BARRED OWL
REPRODUCTIVE HABITAT

HABITAT SUITABILITY INDEX MODEL
VERSION 3

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1. INTRODUCTION

Habitat Suitability Index (HSI) models predict the suitability of habitat for a species based on an assessment of habitat attributes such as habitat structure, habitat type and spatial arrangements between habitat features. This HSI model for the barred owl (*Strix varia*) applies to habitats of the Foothills Model Forest (FMF) in west-central Alberta. The intended use is to predict habitat suitability at landscape scales and over long-time periods. The model will be used to determine potential changes in barred owl habitat area and carrying capacity throughout an entire forest management cycle (200 years). The model was developed using literature review and research conducted on barred owls in the FMF and other boreal forest localities.

2. SPECIES DESCRIPTION AND DISTRIBUTION

The barred owl is a medium sized owl with dark brown eyes and a distinctive streaking pattern on the body. Horizontal dark brown streaks mark the throat and breast and vertical streaks mark the lower breast and flanks (Johnsgard 1988).

Barred owls inhabit mature to old mixedwood and coniferous stands (Godfrey 1986) and occur from the Atlantic coast across north-eastern United States and central Canada and westward into British Columbia and the Pacific Northwest (Grant 1966, Taylor and Forsman 1976). Since 1940, the barred owl has extended its range into south-eastern British Columbia (Grant 1966) and has recently become a permanent resident in Idaho, Washington, Oregon and north-western California (Allen 1987, Hamer et al. 1987, Johnsgard 1988). Barred owls are considered a sensitive species in Alberta because they are associated with habitats (mature forests) that are or may be deteriorating (Wildlife Management Division 1996).

Barred owl sightings in the Upper Foothills and Rocky Mountains of Alberta have increased since the 1970's (Boxall and Stepney 1982). Barred owls occur sporadically throughout the FMF where they are resident year round (Takats 1998). Jones (1966) reported the first confirmed nest of barred owls in Alberta, 9 m up a dead balsam poplar tree (*Populus balsamifera*). The nest had been used for a number of years because of the accumulated prey remains at the site (Jones 1966). The first confirmed nest in Saskatchewan was in a broken off balsam poplar tree (Houston 1961).

Oeming (1955) made early observations of barred owls in Alberta during his investigations of great gray owls. He concluded that barred owls were likely a common bird in remote areas of undisturbed mature and old growth forests. Nests are usually in large deciduous trees or snags with some spruce in the stand and a fairly closed tree canopy (R.E. Gehlert, personal communication, Takats 1998).

Barred owl reproductive success is dependent on courtship, nesting, shelter and roost sites and the availability of food (Nicholls and Warner 1972). Mature and old growth forests represent good reproductive habitat because they often contain dead trees or stubs needed for nesting. The nesting requirement of large diameter mature trees may limit population densities in the FMF.

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3. FOOD

Barred owls are opportunistic predators of small mammals, birds, amphibians, reptiles, fish and insects (Bent 1961). This owl is primarily nocturnal but will hunt during the day while supporting broods (Johnsgard 1988). Voles are the most common prey item (Cahn and Kemp 1930, Wilson 1938). Remains of voles (*Microtus* spp.) accounted for 83% of the 777 prey items identified in barred owl pellets in a Michigan study (Wilson 1938). Short-tailed shrews (*Blavina brevicauda*), mice (*Peromyscus* spp.), birds and insects made up a smaller portion of the prey (Wilson 1938). During nest checks, the remains of a northern flying squirrel (*Glaucomys sabrinus*), the hind leg of a snowshoe hare (*Lepus americanus*) and a pellet containing the leg bones of a ruffed grouse (*Bonasa umbellus*) were found (Leder and Waters 1980).

In the FMF, barred owls were opportunistic generalist predators and foraged in mixedwood forests composed of trembling aspen, balsam popular and white spruce (Takats 1998). Eleven foraging sites had 23-90% canopy cover and hunting structures had a mean diameter and height of 27 cm and 18 m respectively (Takats 1998). Hunting structures were in live trees (7 trembling aspen and 1 balsam poplar), a white spruce stub and a man-made post. Mean perch height was 5.2 m (Takats 1998). Shrub and herb cover under the perches were significantly lower than the surrounding stand (Takats 1998).

