BROWN CREEPER

(Certhia americana)

Source: Salt and Salt (1976)

Prepared for Millar Western Forest Products' Biodiversity Assessment Project

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May 2000

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1.0 CONSERVATION AND THE EFFECT OF FOREST ACTIVITIES

1.1 Introduction

The Brown Creeper (*Certhia americana*) is a member of Alberta's boreal forest bird population (Figure 1). Though it has been known to over-winter in the province (Semenchuk 1992), most individuals probably undertake short migrations, reducing Alberta's winter density of Brown Creepers (Holroyd and Van Tighem 1983).

1.2 Effects of Forest Management Activities

The Brown Creeper is a member of the guild that uses structurally complex closed-canopy coniferous habitats (Hansen *et al.* 1995) and is highly dependent on mature and overmature stands (Mannan *et al.* 1980). Small-scale clearcutting (Derleth *et al.* 1989) and selection cutting (Medin 1989) may have a negative impact on this species. Still, it was found by Stribling *et al.* (1990) that if snags are retained following harvest, Brown Creepers may be able to continue to occupy selectively cut hardwood stands in Virginia. Conversely, other studies have shown that density decreased on timber-harvested plots both with and without snag retention, but increased on an unharvested control plot (Scott 1979). According to Schieck (pers. comm. 2000), it is thought that the birds do not use patches of residual trees within cutblocks. Indeed, even those patches that contain 800 trees may not be used. Because of the Brown Creeper's probable low versatility, Banks *et al.* (1995) recommended maintaining old spruce stands within managed landscapes.

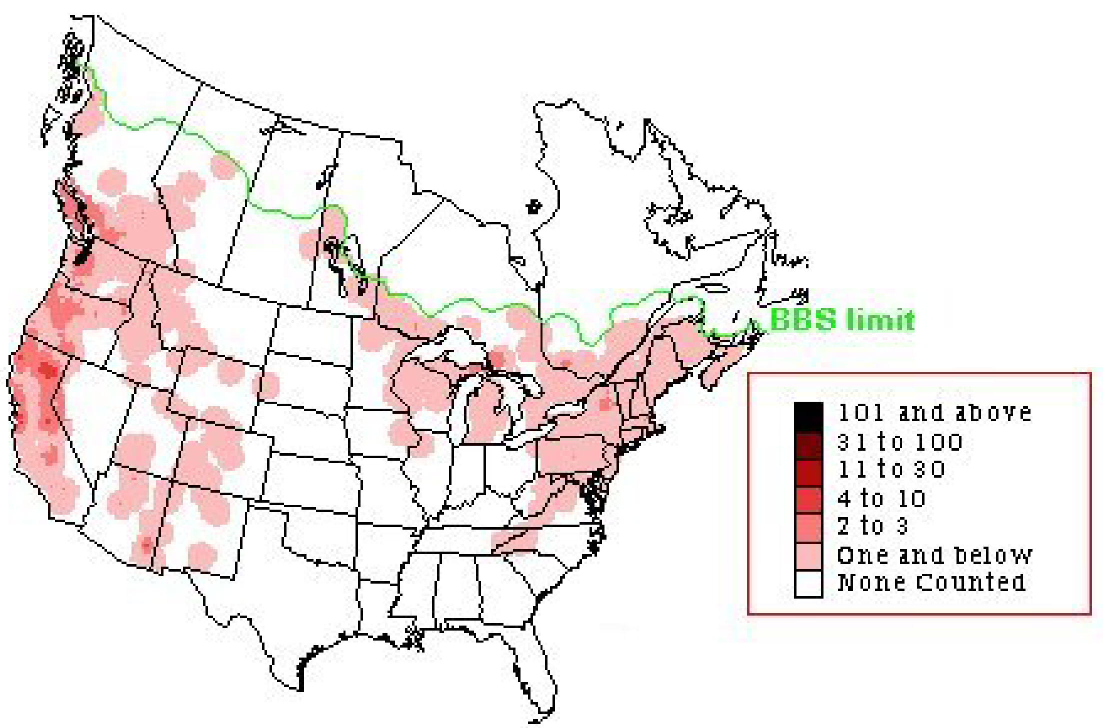

Figure 1. Breeding distribution of the Brown Creeper in North America, BBS data (Gough *et al.* 1998).

2.0 HABITAT USE INFORMATION

2.1 Food Requirements

The Brown Creeper feeds on insects and arachnids (Davis 1978; Ehrlich *et al*. 1987; Armstrong 1990) by gleaning the bark of tree trunks with its long beak (Raphael and White 1984; DeGraaf *et al*. 1985). Because trees with textured bark are likely to provide cover for more insects (Brawn *et al.* 1982; Raphael and White 1984; Adams and Morrison 1993), one can suppose that young trees, as well as aspen and poplar tree species, may be least suitable.

