



Source: Becky Ruzicka

# Habitat Requirements of Texas Quail

M. Frank, K. Ruppert, and J. Cathey\*

## Quail across Texas

Texas is home to four species of quail: northern bobwhite (*Colinus virginianus*), scaled quail (*Callipepla squamata*), Gambel's quail (*Callipepla gambelii*), and Montezuma quail (*Cyrtonix montezumae*). Northern bobwhites are distributed across most of the state—except the Trans-Pecos region. Scaled quail have the next largest geographic distribution in Texas and can be found in the western half of the state. Gambel's quail and Montezuma quail have small distributions in portions of the Trans-Pecos. However, the geographic distributions of Texas quail do not tell the whole story about where they live.

## Declining habitat, declining quail

Many Texans can recall experiences with quail, whether they were hunting quail, watching quail, or just listening to quail calls. However, overall abundance of Texas quails, especially northern bobwhites, has declined over the past few decades. Recent research efforts have sought to determine what factors have contributed to the decline of quail in Texas. Potential causes evaluated by this research include drought, changes in land use, land fragmentation, invasive species, insecticides, and habitat loss. Habitat is a common term used in wildlife management, and refers to four components: food, water, shelter, and space. Loss of quail habitat occurs when there is a decrease in the amount or the quality of one or more of the components of quail habitat. To manage for quail, landowners need to know the specific habitat requirements of each locally occurring quail species (Fig. 1).

\*Assistant Professor & Extension Wildlife Specialist, Texas A&M AgriLife Extension Service; Student, Texas A&M University; and Associate Director, Texas A&M Natural Resources Institute  
 The Texas A&M University System

## Quail Habitat

### Food

High-quality habitat has a variety of native seeds and vegetation for quail to meet their nutritional and caloric needs. Insects will be abundant in good habitat, and are a rich source of calories. Poor-quality habitat may have invasive species or be a monoculture.

### Water

Quail can meet most of their water needs through “preformed water,” which is the water contained in vegetation, seeds, and insects. Habitat that provides adequate vegetation should meet the water needs of quail, although free water (ponds, streams, and dew) may also be used.

### Shelter

Quail need cover for nesting, brooding, loafing, roosting, and escaping from predators. Good quail habitat provides thermal cover and protection from predators while not being so dense as to restrict movement. Quail need sufficient openness to move across the landscape.

### Space

The food, water, and shelter needs of quail will be spread across the landscape. Large, contiguous tracts of land give quail access to all of the different resources they need and allow quail to move to different areas as needed. Space also refers to the abiotic features of the landscape such as soil type, elevation, climate, topography, etc.

Figure 1.

## Basic life cycles of Texas quails

### Northern bobwhite

Northern bobwhites form large coveys in the fall and winter, then pair up for the breeding season beginning in mid-March and into April. Bobwhite females can produce more than one clutch per season and may pair with more than one mate during the breeding season. Nesting begins as early as mid-April. Bobwhites nest on the ground and typically lay 12 to 15 eggs. Incubation lasts about 23 days, with males incubating about 25 percent of all nests. Bobwhite chicks reach maturity around 15 weeks of age.



Male northern bobwhite. Source: Becky Ruzicka  
Female northern bobwhite. Source: Becky Ruzicka

### Scaled quail

Scaled quail begin to select mates while still in coveys, sometimes as early as late February. Covey breakup and pairing are typically complete by the end of April. Scaled quail nest on the ground in a variety of vegetation types. Egg production and incubation of scaled quail are similar to that of northern bobwhites, with an average clutch size of 14 and an incubation period of 22 to 23 days. Scaled quail reach maturity around 12 to 20 weeks of age, at which time they associate with coveys.



Male and female scaled quail are difficult to distinguish in the field. Sources: Left, Becky Ruzicka; right, Greg Schechter–Flickr CC by 2.0

## Gambel's quail

The breeding season of Gambel's quail depends largely on the weather. After a cool, wet winter, Gambel's quail will begin to breed in mid- to late February; initiation of breeding is delayed after a warm, dry winter, in which case Gambel's quail may remain in coveys for several months. Gambel's quail hens take longer to lay a complete clutch of eggs than other quail, sometimes taking over 30 days to produce 10 to 14 eggs. Both parents typically tend to broods; chicks remain dependent on their parents for about 12 to 13 weeks.