Based on 78 pellets and 11 prey remains, the diet of barred owls in the FMF consisted of 46% mammals, 25% birds, 25% amphibians and 5% invertebrates (Takats 1998). The important prey species were: southern red-backed voles, long-tailed voles, deer mice, meadow voles, northern flying squirrel, and red squirrels. Ruffed grouse, varied thrush, and american robin were the most common bird species found in the pellets.

4. COVER

Barred owls prefer habitats with large trees, high structural diversity, and relatively open understories. In Minnesota, the barred owl preferred oak woods, mixed hardwood and conifer forests over white cedar (*Thuja occidentalis*) swamps, oak savannas, alder swamps, marshes and open fields (Nicholls and Warner 1972). Habitat preference was independent of season, phenology, weather condition and year (Nicholls and Warner 1972). Barred owls also occur in coniferous forests across their range where they nests in hollow trees, abandoned hawk nests and squirrel nests (Bent 1961). In south-eastern Massachusetts, barred owls preferred heavy pine woods over deciduous and mixedwood forests (Bent 1961). In western Canada the barred owl preferred mixedwood and coniferous habitats throughout the boreal forest, boreal foothills and subalpine ecoregions of Alberta (Boxall and Stepney 1982). Barred owls are less common in the aspen parkland of Alberta possibly because undisturbed stands are scarce and there are few trees or snags large enough to provide nesting sites (Boxall and Stepney 1982).

The barred owl shows a strong association with mature and old growth forests. Mature to old stands usually have low stem densities providing more subcanopy flying space (Nicholls and Warner 1972, McGarigal and Fraser 1984, Haney 1997) which is important in the habitat selection of many raptors (Fuller 1979). In addition, potential nesting habitat increases with stand maturity as nest sites become available in large diameter trees.

In the FMF, Takats (1998) found barred owls roosting in mature and old mixedwood, aspen, balsam poplar or white spruce stands with very little lodgepole pine. Roosts were found in trembling aspen (N = 11), balsam poplar (N = 8) and white spruce (N = 6). The diameter at breast height (dbh at 1.3 m) of these trees ranged from 17-70 cm, with an average of 36 cm. Roost stands had a mean tree height of 24 m and a mean of 45 trees ≥ 35 cm dbh per hectare. Roost stand characteristics were similar to nest stands (Takats 1998). In Saskatchewan, there was no difference in habitat use between breeding and nonbreeding seasons and preference was for old and mature mixedwood and deciduous stands (Mazur 1997).

5. REPRODUCTION

In the FMF, courtship and nesting begins in March and lasts through to May (Takats 1998). Nesting pairs are highly territorial and will defend a territory from intruders (Mazur 1997). Nesting home range is smaller and usually within the winter home range (Mazur 1997). A clutch size of 2 or 3 (rarely 4) pure white eggs is common for barred owls (Bent 1961). Incubation begins after the first egg is laid, which results in the staggered hatching of young (Johnsgard 1988). The incubation period can range from 28-32 days and re-nesting is common if eggs or broods are lost (Johnsgard 1988). The male will feed the female while she is incubating (Takats 1998). Young are born with eyes closed (Bent 1961) and leave the nest after 4 to 5 weeks and can fly by 6 weeks (Johnsgard 1988).

An average nesting success of 2.02 young per breeding pair (N = 55) has been reported (Appfelbaum and Steelbach 1983).

Courtship, mating and nesting typically occur in large remote forests with mature and old trees (Devereux and Mosher 1984, McGarigal and Fraser 1984). Reproductive habitats of barred owls vary from dry upland sites to riparian areas (Johnsgard 1988). Early ecological studies concluded that barred owls preferred to nest near water (Bent 1938, Apellgate 1975, Soucy 1976). However, water may be less significant than stand structure and maturity of vegetation in lowland areas (Dereveux and Mosher 1984) which often escape fire and logging. These sites also contain large trees due to species differences and high productivity associated with moisture and nutrients. Water is abundant throughout the boreal forest of Alberta and therefore proximity to water may not be a significant factor in reproductive habitat selection of barred owls in this region. Nicholls and Warner (1972) observed that barred owls preferred upland oak and mixedwood sites with suitable cavities for nesting.

Average tree diameter in stands used by breeding barred owls on the Appalachian Plateau was ≥ 30 cm dbh (Haney 1997). Presence of large diameter trees that provide natural cavities in broken off tops and holes from fallen limbs is consistent with preferred nesting requirements for barred owls (Degraaf and Shigo 1985). Barred owls are often unsuccessful at constructing their own nests (Bent 1961). This species is known to utilize stick nests of other raptors (Bent 1961). If the nest remains in good condition, barred owls may continue to use the nest for over 20 years (Bent 1938, Benyus 1989).

