

13.0 SPECIES – HABITAT MODEL FOR STONE’S SHEEP

Common Name:	Stone’s Sheep
Scientific Name:	<i>Ovis dalli stonei</i>
Species Code:	M-OVDA
B.C. Status:	Blue-listed (B.C. MoELP, 1996; B.C. CDC, 1997)
Identified Wildlife Status:	None
COSEWIC Status:	Not applicable

13.1 Introduction

Information from two studies completed within northeastern B.C. (Seip, 1983 and Luckhurst, 1973) has been incorporated into this species habitat-model. There have been no specific Stone’s sheep habitat studies or inventories within the Dunedin study area (B. Webster, *pers. comm.*). Mountain sheep habitat ecology and diet have been well researched for most of British Columbia and the United States, and relevant literature from B.C. and western north America has been included in this species-habitat model. At this time, general habitat ratings for the Stone’s sheep are predicted to have low reliability as no model verification has been done.

13.2 Distribution

13.2.1 Provincial Range

The Stone’s sheep, a subspecies of thinhorn sheep (*Ovis dalli*), inhabits mountainous areas of northern British Columbia and the southern Yukon (Seip, 1983). The world population of Stone’s sheep occurs only in British Columbia and the Yukon with approximately 75% of the world’s population living in B.C. (B.C. Ministry of Recreation and Conservation, 1978). Populations of Stone’s sheep are found on the Yukon and Stikine Plateaus, the Skeena, Cassiar and Omineca Mountains, the Rocky Mountains from the Pine river to the Liard River, and the Boundary Ranges of the Coast Mountains (B.C. Ministry of Recreation and Conservation, 1978). The British Columbia population of Stone’s sheep was estimated at 12,000 ± 1,200 sheep in 1978 (B.C. Ministry of Recreation and Conservation, 1978).

13.2.2 Distribution in the Study Area

Stone’s Sheep do not regularly occur in the Taiga Plains ecoprovince, and within the Dunedin study area, they are expected to be found only in the Northern Boreal Mountains Ecoprovince, MUF ecosection, located in the southwest corner of the study area.

Relative abundance of sheep is rated as moderate (1 sheep per 1.3 km² to 5 km²) over the lower portion of the study area. The area immediately surrounding Stone Mountain Park has a plentiful rating of over 1 sheep per 1.3 km² (Fish, Wildlife and Habitat Protection Department, 1994). The lower eastern ridge of the study area is rated as few (1 sheep per 5 km² to 250 km²) sheep present (Fish, Wildlife and Habitat Protection Department, 1994).

Stone’s sheep occurrence within the ecoregions, ecosections, and biogeoclimatic zones of the study area is summarized in Table 80.

Table 80: Expected Stone’s Sheep Occurrence within the 6 Ecosection - BEC Variant Combinations Found within the Dunedin Study Area

<i>Ecoprovinces</i>	TAIGA PLAINS		NORTHERN BOREAL MOUNTAINS			
<i>Ecoregions</i>	Muskwa Plateau		Northern Canadian Rocky Mountains			
<i>Ecosections</i>	MUP		MUF			
<i>BEC Variants</i>	BWBSmw2	BWBSwk3	BWBSmw2	SWBmk	SWBmks	AT
Species						
Stone’s Sheep	?	?	•	•	•	•

Legend:

- = occurs in the variant
- ? = probably occurs in the variant
- ? = unlikely to occur in the variant

13.2.3 Elevational Range

Within the study area, Stone’s sheep are found from the AT zone down to the BWBS zone (approx. 2,105 m to 250 m), although most of their time will be spent at the upper elevations.

13.3 Ecology and Habitat Requirements

Stone’s sheep generally occur above tree line in the northern Rocky Mountains (Luckhurst, 1973). They inhabit open areas in mountainous terrain with steep terrain used for escape. Stone’s Sheep are limited to foraging areas near to escape terrain. Typically, sheep depend on several seasonal ranges to which they show a great fidelity and which may be separated by great distances (Geist, 1971).

Usually, Stone’s sheep separate into ram and ewe-juvenile groups that tend to occupy distinct home ranges over the year (Luckhurst, 1973). In the late fall and early winter during the rut, the rams leave their summer home range and travel to ewe-juvenile ranges where they spend part of the winter (Luckhurst, 1973).

