



Habitat Appraisal Guide for Bobwhite Quail

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Introduction

The northern bobwhite quail (*Colinus virginianus*) is the most well known and popular upland game bird in Oklahoma. The bobwhite occurs statewide and its numbers are directly related to land use, management practices, and weather. The main influence on Oklahoma's landscape and subsequently bobwhite quail habitat has been farming. Farming has directly eliminated bobwhite quail habitat. In addition, plowing prairie or shrubland and replacing it with introduced grasses such as bermudagrass, Old World Bluestems, fescue or other grass monocultures has greatly reduced the quality of the bobwhite's habitat. The major influence on the bobwhite's remaining natural habitat is cattle grazing. In general, cattle grazing at light or moderate stocking rates is beneficial, and in many areas, necessary to maintain high quality habitat. Most of the state's land has the potential to provide habitat for the bobwhite quail, but the quality of habitat will vary from poor to excellent depending on many land use factors.

The purpose of this appraisal guide is to provide a means to systematically evaluate the suitability of prairie, shrubland, or forest for bobwhite quail. The appraisal guide can also be used to evaluate nonnative vegetation such as introduced pasture or cropland. The guide is designed to inventory and analyze existing habitat conditions and to determine an overall habitat value and a limiting factor value. These values will indicate the overall quality of habitat that a unit of land provides in its existing condition, and will identify weak or missing elements that are limiting quail numbers (limiting factors) so that management alternatives can be developed.

The guide allows you to appraise habitat quality on all lands. You must identify a

conceptual home range to evaluate the required habitat elements. The guide is based on the premise that habitat elements providing the requirements for bobwhite quail occur within the home range in various amounts, kinds, conditions, and arrangements. Appraisal of the conceptual home range is based upon the measurement of these variables within the home range.

Habitat Appraisal Guide Components

The bobwhite quail restricts its activities to a home range that varies in size depending on the kind, amount, condition, and interspersion of the required habitat components. The size of this area, within limits, is approximately the same for all individuals within the species. Within this area, or actual home range, must be found all the requirements for the bobwhite's livelihood. The actual size and shape of the home range is determined by the inherent limits of how far the animal can travel and the quality of various habitat elements within the home range. Actual home ranges are not marked by permanent boundaries, nor are they the same from year to year or season to season. A conceptual home range sets fixed boundaries which approximate the ordinary limits of movement for the bobwhite and provides a convenient area of planning within which habitat elements can be measured.

The bobwhite is primarily a species of edges and early to mid-seral stages of plant succession (annual and perennial forbs) resulting from disturbance of the plant community (Stoddard 1931). The bobwhite is most abundant where herbaceous and woody plants occur together and are closely intermixed (Edminster 1954).

Home Range and Carrying Capacity

The size and shapes of the bobwhite's home range varies according to the quality of habitat within the home range. The home range seldom exceeds 80 acres and averages between 20 and 40 acres (Bartholomew 1964, Lehman 1946, Mangold 1950, Murphy and Baskett 1952). However, individual birds may move up to 40 miles during the "fall shuffle" and lesser distances during the spring (A.D. Peoples, pers. comm., 1993). An individual quail covey can occupy as little as four acres, however, the average density on intensively managed areas is one covey per 15 acres (Rosene 1969). Carrying capacity for quail averaged over several years rarely exceeds one bird per acre.

Habitat Requirements

Nesting Cover

Bobwhites build nests on the ground in dead warm-season grass clumps left from the previous growing season. Most nests are within 50 feet or less of an opening or edge. Little bluestem and other grasses of similar growth habit make up the majority of nest sites (Wiseman 1977). Weeping lovegrass is also used for nesting cover when close to other habitat requirements (De Arment 1950). Broomsedge bluestem is a primary nesting cover throughout much of the eastern part of the State (Rosene 1969). Practically all tall warm season grasses are used for nesting, but native bluestems, indiagrass, switchgrass and sideoats grama compose the majority of nesting sites within Oklahoma. Warm-season native short grasses such as buffalograss, blue and hairy grama and introduced grasses such as bermudagrass are not used for nesting. Because of their growth habit, Old World Bluestems may be used for nesting if other habitat requirements are also available, but its other negative attributes preclude it from be-

ing considered as desirable. Cool season grasses such as tall fescue, smooth brome, tall wheatgrass, annual bromes, and wild ryes are seldom used for nesting.

