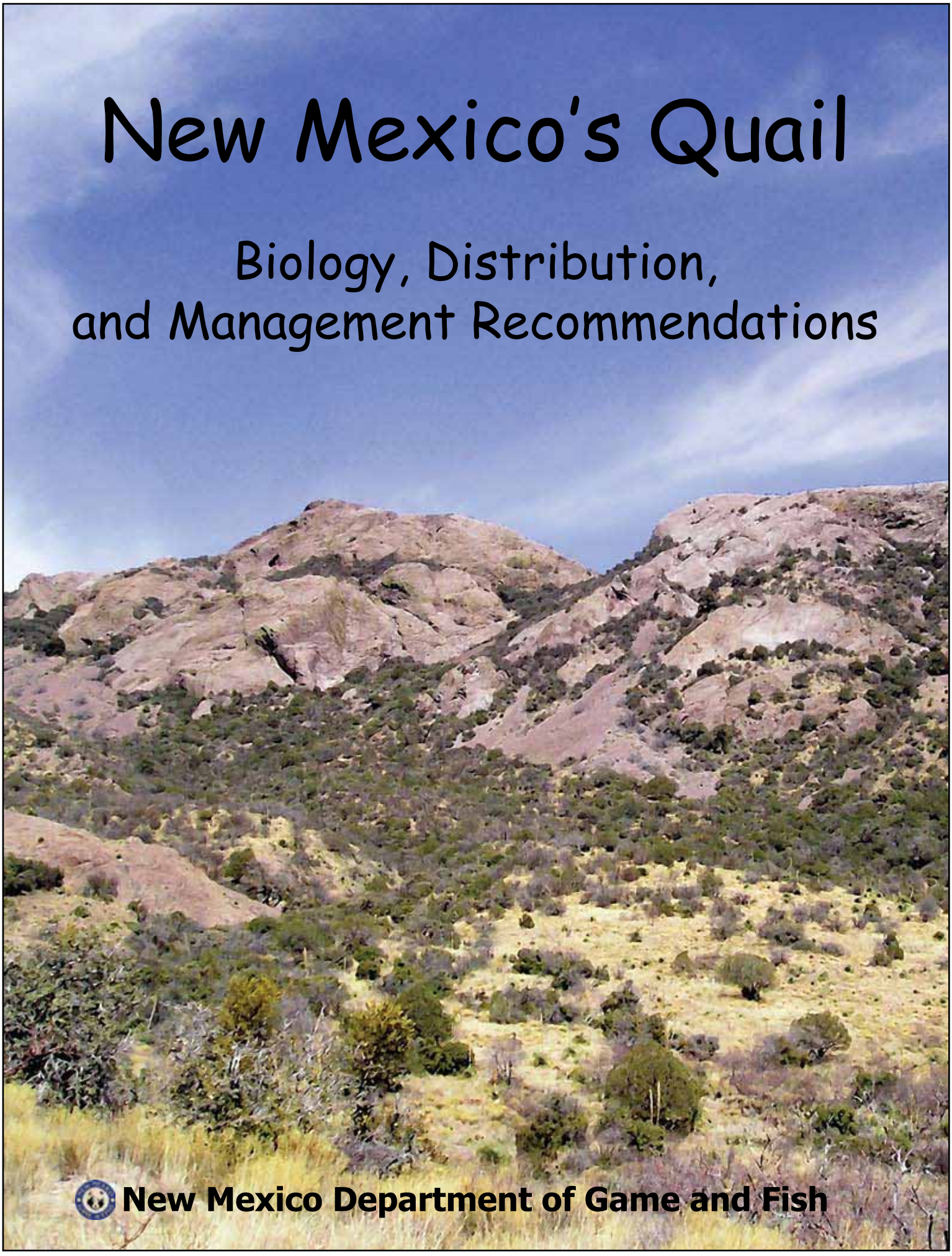
New Mexico's Quail

Biology, Distribution, and Management Recommendations



New Mexico Department of Game and Fish

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New Mexico Department of Game and Fish
2008

Larry Kamees

Tim Mitchusson

Mark Gruber

Introduction

New Mexico is one of only four states including Arizona, California, and Texas that has the distinction of offering four species of quail to hunters and birdwatchers. These quail include northern bobwhite, Gambel's, Montezuma, and scaled quail. Quail are one of the most abundant non-migratory bird species in New Mexico.

However, during the last 15 years, hunters, wildlife managers, and outdoor enthusiasts have noted a general decline in the number of quail seen on any given day spent in the field. Data from breeding bird surveys and Christmas bird counts indicate a steady decline in quail throughout much of their range. Quail populations naturally fluctuate widely and are often referred to as a "boom or bust" species. These fluctuations are typically short-term natural population changes, unlike the long-term decline we are witnessing today.

Many factors contribute to this decline but the facts remain; quail are losing habitat and the quality of the remaining habitat has diminished. However, proper range management can do more for quail habitat than any other management practice.

Quail are a relatively short-lived species relying on high productivity over a short period of time. Maximizing their production is key to maintaining quail populations. During good quail producing years, young of the year will comprise 70-84% of the total quail population in the fall.

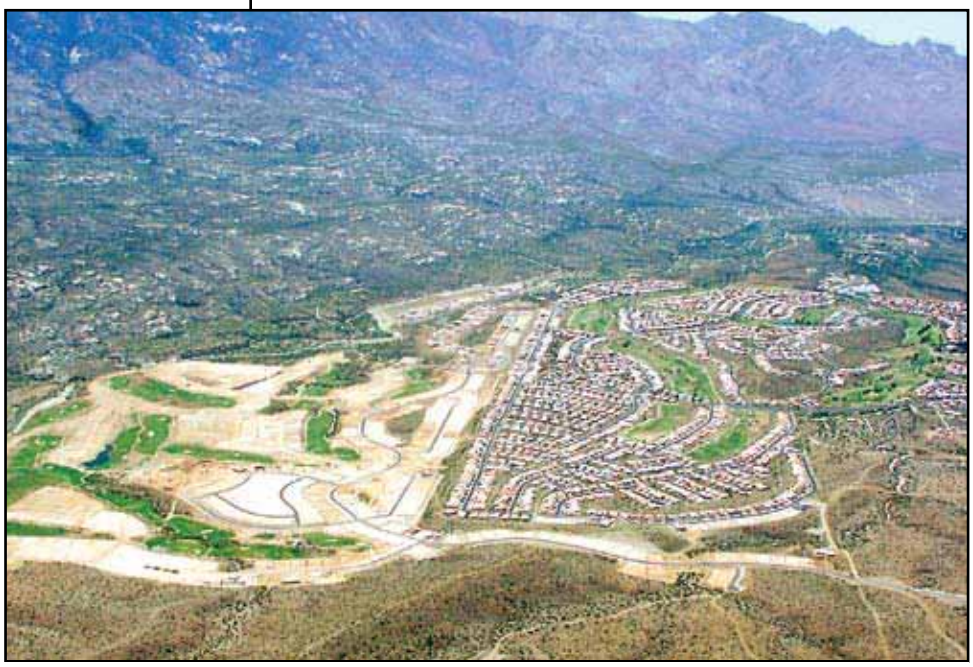
These high-production periods occur during favorable weather and moisture conditions. For bobwhite, Gambel's and scaled quail, above average moisture results in good plant growth and good quail production. For Montezuma quail, summer rains are key to good production. Adverse weather such as prolonged periods of extreme cold, snow cover, hail storms, or severe drought will adversely affect quail populations.

Optimum quail habitat will moderate these impacts during harsh times and allow quail populations to rapidly rebound during favorable weather conditions.

Causes Of Mortality

Like most gallinaceous (chicken-like) birds, quail vary in abundance from year to year. If fact, most quail die in their first year of life. Annual precipitation has a significant influence on abundance, particularly summer precipitation. Population levels are typically at their highest point shortly after the young-of-the-year hatch. The population will decline over time to a low point just before the next breeding season.

Populations may be low in areas that receive extremely heavy hunting pressure near urban areas and areas with high road densities. However, hunter harvest is considered compensatory (removing what would have died from natural mortality anyway) and appears to have little permanent effect on populations in habitats even in poor condition.



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Housing development expands into quail habitat

Quail are taken by numerous predators. Several predatory bird species take quail. They include Cooper's hawk (*Accipiter cooperii*), northern harriers (*Circus cyaneus*), prairie falcons (*Falco mexicanus*), Harris hawks (*Parabuteo unicinctus*), Swainson's hawks (*Buteo swainsoni*), great-horned owls (B*ubo virginianus*), and greater roadrunners (*Geococcyx californianus*). Skunks (*Mephitis spp.*), raccoons (*Procyon lotor*), ringtails (*Bassariscus astutus)*, foxes (*Vulpes spp.*), coatis (*Nasua nasua*), badgers (*Taxidea taxus*), bobcats (*Felis rufus*), and coyotes (*Canis latrans*) are potential nest predators feeding on adults and young birds. Chicks are taken by many species. Introduced bullfrogs (*Rana catesbeiana*) have been known to take chicks at water sources. Eggs and newly hatched young also fall prey to pack rats (*Neotoma spp.*), ground squirrels (*Spermophilus spp*), snakes (*Colubridae* and *Viperidae*), and ants (*Formicidae*). Domestic cats and dogs also contribute to quail mortality.

The best defense against predators is providing abundant nest sites and escape cover. Habitat deficiencies should be addressed before conducting any predator control.

What is Good Quail Habitat?

Quail require four basic habitat components: food, cover, water, and space. When habitat requirements are nearby, travel through less than optimal habitat is reduced. Optimal habitat quality results in smaller home ranges increasing quail survival.

Food

Seeds of annual forbs and grasses such as snakeweed (*Gutierrezia spp.*), croton (*Croton spp.*), pigweed (*Amaranthus spp.*), bristlegrass (*Setaria spp.*), and panicgrass (*Panicum spp.*) are essential food sources for quail. They sometimes comprise 70% of a quail's annual diet. Green vegetation such as filaree or storksbill (*Erodium spp.*) and kochia (*Kochia scoparium*) becomes essential food in the late winter, early spring, and summer months by improving quail body condition and thereby improving nesting success.

Common Quail Foods Table 1

Montezuma Quail

Gray's woodsorrel (*Oxalis grayi)*
Yellow nutsedge (*Cyperus esculentes)*
Oak acorns (*Quercus spp.*)
Whitemouth dayflower (*Commelina erecta)*
Piñon pine (*Pinus edulis)*

Bobwhite Quail

Shinnery oak (*Quercus havardii)*
Mesquite (*Prosopis spp.*)
Hackberry (*Celtis spp.*)
Panicgrass (*Panicum spp.*)
Clover (*Trifolium spp.*)
Ragweed (*Ambrosia spp.*)
Switchgrass (*Panicum virgatum)*
Sunflowers (*Helianthus spp.*)
Croton (*Croton spp.*)

Succulent fruits from Christmas cactus (*Opuntia lepticaulis*) and pricklypear cactus (*Opuntia spp.*) are eaten in the summer and fall. In the fall, Gambel's quail often eat mistletoe berries from cottonwood and oak trees. Ironically, many plants favored by quail are considered weed species and emerge after soil disturbances.

Insects, often eaten by adults, are critical to nourishing young chicks. Insects are considered the ideal quail food providing protein, energy, and water. Managing for a diversity of forbs (broad-leafed weeds) will provide an abundance of insects and seeds.

Montezuma quail differ from other quail by feeding mainly on underground bulbs and tubers of wood sorrel and nut sedges. Insects are second, followed by grass and forb seeds.

Table 1 provides a sample of plants, seeds, and nuts commonly eaten by quail in New Mexico. Insects are not included but are extremely important to all species.

Scaled Quail

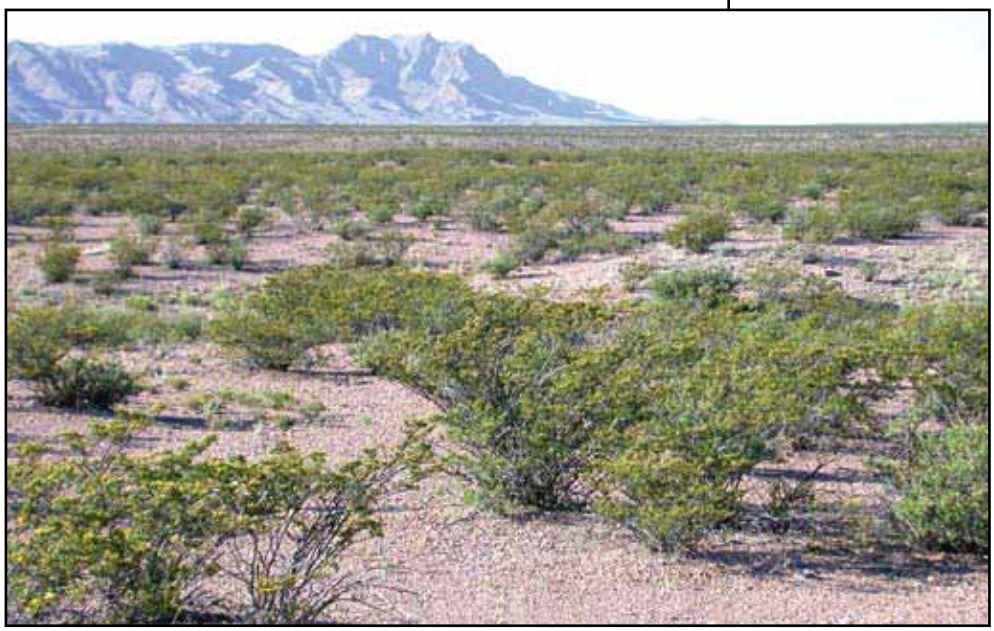
Mesquite (*Prosopis spp*.)
Snakeweed (*Gutierezzia spp*.)
Sunflowers (*Helianthus spp*.)
Pigweed (*Amaranthus spp*.
Croton (*Croton spp*.)
Plains bristlegrass (*Setaria*)
Dropseeds (*Sporobolus spp*.)
Ragweed (*Ambrosia spp*.)
Kochia (*Kochia scoparium)*

Gambel's Quail

Russian thistle (*Salsola tragus*)
New Mexico lotus (*Lotus neomexicanus)*
Mentzellia (*Mentzellia spp*.)
Wolf berry (*Lycium spp*.)
Sumac (*Rhus spp*.)
Acacia (*Acacia spp*.)
Kochia (*Kochia scoparium)*
Prickleypear cactus (*Opuntia spp*.)
Filaree or storksbill (*Erodium spp*.)

Cover

Adequate cover is an essential component of quail habitat. Cover refers to the structure of the habitat. When differing cover types are provided, food and water generally are not a limiting factor. Necessary types of cover include nesting, brooding, loafing, roosting, escape and thermo-regulation (providing shade, warmth, or cover from adverse weather conditions, i.e. hail). Nesting cover is extremely important and is typically associated with grasses that form a canopy over the nest, protecting it from the sun and rain and concealing the hen while she is incubating. Examples of nesting cover plants are bunchgrasses and bluestem (*Andropogon*, *Bothriochloa*, and *Schizachyrium* spp.), switchgrass (*Panicum virgatum*), and tobosagrass (*Hilaria mutica*).



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Quail habitat severely impacted by inappropriate grazing and drought

Bunchgrasses are typically considered desirable cattle forage and can become unsuitable to quail when they average less than 8 inches (in) tall and/or occur at a rate of less than 200 clumps per acre (ac). At this point grazing should be deferred. Conversely, when bunchgrasses exceed 500 clumps per ac, management techniques such as grazing or burning, should be applied to increase the amount of bare ground. This is rarely a problem in New Mexico due to our dry climate.

Although bunchgrass is important to most species of quail for nesting habitat, it is by no means the only vegetation used for nesting. Gambel's quail often create small depressions in leaf litter at the base of a shrub. In some areas, pricklypear cactus and mesquite (*Prosopis spp*.) are important nest sites. Even in these later examples, grass such as bush muhly (*Muhlenbergia porteri*) is an important component of the nest site.

Brood cover is very important to young birds. Newly hatched chicks require open ground to move around but also a vegetation overstory to protect them from predators. This overstory is usually a mixture of forbs such as

snakeweed, croton, sunflower (*Helianthus spp*.), and tall grasses. These form a dense canopy above and bare ground below. Insects are attracted to these areas, and they provide the needed protein source for the growing chicks. Loafing and escape cover are the most important components of suitable quail habitat often lacking in many areas. Loafing cover is required during periods when quail are not feeding, avoiding predators, resting in shade, or seeking protection from adverse weather. This shrub cover is typically composed of mesquite, sumac (*Rhus spp*.), shinnery oak (*Quercus havardii*), four-winged saltbush (*Atriplex canescens*), winterfat (*Krascheninnikovia lanata*), sandsage (*Artemesia*

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Good quail habitat surrounds this earthen tank

filifolia), yucca (*Yucca spp*.), and other tall shrubs. They form a dense overstory and an open understory. Suitable loafing and escape cover is approximately 4 feet high and 7 foot by 7 foot (ft) wide. The proper distribution of loafing cover will vary by quail species, habitat type, and topography. For most species, loafing and escape cover should be 60 ft. apart. Artificial loafing areas such as brush piles can be created but require regular maintenance.

