**Habitat Suitability Index Model: Steve Dobrott**

The following habitat suitability index model is the result of information obtained from the consensus of two species experts. Aspects of the model for which the experts failed to reach a consensus are identified as such. 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 two species experts.

1. Model Applicability:

1.1 Geographic area. This model was developed based on knowledge of masked bobwhite habitat in both Arizona, specifically Buenos Aires National Wildlife Refuge, and northern Mexico.

1.2 Season. This model was developed to evaluate habitat needs of masked bobwhites over the entire year. The suitability of certain variables differs among seasons and these differences are noted and described in the model.

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. If conditions provide adequate food, cover, and water then reproductive requirements are assumed to also be adequate.
2. Food. Adequate winter food is critical for masked bobwhite survival. A diversity of legumes such as senna, white ball acacia, and acacia angustissima can improve winter food supply.
3. Cover. Masked bobwhites need adequate cover in the form of both native grasses and small shrubs. Bufflegrass is detrimental to masked bobwhite habitat
4. Water.

**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

Tree Cover

Forb Cover

Reproduction

Forbs

Forb Diversity

Forb Height

Food

Grass Cover

Suitability Index

Grass

Grass Diversity

Cover

Grass Height

Shrubs

Shrub Cover

Thermal Refuge

Brush Piles

Shrub Height

Bare Ground

Leaf Litter

**3. Suitability Functions and Graphs**

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Description | Suitability Function | Suitability Graph |
| FC | Forb cover measured as the average percent canopy cover dominated by forbs. The optimal canopy cover of forbs differs between the fall/winter and spring/summer. | Late Summer/Fall/Winter: | X:\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\FC Fall-winter Sally-Dan.emf |
|  |  | Spring/ Summer: | X:\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\FC Spring-summer Sally-Dan.emf |
| FD | Forb Diversity measured as the total number of forb species on a typical home range (10.9 ha) throughout the year. | (Gamma CDF with α=22.5, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\FD Sally-Dan.emf |
| FH | Forb height measured as the average height of forbs. Optimal forb height differs between the spring/summer and the fall/winter. | Fall/ Winter:  (Gamma CDF with α=13, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\FH Fall-winter Sally-Dan.emf |
|  |  | Spring/ Summer:  (Gamma CDF with α=13, β=1) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\FH Spring-summer Sally-Dan.emf |
| GC | Grass cover measured as the percent canopy cover of grass. The optimal canopy cover of grass differs between perennial and annual grasses. | Perennials: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GC Perennial Sally-Dan.emf |
|  |  | Annuals: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GC Annual Sally-Dan.emf |
| GD | Grass diversity measured as the total number of grass species found on a typical home range (10.9 ha). The optimal number of species differs between perennial and annual grasses. | Perennials:  (Gamma CDF with α=7, β=2.33) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GC Perennial Sally-Dan.emf |
|  |  | Annuals:  (Gamma CDF with α=5, β=2.5) | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GD Annual Sally-Dan.emf |
| GH | Grass height measured as the average height of grass on a typical home range (10.9 ha). The two experts differed on their assessment of optimal grass height. | Expert 1: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GH Dan.emf |
|  |  | Expert 2 Cover: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GH Sally Cover.emf |
|  |  | Expert 2 Nesting: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\GH Sally Nesting.emf |
| SC | Shrub cover measured as the average canopy cover of shrubs. The two experts differed in their assessment of optimal shrub cover. | Expert 1: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\SC Dan.emf |
|  |  | Expert 2: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\SC Sally.emf |
| SH | Shrub height measured as the average height of shrubs. |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\SH Sally-Dan.emf |
| TC | Tree cover measured as the average canopy cover of trees. The optimal value of tree cover differs between the uplands and arroyos. | Uplands: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\TC Uplands Sall-Dan.emf |
|  |  | Arroyos: | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\TC Arroyos Sally-Dan.emf |
| BG | Bare ground measured as the average canopy cover of bare ground. Bare ground should be in the form of a matrix interspersed with other canopy components |  | C:\Documents and Settings\cnadeau\My Documents\Work\Masked Bobwhite\Graphs\Suitability Functions\Dan and Sally\BG Sally-Dan.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).