The bird clearly prefers to forage on large trees (Raphael and White 1984). Several sources (Raphael and White 1984; Keller and Anderson 1992; Adams and Morrison 1993) suggest that the use of large trees minimises energy expenditure as the bird can obtain sufficient food without continuously flying from tree to tree. Therefore, its presence is positively related to the density of large trees (Lundquist and Mariani 1991; Adams and Morrison 1993; Schieck and Nietfeld 1993; Hansen *et al.* 1995; McGarigal and McComb 1995). Schieck suggested that a minimum of 100 large feeding trees may be required per ha (pers. comm. 1998). Since foraging habitat suitability appears to increase with density of large trees, we assume that a density of 500 large trees or snags per ha is optimal. It is important to note that this number is simply an estimate and as additional information on Brown Creeper habitat use in Alberta becomes available, this portion of the model must be updated.

2.2 Cover Requirements

Cover

The preferred habitat of the Brown Creeper is thought to be mature to old closed-canopy coniferous-dominated forest (Godfrey 1986; Salt and Salt 1976; Mannan *et al.* 1980; Holroyd and Van Tighem 1983; Armstrong 1990; Ralph *et al.* 1991; Hansen *et al*. 1995). Studies done in forests on the west coast of the United States have suggested that Brown Creepers do not use stands younger than 60 years (Zarowitz and Manuwal 1985). Similarly, in Alberta's mixedwood forest, the species is most commonly found in old (Schieck and Nietfeld 1993) white spruce-dominated stands (Farr 1992). Small patches of appropriate habitat will likely not suffice since the birds are usually found in continuous old forest (Schieck pers. comm. 2000).

Hiding Cover

When pursued, a Brown Creeper lands on a tree trunk, flattens, spread its wings, and remains motionless (Ehrlich *et al.* 1987). Because of its cryptic plumage, this technique effectively protects it from predation. It would not function as effectively, however, on light-coloured trees like aspen, poplar, and white birch. Large trees (live or dead) are critical elements of escape cover. We speculate that stands with significant canopy closure would best provide hiding cover since the bird would be more effectively camouflaged with the bark of dark-coloured trees in forests with more shade. Therefore, we assume that a stand with a relatively closed canopy and a high density of large trees, preferably with dark-coloured bark, would be suitable as hiding cover habitat.

2.3 Reproduction Requirements

The Brown Creeper generally produces one brood of about five chicks per year (Terres 1980). Females incubate the eggs for approximately 14 days and fledglings remain in the nest for about 13 days (Ehrlich *et al.* 1987).

The birds typically nest under pulled bark, between the tree and the bark of dead or dying trees (Bradbury 1919; Salt and Salt 1976; Davis 1978; Mannan and Meslow 1984; Raphael and White 1984; Peck and James 1987; Benyus 1989; Armstrong 1990). Nests are formed of twigs, bark pieces, feathers, fibres, grasses, mosses, hair, spider webs, plant fibres, plant down, leaves, and rootlets (Bradbury 1919; Salt and Salt 1976; Peck and James 1987; Benyus 1989). Large dead or dying trees (dbh > 25cm) are thought to be preferred nesting sites (Evans and Conner 1979; Raphael and White 1984). These trees must be decayed just enough so the bark is peeling off but is still stable (Raphael and White 1984; Lundquist and Mariani 1991). Schieck recommends that at least 10, but preferably more than 100, dead or dying trees should exist per ha to provide suitable nesting conditions (pers. comm. 1998). Although some research suggests that in Alberta's mixedwood forests, Brown Creeper density may be associated with white birch density (Schieck and Nietfeld 1993), the type, size, and condition of required trees is not well known (Schieck pers. comm. 2000). As more specific information becomes available, it must be incorporated into the model.

2.4 Habitat Area Requirements

Little is known about the habitat area requirements of the Brown Creeper. In eastern England, *Certhia familiaris*, the European subspecies of the American Brown Creeper, did not breed in woodland fragments smaller than 0.11 ha (Hinsley *et al.* 1995). In Michigan, territory size ranged from 2.3 to 6.4 ha. Birds holding smaller territories engaged in more vocal defence than those with larger territories (Davis 1978). Because of the uncertainty associated with habitat area requirements of the Brown Creeper, the home range size for HSM development has been set at 7 ha, slightly larger than the largest estimate of Davis (1978).