Roosting cover varies for each species and typically occurs at ground level. Scaled and bobwhite quail prefer roosting in tight circles at night in grassy, relatively open areas with little overhead cover allowing for quick escape when disturbed. Gambel's quail are the only species that use trees or shrubs for roosting. Montezuma quail is another ground roosting bird requiring tall grass for thermal cover. At night, Montezuma quail huddle in tight groups on the ground in tall grass commonly in a drainage bottom. The roost site is often near habitat structure that provides additional thermal cover. In the winter, grassy southeast facing slopes are often preferred.

A mosaic of various cover types on approximately 1-5 ac sized plots over a large area will typically provide most quail habitat requirements. When plant diversity is low, quail populations are low or non-existent.

Water

Water availability was once considered an important aspect of wildlife management. However, biologists are realizing wildlife in the Southwest have developed many different ways for meeting their needs without relying on permanent, free-standing water sources.

Quail are able to meet their water needs from sources such as dew, green vegetation, fruits, and insects. Quail will use freestanding water when available, but providing it should not be emphasized in habitat improvement projects. Water allowed to flow onto the ground from storage overflow or stock ponds increases forb and insect production. Typically, areas near stock water troughs are devoid of grasses and

herbaceous vegetation but large shrubs may be present. If moderate use of livestock watering occurs at dirt tanks, thick stands of tall vegetation may occur. Plants such as sacred thornapple (*Datura wrightii*), provide food and cover for quail. All wildlife guzzlers and livestock water troughs should be equipped with access and escape ramps to prevent drowning of quail and other wildlife. If water sources are designed with quail in mind, escape cover should be provided nearby.

Waterspreading on rangeland is a multi-purpose practice to control soil erosion and conserve moisture. Runoff is diverted from eroding channels and spread over adjacent floodplains or valley floors. Benefits include retarding sediment, increasing forage and insect production, restoring groundwater, regulating stream flow, and improving wildlife habitat. The principal diversion structure is usually placed upstream, above the advancing headcut. This allows the gully to stabilize and re-vegetate.

Space

Another component of quail habitat is space. Space refers to open ground between cover types. Habitat should have the proper components and quantities of woody and herbaceous cover so distances between cover types allow free movement between them. Too much open ground between cover increases quail susceptibility to predation. Cover that is too dense makes it physically inaccessible.

Suggestions for Enhancing Quail Habitat

Defer grazing 1 out of 3 years on ranges in poor condition and 1 out of 5 years on ranges in good condition.

- Grazing less than 50% of current annual growth in years of average rainfall.
- Maintain bunchgrass for nesting cover at 100-300 clumps (12" diameter by 8" tall) per acre depending on species.
- Grass canopy cover should be maintained at a 30% minimum for Scaled quail and greater than 60% for Montezuma quail.
- Avoid complete brush removal. Each species requires brush for various reasons. Table 2 provides guidelines for each species when planning habitat projects.
- The distance between cover or brush is extremely important as well. Again, each species' requirement is different.

Guidelines For Habitat Improvement Projects Table 2

	Scaled Quail	Gambel's Quail	Montezuma Quail	Bobwhite Quail
% of Tree or Brush Canopy Cover	10-25 %	> 40 %	25-50%	10-20%
% of Grass Canopy Cover	30-50 %	30-50 %	> 60%	30-50 %
Distance Between Cover	60 yards	40-50 yards	5-15 yards	60 yards
Nesting Cover (bunch-grasses 12 inches in diameter and 8 inches tall)	200 – 300 grass clumps per acre	100-200 grass clumps per acre	200 – 300 grass clumps per acre	>200-300 grass clumps per acre
Grazing % of Annual Growth Removed During Years of Average Rainfall	< 50%	< 50%	< 50%	< 50%

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Scaled Quail

(Blue quail, Cotton top)
(Callipepla squamata)

Identification

Scaled quail are a grayish blue bird with a conspicuous white-tipped crest commonly called a "cotton top". The name scaled quail comes from the fish scale-like feathers on their breast and mantle (upper back). The sexes look similar. However the hen's crest is smaller with a buff hue and they have brown streaks on their throat. Males' throat patches are not streaked. Males are typically much bluer than females during mating season. Males call with a high raucous "QUEESH" or a slow rhythmic "ket kut". The primary coverts on sub-adult birds are tipped with white.

Distribution

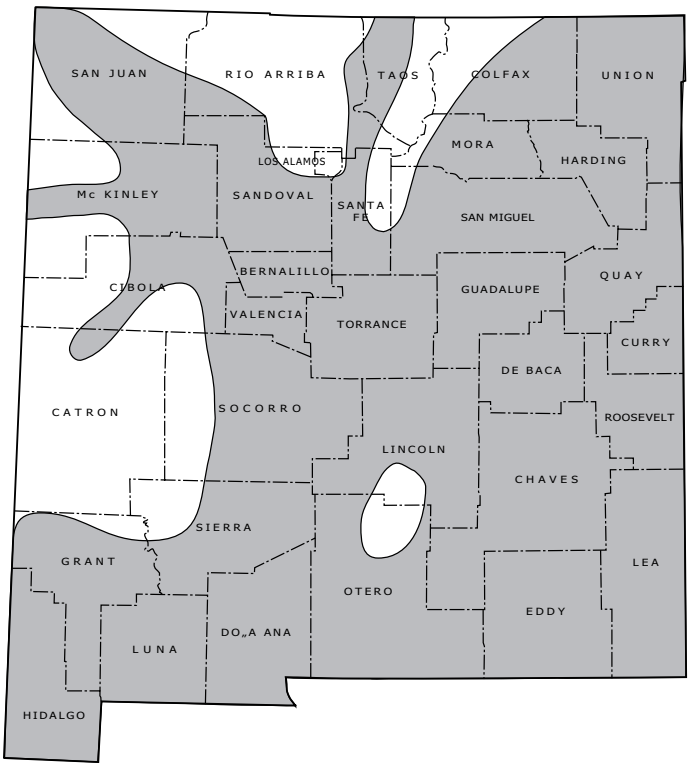
In New Mexico, scaled quail are the most widely distributed species occurring throughout suitable habitats.

Breeding and Nesting

Like many other species, scaled quail nests are constructed of grasses and feathers and are found primarily on the ground. Nests are occasionally found with an overhead cover of woven grass, and are usually associated with a guard object such as a pricklypear, yucca, dead Russian thistle (*Salsola tragus*) or abandoned farm machinery. Nesting begins as early as April, peaking in June and continuing through September.

The timing of adult pairing, nesting and egg laying is dependent primarily on precipitation and habitat condition. Double brooding (mating with different males and laying two separate clutches of eggs) has been documented. Clutches range from 9-18 eggs but average 13. Nests seen in May typically have more eggs than nests in August. Hens may sometimes re-nest if the first nest is destroyed. This depends on the hen's condition and if there is enough time to raise chicks before cold weather arrives. If range conditions are extremely dry during the nesting season, scaled quail may delay pairing or stop nesting altogether until conditions improve.

Scaled Quail Distribution



Home Range

Home range for scaled quail coveys are generally larger than that of Gambel's quail. This is probably because the habitat they live in is generally more open with cover spaced farther apart. Home ranges during the winter vary from 25-84 ac to 175-519 ac. Summer ranges are larger, typically 291-882 ac. Movements from summer range to winter range are typically small, about 2.5 miles (mi) and are generally upward in elevation into foothill habitat. In New Mexico, an individual quail has been documented to move 60 mi.

Habitat Requirements

Scaled quail are found in semi-arid rangelands with mixed scrub (shrubs, grass, and bare ground). Common vegetation includes mesquite, pricklypear cactus, and scattered shrubs and grasses. With good grass cover, scaled quail and Gambel's quail often occur together. In New Mexico, scaled quail inhabit most of the state except high-elevation habitats.

Scaled quail appear linked to desert grasslands, although they have been reported in areas dominated by creosote bush in Mexico and in similar areas in southwestern New Mexico. This species is generally associated with open habitats and seem to avoid rugged slopes and dense stream courses. They tend to avoid pure grasslands, particularly stands of introduced Lehman's lovegrass and areas that lack interspersed shrubs and forbs. In Arizona, scaled quail are most abundant in areas with a diverse community of 50% native grass and a canopy of 10% shrubs. Areas with dense trees (defined as a tree or shrub greater than 5 ft. in height) were avoided. When forb cover is high, perennial grass cover appears less important.

Quail numbers may also be greater in areas with high plant diversity. Scaled quail are often observed in areas of high forb cover and low perennial grass cover. Interspersed bare ground also appears to be an important habitat component, since this species will often run, rather than fly when disturbed.

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Typical scaled quail habitat

While this species remains common or abundant in portions of its range, it is generally declining due to habitat degradation. Scaled quail populations are widely known for "boom and bust" cycles in response to drought. However, in contrast to Gambel's quail, scaled quail population response to winter precipitation is less clear while spring and summer precipitation

appears to be more important. Scaled quail seldom inhabit areas that receive less than 6 in. of summer precipitation.

Food

Seeds from forbs make up the largest portion of the scaled quail's diet. Seeds most often eaten are from those species considered undesirable as range plants, including small-flowered milkvetch (*Astragalus nuttalianus*), morning glory (*Ipomoea eriocarpa*), foothill deervetch (*Lotus humistratus*), lupine (*Lupinus sparsiflorus*), snakeweed, doveweed, kochia, pigweed, and thistles (*Salsola spp*., *Scoparia iberica* and *Cirsium spp*.). Seeds of woody plants like mesquites, skunkbush, acacias (*Acacia spp*.), wolfberry (*Lycium berlandieri*), and hackberry (*Celtis spp*.) are important. Scaled quail feed on green herbaceous material, especially during winter and spring months. Green plants are an important source of Vitamin A, which is necessary for reproduction. Insects, when available, are consumed by both adults and young.

Management Considerations

Scaled quail may respond best to light or moderate (25-35%) grazing. Many scaled quail ranges have been overgrazed by livestock. This results in a lack of lateral cover around loafing and feeding areas.

Desirable cover plants for scaled quail include saltbushes (*Atriplex spp*.) and winterfat, which are consumed by livestock. Reduction of saltbush decreases scaled quail carrying capacity. In areas with light to no grazing, winterfat provides excellent screening cover. Uniform heavy grazing pressure degrades habitat quality for scaled quail by reducing patchy ground cover.

In well-watered areas in New Mexico, moderate grazing may have a beneficial effect on quail range by encouraging forbs and weeds that provide a large portion of the scaled quail diet.

Upland sandy areas in fair to good range condition provide optimum habitat for scaled quail in south central New Mexico. These ranges should experience light grazing (25 to 35%) by cattle. This level of use maintains shrub and grass

Mark Gruber photo

Hunting scaled quail in southern New Mexico

habitat that is beneficial to scaled quail. Increases or decreases in scaled quail numbers have not been noted among ranges cleared of mesquite, or ranges with small irregular clearings within mesquite, or in undisturbed mesquite. However, significantly more scaled quail calls were heard in undisturbed mesquite than in mesquite-free range. Mesquite and broom snakeweed reduction projects may have an adverse effect on winter food availability for scaled quail.

Grasses including plains bristlegrass, panicgrasses (*Panicum spp.*), knotgrass (*Paspalum distichum*), and barnyardgrass (*Echinocloa crusgalli*), that increase in abundance following a reduction of mesquite are acceptable substitutes in scaled quail diets. However, these grasses are usually replaced by climax grasses, which are beneficial as nesting cover but provide little towards scaled quail food resources.

Scaled quail populations fluctuate widely and are adversely affected by drought, heavy snow cover and heavy rains. In Colorado, the movement of winter coveys to farmlands was reduced by the development of good winter habitat. This included creating brush piles for overhead cover, guzzlers (artificial sources of water used by scaled quail for both water and cover), and cover plantings around blowouts. Establishing natural cover (vegetation native to a particular area including mesquite, sumac, Apache plume, or saltbush) is preferable to the construction of artificial cover. Brush, post, and board piles, however, are inexpensive and readily used by scaled quail. Cover is especially important during extreme weather such as blizzards, hailstorms, and drought.

Recommended scaled quail habitat consists of early succession (multi-layered canopy with annual and perennial plants and grasses) plant stages with annual and perennial forbs and some food-producing shrubs. A patchwork of short grasses, tall grasses and forbs, and at least 25% low woody cover is ideal. Recommendations for habitat improvement in Oklahoma include maintaining natural cover by fencing off four-wing saltbush and skunkbrush to protect them from trampling and grazing by cattle. An area to be managed for scaled quail should include at least one loafing covert per 52 to 70 ac, or the average size of a covey's winter home range. In Texas, recommendations include maintaining a 5 - 15 % brush canopy in pastures. At such levels, the distance between loafing coverts should ideally be about a softball throw apart (60-80 yds).

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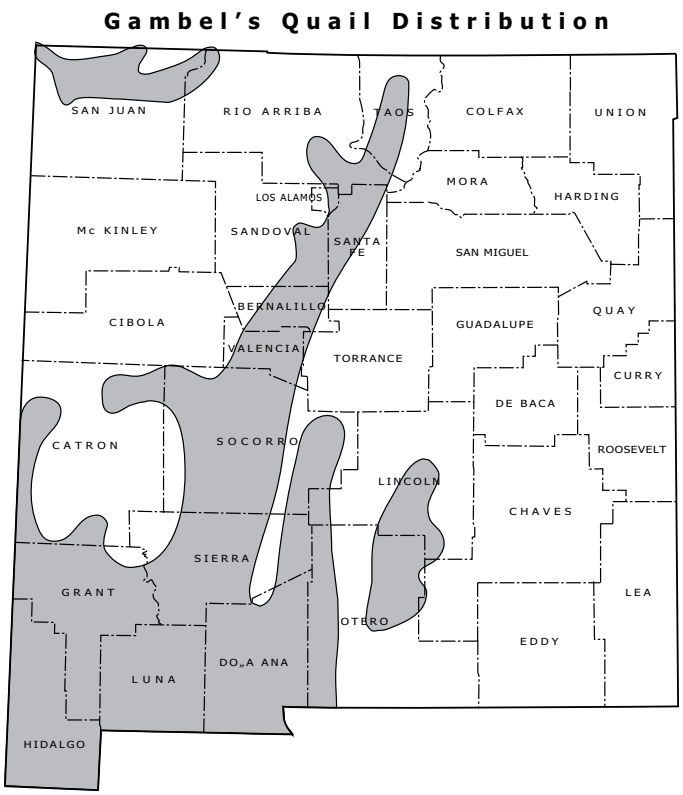
Gambel's Quail

(*Callipepla gambelii*)

Identification

The Gambel's quail is a very distinct quail with a prominent teardrop-shaped black plume on top of its head. The overall body color is grayish with chestnut colored sides and plain underparts. Males have a dark forehead, black throat and belly patch, a chestnut crown. Females have a smaller, less distinct plume and no black throat or abdomen. The most often heard call of the Gambel's quail is the assembly call, this is a nasal "Chi-ca-go-go".



Distribution

A true desert bird, Gambel's quail evolved in the much drier Sonoran Desert. This species thrives in brushy drainages dominated by mesquite, acacia, skunkbush (*Rhus trilobata*), littleleaf sumac (*Rhus microphylla*), and various cactus species. In New Mexico, Gambel's quail are found in the central and western two-thirds of the state and north along the Rio Grande. Small, isolated populations occur in the north-western part of the state while others occur in drier habitats of south-central New Mexico. At the edge of their range, riparian zones become increasingly important to Gambel's quail.

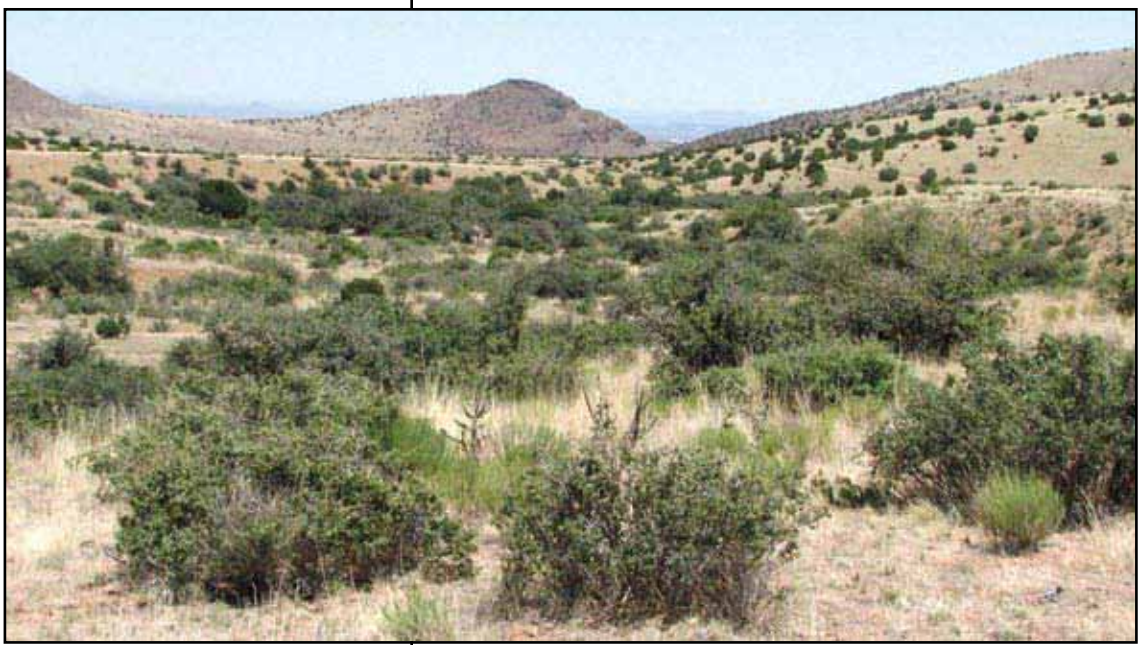
Breeding And Nesting

Pair formation in Gambel's quail follows the break-up of winter coveys. Males leave winter coveys first and begin seeking females. This typically occurs during March, but may occur in February or earlier during good years.

Nesting usually begins in April and lasts until June or July. In extremely wet years, young chicks may be observed as late as September. Vitamin A, obtained from green vegetation produced by winter moisture, is stored in the quail's liver. It stimulates reproductive organ development and assists reproduction in this species. Gambel's quail may produce a double clutch in wet years but typically produces only a single brood. In extremely dry years, they may have small clutches or not reproduce at all. The average clutch size is 10-14 eggs. As with scaled quail, Gambel's quail may lay a second clutch if the first is destroyed.

Home Range

Home range varies from 20-94 ac per covey. Maximum yearly movement of coveys has been reported to be less than 1.2 mi, although individuals may travel greater distances. In one study, 22% of birds displayed annual movements greater than 1.8 mi.



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Quality Gambel's quail habitat

Habitat Requirements

Gambel's quail are a warm-desert resident of brushy and thorny vegetation in parts of the Chihuahuan Desert, as well as adjoining cultivated lands. Favorite habitats within this range are river valleys and drainages, including those adjacent to cultivated fields. Generally speaking, Gambel's quail are closely associated with honey mesquite (*Prosopis glandulosa*) throughout it's range. However, in New Mexico, mesquite is not essential to the bird's welfare. This is especially true along drainages. These birds are particularly abundant along mesquite-lined rivers, creeks, and arroyos below an elevation of 5,400 ft. Springs, seeps, and stock tanks with good shrub components are favored. Gambel's quail are also associated with arroyos dominated by obligate vegetation (usually occur in arroyos), such as sumac and acacia.

Good populations are also found in New Mexico's desert mountain foothills and arroyo-laced plains within the Chihuahuan Desert, scrub-invaded semi-desert grassland, and interior chaparral communities. Key plants other than mesquite include: Apache plume, desert hackberry (*Celtis pallida*), desert willow (*Chilopsis linearis*) catclaw acacia (*Acacia greggii*), skunkbush, littleleaf sumac, pricklypear cactus (*Opuntia phaeacantha*), chollas (*Opuntia spp*.), desert thorns (*Lycium spp*.), and scrub oak (*Quercus turbinella*). Dominant understory plants may include brittlebush (*Encelia farinosa*), triangle-leaf bursage (*Ambrosia deltoidea*), shrubby buckwheat (*Eriogonum wrightii*), burroweed (*Haplopappus tenuisectus*), jimmyweed (*H. pluriflorus*), turpentine bush (*H. laricifolius*), snakeweed, bush muhly (*Muhlenbergia porteri*), and various dropseeds (*Sporobolus spp*.).

Important cover plants in bushy drainages include: honey mesquite, littleleaf sumac, white-thorn acacia (*Acacia constricta*), one-seed juniper (*Juniperus monosperma*), bear grass (*Nolina microcarpa*), allthorn (*Koeberlinia spinosa*), catclaw acacia, condalia (*Zizyphus obtusifolia*), and various yuccas.

In mountains adjacent to semi-desert grassland, Gambel's quail commonly extend upward into chaparral and oak woodland habitats. In some areas, this species may even be found in pines forests. However, they avoid the densest chaparral, and most piñon-juniper (*Pinus edulis-Juniperus spp*.) woodlands that are too cold to support Gambel's quail. The few individuals living within the Great Basin desert scrub are confined to brushy drainages. Gambel's quail are generally absent from the creosote bush (*Larrea tridentata*) dominated plains that are such an extensive landscape feature in the more arid portions of the Chihuahuan Desert.

At the eastern end of the Gambel's quail range, drainages become increasingly important. Washes and riparian habitats are an essential component of "quail country." This is especially true along the lower Rio Grande and its tributaries. Here the species is often observed near dense thickets of salt cedar (*Tamarix spp*.), arrow weed (*Pluchea sericea*), screwbean mesquite (*Prosopis pubescens*), saltbush (especially quail bush [*Atriplex lentiformis*] and four wing saltbush [*A. canescens*]), and other riparian vegetation.

Other superior quail habitats can be found at the edges of agricultural fields, especially those adjacent to brush-lined river channels, irrigation ditches, and remnant wildlands. Shrubby fence rows are required components of cultivated quail habitat, and the increasing tendency toward clean farming has taken a toll on what were formerly productive quail areas. The clearing of mesquite trees in an effort to increase productivity of western rangelands for cattle can also be detrimental to Gambel's quail.

Food

Gambel's quail are primarily herbivorous, but insects are important seasonally. Gambel's quail diets vary considerably throughout the species' range, but generally consist of seeds gleaned from forbs, shrubs, trees, and cacti. Seeds from legumes are important throughout their range. Fruits from shrubs and cacti, particularly pricklypear (*Opuntia spp*.), are important food

items. Green vegetation, especially New Mexico lotus (*Lotus neomexicanus*), filaree or storks bill, stickleaf (*Mentzelia spp*.), and twinleaf senna (*Senna bauhinioides*), are very important during winter and early spring months before reproduction. They provide much of the quail's moisture requirements. Like other quail, insects are important, especially for the growing young. Mesquite seeds and leaves, mustards (*Brassicaceae*), ragweeds, sumac, acacia, tumbleweed, and a host of other native seeds produced by shrubs and forbs are consumed if available.

