Coastal Wetlands Planning, Protection and Restoration Act

Wetland Value Assessment Methodology

Coastal Chenier/Ridge Community Model

Prepared by:

Environmental Work Group

Point of Contact:
Kevin J. Roy
U.S. Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
(337) 291-3120
kevin_roy@fws.gov

February 6, 2008August 1, 2002

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I. Introduction

The habitat assessment model presented in this document is a modification of the U. S. Fish and Wildlife Service's Habitat Evaluation Procedures (HEP). It utilizes a set of variables considered important in determining the suitability of non-grazed barrier headland ridges, cheniers, and spoil areas in Louisiana that are, or are proposed to be, vegetated in primarily non-obligate wetland plant species, to provide the habitat necessary to support transient migratory landbirds in the spring and fall. The area of the state to which this model is applicable to includes the portions of Cameron, Vermilion, Iberia, St. Mary, Terrebonne, Lafourche, Jefferson, Plaquemines and St. Bernard Parishes south of the Intracoastal Waterway. The model attempts to assess the suitability of habitat for providing foraging and resting requirements to a diverse assemblage of migratory landbirds. This model has not been validated with field data.

II. Variable Selection

Several existing Habitat Suitability Index (HSI) models were considered for use in determining migratory landbird stopover habitat quality, including the models for roseate spoonbill, great egret, brown thrasher, swamp rabbit, veery and yellow warbler. However, the emphasis for all these models was breeding habitat requirements. None addressed the set of variables that were determined to be most pertinent to assessment of stopover habitat quality, where a variety of species with differing foraging strategies occupy the habitat for a relatively brief time period. Selection of the variables used for this model was based upon a review of available literature, interviews with specialists who have studied various aspects of migratory landbird ecology in coastal stopover habitats, and the field knowledge of those involved with development of this model.

More than 80 species of neotropical migratory landbirds from at least eleven Families pass through Louisiana during the spring and fall (Sauer et al. 2000). At the peak of spring migration, it is estimated that as many as 50,000 birds per day per mile of coastline enter the state (Conner and Day 1987). During favorable weather conditions, the majority of these birds will bypass small wooded areas embedded in coastal marsh and land in extensive forested areas north of the marshes, but during thunderstorms or other unfavorable conditions, a large percentage of these individuals may stop in these small coastal wood patches (Gauthreaux 1971). Identifying the optimal stopover habitat characteristics for such a varied group of birds is challenging. Martin (1980) stated that migrants often select habitats en route that superficially resemble their breeding habitat. Moore et al. (1995) concluded that spring migrants on the northern Gulf of Mexico coast preferentially select structurally diverse stopover sites, consisting of forested areas with mixed shrub layers, and that maintenance of

plant species and structural diversity should be a goal at migratory landbird stopover sites. Similarly, Martin (1980) found that habitat structure in shelterbelt "island" habitat in the Great Plains influences migrant diversity and abundance. Robinson and Holmes (1984) determined that the diversity of bird species in terrestrial habitats is correlated with factors associated with vegetation structure or composition, including diversity of foliage height, and stated that, in general, the number of bird species increases with the addition of vertical vegetation layers. Based upon the findings above and upon prior field investigations, we proposed three habitat assessment variables: 1) percent tree canopy cover, 2) percent shrub/midstory canopy cover, and 3) the number of native woody species planted/present on the site. We also identified some tentative variables, including percent herbaceous ground cover, minimum patch size, average tree height, and proximity of the site to other forested patches.

We asked three specialists with expertise in the arena of migratory landbird habitat requirements to comment on our proposed habitat variables: William C. Hunter, U.S. Fish and Wildlife Service, Atlanta, GA; Mark Woodrey, U.S. Fish and Wildlife Service, Jackson, MS; and Wylie Barrow, U.S.G.S., National Wetlands Research Center, Lafayette, LA. Their comments have been incorporated into the model and referenced as personal communications.

