COMMON YELLOWTHROAT REPRODUCTIVE HABITAT

HABITAT SUITABILITY INDEX MODEL VERSION 5

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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 common yellowthroat (*Geothlypis trichas*) 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 common yellowthroat habitat area and carrying capacity throughout an entire forest management cycle (200 years). The model was developed using literature review.

2. SPECIES DESCRIPTION AND DISTRIBUTION

The common yellowthroat (hereafter, yellowthroat) is a yellow warbler, 12-14 cm long (Salt and Salt 1976). Males have a black "mask" whereas females and juveniles lack the mask and have olive-gray upper parts, buffy-yellow breast and whitish belly (Peterson 1961). The song is a loud “witchety, witchety, witchety” and the call is a grating “chat, chat”. Breeding distribution extends from British Columbia east to Newfoundland, throughout the continental U.S. to southern Mexico. The wintering area is throughout the southern United States and Central America (Salt and Salt 1976, Godfrey 1986).

In Alberta, yellowthroats are found in all regions of Alberta (Salt and Salt 1976) but are most common in the Foothills and Boreal Forests (Semenchuk 1992). Yellowthroats are not considered at risk in Alberta and their habitats are considered secure (Wildlife Management Division 1996).

3. FOOD

Yellowthroat gleans insects from shrubs and other vegetation usually within 1 m of the ground (Hamel et al. 1982, Yahner 1983, Morgan and Freedman 1986). In early summer, yellowthroats forage close to the ground (up to 0.3 m). By late summer foraging occurs throughout a larger range of vegetation heights, although over 80% of foraging still occurs on shrubs between 0-2.4 m from the ground (Hutto 1981).

4. COVER

Yellowthroats are associated with marshy areas with high shrub cover and little or no tree canopy (Salt and Salt 1976, Collins et al. 1982, Childers et al. 1986, Morgan and Freedman 1986, Sedgewick and Knopf 1986). Yellowthroat numbers increase with the number of raspberry stems and deciduous stems less than 2.5 m in height

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(Titterington et al. 1979, Freedman et al. 1981, Morgan and Freedman 1986). Yellowthroat numbers were positively associated with sapling richness and vertical stratification of vegetation less than 3 m tall (Stauffer and Best 1980). Yellowthroat numbers had a negative relationship with sapling size and softwood trees with a diameter at breast height (dbh at 1.3 m) > 20 cm (Titterington et al. 1979, Sedgewick and Knopf 1986). Yellowthroats occur in areas with up to approximately 12% tree canopy closure (Morgan and Freedman 1986, Collins et al. 1982).

5. REPRODUCTION

Yellowthroats are very specialized in nest selection, choosing mainly areas covered with tall grasses and dense low growing shrubs (Salt and Salt 1976, Stauffer and Best 1980, Collins et al. 1982, Childers et al. 1986). Nests are built on or near the ground in marsh vegetation (Salt 1973, Gill et al. 1974, Hamel et al. 1982, Morgan and Freedman 1986, Sedgewick and Knopf 1986). Nest sites are usually near standing water (Salt and Salt 1976). In one study, yellowthroat numbers were negatively associated with slope, as slope resulted in greater runoff and thus dryer sites (Sedgewick and Knopf 1986).

Three to 5 speckled eggs are laid (Godfrey 1986). The female incubates the eggs for 12 days (Godfrey 1986). Both adults feed the young and fledging occurs within 9-10 days (Semenchuk 1992). Two broods are raised in a summer (Ehrlich et al. 1988).

6. HABITAT AREA

Female common yellowthroats had an activity radius of approximately 50 m (Lopez-Ornat and Greenberg 1990). Population densities cited for common yellowthroats include 1.7 pairs/ha in Maine (Titterington et al. 1979), 0.3-3.0 pairs/ha in Nova Scotia (Freedman et al. 1981), 0.4-0.5 birds/ha in Pennsylvania (Yahner 1983), 1.1 pairs/ha in Nova Scotia (Morgan and Freedmen 1986) and 0.5-1.4 males/ha for the eastern half of the FMF (MacCallum and Ebel 1985). Until specific density information is collected, 1 pair/ha is assumed to be the density of common yellowthroats in the most suitable habitat throughout the FMF.

