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FWS/OBS-82/10.22
JULY 1982

HABITAT SUITABILITY INDEX MODELS: VEERY

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The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.
- To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major changes in land and water use.
- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technical assistance services are based on an analysis of the issues, a determination of the decisionmakers involved and their information needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

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The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for contracting biological services studies with states, universities, consulting firms, and others; Regional Staffs, who provide a link to problems at the operating level; and staffs at certain Fish and Wildlife Service research facilities, who conduct in-house research studies.

This model is designed to be used by the Division of Ecological Services in conjunction with the Habitat Evaluation Procedures.

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HABITAT SUITABILITY INDEX MODELS: VEERY

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

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CONTENTS

ACKNOWLEDGMENTS

Dr. Robert Bertin and Dr. Barry Noon provided valuable critiques of earlier drafts of an HSI model for the veery. Their comments and suggestions added significantly to the quality of this HSI model, and their contributions are gratefully acknowledged. The cover of this document was illustrated by Jennifer Shoemaker. Word processing was provided by Carolyn Gulzow and Dora Ibarra.

VEERY (*Catharus fuscescens*)

HABITAT USE INFORMATION

General

The veery (*Catharus fuscescens*) is an inhabitant of damp forests throughout much of its range (Dilger 1956; Morse 1971; Stewart 1975; Bertin 1977). Veeries also inhabit shrub thickets, at least in the New England area (Morse 1971; Bertin, pers. comm.).

Food

The diet of the veery is approximately 60% insects and 40% fruit (McAtee 1926, cited by Tyler 1949). Nestlings are fed insects (Day 1953). Veeries feed primarily on insects during the breeding season and on fruits in late summer and fall (Bertin, pers. comm.). Vegetative items may account for two-thirds of the autumn diet (Martin et al. 1961). Veeries forage primarily on the forest floor (Tyler 1949; Dilger 1956; Bertin 1975), but also feed by flycatching and by gleaning insects from foliage (Noon 1977). In Connecticut, 76% of the prey items were obtained by ground foraging, 22% by foraging on vegetation, and 2% by flycatching (Bertin 1975).

Water

Veeries in mature woodlands in Connecticut tended to select sites with the wettest ground for territories (Bertin 1977). Veery territories were also generally located near running water, possibly as a result of drinking and bathing requirements (Bertin 1975).

Cover

Cover requirements reported in the literature generally apply to the breeding season. It is assumed that cover needs for the breeding season are the same as cover needs throughout the summer.

Veeries occur in deciduous, mixed, and evergreen forests (Dilger 1956; Morse 1971; Temple et al. 1979). Optimal cover in New York was provided by moist bottomland forests with a lush herbaceous canopy (Dilger 1956). Veeries inhabit moist or floodplain deciduous forests with a shrub understory in North Dakota (Stewart 1975) and are characteristic of damp deciduous forests in Maine (Morse 1971). The veery also breeds in wooded riparian habitats of the Great Plains (Tubbs 1980).

There was no apparent relationship between the ratio of coniferous to deciduous trees and veery densities in mixed hardwood-coniferous forests in the Northcentral and Northeastern United States (studies summarized by Temple et al. 1979). The utilization of forest types by the veery may be influenced by the presence of other thrushes (Noon 1977). In a study involving both a northeastern (Vermont) and southeastern (Tennessee) study site, Noon (1977:128) reported that the veery in the Northeast "... is confined to purely deciduous forests while along southeastern mountains, it exploits these as well as mixed and totally coniferous forests. The latter habitat categories are primarily utilized by ustulatus [C. ustulatus, Swainson's thrush] in the northeast."

Disturbed forests in New York supported greater densities of veeries than did undisturbed forests, apparently because they had a denser understory (Dilger 1956). In northern hardwood forests, veeries were recorded in 77% of 30 breeding bird censuses conducted in disturbed and successional habitats, but in only 18% of 40 censuses conducted in mature undisturbed habitats (Noon et al. 1979). Densities of veeries increased in response to greater logging intensity in a northern hardwood forest in New York (Webb et al. 1977). The density of veery populations in Wisconsin is expected to increase when the abundance of aspen (Populus tremuloides) or the understory density increases (Temple et al. 1979). An opening of the forest canopy, with increased herbaceous and/or shrub growth resulting from increased light penetration, can be expected to result in increased numbers of veeries (Bertin 1975).

