BARRED OWL

(Strix varia)

Source: Salt and Salt (1976)

Prepared for Millar Western Forest Products'
Biodiversity Assessment Project

Prepared by:

Doyon, F., P.E. Higgelke and H.L. MacLeod

KBM Forestry Consultants Inc.
Thunder Bay, Ontario

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1.0 INTRODUCTION

The Barred Owl (*Strix varia*) is named for the striped pattern of dark feathers on the white background of its lower body. It is a nocturnal species (MFWMP 1994) and is observed as a year-round resident of the boreal and montane forests in western Alberta and the boreal forests in central and eastern Alberta (Figure 1). It is thought to be absent, however, in the northernmost part of the province (Allen 1987).

Though one of the most common owls of North America (Boxall and Stepney 1982; Boxall 1986), it is considered by some to be very rare in Alberta (Boxall 1986; Semenchuk 1992; MFWMP 1994; Takats pers. comm. 1999). Possibly because of its rarity, little detailed information on Barred Owl forage and roost requirements has been collected in Alberta. Sightings have been recorded within Millar Western's FMA area and a nest box program was established in early 1997 to monitor the population. Pineau (pers. comm. 1999) established the nest box program and believes that these owls are still not as abundant in westcentral Alberta as they are in the rest of their range.

The Barred Owl has been selected as a management indicator species in some National Forests of the United States (McGarigal and Fraser 1984). This designation would also be logical in Canada since it is an easily monitored carnivore that is present across the country year-round. In addition, its supposed specific habitat requirements for closed canopy mature and overmature forest also give it potential as a bioindicator (McGarigal and Fraser 1984; Derleth *et al*. 1989; James 1993).

In Alberta, the Barred Owl has been placed on the Yellow B list. Yellow listed species are considered sensitive though not currently at risk of extirpation (Alberta Environmental Protection 1996). The Barred Owl's placement on the list is a consequence of its naturally rare status (there are thought to be less than 1,000 breeding pairs in the province), its tendency for clumped breeding distribution, and its association with habitat elements that warrant special attention in forest management planning (Takats pers. comm. 1999).

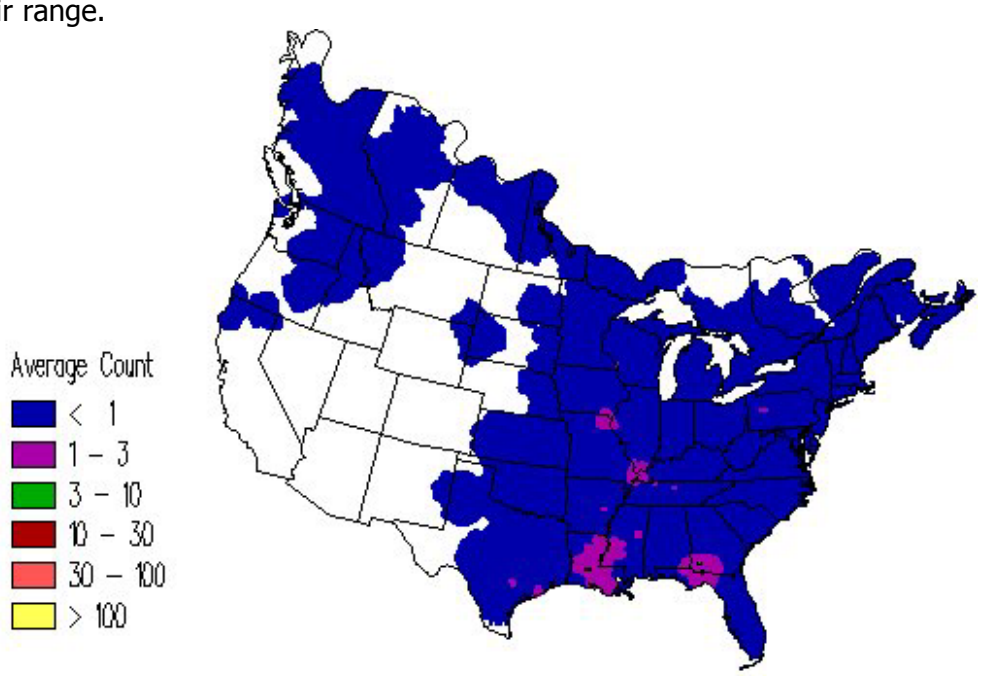

Figure 1. Winter distribution of the Barred Owl in North America, CBC data (Gough *et al.* 1998).

2.0 HABITAT USE INFORMATION

2.1 Food Requirements

The Barred Owl feeds opportunistically on a variety of prey including small mammals (mice, voles, hares, shrews, chipmunks, bats, squirrels), birds (passerines, woodpeckers, jays, robins, grouse), amphibians, reptiles, crustaceans, fish, and insects (Devereux and Mosher 1984; Bosakowski *et al*. 1987; Ehrlich *et al*. 1987; DeGraaf and Rudis 1992; Semenchuk 1992; Olsen *et al.* 1995; James 1996; Takats 1998). It is considered a feeding generalist (MFWMP 1994) as it is known to consume any animal that it is able to catch (Johnsgard 1988; Mazur pers. comm. 1999). Research suggests, however, that it may preferentially select representatives of the genus *Microtus* at certain times (Marks *et al*. 1984; Bosakowski *et al*. 1987; Elderkin 1987). It is not known if the owls actually prefer these animals as prey items or if they simply ingest more of them because they are plentiful in their chosen habitat (Mazur pers. comm. 1999). The experience of Takats (pers. comm. 1999) has suggested that some pairs of Barred Owls will specialise on a particular locally abundant food item.

As a ground hawker (DeGraaf *et al*. 1985), the Barred Owl watches its prey from a perch 5 to 6 m above the ground (Fuller *et al.* 1974; Takats 1996; Takats 1998) and swoops down to capture it (DeGraaf and Rudis 1992). Prey is more vulnerable to Barred Owl attack where understorey is of low density (Nicholls and Warner 1972; Elody 1983; Devereux and Mosher 1984) as the birds are provided with ample subcanopy flying space (McGarigal and Fraser 1984; James 1996). Therefore, though a relatively thick shrub layer probably provides better habitat for prey, it may impede access for the owls (Van Ael 1996). While thick understorey is not beneficial, dry leaf litter is thought to facilitate prey detection since the sound of rustling leaves alerts the owl to their presence (Van Ael 1996). Desirable habitat features are commonly present in mature mixedwood forests with large trees (MFWMP 1994). In particular, Barred Owls in the Foothills Model Forest of Alberta seem to select balsam poplar, trembling aspen, and white spruce stands as foraging habitat (Takats 1998).