All specialists queried concurred that structural and floristic diversity were key factors to consider. Additionally, they all stressed the importance of fresh water sources for spring trans-Gulf migrants. However, we did not develop a variable to capture this factor, as the model was being designed for created habitat in an area where fresh water input would probably be limited to precipitation. A variable to measure fresh water proximity should probably be created for assessing extant stopover sites. We decided not to use a variable for percent herbaceous ground cover because for the majority of birds that would be likely to use forested coastal areas, the amount of herbaceous ground cover would not be as critical a habitat need as would tree and shrub cover (Moore et al. 1995). Neotropical migratory landbirds dependent upon grasslands would not typically use forested cheniers, spoil banks, etc., instead gravitating towards marshes, pastures, and agricultural fields. No minimum patch size for sites was established, because while larger patches are accepted to be more valuable to birds than small patches, a small patch surrounded by non-forested habitat could be very important at times to migrants (Barrow, pers. comm.). The same basic rationale was used in determining that a variable to rank sites on the basis of their proximity to other forested patches was not practical. Sites adjacent to other forested sites are assumed to facilitate migration of forest birds by reducing the distance needed to travel through open and potentially inhospitable terrain, but an isolated woodland could be important during periods of inclement weather (Barrow, pers. comm.). Canopy height was ruled out as a variable because no data was discovered that addressed minimum canopy heights at stopover sites. The developers of this model assumed that percent canopy cover was a more pertinent variable to consider.

III. Suitability Index Graph Development

Variable V1 – Percent tree canopy cover. Neotropical migratory landbirds preferentially use stopover sites exhibiting high structural and floristic diversity (Moore et al.1995). To achieve the desired vertical plant diversity (i.e., a mix of trees, tree saplings, shrubs, vines, and

herbaceous plants), a moderately closed tree canopy would be preferred to over a totally closed canopy (Hunter, pers. comm.; Barrow, pers. comm.; Woodrey, pers. comm.). Tree canopy coverage ranging from 65 - 85% is assumed to provide optimal conditions to allow for establishment of midstory trees, shrubs, vines, and herbaceous plants, provided that the site is not grazed. Tree species that may occur at coastal stopover sites include sugarberry *(Celtis laevigata)*, toothache tree *(Zanthoxylum clava-herculis)*, live oak *(Quercus virginiana)*, water oak *(Q. nigra)*, honey locust *(Gleditsia triacanthos)*, red mulberry *(Morus rubra)*, and green haw *(Crataegus viridis)* (Louisiana Natural Heritage Program 1988, Materne 2000, Gosselink et al. 1979,Thomas and Allen 1996, Thomas and Allen 1998).

Variable V2 – Percent shrub/midstory cover. Shrub-scrub habitats provide important foraging and resting areas for migrant landbirds (Moore et al. 1995). Shrub-scrub habitats are also presumed to be important to migratory passerine birds as refuges from raptor predators (Moore et al. 1990). For the purposes of this model, shrub/midstory means multi-stemmed shrubs, single-stemmed midstory trees, single-stemmed saplings of overstory tree species, and woody vines. Shrub/midstory canopy coverage ranging from 35 - 65% is assumed to represent optimal conditions at a forested site. Species of shrubs, small trees, and woody vines that may be found at stopover sites include Small's acacia *(Acacia minuta)*, wax myrtle *(Morella cerifera)*, dwarf palmetto *(Sabal minor)*, yaupon holly *(Ilex vomitoria)*, saltbush *(Baccharis halimifolia)*, greenbriars *(Smilax spp.)*, grapes *(Vitis spp.)*, prickly pear cactus *(Opuntia spp.)*, Virginia creeper *(Parthenocissus quinquefolia)*, pepper vine *(Ampelopsis arborea)*, blackberries *(Rubus spp.)*, rattlebox *(Sesbania drummondii)*, marshelder *(Iva frutescens)*, poison ivy *(Toxicodendron radicans)*, Carolina wolf-berry *(Lycium carolinianum)*, marine vine *(Cissus incisa)* and elderberry *(Sambucus canadensis)* (Louisiana Natural Heritage Program 1988, Materne 2000, Gosselink et al. 1979, Thomas and Allen 1996, Thomas and Allen 1998).

Variable V3 – Native woody species diversity. A wide variety of fruits, flowers, nectars, and animals, primarily invertebrates, are consumed by migrant landbirds (Moore et al. 1995, Fontenot 1999, Barrow, pers. comm.). Robinson and Holmes (1984) concluded that vegetation provides birds with foraging opportunities and constraints depending upon the structure of individual plants, aggregations of plants, and the arthropods that these plants host. The resulting foraging conditions define the diversity of bird species in the habitat. While some exotic plant species provide foraging opportunities to migrant landbirds, others are of limited value to spring and fall migrant birds (Barrow and Renne, 2001, Barrow, pers. comm.). It is assumed that a variety of native shrubs, midstory trees, woody vines and overstory trees will provide sufficiently diverse foraging and resting habitat to enable spring and fall transient birds to continue their migration. Woody plant species composition and diversity in stopover habitat is influenced by elevation, soil type, and salinity levels (Materne 2000, Louisiana Natural Heritage Program 1988), and the capacity of sites to support certain species will depend upon these and other factors. Based upon a review of available written information and upon the field knowledge of those involved in development of this model, and upon the range of conditions likely to be encountered in stopover habitat in the area the model addresses, presence of $\geq$10 species of native trees, shrubs, and woody vines is assumed to represent optimal conditions. It is also assumed that the parameters defining optimal conditions for variables V1 and V2 will moderate the potential for variable V3 to exert a false reading of