Stone’s sheep occupy high summer alpine range, and with the first autumn snows, they move down to feed on lower alpine slopes with a warm exposure (Luckhurst, 1973). As upper slopes and ridges are swept free of snow, sheep move to these sites and feed on the often sparse vegetation of these sites (Luckhurst, 1973).

13.4 Habitat Use (Life Requisites and Seasons)

Stone’s sheep habitat use for the study area is broken down into two seasons – growing and winter. Life requisites that are rated for Stone’s sheep include living, feeding, and security, as summarized in Table 81.

Table 81: Summary of Rated Life Requisites and Seasons for Stone’s Sheep in the Dunedin Study Area

Rated Life Requisites and Seasons	Code	Months of Use	Comments
Living during the growing season - food	LI_G_FD	May-September	- Movements to seasonal ranges - exploiting phenology of plants
Living during the growing season - security	LI_G_SH		
Living during the winter season - food	LI_W_FD	October-April (February to March most critical time)	- Snow free alpine peaks and ridges form core winter range - winter range is limiting due to snow depth conditions
Living during the winter season - security	LI_W_SH		

Ecosystem units were not rated for security and feeding values for Reproducing (RB) as birthing habitat is not well defined for Stone’s Sheep. Birthing generally occurs in late May to early June usually in areas of steep rocky terrain (Luckhurst, 1973). Winter thermal values were not rated because Stone’s Sheep are primarily selecting for regions of low snow depth and available forage. Winter thermal habitat is therefore assumed to be the same as winter security habitat.

Rated life requisites are described in detail below. Additional information on mineral licks and migration routes has also been included.

13.4.1 Living

The living life requisite for Stone’s sheep is satisfied by the presence of suitable feeding and security habitat and access to mineral licks and to migration routes, which are described in detail below.

13.4.2 Feeding

The following feeding account is synthesized from Seip (1983). Seip’s study was conducted in the vicinity of Toad River in two areas to the immediate west and southwest of the Dunedin study area. Therefore, sheep foraging within the Dunedin study area is expected to be similar to that found by Seip (1983).

Growing Season

Spring range consists of low elevation (1,200 m to 1,500 m) subalpine clearings including avalanche chutes, streamsides, talus slopes, rockslides, and burns (Seip, 1983). Sheep descend to these clearings in late April and forage on subalpine grasses (*E. innovatus* and *Poa* spp. important) and browse (including conifers) (Seip, 1983). A gradual migration up to summer range occurs with sheep moving from the subalpine clearings in May and reaching high alpine by July, paralleling the green-up of the vegetation (Seip, 1983). Typically at this time, there is a decrease in the use of grasses and an increased use in forbs (especially locoweed), willows, and poplars (Seip, 1983).

By July, Stone’s sheep have reached their high alpine summer range and begin feeding on newly emergent vegetation. Sedges are the most important forage species with a wide variety of forbs and browse (willows important) being utilized (Seip, 1983). Sheep may use subalpine mineral licks and return to the alpine for foraging or they may use lower elevation licks (Seip, 1983).

In the fall, Stone’s sheep are less selective in their habitat preferences due to declining forage quality (Seip, 1983). Sheep will utilize a wide variety of range types from high alpine slopes to burned, subalpine slopes. *Poa* spp. of grasses is heavily used throughout the year on subalpine and alpine ranges. Yarrow (*Achillea*) and locoweed also predominate in the diet (Seip, 1983).

Winter Season

Stone’s Sheep (to the immediate west of the Dunedin study area) use windswept mountain peaks and ridges as winter range at elevations of 1,500 to 2,200 m (Seip, 1983). The critical characteristic of winter range is that the area be blown free of snow as Stone’s sheep are restricted to areas with snow accumulation of less than 25 cm to 30 cm (Seip, 1983). These areas are generally very limited. In a survey by Seip (1983) of 1,000 square km, all the sheep located were using a total of less than 3 square km. In years of low snowfall, lower subalpine slopes may be available for use as winter range, but these will be inaccessible in typical winters. Vegetation is very sparse on wind-swept alpine peaks and Stone’s sheep feed largely on sedges (*Carex* spp.), grasses (blue grass - *Poa* spp. important) and lichens, with forbs making up a small part of the winter diet (Seip, 1983).