Male Gambel's quail.  
Source: JeffB-Flickr CC by 2.0



Female Gambel's quail.  
Source: Matt Tillett-Flickr CC by 2.0



## Montezuma quail

Montezuma quail depend heavily on summer precipitation as a signal for nest initiation, but occur in two distinct areas of Texas with very different seasonal rainfall patterns. Montezuma quail may nest earlier in the Edwards Plateau region, where peak rainfall usually occurs in late spring, as opposed to the Trans-Pecos region where rainfall typically peaks in midsummer. Clutch size for Montezuma quail ranges from 6 to 16 eggs, which are incubated for 24 to 26 days. Both parents tend the chicks.



Male Montezuma quail.  
Source: Bettina Arigoni-Flickr CC by 2.0



Female Montezuma quail.  
Source: Bettina Arigoni-Flickr CC by 2.0



## Definitions for the "Habitat Requirements of Texas Quails" chart

**Space:** The area wherein quail find food, water, and shelter is the space component of habitat. Abiotic factors, such as slope, elevation, soil type, and presence of rocky outcroppings also are part of the space needs of quail.

**Diet:** For all quail species, diet plays a key role in determining which habitats they use. If an area lacks sufficient food, quail are not likely to use that area. The primary components of a quail's diet are seeds, insects, and green vegetation. The exact types of plants preferred vary depending on the species of quail.

**Water:** All species of quail found in Texas can meet their daily water needs through preformed (in food) and metabolic (produced during metabolism) water, given sufficient availability of succulent food items. However, quail will use free water (water in ponds and streams) when it is available, and may prefer habitats where free water is available.

**Nesting cover:** Depending on the quail species, nesting areas may or may not be densely covered with vegetation. Nesting cover helps shield eggs and incubating adults from predators, and also provides protection from the heat.

**Brooding cover:** Quail chicks are small and have difficulty moving through dense vegetation, but are also vulnerable to predation due to their inability to flee quickly. Often, a mosaic of vegetation types is best for brooding, but the most important qualities of brooding habitat are the presence of nutrient-rich insects, limited vegetative litter, and overhead cover.

**Loafing cover:** After eating, quail will retreat to loafing cover to digest their food, rest, and escape the heat. Loafing areas will typically have a closed canopy and be open at ground level, providing a screen from aerial predators without blocking the quails' view of potential ground predators. A dense overhead canopy also provides shade from the midday sun. Woody brush or small trees are common loafing cover.

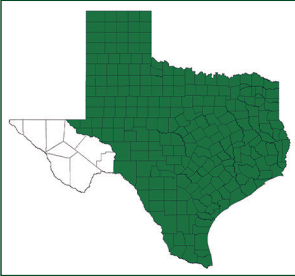
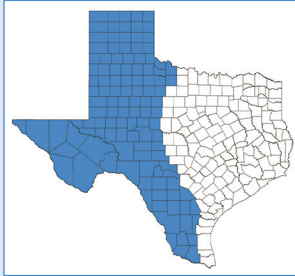


**Escape cover:** When quail encounter a predator, they will run or fly into dense cover to hide. Escape cover often overlaps with loafing cover, but quail will use almost any dense or visually obscuring structure

available to flee into and hide from predators.

**Roosting cover:** Preferred roosting cover varies widely among the four quail species found in Texas.

Scaled and Gambel's quails typically roost in shrubs, while bobwhites and Montezuma quail often roost on the ground in tall grasses.

