6.3 CANADA LYNX SPECIES ACCOUNT

SPECIES NAME: **Lynx (*Lynx canadensis*)**

SPECIES CODE: **M-LYCA**

INTRODUCTION:

This document provides the background information for rating lynx habitat values for pre-defined ecosystem units in TFL 15, south-central British Columbia. Information on habitat requirements, life requisites, and habitat / landscape use patterns of lynx has been accumulated from a variety of sources, including literature reviews, species experts, and previous inventory and mapping efforts.

In an effort to further strengthen this lynx habitat model, key species experts were solicited to provide reviews of the species account and general habitat requirements. The following individual(s) is/are acknowledged for provided critiques and reviews of the following species account:

- Clayton Apps, Wildlife Biologist
  Aspen Wildlife Research
  Calgary, AB

STATUS:

Status in Canada (COSEWIC 1998):	**Not at Risk**
Status in British Columbia (CDC 1999):	
Provincial Management List:	**Yellow**
Global Rank:	**S5/S4**
Provincial Rank:	**S5/S4**
Identified Wildlife (Y/N):	**N**

DISTRIBUTION:

Continental Range:

In North America, lynx occupy forested regions of Canada and northern portions of the United States and are strongly associated with boreal or similar types of ecosystems (Apps pers. comm.). Their range extends from east to west coasts and to the most northern tip of Alaska (McCord and Cardoza 1982). The species remains fairly widespread throughout its northern range but has receded from much of its former range in the southern periphery.

Provincial Range:

Lynx are distributed throughout British Columbia east of the Coastal Mountain range (Stevens and Lofts 1988). This native yearlong resident inhabits many of the biogeoclimatic zones within the province. Based on Apps (pers. comm.) and Stevens (1995), lynx typically do not occur in the Alpine Tundra (AT), MH (Mountain Hemlock), IDF (Interior Douglas-Fir), PP (Ponderosa Pine), and BG (Bunchgrass) biogeoclimatic zones.

The population levels of lynx in British Columbia are extremely variable. Populations of lynx tend to be

cyclical and are dependent upon several factors, such as locality, influx of lynx, and density of prey. Therefore, the estimate of lynx between years may fluctuate, however at low populations, lynx occur at densities of approximately 2-4 animals per 100 km^2 (MOE n.d.). During high population levels, these densities may increase 3-4 fold, reflecting the ability of lynx populations to reproduce quickly. Apps *et al*. (1999) has postulated that southern lynx populations in BC do not fluctuate as dramatically as northern populations.

Based on estimates by Hatler (1988) and Goodchild and Munro (1980) the provincial population of lynx ranges from 20,000 to 127,000. Obee (1996) estimated British Columbia to have a declining population of 20,000 to 80,000 lynx. More specific to the study area, Koehler (1990) in Okanagan County of northcentral Washington bordering Canada found a mean annual density of adults and kittens to be 2.6 lynx / 100 km^2.

Range of Lynx in the Project Area:

Ecoprovinces:	Southern Interior
Ecoregions:	Thompson-Okanagan Plateau, Okanagan Highland
Ecosections:	Northern Okanagan Highland, Southern Okanagan Highland, Northern Okanagan Basin, Southern Okanagan Basin
Biogeoclimatic Zones:	ESSFdc1, ESSFdcu, ESSFdcp1, MSdm1

Elevational Range:

Where suitable forest communities are present, lynx will occupy a wide variety of coniferous habitats, ranging from 122 m in elevation in Alaska to above 2,400 m in Wyoming, Colorado, and Utah (Bailey *et al*. 1986, Koehler and Brittel 1990). Koehler (1990) noted lynx in the Okanagan valley to vary their elevational use based upon season. Lynx utilized higher elevations during the summer (up to 1,787 m) than during the winter (up to 1,738 m). This seasonal pattern of habitat use has been observed and confirmed by other researchers as well (Apps pers. comm.).