13.4.3 Security Habitat

Escape terrain is a very important habitat requirement for Stone’s sheep. Typical escape habitat includes cliffs, rock outcroppings, and bluffs often with sparse cover of trees or shrubs that provide both thermal and hiding cover. Talus slopes may also be used as a form of escape cover. Steep escape terrain (slopes >100%) must be within 0.5 km of feeding areas (Luttmerding *et al.*, 1990). While sheep are not always found in precipitous escape terrain, ewes and lambs rely heavily on these areas, especially during the lambing period (Lawson and Johnson, 1982). Elevation also serves as security habitat as higher elevations will afford protection from many terrestrial and aerial predators.

Good visibility is important for Stone’s sheep allowing for predator detection, visual communication, and efficient foraging. Wild sheep select ranges where their view is unrestricted by standing timber, high shrubs, brush, or other obstructions (B.C. MoELP, 1997)

Stone’s Sheep will not generally bed or forage farther than 200 m from rugged escape terrain (D. Seip, *pers. comm.*). Foraging habitat must be near enough to escape habitat for it to be used. They will travel further from escape habitat to travel to new feeding sites or to mineral licks.

13.4.4 Mineral Licks

Mineral licks are an important but localized feature for Stone’s Sheep. Licks are used primarily from April to July but may be used year round (Seip, 1983). Luckhurst (1973) found Stone’s sheep to use mineral licks heavily in the early fall in addition to use in the late spring. Many forms of licks exist including soil licks exposed along creek beds and road cuts and weathered, rocky outcrops (Seip, 1983). Sheep may make long excursions to reach these mineral licks and remain in unsuitable habitat to utilize licks (Tankersley, 1984, *in* Festa-Bianchet, 1986).

13.4.5 Migration Routes

Sheep will follow the same paths year after year often making well defined trails as they move between traditional seasonal ranges and mineral licks (Geist, 1971).

13.4.6 Seasons of Use

Table 82 summarizes the rated life requisites for Stone’s sheep for each month of the year.

Table 82: Monthly Rated Life Requisites for Stone’s Sheep in the Dunedin Study Area

Month	Season*	Rated Life Requisites
January	W	LI-SH, FD
February	W	LI-SH, FD
March	W	LI-SH, FD
April	W	LI-SH, FD
May	G	LI-SH, FD
June	G	LI-SH, FD
July	G	LI-SH, FD
August	G	LI-SH, FD
September	G	LI-SH, FD
October	W	LI-SH, FD
November	W	LI-SH, FD
December	W	LI-SH, FD

Legend

W=Winter G=Growing LI=Living FD=Food SH=Security

*Seasons defined per the Chart of Seasons by Ecoprovince (RIC, 1998; Appendix B).

13.5 Habitat Use and Ecosystem Attributes

Table 83 outlines how each rated life requisite relates to specific ecosystem attributes.

Table 83: Terrestrial Ecosystem Mapping (TEM) Relationships for each Life Requisite for Stone’s Sheep

Life Requisite	Ecosystem Attribute
Living Habitat (Feeding)	site: slope, aspect, elevation, structural stage, site disturbance soil/terrain: bedrock, terrain texture, flooding regime vegetation: % cover by layer, species list by layer, cover for each species for each layer low snow depth
Living Habitat (Security)	site: slope >100%, aspect, elevation, structural stage soil/terrain: terrain texture vegetation: % cover by layer, species list by layer, cover for each species for each layer cliffs, rugged terrain, areas of high visibility, low snow depth

13.6 Development of the Habitat Ratings

13.6.1 Rating Scheme

A 6-Class rating scheme of high (1), moderately high (2), moderate (3), low (4), very low (5), and nil (6) is employed due to the substantial level of knowledge on habitat use of Stone’s sheep (RIC, 1998). The used ratings scheme is defined in Table 84.

Table 84: Habitat Capability and Suitability 6-Class Rating Scheme
(from RIC, 1998)

% of Provincial Best	Rating	Code
100% - 76%	High	1
75% - 51%	Moderately High	2
50% - 26%	Moderate	3
25% - 6%	Low	4
5% - 1%	Very Low	5
0%	Nil	6

This rating scheme is used when assigning habitat ratings to the ecosystem units present within the Dunedin study area. The habitat ratings express the ability of the units to fulfil habitat requirements for the specific life requisites and seasons rated for Stone’s sheep, as previously outlined in Table 81.