7. HSI MODEL

7.1 MODEL APPLICABILITY

Species: Common Yellowthroat (*Geothlypis trichas*).

Habitat Evaluated: Reproductive Habitat (Food, Cover, Reproduction).

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

Seasonal Applicability: Mid-spring to Mid Summer.

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 to which the model will be applied. The high mobility of this species should result in all suitable habitat being available to it, regardless of interspersion with other habitat types. Therefore, no minimum contiguous habitat area is specified.

Model Output: The model will produce a single HSI value based on food, cover and the reproductive needs of the common yellowthroat. Habitat Units (HU) for an area are determined by multiplying the HSI value by the stand areas in hectares. The performance measure for the model is carrying capacity (pairs per ha). The HU must be correlated to estimates of carrying capacity for a large area to verify the model's performance.

Carrying Capacity (Breeding Pairs per ha where HSI = 1.0): Based on literature reviews and local expertise, the current estimate of the maximum number of breeding pairs in fully suitable habitat is 1 per hectare.

Verification Level: The reliability of this model has not been evaluated against local data. The verification level is 1: model developed based on literature review.

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 common yellowthroat 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

Because the common yellowthroat feeds, hides and nests all in the same habitat, it is difficult to differentiate variables as belonging to any specific life requisite (food, cover or reproduction). As a result, food, cover and reproductive needs have been set as equally limiting in this HSI model. The common yellowthroat is not assumed limited by human use or landscape management activities as long as the needed structural elements exist within a particular habitat.

7.2.1 Habitat Variables and HSI Components

The common yellowthroat model assumes that all reproductive needs can be provided by tree canopy closure and shrub cover which are used to define HSI components S_1 and S_2 (Table 1). However, this cover must be found near open water or in an area with saturated soils as defined in Table 1.

Table 1. Relationship of habitat variables to life requisites for the common yellowthroat HSI model.

HSI Component	Life Requisite	Habitat Variable	Habitat Variable Definition
S_1	Food / Cover / Reproduction	Tree and Sapling Canopy Closure (%)	Percent of ground covered by a vertical projection of tree and sapling crown areas onto the ground. Includes trees ≥ 8 cm dbh and saplings ≥ 1 m in height.
S_2	Food / Cover / Reproduction	Shrub Cover (%)	Percent of ground covered by a vertical projection of shrub crown areas onto the ground.
S_3	Food / Cover / Reproduction	Area with Saturated Soil	Saturated soil are soils where the yearly average water table is at or near (to 0.3 m depth) the surface. All wetlands (bogs, fens, marshes and swamps) have 100% saturated soil.
S_4	Food / Cover / Reproduction	Distance from Open Water (m)	Open water is defined as a lake, pond, river, stream, or brook.

7.2.2 Graphical HSI Component Relationships

S_1. Common yellowthroats are rarely, if ever, seen in stands that have 30-100% tree canopy closure. Tree canopy closure of 0-15% has been set as optimal for the common yellowthroat. The habitat suitability then decreases from 1 at 15% to 0 at 30% (Figure 1a).

S_2 Shrub cover of 50-100% is considered optimum for the common yellowthroat. Suitability decreases linearly to 0 at 0% shrub cover (Figure 1b).

S_3 Areas with well drained soils (most upland forest areas and grass meadows) are unsuitable for yellowthroats, except where superseded by component S_4. Suitability increases linearly as the area with saturated soil increases to a maximum value of 1 at 100%.

S_4 The yellowthroat is commonly found around open water. The yellowthroat is assumed to use dry shrubby forested habitat if it is close to open water. All areas within 50 m of water are considered useful, whereas areas beyond 50 m are set as unsuitable. The 50 m distance was chosen because a 50 m buffer is often used to delineate the ecotone influence of open water on terrestrial habitats and is approximately the size of the activity area of female common yellowthroats (Figure 1c).

7.3 MODEL ASSUMPTIONS

1. The life requisites of nesting, foraging, and cover are all equally limiting to the common yellowthroat reproductive habitat.
2. Nesting habitat for common yellowthroats can be satisfied best in open forest canopies or non-forested areas with high shrub cover near water.
3. All shrub and sapling species are equally useful for common yellowthroat nesting, foraging, and cover.
4. The common yellowthroat is not affected by human use, clearings or roads.
5. Open water within 50 m of reproductive habitat in an upland area is equal in habitat value to a wetland area.