KEY LIFE REQUISITES:

Lynx typically occupy forested or shrubby habitats. Lynx habitat preferences have been reported to range from early seral to climax stands, but they likely prefer combinations of both of these habitats. Banfield (1974), Murray and Boutin (1994), and Poole *et al.* (1996) suggested that lynx occupy dense closed spruce forests and avoid shrub habitats. In contrast, Parker (1981) suggested that lynx select habitats with structurally mature and open coniferous stands. Despite lynx being widely distributed over numerous habitat types in British Columbia, the predominant centers of lynx activity occur in the northeast, and possibly in the dry forests of the central and southern interior (RIC 1997).

Living Habitat:

Lynx utilize a variety of landscape and forest structural habitat types in order to meet various life requisites. Given that lynx are a wide-ranging carnivore, their use of various landscapes and microhabitats is diverse. In order for lynx to adequately address all life requisites, the available resources (i.e. habitat and food resources) must be interspersed in a pattern that facilitates reasonable access to all the required resources.

In the western mountains, where environmental conditions support boreal forest habitat types similar to

those found in northern regions, lynx inhabit structurally different forest types. Koehler and Aubry (1994) believe that early structural stages are used for foraging purposes while later structural stages are utilized as reproductive/birthing habitats. Intermediate structural stages may function as movement corridors and provide connectivity between foraging and denning habitats within a landscape mosaic of forest structural stages. Apps et al. (1999) described landscape or topographic features that can be managed to sustain or enhance habitat effectiveness and connectivity for lynx as valley bottoms, or broad, forested mountain passes. Both of these types of landscapes have high potential to support resident lynx and to facilitate dispersal.

Within TFL 15, the usual landscape and vegetation features that provide early structural stage habitats dominated by dense shrubby understoreys, include cutblocks, fire burns, and some lowlands areas. These habitat types typically provide the greatest densities of prey for lynx (Litvaitis *et al.* 1985). Generally, shrubby habitats found in association with dense mature stands provide the greatest relief for lynx, who favor high contrast forest edges with abundant prey in close proximity to escape and cover. Quinn and Parker (1987) indicate that *"any irregular pattern of logging or fire in boreal forest should produce prime hare (and lynx) habitat."*

Feeding Habitat:

In many areas of British Columbia, lynx occupy habitats overlapping or contiguous to abundant populations of snowshoe hare (*Lepus americanus*). Snowshoe hare are the primary prey species of lynx, and, therefore represent their most important food source (Bergerud 1971, Koehler *et al.* 1979, Parker *et al.* 1983, Todd 1985, Ward and Krebs 1985, Bailey *et al.* 1986, Quinn and Parker 1987, Poole 1994, Poole *et al.* 1996, Koehler and Aubry 1994, Murray and Boutin 1994, Apps et al. 1999). Hares not only influence where lynx may occur but also influence relative densities of lynx in an area. In short, hares constitute approximately 35-97% of a lynx diet; therefore, it is generally accepted that lynx select habitats with abundant snowshoe hare populations (Brand and Keith 1979, Koehler and Aubry 1994, Murray and Boutin 1994).

The synchronous relationship that exists between lynx and snowshoe hare (*Lepus americanus*) was first described by Elton and Nicholson (1942) and has since attracted much attention from ecologists and wildlife biologists. The basic cause of the ten-year population cycle in snowshoe hares and lynx is, first, an interaction between the snowshoe hare and its food supply and, second, an interaction between snowshoe hares and its primary predator, the lynx (Keith 1974). Since lynx depend so heavily on snowhoe hare as their primary food item, good hare habitat is generally regarded as good lynx habitat as well. Table 16 summarizes reported diet compositions of lynx from various research projects in Canada.