habitat value for migrant landbirds, should the diversity of plant species be confined only to trees, or to shrubs, or to woody vines.

IV. Habitat Suitability Index Formula

The final step in model development was to construct a mathematical formula that combines all Suitability Indices into a single Habitat Suitability Index (HSI) value. Because the Suitability Indices range from 0.1 to 1.0, the HSI also ranges from 0.1 to 1.0, and is a numerical representation of the overall or "composite" habitat quality of the area being evaluated. Within the HSI formula, any Suitability Index can be weighted by various means to increase the power or "importance" of that variable relative to the other variables in determining the HSI. For this model, it was assumed that the variables are of equal weight in determining the habitat quality of a coastal chenier/ridge.

To combine the variables into an HSI formula, a geometric mean was chosen, as opposed to an arithmetic mean, to convey the weak compensatory relationship between the three variables. An arithmetic mean is often used when it is assumed that the model variables have a strong compensatory relationship (i.e., a high value for one variable can compensate for the low value of another variable). The geometric mean is used to discourage a variable with a marginal or low suitability from being offset by the high suitability of the other variables (U.S. Fish and Wildlife Service1981). It was assumed that the three variables in this model do not have a strong compensatory relationship.

HSI Calculation: $HSI = (SIV_1 \times SIV_2 \times SIV_3)^{1/3}$

V. Benefit Assessment

The net benefits of a proposed project are determined by predicting future habitat conditions under two scenarios: future without-project and future with-project. Specifically, predictions are made as to how the model variables will change through time under the two scenarios. Through that process, HSIs are established for baseline (pre-project) conditions and for future without- and future with-project scenarios for selected "target years" throughout the expected life of the project. Those HSIs are then multiplied by the project area acreage at each target year to arrive at Habitat Units (HUs). Habitat Units represent a numerical combination of quality (HSI) and quantity (acres) existing at any given point in time. The HUs resulting from the future without- and future with-project scenarios are annualized, averaged over the project life, to determine Average Annual Habitat Units (AAHUs). The "benefit" of a project is quantified by comparing AAHUs between the future without- and future with-project scenarios. The difference in AAHUs between the two scenarios represents the net benefit attributable to the project in terms of habitat quantity and quality.

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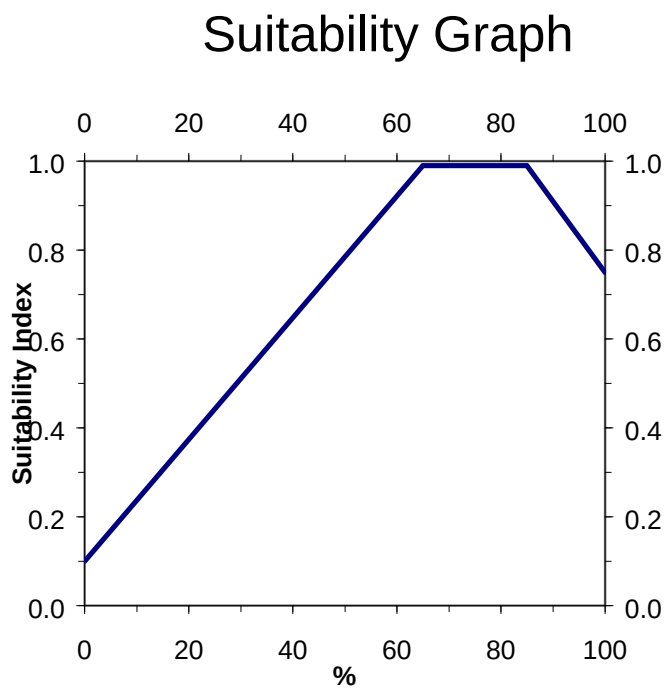
COASTAL CHENIER/RIDGE