Barred owls in western Oregon and Washington nested in cavities of decaying trees at a minimum height of 9 m (Brown 1985). In Minnesota, cavities were no lower than 7.6 metres above the ground (Dunstan and Sample 1972) Cavity nests in Ontario ranged in height from 4.5-10.5 m, with half of the cavities between 7.7 and 10.5 m (Johnsgard 1988). In Maryland, nests were in areas with well developed understories and closer to openings than random plots. Nests (N = 8) were in the top of hollow tree stubs (6 nests), in a cavity created by disease and in an old stick nest (Devereux and Mosher 1984)

In Michigan, 80% of nests in natural cavities or nest boxes were productive (N = 101) and 31% of nests in open nests (N = 13) were productive (Postupalsky et al. 1997). Open nests were in old stick nests (7 red-shoulder hawk, *Buteo lineatus* nests, 1 northern goshawk, *Accipiter gentilis* nest and 1 unknown), in the flat area of a fork in a yellow birch, on the ground and in a man-made platform built for great-horned owls (*Bubo virginianus*). Only one stick nest was productive, while birds using the other open nests successfully raised chicks. However, brood sizes at or near fledging were smaller than broods raised in cavities, because some chicks fell out of the nests before they were able to climb up nearby trees to safety (Postupalsky et al. 1997).

In the FMF, 6 nests were in natural cavities of large diameter (mean = 74 cm dbh, range = 61-85 cm dbh) balsam popular trees (Takats 1998). Average nest tree height was 25 m (range = 19-29 m) and average cavity height was 16 m (range = 10-17 m). Mean dbh, number of deciduous trees ≥ 35 cm dbh, percent deciduous trees, percent white spruce and fir and mean canopy cover ranged from 22-35 cm, 20-70 trees/ha, 20-50%, 50-80% and 66-80% respectively for the nest stands. The distance from human disturbance and openings ranged from 70-300 m and 15-200 m, respectively.

In north-central Alberta, nests were found in natural cavities (N = 5), tops of broken off snags (N = 4) and a stick nest (N = 1; B. Olsen, MSc. Candidate, University of Alberta, personal communication). Eight of the nests were in balsam poplar and 2 were in aspen. Nest tree dbh ranged from 34-77 cm, nest tree height ranged from 7-29 m and cavity height ranged from 6-27 m. Canopy cover around the nest tree ranged from 39-86% and canopy height ranged from 20-29 m.

In Saskatchewan, nests were found in old mixedwood stands, old coniferous stands and mature deciduous stands (Mazur et al. 1997). Nests were in white spruce (N = 5), trembling aspen (N = 5), balsam popular (N = 4) and white birch (N = 1). Nest trees were most often in live trees (67%) and in tree cavities (67%). Cavities were either in tops of broken off trees (N = 6) or in cavities created by limbs breaking off (N = 4). Two stick nests (an old accipiter and an old corvid nest) were used. Two pairs nested on top of red squirrel nests and one pair nested on top of a witch's broom. Nest tree height and dbh averaged 19 m (range 8-29 m) and 47 cm (range 32-74 cm) respectively. Distance to an all weather road ranged from 25-2000 m (average 430 m).

6. HABITAT AREA

The barred owl maintains exclusive use over its home range which is stable among years and generations (Bent 1938, Nicholls and Fuller 1987). Home range estimates vary according to the habitat and the technique used to determine home range size. Radio telemetry data in Minnesota indicated a mean home range size of 229 ha (range: 86-369 ha; Nicholls and Warner 1972). A mean home range size of 282 ha in the winter, decreased to 118 ha during the summer months (Elody and Sloan 1985). Great horned owls may influence habitat use, distribution and movement of barred owls (McGarigal and Fraser 1985).

Research from the eastern United States concludes that 9,300 ha of extensive deciduous forest could support 3 pairs of barred owls (Craighead and Craighead 1956). In New England, population densities of barred owls were significantly greater (0.0015 pairs/ha; Smith 1978). A northern Michigan study located 33 pairs of barred owls in 9,308 ha of prime habitat revealing a population density of 0.0036 pairs/ha (Elody 1983).