Table 16: Food Habits of the Lynx
(summarized from Quinn and Parker 1987)

Location	% Prey Items						Source
	Snowshoe Hare	Mice and Voles	Squirrels	Grouse	Other Birds	Other	
Alberta	35-90	4-28	9-12	2-6	3-6	2-15	Brand and Keith (1979)
Alberta	69	-	1	13	-	17	Nellis and Keith (1968)
Northwest Territories	60	7	1	7	10	13	Van Zyll de Jong (1966)
Newfoundland	45	21	-	-	21	15	Saunders (1963)

Ontario	70	4	-	5	5	13	Stewart (1973)
Cape Breton Island	93	3	1	3	-	-	Parker *et al.* (1983)

Although numerous other prey species are present in lynx diets, the significant composition of snowshoe hare indicates that lynx select hare as a primary prey species. In contrast, most other prey species are either consumed as carrion or taken as alternate prey species during periods of low hare density. To maximize the potential of lynx to capture snowshow hare, lynx select for habitats frequented by this prey species. These types of foraging habitats are described as *"…diverse forests with alternate stands of swamp conifer for cover and shrubby openings for feeding."* (Quinn and Parker 1987 from a compilation of Bider 1961, Wolff 1980, Orr and Dodds 1982, Wolfe *et al.* 1982, Pietz and Tester 1983). Specifically, structural characteristics such as stand age, tree species compostion, stem density, and stem height influence the density of snowshoe hares and, therefore, the density of lynx (Koehler and Aubry 1994, Keith 1990).

Table 17 outlines some of the key prey or carrion species utilized by lynx as food resources (Saunder 1963, Quinn and Parker 1987, Brand *et al.* 1976, Poole *et al.* 1996, Stevens and Lofts 1988, Hatler 1988, Koehler 1990, Apps *et al*. 1999).

Table 17: Key Prey or Carrion Species for Lynx

Alces alces
Bonasa umbellus
Castor canadensis
Colaptes auratus
Dengragapus spp.
Glaucomys sabrinus
Lagopus spp.
Lepus americanus
Marmota caligata
Martes americanus
Mephitis mephitis
Microtus spp.
Neotoma cinerea
Odocoileus spp.
Spermophilus spp.
Tamiasciurus hudsonicus
Vulpes spp.
Rangifer tarandus

Of the limited lynx diet information available for British Columbia, Wilson (1969, from Hatler 1988) documented the remains of a marmot in a lynx stomach analysis. More recently, for the Southern Interior Mountains Ecoprovince, Apps *et al.* (1999) reported lynx diet from 137 kills to comprise of snowshoe hares (52%), red squirrels (30%), northern flying squirrels (5%), grouse (*Dengragpus* spp.)(3%), martens (3%), voles (3%), a northern flicker (<1%), and unknown species (3%). One case of scavenging on mule deer (assumed vehicle collision) was noted. Apps (pers. comm.) suggested that alternate prey may be important among southern populations, where hares may occur at low densities and may be relatively patchy. Numerous other studies throughout North America echo that the greatest biomass of prey consumed throughout the year is snowshoe hare (Nellis *et al.* 1972, Brand and Keith 1979, Quinn and Parker 1987). In periods of low hare density, lynx tend to utilize alternate prey sources but despite increased use of alternate prey sources, as reported by Brand *et al.* (1976), hares still comprised 91% of biomass consumed. Koehler (1990) found that, within the Okanagan area of the United States, lynx habitat use was consistent with other studies showing that lynx use habitats where snowshoe hares are most abundant. Lynx use of lodgepole pine habitats was 4-5 times greater in 20 year old stands compared to

older (43 or >82 year old) stands of lodgepole pine and 9 times greater than Engelmann-spruce – subalpine fir stands.

There is some evidence that snow density and crust characteristics may affect lynx access to food items, as Parker (1981) and Nellis and Keith (1968) reported reduced hunting success under soft footing conditions. Hunting success may also be affected by the degree to which hare activity is confined to well-defined trails in the snow. Thus, broad patterns of snow deposition in relation to forest cover is generally a useful, broad-scaled indicator of good lynx habitat capability.