Nesting Cover Criteria

Nesting Cover Quantity: The optimum percentage of native prairie is 30 to 40 percent within the bobwhite's home range (Edminster 1954). Taking the lowest percentage (30 percent) and applying it to the minimum home range size (15 acres) suggests 4.5 acres or more of native prairie is needed to optimize the nesting cover.

Nesting Cover Use: Bobwhites begin nesting in Oklahoma after covey break-up in April. Tall and mid-height warm season grasses from the previous season (last year's growth) must be available for nesting at that time. Height of the grasses must be tall enough (6-8 inches) to conceal quail, thus requiring light to moderate use of the grasses by bison, elk, or domestic livestock.

Brood Habitat

Insect availability for food is required for nesting hens and quail broods (Hurst 1973). Open areas of herbaceous plants or grain and seed crops are used for feeding. Areas that have been burned produce green forage early and will attract high concentrations of insects and are often called "bugging grounds".

Brood Habitat Criteria

Brood Habitat Quantity: 30 to 40 percent of the bobwhite's home range should be open grassy areas and 40-60 percent food-producing plants such as annual forbs or planted crops (Edminster 1954). Applying the common percentage (40 percent) to the minimum home range size limit results in a six acre or larger area, of either native prairie or crops for optimum brood habitat value.

Forage Accessibility: Quail chicks require herbaceous plants spaced far enough apart to provide travel corridors. Dense, tangled veg-

etation or heavy mulch on the soil surface presents obstacles for the movement of young chicks and restricts food accessibility (Hurst 1973).

Protective Cover (escape and loafing)

Protective cover is used for loafing and is necessary for escaping from predators. Low-growing woody plants and upright growing forbs are used for this type of cover because they provide a visual screen from aerial and ground predators. Protective cover must also persist during cold weather when thermal protection is needed.

Protective Cover Criteria

Protective Cover Quantity: 5 to 20 percent of the bobwhite's home range should be brush or shrub cover (Edminster 1954). The least percentage (5 percent) of the minimum home range size limit (15 acres) requires 0.75 acres or more to optimize the quantity of low-growing woody plants for protection.

Protective Cover Composition: Living, low-growing woody plants such as plums, blackberries, sumacs, and buckbrush provide the best protection because they are persistent over a number of years. Brush piles are more temporary protection, although they last longer than dense herbaceous plants such as cudweed or sunflowers.

Overhead Protection: Protective cover should completely conceal quail from aerial predators (Stoddard 1931). Protective cover should be thick, several feet above the ground, but relatively open at ground level to permit quail movement underneath (Umber et al. 1979).

Covert Size: The protective cover area (covert) may be as small as 10 feet in diameter, however, greater than 30 feet in diameter is preferred (Roseberry and Klimstra 1984).

Covert Density: At least one covert, greater than 10 feet in diameter, is necessary within the bobwhite's home range. One covert per 5 acres

is necessary for intensive management (Lehaman 1946).

Food

The diet of adult bobwhite quail consists of insects and seeds and fruits of native forbs, grasses, shrubs, trees, and cultivated crops. Seeds are eaten throughout the year. Insects are high in protein and are eaten during the spring, summer, and fall, especially by adult females (Davis 1964). Because of their high dietary protein requirement, insects are the primary food for quail broods during their first few weeks of life (Hurst 1973).

Food Criteria

Food Quantity: A single adult bobwhite quail consumes an average of 0.05 lbs. of food per day (Edminster 1954). Applying that consumption rate to the average size covey (14.3 birds) (Rosene 1969) results in a daily consumption rate of 0.72 pounds per covey per day. Enough food must be produced in the fall to last through the winter until the critical month of March (Rosene 1969). This means that at least 130 pounds of food (0.72 pounds per covey per day times 182 days = 131 pounds) has to be produced and available for this period. Generally this amount can be produced easily in 0.25 acre food plots if soil fertility and weather conditions are ideal (Allen and Waters 1962). However, naturally occurring foods do not always produce this heavily and may require greater than a 0.25 acre area to provide adequate amounts of food. Natural occurring foods are preferred over cultivated food plots or feeders because of their nutritional diversity. Forty to 60 percent of the bobwhite's home range should be in early seral stage prairie, shrubland, or forest. Cropland may also provide this element (Edminster 1954), although it is less desirable. By applying 40 percent (Edminster 1954), to the minimum quail home range size limit (15 acres), six acres or more of naturally occurring forbs (low range

condition) would be needed to optimize the bobwhite's food requirements.