13.6.2 Provincial Benchmark

The provincial standard (best in B.C.) for the winter season for the Stone’s sheep is the MUF ecosection, SWBmk subzone, within the Northern Boreal Mountains ecoprovince (RIC, 1998). The growing season benchmark is the MUF ecosection, AT subzone (RIC, 1998).

The southwestern section of the Dunedin study area is located within the MUF ecosection, which is the provincial benchmark for Stone’s sheep (RIC, 1998). The majority of the study area is located within the MUP ecosection, which has a low (25% to 6%) capability compared to the standard (RIC, 1998).

As a smaller scale reference, the Northeastern British Columbia Biophysical Overview Mapping project has assigned Stone’s sheep habitat capability ratings for the ecosection/BEC variant combinations found within this region (Table 85) (Habitat Inventory Section, 1994).

Table 85. Ecosection/BEC variant combinations for Stone’s Sheep
Class values for habitat capability mapping of the northeastern portion of B.C. (Habitat Inventory Section, 1994)

<i>Ecosection</i>	MUP		MUF			
	<i>Variant</i>	BWBSmw2	BWBSwk3	BWBSmw2	SWBmk	AT
<i>Species</i>						
Stone’s Sheep		5	5	3	1	1

Legend:
6-class rating scheme: Class 1 - high, Class 2 - moderately high, Class 3 - moderate, Class 4 - low, Class 5- very low and Class 6 - nil value.

13.6.3 Ratings Assumptions

Habitat ratings for Stone’s sheep are presented in Appendix 5. Each combination of ecosystem unit and structural stage was individually assessed for its ability to meet the Stone’s sheep’s seasonal requirements for feeding and security. The expanded legend and field data were used to determine if these combinations provided the necessary ecosystem attributes (as outlined in Table 83) to meet these requirements. Further study is needed to validate and refine these ratings. The following assumptions have been made:

- During the growing season ecosystem units with preferred vegetation and high percent cover are given high food ratings. Grasses, sedges, forbs and willows are considered high value forage species (Seip, 1973). Sheep may forage in burned units of early shrub stages of BWBS if near to escape terrain. Structural stage 2 generally has the highest foraging values for Stone’s sheep. Often, stages 3 and 3a

also have moderate to high values. In general, structural stage 1 has poor foraging value as it is mainly unvegetated.

- In the winter season vegetation within the BWBS is considered inaccessible, due to restrictive snow depths. Therefore, all BWBSmw2 and BWBSwk3 units are given a rating of nil for food value in this season.
- Throughout most of the study area, suitable escape terrain does not exist for Stone’s sheep. The only areas of BWBS which will be utilized are located in valley bottoms within the MUF ecosection of the study area. These areas are probably used by sheep travelling between mountains, or to water or mineral licks. Sheep will forage in units adjacent to good escape terrain.
- Security habitat consists of cliffs, rock outcroppings and bluffs, rugged terrain and steep slopes >100%. Units which provide these characteristics receive high security habitat ratings. Open habitats providing good visibility will also afford some protection, so are given low to moderate security ratings. Units in the SWB zone are given a minimum security habitat rating of 5 in the growing season due to the higher elevation providing some protection from predators. Units in the SWBmks receive a minimum security habitat rating of 4 and AT units receive a minimum security habitat rating of 3 in the growing season due to the higher elevation and greater visibility in these sites.
- In winter, security habitat is assumed to be barren, wind-swept ridges as these are the core winter range of Stone’s Sheep. Therefore, all BWBS units are given a rating of nil for security habitat, except cliffs. Sheep may pass through BWBS units as they travel between winter ranges.

13.6.4 Rating Adjustment Considerations

Factors such as adjacency to escape terrain, behavioural adaptations, interspersions of habitats, location of mineral licks, and migration routes will strongly affect habitat use. Aspect and snow depth are very important factors, yet there is insufficient understanding of these factors within the Dunedin study area to build them into the species habitat-model at this time. Future information on snow conditions within the Dunedin area will help to refine the model.

Stone’s sheep will generally forage within 200 m of escape terrain (D. Seip, *pers. comm.*). Units farther away than this from suitable security habitat will have proportionally less value. Habitats over approximately 500 m away from escape terrain will probably have very low habitat value.

13.7 References

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