2.5 Landscape Configuration Requirements

The European Brown Creeper's presence in woodlot fragments decreases as the distance between fragments increases (Hinsley *et al.* 1995). According to both Keller and Anderson (1992) and McGarigal and McComb (1995), its presence seems related to the percentage of preferred habitat within the surrounding area. In fact, Keller and Anderson (1992) have found that the birds may be sensitive to the presence of clearings within a 100 m radius of the nest. This finding indicates that the Brown Creeper prefers a continuous area of at least 3 ha of mature to old forest around the nest site. Similarly, Hagan *et al.* (1995) found that the probability of detecting a Brown Creeper is inversely related to the proportion of early successional habitat in a 1,000 m radius surrounding the area (314 ha).

Davis (1978) observed the bird's preference for nesting habitat in proximity to water and Terres (1980) and Peck and James (1987) stated that the animal is attracted to swamps, bogs, and beaver ponds. It is possible, however, that the attraction to wetlands is related to the frequency with which suitable habitat is found adjacent to them, instead of by the resources of wetland habitat itself.

At this time, it is believed that the birds are attracted to continuous old coniferous-dominated stands with a relatively high density of large trees and snags (Schieck pers. comm. 2000). A great deal of research is required in order to develop a more complete understanding of this species and its habitat requirements.

2.6 Sensitivity to Human Disturbance

Although the Brown Creeper is usually discrete and secluded, there is no evidence that it is sensitive to human activities that do not destroy habitat.

3.0 MODEL

3.1 Envirogram

Three elements have been identified as critical for the Brown Creeper: availability of food resources, availability of nest sites, and protection from predators (Figure 2). The variable linked to food availability is well-textured bark of large trees and snags. Bark is also an important variable for escape cover. Large dead or dying trees with peeling bark are critical as nesting sites.

3.2 Application Boundaries

Season: This model produces SI values for use during the critical breeding season.

Habitat Area: Home range size for a pair of Brown Creepers is 7 ha.

Model Output: The model assigns a SI value for foraging, hiding cover, and nesting habitat suitability to each 25 m pixel of forested habitat.

3.3 Model Description

The HSM for Brown Creeper breeding habitat follows the structure described in the envirogram (Figure 3). As each element is critical and needed at the same time for breeding habitat, no compensation is allowed between them. The SI_{food} combines density of large trees with percentage of tree cover of desired species. As both variables are required, no compensation is allowed between them. The SI_{hiding} takes into account the bird's specificity to stands with significant canopy closure and large trees with dark-coloured bark. These variables are all required components of hiding cover habitat. Therefore, there is no compensation allowed between them. The $SI_{nesting}$ considers the density of suitable large dead and dying trees. Habitat suitability declines with the presence of clearings within a 100 m radius of the potential nest site. This is accounted for in the Computation section.