Since Barred Owls consume aquatic organisms, drink water, and bathe regularly yearround (MFWMP 1994), they are frequently found in association with wetland habitats (Fuller 1979; Elody 1983). In particular, water bodies or wetlands surrounded by woodlands are important as foraging grounds (Dunstan and Sample 1972; Nicholls and Warner 1972; Soucy 1976; Francis and Lumbis 1979; Bosakowski *et al*. 1987; DeGraaf and Rudis 1992). Takats (pers. comm. 1999) suggested that the attraction to wet areas may be partly explained by the presence of large trees for nesting and the abundant food supply available.

Although the Barred Owl usually hunts at night, it may also take prey during the day (Johnsgard 1988). Highly territorial Barred Owls may alter traditional ranges in times of food shortage (DeGraaf and Rudis 1992). It has been observed that home range size is several times greater during winter than summer (Mazur *et al*. 1998) likely due to reduced prey availability.

2.2 Cover Requirements

Research indicates that Barred Owls inhabit mature to overmature stands (Dunstan and Sample 1972; Nicholls and Warner 1972; McGarigal and Fraser 1984; Devereux and Mosher 1984; Sutton and Sutton 1985; Bosakowski *et al*. 1987; Derleth *et al.* 1989; Benyus *et al*. 1992; Van Ael 1996; Mazur *et al*. 1997; Mazur *et al*. 1998a; Takats 1998) and work in the boreal region suggests that mixedwood forests are the preferred habitat type (Smith 1978; Tyler and Philips 1978;

Elody and Sloan 1985; Olsen *et al*. 1995; Van Ael 1996; Mazur *et al*. 1997; Mazur *et al*. 1998a). In Alberta, mixedwood forests of white spruce, aspen, and poplar are used most often (Takats 1996; Takats 1998). Older mixedwoods are thought to supply abundant prey resources (James 1996), provide access to numerous suitable nesting cavities, and offer a range of roost site conditions for protection from inclement weather and predators (MFWMP 1994; Mazur *et al.* 1998a). In addition, the presence of some coniferous trees within the stand offers year-round protection from the elements. In fact, Takats (pers. comm. 1999) has actually observed three owls move directly to coniferous cover as it began to rain.

Barred Owls require large tracts of mature to old forest to satisfy their life requisites (Elody 1983; Devereux and Mosher 1984; Elody and Sloan 1985; Bosakowski *et al.* 1987). Appropriate cover is found in stands with canopy closure between 50% and 80% (though those with > 30% cover may be used) and with trees of height greater than 20 m (Takats 1998).

As the Great Horned Owl is an important predator of the Barred Owl, it is detrimental for the Barred Owl to interact with it. The Great Horned Owl nests and forages preferentially in large clearings (> 5 ha). It is thought that the Barred Owl's aversion to large clearings is related to reduction of predation pressure (Bosakowski *et al.* 1987; Takats 1998).

2.3 Reproduction Requirements

The Barred Owl nests most often in natural tree cavities (Johnsgard 1988; Mazur *et al.* 1998). In fact, of 47 Barred Owl nests found by Takats (1999), 37 were in cavities. Alternatively, the owl may select the abandoned nest of a squirrel or large bird, such as a hawk or a raven, and may even nest on the ground (Peck and James 1983; Godfrey 1986; Ehrlich *et al*. 1987). The wood of damaged, diseased, or dead trees is commonly of the appropriate consistency for cavity development (MFWMP 1994). Thus, natural cavities are most likely to develop in trees with a suitable degree of decay. Similarly, primary cavity nesters commonly excavate nests in relatively decayed trees. These cavities may subsequently be used by Barred Owls.

Two to four eggs are laid in March or April and only one brood is produced per year (Murray 1976; DeGraaf and Rudis 1992). The female incubates the eggs continuously for 28 to 33 days while the male feeds her (Elderkin 1987). Although the young first attempt flight at six weeks of age, they are dependent on their parents for food for the first four months of life (Bent 1938).

According to Olsen *et al*. (1995), the stand characteristic most important to habitat selection is the presence of suitable nest trees. In fact, the availability of nesting sites is thought to limit the population size of the Barred Owl (Elderkin 1987; MFWMP 1994) since nest boxes tend to be occupied fairly quickly once installed. The Barred Owl requires several nest sites within its home range as it may move to a new nest each year (Takats pers. comm. 1999). It may elect to shift nest sites if nest failure occurred in the previous year. Alternatively, moving periodically to new nests may be an adaptation to reduce predation pressure by Marten and Fisher (Mazur *et al*. 1998). Data collected in Saskatachewan have revealed that nest sites are chosen based on tree height and diameter. All other habitat variables in this study were found not to influence nest site selection (Mazur pers. comm. 1999).

Several authors have stated that optimal nesting sites occur in large *Populus* spp. or spruce trees (Mazur *et al*. 1998) of dbh > 40 cm (Thomas *et al.* 1979; Devereux and Mosher 1984; James 1996) and of height > 8 m (Dunstan and Sample 1972). Research by Takats (1998) has shown that most suitable nest sites exist in poplar trees of dbh greater than 60 cm and height greater than 20 m within the mixedwood stands of the Foothills Model Forest in Alberta. According to

Semenchuk (1992) and Mazur *et al.* (1998b), mature and overmature mixedwood stands tend to provide the large deciduous trees necessary for nesting.

2.4 Habitat Area Requirements

The Barred Owl is highly territorial and actively protects its range against conspecific intrusion (Nicholls and Fuller 1987; Johnsgard 1988; Olsen *et al.* 1995). Its home range boundaries remain relatively constant over time (Nicholls and Fuller 1987). The young must acquire their own home range for use during their first winter since the parents keep their territory (Bent 1938; Basakowski *et al*. 1987).

Barred Owl territory size varies regionally. Recorded breeding territories range from 149 to 363 ha and year-round territories may encompass an area of 655 to 1,700 ha (Nicholls and Warner 1972; Fuller 1979; Elody 1983; Elody and Sloan 1985; Nicholls and Fuller 1987; Hamer 1988; Mazur *et al.* 1998). It has been suggested that at least 500 ha of suitable habitat are required for a pair of Barred Owls to establish a territory (MFWMP 1994).

2.5 Landscape Configuration Requirements

Several authors have suggested that Barred Owls prefer remote mature or overmature forest and avoid large (> 5 ha) clearings (Oeming 1955; Bosakowski *et al.* 1987; Takats 1998). Proximity to small clearings may not be detrimental to the owls, however. In fact, Devereux and Mosher (1984) found that nests were nearer to this sort of edge than randomly expected. Nest trees have been found as close as 25 m to all-weather roads (Mazur *et al*. 1998). This is probably due to the enhanced foraging opportunities enjoyed along the open flyways of thin clearings.

Several authors agree that mature forest in proximity to a wetland is valuable Barred Owl habitat (Eckert 1974; Francis and Lumbis 1979; Sutton and Sutton 1985; DeGraaf and Rudis 1992). This association is probably due to the abundance and diversity of prey and the presence of large old trees at the interface between these habitat types (Takats pers. comm. 1999).