Food Variety: Over a hundred different quail food plants have been recorded in the diets of Oklahoma quail (Baumgartner 1952, Lee 1948, Bird 1931, Wiseman 1977, Rollins 1981, Peoples 1992). The forty most common food plants are listed in order of importance in Table 1 according to an index based on volume and frequency of occurrence of foods found in the crops of 1,271 Oklahoma quail (Baumgartner 1952). The importance of variety of foods to animal populations has been well documented. Variety provides fulfillment of nutritional requirements, increases selectivity, helps insure production, and distributes the period of use. Variety is best fulfilled by native plant communities. In contrast, food plots and feeders may have a negative effect on reproduction because of the lack of diversity of essential amino acids in the bobwhite's diet.

Food Accessibility: Bobwhites secure most of their food on the ground or from the layer of leaves and stems on the soil surface (Rosene 1969). If seeds are to be found by quail, they must be seen on bare ground or in litter that is sparse and can be moved easily (Rosene 1969). If seeds drop on a thick mat of stems and leaves, they fall to the bottom and become inaccessible to quail. Bobwhite quail require at least 25 percent bare soil. Sandy soils provide better interspersions of plant canopies and bare ground than fine-textured (clay) soils.

Water Requirements

Surface water is not essential for bobwhites, although it may be used if provided. Water needs are usually met by succulent herbs, in-

sects, dew, and snow (Rosene 1969). Also, metabolic water is produced during digestion and provides an additional source of water. Surface water such as ponds, creeks, and overflow from windmills produce microhabitats which can provide green, succulent vegetation and insects during dry or unfavorable weather conditions.

Interspersion

Bobwhite prefer habitat where herbaceous and woody plants are interspersed. Bobwhite are thus referred to as edge species, requiring the previously listed habitat elements for survival. The closer one requirement is to another results in less distance quail must travel for their needs. Optimal bobwhite habitat in central Oklahoma is composed of closely interspersed patches of grasses, forbs, vines, shrubs, and motts of low-growing trees (De Arment 1950).

Interspersion Criteria

The optimum amount of interspersions is as follows: 30-40 percent native prairie or early seral stage forest (dominated by grasses and forbs) in 5-20 acre patches; 40-60 percent in early to mid-seral stage prairie (high annual and perennial forb component) or cultivated crop fields in 1-5 acre patches; 5-20 percent brushy (shrubs or tree sprouts) cover in 1/4 to 1 acre patches and 5-40 percent woodland in 5-20 acre patches (Edminster 1954). Later research has shown the woodland or forest component to be unnecessary if shrubland species are present. These percentages and sizes have been used to construct ratings for the various habitat requirement quantities and an overall interspersions index.

General Instructions

An overall habitat quality value and an overall limiting factor can be calculated from the values assigned to each habitat requirement. A formula has been developed using the requirement values to derive an overall habitat quality value for the species. The overall limiting factor value is determined by selecting the lowest limiting factor value assigned to any of the requirements. These values represent the general quality of habitat and the factor that is limiting the bobwhite quail population within the conceptual home range.

The system is used by matching the criteria ratings with the nearest match of existing land use and cover conditions and calculating the necessary values for determining habitat quality.

The following procedures describe the method for inventorying existing habitat conditions, rating the element criteria and calculating the habitat quality and limiting factor values. Since the system is based primarily on the kinds, amounts, condition and arrangement of plants, inventories should be performed during the growing season. However, habitat can be evaluated year-round as long as the observer conceptualizes growing season conditions.

Ratings

Ratings for the various habitat criteria range from 1 (poor) to 10 (excellent). The number of ratings per criteria depend on the number of variables that can be practically measured and levels of management that can be practically applied.