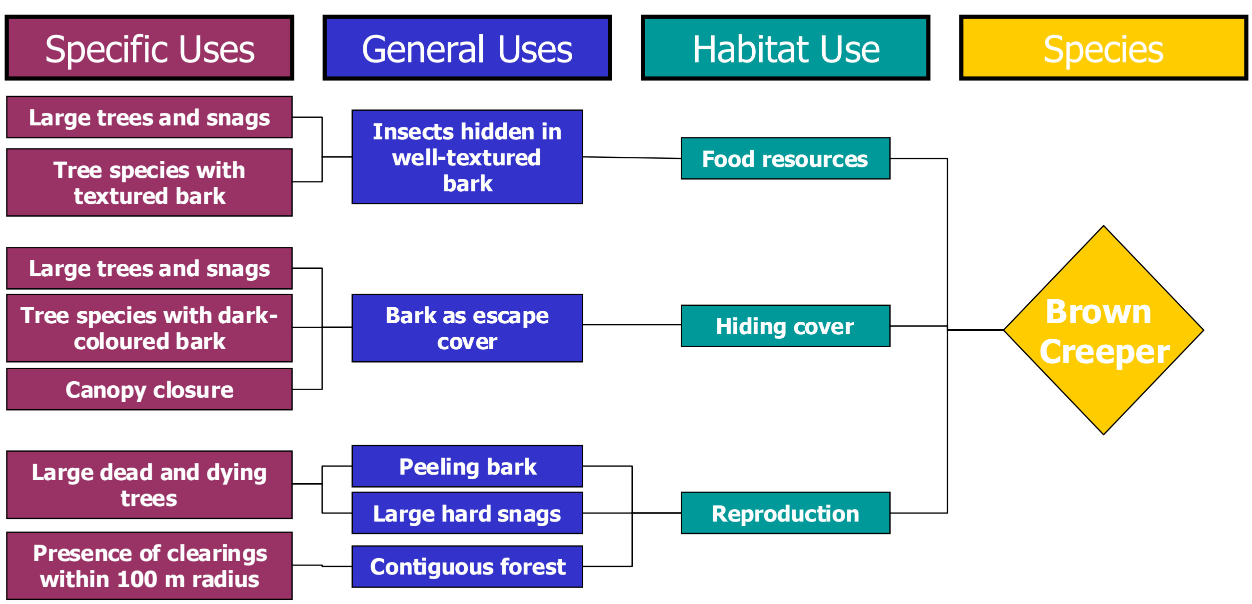

Figure 2. Envirogram of the Brown Creeper based on available habitat information for HSM development.

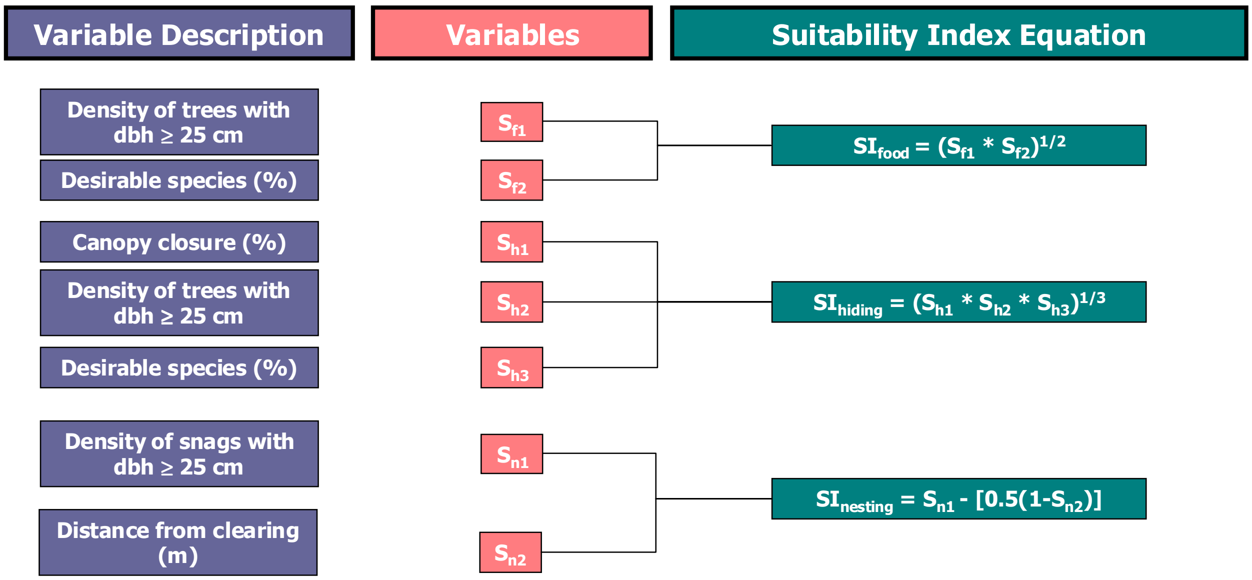

Figure 3. HSM structure for the Brown Creeper within Millar Western's FMA area.

3.4 Habitat Variable SIs

Food

The first variable included to ensure adequate feeding habitat for Brown Creepers is S_{f1}, the density of trees (living and dead) with dbh at least 25 cm. It is assumed that suitability increases linearly with density after a minimum of 100 stems per ha and reaches a maximum at 500 stems per ha (Figure 4). The second variable, S_{f2}, relates to the proportion of desirable tree species within the stand (Figure 5). The HSM assumes that suitability increases linearly to a maximum at 80% representation of desirable species (Figure 5).

Hiding Cover

As this species relies on its cryptic plumage to escape from predators, dark shades in closed stands probably make it more difficult to distinguish while it is hiding. Hiding cover suitability variable, S_{h1}, is, therefore, canopy closure. A stand becomes suitable with canopy closure greater than 20% (Figure 6). Maximum suitability is reached at 80% cover. Hiding cover habitat suitability increases with density of large trees and snags, S_{h2}, as shown in Figure 4. Tree species desirable as hiding cover include those with dark-coloured bark, S_{h3}. A stand is considered optimal at 80% representation of desirable trees (Figure 7).

Nesting

The Brown Creeper uses dead or dying trees with peeling bark as nesting sites. Suitability of the variable S_{n1}, the density of large dead and dying trees, increases linearly with density to a maximum at 100 dead and dying trees per ha (Figure 8). As shown in Figure 9, suitability increases linearly with distance from clearings to a maximum rating at 100 m (S_{n2}).