Using roadside surveys, Takats (1998) determined a conservative estimate of barred owl density in the FMF to be 0.05 owls/km^2 . Radio telemetry data indicated a home range size for a female ranged from 150 ha to 185 ha in the summer and 170 ha in the winter (Takats 1998). A male summer home range was 155 to 240 ha (Takats 1998). Home ranges were between 131-528 ha in north-central Alberta (B. Olsen, MSc. Candidate, University of Alberta, personal communication). A mean breeding and nonbreeding season home range of 149 ha (range: 38-364 ha) and 1234 ha (range: 573-2678 ha) were determined in southern Saskatchewan and non-breeding home ranges overlapped the breeding season home ranges entirely for most owls (80%, N = 15; Mazur 1997).

6.1. HABITAT EFFECTIVENESS

Extensive areas of harvested and regenerating forests less than 80 years old may not have adequate cover and nesting requirements to support a population of barred owls (Devereux and Mosher 1984). Retaining patches of old-growth forest within harvested areas could increase habitat suitability, if these areas were strategically placed (Forsman et al. 1984). Human habitation has been negatively correlated with barred owls, even when the forest canopy was uninterrupted in low density urban areas (Smith 1978). Barred owls avoid woodlands adjacent to major paved roads with moderate to heavy traffic (Bosaskowski et al. 1987).

7. HSI MODEL

7.1 MODEL APPLICABILITY

Species: Barred owl (*Strix varia*).

Habitat Evaluated: Reproductive habitat (nesting, roosting, post-fledging and foraging habitat).

Geographic area: This model is applicable to the Foothills Model Forest in west-central Alberta.

Seasonal Applicability: Full year.

Cover types: This model applies to all forest and non-forest habitat areas of the Lower and Upper Foothills, Montane and Subalpine Natural Subregions (Beckingham et al. 1996) since suitability is determined from structural characteristics within stands rather than classified forest stands directly. The model should also be broadly applicable to other habitat areas dominated by vegetation similar to that in this region, including pure deciduous, mixedwood and pure coniferous forest types, as well as wetland and riparian forests, meadows, shrublands, and areas regenerating after forest harvesting.

Minimum Habitat Area: Minimum habitat area is defined as the minimum amount of contiguous habitat required before an area can be occupied by a species (Allen 1987). A minimum habitat area is not necessary for this model because components S_5 and S_6 ensure that, in optimal habitat, the nest will be at least 100 m (3 ha buffer) from human disturbance and 200 m (12 ha buffer) from an opening. Further, there must be at least 40 Habitat Units (HU) of nesting habitat and 100 HU of foraging habitat within 700 m of the nest before an area is considered suitable for barred owl reproductive habitat.

Model Output: The model will produce Habitat Units (HU) of reproductive habitat for each stand or forest type based on HSI value and polygon area. Habitat units are calculated by multiplying the HSI score for an area by the hectares. The performance measure for the model is potential carrying capacity (birds per ha). Model output (HU) must be correlated to estimates of carrying capacity.

Carrying Capacity (Breeding Pairs per ha where HSI = 1.0): Based on Mazur (1997), Takats (1998), and B. Olsen (MSc. Candidate, University of Alberta, personal communication, 1998) the home range size of breeding barred owls in good habitat in Canada is approximately 150 ha. This translates into a density of 0.01 pairs/ha.

Verification Level: Data collected within the FMF by Lisa Takats for a barred owl research graduate program was used to develop version 3. The reliability of this model has not been evaluated against local data. The verification level is 5: model tested/revised using local data, but predictive performance of revised model has not been tested.

Application: This HSI model is designed to assess habitat suitability for relatively large forest landscapes using generalized species-habitat relationships and stand-level vegetation inventory. Its purpose is to predict relative changes in barred owl habitat supply at the landscape level over long time periods (200 years), for integration with forest management planning. The model is not designed to provide accurate prediction of suitability or use at the stand level. Approximate population size can be calculated by assuming linear habitat-population relationships, but the model is not designed to provide accurate population density estimates. Any attempt to use the model in a different geographic area or for other than the intended purpose should be accompanied by model testing procedures, verification analysis, and other modifications to meet specific objectives.

7.2 MODEL DESCRIPTION

This model assumes that reproductive habitat, which includes nesting, roosting, post-fledging and foraging habitat is limited in the FMF. Mature stands with large trees increase the potential for suitable nest sites and is representative of high quality reproductive habitat.