Procedures

Step 1 - Determine the practicability of managing the bobwhite on the land unit of interest. For example, if the unit is all in wheat or introduced pasture such as bermudagrass, it is not practical to manage for bobwhite quail

without an extensive vegetation change and economic outlay.

Step 2 - Determine the intensity of management that you wish to use. Do you want high intensity management where bobwhite quail is the primary species of concern? Is the bobwhite a secondary species of concern behind beef cattle, goats, or white-tailed deer or a combination of species? Do you want moderately intensive management where farming and beef cattle or other combinations are the primary land use with white-tailed deer as a secondary land use? Or, do you wish to make few if any changes to your current operation and wish to provide the minimum habitat necessary to maintain bobwhite quail?

Step 3 - Select areas which will represent the conceptual home range of bobwhite quail. The size of the home range will be predetermined, based on the intensity of management you wish to employ. If high intensity management is desired, small home ranges will be used. If medium intensity management is desired, medium-sized home ranges will be used, etc. Conceptual home ranges may be square, rectangular, triangular or any other shape that is practical to appraise and manage. The conceptual home range may consist of one field or may cross field or land use/cover boundaries. A single home range may represent the entire operating unit, or several home ranges may be superimposed over the entire unit. A portion of the operating unit may be appraised by evaluating one or more conceptual home ranges. The remainder of the unit can be not appraised at all, or appraised by evaluating the habitat for another species. The designation of the conceptual home range, however, must always be within your operating unit and must always be within specified home range size limits.

Step 4 - Examine the home range area to assure that all required elements are present. If any

element is missing, a “0” value is recorded on that element’s quantity criteria rating, which means that the habitat is unsuitable for bobwhite quail unless that habitat element is going to be provided. Some requirements may be filled by more than one element. For example, native herbaceous plants (forbs, grasses, or legumes) fulfill the bobwhite quail’s food requirement and brood habitat requirement. When this occurs, the criteria and rating will be adjusted to account for the situation.

Step 5 - Evaluate each required habitat element by matching habitat conditions with the ratings for the various criteria. Specific instructions are contained in the next section and the appraisal form.

Step 6 - Determine the limiting factor value for each requirement.

Requirement limiting factor values =
criteria with lowest rating value
for each requirement.

Step 7 - Calculate the overall habitat quality value for all requirements.

Overall habitat quality value =
$$\frac{\text{Sum of value of each habitat requirement}}{\text{number of habitat requirements}}$$

Step 8 - Determine the overall limiting factor value.

Overall limiting factor value =
habitat element with lowest value.

Step 9 - Assess the elements or criteria that are limiting or missing and prepare a total management plan that addresses the limiting factors.

Instructions for completing the Bobwhite Quail Habitat Appraisal Form

Bobwhite Quail

Home Range: 15-80 Acres

Habitat Requirements: Nesting cover, brood habitat, protective cover, food, and interspersion.

Nesting Cover Criteria

Nesting cover quantity

Nesting cover is defined as any open native grass area where at least 10 percent of the plant community is composed of tall-mid perennial warm-season bunch grasses, i.e., big and little bluestem, silver bluestem, broomsedge, splitbeard bluestem, indiagrass, switchgrass, sideoats grama, weeping lovegrass, or others that reach a height of at least eight (8) inches at maturity. Nesting cover does not include cool season grasses, i.e., bromes, fescue, and wild ryes, or warm season grasses such as uniolas, “Old World bluestems”, Johnsongrass, buffalo grass, blue grama, vine mesquite, and bermuda or annual grasses such as crabgrass and sprangletops.

NOTE: Quail nest in the dead growth of preferred grasses left from the previous growing season. Areas will not qualify as nesting cover unless at least some of the previous season’s growth of preferred grass species remain prior to nesting (April 1-September 30).

The same area that provides food may also qualify for nesting cover, provided that the criteria for each requirement are met.

Nesting cover height (use by grazing, mowing or burning) - rated for the nesting season (April 1 - September 30) and last year’s growth.

Light - less than 25% (by weight) of the

year's growth removed. Only part of the tops of grasses and other plants used (more than 8 inches stubble height).