Barred Owls tend to remain within 300 m of cover while foraging and avoid entering large openings where they are more vulnerable to predation by Great Horned Owls (Bosakowski *et al.* 1987; Takats 1998).

2.6 Sensitivity to Human Disturbance

The Barred Owl is not attracted to human habitations (Smith 1978; Sutton and Sutton 1985; Bosakowski *et al.* 1987). In general, large tracts of mature mixedwood forests not inhabited by Barred Owls are significantly influenced by human activity (Takats 1995). The birds can be found in areas where limited human use (e.g. horseback-riding, skiing, hiking) occurs or near train tracks and roads of low traffic intensity (Takats pers. comm. 1999).

3.0 MODEL

3.1 Envirogram

Three elements have been identified as critical for the Barred Owl: food supply, nesting opportunities, and protection from inclement environmental conditions and predators (Figure 2). Foraging habitat suitability is dependent on prey density, which, in turn, is related to prey habitat suitability. However, if the sub-canopy structure is unsuitable for manoeuvring, the success of capture will be low and habitat will not fulfil the food requirement, even where prey density is sufficient. In addition, proximity to water bodies or wetlands is thought to be a habitat characteristic beneficial to Barred Owls and proximity to thin clearings may improve capture success. Since the sound of displaced dry deciduous leaf litter alerts the owl to the presence of prey, some deciduous representation is thought to be beneficial.

The Barred Owl will seek habitat with relatively closed canopy cover and some coniferous representation as shelter from inclement weather conditions. Barred Owls prefer continuous forest as it is less likely to support Great Horned Owls, further reducing the risk of predation.

Nesting habitat suitability depends on the presence of tall, large diameter trees of suitable species. In particular, Barred Owls prefer to nest in aspen, poplar, or white spruce trees of dbh > 60 cm and height > 20 m though those > 40 cm dbh and > 8 m height may suffice.

3.2 Application Boundaries

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

Habitat Area: Based on Mazur *et al.* (1998a), a home range size of 150 ha was used to represent a breeding range.

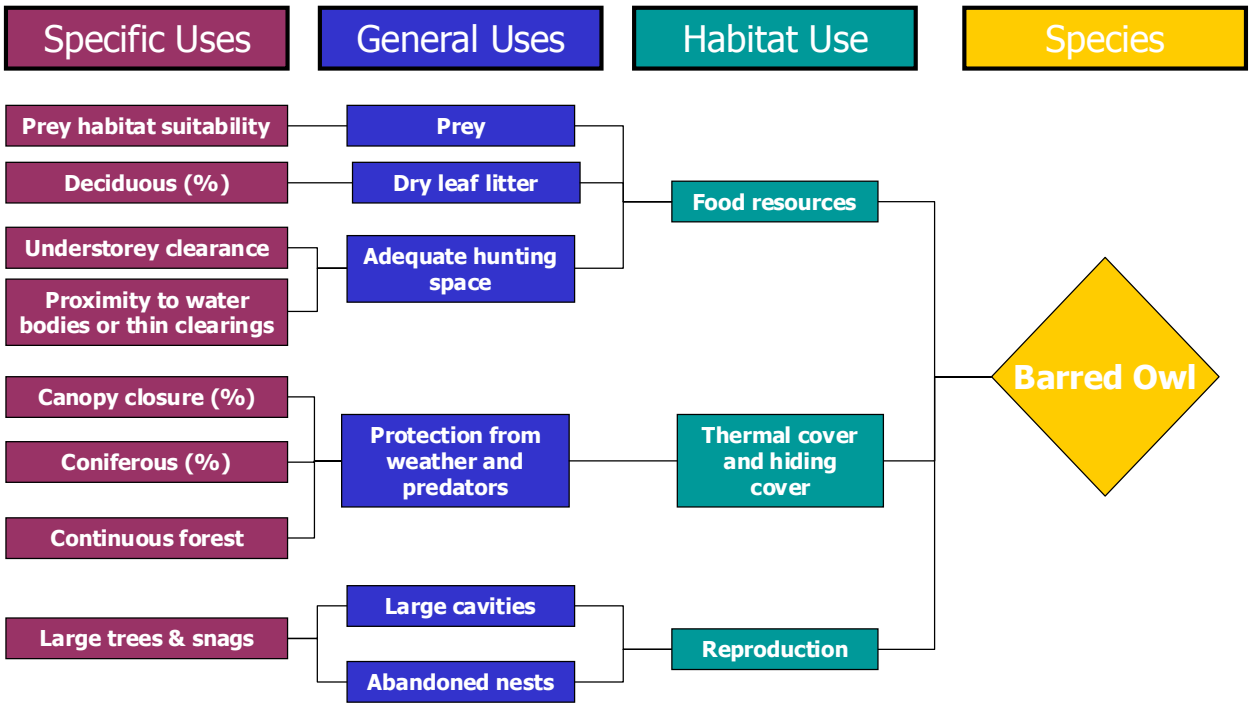

Figure 2. Envirogram for the Barred Owl based on available habitat information for HSM development.

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

3.3 Model Description

The HSM structure is based on the envirogram (Figure 3). The SI_{food} is driven by prey capture success, proximity to water bodies or wetlands, and proximity to narrow clearings. Since Barred Owls take variable species as prey, it can be assumed that prey will be available in any chosen habitat type. Prey capture success is maximised in stands with relatively clear flyways and with some deciduous representation. An indication of the flight impedance due to habitat complexity is taken from the free-to-manoeuvre flying space index. Therefore, the variables, flying space and % deciduous, quantify the owls' ability to capture prey in a given habitat type. In addition, it is thought that the birds have better access to foraging habitat in areas proximate to water bodies, wetlands, or thin clearings such as tertiary roads, trails, or seismic and utility lines. As well, in the Computation section, the importance of proximity to cover habitat is incorporated into the model for foraging habitat suitability.

The cover SI takes into account the canopy closure and the percentage of coniferous trees in the stand. As well, in the Computation section, the value of cover habitat in proximity to foraging habitat is taken into account.