This model will produce index values proportional to the ability of forest stands to provide suitable reproductive habitat for the barred owl. An HSI value of 1 is assumed to represent the highest quality reproductive habitat. A forest stand with an HSI value of 0 is assumed to represent unsuitable reproductive habitat.

7.2.1 Habitat Variables and HSI Components

A. Nest Tree

Potential reproductive habitat for barred owls based on stand maturity is indicated by tree canopy height (S_1) and the number of deciduous trees ≥ 35 cm dbh per hectare (S_2). Mature stands typically have large trees that are susceptible to damage as a consequence of climatic extremes or insect or fungal infestations (Spurr and Barnes 1980). This results in a greater distribution and abundance of dying and dead trees that have a high probability of containing suitable nest sites in the form of cavities and broken off tops compared with young stands (Spurr and Barnes 1980).

Barred owls nested most often in large balsam poplar trees (B. Olsen, MSc. Candidate, University of Alberta, personal communication, 1998, Takats 1998). Balsam poplar grows in small pure stands or mixed with aspen, spruce and pine in percentages too small to show up in the forest inventory. Number of deciduous trees ≥ 35 cm is used to ensure that enough large aspen and balsam poplar trees will be present in an area for nesting.

B. Nesting/Roosting Cover

Barred owls are found in mature or old growth forests with large, tall canopy trees and numerous dead or dying trees with cavities or broken off tops suitable for nesting. Tree canopy closure and percent of spruce and fir in the tree canopy are included in the model to ensure suitable cover will be available around the nest and roost sites. Tree canopy closure (S_3) ensures shelter will occur in the overhead horizontal plane, and percent spruce and fir in the tree canopy (S_4) ensures there are sufficient numbers of conifer branches in the vertical plane for shelter and concealment during nesting and post-fledging.

C. Spatial Components of Nesting Habitat

It is assumed that barred owls are adversely affected by human disturbance, defined as roads and trails with motorized access (including railroads), camps, industrial activity, and human settlements. The distance to human disturbance is used to predict HSI component S_5. It is assumed that barred owls avoid clearings or other open areas as well as the mature forest edge within the first 200 metres, so this distance is used to predict HSI component S_6.

Openings 5 ha or greater are assumed suitable for great-horned owls and thus not suitable for barred owls (Takats 1998).

D. Foraging Habitat

Barred owls foraged in more open areas compared with the nest stand (Takats 1997) so tree canopy cover (S_7) is included in the model to describe foraging habitat. Tree height (S_8) is also included in the model to ensure that foraging habitat occurs in stands that are at least 30 years old.

Table 1. Relationship of habitat variables to life requisites for the barred owl HSI model.

HSI Component	Life Requisite	Habitat Variable	Habitat Variable Definition
S_1	Nesting, Cover	Tree Canopy Height (m)	Average top height of 100 trees/ha that have the largest diameter at breast height (dbh at 1.3 m).
S_2	Nesting	Deciduous Trees ≥ 35 cm dbh/ha	Number of hardwood trees with a minimum diameter of 35 cm at 1.3 m height per hectare.
S_3	Cover	Tree Canopy Closure (%)	Percent of ground covered by a vertical projection of tree crown areas onto the ground. Includes all trees ≥ 8 cm dbh.
S_4	Cover	Spruce + Fir Composition (%)	Sum of the percent composition of all spruce and fir species in the tree canopy.
S_5	Cover	Distance From Human Disturbance (m)	Human disturbance is defined as roads and trails with motor vehicle access, railways, industrial sites, active well sites, and settlement areas.
S_6	Cover	Distance From Opening (m)	Openings are defined as all areas with < 6% crown closure and at least 5 ha in size This also includes regenerating clearcuts which do not yet have canopy tree development.
S_7	Foraging	Tree Canopy Closure (%)	Percent of ground area covered by a vertical projection of tree crown areas onto the ground. Includes all trees ≥ 8 cm dbh.
S_8	Foraging	Tree Canopy Height (m)	Average top height of 100 trees/ha that have the largest diameter at breast height (dbh at 1.3 m).

7.2.2 Graphical HSI Component Relationships

S_1 The state of forest development is assumed good in forests with an average height ≥ 20 m. Thus, S_1 is 0 unless the trees are ≥ 10 m in height and S_1 = 1 when the trees are ≥ 20 cm height (Figure 1a).