Moderate - 26%-50% (by weight) of the year's growth removed (6-8 inches stubble height for tall grasses).

Close - 51%-75% (by weight) of the year's growth is removed (4-6 inches stubble height for tall grasses).

Severe - more than 75% (by weight) of the year's growth is removed (less than 4 inches for tall grasses).

Brood Habitat Criteria

Brood habitat quantity

Brood habitat is defined as any area that provides lush green forage and associated insects during the time of brood rearing (June 30-October 15). These areas are generally open areas consisting of the new growth of native warm-season forbs and grasses or cultivated crops.

NOTE: The same areas that provide either food or nesting cover may also qualify for brood habitat, provided that the criteria for each requirement are met.

Screening cover

Screening cover is defined as the canopy provided by warm season herbaceous plants (forbs, grasses or crops) formed at a height above which the brood is foraging (6 inches).

Grass, Forb, and Legume Accessibility

Open conditions beneath indicates that the brood can move freely beneath the herbaceous canopy, or that vegetation at less than six inches in height contains continuous trails or openings throughout the plant community.

Moderately open conditions indicates that the brood can move through the near ground vegetation only with some difficulty, or the veg-

etation at less than six inches contains trails or openings, but they are not continuous throughout the plant community.

Rank vegetative growth indicates that the brood can move through the near ground vegetation only with a great deal of difficulty, or the vegetation at less than six inches is matted and thick, with few or no trails or openings.

NOTE: Interpolations can be made if existing conditions do not precisely fit the criteria.

Protective Cover Criteria

Protective cover (loafing and escape) quantity

Protective cover is defined as any woody plants or brush piles arranged densely enough to form a canopy which provides protection from the elements and predators. The areas of protection, or coverts, must be at least 10 feet in diameter and must be arranged loosely enough beneath the canopy to permit quail movement.

NOTE: Protective cover requirements are most critical during the winter, therefore projections must be made as to how the protective cover elements would appear at that time. One male eastern redcedar (*Juniperus virginiana*) or ashe juniper (*Juniperus ashei*) tree with a minimum canopy of 10 feet in diameter and touching the ground is valuable protection for bobwhite during ice and snow storms. One of these trees per 20 acres is sufficient, however the inherent ecological problems that these juniper species cause will preclude their use for most land managers.

Protective cover composition

Living woody plants include live vascular plants whose woody stems are persistent throughout the winter. Trees with low canopies, half-cut trees, shrub thickets, brambles, and oak motts are examples.

Brush piles may be included only if the pile forms overhead protection and the ground beneath the canopy is open to movement throughout the pile. Brush piles made without creating an open condition underneath will not qualify.

Canopy closure

Canopy closure should be measured by selecting a representative area of protective cover (also referred to as a covert). This may be a single low growing tree or shrub, but is usually a thicket or clump of woody plants. All measurements should be made at a height of no more than three feet. Canopy closures above that height do not provide adequate protection from predators or inclement winter weather. Closure at the sides of the cover is also important.

Canopy closure includes both canopy closure providing overhead protection above and canopy closure providing protection horizontally at the quail's level. Canopy closure estimates must therefore be made at three feet, a height which will account for both cover needs. The combination of covert size and canopy closure yielding the highest possible rating value should be recorded.

Food Criteria

Food quantity

Food is defined as the seeds of any of the important quail food plants listed in Table 1.

Very abundant is defined as, if 100 paces were taken in a representative portion of the plant community, the foot would strike an important quail food plant on more than 50 percent of the paces.

Abundant is defined as, if 100 paces were taken in a representative portion of the plant community, the foot would strike an important quail food plant on 30-50 percent of the paces.

Moderately abundant is defined as, if 100 paces were taken in a representative portion of

the plant community, the foot would strike an important quail food plant on less than 10-30 percent of the paces.

Sparse is defined as, if 100 paces were taken in a representative portion of the plant community, the foot would strike an important quail food plant on less than 10 percent of the paces.

NOTE: Interpolations can be made if existing conditions do not neatly fit the specified food quantity criteria. The rating value for any interpolation, however, cannot exceed 10.