The $SI_{nesting}$ is dependent on the density of suitable nest trees. Large (dbh > 60 cm and height > 20 m) aspen, poplar, and white spruce trees are considered suitable for nesting. Several suitable nest trees should be available per ha since the owls may elect to switch nest sites each year. We assume that an appropriate number of large nest trees are readily available in old hardwood, old hardwood-dominated mixedwood, and old white spruce

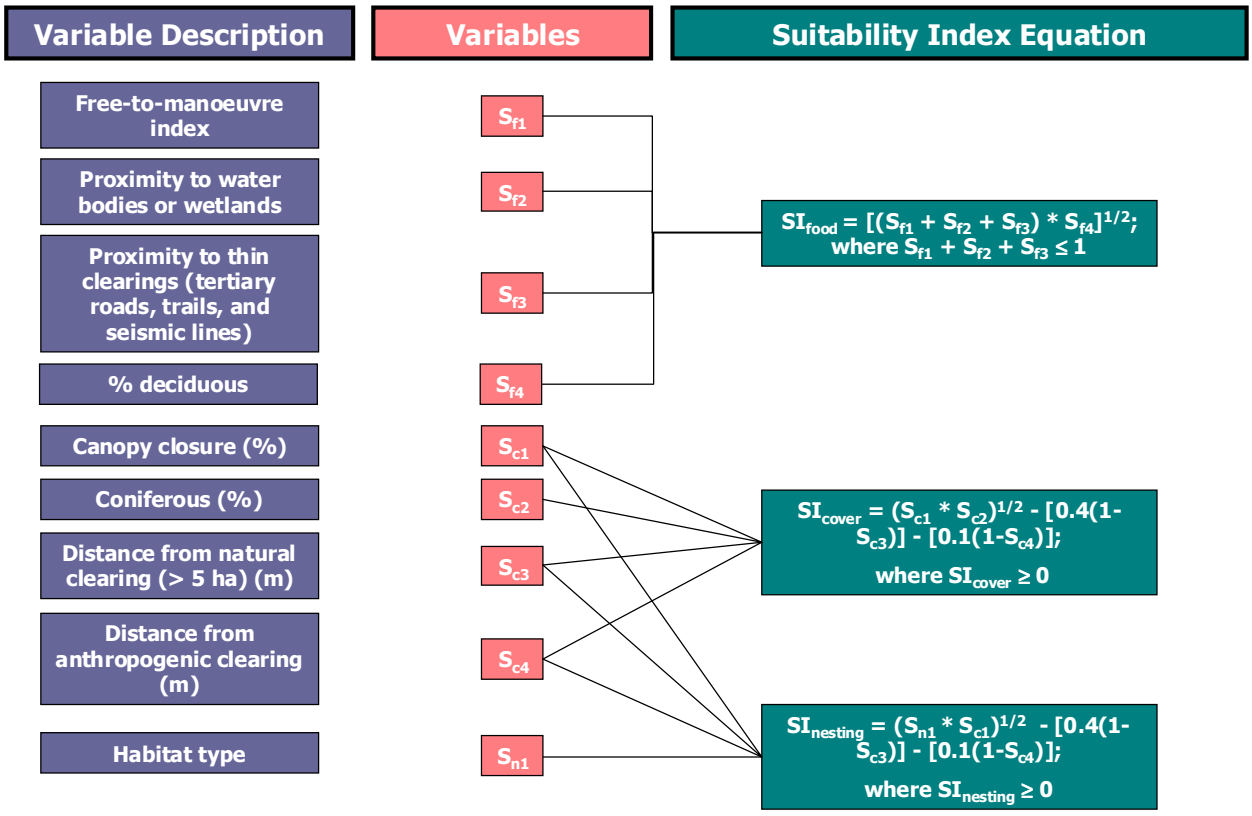

Figure 3. HSM structure for the Barred Owl within Millar Western's FMA area.

stands. It is possible that these trees may also be found in mature hardwood, mature hardwood-dominated mixedwood, mature white spruce, and old softwood-dominated mixedwood forests. Cover habitat suitability is also influenced by proximity to well-used anthropogenic or large (> 5 ha) natural clearings since the animals are subjected to the negative impacts of contact with humans and Great Horned Owls. In addition, canopy closure is considered in this SI.

3.4 Habitat Variable SIs

Food

S_{f1} indicates that the free-to-manoeuvre flying space index is optimal in relatively clear understoreys. The owls may be able to function in obstructed understoreys but will not forage efficiently in those that could be described as entangled (Figure 4). It is thought to be beneficial for Barred Owls to be within 300 m of a water body or wetland (S_{f2}) as these habitat types offer valuable foraging opportunities (Figure 5). As well, it is thought that foraging opportunities are enhanced within 100 m of tertiary roads, trails, and seismic and utility lines (Figure 6). Deciduous representation of at least 30% is considered optimal (Figure 7).

Cover

A stand must have at least 30% canopy cover, S_{c1}, to be useful to the Barred Owl. Suitability increases linearly to a maximum value at 50% closure (Figure 8). In stands with more than 80% cover, suitability again declines to a rating of 0 at 90%. We expect that an owl can use a stand with at least 10% coniferous trees, S_{c2}. Suitability increases linearly to a maximum value at 30% (Figure 9). However, since optimal cover conditions exist if some hardwoods are present, suitability drops off with coniferous representation of 70%. The suitability ratings of S_{c3}, distance to large natural openings, and S_{c4}, distance to human-created openings (anthropogenic non-vegetated land as described in the AVI), decrease with proximity to an opening. The negative impact of proximity to natural clearings is thought to be minimal at distances greater than 200 m (Figure 10) and that of anthropogenic clearings at distances greater than 100 m (Figure 11).

Proximity

Barred Owls are thought to move up to 300 m from cover to forage. The suitability of habitat, therefore, changes with proximity of food and cover resources (Figure 12).

Nesting

It is thought that suitable nesting opportunities more are readily available in some habitat types than others. Suitability ratings for variable S_{n1} are shown by habitat type in Table 1.

Table 1. Nesting habitat suitability rating,, by habitat type.

		Opening	Developing		Forest		Old
Broad	Specific	Clearcut & Burns	Regenerating	Young	Immature	Mature	Old
Hardwoods	Aspen					.5	1
	Poplar					.5	1
	White birch					.5	1
Hardwood Mixed	Aspen-Pine					.5	1
	Aspen-White spruce					.5	1
	Aspen-Black spruce					.5	1
	Poplar-Pine					.5	1
	Poplar-White spruce					.5	1
	Poplar-Black spruce					.5	1
Softwood Mixed	Pine-Poplar						.5
	Pine-Aspen						.5
	White spruce-Poplar						.5
	White spruce-Aspen						.5
	Black spruce-Poplar						.5
	Black spruce-Aspen						.5
Conifers	Pine						
	White spruce					.5	1
	Black spruce						
	Larch						