Variable V_1 Percent Tree Canopy Cover



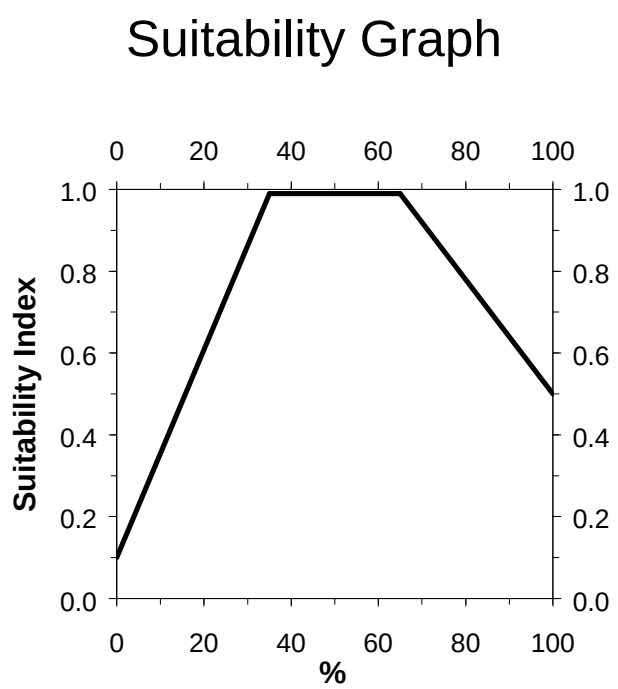
Line Formulas

If % < 65, then SI = (0.014*%) + 0.1
If 65 ≤ % ≤ 85, then SI = 1.0
If % > 85, then SI = (-0.017*%) + 2.445

Suitability index graph relationships for Variable V1 were determined by: 1) reviewing available literature, 2) interviewing specialists who have studied various aspects of migratory landbird ecology in coastal stopover habitats, and 3) field knowledge of those involved with development of this model.

COASTAL CHENIER/RIDGE

Variable V_2 Percent Shrub/Midstory Cover



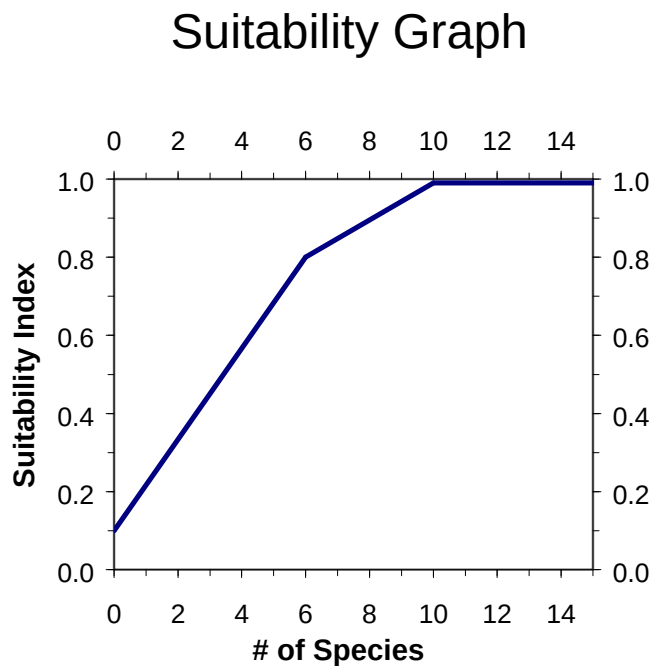
Line Formulas

If % < 35, then SI = (0.026*%) + 0.1
If 35 ≤ % ≤ 65, then SI = 1.0
If % > 65, then SI = (-0.014*%) + 1.9

Suitability index graph relationships for Variable V2 were determined by: 1) reviewing available literature, 2) interviewing specialists who have studied various aspects of migratory landbird ecology in coastal stopover habitats, and 3) field knowledge of those involved with development of this model.

COASTAL CHENIER/RIDGE

Variable V_3 Native Woody Species Diversity



Line Formulas

If % < 6, then SI = (0.117*%) + 0.1
If 6 ≤ % < 10, then SI = (0.05*%) + 0.5
If % ≥ 10, then SI = 1.0

Suitability index graph relationships for Variable V3 were determined by: 1) reviewing available literature, 2) interviewing specialists who have studied various aspects of migratory landbird ecology in coastal stopover habitats, and 3) field knowledge of those involved with development of this model.