Security / Thermal Habitat:

The most influential factor in determining the security or thermal value of a given habitat is its vegetational structure. Lynx utilize dense mature coniferous stands to meet both security and thermal life requisites. In addition to snowshoe hares' association with dense coniferous stands, lynx utilize late-structural and successional stages with abundant downed woody debris for security and thermal cover. Fuller and Heisey (1986) refer to coniferous stands as the habitat type that provides warmer temperatures and lighter snowpacks in winter as well as concealment from predators during the vulnerable denning and reproducing phases. MOE (n.d.) indicate that mature coniferous forests are important to lynx. These habitats provide cover for resting sites and natal dens. In addition to suitable denning sites, suitable travel cover to and from alternate denning sites, security habitats, and foraging areas increase the quality of reproducing habitat. Suitable travel cover is provided by coniferous or deciduous forest greater than 2m in height. Lynx tend to avoid openings greater than 100m wide.

Denning Habitat:

RIC (1998) defined denning habitat as habitat used for sleeping or hiding in a cavity, cave, or burrow and has differentiated it from dens used for "Reproducing Habitat". Lynx have been documented to use den sites as refugia from adverse weather conditions (Koehler and Aubry 1994). Denning and resting habitats are provided by the same habitats that provide for security and thermal cover requisites. Therefore, denning habitat alone will not be rated separately for lynx in this model.

Reproducing Habitat:

For reproducing purposes, lynx select den sites in dense, mature habitats that contain large woody debris, such as, blowdown, upturned stumps, and windthrows (an actual den was located within a windthrow on the edge of a clearcut in northcentral British Columbia (Hatler 1988)). In mature coniferous forests, lynx make dens in hollow trees, tangled thickets, under logs, stumps, and fallen timber (MOE n.d.). Other important features of denning sites are minimal human disturbance, proximity to foraging habitat (early structural stage stands), and stands that are at least 1 ha in size (Koehler and Brittel 1990). In the Okanagan valley, Koehler (1990) observed four denning sites characterized as mature stands with overstorys consisting of Engelmann spruce, subalpine fir, and lodgepole pine. All sites were located on north-northeast aspects with an average of 40 downfall logs/50m.

SEASONS OF USE:

Lynx habitat will be rated on the basis of two seasons of use as follows (Table 18):

The use of seasonal nomenclature (spring and all) is based on that defined by RIC (1998) for the Southern Interior ecoprovince.

HEIRARCHY OF LIFE REQUISITES:

Since suitable feeding habitat for lynx is critical to the occurrence of lynx populations in an area, feeding habitats have been given the primary life requisite and will be incorporated into the hierarchy of life requisites for TFL 15 as follows:

1. ***Year-round feeding habitat***
2. ***Reproducing habitats***
3. ***Year-round security-thermal habitats***

Table 18: Seasons of Use Rated for Lynx

SEASON	CODE	DESCRIPTION (as relates to use by lynx)	DURATION	LIFE REQUISITE THAT MUST BE MET
All	A	With the exception of reproducing habitat, the remainder of lynx life requisites demand similar habitat types throughout their annual cycle	November December January February March	Feeding / Security / Reproducing
Spring	P	Gestation and birthing period	April May	Reproducing / Food / Security
All	A	With the exception of reproducing habitat, the remainder of lynx life requisites demand similar habitat types throughout their annual cycle	June July August September October	Feeding / Security / Reproducing

QUANTIFIABLE ECOSYSTEM ATTRIBUTES:

Table 19 below describes how each life requisite for lynx can be quantified in terms of specific ecosystem attributes, such as site series, canopy closure, *etc*. Table 19 below is a summary of these ecosystem attributes and life requisites.