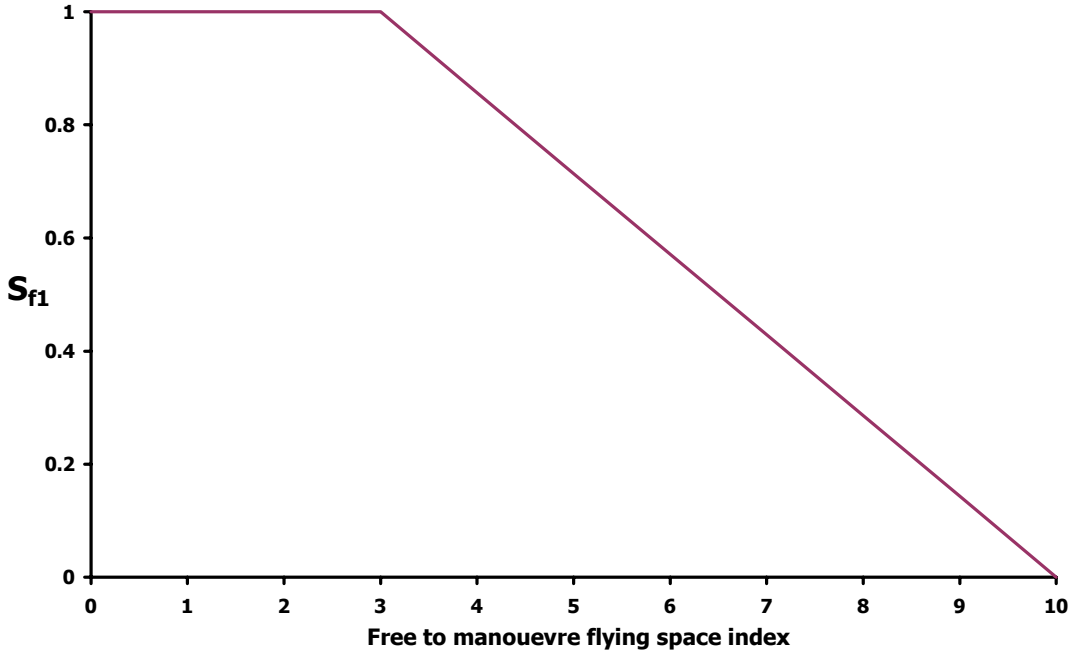

Figure 4. Barred Owl foraging habitat suitability in relation to flying space within Millar Western's FMA area.

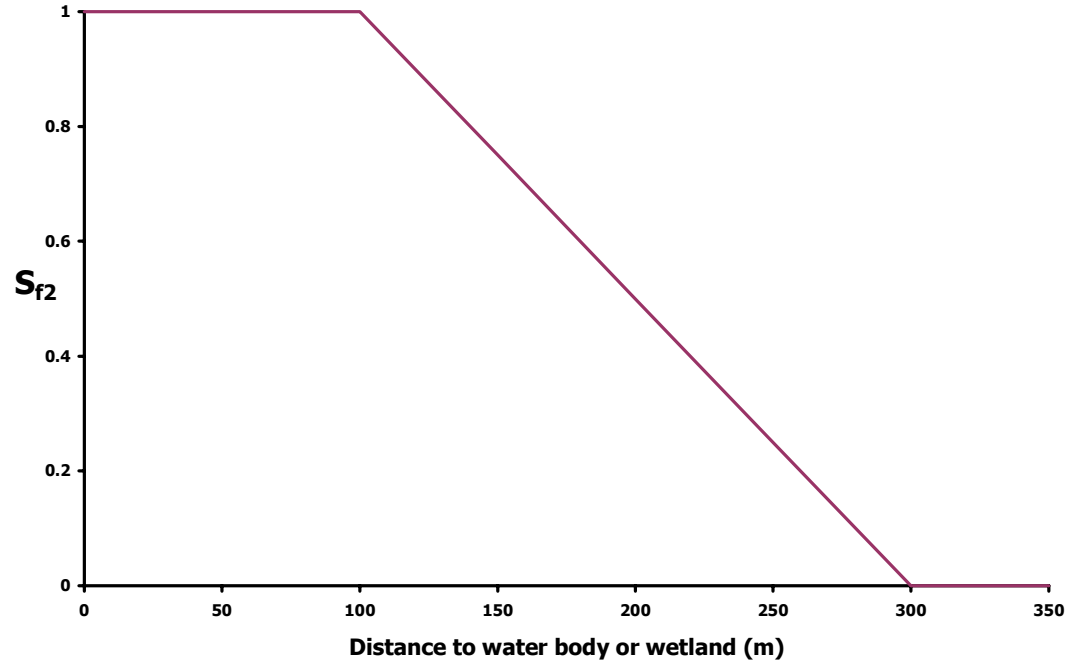

Figure 5. Barred Owl foraging habitat suitability in relation to proximity to water bodies or wetlands within Millar Western's FMA area.

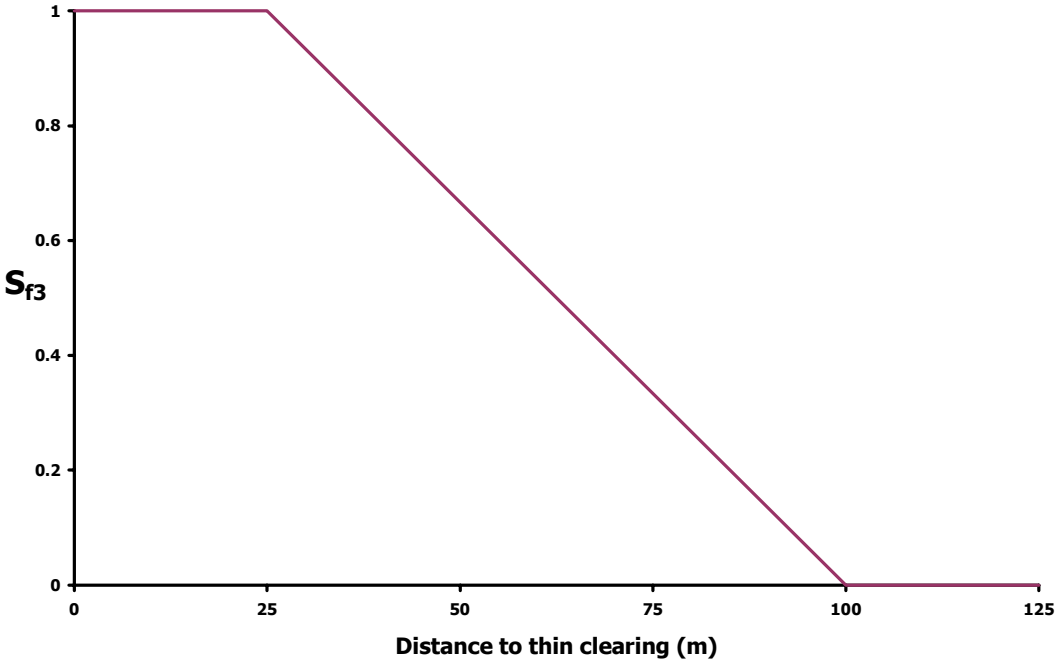

Figure 6. Barred Owl foraging habitat suitability in relation to proximity to thin clearings within Millar Western's FMA area.

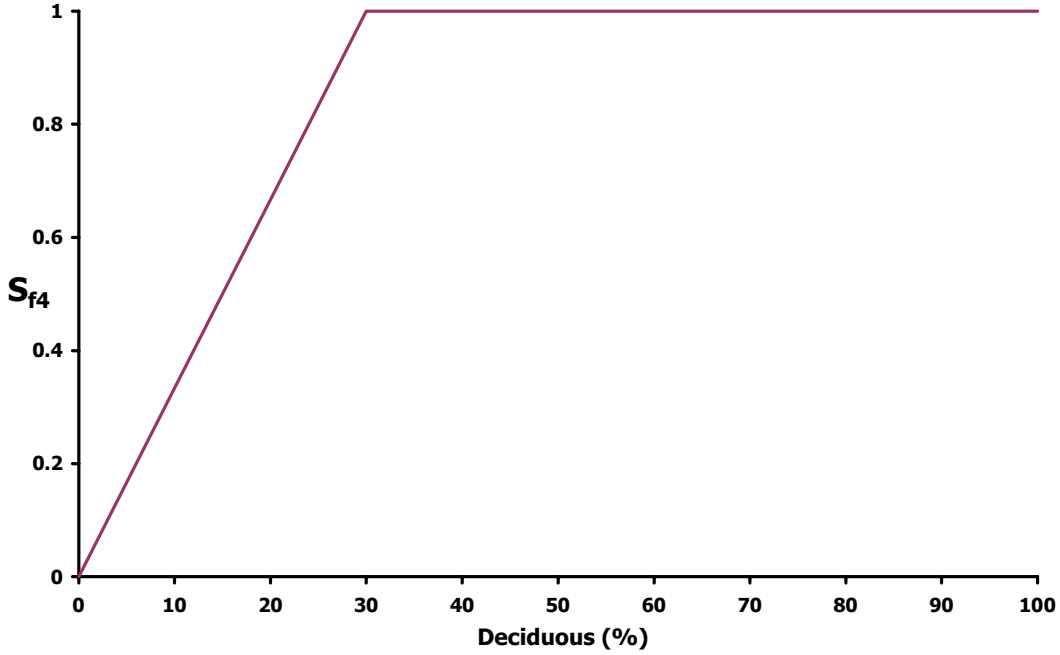

Figure 7. Barred Owl cover habitat suitability in relation to deciduous representation within Millar Western's FMA area.

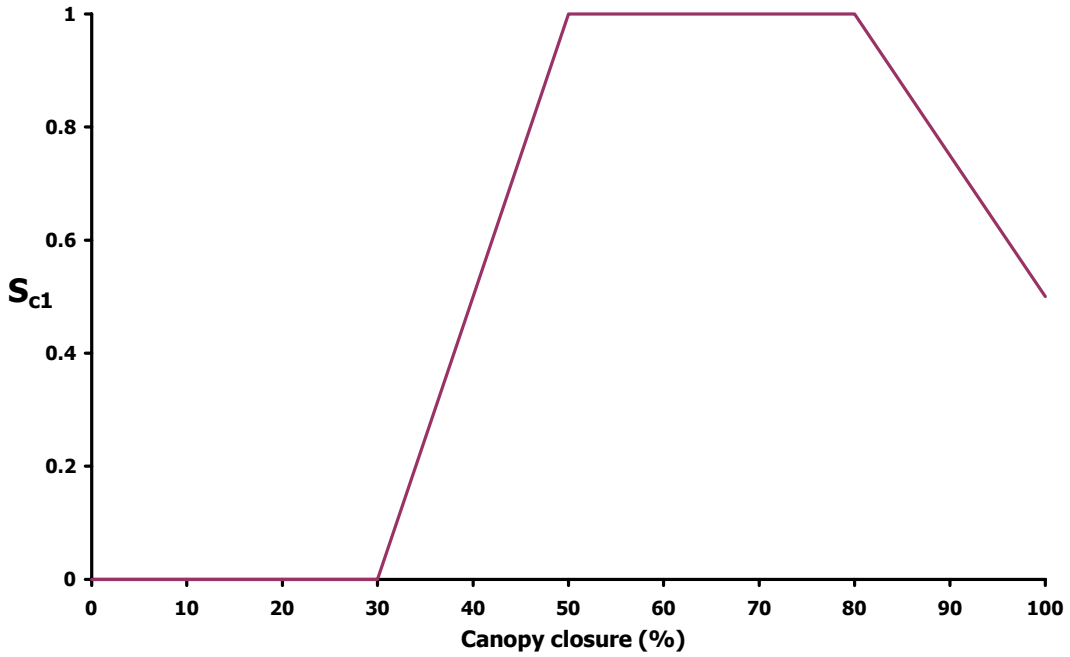

Figure 8. Barred Owl cover habitat suitability in relation to canopy closure within Millar Western's FMA area.

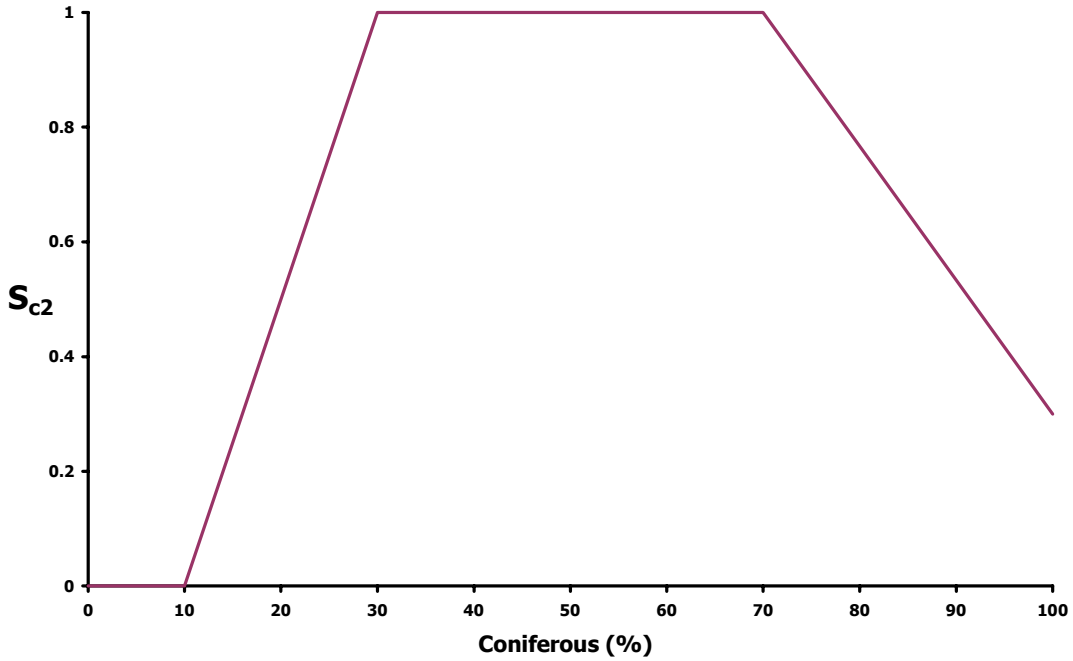

Figure 9. Barred Owl cover habitat suitability in relation to coniferous representation within Millar Western's FMA area.

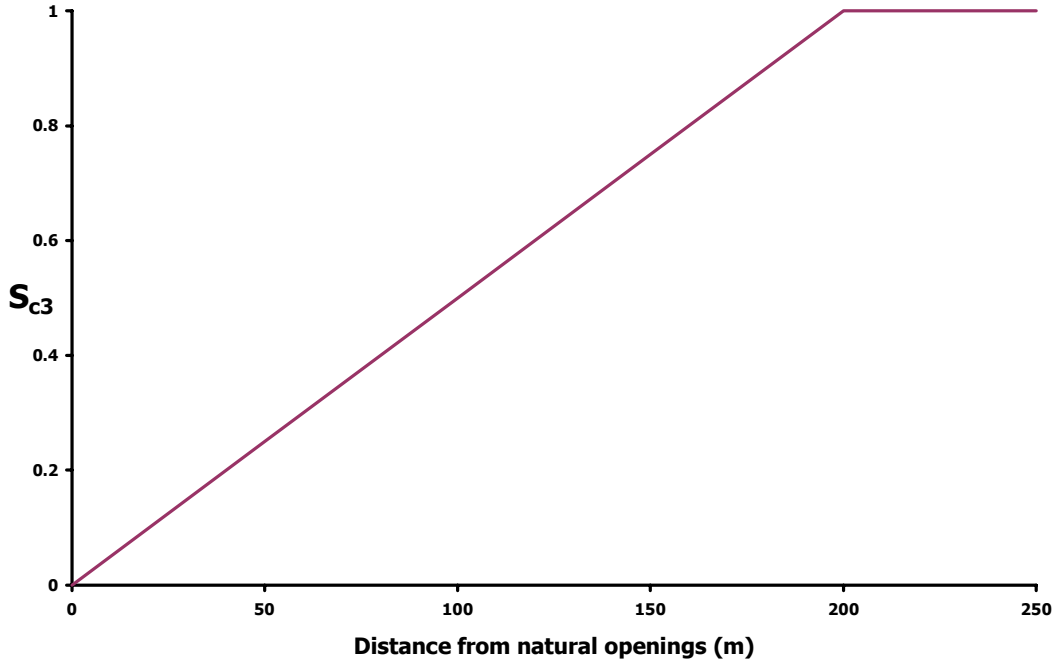

Figure 10. **Barred Owl cover habitat suitability in relation to proximity to natural openings greater than 5 ha in size within Millar Western's FMA area.**

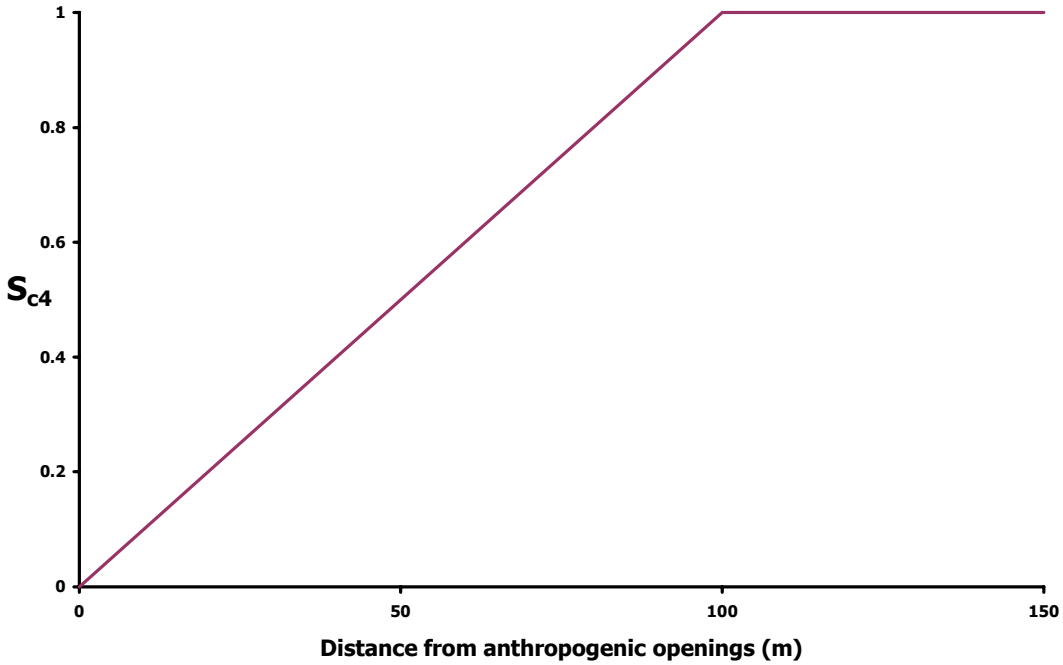

Figure 11. **Barred Owl cover habitat in relation to proximity to anthropogenic openings within Millar Western's FMA area.**

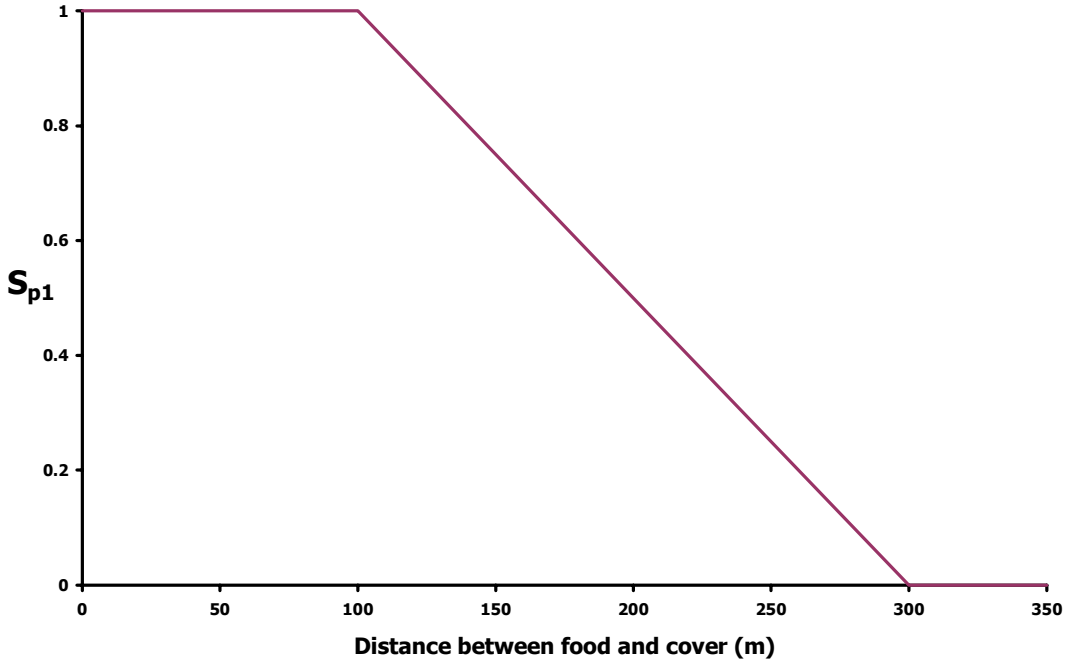

Figure 12. Barred Owl habitat suitability in relation to proximity of food and cover resources within Millar Western's FMA area.

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, cover, and nesting habitats. Therefore, the outputs of the SI_{food}, SI_{cover}, and $SI_{nesting}$ calculations are considered individually to display trends in habitat availability.

Foraging Index

A grid that gives an indication of the free-to-manoeuvre flying space available within each pixel is prepared. Two fully compensatory variables are added to account for the benefits associated with habitat in proximity to a water body, wetland, or thin clearing (tertiary road, trail, or seismic or utility line). To identify the value of the bonus to be added to the foraging index, all water bodies and wetlands within the FMA area are buffered to a distance of 300 m. Tertiary roads, trails, and seismic and utility lines are buffered to a distance of 100 m. Using the SI curves shown in Figures 5 and 6, each pixel within the buffered areas is given a suitability rating for variables S_{f2} and S_{f3}. The bonuses are then added to the food equation as shown below:

$$SI_{food} = [(S_{f1} + S_{f2} + S_{f3}) * S_{f4}]^{1/2};$$

$$\text{where } S_{f1} + S_{f2} + S_{f3} \leq 1.$$

Cover Index

To calculate SI_{cover}, the suitability rating of each pixel, with respect to its canopy closure and tree species composition, is first determined using the following two variables:

$$(S_{c1} * S_{c2})^{1/2}$$

Next, to take into account proximity to clearings all large (> 5 ha) natural clearings, including barred and scattered land, treed muskeg, shrub lands, meadows, and clearcuts, are buffered to a distance of 200

m and anthropogenic clearings are buffered to a distance of 100 m. Using the distance dependent relationships shown in the SI curves (Figures 10 and 11), each pixel receives a suitability rating that is included in the following equation:

$$SI_{cover} = (S_{c1} * S_{c2})^{1/2} - [0.4(1-S_{c3})] - [0.1(1-S_{c4})];$$

$$\text{where } SI_{cover} \geq 0.$$

Nesting Index

The index for nesting considers the habitat types expected to contain a suitable density of desirable nest trees, canopy closure, and distance from natural or anthropogenic clearings. A suitability rating is calculated for each pixel within the FMA area as follows:

$$SI_{nesting} = (S_{n1} * S_{c1})^{1/2} - [0.4(1-S_{c3})] - [0.1(1-S_{c4})];$$

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

Adjustment of SIs Based on Proximity between Foraging and Cover Habitats

Barred Owls are thought to move up to 300 m from cover while foraging to take advantage of prey accessible in small clearings. As shown in Figure 12, however, the risk of predation by Great Horned Owls increases as the Barred Owls move further from cover (Takats pers. comm. 1999). Habitat suitability should be enhanced for both foraging and cover where these resources are located in proximity to each other.

To accomplish this, a circular window of radius 300 m moves over the grid representing Millar Western's FMA area in such a way that its centres are located 300 m (one full radius) apart. Food and cover SIs are adjusted as follows:

$$\text{Adjusted } SI_{food} = [SI_{food} * \text{Window } [\text{Avg } (SI_{cover} * S_{p1})]_{300\ m}]^{1/2}$$

$$\text{Adjusted } SI_{cover} = [SI_{cover} * \text{Window } [\text{Avg } (SI_{food} * S_{p1})]_{300\ m}]^{1/2}$$

Breeding Season HSM

To provide an indication of the quality of breeding habitat available within Millar Western's FMA area, a circular window of radius 700 m (150 ha) moves over the grid representing the forest, in such a way that the circles' centres are located 700 m (one full radius) apart. The adjusted foraging suitability ratings of each pixel within the circle are averaged and this value is applied to the pixel at the centre of the circle. Similarly, the adjusted cover and nesting habitat suitability ratings are averaged and applied to the centre pixel. Since habitat availability during the breeding season is most critical, averages will be taken only at the breeding range scale. It is assumed that habitat supplying suitable breeding habitat also provides appropriate wintering habitat.

4.0 EXTERNAL REVISION

Kurt Mazur, Barred Owl researcher and coordinator of Partners in Flight Manitoba, provided comments on an early draft version of this model on May 17, 1999. The following changes were made to the document based on his advice:

1) Through multivariate analysis, Mazur and fellow researchers have found that the most important variable in nest site selection is the presence of large trees. He suggested that this fact be emphasized in the review.

2) Originally, a portion of the SI_{food} equation included the results of the HSM for the red-backed vole. Our motivation in including this as a part of the model was based on the fact that voles are among the owls' top prey species. Since Barred Owls will eat whatever they can catch, Mazur did not believe that it was appropriate for us to include this variable in the model. On his advice, we have removed it.

3) As Takats had done research for her MSc thesis in the Foothills Model Forest on Barred Owl habitat use, Mazur suggested that we consider her HSI model and incorporate her research into this document to make it more Alberta-specific.

Lisa Takats, Barred Owl researcher and nongame biologist with the Fisheries and Wildlife Management Division of the Resource Allocation and Use Branch of the Natural Resources Service in Edmonton, Alberta was asked to supply comments on the revised version of the HSM for Barred Owls. A copy of her MSc thesis was previously obtained and incorporated into the model. Her comments were received on June 22, 1999. The following changes were made based on her advice:

1) Takats mentioned that Barred Owls are on the Yellow B list in Alberta. She provided information on this listing system and we have incorporated it into the literature review.

2) Takats further explained some of the details of her thesis and speculated on the possible causes for the apparent relationships. Where possible, these were included in the literature review.

3) She provided data on nest site characteristics for a paper to be published in Canadian Field Naturalist. This information was included to strengthen the model.

4) Though we had stated that Barred Owls are very sensitive to human activity, Lisa mentioned that they will use habitat with minimal human use.

5) We had neglected to mention that the coniferous component of the stand is important for protection from inclement environmental conditions. This was included.

Arlen Todd, wildlife biologist with Alberta Environment, Fisheries and Wildlife Management Division, in Whitecourt, Alberta provided comments on the Barred Owl HSM on June 23, 1999. He expressed concern regarding several of the suitability index relationships developed and the habitat types stated to be optimal in the model. He suggested that we approach John Pineau at Millar Western for a final review.

Pineau, biologist with Millar Western, provided comments on a revised version of the Barred Owl HSM, received on June 30, 1999. He mentioned that he feels the model accurately presents known information on Barred Owls in Alberta. Therefore, no further alterations were made on his advice.

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