S_2 Nesting occurs mainly in stands with ≥ 25 deciduous trees of the appropriate size, which provide more choice in nest site locations. Stands with ≤ 10 deciduous trees ≥ 35 cm dbh receive a zero value for component S_2, which increases linearly to 1 at ≥ 25 large deciduous trees (Figure 1b).

S_3 Tree canopy closure must be ≥ 30% to have a positive value of S_3, which equals 1 when canopy closure is ≥ 50% (Figure 1c).

S_4 Optimal vertical coverage by conifer branches occurs at 25% or more spruce and fir in the tree canopy. The spruce and fir component has a value of 0 unless there is at least 5% spruce + fir in the canopy and becomes 1 when spruce + fir comprises at least 25% of the canopy (Figure 1d). Pure spruce/fir forests are not considered suitable as these would not provide deciduous trees used for nesting, therefore suitability begins to decrease at 80% and reaches zero at 90%.

S_5 Habitat within 50 m from human disturbance is assumed to be unsuitable for barred owls (S_5). Suitability increases linearly from 50-100 m where the habitat is considered suitable for nesting (Figure 1e).

S_6 To account for edge effects next to non-treed areas, the spatial variable S_6 was set so it was equal to 0 within any open area (an area with ≤ 6% tree canopy closure, a tree canopy height ≤ 5 m and ≥ 5 ha in size). The value increased to the value 1 over the range 0-200 metres from the forest edge (Figure 1f).

S_7 Foraging occurs in stands that have at least 30% canopy closure and reaches optimal in stands with 50% canopy closure (Figure 1g).

S_8 Stands must be at least 10 m in height before barred owls will use them for foraging. Suitability increases to 1 in stands at least 15 m in height (Figure 1h).

7.3 MODEL ASSUMPTIONS

1. Roosting habitat is similar to nesting habitat. Percent spruce and fir in the tree canopy and canopy closure are the most significant factors that determine roosting habitat. Barred owls prefer stands where the overstory canopy cover is ≥ 50%.
2. Water is not limiting.
3. Deciduous stands with old large trees will have a small percentage of large balsam poplar trees.
4. Reproductive habitat quality increases as forest stands develop structurally to have large trees, dying or dead trees, and trees with broken branches or tops for nest cavities.
5. Mean stand height is indicative of stand age and maturity.
6. Aspen and balsam poplar contain suitable nest sites for the barred owl because they are likely to contain cavities as they mature. Because the majority of nests found in the Canadian boreal forest were in natural cavities or broken off snags, stick nests were not considered in this model.
7. Year round habitat requirements are provided if suitable reproductive habitat is present.