## Habitat Requirements of Texas Quail

	Northern bobwhite <i>Colinus virginianus</i>	Scaled quail <i>Callipepla squamata</i>	Gambel's quail <i>Callipepla gambelii</i>	Montezuma quail <i>Cyrtonix montezumae</i>
<b>Statewide distribution</b>				
<b>Space</b>	<ul style="list-style-type: none"> <li>• Prefer 10–30% brush canopy cover and 29% woody cover</li> <li>• Mixture of short and tall plants with bare ground in a well-interspersed patchwork mosaic</li> <li>• Estimated 1,600 contiguous acres needed for 800 birds</li> </ul>	<ul style="list-style-type: none"> <li>• Prefer sparse ground vegetation and woody plant canopy cover in shrub savannah, savannah, and brush/shrubland habitat types</li> <li>• Bare, open ground and woody cover are selected for more than grass, forbs, and herbaceous ground cover</li> </ul>	<ul style="list-style-type: none"> <li>• Found at 2,500–3,900 ft. elevation</li> <li>• Semiarid grasslands, bajadas, arroyos, chaparral, evergreen woodland, desert scrub, oak woodland, pinyon-juniper, riparian areas</li> <li>• Adaptable to many different habitats, but prefer open ground with high woody canopy cover and few herbaceous plants</li> </ul>	<ul style="list-style-type: none"> <li>• Wooded, steep mountain terrain with prominent grassy understory at elevations greater than 4,900 ft., or riparian corridors, desert washlands, and mixed-oak woodlands at lower elevations</li> <li>• Evergreen woodland matrix, pine-juniper, montane meadows, semidesert grassland, oak woodlands with high grass cover</li> <li>• Prefer high tree species richness and tree canopy cover around 26%</li> <li>• Grass cover should be about 51–75% and mean grass height around 8 in.</li> </ul>
<b>Diet</b>	<ul style="list-style-type: none"> <li>• Seeds, insects, and green vegetation</li> <li>• Annual broomweed, croton, doveweed, hairy vetch, lespedeza, longleaf pine, panicum, partridge pea, plains bristleglass, sunflower, western ragweed, oak, arthropods</li> </ul>	<ul style="list-style-type: none"> <li>• Green vegetation, seeds, fruits, and insects</li> <li>• Blackbrush, bundleflower, doveweed, euphorbia, hairy caltrop, low mendoza, ponyleaf oxalis, prickly pear, spiny hackberry, spreading sida, starwort</li> </ul>	<ul style="list-style-type: none"> <li>• Seeds, mast, green vegetation, and insects</li> <li>• Broom snakeweed, brown dalea, crownbeard, desert willow, grain sorghum, kochia, mesquite, pecan, pigweed, prickly pear, Russian thistle, sumac, wolfberry</li> </ul>	<ul style="list-style-type: none"> <li>• Insects and vegetative material, including underground sorrel, tubers, and rhizomes</li> <li>• Flatsedge, onion, wood sorrels</li> </ul>
<b>Nesting cover</b>	<ul style="list-style-type: none"> <li>• Bunchgrasses 12–18 in. tall</li> <li>• Balsamscales, bluestems, lovegrasses, panicum, paspalums, prickly pear, sand sagebrush, threeawns, yucca</li> </ul>	<ul style="list-style-type: none"> <li>• Scattered shrubs and trees</li> <li>• Build nests under or near shrubs or cactus</li> <li>• Line nests with grass, stems, or leaves</li> <li>• Prickly pear, tobosa grass, yucca</li> </ul>	<ul style="list-style-type: none"> <li>• Nest must be shaded by forbs, shrubs, or rocks</li> <li>• Cool-season forbs that support high densities of invertebrates</li> <li>• Broom snakeweed, cool-season forbs, prickly pear</li> </ul>	<ul style="list-style-type: none"> <li>• Dense understory adjacent to large rocks or tree trunks and perennial bunchgrasses</li> <li>• Beardgrass, sideoats grama, sprangletop, Texas bluegrass, wolfstail</li> </ul>