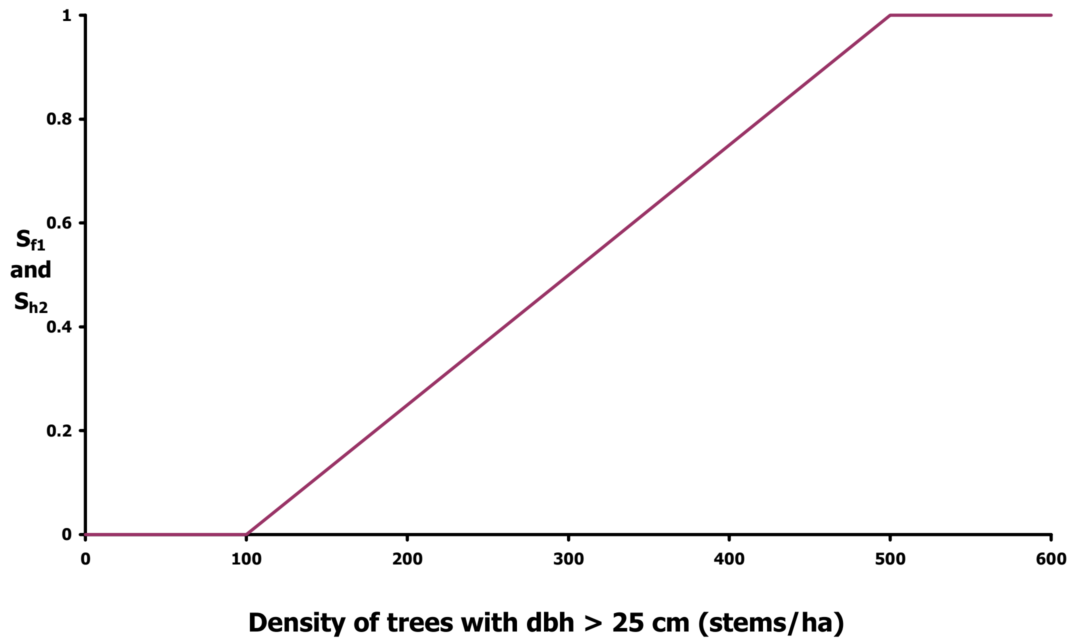

Figure 4. Brown Creeper feeding habitat suitability in relation to stem density (dbh > 25 cm) within Millar Western's FMA area.

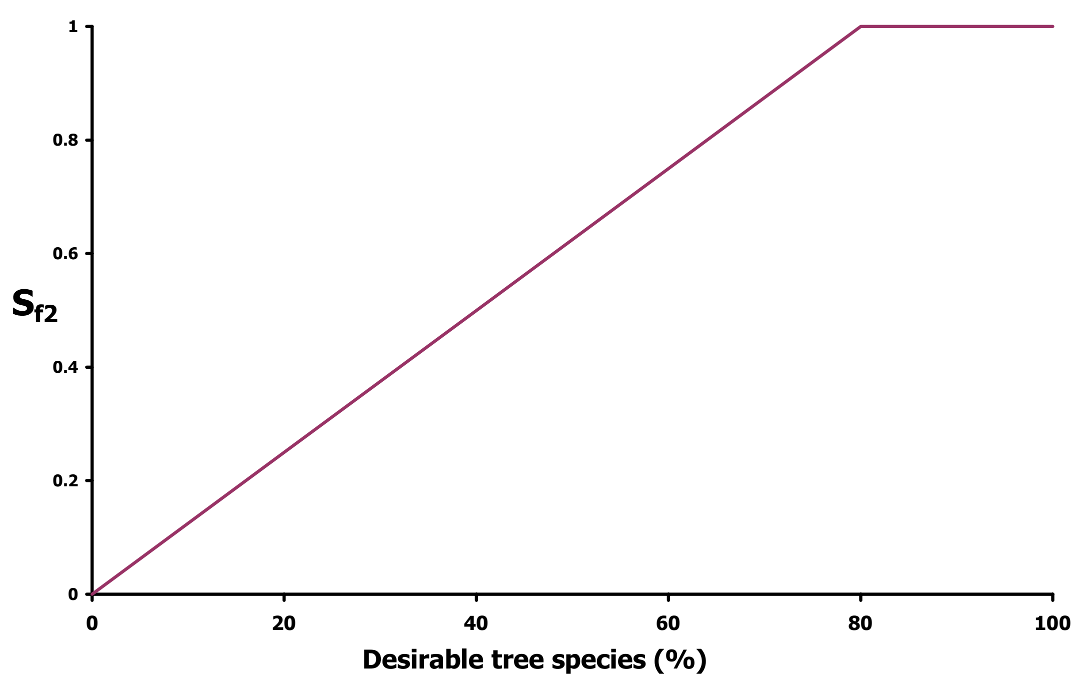

Figure 5. Brown Creeper habitat suitability in relation to tree species composition within Millar Western's FMA area. Weight: white spruce, black spruce, fir, and larch = 1, pine and birch = 0.5, aspen and poplar = 0.1.

