**Habitat Suitability Index Model: Roy Tomlinson**

The following habitat suitability index model is the result of information obtained from a single species expert. We developed this model following the U.S. Fish and Wildlife Service guide to the development of habitat suitability index (HSI) models 103-ESM (USFWS 1981). However, unlike typical HSI models this model is intended to be used in conjunction with alternative HSI models developed from additional experts and existing literature. This model represents the best estimates of a single species expert.

1.Model Applicability:

1.1 Geographic area. This model was developed based on knowledge of masked bobwhite habitat in Mexico.

1.2 Season. This model was developed to evaluate habitat needs of masked bobwhites over the entire year.

2. Model Description:

2.1 Overview. This model considers the ability of assessed habitat to meet the food, reproductive, and cover requirements of masked bobwhite as an indicator of overall habitat suitability. All components of the model are assessed by vegetative conditions. The relationship between habitat variables and critical life history requirements of masked bobwhite is illustrated in Figure 1.

2.2 Written Documentation.

The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for masked bobwhite in order to explain the variables and equations that are used in the HSI model. We present each critical habitat requirement and describe the variables which contribute to it.

1. Reproduction.
2. Food. Forb Diversity is important year round as a source of food. In the winter and early spring, when food is scarce, forb seeds are critical. Forbs are used directly as forage in the summer and fall. Habitat suitability increases with increasing forb diversity.
3. Cover. Masked bobwhites use different habitats in the winter and summer. In the summer masked bobwhites prefer more open areas with primarily grass and forb cover whereas in the winter more closed areas with a mix of small trees and shrubs are preferred. Therefore, the canopy cover of forb, grass, shrub, and tree differs between seasons. In the summer optimal cover percentages are approximately 50 percent for grass cover, 30 percent for forb cover, 10-20 percent shrub and small tree cover, and 25 percent bare ground. In the winter optimal cover percentages are 50 percent for grass and forb combined, 50-75 percent shrub and small tree cover, and 25 percent ground cover. Grass cover should be composed of primarily annuals species such as rothrox, black, or side-oats gramma (see species list below). Both forb and grass cover should be measured as a plant density. Masked bobwhites need a balance between adequate cover and adequate space to move and see predators. Buffelgrass generally fails to meet this balance because it forms stands which are too dense. The value of plant density at which habitat is most suitable for masked bobwhites is unclear. Shrub cover is an important component in the winter and spring when cover from grass and forbs is minimal.

**Figure 1.** The relationship between measured habitat variables, critical life history requirements, and habitat suitability for masked bobwhites.

Measured Habitat Variable Life Requisite Model Output

Forb Diversity

Structural Diversity

Grass Diversity

Food

Tree Cover

Shrub Diversity

Forb Height

Predator Protection

Suitability Index

Grass Canopy Cover

Shrub Height

Grass Height

Grass Stem Density

Grass Cover

Forb Cover

Shrub Cover

Total Cover

Grass Horizontal Cover

Brush Piles

**3. Suitability Functions and Graphs**

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Description | Suitability Function | Suitability Graph |
| FD | Forb Diversity measured as the total number of forb species on a given home range throughout the year | (Gamma CDF with α=23.5, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\FD Ellis.emf |
| GD | Grass Diversity measured as the total number of both annual and perennial grass species on a given home range throughout the year | (Gamma CDF with α=23.5, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\GD Ellis.emf |
| ShD | Shrub diversity measured as the total number of shrub species on a given home range throughout the year | (Gamma CDF with α=11, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\ShDEllis.emf |
| FH | Forb Height measured as the average height of Forbs on a given home range |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\FH.emf |
| GH | Grass Height measured as the average height of grass on a given home range |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\GH Ellis.emf |
| SH | Shrub Height measured as the average height of grass on a given home range |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\SH Ellis.emf |
| TrC | Tree cover measured as the percent canopy cover of trees on a given home range |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\TrC Ellis.emf |
| GC1 | Grass Canopy Cover measured from above the grass canopy as the amount of ground covered by grass foliage on a given home range |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\GC1 Ellis.emf |
| GC2 | Grass Cover from the side measured as the average amount of distance until complete visual obstruction on a given home range. |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\GC2 Ellis.emf |
| GC3 | Grass basal area measured as the average area occupied by stems of grass on a given home range. | (B(5,20) is the Beta function evaluated at α=5, β=20) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\GC3 Ellis.emf |
| TC | Total Cover measured as the average total canopy cover of all vegetation (and brush piles) on a given home range. Suitability of total cover differs in winter and summer. | Winter:  (B(3,7) is the Beta function evaluated at α=3, β=7) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\WTC Ellis.emf |
|  |  | Summer:  (B(4,4) is the Beta function evaluated at α=3, β=7) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dave Ellis\STC Ellis.emf |

**Equations.**

The final habitat suitability index score is a result of the combination of suitability scores from component variables. The equations which describe this combination are governed by the assumptions and relationships described in section 2.2. Additive equations imply each variable in the equation can compensate for other variables with low scores unless otherwise noted. Multiplication implies a score of zero for any variable results in a suitability score equal to zero (i.e. both variables must have non-zero scores for the habitat to be suitable).