	Northern bobwhite <i>Colinus virginianus</i>	Scaled quail <i>Callipepla squamata</i>	Gambel's quail <i>Callipepla gambelii</i>	Montezuma quail <i>Cyrtonix montezumae</i>
<b>Brooding cover</b>	<ul style="list-style-type: none"> <li>Overhead cover with low litter and lush vegetation</li> <li>Vegetation should support an abundance of high protein invertebrates</li> <li>Broom snakeweed, ceniza, goldenweed, lotebush, mesquite, partridge pea, spiny hackberry, sunflower, western ragweed</li> </ul>	<ul style="list-style-type: none"> <li>Rough habitat and shallow soil with low grass cover and bare ground</li> <li>Proximity to water</li> <li>Annual broomweed, western ragweed</li> </ul>	<ul style="list-style-type: none"> <li>Small shrubs that provide shade</li> <li>Succulent forbs with high water content</li> <li>Vegetation that supports invertebrates</li> </ul>	<ul style="list-style-type: none"> <li>Diverse vegetation structure that provides greater visual obstruction</li> <li>Prefer 50–85% grass canopy in mosaic heights of 4–16 in.</li> <li>Near juniper, mesquite, or oak trees</li> </ul>
<b>Loafing cover</b>	<ul style="list-style-type: none"> <li>Dense brush, 3- to 10-foot-tall shrubs about the size of a car (at least 5 ft. diameter) with a closed canopy and open base, located about a softball throw apart from one another (40–50 yd.)</li> <li>Overall brush canopy should cover 5–25%</li> <li>Lotebush, mesquite, multiflora rose, plums, sumac</li> </ul>	<ul style="list-style-type: none"> <li>Brush at least 3 ft. tall, dense above, but open at ground</li> <li>May use mesquite that is wide (~12 ft.) and tall (~6 ft.), or man-made structures if vegetative cover is limited</li> <li>Catclaw mimosa, cholla, lotebush, mesquite, sandplum, yucca</li> </ul>	<ul style="list-style-type: none"> <li>Overhead shrub cover at least 3 ft. tall, and may use artificial brush piles</li> <li>Catclaw mimosa, cholla, mesquite</li> </ul>	<ul style="list-style-type: none"> <li>North-facing hillsides with woody cover</li> <li>Agave, brickellia, catclaw mimosa, forbs, grasses, mountain mahogany, oak, pine, plains lovegrass, sedges, wolfstail</li> </ul>
<b>Escape cover</b>	<ul style="list-style-type: none"> <li>Loafing cover also used for escape cover</li> </ul>	<ul style="list-style-type: none"> <li>Forbs, mesquite, shrubs, or man-made structures that meet loafing requirements</li> </ul>	<ul style="list-style-type: none"> <li>Run or fly to dense cover such as allthorn, catclaw acacia, juniper, mesquite, sumac, or yucca</li> </ul>	<ul style="list-style-type: none"> <li>Prefer grass cover such as perennial bunchgrasses, but will use tree canopy if necessary</li> </ul>
<b>Roosting cover</b>	<ul style="list-style-type: none"> <li>Nesting cover also used for roosting cover</li> </ul>	<ul style="list-style-type: none"> <li>Well-spaced, low shrubs (about 18 in. tall) with canopy cover of about 35%</li> <li>Interspersed grasses covering about 45% of the ground</li> <li>Cholla, mesquite, yucca</li> </ul>	<ul style="list-style-type: none"> <li>Shrubs or trees with dense foliage, branching, and thorns or brush canopy at 6–16 ft. above the ground</li> </ul>	<ul style="list-style-type: none"> <li>Roost at the base of rocks on southeast-facing hillsides</li> <li>Overhanging tall grasses</li> <li>Camphorweed, sideoats grama, tanglehead</li> </ul>
<b>Summary of key plants</b>	<ul style="list-style-type: none"> <li>Grasses: bluestems, lovegrasses, panicum, paspalums, plains bristlegrass, threeawns</li> <li>Forbs: broom snakeweed, croton, hairy vetch, lespedeza, partridge pea, ragweed, sunflower</li> <li>Shrubs: blackbrush, ceniza, dogweed, goldenweed, guajillo, Hercules club, longleaf pine, lotebush, mesquite, oak, plums, sand sagebrush, spiny hackberry, sumac, whitebrush, yucca</li> <li>Cactus: prickly pear</li> </ul>	<ul style="list-style-type: none"> <li>Forbs: bundleflower, doveweed, euphorbia, hairy caltrop, low menodora, ponyleaf oxalis, spreading sida, starwort</li> <li>Shrubs: blackbrush, catclaw mimosa, lotebush, mesquite, sandplum, spiny hackberry, yucca</li> <li>Cactus: cholla, prickly pear</li> </ul>	<ul style="list-style-type: none"> <li>Grasses: blue grama, grain sorghum, sideoats grama</li> <li>Forbs: beargrass, broom snakeweed, burroweed, crownbeard, jimmyweed, kochia, pigweed, Russian thistle</li> <li>Shrubs: allthorn, brittlebrush, brown dalea, catclaw acacia, condalia, desert hackberry, desert thorn, desert willow, ironwood, juniper, littleleaf sumac, mesquite, saltbrush, scrub oak, pecan, shrubby buckwheat, triangle-leaf bursage, turpentine bush, white-thorn acacia, wolfberry, yucca</li> <li>Cactus: cholla, prickly pear</li> </ul>	<ul style="list-style-type: none"> <li>Grasses: beardgrass, blue grama, flatsedge, plains lovegrass, sideoats grama, sprangletop, Texas bluestem, wolfstail</li> <li>Forbs: camphorweed, onion, wood sorrels</li> <li>Shrubs: agave, brickellia, catclaw mimosa, juniper, mahogany, mesquite, oak, pine</li> </ul>

---

## How you can help Texas quails

### *Habitat management*

Do you want to improve quail habitat on your own land? To start, you may want to have a professional evaluate your land. Texas Parks & Wildlife Department and Natural Resources Conservation Service have biologists that can help you with your evaluation. These individuals are trained to help you to develop goals, create a management plan, and improve the landscape for quail. Publications available from universities and state agencies can provide more information about quail and their management. Another useful tool is the Northern Bobwhite Habitat Evaluation app.