Table 19: Quantifiable Ecosystem Attributes for Lynx Habitats			
Season	**Primary Life Requisite**	**Rating Code**	**Quantifiable Ecosystem Attribute**
Winter	Feeding	FDW	• Stand age: early successional and structural stage stands provide the primary feeding habitats; • Tree species composition: provision of conifer stands with abundant densities of snowshoe hare; • Stem diameter: stands with tree and shrub stem DBH (generally <8cm)(Litvaitis *et al.* 1985)(Wolff 1980); • Stem density: stand with 4,690 to 13,440 stem/acre provide; • Cutblocks that have reached 20 to 25 years of age provide optimum forage conditions for snowshoe hare; • Stem height: because snow depths exceed 1m in boreal forests, the height of stems is an important aspect in determining winter forage quantity for hares, and therefore lynx.
	Security - Thermal	STW	• Stand age: late successional and structural stage stands provide the primary cover habitats; • Tree species composition: provision of dense, mature coniferous stands; • Suitable cover consists of structural stage forests greater than 2m in height; • Coarse woody debris: high density (>1/m) of downed trees supported 0.3 to 0.2 m above the ground (Koehler 1990); • Tree density should be greater than 180stems/acre; • Cutblocks or opening should be designed less than 100m across.
Growing	Feeding	FDG	• Same as above winter food ecosystem attribute description;
	Security - Thermal	STG	• Same as above winter security – thermal ecosystem attribute description.
		RB	• Tree species composition: provision of dense, mature coniferous stands; • Mature forests stands of lodgepole pine, spruce, and subalpine-fir older than 200 years; • Coarse woody debris: high density (>1/m) of downed trees supported 0.3 to 1.2 m above the ground (Koehler 1990); • Area of reproducing habitat: small sized parcels (1-2 ha) of late-successional forest connected by corridors of cover to permit females to move kittens to alternate den sites (Koehler and Aubry 1994).

MODEL ASSUMPTIONS:

1. Lynx typically occur in areas where low topographic relief creates continuous forest communities of varying stand ages, thus providing denning habitat, kitten rearing habitat, and foraging habitat in close proximity.

2. Lynx have a high degree of reliance on a single prey species – the snowshoe hare. Therefore, good snowshoe hare habitat is good lynx habitat.

3. Generally, early successional conifer and conifer-dominated mixedwood forests provide the best snowshoe hare habitat.

4. Hare abundance decreases in sparsely stocked stands such as black spruce bogs. Dense stands of deciduous forests are not used extensively by hares in the winter due to the lack of thermal cover. Therefore, lynx use of these habitat types is also lowered.

5. Late successional conifer forests provide security and thermal cover for maternal denning sites and cover for kittens.

6. Conifer-dominated mixedwood forests on fluvial sites that are maintained in early seral conditions by flood pulses will be rated higher than upland sites of similar compositions.

7. Stands of at least 1 ha in size are required to provide the juxtaposition of habitats for all life requisites. Forest stands <1 ha in size may provide one of either foraging or cover habitat and will be used sparingly if they are not connected to one another. Such isolated habitat units will be rated lower than similar connected units.

8. Roads tend to reduce habitat effectiveness for lynx.

9. Lynx tend to avoid openings greater than 100m wide (Koehler and Aubry 1994).

10. Site modifiers that influence habitat suitability ratings for lynx and generally require an upgrade in ratings include “a” (active floodplain – all seasons); while downgrades in habitat suitability ratings are usually experienced by sites with a “z” (very steep, greater than 100 % slope – all seasons).

LYNX
HABITAT SUITABILITY RATINGS

RATED LIFE REQUISITES:

The lynx life requisites that have been selected for the final ratings include:

- FDA (Feeding / All Seasons)
- STA (Security-Thermal / All Seasons, includes ST for reproduction)

HABITAT SUITABILITY RATINGS SCHEME:

Habitats have been rated for lynx using a 4-class rating scheme, acknowledging the species' moderate to high mobility and researchers' intermediate knowledge level about its habitat requirements (Table 20).

Table 20: Habitat Suitability Rating Scheme for Lynx

Suitability Rating	Level of Use by Lynx	Suitability Limits (%)
H	High	76 – 100
M	Moderate	26 – 75
L	Low	1 – 25
N	Nil	0

PROVINCIAL BENCHMARKS:

A provincial benchmark habitat has not been identified by MELP for lynx. However, Apps et al. (1999) has indicated that lynx in the Southern Interior Mountains Ecoprovince exist at low densities, have low productivity, and are patchy in distribution, relative to lynx populations in the northern parts of their range.

PERSONAL COMMUNICATIONS:

Apps, Clayton, RPBio. Aspen Wildlife Research. Calgary, AB.

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