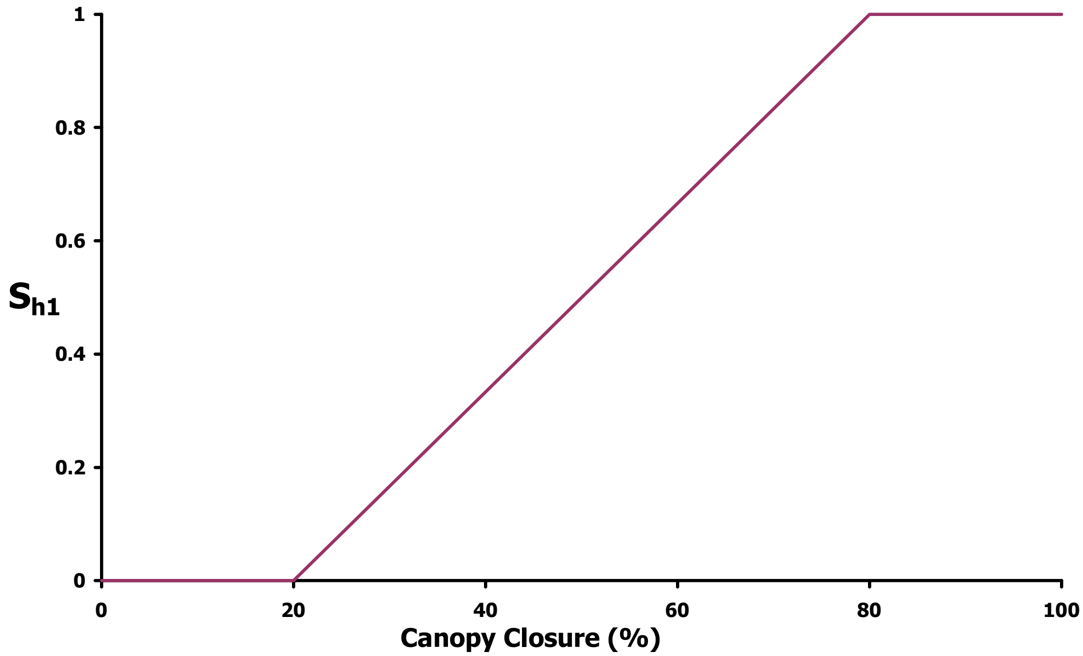

Figure 6. Brown Creeper cover habitat suitability within relation to canopy closure in Millar Western's FMA area.