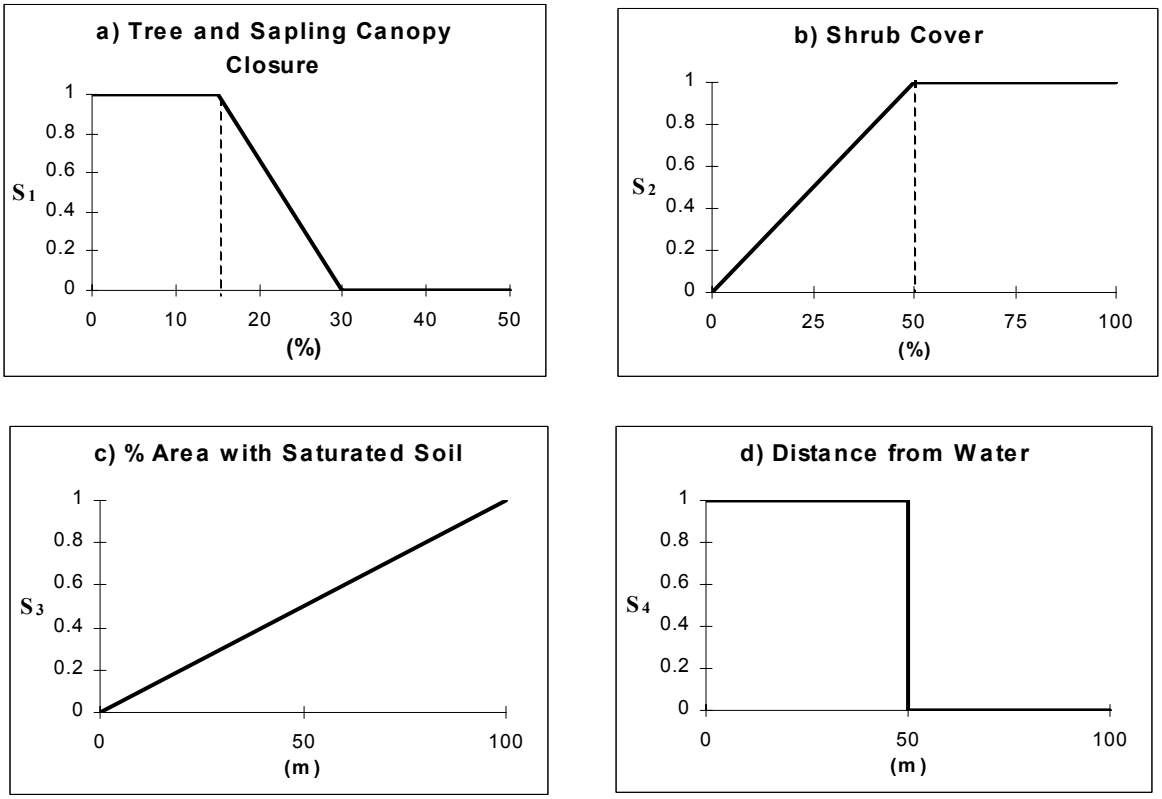

Figure 1. Graphical relationship between habitat variables and HSI components in the common yellowthroat model.

7.4 EQUATION

This equation assumes that all the variables are of equal importance and are not compensatory (a high value in one component cannot compensate for a low value in another).

$$HSI = S_1 \times S_2 \times S_3 \times S_4$$

8. SOURCES OF OTHER MODELS

There were no other HSI models for the common yellowthroat found.

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 (1989) was developed by the Weldwood of Canada Integrated Resource Management Steering Committee (IRMSC).
- Version 2 (1994) was revised by Barb Beck and Melissa Todd.
- Version 3 (1995) was written by Mark Piorecky in a habitat modelling course at the University of Alberta.
- Version 4 (1996) was edited and reformatted by Wayne Bessie.
- Version 5 (1999) was revised by Karen Graham, Rick Bonar, Barb Beck, and Jim Beck to incorporate information from recent literature.

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