Some common management tools include grazing, prescribed fire, mechanical brush management, herbicide application, and invasive species control. The effectiveness of these techniques varies depending on the characteristics of the property and local factors such as weather and soil type. Using a combination of management tools is typically more effective than the use of any one technique on its own. Specific management practices can be found in a variety of print and electronic resources, including the Northern Bobwhite Management Calendar app.

Good habitat management is not a “one and done” endeavor. A landowner should be dedicated to maintaining the habitat that has been created or improved. Habitat monitoring activities, such as fixed photo points, precipitation records, cover surveys, forb diversity surveys, fall covey counts, spring whistling counts, and grass height surveys help you learn about your land and determine whether any management changes should be made. You can then develop maintenance strategies based on the results of monitoring surveys. Habitat maintenance tools may be similar to those used to create habitat, but may vary from year to year depending on factors such as weather. Regular monitoring will help you keep track of changes in the landscape and adapt your maintenance plans accordingly.

Keep in mind that plant communities across Texas vary from the dense Piney Woods of east Texas to the wide-open spaces of the Trans-Pecos,

and everything in between. A local natural resource professional can help you understand specific tools that are best for your area of the state and your other objectives for the land (livestock, white-tailed deer, wild turkey, etc.). Additionally, different species of quail have different habitat requirements, so be sure that any information you use matches to the species found on your land. A strategy intended for northern bobwhite will not necessarily improve habitat for other species of quail.

### *Quail appreciation*

One aspect of quail appreciation is hunting. Texas’ hunting industry provides essential income to rural economies across the state, and federal Pittman-Robertson taxes on hunting supplies help fund habitat restoration efforts. Furthermore, quail hunting can provide landowners with a financial incentive to maintain large, contiguous parcels of land and quail-friendly land use practices. Outside of the quantifiable economic value of quail hunting, participation in hunting activities connects people to each other, to the land, and to Texas’ natural resources. Other quail appreciation practices include birdwatching and photography, which also contribute substantially to the Texas economy through expenditures on equipment and travel. Like hunting, nonconsumptive quail appreciation practices bring people into quail habitats. To be successful at any quail-related endeavor, the recreationist must learn about quail behaviors and habitat preferences.

Many Texans feel a special sense of joy at hearing quail calls on their land. However, many urban and suburban residents have no experience with quail, and in fact, some generations may have passed without any exposure to this iconic species. Quail, particularly bobwhite, are woven into the fabric of Texas culture, and management that benefits quail populations can provide a chance for more Texas residents to experience this hallmark of traditional country life. The value of quail to hunters, birdwatchers, photographers, landowners, and Texas’ ecosystems transcends economics or statistics. Keeping quail in the hearts of Texans may be one of the most important factors for safeguarding the future of these amazing birds.

---

## Additional resources

“Counting quail,” Texas A&M AgriLife Extension Publication B-6173.

“Habitat monitoring for quail on Texas rangelands,” Texas A&M AgriLife Extension Publication B-6172.

Quail of Texas: <http://wildlife.tamu.edu/quail/>

Texas Quail Index: <https://wildlife.tamu.edu/quail/texas-quail-index/>

Plants of Texas Rangelands Virtual Herbarium: <http://rangeplants.tamu.edu/>

Texas Parks and Wildlife Department: <http://tpwd.state.tx.us/>

Wild Wonderings blog: <https://wild-wonderings.blogspot.com/>

TAMU Wildlife and Fisheries Extension YouTube Channel: <https://www.youtube.com/user/WFSCAgriLife/playlists>

Northern Bobwhite Habitat Evaluation app: <https://itunes.apple.com/us/app/northern-bobwhite-habitat/id903595892?mt=8>

Northern Bobwhite Management Calendar app: <https://itunes.apple.com/us/app/northern-bobwhite-management/id903580244?mt=8>

## Acknowledgments

Funding for this publication was provided through the Reversing the Quail Decline in Texas Initiative and the Upland Game Bird Stamp Fund, based on a collaborative effort between the Texas Parks and Wildlife Department and the Texas A&M AgriLife Extension Service. The authors also thank J. M. Tomeček, F. Hernández, and R. D. Elmore for their reviews of the manuscript.



### Texas A&M AgriLife Extension Service

*AgriLifeExtension.tamu.edu*

More Extension publications can be found at *AgriLifeBookstore.org*

Texas A&M AgriLife Extension provides equal opportunities in its programs and employment to all persons, regardless of race, color, sex, religion, national origin, disability, age, genetic information, veteran status, sexual orientation, or gender identity.

---

The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating.