response - population mobility - moderate time unit - month area unit - km^2
1:20,000 Specific Ecosystem Units	response - population mobility - limited time unit - month area unit - km^2	response - individual mobility - substantial time unit - day area unit - hectares	response - individual mobility - substantial time unit - day area unit - hectares
1:5,000 Specific Ecosystem Units	response - individual mobility - moderate time unit - day area unit - hectares	response - individual mobility - substantial time unit - hour area unit - hectares	response - individual mobility - substantial time unit - hour area unit - hectares

*Response refers to whether the rating for a habitat unit reflects a population's response to the habitat over time or individual animals' response to a habitat over time; mobility refers to the amount of daily movement among two or more habitats (map polygons).

The capability and suitability ratings are ideally based on a measurement of actual numbers of animals using the habitat rather than on a loose definition that cannot potentially be tested. In most cases, these data are not available. However, a wildlife species expert should be able to describe the best habitat for a particular species based on having observed the most animals associated with that habitat. Such knowledge may be supplemented with "hard data" over time, as more animal survey and census studies are completed. It is also recognized that "animal density" measures are not always an accurate reflection of habitat quality. But the concept that the best habitats have the highest densities, or the greatest amount of use, is still the guiding principle when evaluating wildlife habitat and applying capability and suitability ratings in British Columbia.

In most cases then, habitat capability and suitability ratings do not represent actual animals but reflect the potential or *expected use* of the habitat by the species of concern. The animal density measures are primarily used as a *conceptual framework* for evaluating the value of a habitat (i.e., its potential use by animals) rather than real numbers of actual animals.

2.3 Rating Schemes

Since our ability to assign capability and suitability ratings accurately is dependent on knowledge, and because our knowledge of species' habitat use varies dramatically between species, more than one rating scheme is required. Differences in the level of detail that ecosystem classes are shown on maps of various scales may also limit the detail in which habitat use values can be interpreted and rated.

Three rating schemes have been developed to reflect these knowledge levels of habitat use (Table 4). The appropriate rating scheme is the one that reflects our knowledge of a given species' habitat use and the scale at which that knowledge is applied. Appendix A indicates the appropriate rating scheme for certain wildlife species. The highest provincial rating is assigned to habitats of greatest concentration or importance to each species, based on previous measures or estimates in benchmark areas. All other habitats are evaluated in comparison to these benchmark habitats.

Table 4. Habitat capability and suitability rating schemes for three levels of knowledge about a species' use of habitat.

% of Provincial Best*	**Substantial Knowledge of Habitat Use (6-class)**		**Intermediate Knowledge of Habitat Use (4-class)**		**Limited Knowledge of Habitat Use (2-class)**	
	Rating	**Code**	**Rating**	**Code**	**Rating**	**Code**
100 - 76%	High	1	High	H	Habitat Useable	U
75 - 51%	Moderately High	2	Moderate	M		
50 - 26%	Moderate	3				
25 - 6%	Low	4	Low	L		
5 - 1%	Very Low	5			Likely No Value	X
0%	Nil	6	Nil	N		

*"Provincial Best" is the provincial benchmark habitat for a species against which all other habitats for that species are rated.

Six-Class Scheme -- Detailed Knowledge of Species' Habitat Use

This scheme uses ratings of high (1), moderately high (2), moderate (3), low (4), very low (5) and nil (6) for defined seasons and habitat uses. This rating system is most useful at medium map scales (1:50,000 - 1:100,000) where seasonal habitat use can be readily depicted, and at large map scales (1:5,000 - 1:20,000) for many species where specific habitat uses can be identified.

Four-Class Scheme -- Intermediate Knowledge of Species' Habitat Use

This scheme employs high (H), moderate (M), low (L) and nil (N) ratings for defined seasons and habitat uses. The four-class approach is most effective at medium (1:50,000 - 1:100,000) to small (1:250,000 - 1:500,000) map scales where seasonal information is available and at larger map scales (1:20,000) for species where there is not a detailed knowledge level.

Two-Class Scheme -- Limited Knowledge of Species' Habitat Use

The two-class scheme is used for species for which there is little information and for small map scales. Species in this category are assigned capability or suitability ratings of "habitat useable" (U) or "likely no value" (X). This scheme can be applied in most areas for almost any species even with very limited information on habitat attributes, although the range of values is so broad that it is of limited value for species that we can map at greater detail.

2.4 Habitat Use

How an animal uses habitat is closely associated with the season or time of year and the specific activity or life requisite. Habitats providing food and cover in the winter season may be quite different from habitats used for food and cover in the spring, summer or fall (i.e. growing season). Habitats used for reproductive activities may be important in the fall (e.g. courting/ mating), spring (e.g. birthing), or summer (e.g. rearing). Often the "season" required for each seasonal activity will vary from one species to another, from low to high elevations, and from southern to northern parts of the province.

2.4.1 Seasons

Seasons can be described at four levels of detail (Table 5): one-season, two-season, four-season and six-season. Detailed seasonal information cannot be depicted for the broad habitat units that are shown at small map scales (e.g., 1:250,000). A one- or two-season rating must be used at these scales, regardless of the species. With larger map scales and a more substantial knowledge level of the species, seasonal use of habitats can be described in greater detail. A four-season rating can then be used. The six-season rating subdivides winter and spring into early and late periods, a level of detail that is only used for grizzly bear, black bear and ungulates.

Table 5. Four levels for describing seasons of habitat use.

Level	Code	Description	Application
1-season	A	All seasons	• when habitat use between seasons cannot be differentiated (small map scales and/or species with low mobility)
2-season	W G	Winter* Growing (spring, summer, fall)	• when seasonal habitat use can only be roughly differentiated • small map scales
4-season	W P S F	Winter* Spring Summer Fall	• when four distinct seasons of habitat use can be differentiated (medium to large map scales) • species for which there is an intermediate or substantial knowledge level • when species occur in B.C. only part of the year (migratory species - only 3 of the 4 seasons rated)
6-season	WE WL PE PL S F	Early Winter Late Winter Early Spring Late Spring Summer Fall	• when distinguishing detailed seasons for grizzly bear, black bear and ungulates (for most of these species, only 4 or 5 of the 6 seasons will be rated; e.g. food habitat for bears may be rated for Early Spring, Late Spring, Summer and Fall).

*Winter can be used for either a 2-season or a 4-season rating; in both cases, it is the same period of time (as defined in the Chart of Seasons [Appendix B]).

Not all seasons in the year have to be rated. A four-season rating may be used for a migratory species that breeds in the province, but obviously "winter" will not be rated because the animal does not occur in B.C. at that time. Some special mapping projects may focus on a particular season (e.g. winter ranges). The six-season rating used for bears and ungulates, subdivides winter and spring. When using this detail: 1) it is not necessary to subdivide both winter and spring for some species (refer to the season requirements for bears

and ungulates in Appendix A for examples); 2) if only one early or late period is rated, do not include the full season (e.g. do not rate "early winter" and "winter" or "early spring and spring"); and 3) "early spring" and "growing" may both be rated, but the growing season rating must include the early spring rating.

An ecological approach has been developed for describing seasons of habitat use because the duration of each season and the time when one season changes to the next depends on where you are in the province. The Chart of Seasons by Ecoprovince (Appendix B) indicates the months in which Winter, Spring, Fall and Summer occurs in each Ecoprovince of British Columbia as represented by generalized lower elevation sites. It is intended only as a guide for the habitat mapper in delineating seasons of use. Elevational and zonal differences should be taken into consideration when mapping a specific area within the Ecoprovince.

2.4.2 Life Requisites

Life requisites are the special requirements of an animal for sustaining and perpetuating the species. These requirements are supplied by the species' habitat and include food, cover (security and/or thermal), reproduction, migration, hibernation, etc. For the purposes of developing habitat capability and suitability ratings, life requisites have been divided into two categories: 1) food and cover life requisites and 2) specific life requisites. The definitions and codes for these life requisites are described in Table 6.

An animal spends most of its time feeding or using cover for resting or protection from predators and the elements. Thus the basic *food/cover life requisites* are met by habitat that provides food, security and thermal values. Because the habitats used for food and cover vary depending on the time of year, a season must be identified explicitly in the ratings for these life requisites.

All other life requisites (reproducing, migrating, hibernating, etc.) have a specific habitat and time of the year associated with them. These *specific life requisites* do not require a season to be identified in the ratings, because it is implied by the particular activity (however, the time of year when a specific life requisite occurs for any one species must be clearly defined in the species account section of the species-habitat model).

The life requisite called "living" includes general activities that are mostly comprised of feeding, using cover and moving between the habitats required for these activities. As with the food/cover life requisites, "living" requires a season to be explicitly identified in the ratings. "Living" also includes all the other life requisites that occur in the season to which it is applied.

Table 6. Life requisites used in capability and suitability ratings: definitions and codes

Life Requisite	Code	Definition
Food/Cover		
Food	FD	habitat used for consuming food items, including searching for and consuming food simultaneously (such as done by grazers, browsers, flying insectivores, ducks, etc.)
Security	SH	habitat used for protection or hiding from predators
Security/Thermal	ST	habitat used for security and/or thermal values (this category used when differentiation between thermal and security values is difficult or impossible)
Thermal	TH	habitat used for protection from heat, cold, precipitation or wind
Specific		
Courtship/Mating	CO	habitat used for courting , pair-bonding or mating (when separate from reproducing habitat)
Hibernating	HI	habitat used for hibernating
Living	LI	habitat used for general living activities and includes other life requisites such as FD, ST, CO, HI, MS, RB, RE, or SG
Migrating (seasonally)	MS	habitat used for regular, annual travel (e.g., habitat used by elk for spring and fall migrations)
Reproducing (birthing)	RB	habitat used specifically for giving birth to live young (mammals); may or may not include courtship/mating, depending on the animal species
Reproducing (eggs)	RE	habitat used for building a nest, laying eggs, incubation, hatching and feeding non-mobile young (amphibians, birds and reptiles); may or may not include courtship/mating, depending on the animal species
Staging	SG	habitat used for staging during spring and fall migrations

2.4.3 Rating Habitat Use

Capability and suitability ratings are used in conjunction with seasons and life requisites to provide a more precise description of the value of a habitat to a particular species. Thus for each species, a habitat is evaluated according to the season in which it is being used and the type of use it receives (feeding, reproducing, etc.). *All capability and suitability ratings are expressed as a value for a particular season and life requisite for the species of concern, compared to the best habitat in the province used for the same season and life requisite for that species***.** For example, reproducing habitats for California Bighorn Sheep are rated in comparison to the best California Bighorn Sheep reproducing habitat in the province.

The relationship between life requisites and seasons and the requirements for capability and suitability ratings is shown in Table 7. "Living" is the default life requisite used in most capability and suitability wildlife habitat mapping projects. Thus, when a suitability map of deer winter range is required, the ratings would be for "Living in Winter". For wildlife habitat projects that require more detail, one or more of the food/cover life requisites can be rated. Deer winter range may be rated as "Food in Winter" and, in some cases, "Security in Winter" and "Thermal in Winter" (or "Security/Thermal in Winter") may also be rated.

A habitat may also be rated for its ability to provide the requirements for a specific life requisite. Thus, to provide a 2-season rating for a hibernating species, the ratings would be for "Living in the Growing Season" and "Hibernating" (because "hibernating" occurs in winter, the season is implicit in the definition of hibernating and does not need to be stated).

Often habitat is rated for "Living in Winter" and "Living in the Growing Season." The following characteristics should be considered when rating them:

- Winter is one season – i.e., Early Winter plus Late Winter equals Winter. Ratings for Winter should always include Early/Late Winter ratings (when appropriate to the species). When rating Hibernating, it is not necessary to rate Winter because it is considered the same period of time.
- The Growing season is an amalgamation of three seasons and Living during this season includes a number of specific life requisites (Reproducing, Migrating, Staging and Courtship). A rating for Living in the Growing season should reflect habitats used for any of these activities. In some cases, a specific life requisite such as Reproducing, or an early season such as Early Spring, may be rated as well, but should still be included in the overall rating for Living in the Growing season.

This allows two adjacent projects to rate "Living in Winter" and "Living in the Growing Season" with the same definition, even though one of the projects may be rating an additional habitat use separately.

Table 7. Relationship between life requisites and seasons and the requirements for capability and suitability ratings

Season Requirements	**Food/Cover Life Requisites**	**Specific Life Requisites**	**Capability/Suitability Rating Requirements**
Seasons Required (i.e. a season must be stated in the ratings)	• Food • Security • Security/ Thermal • Thermal	• Living (default)	*All projects:* 1) "Living" to be rated 2) one or more food/cover life requisites may be rated
Seasons Implied (i.e. a season is already identified for the specific life requisite in the species account)		• Courtship/Mating • Hibernating • Migrating (seasonally) • Reproducing (birthing) • Reproducing (eggs) • Staging	*Optional:* 1) one or more of these specific life requisites may be rated; 2) one or more of the food/cover life requisites may be rated for a specific life requisite (for detailed projects only)

2.4.4 Other Effects to Consider in the Ratings

When long-term changes to habitats are brought about by human activity, these anthropogenic effects may be included in the suitability rating. It is important to specify the activity that is affecting the rating and whether it is increasing the suitability (e.g. agricultural fields for elk in the growing season) or decreasing the suitability (e.g. mining activities in deer winter habitats).

A high quality habitat may not be used by an animal or population for a number of reasons, some of which include:

- isolation or inaccessibility of the habitat to the species

- small size of the habitat relative to the species needs
- lack of nearby required habitats (e.g., escape cover)

These effects may be addressed through adjustments to the ratings table so that habitat capability and suitability maps reflect the shortcomings of these otherwise high-rated habitats.

2.5 Minimum Requirements for Rating Habitat Use

The combination of seasons, life requisites and rating scheme used for capability and suitability ratings as well as the detail at which they are applied, will vary depending on: 1) the particular requirements of each animal species, 2) the map scale, and 3) the objectives of the habitat mapping project.

For most species, the minimum required life requisite to rate is "living." The exception is for birds that breed in the province when "reproducing" must also be rated. Also, for most species only one or two seasons need to be rated as a minimum. Table _ provides the minimum requirements for some wildlife species for which capability and suitability mapping is most often required. For minimum requirements and additional options for more vertebrate species, refer to Appendix A.

Table 8. Minimum requirements for rating habitat use (life requisites and seasons) and the rating scheme to use for some commonly rated vertebrate species at two map scales.

Map Scale:	**1:50,000**		**1:20,000**	
Species*	**Rating Scheme**	**Habitat Use**	**Rating Scheme**	**Habitat Use**
Mammals				
UNGULATES**	6-class	Living-Winter Living-Growing	6-class	Living-Winter Living-Growing
BEARS	6-class	Living-Growing	6-class	Living-Growing
MUSTELIDS: Marten, Fisher Wolverine, Badger	4-class	Living-Winter Living-Growing	4-class	Living-Winter Living-Growing
Birds				
RESIDENTS	4-class	Living -All	4-class	Living -All
BREEDING VISITANTS	4-class	Living-Growing	4-class	Living-Growing Reproducing
PELAGIC (BREEDING COLONIES ONLY)	4-class	Reproducing	4-class	Reproducing
Amphibians and Reptiles				
POND-DWELLING AMPHIBIANS	4-class	Living -All	4-class	Living -All
ALL OTHER AMPHIBIANS; REPTILES: TURTLES & LIZARDS	2-class	Living -All	4-class	Living -All
REPTILES: SNAKES	2-class	Living -All	4-class	Living-Growing Hibernating

* For more information on particular species and other optional habitat uses to rate see Appendix A and for more detailed projects refer to Appendix J.

** For special winter range mapping projects, only Winter ratings are required.

3. Managing Wildlife Habitat Assessment Projects

This section provides some guidelines for managing a capability and suitability mapping project. Applying wildlife habitat capability and suitability ratings to ecological maps is a complex undertaking with many components. While it is presented here as a stand-alone process, it is actually only one component of the whole mapping process. Whenever possible it should be integrated with efforts of the rest of the ecological mapping team: the surficial geologist, the plant ecologist and the GIS specialist.

Who are the players in a wildlife habitat capability and suitability mapping project? Generally:

Provincial government (Ministry of Environment, Lands & Parks):

- sets the technical guidelines and standards
- review and approval of management plans
- program effectiveness monitoring
- manages contracts

Industry (e.g. forest companies, mining companies):

- develops management plans (Forest Development Plans, Operational Plans, Mine Development Plans, etc.)
- responsible for incorporating wildlife concerns into management plans
- initiates wildlife capability and suitability mapping projects to provide input to these management plans
- manages contracts

Contractors (soils/terrain specialists, plant ecologists, wildlife biologists)

- undertakes ecosystem mapping projects
- undertakes wildlife capability and suitability mapping projects

Specifically, in terms of project management, the key players are the project manager and the wildlife biologist. The project manager is the individual who is responsible for administering the overall mapping project. This person may be part of the mapping team or a regional resource specialist for the Ministry of Environment, Lands and Parks, the Ministry of Forests, or an employee or contractor for a private company in a resource industry (timber, mining, etc.). If the mapping project is partially or entirely contracted out, the project manager may also be the contract administrator. In some cases, several people may share the roles and responsibilities of the project manager (but for simplicity will be considered one person here). The project wildlife biologist may be either a government biologist or a private contractor. In some cases, the biologist may also be the project manager, but for the purposes and clarity of these procedures, the two roles are considered to be separate.

3.1 Role of the Project Manager

The project manager oversees the project from beginning to end. The "project" often includes both the terrestrial ecosystem mapping component as well as the wildlife interpretations. The initial planning sessions between the project manager, the wildlife

biologist and the rest of the mapping team set the framework and direction for the rest of the project. However, coordination and communication is an integral part of all steps in the ecosystem and habitat mapping process.

Responsibilities of the project manager are to ensure that:

- project plan has been developed;
- adequate funding is in place;
- map scale, air photo scale, mapping methodology and wildlife species chosen reflect the purpose of the project;
- project area is defined adequately;
- team approach among project disciplines is encouraged;
- communications among team members, field crews, clients and correlators are maintained;
- contract work schedules, payments and deliverables are adhered to ;
- products are adequately reviewed;
- correlation for provincial standards is completed; and
- required products received by clients and other users.

Contract Management

Contract requirements for wildlife habitat ratings are often included in the ecosystem mapping contract. The requirements outlined here are applicable to either separate wildlife habitat interpretations contracts or as part of an ecosystem mapping project contract.

The Project Plan (see Section 4.1), which identifies the overall approach and level of detail for the project, is the basis for developing a Request for Proposals (RFP) for wildlife habitat capability and suitability mapping. If the RFP for wildlife is included with the RFP for ecosystem mapping, then that all the components of the Project Plan for wildlife habitat mapping must be included. The example Schedule A in Appendix C outlines the contract requirements which should also be included in an RFP.

Qualifications of Wildlife Personnel

The project manager is responsible for ensuring the ecosystem mapping and wildlife interpretations team has the proper qualifications. Table 9 gives some minimum qualifications for wildlife biologists and technicians undertaking wildlife habitat capability and suitability projects. Each field crew must meet Workman's Compensation Board requirements (e.g., Occupational First Aid Level 1 with Transportation Endorsement).

Deliverables Required

Deliverables for a wildlife habitat capability and suitability project include:

- Preliminary Wildlife Species-Habitat Models (which includes the Preliminary Ratings Tables)
- Habitat Assessment Field Sampling Plan
- Field Data
- Final Species-Habitat Models (which includes the Final Ratings Tables)
- Draft Maps and Reports
- Final Maps and Reports

Table 9. Minimum qualifications for wildlife biologists and technicians undertaking wildlife habitat capability and suitability projects

Position	Role/Responsibilities	Qualifications
Senior Wildlife Biologist	coordinator of wildlife habitat mapping responsible for: • completion of wildlife interpretations to a final product following RIC standards; • developing Species-Habitat Models (including ratings tables); • modifying ecological sampling plan in the field; • analyzing data and overseeing habitat map production.	B.Sc. and M.Sc. or minimum 5 years experience in wildlife habitat analysis RPBio (preferred) Courses required: - BC Wildlife Habitat Rating Standards
Junior Wildlife Biologist	under supervision of senior wildlife biologist: • developing Species-Habitat Models (including ratings tables); • modifying ecological sampling plan in the field; • analyzing data and overseeing habitat map production.	B.Sc. or technical diploma or minimum 3 years experience in habitat assessment Courses required: - BC Wildlife Habitat Rating Standards Preferred: - Describing Ecosystems in the Field (DEIF)
Wildlife Technician	under supervision of either senior or junior wildlife biologist: • assists in field work preparation • undertakes field sampling	Technical Diploma in natural resource management or minimum 2 years experience in habitat assessment
Field Assistant	under supervision of a wildlife biologist or technician: • assists in field work (e.g. digging soil pit, carrying equipment, etc.)	Minimum age: 16 years Ability to work in a field environment

Reviewing Projects

A checklist for wildlife habitat capability and suitability projects is provided in Appendix D. The project manager should contact the wildlife correlator to discuss which components of the project will be reviewed by the project manager and which will be reviewed by the regional and provincial correlators, as well as the turn around time required for this review.

3.2 Role of the Project Wildlife Biologist

The project wildlife biologist is responsible for developing the wildlife habitat ratings and ensuring that wildlife interpretations follow the RIC standards outlined in this document for wildlife habitat capability and suitability ratings and mapping procedures.

The project wildlife biologist ensures that:

- preliminary species-habitat models are developed (or revised) for each of the project wildlife species;
- the field sampling plan adequately reflects the habitat information needs identified in the preliminary species-habitat models and, where appropriate, addresses any information gaps identified;
- wildlife considerations are incorporated into the ecological sampling plan;
- ecosystem attributes required for the project species are captured in the ecosystem map;
- wildlife field crews are adequately trained and knowledgeable on the project's wildlife species;
- final species-habitat models accurately reflect the findings from the field sampling;
- a close working relationship with the GIS technician is maintained and habitat maps are produced that reflect current knowledge of species-habitat relationships;
- final products for the wildlife capability and suitability project are satisfactorily completed.

Because of the interdisciplinary approach required for developing wildlife habitat capability and suitability ratings a wildlife biologist must have:

- a good knowledge of the available land inventory tools and the information that they provide;
- a good knowledge of the habitat needs of wildlife in British Columbia, how those needs relate to ecosystem units and how ecosystem units change over time; and
- a good understanding of the standard approach to establishing wildlife habitat relationships and ratings for ecosystem units on a provincially consistent basis.

Development of Species-Habitat Models

The species-habitat models used for habitat capability and suitability mapping are conceptual or descriptive rather than mathematical models. In the past, the species-habitat model was implicit in the wildlife biologist's interpretation and rating of a species' habitat. However, current standards require the biologist to be explicit in documenting the details of the model so that it can be assessed, defended and replicated by other biologists. A species-habitat model is required for each wildlife species on the project list (detailed instructions for development of species-habitat models are provided in Section 4.2).

A wildlife habitat capability or suitability map is a graphic representation of the species-habitat model. The map is only as accurate and reliable as the information in the model. The preliminary species-habitat model, in turn, provides the input required for data collection in the field and for building the final ratings table. Thus, the time and effort put into

developing the species-habitat model at the outset will pay off in the end by ensuring the accuracy and usefulness of the resulting habitat map.

3.3 Project Co-ordination Meeting

A pre-fieldwork coordination meeting should be held early on in the project. The project manager, the ecosystem mapping team and the project wildlife biologist need to discuss the details of the project to ensure there is clear agreement on what is to be achieved by the end of the project.

Discuss the following items at the project coordination meeting:

- project objectives
- mapping methodology and scale
- wildlife species, seasons and life requisites to be rated
- air photo pre-typing
- ratings tables
- ecosystem map attributes required
- data collection (including additional wildlife and vegetation data)
- report requirements
- correlation and quality assurance review of deliverables
- capability and suitability maps, combined maps and other interpretations required

3.4 Quality Control and Correlation

The project manager and the wildlife biologist are responsible for ensuring that the RIC standards and procedures outlined in this document are followed throughout the project. Also, it is their responsibility to ensure that draft project deliverables are submitted for review and correlation in a timely manner.

Table 10 shows the sequential order of activities and the role of both the regional contract monitor and headquarters Ministry staff in reviewing projects administered by the Ministry of Environment, Lands and Parks. Headquarters project review includes compliance with provincial standards and provincial benchmarks and digital quality assurance checks on all data. The contract monitor (who correlates with Regional wildlife staff) reviews for compliance with the contract and accurate reflection of "local" knowledge. Also shown is the estimated minimum turn around for HQ/Region to review and return comments to the Contractor (from the time files are submitted in the correct format). At least one week notification is required prior to submitting document and data for review.

Table 10. Activities and responsibilities for review of wildlife habitat capability and suitability mapping projects.

Activity	Responsibility*	Min. Review Time**
Project Initiation Meeting	• both HQ and REG attend	--
Project Plan: • List of Species, contract specifications, etc. • Existing Information	• REG to lead with HQ input • REG to lead with HQ input of Provincial materials	
Preliminary Species Accounts & Preliminary Ratings Tables	• send to both REG and HQ (or contract correlators) • HQ to review and send comments to REG and Contractor • REG to review Species Accounts/ Preliminary Ratings Tables and HQ's comments and forward additional comments to Contractor • Contractor has up to 2 sets of comments to incorporate into revised Species Accounts/ Preliminary Ratings Tables	2 weeks 1 additional week
Sampling Plan	• Contractor to send copies to REG and HQ (or contract correlators) • HQ to review 1st and send comments to REG and Contractor • REG to review sampling plan and HQ's comments and forward additional comments to contractor • Contractor has up to 2 sets of comments to incorporate into sampling plan	2 weeks 1 additional week
Field Sampling	• both REG and HQ to attend	
Revised Species Accounts & Revised Ratings Tables	• send to HQ and REG (or contract correlators) after field work • HQ to review and send comments to REG and Contractor • REG to review Species Accounts/ Preliminary Ratings Tables and HQ's comments and forward additional comments to Contractor • Contractor has up to 2 sets of comments to incorporate into revised Species Accounts/ Preliminary Ratings Tables	2 weeks 2 additional weeks
Draft Maps, Updated Species Accounts & Ratings Tables (not final yet) ** note draft maps must include draft map legend. Send 1 set of paper maps and all digital files.* ** note: the draft exp. legend and digital ecosystem database must accompany the Species Accounts/Ratings Tables*	• send draft wildlife maps produced from approved TEM base and updated (after 2nd review) species accounts/ratings tables to HQ with all relevant information.(*) • HQ to review (including digital QA checks) and forward comments and all materials to REG and comments to contractor. • REG to review and forward comments and materials to Contractor for editing • Contractor has up to 2 sets of comments to incorporate into wildlife maps and Species Accounts/ Preliminary Ratings Tables	2 weeks 3 weeks
Final Maps, Species Accounts in Report and Final Ratings Tables ** note: final maps must include final map legend* ** note: the final expanded legend, final digital ecosystem database and digital spatial files must accompany the Species Accounts/Ratings Tables*	• send final Species Accounts/ Ratings Tables, final wildlife maps and all other materials (*) to HQ • HQ to check that all edits were made including running the digital file QA checks again. HQ to forward comments and all materials to REG and comments to contractor. • REG to check that all edits were made and for compliance with contract then close contract OR forward comments and materials to Contractor for editing	2 weeks 3 weeks
Revised Final Wildlife Products *This step to be done if edits are required to final wildlife deliverables.*	• contractor to send all relevant materials back to HQ if edits were requested by HQ. If edits requested only by REG then send directly to REG. REG must see all final deliverables to sign off contract. • If applicable, HQ to check that all edits were made and digital files pass QA checks. HQ to forward comments and all materials to REG and comments to contractor. • REG to check that all edits were made and for compliance with contract then close contract OR forward comments and materials to Contractor for editing • repeat loop as many times as it takes to get final products	2 weeks (may be less if edits are minor) 2 weeks (may be less if edits are minor)

	which are "clean" (i.e. no errors and all requested changes have been addressed).	

*HQ = Head Quarters Provincial wildlife correlator; REG =Regional contract monitor
**Min. Review Time Required = estimated minimum turn around for HQ/REG to review and return comments to the Contractor (from the time files are submitted in correct format).

3.5 Co-ordination with Ecosystem Mappers

There are several key areas of ecosystem mapping and wildlife capability and suitability mapping where coordination and communication between the disciplines is critical. Both the project manager and the wildlife biologist must ensure that this coordination occurs.

When Wildlife Interpretations are Undertaken in Conjunction with Ecosystem Mapping

Wildlife habitat inventory is an interpretation of the ecosystem map and very often it is the driving force behind development of the ecosystem map. Combining the two efforts into one project ensures that the ecosystem map provides a practical basis for evaluating wildlife habitat values and that full use is made of the ecological information available.

Key steps in an ecosystem mapping process where wildlife concerns need to be addressed:

Ecosystem Mapping Process	Wildlife Requirements
Project Planning	• ensure ecosystem mapping methodology and map scale are appropriate for the wildlife species that have been selected for the project, or conversely: • ensure that attributes required for each of the project species will be included in the ecosystem mapping; • ensure wildlife species selected are appropriate for the mapping methodology and map scale; • consider other data sources for non-TEM attributes (e.g. Forest Cover, TRIM) when appropriate
Air Photo pre-typing	• examine air photos with ecosystem team and discuss important wildlife habitats, features and attributes
Development of the Working Legend	• use the working legend as the minimum level of information for developing the preliminary ratings table;
Sampling Plan	• ensure wildlife concerns identified in the habitat assessment sampling plan are incorporated into the final ecosystem mapping field sampling plan;
Field Sampling	• update sampling plan to ensure it adequately covers the habitats of the project wildlife species; • ensure any optional site modifiers that are important to project wildlife species are included;
Ecosystem Map	• discuss with ecologist any questions on the ecosystems mapped when

Database	developing the final ratings tables.

When Wildlife Interpretations are Undertaken After the Ecosystem Mapping is Completed

Sometimes wildlife interpretations are needed after the original ecosystem mapping has been completed or interpretations for additional wildlife species are added as a separate project. A species-habitat model is still required as well as communications with the original ecosystem mapping team whenever possible.

When wildlife interpretations are not part of the original ecosystem mapping:

- discuss wildlife interpretations with the original project manager and/or the provincial ecosystem correlator;
- develop species-habitat models for the species of concern;
- meet with the original project ecologist;
- an ecologist may need to be hired as a consultant and, if necessary, to accompany the wildlife biologist into the field.

3.6 Minimum Requirements for Project Management

Minimum qualifications for wildlife personnel on a wildlife habitat mapping project are provided in Table 8. A pre-field work project coordination meeting with the project manager, soils/terrain specialist, plant ecologist and wildlife biologist is required to discuss the items described in Section 3.3. Draft project deliverables must be submitted for review and correlation as stated in the contract and agreed to in the coordination meeting.

4. Procedures for Developing Wildlife Habitat Ratings

This section describes the procedures for applying the habitat rating criteria to ecosystem map units through development of species accounts and ratings tables.

Because the wildlife interpretations are derived from ecological mapping, there are a number of ecosystem inventory standards that provide important supporting information to this document:

Ecosystem inventory standards in British Columbia include:

- Standards for Terrestrial Ecosystems Mapping in British Columbia (RIC, 1998a
- Field Manual for Describing Terrestrial Ecosystems (RIC, 1998b)
- Standards for Broad Terrestrial Ecosystem Classification and Mapping for British Columbia (RIC, 1997)
- Ecoregions of British Columbia (Demarchi, 1995)

Ecosystems of British Columbia (Meidinger and Pojar, 1991) also provides useful background information on the Biogeoclimatic Ecosystem Classification.

4.1 Project Plan

The Project Plan identifies the overall approach and level of detail for a habitat mapping project. A wildlife habitat map is a land use planning tool; thus, the type of land use plan determines the scale and detail of the habitat mapping project.

In general, when planning a wildlife habitat inventory project:

- find a balance between scale and level of survey intensity and the planning level in which the inventory is to be used;
- meet a prioritized planning schedule for input into various plans (assuming that all planning is being generated from the broad to site specific levels).

A Project Plan is required for all wildlife habitat capability and suitability mapping projects. It is the framework for implementing the project and completing the final products required. When a contractor's services are required, the Project Plan becomes the basis for the Request for Proposal and is later incorporated into the Contract for Services and thus provides the foundation for discussions during the project initiation meeting.

A wildlife habitat capability and suitability Project Plan includes:

- statement of purpose
- description of the project area
- map scale
- survey intensity
- mapping methodology
- list of wildlife species
- timing and duration of the project components
- final products required
- budget

4.1.1 Define Purpose

The first step in planning a wildlife habitat inventory project is to identify the purpose for which the inventory will be used. This provides the planning context and guides selection of map scale, mapping methodology, wildlife species, data collection and final products required for the project.

Define the level of resource management planning that the project supports:

- Landscape Unit Plan (or other higher level plan)
- Forest Development Plan
- Silviculture Prescription
- Stand Management Prescriptions
- Logging Plans
- Access Management Plans
- Five-Year Silviculture Plans
- Other

4.1.2 Define Project Area

The overall goal of wildlife habitat inventory programs are to provide site specific inventories and evaluations of the habitat values across the province in order to meet operational and higher level planning requirements. Thus, each project area should be bounded by a planning area as defined by the planning level being addressed.

Define project area by one of the following planning areas:

- regional area
- sub-regional area
- landscape unit
- watershed
- mapsheet (when a specific planning area is not defined)
- special project (e.g. mule deer winter range)

4.1.3 Select Map Scale and Survey Intensity

While not tied specifically to map scale, survey intensity and sampling are generally used to conceptualize inventory scale.

The scale of mapping and survey intensity for a wildlife habitat inventory project depends on:

- intended use of the completed products,
- size of the area to be evaluated,
- time allotted for project completion,
- amount of money available for inventory and mapping,
- availability of previous sampling in the surrounding areas
- to a lesser degree, the wildlife species being rated.

The *Standard for Terrestrial Ecosystem Mapping in B.C.* (RIC, 1998a) outlines the survey intensity and field plot inspection density for various map scales. Table 11 indicates the level of detail required for wildlife habitat ratings at each of these survey intensity levels to provide some guidance for choosing the appropriate map scale and survey intensity for wildlife habitat inventory projects. The majority of wildlife habitat mapping projects are reconnaissance level (see Appendix J for guidelines on detailed projects).

Table11. Survey intensity levels for wildlife habitat capability and suitability mapping

Survey Intensity Level	Percentage of Polygon Inspections	Ratio of Full Plots:Ground Insp.:Visual Checks	Suggested Scales (K=1,000)	Range of Study Area (ha)	Level of Detail Required for Wildlife Habitat Ratings
1	76 - 100%	2 : 15 : 83	1:5K to 1:10 K	20-500	Detailed
2	51 - 75%	3 : 17 : 80	1:10 K to 1:20 K	100-10,000	Detailed
3	26 - 50%	5 : 20 : 75	1:10 K to 1:50 K	5,000-50,000	Detailed
4	15 - 25%	5 : 20 : 75	1:20 K to 1:50 K	10,000-500,000	Reconnaissance
5	5 - 14%	5 : 20 : 75	1:20 K to 1:50 K	10,000-1,000,000	Reconnaissance
R*	0 - 4%	0 : 25 : 75	1:20 K to 1:50 K	50,000-1,000,000+	Reconnaissance

(adapted from Table 6.3 in Standard for Terrestrial Ecosystem Mapping, RIC 1998a)
*Level R is reconnaissance level ecosystem mapping.

The four approved scales for provincial ecosystem mapping that are used for supporting wildlife habitat interpretation and evaluation are described below. A more detailed mapping scale (1:5,000) is useful for determining a very detailed habitat description and delineation of a few ecosystem units. Appendix J provides some guidelines for mapping at this level of detail.

Very Small Scale - 1:500,000 Mapping

Use a 1:500,000 scale of inventory and mapping to:

- document the provincial benchmarks for each species of management concern.

This is an overview reference mapping scale that is used to provide direction on the distribution and abundance of a species' potential habitats across the province. Its primary ecosystem classification sources are the provincial Ecosection and Biogeoclimatic subzone/variant units.

Small Scale - 1:250,000 Mapping

Use a 1:250,000 map scale for:

- sub-regional planning, e.g. Land and Resource Mapping Planning (LRMP)
- Commission on Resources and the Environment (CORE) initiatives.

This is an overview reference mapping scale for assessing the potential and existing habitat supply for wildlife species at risk, including regionally significant species. It is intended that the entire province be mapped at this scale in order to provide for efficient analysis at more detailed scales as well as a basis for strategic direction for conducting more detailed ecosystem inventories and habitat interpretations. Its primary ecosystem classification sources are the Ecosections, Biogeoclimatic subzone/variants and Broad Ecosystem units.

Medium Scale - 1:50,000 Mapping

Use a 1:50,000 map scale for:

- large areas within an LRMP or Forest District that do not include detailed logging or range use plans (these should be done concurrently for one or more landscape units)
- providing the framework for limiting and focusing the more detailed habitat information requirements of Logging Plans and Silvicultural Prescriptions
- Forest Development Plans, if the wildlife species-habitat model is explicit and accurate

This is a general reference for assessing both the potential and existing habitat supply for regionally significant species, including wildlife species at risk. It is a field sample-based inventory intended for areas having high wildlife values where resource development is not expected within the next ten years. This scale is also used when there is not enough time to map large areas at large scales. It is used to provide information about the characteristics and distribution of wildlife species and their habitats and about approximate and potential locations of Wildlife Habitat Areas. Its primary ecosystem classification sources in addition to the Ecosections and Biogeoclimatic units are the terrestrial ecosystems or mapped Site Series, although surrogate ecosystem delineations such as Vegetation Resources Inventory or enhanced forest cover classifications may also be used.

Large Scale - 1:20,000 Mapping

Use a 1:20,000 map scale for:

- areas within a landscape unit that are undergoing Forest Development or Range Use Plans.
- providing the framework for limiting and focusing the detailed habitat requirements in Logging Plans and Silvicultural Prescriptions.

This is a reference for the potential and existing habitat supply for wildlife species at risk, including regionally significant species. It is a field sample-based inventory required for areas having high wildlife values that will be undergoing resource development within the next ten years. It is used to delineate most Wildlife Habitat Areas at the more detailed planning and forestry activity level. Its primary ecosystem classification sources in addition to the Ecosections and Biogeoclimatic units are the terrestrial ecosystems or mapped Site

Series, although surrogate ecosystem delineations such as Vegetation Resources Inventory or Predictive Ecosystem Mapping may also be used.

Large-scale habitat inventories should be done within the context of a Landscape Unit Plan or other similar plan. As such it is used to contribute to decisions in the early stages of Forest Development Planning about where to log, and to the establishment of landscape-level biodiversity objectives.

4.1.4 Determine Mapping Methodology

In British Columbia, a number of Resources Inventory Committee-approved ecosystem identification and mapping methods currently exist. While some of the differences are based on scale, most are based on the type of information gathered for determining each ecological unit. As each classification level and method represents a picture of the ecosystems of the province, they can be used to predict the habitat value for most species known to occur, or that could potentially occur, in the province.

To determine the appropriate mapping methodology for habitat evaluation:

1. Identify the planning or management scale of the project.
2. Consider the wildlife species being evaluated: what types of ecological mapping would be best suited to meet the habitat requirements of the species (i.e., given the current level of knowledge we have on the species' habitat requirements)?
3. Consider appropriateness of combining mapping products for some species (eg. TEM plus Forest Cover for Mule Deer).

Ecosection Mapping

Ecosections are the lowest level in the Ecoregion classification. Each unit represents a sub-regional-sized area of the province as determined by macroclimatic processes, geology and landform processes. Within each Ecosection there is a distinctive combination of vegetation zones or Biogeoclimatic units. Even though there is a great deal of internal soil, landform and vegetation heterogeneity, from a small-scale planning perspective (provincial, national or international level) each Ecosection represents a unique ecosystem. Ecosections are normally mapped at 1:250,000 using Biogeoclimatic unit mapping as one of the main identification criteria.

Biogeoclimatic Unit Mapping

Biogeoclimatic units are the result of zonal climatic classification and represent classes of ecosystems under the influence of the same regional climate. There is a hierarchy of units with the Biogeoclimatic subzone being the basic unit as it has a distinct climax plant association on zonal sites. Subzones contain considerable variation from which the Biogeoclimatic variant, based on differences in the regional climate, can be recognized. When used in combination with Ecosection mapping this level of ecosystem recognition is useful for provincial-level strategic planning and resource allocation. Biogeoclimatic units are normally mapped at 1:250,000 using zonal sites as the diagnostic criteria.

Broad Ecosystem Unit Mapping

Broad Ecosystem units are permanent areas of the landscape that support a distinct type of dominant vegetation cover, or distinct non-vegetation cover. Each unit includes a potential (climax) vegetation and any associated successional stages. Broad Ecosystem units are based on the integration of vegetation, terrain, topography and soil characteristics (i.e., amalgamations of Site Series). Units aligned to a zonal climate are unique within a Biogeoclimatic zone. When used in combination with Ecosection and Biogeoclimatic mapping, the Broad Ecosystem unit classification is useful for regional and sub-regional planning and resource allocation. Broad Ecosystem units are mapped at 1:250,000 using Biogeoclimatic unit mapping as a critical diagnostic criteria.

Terrestrial Ecosystem Mapping

The characteristic units of Terrestrial Ecosystem Mapping (TEM) are Ecosystem Units, a combination of site series, site modifiers and structural stage (and sometimes seral association). Each unit is capable of supporting a specific climax plant association and reflecting a specified range of soil moisture and nutrient regimes within a Biogeoclimatic subzone or variant. Ecologically similar site series occurring under more than one climatic regime are grouped together to form a site association. Integral to the mapping of site series is the identification of soil and terrain features. When used in combination with Ecosection and Biogeoclimatic unit mapping, the terrestrial ecosystem unit is useful for landscape unit planning, forest development planning and wildlife resource allocation and management issues. Terrestrial ecosystem units are normally mapped at 1:20,000 using Biogeoclimatic unit mapping as a critical diagnostic criteria, however, the methodology can also be applied at 1:50,000 or 1:5,000.

Estimated Site Series from Vegetation Resource Inventory Mapping

Vegetation Resource Inventory (VRI) units can be considered as enhanced forest cover units, where homogeneous stands of trees have additional ecosystem (soil moisture, soil nutrients), terrain and understory vegetation attributes added to the database. VRI is conducted in two phases. Phase I involves estimating vegetation polygon characteristics, from existing information, aerial photography, or other sources (no sampling is done in Phase I). Phase II provides the information to determine how much of a given characteristic occurs within the inventory area, through the application of a rigid sampling design and ground sampling. VRI is used primarily for forest harvesting, and calculations of the Annual Allowable Cut; however, it can be used as a basis for determining the habitats of some wildlife species, especially forest dwelling birds. VRI is normally mapped at 1:20,000 using alpine, parkland and grassland units as primary breaks; however, the Phase I methodology can also be applied at 1:50,000.

Predictive Ecosystem Mapping Using Forest Cover (Under Development)

In addition to Terrestrial Ecosystem Mapping and Vegetation Resources Inventory methods, the type and distribution of ecosystems (either Site Series or Broad Ecosystem units) can be predicted using older forest cover mapping combined with Biogeoclimatic boundaries, a TRIM-based digital elevation model and other existing map themes.

Predictive Ecosystem Mapping (PEM) may be used to determine habitat values for some species. Species-habitat models may make more extensive use of the wide variety of attributes within the Forest Cover attributes database file for those species, such as forest dwelling birds, that may key more on forest structure than ecosystem type. PEM is normally mapped using existing 1:20,000 forest cover maps, however it can also be applied at 1:50,000.

4.1.5 Select Wildlife Species

Most wildlife habitat inventory projects are limited to those species that have economic or social value and those species that are at risk. However, since not all wildlife species are well suited to this inventory technique, careful consideration should be given to the selection of species. At present, the species listed in *Species and Plant Community Accounts for Identified Wildlife* (Province of British Columbia, 1997) is an abbreviated list taken from the Red and Blue lists of species at risk and includes only those species that could be impacted by forest harvesting and range practices. Of the species of management concern, many species are under demand for harvesting by various sectors of our society, (e.g. resident hunters, natives, guide-outfitters, and trappers). For those species, wildlife habitat capability and suitability mapping is one of the steps required to determine a species' distribution and abundance.

Generally, ungulates and bears should always be included on the list of project species. Although habitat mapping for ungulates has been conducted in British Columbia for over 25 years and bear habitat mapping for the past 10 years, much of the province remains to be inventoried (i.e. at 1:50,000 and 1:20,000 scales). The long-term provincial inventory objectives are to complete this systematic inventory for these two species groups. Exceptions to including ungulates and bears are when capability and suitability mapping for these species already exists for the area (at a comparable scale) or when a special project is focused on a particular species (e.g. Vancouver Island Marmot).

For animal species in which distribution and habitat requirements are poorly understood, ecosystem mapping may not be the best choice of inventory methods. In many instances, animal inventories using RIC methodologies may be a superior method of gathering information for wildlife management, at least until the knowledge base on the specific habitat requirements for these species improves.

The habitat needs of some animal species may not correlate well with the ecosystem map units. For example, if there was a need to identify Peregrine Falcon breeding sites, conducting a specific survey of potential cliff nest sites (using RIC animal inventory methods; RIC, 1996) would be far more effective than attempting to identify important breeding habitats using ecosystem mapping. The Peregrine Falcon would therefore be a very poor candidate species for making habitat interpretations using ecosystem mapping. Other examples of poor candidates include many of the aquatic and marine species (e.g. shorebirds, whales, seals, etc.).

The value of mapping wide-ranging opportunistic carnivores, such as wolverine, is low. In general, predator species can be difficult to map, particularly when the primary prey species have not been considered. For example, if the species of interest is Lynx then the habitat of

its main prey, the Snowshoe Hare, should be inventoried as well. Prey species are also more abundant and their sign is often more detectable in the field, allowing for better data collection opportunities.

In selecting project species, give priority to those species where there is a reasonable likelihood of observing the animals in the field or at least being able to readily detect evidence of use while doing field work. Avoid selecting obscure, secretive species where even presence or absence cannot be verified. Finally, keep the project species list to a reasonable number of species -- six to ten species ideally, but *not exceeding fifteen species*. Find a balance between doing too few species (not cost effective) and too many species with different habitat needs (too costly and unrealistic).

Select wildlife species for a project to include:

- ungulates and bears;
- species that represent a variety of habitats;
- species where there is a good understanding of the relationship between life requisites and habitat attributes;
- species whose habitat requirements correlate well with ecosystem map units;
- species where there is a reasonable likelihood of observing the animals or detecting evidence of use in the field;
- prey species -- when the predator species is on the project species list;
- a list of 6 - 10 species

Do <u>not</u> select wildlife species that include:

- species for which there is very little known about their distribution and habitat requirements in British Columbia;
- wide-ranging, opportunistic carnivores that do not relate well to ecosystem map attributes.

4.1.6 Clarify Timing and Duration

There are a number of considerations that will affect the timing and duration of the project: principally, the amount and timing of project funding approvals and its subsequent affect on field work.

The timing of project funding approvals may not allow ample time to complete the pre-field work components of a project in time for the field work season. In this case, the project should be scheduled over two years so that pre-field work can be completed the first year and field work can follow early in the second year of the project. Allow one to two months for developing a preliminary species-habitat model and getting it approved prior to going out in the field (the number of species and the amount of information on each species will affect the duration of this component).

The field sampling requirements for particular species will also affect the timing and duration of the project. If there is a need for breeding bird surveys in the spring then the pre-field work components may have to be completed in the previous fiscal year. If winter

surveys are required for ungulates, then there may need to be additional time to analyze and incorporate the results into the final ratings table before any habitat mapping can be completed.

Project timing and duration is affected by:

- Amount and timing of budgets
- Pre-field work requirements: development of Preliminary Species-Habitat Model for each species
- Seasonal requirements for species field work

4.1.7 Determine Products Required

The final products include habitat maps and reports. The actual number of habitat capability and suitability maps that will be required depends on the number of wildlife species for the project and the amount of detail, such as the seasons and life requisites to be depicted for each species. Thus, it is important to understand at the outset that if 10 species are being rated, 30 or 40 maps or more may be produced depicting three or four life requisite-season combinations for each species.

4.1.8 Develop a Budget

Most wildlife habitat capability and suitability mapping projects are done in conjunction with the ecosystem mapping project. There are a number of considerations for both ecosystem mapping and habitat interpretations that impact on budgets: scale and scope of project, size of project area, number of map sheets, accessibility for field work (road verses helicopter), number of field crews required and the final products required. However, there are some budget items that relate specifically to the wildlife requirements for a project.

For wildlife habitat capability and suitability mapping, some budgeting considerations include:

- need to extend projects over fiscal year to complete pre-field work requirements;
- availability of habitat information on the project species (e.g., whether or not there are existing species-habitat models and local inventories available)
- need for additional field sampling plots to obtain information for particular wildlife species on the project species list;
- need for additional species inventory (e.g. winter flights, breeding bird surveys, etc.);
- requirements for final products, e.g., if the final product is a ratings table and report, the costs will be less than if GIS and production of habitat maps are required.

4.1.9 Minimum Requirements for Project Plans

All projects must begin with a project plan. A project plan must include: a statement of purpose, description of project area, map scale/survey intensity, mapping methodology, list of wildlife species, timing and duration of project, final products required and a budget.

4.2 Preliminary Species - Habitat Model

The preliminary species-habitat model is developed prior to field sampling and provides the framework for data collection (both for the sampling plan and at the sample plot). The two main components of a species-habitat model for wildlife habitat capability and suitability mapping are:

1) The Species Account - provides the background information on the selected species' biology and identifies the habitat requirements for each life requisite and associated season of use (see Appendix E for an example species account).

2) The Habitat Ratings - relate the habitat requirements described in the species account to the relevant ecosystem attributes. The assumptions used in assigning the ratings are described and a preliminary ratings table is developed, based on the project working legend created by the terrestrial ecosystem mappers. It provides the hypothesis for the species-habitat relationships in the project area which will be verified during field sampling (see Appendix F for an example preliminary ratings table).

Data collected during field sampling enables refinement and revision of the species-habitat model. The final ratings table (also referred to as the look-up table) is then developed. Unlike the preliminary ratings table which is based on general ecological descriptions or potential ecosystem units, the final ratings table provides capability and suitability ratings for each unique mapped ecosystem unit.

Model verification occurs throughout the development and refinement of the species-habitat model. In some cases, (e.g. when ratings are required for an additional wildlife species after the original project has been completed), there may be no field sampling and model verification is accomplished through correlation and review by species experts. A preliminary species-habitat model is still required, however, to provide documentation for the reviewer(s).

Model verification includes:

- review of the written models by species experts
- correlation with provincial standards
- field sampling (ground truthing the model)
- producing draft maps for review and revision

4.2.1 Collect Existing Data

Model development should begin as soon as the project species have been selected. Sources of information and key individuals contributing information to the model should be documented.

Existing Species Models

Species-habitat models have already been developed for some animal species in various areas of the province. These existing models can be identified by regional wildlife biologists or the wildlife correlator in Victoria. While models have been developed for only a few of the vertebrate species in the province, this will change as more information is collected.

Revise an existing species-habitat model when:

- the project study area has different ecological zones than the area for which the existing model was developed,
- the project is using a map scale different from the map scale for which the existing model was developed,
- different populations of the species are known to use habitats differently (e.g. interior verses coastal black-tailed deer populations),
- new information has been obtained on the selected species and habitat use that may not have been available when the existing model was developed.

Broad Ecosystem Mapping

Broad Ecosystem Inventory (1:250,000), where it exists, may provide the basis for the preliminary habitat ratings. Contact the wildlife correlator in Victoria to find out if there is Broad Ecosystem Mapping that covers the project area.

Provincial Benchmarks

Provincial benchmarks are being developed for ungulates (See Appendix H), bears and Identified Wildlife species. Contact the provincial wildlife correlator to ascertain whether benchmark information is available on the project species. For many species, provincial benchmark habitats may need to be identified through discussions with species experts as well as the provincial wildlife correlator.

Literature Review

A literature review is a critical first step in developing a species-habitat model, especially when dealing with the species for which we have a limited or intermediate knowledge. Updating and revising existing models also requires being familiar with the most recent studies on a species, irrespective of our knowledge level of that species.

Conduct a literature review using sources such as:

- references supplied by species experts
- government reports
- on-line searches
- university/college library research

Interviewing Species Experts

For some species in some areas of the province, there may be no existing habitat models and few useful references in the literature. The knowledge of experts on the species may be the primary information source for building a species-habitat model. The required information may be obtained through personal or telephone interviews, written questionnaires or "mini-workshops". If possible, ask the species experts to review the species-habitat model once it is drafted.

Contact species experts. These may include:

- regional and provincial wildlife and habitat biologists
- provincial museum zoologists
- university scientists
- local naturalists

4.2.2 Identify Information Gaps

Lack of information on some species' habitat needs or of information on habitat use specific to British Columbia will hinder development of the species-habitat model and affect the reliability of the resulting capability and suitability maps. Identify these information gaps and describe how they will be addressed.

In some cases, additional data can be collected during field sampling -- extensive population surveys, winter flights, etc. In other cases, the information needed requires more intensive research and species inventory and may be beyond the scope of most habitat capability and suitability mapping projects.

Address information gaps on a species' habitat requirements through:

- more detailed plot assessments as part of the field sampling plan;
- directing species inventory to gather more information.

4.2.3 Develop a Species Account

The species account is a written description of an animal species' life history, biology and habitat requirements. For the purposes of wildlife habitat capability and suitability mapping, "species account" refers to a species' life requisites and habitat requirements which are relevant to the project area. It is more detailed than the species accounts for Identified Wildlife (Province of British Columbia, 1997), the Royal BC Museum books and other species guidebooks, especially in the descriptions of the species' use of specific ecosystem attributes. While the species accounts in these guidebooks provide useful information for developing a habitat capability and suitability species account, they are not sufficient to use "as is."

Information gleaned from the literature review and species experts will be the basis for the species account. It should be focused on what is known about the species and its habitat requirements in (or relevant to) the project area. Include as much detail as possible when relating the species' life requisites to specific habitat requirements and ecosystem attributes. However, remember that this is not a thesis on the species' life history; too many details on the species behaviour, breeding strategy, physiology, etc. are distracting and not helpful to assigning habitat capability and suitability ratings.

Include the following information in a species account:

- Name
- Status
- Distribution
- Project Area and Map Scale
- Ecology and Habitat Requirements
- Habitat Use (Life Requisites and Seasons)
- Habitat Use and Ecosystem Attributes

Name

Provide the scientific and common name of the species, as well as the standard species codes per Cannings and Harcombe (1990).

Status

Identify the species' status as listed by the Ministry of Environment, Lands and Parks and, if applicable, by the COSEWIC designation. To confirm the current status, contact either the regional or provincial Rare and Endangered Species Specialist.

Refer to these sources to identify the species' status:

- B.C. Wildlife Act
- Ministry of Environment, Lands and Parks. 1996. Vertebrate red and blue lists. Wildlife Branch, Victoria, BC
- COSEWIC. 1997. Canadian species at risk, April 1997. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario

Distribution

Describe the following components of the species' distribution:

- provincial range
- elevational range

Indicate whether the species, as it occurs[1] in the project area, is at the *periphery* or at the *centre* of its range.

Project Area and Map Scale

Identify Ecoregions, Ecosections and Biogeoclimatic zones for the project area.

Identify the project map scale for which the Species-Habitat Model is being developed.

Ecology and Habitat Requirements

Provide a brief description of the species' life history and ecology as it relates to the use of habitats in the project area. Describe the general seasonal habitat requirements of the species.

[1] In some cases, the species may not currently occur in the project area but the habitat is being assessed for a potential wildlife transplant.

Habitat Use (Life Requisites and Seasons)

Definitions for the seasons and life requisites used for wildlife habitat ratings are provided in Section 1.4 of this document. Refer to Appendix A for the minimum required habitat uses that can be rated for the project species. Identify the season level (e.g. 1-, 2- or 4-season) and the combination of life requisites and seasons that will be rated for this project. (Note that habitat use data collected in the field is always at the detailed level.)

Food and cover life requisites are generally required throughout the year and the season must always be identified explicitly in the ratings table. However, most other life requisites such as reproduction, hibernation, migration, etc. are confined to specific times of the year and are specific to each species -- the season for these *specific life requisites* must be identified clearly at this point in the Species Account. [Note that the specific life requisite called "living" is an exception (see Section 1.3.) and must always have a season explicitly defined.]

Therefore, identify the month(s) of habitat use for each life requisite and the season for which it will be rated. Each month of the year that the species occurs in the province must be accounted for when identifying seasons of use. Table 12 provides a template that may be useful in identifying the seasons and life requisites being rated. (Hint: enter "NA" for those months a migratory species is absent from the province).

Use the Chart of Seasons by Ecoprovince (Appendix B) for guidance in defining which season a particular month represents. Elevational and other localized differences should be taken into consideration when mapping a specific project area within an Ecoprovince. Document these considerations when defining seasons.

Table 12. Template for identifying the seasons and life requisites of a species being rated for a project.

Assign a season to each month and, for each month, list the life requisites that are to be rated for the species:			
Month	**Season**	**Life Requisites**	**Specific Time Period, if known (e.g. nesting periods, average hibernation dates, etc.)**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Additional considerations when identifying seasons and life requisites to rate:

- for resident species, all months of the year may be accounted for and rated;
- for migratory species, only the months which it occurs in the province are rated;
- for those migratory species in which some individuals or populations regularly overwinter (e.g. mallards), all months of the year should be accounted for and rated;
- for defining seasonal ranges, such as winter ranges, see Appendix G.

Habitat Use and Ecosystem Attributes

For each life requisite-season combination to be rated, describe the specific ecological attributes (such as Site Series/Ecosystem Unit, important plant species, canopy closure, age structure, slope, aspect, terrain characteristics, etc.) which provide the required life requisites. Ensure that these attributes are identified in the ecosystem map database.

4.2.4 Develop the Habitat Ratings

Once the species' life history and habitat requirements are described, the next step is to relate how this information will be used to develop habitat capability and suitability ratings for the preliminary ratings table.

Write the guidelines for rating the species' habitat:

- Rating Scheme
- Provincial Benchmark
- Ratings Assumptions
- Preliminary Ratings Table
- Ratings Adjustments Considerations

Rating Schemes

Three habitat capability and suitability rating schemes have been defined, based on the provincial knowledge base of the species' use of habitat.

Refer to Section 1.2 of this manual to identify the appropriate rating scheme to use for the project species:

Rating Schemes:

- 6-class rating scheme - detailed knowledge of species' habitat use
- 4-class rating scheme - intermediate knowledge of species' habitat use
- 2-class rating scheme - limited knowledge of species' habitat use

The rating scheme identified for a species in Appendix A is the *minimum* level at which the ratings should be applied. A more detailed rating scheme can be used if there is enough information on the species and its use of habitat -- however, this should first be discussed with the project manager and the provincial wildlife correlator.

The level of detail identified here sets the parameters for developing both the preliminary and the final ratings tables. However, *data collected in the field are always collected at the detailed level* (6-class rating scheme).

Provincial Benchmark

The benchmark is the highest capability habitat for the species in the province, against which all other habitats for that species are rated. It is used to calibrate the capability and suitability ratings by providing 'the standard' for comparing and rating each habitat or ecosystem unit for a particular season and life requisite.

Refer to the provincial benchmarks in Appendix G for ungulates. When benchmarks are not yet available, use the 1:250,000 broad ecosystem ratings as guidelines. Contact the provincial

wildlife correlator for assistance in identifying benchmarks.

Ratings Assumptions

Define all the assumptions that will go into building the preliminary ratings table. This is a written description of the assumptions about how a species uses particular ecosystem attributes and how this is reflected in the ratings. The assumptions should always accompany the preliminary ratings table. It is important to provide the basic concepts behind the preliminary ratings and document the reasoning behind the values that appear in the ratings tables. Whenever possible, reference the information source for each assumption.

Provide a descriptive account of the ratings assumptions, including:

- the effects of ecosystem attributes (such as slope, aspect, structural stage, etc.) on the ratings;
- the highest potential rating for each habitat attribute and/or potential ecosystem unit expected in the project area;
- the minimum and maximum ranges expected for each habitat attribute and/or potential ecosystem unit.

Preliminary Ratings Table

Use the working legend developed by the terrestrial ecosystem mapping team to develop the preliminary ratings table. A working legend is an initial list of ecosystem units (site series, site modifiers, structural stages, etc.) expected for the project area and shows the relationships to climatic and bioterrain features (RIC, 1998a). This initial list is based on existing information and the site classification in the Ministry of Forests field guides.

The preliminary ratings are the hypothesized habitat ratings for a particular species that build on the habitat relationships described in the model to this point. Appendix F provides an example of a preliminary ratings table.

In areas where the ecosystems are well described, a list of site series with site modifiers and structural stages expected in the project area may be used for the preliminary ratings table instead of the full working legend. However, this list should be based on the Terrestrial Ecosystem Mapping list of ecosystem units (RIC, 1998a) which provides detailed descriptions of typical situations in which these site series occur, rather than on the list of site series in the Ministry of Forests field guides.

For each Ecoregion/BGC subzone/variant combination, provide suitability ratings (by season and life requisite) for all structural stages*, for features such as:

- landscape position (slope, aspect, crest, special habitats)
- moisture regimes (floodplain, dry average, moist, deep/shallow soil, rock outcrop,
- potential ecosystem unit
- special features (e.g. lakes, cliffs, wetlands, avalanche chute)
- Structural stages may be grouped (e.g. shrub/herb, young forest, mature/old forest)

Rating Adjustment Considerations

Make a preliminary list of habitat attributes that may not be included in the ratings table but nevertheless may be important for the species. These may include size and proximity effects or attributes obtained from other data sources (e.g. TRIM) which may be used to adjust the ratings table to produce a more accurate habitat map. While adjustments are not actually made until later in the mapping procedures, listing expected adjustments at this point provides further direction to the field sampling and verification process.

4.2.5 Information Sources

Provide complete citations for all information sources (i.e., both the literature reviewed and any personal communications with species experts) used in the preliminary species-habitat model.

4.2.6 Minimum Requirements for Species-Habitat Models

Every project must have a written Species-Habitat Model for each of the wildlife species in the project. The detail in the model depends on the degree of knowledge on the species and the scale at which it is being mapped (the larger the map scale, the greater the detail). Each Species-Habitat Model requires both a species account and a ratings table.

The species account must include: name, status, distribution, project area and map scale, ecology and habitat requirements, habitat use (seasons and life requisites being rated), and ecosystem attributes required.

The ratings table must be accompanied by a written description of the ratings assumptions, the ratings scheme used and the provincial benchmark -- for each of the project species. A preliminary ratings table and species accounts must be submitted for review and correlation prior to field work. The final ratings table must include revisions from correlation and field sampling.

4.3 Field Sampling

Once the preliminary species-habitat model has been developed for each of the project species, field sampling can commence. Field sampling provides ground truthing of the preliminary ratings, so that the final species-habitat model can be revised and completed.

4.3.1 Prepare Sampling Plan

Prepare a sampling plan in conjunction with the ecosystem mapping team and ensure that it is approved prior to going out into the field. The sampling objectives for ecological classification may not always include the habitats and attributes required for rating wildlife habitats. It is the wildlife biologist's responsibility to ensure that the ecological sampling plan developed by the ecosystem mappers includes specific wildlife habitats that are either particularly important for the project species or for which the species-habitat relationships are not clear. The sampling plan should also provide some indication of how the wildlife field crews (if there is more than one) will be coordinated.

In developing the preliminary ratings tables, ratings for some habitats may be questionable or

missing, especially for the lesser known species. Be certain to include these habitats in the sampling plan. Also, there may be some types of information identified in Section 3.2.2. (Information Gaps) which can be addressed through a well-designed sampling plan.

Include the following information in a sampling plan:

- location of sample plots;
- rationale for selection of plot sites - what do sites represent and which wildlife species are they important for?
- dates planned for field work;
- field crews: how many crews? comprised of which disciplines? how will they be coordinated?
- field data forms to be completed.

If the information gaps identified in Section 3.2.2. require a species inventory and if that inventory is a component of the habitat mapping project, then separate project plans and sampling plans are required. All species inventories must follow the RIC standards outlined in *Standardized Inventory Methodologies for Components of BC Biodiversity* (RIC, 1996).

4.3.2 Undertake Field Work

Standards for field sampling are provided in *Field Manual for Describing Terrestrial Ecosystems* (RIC, 1998b) which includes the instructions for completing the Wildlife Habitat Assessment field form as well as the rest of the Ecosystem Field Forms. The wildlife biologist should be completely familiar with this reference before undertaking field work.

Sampling Considerations

The species accounts and preliminary ratings tables should also be used as references in the field. As plot data is collected, the preliminary ratings tables and the ratings assumptions should be updated and revised as required. Additional sampling may be required to ensure important habitats for all the project species are represented and to assess the spatial arrangements of habitats.

Preliminary ratings tables and ratings assumptions are used in the field to provide:

- reference for rating sample plots;
- indication of ecosystems for which preliminary ratings are missing or unreliable;
- guidance for choosing additional sampling sites.

In addition to collecting wildlife habitat assessment plot data, the biologist's field work includes additional tasks, such as an ongoing assessment of and revisions to the sampling plan (in conjunction with the ecological mapping team) and becoming familiarized with the sampling areas prior to visiting the plot sites. Initial edits of the field forms may also be done if there is time at the end of the day or when waiting for weather conditions to improve.

At the beginning of field work, all wildlife field crews must meet to ensure everyone is using the same approach for collecting data and assigning ratings. Regular meetings should be

held throughout the field work to summarize and compare findings.

On a regular basis (daily or every few days) the wildlife biologist should:

- preview the air photos;
- update the preliminary ratings tables;
- revise the ratings assumptions;
- keep a running tally of the site series sampled;
- review and, if necessary, revise the sampling plan;
- ensure wildlife crews are maintaining consistency in data collection.

Completing the Ecosystem Field Forms

The Wildlife Habitat Assessment (WHA) Form is part of a suite of Ecosystem Field Forms (FS882) used to collect ecological mapping data. It is not a stand-alone form but must be used in conjunction with the Site Description Form, Soils Description Form and Vegetation Form for full plots, and with the Ground Inspection Form (GIF) for reconnaissance plots (there is no reconnaissance-level form for wildlife habitat assessment).

Ecosystem Field Forms required to develop the wildlife habitat ratings:

- Site Description Form: FS882(1)
- Soil Description Form: FS882(2)
- Vegetation Form: FS882(3)
- Wildlife Habitat Assessment Form: FS882(5)
- Ground Inspection Form (GIF)

Additional Ecosystem Field Forms include the Mensuration Form FS882(4), Tree Attributes for Wildlife Form: FS882(6) and the Coarse Woody Debris Form: FS882(7). These detailed forms are *not* required for most wildlife habitat assessments. An abbreviated section for collecting wildlife tree and coarse woody debris data specifically for habitat assessment is included on side 2 of the Wildlife Habitat Assessment Form FS882(5). In most cases, this information should be adequate for rating habitats of wildlife species dependent on wildlife trees and/or coarse woody debris.

The Wildlife Habitat Assessment Form is designed to collect information and develop suitability ratings for each project species at a detailed level. Thus, a 6-class rating scheme is always used and food/cover life requisites are rated for their value for specific life requisites (the default being "Living"). However, the seasons may be defined at either a less detailed level, such as Winter and Growing (2 seasons) or a more detailed level (early/late subdivisions for bears and ungulates). When rating a specific life requisite other than Living, the season column on the WHA form may be left blank (because the season is implied in the specific life requisite and described in the species account).

For each of the project species, habitat is assessed in two ways: 1) the plot type, and 2) the plot-in-context. Plot type is the combination of site, soil and vegetation characteristics that describe the plot. Two separate sample plots may have the same plot type if they share the same site, soil and vegetation characteristics. However, when put in context with the surrounding habitats and features, these two plots may have different value to a wildlife

species -- these differing habitat values can be discerned through the plot-in-context assessment.

The plot-type assessment is tied to the ecosystem field forms used by the ecosystem mappers to develop the ecosystem units on which the final ratings table is based. Thus the food/cover ratings developed for the plot-type provide guidance in developing the final ratings for the project area. Note that the ratings are often not directly transferable to the ratings table, but will help in the formulation of the final ratings.

The plot-in-context assessment provides a record of the habitat features occurring in the project area that have a synergistic effect on the wildlife values and helps in the formulation of rules about the spatial arrangement required for habitat use. This is useful in both the report writing and in testing the habitat suitability map generated from GIS application.

Detailed instructions for filling out the Wildlife Habitat Assessment form are provided in *Field Manual for Describing Terrestrial Ecosystems* (RIC, 1998b).

4.3.3 Complete, Edit and Store Data

At the end of field work, the biologist is responsible for ensuring that the field data forms are filled out completely and accurately. This is a "mechanical clean-up" of the data forms, not a second-guessing of the ratings applied in the field. Data from the field forms must be entered into the VENUS database and submitted to the project manager for correlation.

Post field work tasks include:

- clean-up the field data forms;
- enter data into the VENUS database;
- submit data forms and an electronic copy of the database to the project manager.

4.3.4 Minimum Requirements for Field Sampling

A sampling plan is required prior to field sampling for all projects. A sampling plan must include: location of sampling plots (on map of project area), rationale for plot selection, and dates for field work.

All field sampling must use the Ecosystem Field Forms (FS 882 (1), (2), (3) and (5) and the Ground Inspection Form. Wildlife habitat data is always collected using the Wildlife Habitat Assessment (FS882(5)) data form. Both sides of the Wildlife Habitat Assessment form must be completed for full plots (wildlife tree and coarse woody debris sections must be completed only for species that require these attributes), but the plot-in-context assessment is not required for Ground Inspection plots.

All field data collected on the Ecosystem Field Forms and the Ground Inspection forms must be entered into the most recent version of the VENUS data capture program and submitted along with other project deliverables.

4.4 Final Species-Habitat Model and Wildlife Report

The final species-habitat model differs from the preliminary species-habitat model in that it includes the final ratings table as developed from the additional data collected during field sampling and reflects the detailed ecosystems mapped. The species account may also be revised after further information has been gathered in the field.

The final species-habitat model includes:

- the revised species account;
- the revised preliminary ratings table;
- revised ratings assumptions
- the final ratings table.

4.4.1 Refine Species Account

Update the species account to reflect additional information on a species' use of habitat collected during field work.

4.4.2 Revise Preliminary Ratings

Ensure that the preliminary ratings table and the ratings assumptions are edited and updated to reflect data collected in the field.

For example, during field sampling for Caribou habitat, plot data may indicate that food and security requirements are rated high for a particular ecosystem unit. However, comments on the field form suggest that because the plot is at a low elevation it is not used by Caribou. The ratings assumptions should therefore be revised to indicate that Caribou require habitats above 1200 meters to maximize security and that for every 150 meters decrease in elevation, security habitat decreases by 20 percent.

4.4.3 Develop Final Ratings Table

Generate a list of unique ecosystem units from the completed ecosystem database (if using MS Excel, use the Data/Filter/Advanced Filter option). Ensure that the ecosystem database is correlated and up-to-date. Provide a suitability rating for each of the required life requisites and seasons, making a separate ratings table for each species. The structural stage with the highest rating will be the capability for the ecosystem unit. All ecosystems units must be rated, otherwise unrated units result in "blanks" in the habitat maps produced from the final ratings tables.

Field-derived ratings are the basis for the final ratings. Summary reports generated from the VENUS database will be useful in synthesizing field data for development of final ratings.

The final ratings tables are developed from:

- project species list
- standard ratings schemes required for each species
- standard life requisites and seasons required for each species
- preliminary ratings tables as revised from field sampling
- field data as summarized in VENUS reports
- expanded legend from Terrestrial Ecosystem Mapping (for list of unique ecosystems)

Follow the standard format and guidelines for final ratings tables in Appendix I as well as the technical standards outlined in *Standard for Digital Wildlife Habitat Rating Data Capture in British Columbia* (RIC, in prep.).

4.4.4 Assign a Reliability Qualifier

The reliability qualifier reflects the level of information available on a species' life requisites as well as the corresponding understanding of the species-habitat relationships and their applicability to ecosystem mapping. This level of information affects the accuracy of the species-habitat model and the resultant habitat maps.

General criteria for assigning a reliability qualifier to a species-habitat model and habitat maps:

- Low Reliability. Available information is based on studies in other provinces or countries with some or little local information on the species-habitat relationships. No verification has been done.
- Moderate Reliability. Available information is based mainly on studies, reports and expertise on the species-habitat relationships gained within British Columbia. Some information from ecosystems in the study area, but mostly extrapolated from similar ecosystems. No verification or limited verification has been done.
- High Reliability. Available species-habitat relationship information is based mainly on detailed studies, reports and expertise gained within British Columbia and pertaining directly to the ecosystems in the study area. Ratings have been verified.

Verification includes testing the model against actual data (such as nest records, element occurrence records, etc.) or by ground truthing and sampling.

4.4.5 Draft the Wildlife Final Report

The final report ties together the entire project in a written format. The project manager and the wildlife biologist should discuss the report format during the project coordination meeting early in the project. However, the minimum requirements are outlined below.

The final report should include:

- a copy of the habitat mapping project contract Schedule A
- final species-habitat models (i.e., the revised species accounts, the revised preliminary ratings tables and final ratings tables)
- qualitative discussion of the habitats requirements (in relation to the project area) of each of the project species
- habitat management recommendations, if required in the contract

4.4.6 Minimum Requirements for Final Products

All projects require species accounts and ratings for each of the project species in the format outlined in this document. The final ratings table must include ratings for structural stages two through seven for each unique ecosystem in the project: Ecosection, Biogeoclimatic Zone, Subzone, Variant, Phase, Site Series, and Site Modifiers. Coding for the ecosystems must follow the ecosystem mapping standards (Resources Inventory Committee,1998c). Format for the final ratings table and coding for seasons, life requisites and wildlife species

must follow the codes and definitions used in this manual (refer to the guidelines for formatting a final ratings table in Appendix I) and in *Standard for Digital Wildlife Habitat Rating Data Capture in British Columbia* (Resources Inventory Committee. In Prep.).

A report is also required that includes: contract Schedule A or a project plan, final species-habitat models and a discussion on the habitat requirements of each species.

All deliverables must be reviewed and correlated by the provincial wildlife correlator or a species expert as agreed to at the project coordination meeting.

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Glossary

The following definitions generally include a dictionary definition (see either *Webster's Ninth New Collegiate Dictionary*, Merriam Webster, 1989 or *Dictionary of Natural Resource Management, Dunster, 1996*) and/or a definition specific to the word's use in this manual.

Accuracy: The number of errors; degree of correctness; the degree by which measurements differ from their true value.

Adjacency: Closeness to; adjoining; contiguous; having a common border. Adjacency refers to ecosystem units or polygons sharing a common border. The relative closeness of one habitat to another is important for some species. Adjacency is often used as an adjustment when rating habitat use of a smaller or less mobile animal species. (See *proximity* for comparison).

Adjustments: Making accurate by regulating; conformations or adaptations; to bring into correct relationship; a process in which observations are corrected in an effort to reduce or remove errors or internal consistencies in the results. A series of underlying logic rules which correct ratings given to an ecosystem unit based on additional attributes which are not explicitly identified in the ratings table. Adjustments are used as part of the algorithm for generating a habitat capability or suitability map.

Algorithm: A set of mathematical instructions or problem-solving procedures designed to provide answers to complex problems. Used in modeling applications to portray the interrelationships between different sets of data. A series of commands which specifically assign habitat capability and suitability ratings for an animal species to ecosystem unit polygons.

Anthropogenic: Modified by human activity.

Assumptions: An idea or statement assumed to be true without proof. An organized list of logic rules based on information in the species account and used for rating a species' habitat requirements. The assumptions direct the rating of ecosystem units in the ratings table.

Attributes: A characteristic required for describing or specifying some entity; a readily definable and inherent characteristic of a plant, animal, habitat or abiotic feature. Any feature of an ecosystem unit which is not represented by the site series, site modifier or structural stage. Attributes may either be recorded from fieldwork or inferred by extrapolating features from similar ecosystem units.

Benchmark: A point of reference from which measurements may be made; something that serves as a standard by which others may be measured. The highest capability habitat for a species in the province, against which all other habitats for that species are rated. Both capability and suitability ratings are measured against the provincial benchmark.

Capability: The ability of the habitat, under optimal natural (seral) conditions to provide the life requisites of a species, irrespective of its current habitat condition.

Carrying Capacity: The number (or weight) of organisms of a given species and quality (in terms of health) that can survive in a given ecosystem without causing its deterioration, through the least favourable environmental conditions that occur within a stated interval of time. In wildlife management, often described in terms of number of animals per square kilometers (or hectares) per month.

Compound Polygon: A polygon containing more that one ecosystem unit, up to a maximum of three. The estimated proportion of each ecosystem unit is described in deciles.

Ecosystem: A volume of earth-space which is composed of non-living parts (climate, geologic materials, groundwater, and soils) and living or biotic parts, which is set apart from other volumes of earth-space in order to study the processes and products of production.

Ecosystem Unit: A classification unit defined as being a combination of site unit, site modifiers, and structural stage (and sometimes seral community type).

Ecosystem Unit Series: A complete set of ecosystem units (and sometimes seral community type) for a given area, which may include site modifiers depending on the resolution of mapping.

Enhancement: The intentional alteration of habitat in order to provide improvements for a particular species or group of species. Enhanced habitats may increase the suitability of a habitat greater than the *capability*. This increases the carrying capacity to greater than that which would normally occur in a natural system.

Expanded Legend: A detailed list of ecosystem units and their features for all structural stages and conditions. This must also include key habitat attributes, both recorded and inferred. An expanded legend is used to assist in the interpretation of an animal's habitat use of all ecosystem units.

Habitat Feature: A prominent characteristic (either artificial or natural) of a habitat that is not a terrestrial ecosystem classification attribute. It consists of a structure (e.g., road, cliff) or habitat (e.g., clear-cut, wetland) that affects the suitability or usability of the habitat (polygon) by a species. A habitat feature is included in the suitability rating of the polygon for a particular species. (Contrast with "non-habitat feature.")

Identified Wildlife: a term defined under the Forest Practices Code that refers to species or plant communities that are considered to be sensitive to habitat alteration associated with forest and range practices. Most of these are considered to be "species at risk."

Key Habitat Attributes: The attributes of any ecosystem unit which are essential for supplying the *life requisites* of a species.

Life Requisites: Specific activities of an animal that are critical for sustaining and perpetuating the species and that depend on particular habitat attributes or conditions. Life requisites include feeding, cover, breeding, migration, hibernation, etc.

Migration: The regular seasonal or daily movement of animal populations to and from different areas, often considerable distances apart. Migration often occurs in suboptimal corridors between preferred habitat types.

Migration corridors: A physical and/or biological feature that acts to concentrate or funnel animals, providing a completely or partially suitable habitat and which animals follow during migration.

Model: An idealized representation of reality developed to describe, analyze or understand the behaviour of some aspect of it; a mathematical representation of the relationships under study. See species-habitat model.

Non-habitat Feature: A quality of the environment in or adjacent to the habitat (polygon) that affects the use of the habitat by a species, but cannot be considered a characteristic or attribute of the habitat itself. Human activities or developments are the most readily identifiable non-habitat features, but other aspects of the environment that may affect use of a habitat include predation, disease, social interactions, weather, etc. A non-habitat feature is not included in the suitability rating of the polygon.

Polygon: In GIS work, a stream of digitized points approximating the delineation (perimeter) of an area (e.g., ecosystem map unit) on a map. In terrestrial ecosystem mapping a polygon consists of from one to three *ecosystem units*.

Predation: An interspecific association between species that may be positive or negative. Positive - when predator populations fluctuate in positive response to variations in prey. Negative - when high predator population densities produce a local population depression of prey. Predation is not generally considered when developing the rating for suitability of a habitat, even though it may negatively affect the population being rated.

Proximity: The quality, state or fact of being near. In habitat mapping, the relative closeness of one habitat to another; ecosystem units or polygons do not necessarily share a common border (see *adjacency* for comparison). The proximity of habitats often determines whether a habitat is used by a species, despite the capability of that habitat to support the species. Proximity is often used as an adjustment when rating habitat use of a species.

Rating: A relative estimate or evaluation. A value assigned to a map unit to express the capability or suitability of that unit to support a wildlife species for a particular life requisite and season. The rating is based on assumptions about the species habitat requirements as defined in the species-habitat model.

Preliminary Ratings Table: The initial habitat capability/suitability ratings assigned to generalized ecosystems (or a list of potential site series) developed prior to field sampling and used as a guide in developing the sampling plan for a project.

Rating Scheme: A classification system for wildlife habitat capability/suitability ratings based on the knowledge level about a species and its habitat requirements. Three types of rating schemes (6-class, 4-class and 2-class) have been defined. The rating scheme to be used for a particular species or category of wildlife species is identified in Appendix A of this document.

Ratings Table: The application of habitat suitability/capability ratings for a species to each ecosystem unit (derived from the site series legend) in each of its natural conditions or structural stages. The ratings table and adjustments are integrated into an algorithm and used to develop map models using GIS.

Reliability Qualifier: A value (low, moderate, high) assigned to the species-habitat model, based on the relative level of information on its habitat requirements. This level of information reflects the accuracy of the model.

Resolution: The capability of making distinguishable the individual parts of an object. Specifically, the level of detail at which ecological information is collected, which may be different than the map scale at which it is presented.

Scale: The ratio between the distance traveled between two points on a map and the equivalent true distance that this would represent on the ground. The level of detail on a map increases as the ratio decreases. Scale determines the level of *accuracy* that can be expected. Specifically, the map scale at which habitat information is presented (e.g. 1:20,000, 1:50,000 or 1:250,000).

Site Series: Encompasses all sites capable of producing the same late seral or climax plant communities within a biogeoclimatic subzone or variant. Site series form the basis of ecosystem units and indicate climax site potential.

Species Account: A summary of geographic distribution, life requisites, seasonal use of habitats, limiting factors, and habitat attributes for an animal species within a geographic range.

Species-at-Risk: Endangered, threatened, vulnerable or sensitive species requiring management of critical habitats to maintain populations and/or distributions. Includes some species not considered at risk provincially but which have regional populations that may be threatened.

Species-Habitat Model: A written or graphical representation of an animal species' habitat use over a defined landscape. It is based on the species account and is used to develop the assumptions, rating tables, and adjustments.

Suitability: Ability of the habitat in its current condition to provide life requisites of an animal.

Appendix A: Ratings Criteria (Reconnaissance Level) for BC Wildlife Species

The following tables provide the minimum requirements for the rating schemes and habitat uses to rate for three different scales of wildlife habitat capability and suitability mapping projects. The species included are those most commonly chosen for habitat mapping projects: ungulates, bears, provincial red- and blue-listed species and Identified Wildlife species. If the project species is not specified in this list, it should fit into one of the categories identified; however, if there is any uncertainty, contact the provincial wildlife correlator. The rating criteria identified in this appendix are the minimum standards. For projects requiring greater detail, see Appendix J.

Because there is a substantial knowledge level of bears and ungulates in British Columbia, there is a tendency to want to rate habitat uses for these species at greater detail than the project requires. Wildlife habitat assessment projects can be considered either reconnaissance level projects or detailed projects. Generally, projects mapped at 1:250,000 are reconnaissance and projects mapped at 1:5,000 are detailed. Projects mapped at scales between these two can be either reconnaissance or detailed, depending on the inventory effort and time spent on collecting wildlife habitat use information. However, most 1:50,000 and 1:20,000 habitat inventory projects are reconnaissance level.

Reconnaissance Projects: reconnaissance level habitat assessment projects are those that have a one-time field sampling effort. Most Terrestrial Ecosystem Mapping projects are reconnaissance level because the standard TEM sampling intensity requirements are low and the wildlife habitat sampling is done at a similar low sampling intensity. While there may be some limited population surveys (e.g. winter ungulate surveys) associated with capability/suitability mapping projects, these surveys are also done at a reconnaissance level.

Detailed Projects (see Appendix J): detailed habitat assessment projects, on the other hand, require multiple field sampling over time and/or a high sampling intensity. More intensive population surveys and species-habitat relationship studies usually provide the basis for detailed habitat assessments. These projects are often limited to one or two wildlife species.

In these tables, the first column for each map scale identifies the rating scheme (RS): 6-class, 4-class or 2-class (see Section 2.3). The next two columns identify the habitat uses that can be rated: 1) the minimum required habitat uses to rate in a project, and 2) optional habitat uses that may be rated if more detail is needed for the project. Habitat use is a combination of a life requisite and a season. Refer to Tables 5 and 6 in Section 2.4 for more detailed definitions of the habitat uses.

Some more detailed habitat uses are optional for reconnaissance level habitat assessments. For example:

- One of the early/late seasons (e.g. Early Spring) can be rated (for food/cover) along with the Growing season.
- One or more of the specific life requisites (Reproducing) can be rated along with the Growing season.

Caution: the Growing season includes Early Spring; it also includes the season for the specified life requisites such as reproducing, courting, etc. Such overlap between the seasons being rated should be kept to a minimum. If there is too much overlap of the seasons, or if food/cover can be readily differentiated, the ratings should be applied to more detailed seasons (e.g. Early/Late Spring, Summer and Fall).

The codes used for habitat use are as follows:

Life Requisites				**Seasons**			
LI	Living	HI	Hibernating	A	All seasons	WE	Early Winter
FD	Food	MS	Migrating (seasonally)	W	Winter	WL	Late Winter
SH	Security	RB	Reproducing (birthing)	G	Growing (spring, summer, fall)	PE	Early Spring
ST	Security/ Thermal	RE	Reproducing (eggs)	P	Spring	PL	Late Spring
TH	Thermal	SG	Staging	S	Summer		
CO	Courtship/ Mating			F	Fall		

Amphibians and Reptiles

Map Scale	1:250,000			1:50,000			1:20,000		
Species	RS	Habitat Minim. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional
POND-DWELLING AMPHIBIANS Tiger Salamander Great Basin Spadefoot Toad Northern Leopard Frog Spotted Frog	2	LI-A		4	LI-A	LI-W LI-G RE	4	LI-A	LI-W LI-G RE
ALL OTHER AMPHIBIANS Pacific Giant Salamander Coeur D'Alene Salamander Tailed Frog	2	LI-A		2	LI-A		4	LI-A	
REPTILES: TURTLES & LIZARDS Painted Turtle Short-Horned Lizard	2	LI-A		2	LI-A		4	LI-A	
REPTILES: SNAKES Rubber Boa Western Yellow-bellied Racer Sharptail Snake Night Snake Gopher Snake Western Rattlesnake	2	LI-A		2	LI-A		4	LI-G HI	

Birds (see attached list of species for provincial occurrence)

Map Scale	1:250,000			1:50,000			1:20,000		
Species by Provincial Occurrence*	RS	Habitat Min. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional
RESIDENTS	2	LI-A		4	LI-A	LI-W LI-G RE	4	LI-A	LI-W LI-G RE
BREEDING VISITANTS	2	LI-G	RE	4	LI-G	RE	4	LI-G RE	
WINTER VISITANTS	2	LI-W		4	LI-W		4	LI-W	
NON-BREEDING SUMMER VISITANTS	2	LI-G		4	LI-G		4	LI-G	
SPRING/AUTUMN VISITANTS	2	LI-G		4	LI-G		4	LI-P LI-F	SG
PELAGIC (BREEDING COLONIES ONLY)	2	RE		4	RE		4	RE	

*For some bird species, when habitat requirements are better known, more detailed rating criteria may be considered (see Appendix J).

Mammals

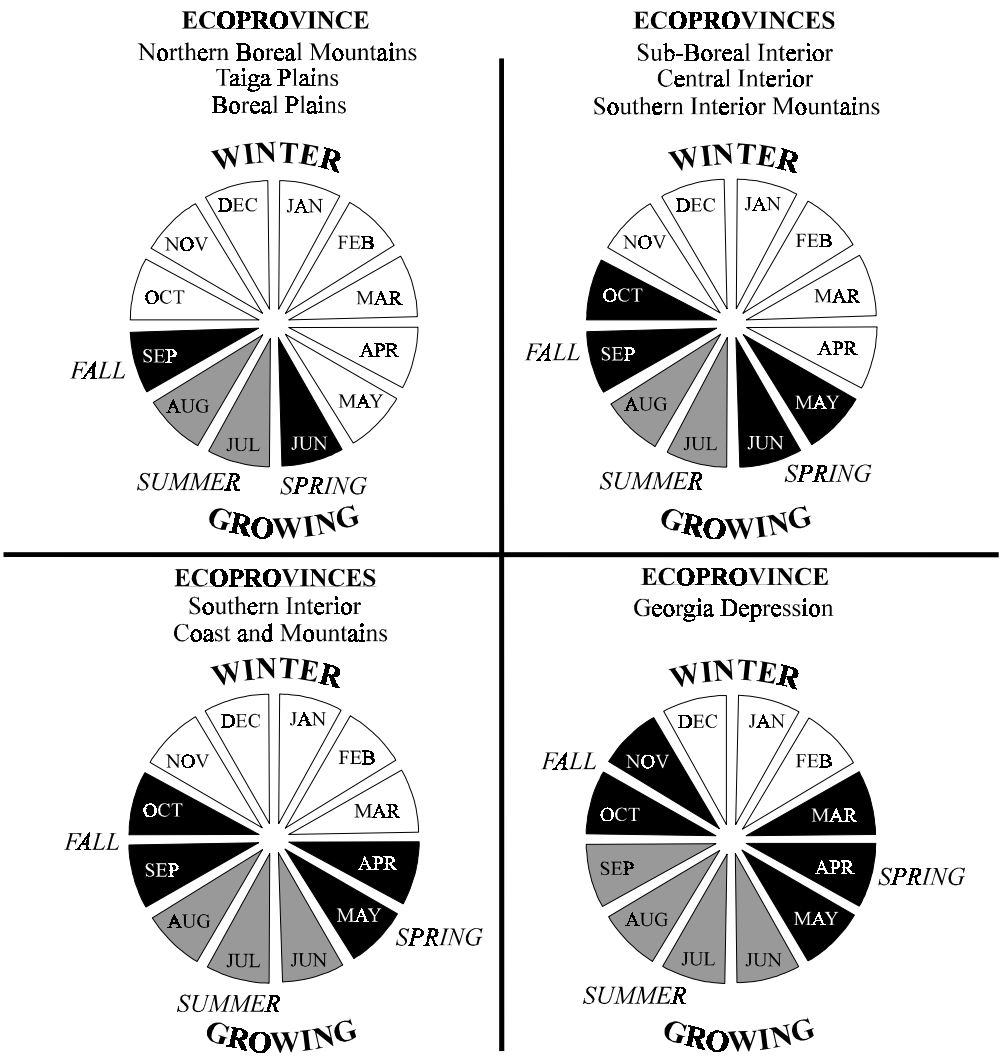
Map Scale	1:250,000			1:50,000			1:20,000		
Species	RS	Habitat Minim. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional	RS	Habitat Minim. Req'd	Use Optional
INSECTIVORES Pacific Water Shrew	2	LI-A		2	LI-A		4	LI-A	
BATS - intermediate knowledge level Western Small-footed Myotis Townsend's Big-eared Bat Pallid Bat Spotted Bat	2	LI-A		4	LI-G	HI RB	4	LI-G	HI RB FD-G ST-G
BATS - limited knowledge level Keen's Long-eared Myotis Northern Long-eared Myotis Fringed Myotis Western Red Bat	2	LI-A		2	LI-A	RB	2	LI-G	HI RB
LAGOMORPHS Nuttall's Cottontail Snowshoe Hare (Washingtonii) White-tailed Jackrabbit	2	LI-A		4	LI-A		4	LI-A	
RODENTS - HIBERNATING Vancouver Is Marmot Golden-mantled Ground Squirrel	2	LI-A		4	LI-G	HI	4	LI-G	HI
RODENTS - NON-HIBERNATING **1) well-defined homesites** Mountain Beaver Northern Pocket Gopher	2	LI-A		4	LI-A		4	LI-A	
2) poorly defined homesites Mice, Voles, Lemmings	2	LI-A		2	LI-A		2	LI-A	
MUSTELIDS: Ermine, Weasel	2	LI-A		2	LI-A		4	LI-W LI-G	
MUSTELIDS: Marten, Fisher, Wolverine, Badger	4	LI-A		4	LI-W LI-G		4	LI-W LI-G	RB
BEARS	6	LI-G	FD-G	6	LI-G	FD-G FD-PE ST-G HI	6	LI-G	FD-G FD-PE ST-G HI
UNGULATES*	6	LI-W LI-G	FD-W FD-G	6	LI-W LI-G	FD-W FD-G FD-WE FD-WL ST-W ST-G	6	LI-W LI-G	FD-W FD-G FD-WE FD-WL FD-PE ST-W ST-G RB

* For special winter range mapping projects, only Winter ratings are required.

Provincial occurrence of selected bird species in British Columbia (from CDC Provincial Tracking List for Vertebrate Animals, March 10,1997). See Birds of British Columbia, Volume 1 for definitions of occurrence categories.

Species	Occurrence	Species	Occurrence
Western Grebe	Resident	Common Murre	Pelagic (breeding only)
American White Pelican	Breeding visitant	Thick-billed Murre	Pelagic (breeding only)
Double-crested Cormorant	Resident	Marbled Murrelet	Pelagic (breeding only)
Brandt's Cormorant	Resident	Ancient Murrelet	Pelagic (breeding only)
Pelagic Cormorant	Resident	Cassin's Auklet	Pelagic (breeding only)
Baird's Pelagic Cormorant	Resident	Rhinoceros Auklet	Pelagic (breeding only)
American Bittern	Resident	Tufted Puffin	Pelagic (breeding only)
Breat Blue Heron	Resident	Horned Puffin	Pelagic (breeding only)
Green Heron	Resident	Yellow-billed Cuckoo	Non-breeding summer visitant
Black-crowned Night-heron	Resident	Barn Owl	Resident
Tundra Swan	Winter visitant	Flammulated Owl	Breeding visitant
Trumpeter Swan	Resident	Western Screech-Owl	Resident
Snow Goose	Winter visitant	Snowy Owl	Winter visitant
Brant	Winter visitant	Van. Is. Pygmy-Owl	Resident
Redhead	Resident	Burrowing Owl	Resident
Harlequin Duck	Resident	Spotted Owl	Resident
Oldsquaw	Winter visitant	Short-eared Owl	Resident
Surf Scoter	Resident	Q.C Saw-whet Owl	Resident
Turkey Vulture	Resident	White-throated Swift Breeding migrant	Breeding visitant
Bald Eagle	Resident	Q.C. Hairy Woodpecker	Resident
Q.C. Goshawk	Resident	White-headed Woodpecker	Resident
Broad-winged Hawk	Breeding visitant	Yellow-bellied Flycatcher	Breeding visitant
Swainson's Hawk	Breeding visitant	Gray Flycatcher	Breeding visitant
Ferruginous Hawk	Breeding visitant	Streaked Horned Lark	Resident
Rough-legged Hawk	Winter visitant	Purple Martin	Breeding visitant
American Peregrine Falcon	Resident	Canyon Wren	Resident
Peale's Peregrine Falcon	Resident	Sage Thrasher	Breeding visitant
Gyrfalcon	Resident	Hutton's Vireo	Resident
Species	**Occurrence**	Philadelphia Vireo	Breeding visitant
Prairie Falcon	Resident	Cape May Warbler	Breeding visitant
V I White-tailed Ptarmigan	Resident	Black-throated Green Warbler	Breeding visitant
Sage Grouse	Resident	Bay-breasted Warbler	Breeding visitant
Sharp-tailed Grouse (Columbianus subspp)	Resident	Connecticut Warbler	Breeding visitant
Sandhill Crane	Breeding visitant	Canada Warbler	Breeding visitant
Lesser Golden-Plover	Winter visitant	Yellow-breasted Chat	Breeding visitant
American Avocet	Spring/fall visitant	Sagebrush Brewer's Sparrow	Breeding visitant
Wandering Tattler	Breeding visitant	Vesper Sparrow (Affinis subspp)	Breeding visitant
Upland Sandpiper	Spring/fall visitant	Lark Sparrow	Breeding visitant
Long-billed Curlew	Breeding visitant		
Hudsonian Godwit	Spring/fall visitant		
Short-billed Dowitcher	Spring/fall visitant		
Red-necked Phalarope	Spring/fall visitant		
Ring-billed Gull	Resident		
California Gull	Spring/fall visitant		
Caspian Tern	Non-breeding summer visitant		
Forster's Tern	Spring/fall visitant		

Appendix B: Chart of Seasons By Ecoprovince



This chart indicates the months in which Winter, Spring, Fall and Summer occurs in each Ecoprovince of British Columbia. Winter can be used for either a 2-season or a 4-season rating; in both cases, it is the same period of time. Fall is included here in the Growing season because there is still considerable foliage and herbaceous plant material as well as berries available -- important forage for many species of wildlife.

The seasons depicted here represent generalized lower elevation sites of the Ecoprovince and are intended as a guide only for defining seasonal ratings values for wildlife habitat capability and suitability. Elevational and other localized differences should be taken into consideration when mapping a specific area within the Ecoprovince.

This chart was developed through a review of the following sources:

1. Climatic diagrams associated with biogeoclimatic zones presented in Ecosystems of British Columbia (Meidinger and Pojar, 1991).
2. Average turn-out dates on cattle ranges as estimated through discussions with Ministry of Forests regional Range Officers.

Appendix C: Example Contract Schedule A for Wildlife Habitat Capability and Suitability Mapping Projects

Schedule A

PURPOSE

The wildlife habitat map displays values for a particular animal species using a rating scheme. Application of prescribed standards results in one or more wildlife habitat maps with a map legend and polygon database, and wildlife habitat field data. This mapping must be done along with Terrestrial Ecosystem Mapping (RIC, 1998a), or RIC approved surrogate ecosystem mapping. The expertise required for these projects includes a wildlife biologist, and to produce the ecosystem base map, a plant ecologist and a pedologist/surficial geologist.. This Schedule outlines the requirements for conducting Wildlife Habitat Capability & Suitability Mapping at [INSERT SCALE] scale for projects.

SERVICES

The Contractor shall:

1. Provide habitat capability and suitability maps for the following wildlife species and habitat uses [INSERT SPECIES/SEASONS/LIFE REQUISITES] in accordance with the current methods outlined in the RIC manual *British Columbia Wildlife Habitat Ratings Standards* (RIC, 1999), and the specifications and requirements outlined in this Schedule.
2. Provide Ministry Representative with:
    a) map of study area with boundary clearly marked;
    b) survey objectives;
    c) sampling intensity selected for project;
    d) summary of background and previously known information, including previously collected plot data and species-habitat relationships for project area;
    e) scale of final maps and scale of photos;
    f) prints of base maps to be used;
    g) technical proposal (where applicable);
    h) copy of contract with any subcontractor(s) doing the mapping work; and
    i) names, qualifications, and responsibilities of project staff and subcontractors and a statement confirming their ability to complete the project to the necessary standards.
    j) Each member of the mapping project staff must be clearly qualified to collect plot data and assess wildlife habitat capability and suitability, by having successfully completed the Wildlife Habitat Rating Standards course.
    k) Subcontractors who are actually doing the mapping must be involved in fieldwork in the project area. As well, wildlife habitat expertise must be represented in each field crew.
    l) If inexperienced people are in the field or mapping crew, the subcontractor must provide information on how these personnel will be trained before the project.
3. Participate in a pre-fieldwork coordination meeting with the Ministry Representative, Project Ecologist, Regional Ecologist and the subcontractor mapping team to discuss:

- objectives;
- species list
- species-habitat models
- mapping methodology;
- data collection;
- reports; and
- legends.

4. Ensure that:

   a) unless advised otherwise by the Ministry Representative, field sampling follows Survey Intensity Level 4 (RIC, 1998a) using a combination of Ecosystem Field Forms (FS882), Ground Inspection Forms and Visual Checks in a ratio of 5:20:75;

   b) wildlife habitat assessment field plot data meet the minimum standards outlined in *BC Wildlife Habitat Rating Standards* RIC (1999);

   c) products meet provincial standards and each stage is signed off by the senior wildlife contractor responsible for the project.

5. Ensure that each stage receives sign-off for meeting the current standards and certifying that the submitted items have been carefully edited according to direction received from the Ministry Representative.

6. Ensure that the Services are carried out in accordance with the technical standards set out in the current edition of the following documents:

   - BC Wildlife Habitat Rating Standards, RIC 1999
   - Field Manual for Describing Terrestrial Ecosystems in the Field (1998). Province of B.C.
   - Ecosystem Field Forms (FS882 and FS882A) 1997. Province of B.C.
   - VENUS (1997) Interim Version 2.2d. RIC, Ecosystems Working Group
   - Data Capture for Wildlife Habitat Capability/Suitability Mapping Databases. RIC, Ecosystems Working Group (in prep.)

DELIVERABLES

The Contractor shall deliver the following:

1. Species Accounts for each of the project species
2. Preliminary Ratings Tables
3. Wildlife habitat assessment sampling plan.
4. Field Sampling
5. Correlation meeting in the field
6. Completed data forms: Wildlife Habitat Assessment forms
7. VENUS data entry at end of field sampling
8. Final Ratings Tables – one for each species in the format provided in BC Wildlife Habitat Rating Standards
9. Draft Maps and Reports in a format determined by the Ministry Representative
10. Final Products:

    a) Wildlife habitat maps in ARCINFO-compatible digital format according to current Ministry standards. Hard copy of map to include polygon numbers, colour ratings by species for

capability and suitability on separate maps and a map legend defining all units. Any initial mapping must have symbology provided for each polygon. Corresponding digital polygon databases with all core attributes, as well as and adjustment programs, following current Ministry standards is also required

b) A report with format agreed to by Contractor and Ministry Representative.

c) Plot location map. A separate Geographic Information System layer and map of polygon inspections (ecosystem field plots, ground inspection plots and visual checks) labeled with numbers, as required for ecosystem mapping, and any plots done specifically for wildlife habitat information.

d) Field data forms (originals or photocopies) and digital databases in VENUS format within 2 months of fieldwork, and a spreadsheet of all visual check data.

e) Wildlife habitat assessment sampling plan.

f) All materials purchased for the project, including typed air photos, field plot cards maps, equipment, etc. will be provided to the Province. All final digital products will be provided to the Province, in approved formats, including wildlife habitat maps, field data, digital TRIM maps etc.

g) Milestone reports upon completion of the Services or, where the Services are phased in over more than one year, at the Ministry's fiscal year end (March 31).

SCHEDULE

The Contractor shall provide the Services based on the following schedule:

1. Preliminary species- habitat models completed and delivered by [DATE]
2. Wildlife habitat assessment sampling plan completed and delivered by [DATE]
3. Field sampling and field visit completed and delivered by [DATE]
4. Draft ratings tables, maps and report completed and delivered by [DATE]
5. Final products completed and delivered by [DATE]

PAYMENT

Payment will be made upon completion and approval of the following reviews:

Payment #1 (20%)	preliminary species-habitat models
Payment #2 (30%)	field sampling
Payment #3 (30%)	draft ratings tables, maps and report
Payment #4 (20%)	final products

PROPOSAL INCORPORATED

The Contractor will provide the Services as described in their attached proposal:

- Budget
- Schedule
- Methodologies
- Management & Personnel
- Other

MINISTRY CONTACTS

All Schedule administration inquiries and submissions of deliverables shall be directed to the Ministry Representative:

Ministry Representative: [NAME, ADDRESS]

Quality Control/Quality Assurance -- Wildlife Reviewer: [NAME, ADDRESS]

Appendix D: Checklist for Wildlife Capability and Suitability Mapping Projects

Project Name: _____ **Wildlife Biologist:** _____				**Comments/Notes**
☐ **PROJECT COORDINATION MEETING**	Date: Location:			
	Project Objectives		☐	
	Wildlife species & habitat uses		☐	
	Ecosystem map attributes		☐	
	Air photo pre-typing		☐	
	Data collection		☐	
	Wildlife habitat sampling requirements		☐	
	Preliminary and final ratings		☐	
	Maps and reports required		☐	
☐ **PRELIMINARY SPECIES-HABITAT MODELS**	**Species Accounts**:			
	Species 1:		☐	
	Species 2:		☐	
	Species 3:		☐	
	Species 4:		☐	
	Species 5:		☐	
	Species 6:		☐	
	Species 7:		☐	
	Species 8:		☐	
	Species 9:		☐	
	Species 10:		☐	
	Preliminary Ratings Table		☐	
☐ **FIELD SAMPLING**	Field sampling plan		☐	
	Field work		☐	
	Field data forms		☐	
	VENUS database		☐	
☐ **Draft Wildlife Report**			☐	
☐ **Final Species-Habitat Models**		**Species Accounts**	**Ratings Tables**	
	Species 1	☐	☐	
	Species 2	☐	☐	
	Species 3	☐	☐	
	Species 4	☐	☐	
	Species 5	☐	☐	
	Species 6	☐	☐	
	Species 7	☐	☐	
	Species 8	☐	☐	
	Species 9	☐	☐	
	Species 10	☐	☐	
☐ **Draft Habitat Maps**			☐	
☐ **Final Products**	Species-Habitat Models		☐	
	Habitat Maps		☐	
	Reports		☐	

Appendix E: Example Species Accounts

These species account were developed for a training course in the Cowichan Lake area; they are not from an actual project.

EXAMPLE SPECIES ACCOUNT
FOR A PRELIMINARY SPECIES-HABITAT MODEL

COLUMBIAN BLACK-TAILED DEER

Name: *Odocoileus hemionus columbianus*

Species Code: M-ODHE

Status: Yellow-listed (Any indigenous species or subspecies (taxa) which is not at risk in British Columbia).

Distribution

Provincial Range

Occurs in the southwestern corner of British Columbia, on most islands south of Rivers Inlet, including Vancouver Island, and ranges east to near the summits of the Cascade and Coast ranges. Their range extends south into the United States where the deer range through Washington and Oregon, into California.

Elevational Range

Sea-Level to Subalpine Habitat, although elevations greater than 1000 m are rarely used as winter habitat.

Provincial Context

Columbian black-tailed deer occur commonly throughout their range. Populations in BC are stable, and currently approximately 180,000 Columbian Black-tailed Deer (Ian Hatter pers. comm.) reside in BC. Columbian Black-tailed Deer occur from sea-level to subalpine habitat, although elevations greater than 1000m are rarely used as winter habitat.

Project Area: Cowichan Lake

Ecoprovince:	Georgia Depression
Ecoregions:	Eastern Vancouver Island
Ecosections:	Leeward Island Mountains (LIM)
Biogeoclimatic Zones:	CWHvm1; CWHvm2; CWHxm; MH

Project Map Scale: 1:20,000

Ecology and Key Habitat Requirements

General

Columbian black-tailed deer are a subspecies of interior mule deer, however they have smaller bodies, smaller ears and a largely black tail surrounded by a smaller white rump patch.

Columbian black-tailed deer require food, water and security and thermal habitat to ensure survival during the spring, summer and winter seasons. During spring, deer favour areas with early green up (e.g., low elevation areas with warm aspect on moderate to steep slopes). Summer habitat consists of areas with a suitable mix of young to old forest areas, with an adequate supply of forage and cover elements. Winter forces deer from high elevation habitat to low elevation areas, with south-facing, warm-aspect slopes or floodplain areas where snowpack is very low (i.e., CWHxm).

Plant material comprises a significant portion of Columbian Black-tailed Deer diet. Although deer are capable of digesting a wide variety of plants, forage preferences are determined, in part, by seasonal variations in forage digestibility and protein content, and by the nutritional requirement of the animals (Nyberg & Janz 1990). Optimum growth occurs in the spring when plant proteins are easily digestible, whereas fall and winter represent periods of maintenance.

Columbian black-tailed deer breed during November and early December. Fawns are born during the first half of June. Females 2 years and older have higher rate of conception, than younger females.

It remains unclear whether specific habitats are used for Columbian Black-tailed Deer reproduction habitat. Reproduction habitat will not be rated separately.

Columbian black-tailed deer populations can have either resident or migratory individuals.

Average annual home range for migratory deer in the moderate snowpack zone is 1770 ha, whereas the home range for resident deer in the same zone is 140 ha (Nyberg & Janz 1990). In deep snowpack average annual home ranges decrease from 48 ha in the winter, to 25 ha in the spring.

Deer requirements differ between seasons, and deer may extend their home ranges to obtain the different requirements by either migrating or shifting locally as the seasons changes (McNay & Dole 1987). For example, in moderate snowpack areas, 20-25% of deer migrate between summer and winter ranges, whereas deep snowpack forces up to 70% of deer to migrate.

Important habitat features for Columbian Black-tailed Deer are summarized in Table 1.

Table 1. Important habitat features for different seasons and snowpack conditions for Columbian Black-tailed Deer (Nyberg & Janz 1990).

Season/Snowpack	Habitat Feature
winter/moderate to deep snowpack	• topographic features that reduce snowpack • tall, large-crowned conifers with 65-70% average canopy closure • arboreal lichens • tall shrub understory • small forest openings less than one tree height across • cedar hemlock thickets
winter/shallow snowpack	• topographic features that reduce snowpack • patches of cover with shrub understory • small clear-cut or burned openings (less than 400 m across)
spring	• topographic features that encourage early growth • openings that encourage early growth of herbaceous forage • cover near forage (i.e., within 200m)
summer	• abundant forage, especially herbs and shrubs • patches of cover interspersed with food.

Habitat Use - Life Requisites

The life requisites that will be rated for Columbian Black-tailed Deer are: food (FD), security (SH) and thermal (TH) habitats, which are described in detail below.

Food Habitat

Feeding requirements for Columbian Black-tailed Deer are tied closely to food availability and season. During spring, deer favour areas with early green up (e.g., low elevation areas with warm aspect on moderate to steep slopes). Important spring forage species include Fireweed, Pearly Everlasting, Bunchberry, *Rubus* species, *Vaccinium*, willow and many herbs and grasses (Nyberg & Janz 1990). Summer habitat consists of areas with a suitable mix of young to old forest areas, with adequate supply of forage and cover elements. Key summer forage species include fireweed, pearly everlasting, salal, *Rubus* species, *Vaccinium*, willow and alder (Nyberg & Janz 1990). Forage quality and variety is reduced in summer, although summer forage is typically greater in quantity (Wallmo 1981). Winter forces deer from high elevation habitat to low elevation areas, with south-facing, warm-aspect slopes or floodplain areas where snowpack is very low (i.e., CWHxm). The height of key browse species, such as salal and huckleberry is important on winter ranges. During severe winters, arboreal lichens (e.g., *Alectoria*, *Bryoria*, and *Usnea*) and branches of Douglas-fir and Western Redcedar are major food sources. Key winter forage species include Western Redcedar, Douglas fir, Red Huckleberry, Salal, Deer Fern and arboreal lichens (Nyberg & Janz 1990). Salal is only digestible when eaten in

combination with other species. Table 2 illustrates important forage plants for Columbian black-tailed deer.

Table 2. Important forage plants for Columbian Black-tailed Deer in southern British Columbia (taken directly from Nyberg & Janz 1990). The most important or preferred species are in bold type.

	Winter forage		Spring forage	Summer forage
TREES:	Douglas-fir western hemlock western redcedar		bigleaf-maple Douglas-fir	red alder
SHRUBS:	Alaskan blueberry five-leafed bramble kinnickinnick oval-leafed blueberry red huckleberry	rose spp. salal saskatoon twinflower vine maple willow spp.	Rubus spp. (salmonberry, blackberry, thimbleberry, raspberry, bramble) salal willow spp.	salal willow spp.
FERNS	deer fern		bracken	
HERBS	bunchberry grass spp.		bunchberry fireweed grass spp. hairy cat's-ear horsetail pearly everlasting	fireweed grass spp. hairy cat's-ear pearly everlasting
ARBOREAL LICHENS	*Alectoria* *Bryoria* *Lobaria oregana* *Usnea* spp.			

Security Habitat

Security habitat for Columbian Black-tailed Deer conceals deer from hunters and predators. Foliage and trunks of trees provide the best security cover, however Columbian Black-tailed Deer may also use short, dense vegetation, logs or take advantage of topography (e.g., swales) as security cover. Very dense stands of young trees (e.g., sum of basal diameter exceeding 311 m (Smith & Long 1987)) may form adequate security habitat, as they do with elk. For mule deer, a slightly larger but similar species, the most effective security cover hides 90% of the animal at a distance of 60 m or less, and security cover patches need to be 180 m or more in diameter. In general, old growth forests with a patchy conifer understory and most well-stocked stands of young trees with live branches satisfy security cover requirements. Deer forage more often in clearcuts within 100 m of cover (Kremsater 1989) and this should be considered when making adjustments to the ratings.

Thermal Habitat

Thermal habitat allows deer to expend less energy to maintaining body temperature, allowing allocation of conserved energy to growth and reproduction. Thermal habitat can vary daily, seasonally, with prevailing weather conditions, and age, size and nutritional condition of the animal. In general, nighttime thermal cover should trap long-wave radiation and maintain warmer air temperatures (occurring under a closed canopy above a deer's head or above 3 m), reduce wind at deer height (occurring in a forest stand or dense underbrush) and intercept precipitation (occurring under a closed canopy and large crown volume). In general, daytime thermal requirements are met by areas that gather heat (on or near rock bluffs, in clearcuts) or intercept excessive solar radiation (canopy closure).

Winter, represents a critical season for Columbian Black-tailed Deer due to the associated energetic costs of maintaining body temperature and moving through snow,. Forest cover influences snow depth, density and surface hardness (Nyberg & Janz 1990), and deer typically expend most energy walking through crustless, dense, deep snow (i.e., sinking depths greater than 25 cm). Conditions that produce

favourable snow conditions for Columbian Black-tailed Deer include dense young-growth (>10 m tall) and old-growth forests (Nyberg & Janz 1990). Canopy closure (i.e., stands, taller than 10 m, with greater than 60% crown completeness) exerts the most influence on snow interception, and creates areas with snow conditions that don't limit deer movement (Bunnell *et al.* 1985).

Seasons of Use

Columbian black-tailed deer require thermal, security and feeding habitat differentially throughout the year. Table 3 summarizes the life requisites for Columbian Black-tailed Deer for each month of the year.

Table 3. Monthly Life Requisites for Columbian Black-Tailed Deer.

Life Requisites	Month	Season*
Food, Security, Thermal	January	Winter
Food, Security, Thermal	February	Winter
Food, Security, Thermal	March	Winter
Food, Security, Thermal	April	Early Spring
Food, Security, Thermal	May	Growing (Late Spring)
Food, Security, Thermal	June	Growing (Summer)
Food, Security, Thermal	July	Growing (Summer)
Food, Security, Thermal	August	Growing (Summer)
Food, Security, Thermal	September	Growing (Fall)
Food, Security, Thermal	October	Growing (Fall)
Food, Security, Thermal	November	Winter
Food, Security, Thermal	December	Winter

*Seasons defined for Coast and Mountains Ecoprovinces per the Chart of Seasons by Ecoprovince (Appendix B).

Three seasons will be rated for Columbian Black-tailed Deer: Winter, Early Spring, and Growing (an amalgamation of Spring, Summer and Fall seasons).

Winter Season (November - March) - Columbian Black-tailed Deer have specific thermal requirements (eg. aspect, snow depth, canopy closure) and feeding requirements (e.g. salal, huckleberry, arboreal lichens, coniferous branches) during the winter season.

Early Spring Season (April) - Columbian Black-tailed Deer concentrate their activity to feeding on emergent, easily digestible spring vegetation.

Growing Season (Growing) (April - August) - Columbian Black-tailed Deer require feeding and security habitat, taking advantage of plant phenology and food availability.

Habitat Use and Ecosystem Attributes

Table 4 outlines how each life requisite relates to specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics)

Table 4. Terrestrial Ecosystem Mapping (TEM) Relationships for each Life Requisite for Columbian Black-tailed Deer.

Life Requisite	TEM Attribute
Food Habitat	• site: site disturbance, elevation, slope aspect, structural stage • soil/terrain: bedrock, terrain texture, flooding regime • vegetation: % cover by layer, species list by layer, cover for each species for each layer,
Security Habitat	• site: elevation, slope, aspect, structural stage • soil/terrain: terrain texture

	• vegetation: % cover by layer • mensuration: tree species, dbh, height
Thermal Habitat	• site: elevation, slope, aspect, structural stage • soil/terrain: terrain texture • vegetation: % cover by layer • mensuration: tree species, dbh, height

Ratings
There is a detailed level of knowledge of the habitat requirements of Columbian Black-tailed Deer in British Columbia to warrant a 6-class rating scheme.

Provincial Benchmark

Ecosection:	Leeward Island Mountains (LIM)	
	Winter	Growing
Biogeoclimatic Zone:	CWHxm	CWHvm
Broad Ecosystem Unit:	Coastal Western Hemlock-Douglas-fir (successional stage 6)	Douglas-fir-Arbutus (successional stage 1)
Habitats:	Critical habitat varies with season and snowpack conditions. Table 4 shows a summary of important habitat features on different seasons and different snowpack conditions.	

Ratings Assumptions

1. Structural stage 1-4 have minimal winter value (suitability ≤ 4) for food and shelter. Although these stands may be available to deer in low elevation subzones, heavy snowpack will not allow access to these habitats. Structural stage 4 may provide limited winter thermal/security habitat depending on adjacent habitat.
2. Young forests (structural stage 5) may provide security and thermal habitat (suitability ≤ 2) depending forage availability, subzone and snowpack.
3. Mature forests (structural stage 6) provide good winter habitat (suitability ≤ 1) because of the combination of well-developed shrub layers, arboreal lichen abundance, and canopy closure.
4. Old forests (structural stage 7) provide the best food availability in winter, however, because of the presence of canopy gaps may offer limited thermal habitat. Regardless, with the appropriate slope, aspect, and adjacency with uneven-aged stands, old forests can be good Columbian Black-tailed Deer winter habitat (suitability ≤ 1).
5. In winter and early spring, the Mountain Hemlock (MH) zone generally is poor deer habitat (suitability ≤ 5) because of excessive snowpack.
6. Structural stage 2 and 3 should provide abundant forage and be rated high (suitability ≤ 1) during the growing season, when adjacent to security habitat.
7. Structural stage 5-7 provide adequate thermal and security cover for deer during the winter season, however, value of the stand increases with age so that mature forests are rated highest (suitability ≤ 1).
8. Riparian habitat should provide good habitat throughout the growing season (suitability ≤ 1).

Preliminary Ratings Table

See attached.

Ratings Adjustments

Final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g., roads, settlements); 3) interspersion of different structural stages within the landscape. Adjustments will typically increase or decrease suitability value by a single class.

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***refer to Nyberg and Janz 1990 for detailed list of references available for Columbian black-tailed deer.

EXAMPLE SPECIES ACCOUNT
FOR A PRELIMINARY SPECIES-HABITAT MODEL

PILEATED WOODPECKER

Scientific Name: *Dryocopus pileatus*
Species Code: B-PIWO

Status: Yellow-listed (Any indigenous species or subspecies (taxa) which is not at risk in British Columbia).

Distribution

Provincial Range

Pileated Woodpeckers are widely distributed in southern British Columbia, becoming relatively sparse across central BC, north through the Peace Lowlands to the northeastern regions of the province. Breeding likely occurs throughout their range (Campbell *et al*. 1990).

Elevational Range:

Sea-Level to Sub-Alpine

Provincial Context

Pileated Woodpeckers occur more commonly in southern BC than in northern parts of their range. Few winter records of this species are found.

Project Area:

Ecoprovince:	Georgia Depression
Ecoregions:	Eastern Vancouver Island
Ecosections:	Leeward Island Mountains (LIM)
Biogeoclimatic Zones:	CWHvm1; CWHvm2; CWHxm; MH

Project Map Scale: 1:20,000

Ecology and Key Habitat Requirements

Pileated Woodpeckers occur in mature, coastal and interior Douglas-fir and western hemlock forests, including adjacent logged and second growth areas, to the open deciduous and mixed woods of the Chilcotin-Cariboo Basin (Campbell *et al*. 1990). Breeding occurs in a variety of different forest types from open deciduous forests to dense, mature coniferous stands (Campbell *et al*. 1990). This species excavates its own nest cavities and nests occur mostly in deciduous trees, however conifers and man-modified structures (e.g., power poles) may also be used. Nests typically occur in the main trunk of large live trees (i.e., >25 cm DBH). The breeding period extends from April to early June. The Pileated Woodpecker feeds primarily on carpenter ants which it extracts from large diameter logs, stumps or standing dead trees. This species requires large territories and takes advantage of late successional stages of coniferous or deciduous forest, but also younger forests that have scattered, large, dead trees (Bull & Jackson 1995).

Territory size can be variable. Studies in Oregon show that territory size of individual birds varies from 200 - 1586 ha, with pair territories slightly larger than either partner (Bull & Holthausen 1993)

Habitat Use and Life Requisites

Living

The life requisite that will be rated for Pileated Woodpeckers is Living, which is satisfied by the presence of suitable feeding, security/reproducing (roosting) habitats, as described in detail below.

Feeding Habitat

Wood-dwelling insects are the primary diet of Pileated Woodpeckers throughout the year, and carpenter ants are a major food item in all seasons (Beckwith and Bull 1985; Bull et al. 1992). Carpenter ants are particularly important in winter, when they form the majority of the diet. Diet can vary seasonally, with woodpeckers making excavations in fairly sound wood to access carpenter ant colonies in winter. Foraging in summer can be excavations in soft wood, surface gleaning and probing. Pileated Woodpeckers can be opportunistic taking advantage of outbreaks in western spruce budworm larvae, as well as berries, nuts ands fruits. In winter Pileated Woodpeckers use deep excavations in sound wood, whereas summer food occurs near the wood surface precluding deep excavations. Pileated Woodpeckers prefer logs ≥ 50 cm dbh, and snags with dbh ≥ 45 cm, and ≤ 5% bark remaining as foraging habitat (C. Hartwig pers.comm.)

Security (Roosting/Reproduction) Habitat

Eggs are laid in late April or early May and hatch after an 18 day incubation. Fledged young remain with the parents for most of the summer and leave in August or September. Reproductive habitat contains suitable trees for nesting. Pileated Woodpeckers almost always excavate their own cavity, and only trees with main trunks large enough to hold a large cavity high above the ground are used for nesting. Minimum nest tree dbh ranges from 29 to 33 cm dbh (Conner et al. 1976, Bonar and Bessie 1996). Nests usually are located in high (≥ 4 m) branch-free portions of the main trunk. In coastal forests, most nest trees were western hemlock (Aubry & Raley 1992). Pileated Woodpeckers show a preference for trees with fungal-softened heartwood at the cavity location, as softer hardwood is easier to excavate, and fungal respiration may heat the cavity.

Seasons of Use

Pileated Woodpeckers are year round residents of the project area. They are closely associated with tree cover for nesting, roosting and foraging. In spring and summer, habitat use occurs in both open and closed canopied areas. In winter, use of open areas declines as logs and stumps are unavailable due to snow cover. However, the differences between winter and growing season habitats is not sufficiently known to rate them separately. Therefore, only one all- season rating will be used. Table 2 summarizes the life requisites required for each month of the year.

Table 2. Monthly Life Requisites for Pileated Woodpecker

Life Requisite	Month	Season*	Life Requisite	Month	Season*
Living	January	All (Winter)	Living	July	All (Growing)
Living	February	All (Winter)	Living	August	All (Growing)
Living	March	All (Growing)	Living	September	All (Growing)
Living	April	All (Growing)	Living	October	All (Growing)
Living	May	All (Growing)	Living	November	All (Winter)
Living	June	All (Growing)	Living	December	All (Winter)

*Seasons defined for Coast and Mountains Ecoprovinces per the Chart of Seasons by Ecoprovince (Appendix B).

Habitat Use and Ecosystem Attributes

Table 3 outlines how each life requisite relates to specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics)

Table 3. Terrestrial Ecosystem Mapping (TEM) Relationships for each Life Requisite for Pileated Woodpecker.

Life Requisite	TEM Attribute
Living Habitat (feeding, roosting,	• site: structural stage

security)	• soil/terrain: flooding regime • vegetation: % cover by layer, coarse woody debris (CWD) (dbh, decay class, abundance) • mensuration: tree species, dbh, height, wildlife tree characteristics

Ratings

There is an intermediate level of knowledge on the habitat requirements of Pileated Woodpeckers in British Columbia and thus, a 4-class rating scheme will be used.

Provincial Benchmark

Ecosection: Shuswap Highland (SHH); Nanaimo Lowland (NAL)

Biogeoclimatic Zone: ICH, CWH

Habitats: mature - oldgrowth forests with high abundance of large diameter trees and high abundance of CWD

Ratings Assumptions

1. Units with large wildlife trees (≥ 25 cm dbh), such as mature and old-growth coniferous forests will be rated high roosting and reproducing habitat.
2. Units with high coarse woody debris abundance will be rated as high feeding habitat.
3. Units closed canopy will be rated higher than units with open canopy.

Table 4 summarizes the habitat requirements for Pileated Woodpeckers in the study area for the seasons and life requisites being modeled.

Season	Life Requisite	Structural Stage	Requirements
All Seasons	Living (Feeding)	2-3, 5-7	Mature & old-growth coniferous forests (high abundance CWD)
	(Security/ Thermal)		Mixed conifer/deciduous mature forest. Shrub cover >50% and canopy closure >66%.

Preliminary Ratings Table

See attached.

Ratings Adjustment Considerations

Final habitat capability and suitability maps may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g., settlements); 3) interspersion of different structural stages within the landscape

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Appendix F: Example Preliminary Ratings Tables

This example Preliminary Ratings Table is based on Species Accounts in Appendix E; these ratings are examples only and are not from an actual wildlife habitat mapping project. Refer to the guidelines for formatting a Final Ratings Table (Appendix I) and whenever possible, use similar formatting.

Notes:

1) Refer to Standard for Terrestrial Ecosystem Mapping (RIC 1998a) for ecosystem codes.

2) Wildlife codes used in this table:

BPIWO_G	Pileated Woodpecker (Living)Growing
MMYKE_G	Keen's Long-eared Myotis (Living)Growing
MODHE_EP	Columbian Black-tailed Deer (Living)Early Spring
MODHE_G	Columbian Black-tailed Deer (Living)Growing
MODHE_W	Columbian Black-tailed Deer (Living)Winter
MURAM_EP	Black Bear (Living)Early Spring
MURAM_G	Black Bear (Living)Growing
MURAM_HI	Black Bear/Hibernating

ECO_SEC	BGC_ZONE	BGC_SUBZON	BGC_VRT	BGC_PHASE	SITE_S	Ecosystem Name	STRCT_S	Landscape Position Soil depth, drainage	B PIWO_G	M MYKE_G	M ODHE_EP	M ODHE_G	M ODHE_W	M URAM_EP	M URAM_G	M URAM_HI
LIM	CWH	xm			01	HwFd-Kinbergia	1,2,3	gentle-slope; dp-med text. soil	L	U	2	3	5	4	3	6
LIM	CWH	xm			01	HwFd-Kinbergia	4,5	gentle-slope; dp-med text. soil	M	X	3	4	3	5	5	6
LIM	CWH	xm			01	HwFd-Kinbergia	6,7	gentle-slope; dp-med text. soil	H	U	5	4	1	4	2	2
LIM	CWH	xm			02	FdPl-Cladina	1,2,3	gentle slope, crest position, shallow soil	L	U	2	3	5	4	3	6
LIM	CWH	xm			02	FdPl-Cladina	4,5	gentle slope, crest position, shallow soil	M	X	3	4	3	6	6	6
LIM	CWH	xm			02	FdPl-Cladina	6,7	gentle slope, crest position, shallow soil	H	U	5	4	1	5	3	6
LIM	CWH	xm			02	FdPl-Cladina	1,2,3	gentle slope, crest position, shallow soil	L	U	1	3	5	3	2	6
LIM	CWH	xm			02	FdPl-Cladina	4,5	gentle slope, crest position, shallow soil	M	X	3	4	3	5	5	6
LIM	CWH	xm			02	FdPl-Cladina	6,7	gentle slope, crest position, shallow soil	H	U	5	4	1	4	2	2
LIM	CWH	xm			03	FdHw-Salal	1,2,3	sig.slope, upper slope, warm aspect	L	U	2	3	5	4	2	6
LIM	CWH	xm			03	FdHw-Salal	4,5	sig.slope, upper slope, warm aspect	M	X	3	4	3	6	6	6
LIM	CWH	xm			03	FdHw-Salal	6,7	sig.slope, upper slope, warm aspect	H	U	5	4	1	4	2	4
LIM	CWH	xm			03	FdHw-Salal	1,2,3	sig.slope, upper slope, warm aspect	L	U	2	3	5	4	2	6
LIM	CWH	xm			03	FdHw-Salal	4,5	sig.slope, upper slope, warm aspect	M	X	3	4	3	6	6	6
LIM	CWH	xm			03	FdHw-Salal	6,7	sig.slope, upper slope, warm aspect	H	U	5	4	1	4	2	5
LIM	CWH	xm			07	Cw-Foamflower	1,2,3	gentle slope,lower slope,dp-med.soil	L	U	2	3	5	2	1	6
LIM	CWH	xm			07	Cw-Foamflower	4,5	gentle slope,lower slope,dp-med.soil	M	X	3	4	3	6	6	6
LIM	CWH	xm			07	Cw-Foamflower	6,7	gentle slope,lower slope,dp-med.soil	H	U	5	4	1	4	2	4
LIM	CWH	xm			07	Cw-Foamflower	1,2,3	gentle slope,lower slope,dp-med.soil	L	U	2	3	5	2	1	6
LIM	CWH	xm			07	Cw-Foamflower	4,5	gentle slope,lower slope,dp-med.soil	M	X	3	4	3	6	6	6
LIM	CWH	xm			07	Cw-Foamflower	6,7	gentle slope,lower slope,dp-med.soil	H	U	5	4	1	4	2	4
LIM	CWH	xm			08	Ss-Salmonberry	1,2,3	high bench, floodplain, dp-med.soil	L	U	2	3	5	1	2	6
LIM	CWH	xm			08	Ss-Salmonberry	4,5	high bench, floodplain, dp-med.soil	M	X	3	3	4	5	5	6
LIM	CWH	xm			08	Ss-Salmonberry	6,7	high bench, floodplain, dp-med.soil	H	U	5	3	1	1	2	2
LIM	CWH	xm			CF			unvegetated unit - cultivated field	N	U	6	3	5	6	6	6
LIM	CWH	xm			LA			unvegetated unit - lake	N	U	6	6	6	6	6	6
LIM	CWH	xm			OW			unvegetated unit - open water	N	U	6	6	6	6	6	6
LIM	CWH	xm			PD			unvegetated unit - pond	N	U	6	6	6	6	6	6

Appendix G: Procedures for Defining Seasonal Ranges

Sometimes wildlife habitat managers require a seasonal range map for managing and protecting a species' habitat. A seasonal range is a habitat used by a wildlife species during a particular season or period of the year that is critical to its survival (e.g. "winter range"). The methodology for developing a seasonal range map is the same as for applying habitat capability and suitability ratings to ecosystem maps, as described in this manual (B.C. Wildlife Habitat Rating Standards).

Seasonal ranges can be defined by both area and season. The area or boundary of the range is delineated by habitat polygons. For example, these habitats may be defined as ecosystem units (TEM), broad ecosystem units (BEI) or units derived from a combination of TRIM and forest cover data (VRI). The season must be clearly defined by the calendar months in which the habitat is being used and the climatic conditions in the project area.

To define seasonal habitats, such as winter ranges:

Task	Cross-reference to this manual	Other Resources Inventory Committee References
1. Identify the actual areas being considered through one of the Resource Inventory Committee ecosystem mapping standards	Section 4.1 (Project Plan)	• Standards for broad terrestrial ecosystem classification and mapping for British Columbia: classification and correlation of the Broad Habitat Classes used in 1:250,000 ecological mapping. Review Draft. 1997. • Standards for terrestrial ecosystems mapping in British Columbia. Review Draft. 1998. • Vegetation Resource Inventory: Photo Interpretation Procedures. 1996
2. Develop a Species-Habitat Model	Section 4.2 (Preliminary Species-Habitat Model)	
• identify ecology, habitat uses and associated ecosystem attributes required for the species during the season of concern	Section 4.2.3 (Species Account)	
• identify the season of habitat use by both: a) calendar months b) climatic conditions	a) template in Section 4.2.3.5 b) Chart of Seasons (Appendix B)	
• use the standard season and life requisite definitions	Tables 5 and 6 in Section 2.4	
• develop a Preliminary Ratings Table by assigning habitat ratings for the season and area of interest (compared to the provincial benchmark for the season of concern)	a) Section 4.2.4 (Develop Habitat Ratings) b) Appendix A	
3. Refine boundaries and ratings of the seasonal range through wildlife surveys (using standard species inventory methodologies)		Standardized Inventory Methodologies for Components of BC Biodiversity. 1996

Appendix H: Provincial Benchmarks for Selected Species

The following tables provide the benchmark ratings at several ecosystem levels for a number of wildlife species. For each species, the best Ecoprovince in British Columbia is identified by the shaded highlighting. Within that Ecoprovince, the best Ecosection is identified and within that Ecosection the best Biogeoclimatic Subzone is identified. And finally, within each subzone the best Broad Ecosystem Unit and seral stage is identified for winter and for the growing season.

Ecoprovince. Ratings are provided for each Ecoprovince where the species can potentially occur. In some cases, two Ecoprovinces may be identified as benchmarks. Both benchmarks have the same rating (i.e., 100% of Class 1), but for wide-ranging species it is easier to conceptualize them separately when assigning capability and suitability ratings (for example, interior mountain goats versus coastal mountain goats, or northern Rocky Mountain elk versus southern Rocky Mountain elk).

Ecosections. The highest rated Ecosection in the province is the benchmark Ecosection (and similar to Ecoprovinces, there may be more than one benchmark Ecosection in the province). Other Ecosections that are rated Class 1 are 76 - 100% of the value of the benchmark. All Class 1 Ecosections are listed. Some Ecosections that are rated lower than Class 1 have also been included to provide some comparison for different geographical parts of the province.

Broad Ecosystem Unit. A rating for winter habitats and growing season habitats is provided for the best Broad Ecosystem Unit and the best Biogeoclimatic subzone in each listed Ecosection. The best seral stage (seral stages are analogous to generalized structural stages) for supporting the species is also identified. The best winter habitat and the best growing season habitat in the benchmark Ecoprovince(s) are the benchmarks against which all other winter and growing season habitats are rated.

Note, just because an Ecoprovince, Ecosection or Broad Ecosystem Unit has a rating of Class 2 or 3, does not mean that there are no high ecosystem or site series classes in that ecosystem. For instance, it is possible to have a Class 1 or 2 Broad Ecosystem Unit within a Class 3 Ecosection and so on down the hierarchy of ecosystems.

Provincial Benchmarks for Moose

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit Name	Rating
Winter					
Coast and Mountains	NAB	3	ICHmc	BA/1 - Boreal White Spruce-Trembling Aspen	3
Central Interior	BUB	1	SBSdk	BA/1 - Boreal White Spruce-Trembling Aspen	1
Sub-Boreal Interior	NEL	1	SBSmk	BA/1 - Boreal White Spruce-Trembling Aspen	1
	PAT	1	SBSmk	BA/1 - Boreal White Spruce-Trembling Aspen	1
Southern Interior Mountains	BRR	3	MSdk	DL/1 - Douglas Fir-Lodgepole Pine	3
	UFT	2	SBSdh	SA/1 - Subboreal White Spruce-Trembling Aspen	2
Southern Interior	NTU	3	MSdm	DL/1 - Douglas Fir-Lodgepole Pine	3
Boreal Plains	HAP	1	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	1
	PEL	**B**	**BWBSmw**	**BA/1 - Boreal White Spruce-Trembling Aspen**	**1**
Taiga Plains	MUP	1	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	1
Northern Boreal Mountains	MUF	1	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	1
Growing Season					
Coast and Mountains	NAB	3	ICHmc	PR/1 - White Spruce-Balsam Poplar Riparian	2
Central Interior	NAU	2	SBSmc	PR/1 - White Spruce-Balsam Poplar Riparian	1
Sub-Boreal Interior	MCP	2	SBSwk	PR/1 - White Spruce-Balsam Poplar Riparian	1
	NEL	1	SBSmk	PR/1 - White Spruce-Balsam Poplar Riparian	1
Southern Interior Mountains	BRR	3	MSdk	MR/1 - Marsh	3
	UFT	2	ICHwk	PR/1 - White Spruce-Balsam Poplar Riparian	3
Southern Interior	NTU	3	MSxk	PR/1 - White Spruce-Balsam Poplar Riparian	3
Boreal Plains	HAP	1	BWBSmw	PR/1 - White Spruce-Balsam Poplar Riparian	1
	PEL	**B**	**BWBSmw**	**PR/1 - White Spruce-Balsam Poplar Riparian**	**1**
Taiga Plains	MUP	1	BWBSmw	PR/1 - White Spruce-Balsam Poplar Riparian	1
Northern Boreal Mountains	MUF	1	SWBmk	PR/1 - White Spruce-Balsam Poplar Riparian	1

Provincial Benchmarks for Bison

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Sub-Boreal Interior	PEF	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Southern Interior Mountains	FRR	4	BWBSwk	BA/1 - Boreal White Spruce-Trembling Aspen	**5**
Boreal Plains	HAP	3	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
	PEL (Pre-contact)[1]	*B*	*BWBSmw*	*BA/1 - Boreal White Spruce-Trembling Aspen*	***1***
Taiga Plains	ETP	3	BWBSmw	TF/1 - Tamarack Wetland	**4**
Northern Boreal Mountains	**MUF** *(Current)*[2]	**B**	**SWBdk**	**BA/1 - Boreal White Spruce-Trembling Aspen**	**1**
Growing Season					
Ecoprovince	**Ecosection Unit**	**Ecosection Rating**	**BGC Subzone**	**Broad Ecosystem Unit/Seral Stage**	**Rating**
Sub-Boreal Interior	PEF	4	BWBSwk	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Southern Interior Mountains	FRR	4	AT	AM - Alpine Meadow	**3**
Boreal Plains	HAP	3	BWBSwk	SM - Subalpine Meadow	**1**
	PEL (Pre-contact)[1]	*B*	*BWBSmw*	*WL - Wetland*	***3***
Taiga Plains	ETP	3	BWBSmw	WL - Wetland	**3**
Northern Boreal Mountains	**MUF** *(Current)*[2]	**B**	**SWBdk**	**SM - Subalpine Meadow**	**1**

[1] *Pre-contact*: prior to European settlement, the greatest densities of Wood Bison inhabited the Peace Lowlands; consequently, this is the historical benchmark for Wood Bison. *Current*: current bison populations in the Muskwa Foothills are comprised of populations of Wood Bison and of Plains Bison that have been introduced into Wood Bison habitat.

Provincial Benchmarks for Roosevelt Elk [1]

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Coast and Mountains	NIM	1	CWHxm	CR/6 - Black Cottonwood Riparian	**1**
Georgia Depression	**LIM**	**B**	**CWHvm**	**CR/6 - Black Cottonwood Riparian**	**1**
Growing Season					
Coast and Mountains	NIM	1	CWHxm	CR/6 - Black Cottonwood Riparian	**1**
Georgia Depression	**LIM**	**B**	**CWHvm**	**CR/6 - Black Cottonwood Riparian**	**1**

[1] Rocky Mountain Elk have been introduced into Roosevelt Elk habitat (e.g. Queen Charlotte Islands, Sechelt)

Provincial Benchmarks for Rocky Mountain Elk

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter Benchmarks					
Central Interior	FRB	3	IDFxm	DF/1 - Interior Douglas Fir	**3**
Sub-Boreal Interior	HAF	2	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Southern Interior Mountains	**EKT**	**B**	**IDFdm**	**DF/1 - Interior Douglas Fir**	**1**
Southern Interior	STU	2	IDFxh	BS - Bunchgrass Grassland	**1**
Boreal Plains	PEL	2	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**2**
Taiga Plains	MUP	2	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Northern Boreal Mountains	**MUF**	**B**	**SWBmk**	**BA/1 - Boreal White Spruce-Trembling Aspen**	**1**
Growing Season Benchmarks					
Central Interior	CCR	3	AT	AM - Alpine Meadow	**1**
Sub-Boreal Interior	HAF	2	ESSFmv	SM - Subalpine Meadow	**1**
Southern Interior Mountains	FRR	2	AT	AM - Alpine Meadow	**1**
Southern Interior	STU	2	MSxk	WL - Wetland	**1**
Boreal Plains	PEL	2	BWBSmw	WL - Wetland	**2**
Taiga Plains	MUP	2	BWBSmw	CR/6 - Black Cottonwood Riparian	**3**
Northern Boreal Mountains	**MUF**	**B**	**SWBmk**	**SM - Subalpine Meadow**	**1**

Provincial Benchmarks Columbian Black-tailed Deer

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Coast and Mountains1	NIM	1	CWHxm	CD/6 - Coastal Douglas-fir	**1**
Georgia Depression	FRL	1	CWHxm	DA/6 - Douglas-fir-Arbutus	**1**
	LIM	**B**	**CWHvm**	**CW/6 - Coastal Western Hemlock-Douglas-fir**	**1**
	SGI	1	CDFmm	DA/1 - Douglas-fir-Arbutus	**2**
Growing Season					
Coast and Mountains[1]	NIM	1	CWHxm	CW/1 - Coastal Western Hemlock-Douglas-fir	**1**
	OUF	2	CWHmm	CW/1 - Coastal Western Hemlock-Douglas-fir	**1**
Georgia Depression	FRL	1	CWHdm	CW/1 - Coastal Western Hemlock-Douglas-fir	**1**
	GEL	1	CWHdm	CW/1 - Coastal Western Hemlock-Douglas-fir	**1**
	LIM	**B**	**CWHxm**	**DA/1 - Douglas-fir-Arbutus**	**1**
	NAL	1	CWHxm	DA/1 - Douglas-fir-Arbutus	**1**

[1] Black-tailed Deer and Mule Deer co-habit in some of the eastern areas of the Coast and Mountains Ecoprovince

Provincial Benchmarks for Sitka Black-tailed Deer

Ecoprovince	Ecosection Unit	Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Coast and 'Mountains	**SKP**	**B**	**CWHwh**	**HS/6 - Western Hemlock-Sitka Spruce**	**1**
Growing Season					
Coast and 'Mountains	**SKP**	**B**	**CWHwh**	**HS/1 - Western Hemlock-Sitka Spruce**	**1**

Provincial Benchmarks for Mule Deer

Ecoprovince	Ecosection Unit	Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Central Interior	**FRB**	**B**	**IDFxm**	**DF/6 - Interior Douglas-fir Forest**	**1**
Sub-Boreal Interior	PEF	3	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Southern Interior Mountains	**EKT**	**B**	**IDFdm**	**DF/1 - Interior Douglas-fir Forest**	**1**
Southern Interior	NOB	1	PPxh	DP/6 - Douglas-fir-Ponderosa Pine	**1**
	OKR	1	IDFxh	DF/6 - Interior Douglas-fir Forest	**1**
	SOB	1	PPxh	DP/6 - Douglas-fir-Ponderosa Pine	**1**
	SOH	1	IDFxh	DF/6 - Interior Douglas-fir Forest	**1**
	THB	1	PPxh	DP/6 - Douglas-fir-Ponderosa Pine	**1**
Boreal Plains	PEL	2	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**3**
Taiga Plains	MUP	3	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**5**
Northern Boreal Mountains	MUF	3	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**5**
Growing Season					
Central Interior	CAB	2	IDFdk	DF/3 - Interior Douglas-fir Forest	**2**
Sub-Boreal Interior	PEF	3	BWBSmw	PR/1 - White Spruce-Balsam Poplar Riparian	**3**
Southern Interior Mountains	**EPM**	**B**	**ESSFdk**	**SM - Subalpine Meadow**	**1**
	MCR	2	ESSFdk	SM - Subalpine Meadow	**1**
	SCM	2	ESSFwv/wm	SM - Subalpine Meadow	**1**
Southern Interior	OKR	1	ESSFxc	SM - Subalpine Meadow	**1**
Boreal Plains	PEL	2	BWBSmw1	PR/6 - White Spruce-Balsam Poplar Riparian	**4**
Taiga Plains	MUP	3	BWBSmw	PR/6 - White Spruce-Balsam Poplar Riparian	**4**
Northern Boreal Mountains	MUF	3	BWBSmw	PR/6 - White Spruce-Balsam Poplar Riparian	**4**

Provincial Benchmarks for White-tailed Deer

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Seral Stage	Rating
	Unit	Rating	Subzone		
Winter					
Central Interior	FRB	3	IDFxm	DF/6 - Interior Douglas-fir Forest	**3**
Sub-Boreal Interior	NEL	4	SBSmh	WR/6 - White Spruce-Black Cottonwood Riparian	**4**
Southern Interior Mountains	**EKT**	**B**	**PPdh**	**DP/1 - Douglas-fir-Ponderosa Pine**	**1**
Southern Interior	NOB	1	PPxh	DP/6 - Douglas-fir-Ponderosa Pine	**1**
	SOB	1	PPxh	DP/6 - Douglas-fir-Ponderosa Pine	**1**
	SOH	**B**	**IDFxh**	**DF/6 - Interior Douglas-fir Forest**	**1**
Boreal Plains	PEL	2	BWBSmw	BA/5 - Boreal White Spruce-Trembling Aspen	**3**
Taiga Plains	MUP	5	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**5**
Northern Boreal Mountains	MUF	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen	**5**
Growing Season					
Central Interior	BUB	4	SBSdk	PR/6 - White Spruce-Balsam Poplar Riparian	**2**
	FRB	3	IDFxm	DF/3 - Interior Douglas-fir Forest	**2**
Sub-Boreal Interior	NEL	4	SBSdw	BA/1 - Boreal White Spruce-Trembling Aspen	**2**
Southern Interior Mountains	**EKT**	**B**	**IDFdm**	**DF/1 - Interior Douglas-fir Forest**	**3**
	SFH	2	ICHdw	IH/1 - Interior Western Hemlock-Douglas-fir	**1**
Southern Interior	NOB	1	IDFxh	CR/6 - Black Cottonwood Riparian	**1**
	NOH	2	ICHmk	CR/6 - Black Cottonwood Riparian	**1**
	SOB	1	BGxh	CR/6 - Black Cottonwood Riparian	**1**
	SOH	**B**	**PPxh**	**CR/6 - Black Cottonwood Riparian**	**1**
Boreal Plains	PEL	2	BWBSmw	PR/6 - White Spruce-Balsam Poplar Riparian	**3**
Taiga Plains	MUP	5	BWBSmw	PR/6 - White Spruce-Balsam Poplar Riparian	**3**
Northern Boreal Mountains	MUF	4	BWBSmw	PR/6 - White Spruce-Balsam Poplar Riparian	**3**

Provincial Benchmarks for Mountain Goat

Ecoprovince	Ecosection Unit	Ecosection Rating	BGC Subzone	Broad Ecosystem Unit/Seral Stage	Rating
Winter					
Coast and Mountains	**NAR**	**B**	**MHmm**	**MF/6 - Mountain Hemlock-Amabilis Fir/RO - Rock**	**1**
	NPR	1	MHmm	MF/6 - Mountain Hemlock-Amabilis Fir/RO - Rock	**1**
Central Interior	BUR	1	ESSFmc	EF/6 - Englemann Spruce-Subalpine Fir/RO - Rock	**2**
Sub-Boreal Interior	SSM	2	ESSFmc	EF/6 - Englemann Spruce-Subalpine Fir/RO - Rock	**2**
Southern Interior Mountains	EPM	1	ESSFdk	EF/6 - Englemann Spruce-Subalpine Fir/RO - Rock	**1**
	SPK	**B**	**ESSFdk**	**EF/6 - Englemann Spruce-Subalpine Fir/RO - Rock**	**1**
Southern Interior	OKR	3	IDFdk	DF/1 - Interior Douglas-fir Forest/RO - Rock	**1**
	SCR	2	ESSFdv	EF/6 - Englemann Spruce-Subalpine Fir/RO - Rock	**1**
Boreal Plains	KIP	5	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/Rock	**3**
Taiga Plains	MUP	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/Rock	**3**
Northern Boreal Mountains	THH	1	AT	AG - Alpine Grassland	**1**
Growing Season					
Coast and Mountains	**NAR**	**B**	**AT**	**AM - Alpine Meadow**	**1**
	NPR	1	AT	AM - Alpine Meadow	**1**
Central Interior	BUR	1	AT	AM - Alpine Meadow	**1**
Sub-Boreal Interior	SSM	2	AT	AM - Alpine Meadow	**1**
Southern Interior Mountains	EPM	1	AT	AM - Alpine Meadow	**1**
	NPK	2	AT	AM - Alpine Meadow	**1**
	SPK	**B**	**AT**	**AM - Alpine Meadow**	**1**
Southern Interior	OKR	3	MSxk	DL/1 - Douglas-fir-Lodgepole Pine/RO - Rock	**2**
	SCR	2	AT	AM - Alpine Meadow	**1**
Boreal Plains	KIP	5	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/Rock	**3**
Taiga Plains	MUP	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/Rock	**3**
Northern Boreal Mountains	THH	1	AT	AM - Alpine Meadow	**1**

Provincial Benchmarks for Rocky Mountain Bighorn Sheep

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Seral Stage	Rating
	Unit	Rating	Subzone		
Winter					
Sub-Boreal Interior	HAF	5	AT	AT - Alpine Tundra	**5**
Southern Interior Mountains	BRR	1	AT/IDFdm	AG - Alpine Grassland/DF - Interior Douglas-fir	**1**
	EKT	**B**	**IDFdm**	**DF/1 - Interior Douglas-fir Forest/Steep**	**1**
	FRR	1	AT	AT - Alpine Tundra	**4**
	SPK	1	MSdk	DL/1 - Douglas-fir-Lodgepole Pine/Steep	**3**
Boreal Plains	KIP	5	ESSFmv	SF/1 - White Spruce-Subalpine Fir/RO - Rock	**5**
Growing Season					
Sub-Boreal Interior	HAR	5	AT	AM - Alpine Meadow	**3**
Southern Interior Mountains	BRR	1	ESSFdk	SM - Subalpine Meadow	**1**
	FRR	1	AT	AM - Alpine Meadow (Jasper only)	**3**
	SPK	**B**	**ESSFdk**	**SM - Subalpine Meadow**	**1**
Boreal Plains	KIP	5	ESSFmv	SM - Subalpine Meadow	**4**

Provincial Benchmarks for California Bighorn Sheep

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Seral Stage	Rating
	Unit	Rating	Subzone		
Winter					
Central Interior	**FRB**	**B**	**BGxh**	**SS - Big Sagebrush Shrub/Grassland/Steep**	**1**
	WCU	4	AT	AT - Alpine Tundra	**4**
Southern Interior	OKR	2	IDFdk	BS - Bunchgrass Grassland/Steep	**1**
	PAR[1]	1	PPxh	SS - Big Sagebrush Shrub/Grassland/Steep	**1**
	SOB	1	PPxh	SS - Big Sagebrush Shrub/Grassland/Steep	**1**
	THB[1]	2	PPxh	BS - Bunchgrass Grassland/Steep	**1**
Growing Season					
Central Interior	CCR	4	AT	AM - Alpine Meadow	**1**
	FRB	**B**	**BGxw**	**BS - Bunchgrass Grassland**	**1**
	WCU	4	AT	AM - Alpine Meadow	**1**
Southern Interior	OKR	2	ESSFxc	AM - Alpine Meadow	**1**
	PAR[1]	1	ESSFxc	SM - Subalpine Meadow	**1**
	THB[1]	2	IDFxh	DF/1 - Interior Douglas-fir Forest	**3**

Provincial Benchmarks for Dall Sheep

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Structural Stage	Rating
	Unit	Rating	Subzone		
Winter					
Coast and Mountains	ALR	5	AT	AM - Alpine Meadow	**6**
Northern Boreal Mountains	**TAB**	**3**	**AT**	**AT - Alpine Tundra**	**3**
Growing Season					
Coast and Mountains	ALR	5	AT	AM - Alpine Meadow	**5**
Northern Boreal Mountains[1]	**TAB**	**B**	**AT**	**SM - Subalpine Meadow**	**1**
	TEP	3	AT	SM - Subalpine Meadow	**1**

[1] For Dall Sheep, the best winter habitat (i.e. the benchmark)is only a class 3 compared to the benchmark for Stone Sheep.