The major habitat factors influencing the presence of veeries in Connecticut were moisture regime and, to a lesser degree, herbaceous and woody cover 0.2 to 3.0 m (0.6 to 10 ft) tall (Bertin 1975). These two factors accounted for 78.4% and 38.2%, respectively, of the variability in habitat occupancy (Bertin 1977). Moisture regime was apparently more important than herbaceous cover or distance to running water in habitat selection in mature woodlands, even though most territories were clustered around streams. The reason that veeries prefer moist conditions is unclear, although Bertin (1975:105) suggests that it "... may be either a proximate factor in habitat selection or directly related to some important factor such as foraging behavior or microclimate." In a comparative study of the breeding habitats of veeries and wood thrushes (Hylocichla mustelina) in Connecticut, veeries were more abundant than wood thrushes in early successional woodland, which had a denser shrub layer than mature woodland, in dense shrub thickets, and in cooler and moister sites (Bertin 1975, 1977). Noon (pers. comm.) believes that shrub cover is the key proximal variable used for habitat selection by veeries. Veeries in Connecticut preferred areas with greater shrub cover than did wood thrushes although the reason for the preference is unclear (Bertin 1975). Shrub cover in veery territories in mature woodlands averaged 40.2% (Bertin 1977), with veeries apparently selecting habitats with the highest shrub density available (Bertin 1975). Over 60% of areas with shrub densities of 60-70% were occupied by veeries. Both veeries and wood thrushes inhabit northeastern deciduous forests, but veeries occur in open or disturbed areas of deciduous forests where the density of deciduous shrubs is significantly higher than in the surrounding forest (Noon 1977, 1981). Veeries reached their greatest densities in wet areas with dense ground cover and understory.

Reproduction

Veeries generally nest on or near the ground (Tyler 1949; Noon 1977). Nests in New Hampshire were built on the ground, between stems of saplings, on stumps, and in shrubs (Day 1953). Four veery nests in Connecticut were located on the ground, or in grass tussocks, in dense cover (Bertin, pers. comm.). The majority of 138 nests located in Maine were in stands of red maple (Acer rubrum) (36%) and alder (Alnus spp.) (24%) (Morse 1971).

Most singing perches used by males are from 2 to 8 m (6.6 to 26.2 ft) above ground (Bertin 1977).

Interspersion

Veery territories range in size from about 0.1 hectare (0.25 acre) to several hectares (Bertin 1975). The average size of 61 veery territories in Ontario was 0.27 ± 0.24 ha (0.67 ± 0.59 acre); the range was from 0.04 to 1.1 ha (0.1 to 2.7 acres) (Martin 1960).

The highest reported density of veeries was 20 territorial males per 20 ha (50 acres) of ash-basswood (Fraxinus-Tilia) habitat in New York (Van Velzen 1975, 1977, cited by Samson 1979). Alsop (1970) reported a density of 33 males per 40 ha (100 acres) in virgin spruce-fir (Picea-Abies) forests in North Carolina. Based on a summary of previous censuses, Back (1979) reported an increase in veery densities with an increase in age of aspen-birch (Populus-Betula) forests, an early stage of forest succession.

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This HSI model was developed for use within the breeding range of the veery.

Season. This HSI model was developed to evaluate quality of spring and summer habitat for veeries. It may be used to evaluate migratory or winter habitat if it is assumed that year-round habitat needs are similar to habitat needs during the breeding season.

Cover types. This model is intended to evaluate veery habitat in the following cover types (terminology follows that of U.S. Fish and Wildlife Service 1981): Evergreen Forest (EF); Evergreen Forested Wetland (EFW); Deciduous Forest (DF); Deciduous Forested Wetland (DFW); Deciduous Shrubland (DS); and Deciduous Scrub/Shrub Wetland (DSW).

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. Information on the minimum habitat area for the veery was not reported in the literature, but reported territories ranged from 0.04 to 1.1 ha (0.1 to 2.7 acres). It is assumed that if less than 0.04 ha (0.1 acre) of habitat is available, the HSI will be 0.0.

Verification level. Earlier drafts of an HSI model for the veery were reviewed by Drs. Robert Bertin and Barry R. Noon. Their review comments have been incorporated into this model.