Food plant variety

The major food groupings are provided by species in Table 1. Food plants are represented in this criteria when: 1) it is not difficult to observe the presence of important food plants listed in Table 1 in a casual examination of the home range and 2) when the abundance of those plants appears great enough to contribute to quail food needs.

Food accessibility

Light plant litter is defined as less than 50 percent coverage of the soil surface with dead leaves and stems from the previous season's growth.

Moderate plant litter is defined as 51-70 percent coverage of the soil surface with dead leaves and stems from the previous season's growth.

Heavy plant litter is defined as 71-90 percent coverage of the soil surface with dead leaves and stems from the previous season's growth.

Very heavy plant litter is defined as more than 91 percent coverage of the soil surface with dead leaves and stems from the previous season's growth.

NOTE: The area selected for estimating food accessibility must fall within the same boundary as where the majority of food is produced. Interpolations can be made if existing conditions do not precisely fit the criteria.

Table 1. Important Oklahoma bobwhite quail foods listed in order of importance according to Baumgartner's volume-frequency index of seed found in the contents of Oklahoma quail crops.

<i>Scientific names</i>	<i>Common Names</i>	<i>Food Group</i>
<i>Ambrosia</i> spp.	Western & common ragweeds	Forb
<i>Helianthus</i> spp.	Sunflowers	Forb
<i>Sorghum vulgare</i>	Grain Sorghum	Grass
<i>Strophostyles</i> spp.	Wild Beans	Legume
<i>Quercus</i> spp.	Oaks	Woody
<i>Lespedeza</i> spp.	Annual Lespedeza	Legume
<i>Panicum</i> spp.	Panic Grasses	Grass
<i>Zea mays</i>	Corn	Grass
<i>Sorghum halepense</i>	Johnson Grass	Grass
<i>Rhus</i> spp.	Sumacs & Poison Ivy	Woody
<i>Digitaria</i> spp.	Crabgrass	Grass
<i>Leptoloma</i> spp.	Sprangletops	Grass
<i>Euphorbia</i> spp.	Spurges	Forb
<i>Paspalum</i> spp.	Paspalum	Grass
<i>Croton</i> spp.	Crotons	Forb
<i>Desmodium</i> spp.	Tick Clovers	Legume
<i>Vitis</i> spp.	Grapes	Woody
<i>Bumelia lanuginosa</i>	Chittamwood	Woody
<i>Iva ciliata</i>	Seacoast Sumpweed	Forb
<i>Cassia fasciculata</i>	Showy Partridge Pea	Legume
<i>Fraxinus</i> spp.	Ashes	Woody
<i>Haplopapus ciliatus</i>	Golden Waxweed	Forb
<i>Cissus</i> spp.	Ivy Treebine	Woody
<i>Triticum aestivum</i>	Wheat	Grass
<i>Polygonum</i> spp.	Smartweeds	Forb
<i>Setaria</i> spp.	Bristlegrasses	Grass
<i>Amaranthus</i> spp.	Pigweeds	Forb
<i>Chenopodium</i> spp.	Lambsquarters	Forb
<i>Mentzelia</i> spp.	Stickleafs	Forb
<i>Galactia</i> spp.	Milk Peas	Legume
<i>Lespedeza</i> spp.	Perennial Lespedezas	Legume
<i>Arachis hypogaea</i>	Peanut	Legume
<i>Celtis</i> spp.	Hackberries	Woody
<i>Amphicarpa bracteata</i>	Southern Hog Peanut	Legume
<i>Secale cereale</i>	Rye	Grass
<i>Perilla frutescens</i>	Beefsteak Plant	Forb
<i>Commelina</i> spp.	Dayflowers	Forb
<i>Robina pseudoacacia</i>	Black Locust	Woody
<i>Cornus</i> spp.	Dogwoods	Woody
<i>Sporobolus</i> spp.	Dropseeds	Grass
<i>Glycine max</i>	Soybean	Legume
<i>Vigna sinensis</i>	Cowpea	Legume
<i>Sesbania exaltata</i> *	Hemp Sesbania	Legume
<i>Trapogon pratensis</i> *	Goat's Beard (Salsify)	Forb
<i>Lithospermum incisum</i> *	Yellow Puccoon	Forb

* Added to Baumgartner's list by authors.