Provincial Benchmarks for Stone Sheep

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Structural Stage	Rating
	Unit	Rating	Subzone		
Winter					
Coast and Mountains	BOR	6	AT	AM - Alpine Meadow	**6**
Sub-Boreal Interior	SOM	4	AT	AT - Alpine Tundra	**3**
Boreal Plains	PEL	5	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/RO - Rock	**4**
Taiga Plains	MUP	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/RO - Rock	**4**
Northern Boreal Mountains	**MUF**	**B**	**SWBmk**	**BA/1 - Boreal White Spruce-Trembling Aspen/RO - Rock**	**1**
Growing Season					
Coast and 'Mountains	BOR	6	AT	AM - Alpine Meadow	**5**
Sub-Boreal Interior	SOM	4	AT	AM - Alpine Meadow	**3**
Boreal Plains	PEL	5	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/RO - Rock	**4**
Taiga Plains	MUP	4	BWBSmw	BA/1 - Boreal White Spruce-Trembling Aspen/RO - Rock	**4**
Northern Boreal Mountains	EMR	1	AT	SM - Subalpine Meadow	**1**
	KEM	1	AT	SM - Subalpine Meadow	**1**
	CAR	3	AT	SM - Subalpine Meadow	**1**
	MUF	**B**	**AT**	**SM - Subalpine Meadow**	**1**
	SBP	1	AT	SM - Subalpine Meadow	**1**
	TEP	3	AT	SM - Subalpine Meadow	**1**

Provincial Benchmarks Northern Caribou

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Seral Stage	Rating
	Unit	Rating	Subzone		
Winter					
Coast and Mountains	BOR	5	AT	AM - Alpine Meadow	**6**
	KIR	5	AT	AM - Alpine Meadow	**6**
Central Interior	BUB	4	SBSdk	LP - Lodgepole Pine/6	**1**
	WCU	1	MSxv	LP/6 - Lodgepole Pine	**1**
Sub-Boreal Interior	SOM	2	AT	AT - Alpine Tundra	**3**
Taiga Plains	FNL	2	BWBSmw	BB/6 - Black Spruce Bog	**3**
Northern Boreal Mountains	MUF	1	AT	AG - Alpine Grassland	**1**
	SBP	2	SWBun/AT	LP/6 - Lodgepole Pine/AG - Alpine Grassland[1]	**1**
	STP	**B**	**SWBun/AT**	**LP/6 - Lodgepole Pine/AG - Alpine Grassland[1]**	**1**
	TEB	1	BWBSdk	LP/6 - Lodgepole Pine	**1**
	TUR	1	SWBun/AT	LP/6 - Lodgepole Pine/AG - Alpine Grassland	**1**
Growing Season					
Coast and Mountains	BOR	5	AT	AM - Alpine Meadow	**3**
	KIR	5	AT	AM - Alpine Meadow	**3**
Central Interior	BUR	3	AT	AM - Alpine Meadow	**1**
	NEU	2	AT	AM - Alpine Meadow	**1**
	WCU	1	AT	AM - Alpine Meadow	**1**
Sub-Boreal Interior	SOM	2	AT	AT - Alpine Meadow	**1**
Taiga Plains	FNL	2	BWBSmw	BB/6 - Black Spruce Bog	**5**
Northern Boreal Mountains	KEM	1	AT	AM - Alpine Meadow	**1**
	MUF	1	AT	AM - Alpine Meadow	**1**
	SBP	2	AT	AM - Alpine Meadow	**1**
	STP	**B**	**AT**	**AM - Alpine Meadow**	**1**
	TEB	1	AT	AM - Alpine Meadow	**1**
	TUR	1	AT	AM - Alpine Meadow	**1**

[1] Lower elevations used in Early Winter; alpine areas in Late Winter

Provincial Benchmarks for Mountain Caribou

Ecoprovince	Ecosection		BGC	Broad Ecosystem Unit/Seral Stage	Rating
	Unit	Rating	Subzone		
Winter					
Sub-Boreal Interior	HAR	1	ESSFwk	EF/6 - Englemann Spruce-Subalpine Fir	**1**
Southern Interior Mountains	**CAM**	**B**	**ESSFwk**	**EF/6 - Englemann Spruce-Subalpine Fir**	**1**
	NKM	1	ESSFvc	EF/6 - Englemann Spruce-Subalpine Fir	**1**
Southern Interior	NOH	4	ESSFdc	EF/6 - Englemann Spruce-Subalpine Fir	**4**
Boreal Plains	KIP	2	BWBSmw	BB/6 - Black Spruce Bog	**3**
Growing Season					
Sub-Boreal Interior	HAF	2	ESSFwk	SM - Subalpine Meadow	**1**
	HAR	1	ESSFwk	SM - Subalpine Meadow	**1**
Southern Interior Mountains	**CAM**	**B**	**ESSFwk**	**SM - Subalpine Meadow**	**1**
	NKM	1	ESSFvc	SM - Subalpine Meadow	**1**
Southern Interior	NOH	4	AT	AM - Alpine Meadow	**3**
Boreal Plains	KIP	2	ESSFmv	SM - Subalpine Meadow	**3**

Appendix I: Example Final Ratings Table

This appendix provides an example of a portion of a final ratings tables for four species. The ratings for woodpecker and deer are based on the Species Accounts in Appendix E and the Preliminary Ratings Table in Appendix F. The ratings shown in this table are for example only; they are not from an actual wildlife habitat mapping project.

Guidelines for developing and formatting a final ratings table in Excel or other CSV files:

1. Refer to Resources Inventory Committee (in prep.) for the technical standards for wildlife ratings digital data capture.
2. Use the TEM list of unique site series for the project.
3. Include all the mandatory ecosystem attribute columns (see Table I-1 below) even if they are not used in the project. In this example, BGC Variant and Phase are not used in the project area, so the column is left blank. Ecosystem units should be sorted in alphabetical order.
4. Include Structural Stages 2 through 7 for each unique combination of site series and site modifier, whether or not it has been mapped in the project area. Structural stage 1 is rarely mapped, so only include it if it has been mapped in the project area.
5. The columns for other attributes (e.g. structural stage modifiers, stand composition modifiers) should only be included in the Final Ratings Table if these attributes are included in the ecosystem database. Structural substages 3a and 3b must be used for all non-forested shrub communities (eg. wetlands). These are project-specific attributes and capability/suitability ratings may be assigned to each unique combination of sites series, site modifiers, structural stage and/or other ecosystem attributes.
6. The wildlife codes in the Final Ratings Table ***must be no longer than 10 characters*** and consist of:
   - the 5-letter species codes, without the hyphen (Vertebrates of British Columbia, RIC 1998d),
   - underscore ("_"),
   - the life requisite (if other than "Living"), and/or
   - the season (if required).
7. Living is the default life requisite so, unless another life requisite (such as "Feeding" or "Hibernating") is identified, it is assumed that the rating is for "Living" and therefore "LI" is not included in the code.
   - The season needs to be identified for food/cover life requisites and "Living", but not for any of the specific life requisites, such as "Hibernating" (see Table 7 in Section 2.4.3).
   - In some cases (for detailed level projects), where both a food/cover life requisite (e.g. SH) and a specific life requisite (e.g. RE) is required, the food/cover life requisite comes first in the code (e.g. BDUCK_SHRE)
8. To ensure the wildlife codes are consistent:
   - For each species, group the life requisites first, then the season (see example Final Ratings Table for Black-tailed Deer);
   - Always start with the winter season;
   - When submitting Final Ratings Tables for a project or presenting them in a report, order the tables alphabetically by species code.
9. Depending on the number of wildlife species and the number of optional attributes being rated, the Final Ratings Table for a project may be quite large and complex. In cases, where this becomes cumbersome, the Ratings Table can be split so that not all species are rated on one table.

Table I-1. Ecosystem attributes and standard codes to be used in the column headings in Final Ratings Tables. For a complete list of terrestrial ecosystem mapping attributes and

associated codes, see *Standards for Digital Terrestrial Ecosystem mapping (TEM) Data Capture in British Columbia* (RIC, 1998c)

Ecosystem description columns	Code	Requirements
Ecosection	ECO_SEC	Mandatory for Wildlife Habitat Final Ratings Tables (always include these columns, even if not used)
BEC Zone	BGC_ZONE	
BEC Sub-zone	BGC_SUBZON	
BEC Variant	BGC_VRT	
BEC Phase	BGC_PHASE	
Site Series #	SITE_S	
Site Series Map Code	SITEMC_S	
Site Modifier 1st	SITE_MA	
Site Modifier 2nd	SITE_MB	
Structural Stage	STRCT_S	
Structural Stage Modifier or Substage	STRCT_M	Optional (Project-specific)
Stand Composition Modifier	STAND_A	
Seral Association	SERAL	
Tree Crown Closure	TREE_C	
Shrub Crown Closure	SHRUB_C	
Site Disturbance Class	DISTCLS	
Site Disturbance Subclass	DISTSCLS	
Site Disturbance Sub-Subclass	DISSSCLS	
Terrain Texture	TTEX_A	
Surficial Material	SURFM	
Surface Expression	SURF_E	
Geomorphological Process Class	GEOP	
Process Subtype	GEOP_ST	

Table I-1. Wildlife codes used in these examples:

BPIWO_G	Pileated Woodpecker - (Living*) Growing
MMYKE _G	Keen's Long-eared Myotis - (Living*) - Growing
MODHE _FDW	Columban Black-tailed Deer - Feeding -Winter
MODHE_FDPE	Columbian Black-tailed Deer - Feeding -Early Spring
MODHE _FDG	Columbian Black-tailed Deer - Feeding - Growing
MODHE _STW	Columbian Black-tailed Deer - Security/Thermal - Winter
MODHE_STPE	Columbian Black-tailed Deer - Security/Thermal - Early Spring
MODHE _STG	Columbian Black-tailed Deer - Security/Thermal - Growing
MURAM_HI	Black Bear - Hibernating
MURAM _PE	Black Bear - (Living*) - Early Spring
MURAM _G	Black Bear - (Living*) - Growing

*Living is the default: do not include it in the code.

Example Final Ratings Table

ECO_SEC	BGC_ZONE	BGC_SUBZON	BGC_VRT	BGC_PHASE	SITE_S	SITEMC_S	SITE_MA	SITE_MB	STRCT_S	BPIWO_G	MMYKE_G	MODHE_FDW	MODHE_FDPE	MODHE_FDG	MODHE_STW	MODHE_STPE	MODHE_STG	MURAM_HI	MURAM_PE	MURAM_G
LIM	CWH	xm			01	HK			2	L	U	5	2	3	5	5	5	6	4	3
LIM	CWH	xm			01	HK			3	L	U	5	2	3	5	5	5	6	4	3
LIM	CWH	xm			01	HK			4	M	X	3	3	4	3	3	4	6	5	5
LIM	CWH	xm			01	HK			5	M	X	3	3	4	3	3	4	6	5	5
LIM	CWH	xm			01	HK			6	H	U	1	5	4	1	5	4	2	4	2
LIM	CWH	xm			01	HK			7	H	U	1	5	4	1	5	4	2	4	2
LIM	CWH	xm			02	DC			2	L	U	5	2	3	5	5	5	6	3	3
LIM	CWH	xm			02	DC			3	L	U	5	2	3	5	5	5	6	3	3
LIM	CWH	xm			02	DC			4	M	X	3	3	4	3	3	4	6	6	6
LIM	CWH	xm			02	DC			5	M	X	3	4	4	3	4	4	6	6	6
LIM	CWH	xm			02	DC			6	H	U	2	5	4	2	5	4	2	5	3
LIM	CWH	xm			02	DC			7	H	U	1	5	4	1	5	4	2	5	3
LIM	CWH	xm			02	DC	v	w	2	L	U	5	1	3	5	5	5	6	3	2
LIM	CWH	xm			02	DC	v	w	3	L	U	5	1	3	5	5	5	6	3	2
LIM	CWH	xm			02	DC	v	w	4	M	X	3	3	4	3	3	4	6	5	5
LIM	CWH	xm			02	DC	v	w	5	M	X	3	3	4	3	3	4	6	5	5
LIM	CWH	xm			02	DC	v	w	6	H	U	1	5	4	1	5	4	2	4	2
LIM	CWH	xm			02	DC	v	w	7	H	U	1	5	4	1	5	4	2	4	2
LIM	CWH	xm			07	RF			2	L	U	5	2	3	5	5	5	6	2	1
LIM	CWH	xm			07	RF			3	L	U	5	2	3	5	5	5	6	2	1
LIM	CWH	xm			07	RF			4	M	X	3	3	4	3	3	4	6	6	6
LIM	CWH	xm			07	RF			5	M	X	3	3	4	3	3	4	6	6	6
LIM	CWH	xm			07	RF			6	H	U	1	5	4	1	5	4	4	4	2
LIM	CWH	xm			07	RF			7	H	U	1	5	4	1	5	4	4	4	2
LIM	CWH	xm			07	RF	c		2	L	U	5	2	3	5	5	5	6	2	1
LIM	CWH	xm			07	RF	c		3	L	U	5	2	3	5	5	5	6	2	1
LIM	CWH	xm			07	RF	c		4	M	X	3	3	4	3	3	4	6	6	6
LIM	CWH	xm			07	RF	c		5	M	X	3	3	4	3	3	4	6	6	6
LIM	CWH	xm			07	RF	c		6	H	U	1	5	4	1	5	4	4	4	2
LIM	CWH	xm			07	RF	c		7	H	U	1	5	4	1	5	4	4	4	2
LIM	CWH	xm			08	SS			2	L	U	5	2	3	5	5	5	6	1	2
LIM	CWH	xm			08	SS			3	L	U	5	2	3	5	5	5	6	1	2
LIM	CWH	xm			08	SS			4	M	X	4	3	3	4	3	3	6	5	5
LIM	CWH	xm			08	SS			5	M	X	4	3	3	4	3	3	6	5	5
LIM	CWH	xm			08	SS			6	H	U	1	5	3	1	5	3	2	1	2
LIM	CWH	xm			08	SS			7	H	U	1	5	3	1	5	3	2	1	2
LIM	CWH	xm				LA				N	U	6	6	6	6	6	6	6	6	6
LIM	CWH	xm				OW				N	U	6	6	6	6	6	6	6	6	6
LIM	CWH	xm				PD				N	U	6	6	6	6	6	6	6	6	6

Appendix J: Guidelines for Detailed Wildlife Habitat Capability and Suitability Ratings

What Constitutes a Detailed Level of Wildlife Habitat Ratings?

- A detailed wildlife habitat mapping project has the following characteristics:
- Large map scale (1:5,000 to 1:20,000)
- Small project area being mapped (under 5,000 ha)
- Multiple field sampling visits (different seasons during the year and/or over a number of years)
- High sampling intensity
- Intensive animal population surveys completed
- Only one or two wildlife species being rated
- Use of more detailed rating criteria

Note: The guidelines provided in this appendix are meant as a supplement to the BC Wildlife Habitat Rating Standards: Minimum Requirements for Reconnaissance Level Mapping Projects. The standards and procedures for reconnaissance level projects are still applicable to detailed level habitat mapping projects.

Map Scales Used for Detailed Habitat Mapping

The very large mapping scales (1:5,000 - 1:10,000) are useful for determining explicit descriptions and delineation of a few ecosystem units. They are used for the evaluation of the habitat needs for some species at risk (e.g. Vancouver Island marmot)and for Wildlife Habitat Area delineation at the detailed planning and forestry activity level. Special projects such as identification of important habitats along highway and pipeline corridors also use very large map scales. The primary ecosystem classification sources, in addition to the Ecosections and Biogeoclimatic units, are the terrestrial ecosystems or mapped site series. It is a sample-based inventory required for areas having high wildlife values that will be undergoing imminent resource development or extraction. This level of habitat assessment should be done within the context of previous 1:20,000 terrestrial ecosystem mapping, or a similar information base.

Use very large map scales for:
- understanding the habitat elements needed by a single wildlife species at risk
- delineation of Wildlife Habitat Areas
- highway and pipeline corridors

Sampling Requirements for Detailed Habitat Mapping Projects

The Standard for Terrestrial Ecosystem Mapping (RIC, 1998a) identifies six survey intensity levels for ecosystem mapping. A detailed habitat mapping project uses Survey Intensity Levels 1 through 3 for field sampling (see Table __ in Section 4.1.3). This means a higher level of field sample plots (polygon visitations) must be conducted. In addition, more field visitations at different times of the year (depending on the seasons/life requisites being rated) are required. This is to ensure that habitat ratings are reliable at this level of detail. If food, security and thermal values for caribou are to be rated for six seasons, then the values for these ratings must be ground-truthed and based on a detailed understanding of these habitat uses.

Animal Population Surveys

In order to map wildlife habitat at a detailed level, information on the numbers and distribution of animals in the project area must be available. For most ungulates in the province, there are data from many years of aerial surveys, population counts and telemetry observations already available. Some species at risk (e.g. Vancouver Island marmot, Marbled Murrelet) have been intensively studied over a period of several years and may provide sufficient information on numbers and distribution to develop a detailed species-habitat model. However, if population surveys have not been carried out, then

species inventories (per the standard methodologies in RIC, 1998e) are a requirement for any detailed habitat mapping project.

Rating Criteria for Detailed Capability and Suitability Ratings

If required, habitat ratings can be applied at more detail than ratings used at the reconnaissance level (per Appendix A). Table J-1 indicates the range of detailed rating criteria that are available for large scale habitat mapping projects. For example, food, security and thermal ratings for mule deer winter range may be applied to early and late winter seasons. Growing season ratings can be further broken down into spring, summer and fall habitat uses.

For some species it may be desirable to apply the food/cover life requisites to a specific life requisite. For example, ratings for reproducing habitat may be broken down into the food and security habitats required for nesting.

If in doubt about what rating criteria to choose for a particular project, contact the wildlife correlator in Victoria.

The codes used in the following tables are:

Life Requisites		Seasons	
LI	Living	A	All seasons
FD	Food	W	Winter
SH	Security	G	Growing (spring, summer, fall)
ST	Security/Thermal	P	Spring
TH	Thermal	S	Summer
CO	Courtship/Mating	F	Fall
HI	Hibernating	WE	Early Winter
MS	Migrating (seasonally)	WL	Late Winter
RB	Reproducing (birthing)	PE	Early Spring
RE	Reproducing (eggs)	PL	Late Spring
SG	Staging		

Table J-1. Rating Criteria for Detailed Habitat Ratings: Amphibians and Reptiles

Map Scale	**1:20,000**			**1:10,000 - 1: 5,000**		
Species	**RS**	**Habitat Use**		**RS**	**Habitat Use**	
		Minimum Required	**Optional**		**Minimum Required**	**Optional**
POND-DWELLING AMPHIBIANS Tiger Salamander Great Basin Spadefoot Toad Northern Leopard Frog Spotted Frog	4	LI-A	LI-W LI-G RE	6	LI-W LI-G	RE
ALL OTHER AMPHIBIANS Pacific Giant Salamander Coeur D'Alene Salamander Tailed Frog	4	LI-A		4	LI-A	
REPTILES: TURTLES & LIZARDS Painted Turtle Short-Horned Lizard	4	LI-A		4	LI-A	
REPTILES: SNAKES Rubber Boa Western Yellow-bellied Racer Sharptail Snake Night Snake Gopher Snake Western Rattlesnake	4	LI-G	HI	4	LI-G HI	

Table J-2. Rating Criteria for Detailed Habitat Ratings: Birds (see provincial occurrence of selected bird species in Appendix A)

Map Scale	**1:20,000**			**1:10,000 - 1: 5,000**		
Species by Provincial Occurrence	**RS**	**Habitat Use**		**RS**	**Habitat Use**	
		Minimum Required	**Optional**		**Minimum Required**	**Optional**
RESIDENTS	4	LI-W LI-G RE	FD-W FD-G ST-W ST-G	6	LI-W LI-G RE	FD-W FD-G ST-W ST-G
BREEDING VISITANTS	4	LI-P LI-S LI-F RE	FD-P FD-S ST-P ST-S	4	LI-P LI-S LI-F RE	FD-P FD-S ST-P ST-S
WINTER VISITANTS	4	LI-W	FD-W ST-W	4	FD-W ST-W	
NON-BREEDING SUMMER VISITANTS	4	LI-P LI-S LI-F	FD-P FD-S FD-F ST-P ST-S ST-F	4	LI-P LI-S LI-F	FD-P FD-S FD-F ST-P ST-S ST-F
SPRING/AUTUMN VISITANTS	4	LI-P LI-F	FD-P FD-F ST-P ST-F SG	4	LI-P LI-F	FD-P FD-F ST-P ST-F SG
PELAGIC (BREEDING COLONIES ONLY)	4	RE		4	RE	

Table J-3. Rating Criteria for Detailed Habitat Ratings: Mammals: Insectivores, Bats, Rabbits, Rodents, Mustelids

Map Scale	**1:20,000**			**1:10,000 - 1: 5,000**		
Species	**RS**	**Habitat Use**		**RS**	**Habitat Use**	
		Minimum Required	**Optional**		**Minimum Required**	**Optional**
INSECTIVORES Pacific Water Shrew	4	LI-A		4	LI-A	
BATS - intermediate knowledge level Western Small-footed Myotis Townsend's Big-eared Bat Pallid Bat Spotted Bat	4	LI-G	HI RB FD-G ST-G	4	FD-G ST-G	FD-W ST-W HI RB
BATS - limited knowledge level Keen's Long-eared Myotis Northern Long-eared Myotis Fringed Myotis Western Red Bat	2	LI-G	HI RB	4	LI-G	FD-G ST-G HI RB
LAGOMORPHS Nuttall's Cottontail Snowshoe Hare (Washingtonii) White-tailed Jackrabbit	4	LI-A		4	LI-A	FD-A ST-A
RODENTS - HIBERNATING Vancouver Is Marmot Golden-mantled Ground Squirrel	4	LI-G	HI	4	FD-G ST-G HI	SH-G TH-G FD-PE
RODENTS - NON-HIBERNATING **1) well-defined homesites** Mountain Beaver Northern Pocket Gopher	4	LI-A		4	FD-A ST-A	
2) poorly defined homesites Mice, Voles, Lemmings	2	LI-A		4	LI-A	FD-A ST-A
MUSTELIDS: Ermine, Weasel	4	LI-W LI-G	FD-W FD-G ST-W ST-G	4	LI-W LI-G	FD-W FD-G ST-W ST-G
MUSTELIDS: Marten, Fisher, Wolverine, Badger	4	LI-W LI-G	RB	6	LI-W LI-G	FD-W FD-G ST-W ST-G RB

Table J-4. Rating Criteria for Detailed Habitat Ratings: Mammals: Bears, Ungulates

Map Scale	**1:20,000**			**1:10,000 - 1: 5,000**		
Species	**RS**	**Habitat**	**Use**	**RS**	**Habitat**	**Use**
		Minimum Required	**Optional**		**Minimum Required**	**Optional**
BEARS	6	LI-P LI-S LI-F HI	FD-PE FD-PL FD-S FD-F MS ST-PE ST-PL ST-S ST-F	6	FD-PE FD-PL FD-S FD-F HI	ST-P ST-S ST-F MS
UNGULATES*: Deer/Elk/Caribou	6	FD-WE FD-WL FD-PE FD-PL FD-S FD-F ST-F ST-WE ST-WL ST-PE ST-PL ST-S	SH-W SH-P SH-S SH-F MS RB TH-W TH-P TH-S TH-F	6	FD-WE FD-WL FD-PE FD-PL FD-S FD-F ST-WE ST-WL ST-PE ST-PL ST-S ST-F	MS RB CO
UNGULATES*: All Other	6	FD-W FD-P FD-S FD-F ST-W ST-P ST-S ST-F	SH-W SH-P SH-S SH-F MS RB TH-W TH-P TH-S TH-F	6	FD-W FD-P FD-S FD-F ST-W ST -P ST-S ST-F	MS RB CO

* For special winter range mapping projects, only Winter ratings are required.