Model Description

Overview. The veery can satisfy all of its habitat requirements within any one of the cover types listed above. In this model, cover and reproductive needs are assumed to be satisfied by the same set of habitat characteristics. Water is assumed to be an important factor in veery habitat quality, but is considered in this model as part of the cover and reproductive component. It is further assumed that food requirements will never be more limiting than cover and reproductive requirements.

In order to evaluate cover and reproductive suitability, it is necessary to characterize the habitat in terms of the needs of the veery. The following section identifies important habitat variables, describes suitability levels of the variables, and describes the relationships between variables. The relationship between habitat variables, life requisites, and cover types used in this model and an HSI value for the veery is shown in Figure 1.

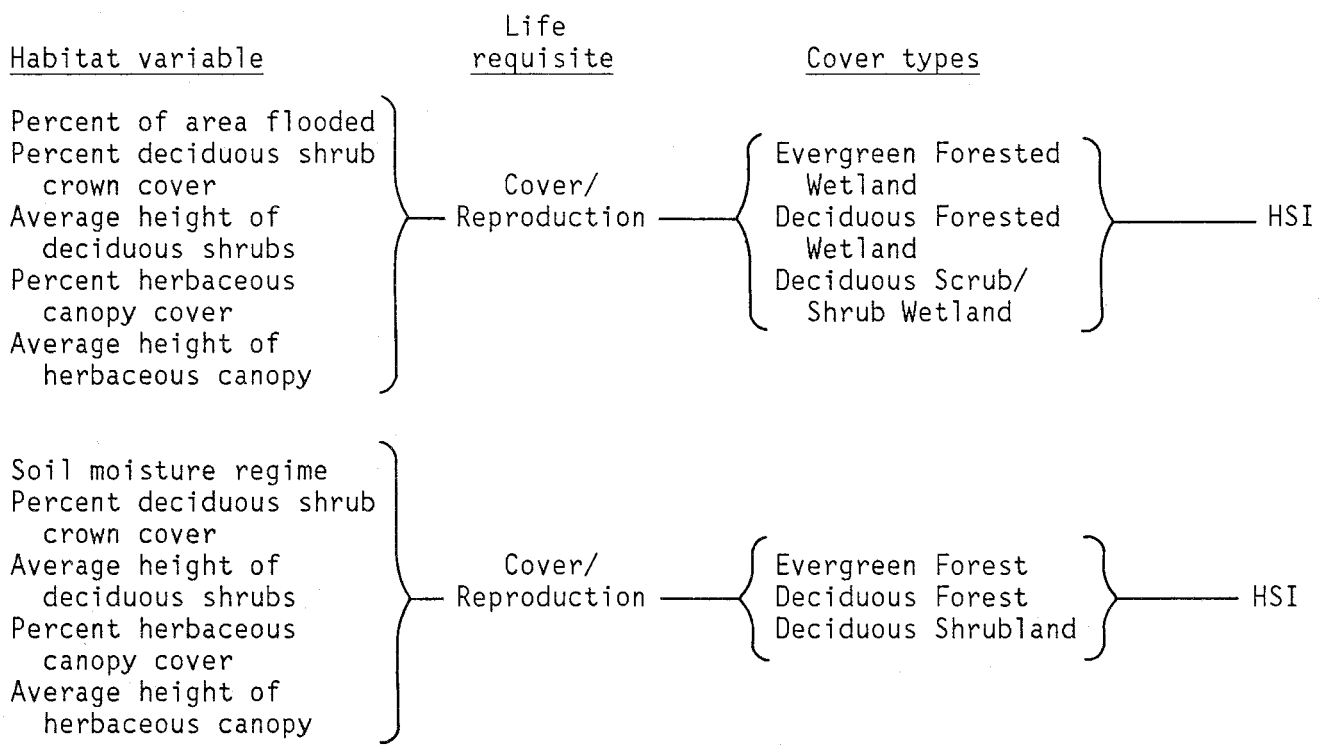


Figure 1. Relationship of habitat variables, life requisites, and cover types in the veery HSI model.

Cover/Reproduction component. Suitable cover and reproduction habitat for veeries is provided by moist forest or shrub cover types with abundant deciduous shrub thickets and/or herbaceous vegetation.