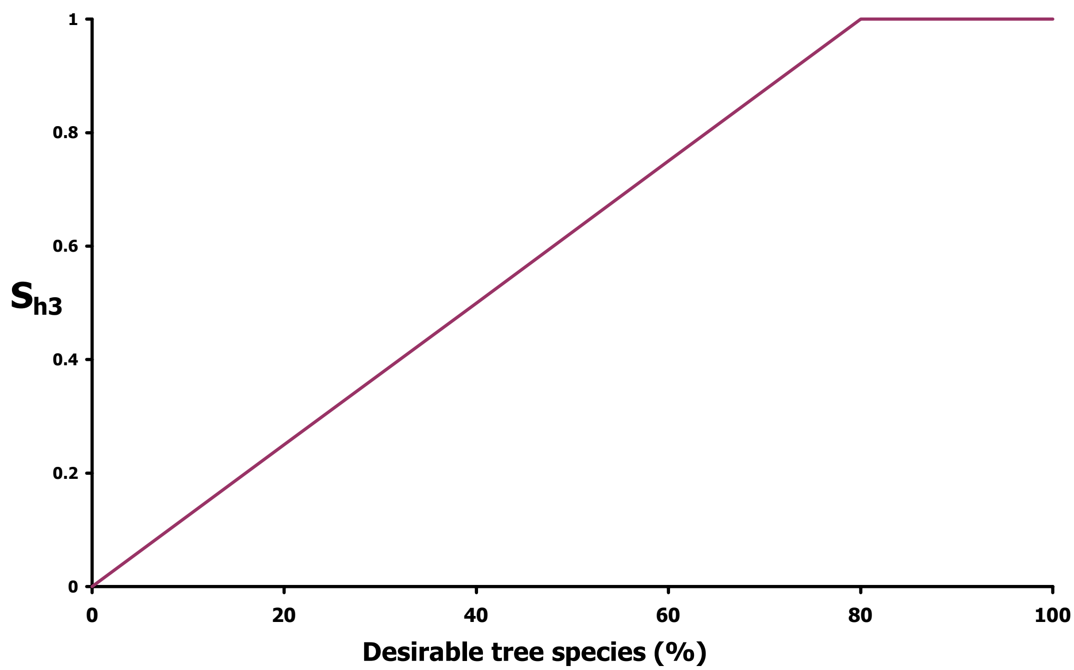

Figure 7. Brown Creeper habitat suitability in relation to tree species composition within Millar Western's FMA area. Weight: white spruce, black spruce, fir, and pine = 1, aspen, poplar, white birch, and larch = 0.1.

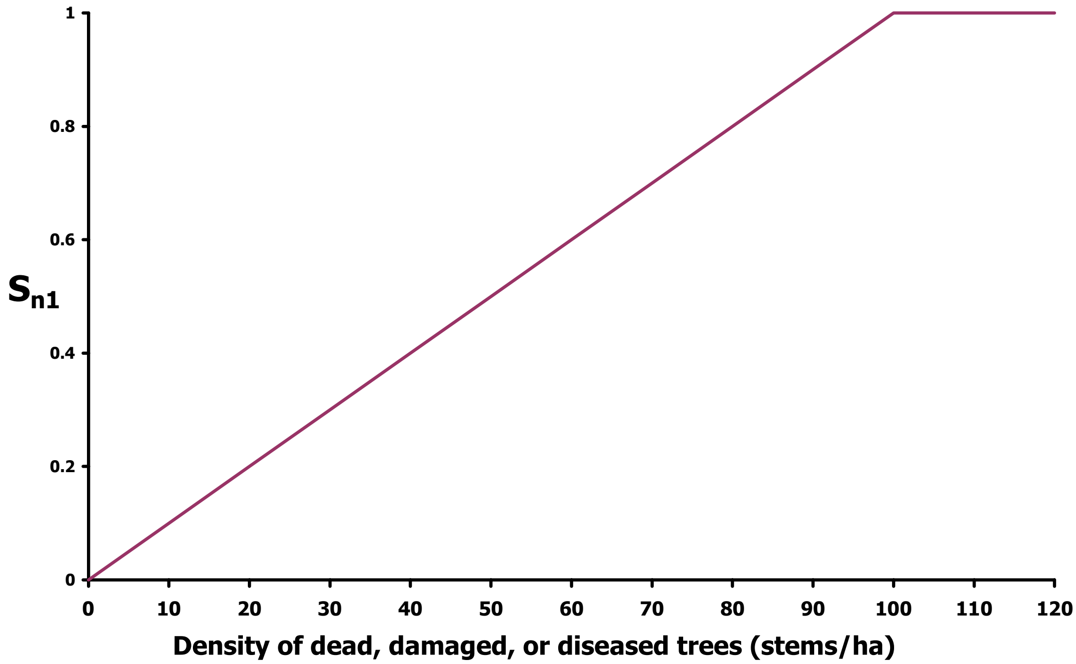

Figure 8. Brown Creeper nesting habitat suitability in relation to density of dead, damaged, and diseased trees within Millar Western's FMA area.

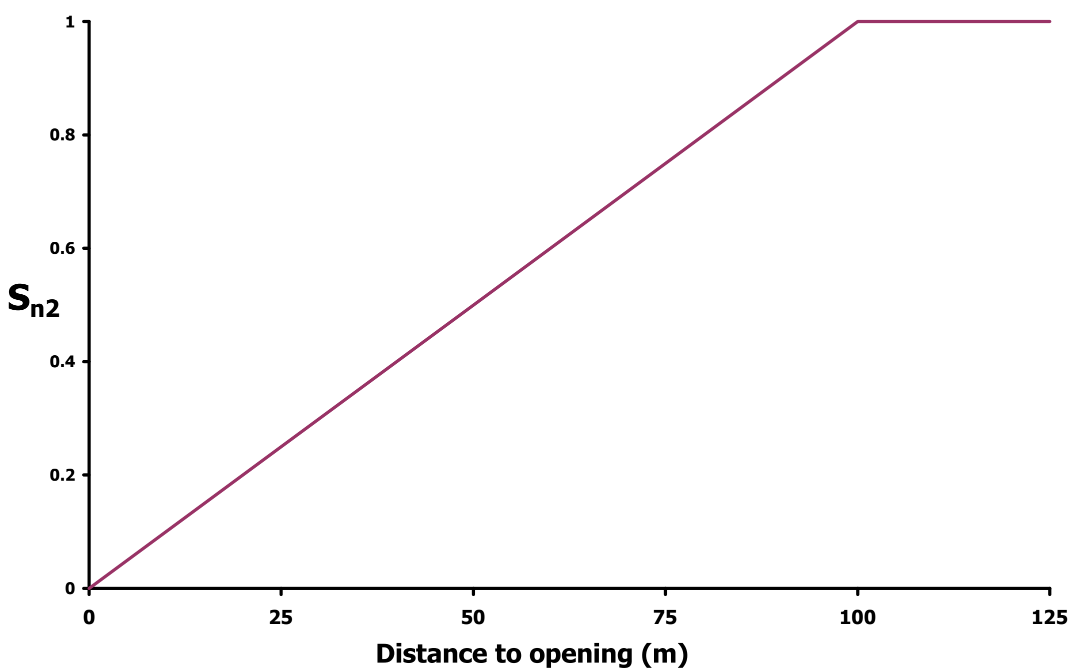

Figure 9. Brown Creeper nesting habitat suitability in relation to distance to clearings within Millar Western's FMA area.

3.5 Computation

Our goal is to create HSMs that allow the user to identify the potential impacts of proposed forest management strategies on foraging, hiding cover, and nesting habitats. Therefore, the outputs of the SI_{food}, SI_{hiding}, and SI_{nest} calculations are considered individually to display trends in habitat availability.

Foraging Habitat Index

The value of each pixel of forested habitat as a foraging zone is first assessed. This calculation involves two variables and is accomplished using the following equation:

$$\mathbf{SI_{food} = (S_{f1} * S_{f2})^{1/2}}$$

Hiding Cover Habitat Index

The capability of the forest to provide hiding cover for the Brown Creeper is evaluated by the calculation:

$$\mathbf{SI_{hiding} = (S_{h1} * S_{h2} * S_{h3})^{1/3}}$$

Nesting Habitat Index

Distance from clearings is assessed by buffering all natural (including barren and scattered land, muskegs, scrublands, meadows, and marshes) and anthropogenic (including farms, burns, clearcuts, and clearings to a distance of 100 m). All pixels that fall within the buffers are given suitability ratings according to the distance dependent relationship in Figure 9. All pixels outside the buffers receive suitability ratings of 1. The potential for each pixel to provide nesting habitat for the Brown Creeper is assessed using the simple equation:

$$\mathbf{SI_{nesting} = S_{n1} - [0.5\ (1 - S_{n2})];}$$

$$\mathbf{where\ SI_{nesting} \geq 0.}$$

Home Range Smoothing

A home range size of 7 ha is considered suitable for a pair of Brown Creepers. To assess the suitability of a potential home range, a circle of radius 150 m (7.1 ha) moves over the grid representing Millar Western's FMA area with each pixel, in turn, acting as its centre. The SI_{food} values of each pixel within the circle are averaged. The average number is recorded as the SI_{food} for the pixel at the centre of the circle. Similarly, the ratings for both SI_{hiding} and $SI_{nesting}$ within the circle are averaged and these average numbers are recorded as the SI_{hiding} and $SI_{nesting}$ for the centre pixel.

4.0 EXTERNAL REVISION

Jim Schieck, wildlife ecologist working with the Forest Resources Alberta Research Council (Vegreville, AB), reviewed the Brown Creeper HSM. We made the following changes from the original version of the document:

1) Migration status: probably more a short distance migrant in west-central Alberta.

2) Large trees density: a minimum of 100-200/ha is considered very marginal to provide enough food for a breeding pair. The shape of the relationship for S_{f1} has been changed to reflect this limitation.

3) Optimal nest requirements have been underestimated. Snag bark cover and snag (dbh > 25 cm) density should be much higher. Jim Schieck proposed to have the optimal nesting suitability for Brown Creeper at 100 to 200 dead or dying trees (dbh > 25 cm) per ha. This is about 100 times what we had set for this variable.

4) Jim Schieck does not believe that canopy gaps are preferred. In fact, even if the Brown Creeper seems to use sunflecks to get rid of parasites, this might not be an essential condition of the cover. We agree that canopy gaps are usually associated with snags and the relationship with the Brown Creeper abundance is probably not causal but more correlational. Therefore, as proposed by Schieck, we have made the line horizontal between 80 and 100% in S_{h1}.

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