Interspersion

Interspersion index

The plant elements that provide nesting cover, brood habitat, protective cover, and food have greater value if they are in close proximity of each other throughout the home range. To measure the interspersion of these elements, use aerial photography or walking transects to determine the number of times the habitat

components (a definite edge) change along a north-south line and an east-west line at the widest part of the home range. If the area is a mosaic of prairie, shrubs, and trees, space the transects close enough together to account for the diversity. Add the numbers together and divide by the number of transects to get the interspersion index value.

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Notes/Calculations

BOBWHITE QUAIL HABITAT APPRAISAL FORM

Size of Home Range or Evaluation Area (Ac.) _____

Pasture Name _____ Pasture Number _____

Habitat Management Unit Number _____

Type(s) of vegetative cover within home range or evaluation area (Assign percent coverage).

VEGETATIVE COVER	(%)
PRAIRIE	
SHRUBLAND	
FOREST	
INTRODUCED PASTURE	
CROPLAND	

HABITAT REQUIREMENTS Essential habitat components needed for survival and propagation of the species. For bobwhite quail, these components include (A) nesting cover, (B) brood habitat, (C) protective cover, (D) food, and (E) interspersion.

A. NESTING COVER: Warm-season tallgrasses or midgrasses. Last year's growth must be available during nesting season (April 1 to September 30).

Rating Criteria for Nesting Cover:

- | | |
|--|---|
| <p>1. <u>Nesting Cover Quantity</u> - Evaluate the plant community.</p> <p>30 percent or more of home range is a plant community with preferred grasses</p> <p>20-30 percent of home range is a plant community with preferred grasses</p> <p>10-20 percent of home range is a plant community with preferred grasses</p> <p>1-10 percent of home range is a plant community with preferred grasses</p> <p>Home range does not have plant community with preferred grasses</p> | <p><u>Value</u></p> <p>10</p> <p>8</p> <p>6</p> <p>4</p> <p>2</p> |
| <p>2. <u>Nesting Cover Height</u> - Evaluate herbaceous height that will remain during nesting season.</p> <p>Degree of utilization Light or None (>8")</p> <p>Degree of utilization Moderate (6-8")</p> <p>Degree of utilization Close (4-6")</p> <p>Degree of utilization Severe (<4") (check the appropriate box) grazing <input type="checkbox"/></p> <p style="padding-left: 20px;">mowing <input type="checkbox"/> or burning <input type="checkbox"/> *</p> | <p><u>Value</u></p> <p>8</p> <p>10</p> <p>4</p> <p>2</p> |

*Nesting cover that is burned or mowed during nesting season will be treated the same as severe utilization caused by grazing.

Limiting factor = Lowest score of 2 rated criteria

B. BROOD HABITAT: Native herbaceous plants and conceptual insect/arthropods abundance.

Rating Criteria for Brood Habitat:

1. <u>Brood Habitat Quantity</u> - Evaluate the area for plants and insect abundance.	<u>Value</u>
40 percent or more of home range is plant community with warm season grasses, forbs, or crops	10
30-40 percent of home range is plant community with warm season grasses, forbs, or crops	8
20-30 percent of home range is plant community with warm season grasses, forbs, or crops	6
10-20 percent of home range is plant community with warm season grasses, forbs, or crops	4
1-10 percent of home range is plant community with warm season grasses, forbs, or crops	2
None of the home range is plant community with warm season grasses, forbs, or crops	0

2. <u>Screening Cover</u> - Above height of a quail (6 inches).	<u>Value</u>
Herbaceous canopy cover 50 percent or greater above height of 6 inches	10
Herbaceous canopy cover 30-50 percent above height of 6 inches	8
Herbaceous canopy cover 10-30 percent above height of 6 inches	6
Herbaceous canopy cover 1-10 percent above height of 6 inches	2
No herbaceous canopy cover above height of 6 inches	0

3. <u>Grass, Forb, and Legume Accessibility</u> - Below height of 6 inches (travel corridor).	<u>Value</u>
Open condition below a height of 6 inches	10
Moderately open condition below a height of 6 inches	6
Closed or rank condition below a height of 6 inches	2