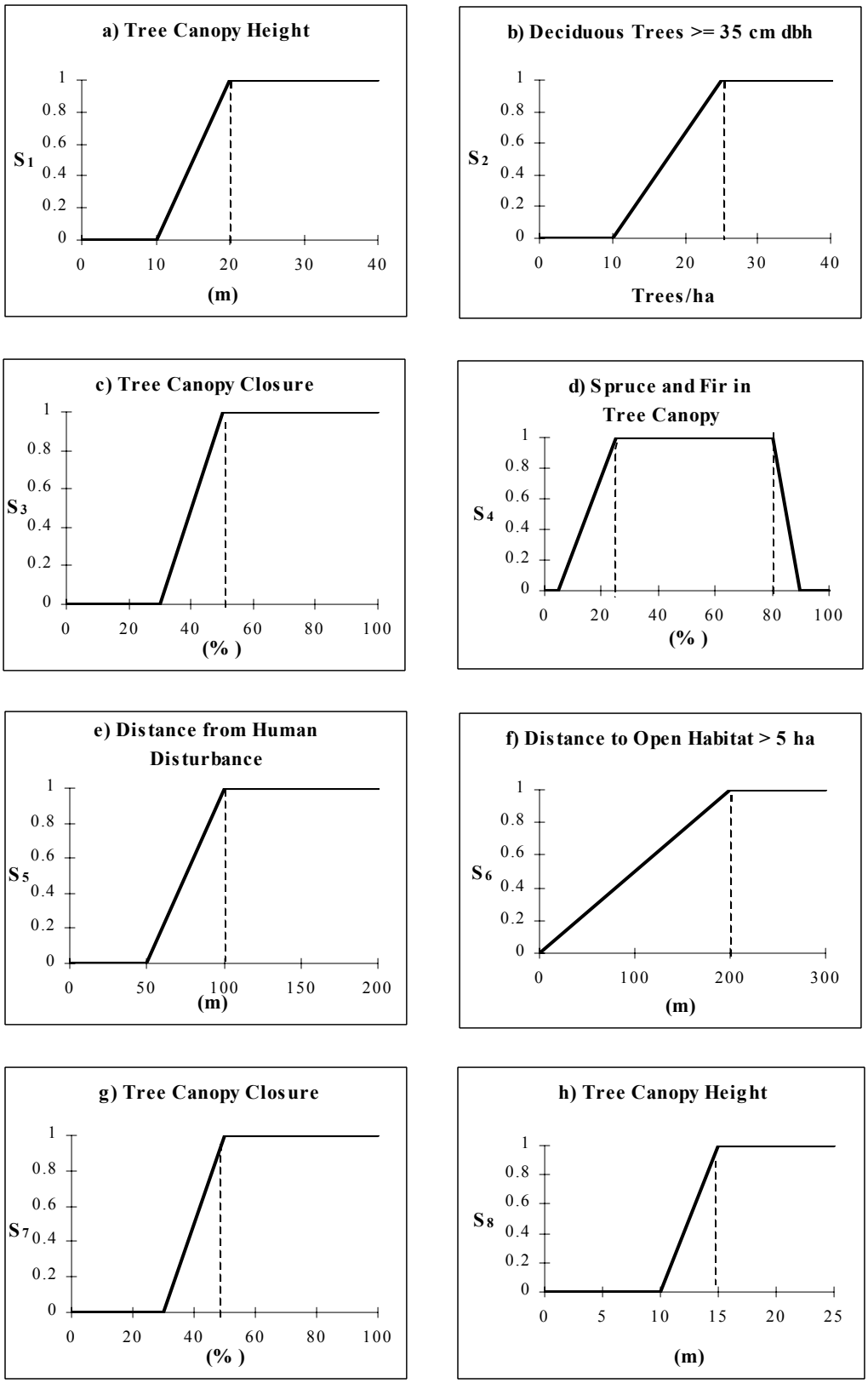

Figure 1. Graphical relationships between habitat variables and HSI components of the barred owl model.

7.4 EQUATIONS

The barred owl HSI model is developed as two separate equations; one for nesting and roosting habitat and one for foraging habitat. The components are all considered equal in importance and non-compensatory. A low value for one component can not be compensated by a high value in another component.

$$\text{HSI-nesting/roosting} = S_1 \times S_2 \times S_3 \times S_4 \times S_5 \times S_6$$

$$\text{HSI-foraging} = S_7 \times S_8$$

To ensure there is enough nesting habitat, 40 habitat units (HU) of nesting habitat within 150 ha is required before an area is considered suitable. Forty habitat units came from Mazur's (1997) smallest home range of 38.1 ha rounded up to 40 ha. We assumed this home range was in optimum breeding habitat and represented the amount of optimum habitat necessary to successfully raise chicks. Takats (1998), Olsen (B. Olsen, MSc. Candidate, University of Alberta, personal communication) and Mazur (1997) had average summer home ranges of approximately 150 ha, which we assumed represented a mixture of both suitable and unsuitable habitat. One hundred and fifty hectares translates to a circle with a radius of 700 m. We assumed that at least 40 habitat units of optimum reproductive habitat are needed within 700 m of a nest before the area is suitable for nesting. In addition, there must be enough foraging habitat near the potential nest stand before the nest stand is suitable. No information was found regarding the area of foraging habitat needed around the nest stand so we assumed that within 700 m of the nest there must be at least 100 HU of foraging habitat before a stand is suitable for nesting.

8. SOURCES OF OTHER MODELS

The US Fish and Wildlife Service has developed an HSI model for barred owls (Allen 1987).

Model History

All of the HSI models for the Weldwood Forest Management Area have undergone several revisions, and they will be revised again as new information becomes available. Contact Rick Bonar for information about the most current version.

- Version 1 (1995) of this model was developed by Ben Olsen and Lisa Takats as part of a special study course in Habitat Modelling at the University of Alberta.
- Version 2 (1996) was edited and reformatted by Wayne Bessie and sent to species experts for critical comment.
- Version 3 (1999) was revised by Karen Graham, Rick Bonar, Barb Beck, and Jim Beck to incorporate reviewer comments, Lisa Takats' research results and information from recent literature.

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