Damp or floodplain forests and shrublands apparently provide optimal conditions for veeries. Wetlands, by definition, have moist to saturated soils. However, wetlands that are completely flooded during the spring and summer will not have any ground surface available for foraging and nest sites. The value of wetland cover types that are partially flooded during spring and summer depends on the amount of available ground surface. The value of non-wetland cover types to veeries depends on soil moisture conditions during the spring and summer. Cover types with moist or saturated soils provide optimum conditions for veeries. Cover types with dry soils do not support high densities of veeries, probably because of the lack of dense vegetation.

The key vegetative component of veery habitat is the structure of the shrub stratum. Suitable shrub cover is assumed to be a function of shrub density, height, and distribution. It is assumed in this model that distribution of shrubs will be adequate at any shrub density and that the shrub component of the habitat may be evaluated by considering shrub density and height only. The evaluation of shrub cover considers deciduous shrubs only, since there is little data in the literature that indicates that veeries will use evergreen shrubs. Deciduous shrub crown cover of greater than 70% is assumed to provide optimal conditions, while areas with less than 20% shrub crown cover will probably not provide suitable shrub cover for veeries (Bertin, pers. comm.). Shrub height of 1.5 to 3.0 m (5 to 10 ft) is considered to provide an optimal combination of low cover and unrestricted mobility. Woody vegetation less than 0.5 m (1.5 ft) tall is assumed to be unsuitable for use by veeries. Shrubs or regenerating deciduous trees that are 5 m (16.4 ft) tall are assumed to have only one-half the value of optimal conditions due to a reduction in low cover.

The suitability of herbaceous cover is a function of both height and density. Areas with either an abundance of short herbaceous vegetation or a small amount of tall herbaceous vegetation provide veeries with very litte concealment. Optimal conditions are assumed to exist if the herbaceous canopy cover is greater than 90% (Bertin, pers. comm.) and the average herbaceous canopy height is greater than 30 cm (12 inches). Densities of herbaceous vegetation that are less than 30% will not provide adequate concealment (Bertin, pers. comm). The suitability of herbaceous vegetation for veery cover and reproductive needs is assumed to approach zero as vegetation height decreases.

The cover and reproductive value of all cover types in which veeries occur is a function of vegetation and moisture conditions. Vegetation is, in turn, a function of the height and density of shrubs and herbaceous vegetation. The height and density of shrubs are considered to be compensatory; i.e., a low suitability for one variable may be partially offset by a high suitability for the other. However, the variable with the lowest suitability should have the greatest impact on the final estimate of the value of shrubs to the cover and reproduction needs of the veery. A similar relationship is assumed to

exist between the height and density of herbaceous vegetation. Shrub cover is considered to be the key vegetative factor in habitat selection, and optimum conditions may exist in the absence of herbaceous vegetation (Noon, pers. comm.). Herbaceous vegetation may add to the overall quality of the habitat but is considered to be capable of providing only one-half of the habitat suitability that can be provided by shrubs.

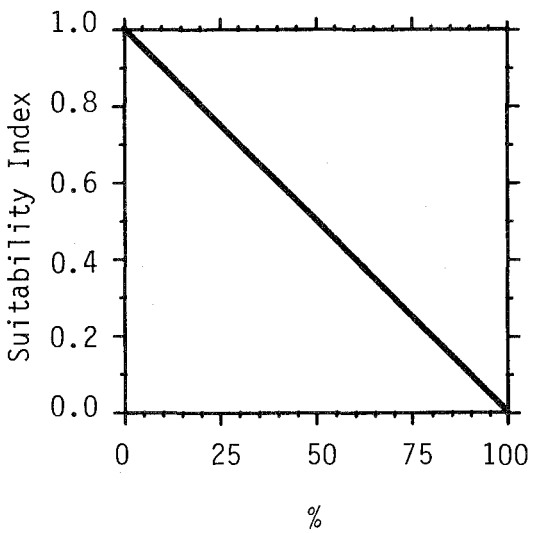
The major factor determining habitat suitability for veeries in nonwetland cover types with suitable vegetation is soil moisture. In nonwetland cover types with suitable soil moisture, the major factor will be vegetative cover. Since both soil moisture suitability and vegetative cover may, in different situations, determine overall habitat suitability in nonwetland cover types, the feature with the lowest suitability will determine the overall suitability of the cover type for veeries.

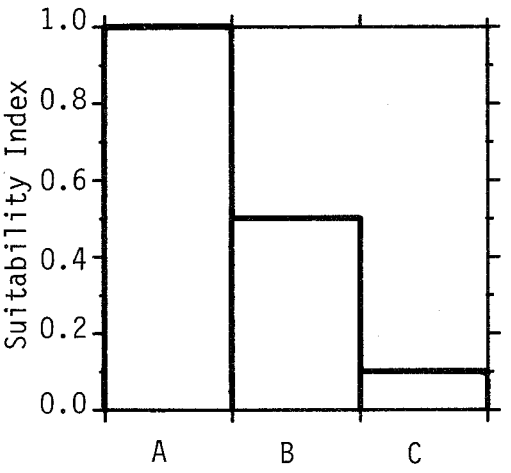
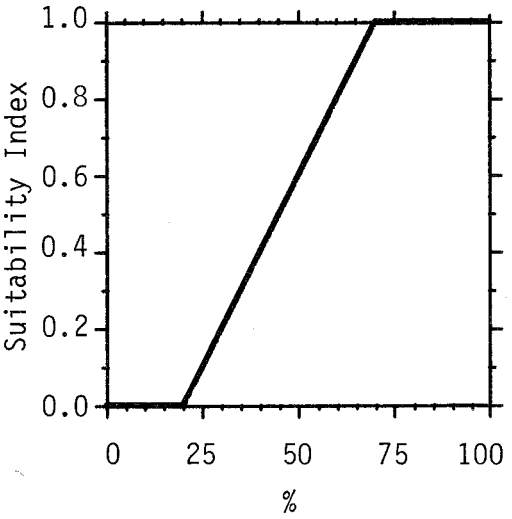
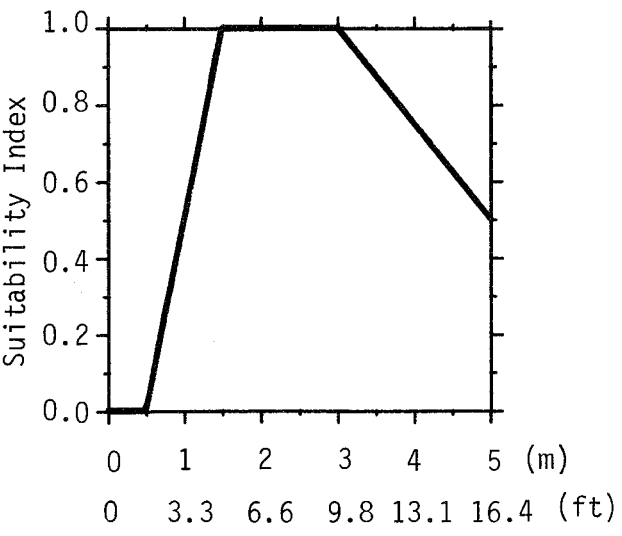
In wetland cover types, an estimate of the area that is flooded represents the area that is unavailable for use by veeries. The value of the vegetation as cover (determined from samples on nonflooded sites) should be reduced in direct proportion to the amount of the cover type that is flooded.

Model Relationships

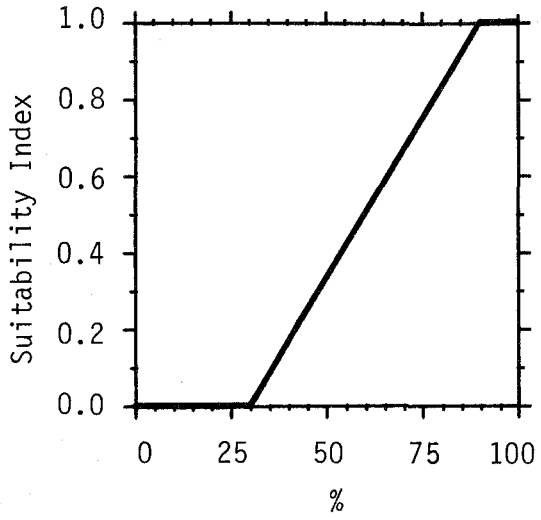
Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

Cover type	Variable	
EFW,DFW, DSW	V_1	Percent of the cover type flooded (average spring/early summer conditions).

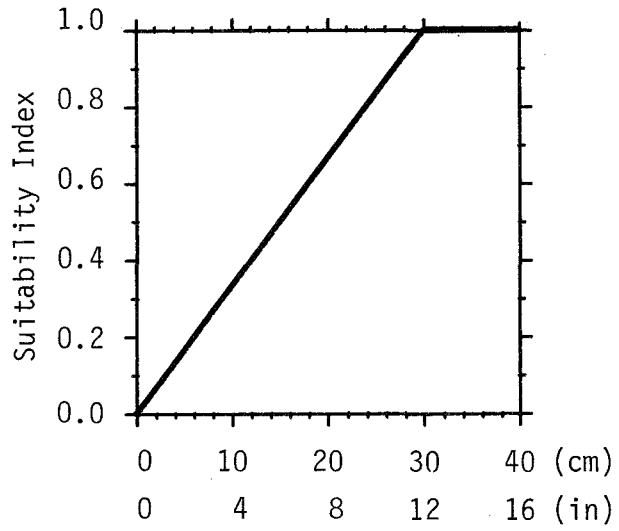


EF,DF, DS	V_2	Soil moisture regime (average spring/early summer conditions). A) Soils typically moist to saturated (e.g., floodplain forest). B) Soils moderately dry to moist (e.g., upland forest occurring in shaded ravines). C) Soils typically dry (e.g., upland forest).	
EF,EFW, DF,DFW, DS,DSW	V_3	Percent deciduous shrub crown cover.	
EF,EFW, DF,DFW, DS,DSW	V_4	Average height of deciduous shrubs.	

EF,EFW, DF,DFW, DS,DSW	V_5	Percent herbaceous canopy cover (late spring/early summer conditions).



EF,EFW, DF,DFW, DS,DSW	V_6	Average height of herbaceous canopy (late spring/early summer conditions).



Equations. In order to obtain a cover/reproduction value for the veery, the SI values for the appropriate variables must be combined through the use of equations. A discussion and explanation of the assumed relationships between variables was included under Model Description, and the specific equations in this model were chosen to mimic the perceived biological relationships as closely as possible. The suggested equation for obtaining a cover/reproduction value for veeries in wetland cover types (EFW, DFW, DSW) is as follows:

$$V_1 \times [(V_3 \times V_4)^{1/2} + 0.5(V_5 \times V_6)^{1/2}]$$

In nonwetland cover types (EF, DF, DS), the suggested equation is the lowest of the following:

$$(V_2) \text{ or } [(V_3 \times V_4)^{1/2} + 0.5(V_5 \times V_6)^{1/2}]$$

Note that the vegetative structure portion of the above equations, $[(V_3 \times V_4)^{1/2} + 0.5(V_5 \times V_6)^{1/2}]$, may exceed 1.0. In those cases where a score greater than 1.0 is obtained, the value should be considered to equal 1.0.

HSI determination. Cover/Reproduction was the only life requisite considered in this model, and the HSI will equal the Cover/Reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 2.

Variable (Definition)		Cover types	Suggested technique
V_1	Percent of the cover type flooded (average spring/early summer conditions).	EFW,DFW,DSW	On-site inspection during spring/early summer.
V_2	Soil moisture regime (the moisture condition of the soil at the ground surface during average spring/early summer conditions. Categorized as: A - Moist to saturated B - Moderately dry to moist C - Dry)	EF,DF,DS	On-site inspection during spring/early summer.

Figure 2. Definitions of variables and suggested measurement techniques.

Variable (Definition)		Cover types	Suggested technique
V_3	Percent deciduous shrub crown cover (the percent of the ground surface that is shaded by a vertical projection of the crowns of deciduous shrubs).	EF,EFW,DF,DFW, DS,DSW	Line intercept, quadrat.
V_4	Average height of deciduous shrubs (the average vertical distance from the ground to the highest point of all woody plants ≤ 5m [16.4 ft] tall).	EF,EFW,DF,DFW, DS,DSW	Line intercept, graduated rod.
V_5	Percent herbaceous canopy cover (late spring/early summer conditions) (the percent of the ground surface that is shaded by a vertical projection of the crowns of all nonwoody vegetation).	EF,EFW,DF,DFW, DS,DSW	Line intercept, quadrat.
V_6	Average height of herbaceous canopy (late spring/ early summer conditions) (the average vertical distance from the ground surface to the dominant height stratum of the herbaceous vegetative canopy).	EF,EFW,DF,DFW, DS,DSW	Line intercept, graduated rod

Figure 2. (concluded).

SOURCES OF OTHER MODELS

No other habitat models for the veery were located in the literature.

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16. Abstract (Limit: 200 words)

Habitat preferences and species characteristics of the veery (Catharus fuscesens) are described in this publication. It is one of a series of Habitat Suitability Index (HSI) models and was developed through an analysis of available scientific data on the habitat requirements of the veery. Habitat use information is presented in a review of the literature, followed by the development of an HSI model. The model is presented in three formats: graphic; word; and mathematical. Suitability index graphs quantify the species-habitat relationship. These data are synthesized into a model designed to provide information for use in impact assessment and habitat management.

17. Document Analysis a. Descriptors

Animal behavior
Birds
Wildlife
Habits
Mathematical models

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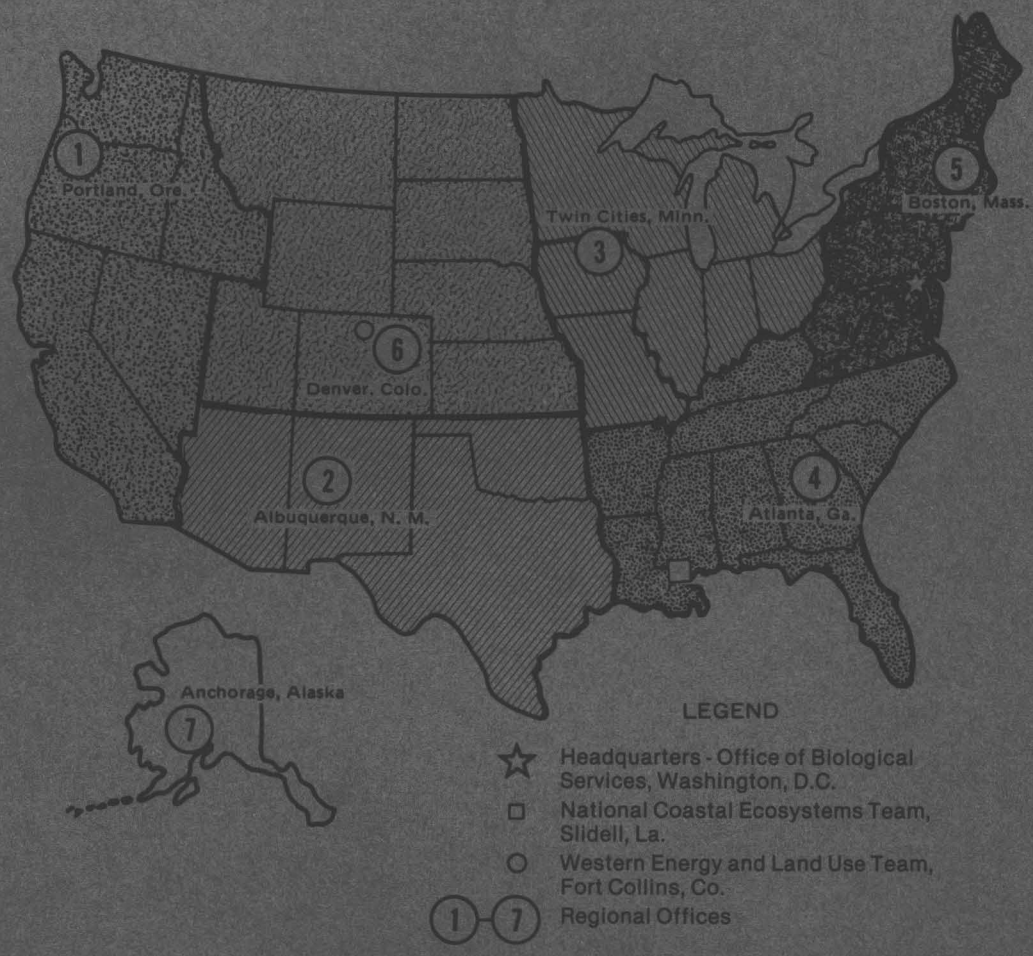

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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