Limiting factor = Lowest score of 3 rated criteria

C. PROTECTIVE COVER (loafing and escape): Woody Shrubs, low growing trees, or artificially created brush piles.

1. <u>Loafing Cover Quantity</u> - Evaluate the plant community.	<u>Value</u>
10 percent or more of home range is comprised of woody plants or brush piles	10
5 to 10 percent of home range is comprised of woody plants or brush piles	8
1 to 5 percent of home range is comprised of woody plants or brush piles	4
Less than 1 percent of home range is comprised of woody plants	2
No woody plants within home range	0

2. <u>Loafing Cover Composition</u> - Evaluate the plant community.	<u>Value</u>
Living woody shrubs or low growing trees	10
Artificial cover including brush piles or shelters	6
Larger trees without extensive low growing stems	2
No woody plants within the home range	0

3. <u>Loafing Cover Density</u> - Evaluate the tree or shrub canopy closure.	<u>Value</u>
80 percent or greater canopy cover at 3 feet height	10
60 to 80 percent canopy cover at 3 feet height	8
40 to 60 percent canopy cover at 3 feet height	6
20 to 40 percent canopy cover at 3 feet height	4
Less than 20 percent canopy cover at 3 feet height	2

4. <u>Escape Cover</u> - Evaluate woody and herbaceous cover that would conceal a quail.	<u>Value</u>
Escape cover present	10
Escape cover absent	0

Limiting factor = Lowest score of 4 rated criteria

D. FOOD: Seeds of grain crops and/or naturally occurring herbaceous or woody plants.

Rating Criteria for Food:

1. <u>Food Quantity</u> - Size of food producing plant community.	<u>Value</u>
40 percent or more of home range is a food producing plant community	10
30-40 percent of home range is a food producing plant community	8
20-30 percent of home range is a food producing plant community	6
10-20 percent of home range is a food producing plant community	4
1-10 percent of home range is a food producing plant community	2
None of home range is a food producing plant community	0
2. <u>Food Abundance</u> - Abundance of food producing plants (step transect).	<u>Value</u>
Food plants are very abundant and comprise 50 percent or more of plants in food producing area	10
Food plants are abundant and comprise 30-50 percent of plants in food producing area	8
Food plants are moderately abundant and comprise 10-30 percent of plants in food producing area	6
Food plants are sparse and comprise 1-10 percent of plants in food producing area	4
Food plants do not occur within home range	0
3. <u>Food Diversity</u> - Based on occurrence of 4 major food groups within the food producing plant community and includes forbs, legumes, grasses and woody plants.	<u>Value</u>
Food plants represented by all 4 of the major food groups	10
Food plants represented by 3 of the 4 major food groups	7
Food plants represented by 2 of the 4 major food groups	5
Food plants represented by 1 of the 4 major food groups	2
4. <u>Food Accessibility</u> - Availability of seed is dependent on the percent of bare ground.	<u>Value</u>
Plant litter covers less than 50 percent of soil surface (light litter)	10
Plant litter covers 50 to 70 percent of soil surface (moderate litter)	7
Plant litter covers 71 to 90 percent of soil surface (heavy litter)	5
Plant litter covers greater than 91 percent of soil surface (very heavy litter)	2

Limiting factor = Lowest score of 4 rated criteria

E. INTERSPERSION: The spatial arrangement and distance between required habitat components including nesting cover, brood habitat, protective cover, and food.

Rating Criteria for Interspersion:

Interspersion Index—Use aerial photography or walking transects to determine the number of times the habitat components change along a north-south line and an east-west line at the widest parts of the home range. Add the two numbers together for an index value. Most rangeland will have many habitat component changes along the transects.

1. <u>Changes Between Habitat Components</u> - Locate Nesting Cover, Brood Habitat, Protective Cover, Food.	<u>Value</u>
Habitat components change more than 8 times within the home range	10
Habitat components change 7 to 8 times within the home range	8
Habitat components change 5 to 6 times within the home range	6
Habitat components change 2 to 4 times within the home range	4
Habitat components change only once within the home range	2
Habitat components do not change at all within the home range	0

Limiting Factor = Lowest Score of 1 Rated Criteria