Management Considerations

Unlike other southwestern quails, which roost on the ground, Gambel's quail typically seek a night-time roost in leafy or densely branched shrubs or trees. Depending on a chosen site, individuals may spend the night perched a few inches to several feet above ground. Roost sites vary with locale and season, but favorite plants, often used night after night include both desert hackberry and netleaf hackberry (*Celtis reticulata*), mesquite, juniper, littleleaf sumac, desert thorn, and catclaw acacia.

Overhead shrubbery that screens the birds from the sun and shields them from birds of prey is an important component of good Gambel's quail habitat. Such cover may take the form of mesquite, acacia, salt cedar, fourwing saltbush, or other relatively tall-structured vegetation along a drainage. Cover may consist of scrub oak, mimosa, sumac, and other upland shrubbery 3 ft. to less than 10 ft. tall.

Productive habitats for Gambel's quail can be almost any brushy southwestern locale with thorny legumes of the genera *Prosopis* or *Acacia* and accompanied by cacti and/or leafy succulents (*Agave*, *Nolina*, and *Yucca*). Some of the best Gambel's quail areas include scrub-infested grasslands, which are being invaded by mesquite and juniper. Maintaining a diverse and moderately dense (at least 40%) shrub component mixed with various forbs and grasses provides excellent habitat for Gambel's quail.

AZ Game and Fish Dept.

Montezuma Quail

(Mearns' or Harlequin quail)
(*Cyrtonyx montezumae*)

Identification

This is a plump, short-tailed quail. Males have a striking facial pattern of black, white, and chestnut that forms a clown-like face, hence the name Harlequin. Males have a black breast and undersides with white or cinnamon-brown colored spots on dark grayish flanks, and grayish brown backs. Females have an overall cinnamon body coloration with mottled pinkish-brown underneath and less distinct head markings. Males have a song described as a melancholy, vibrant, descending, and whistled "Vwirrrrrr". The female's assembly call is a descending whistle. A distinctive feature of this species are its long, sickle-shaped claws used for digging.

Distribution

Montezuma quail occur in the Gila National Forest, southwest portion of the Cibola National Forest, San Andres Mountains, Sacramento Mountains, southwestern portions of the Coronado National Forest (Peloncillo Mountains), and associated sky islands in the extreme southwestern portion of the state.

Breeding And Nesting

Montezuma quail pairing typically occurs from late February to March and nesting usually occurs from mid-June through mid-August. Montezuma quail nest later than other species of quail. Newly hatched young are often seen in mid-September.

Nests are made on the ground either on slopes or adjacent to ground structure such as a tree or boulders. Typical nests are covered chambers with a canopy of perennial bunchgrass but they also occur in a shallow scrape lined with grasses under the cover of a bush or grass tuft. Montezuma quail form smaller winter coveys than the other three species.

Home Range

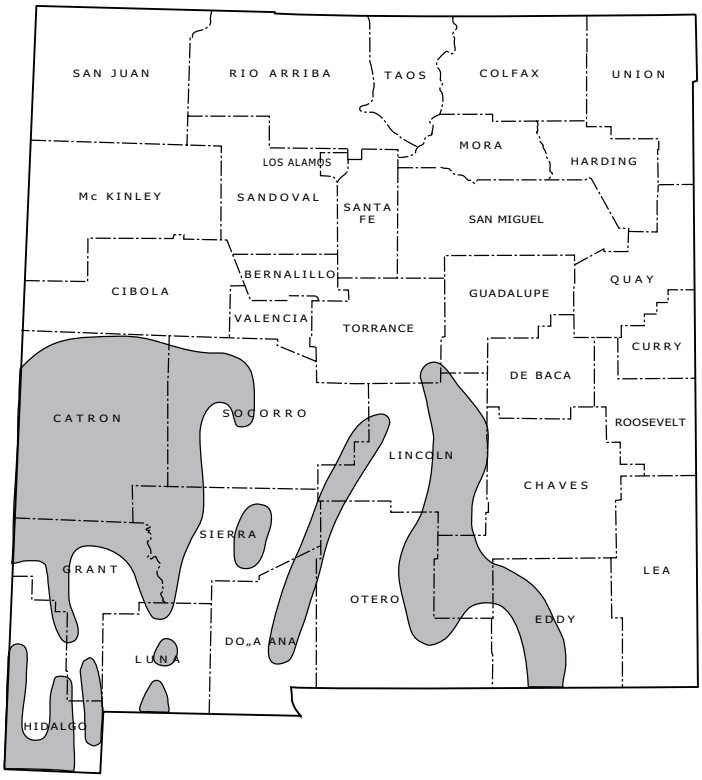
Quality and quantity of habitat influences home range size. Radio-marked birds seldom moved more than 200 ft. in a day. Montezuma quail are unique in that coveys are small (less than 10) and typically range over small areas, less than 15 ac, although larger movements have been documented. Montezuma quail that occupy habitats of higher elevations in west central New Mexico likely move up and down in elevation in response to varying weather conditions.

Habitat Requirements

Montezuma quail are found in pine-oak and oak scrub habitats, especially in open woodlands with a grass understory. They prefer southeast-facing hillsides in tall grasses for night roosts and north-facing hillsides for day use.

Montezuma quail rely heavily on oak-grassland or pine-oak grassland savannas. They rarely occur in other habitats, except during years of abundance. However, they do not occur in areas without an adequate grassland component. They are occasionally associated with other overstory species including catclaw and mesquite. Nearly all habitat studies involving Montezuma quail describe optimal conditions as areas with high grass diversity and grass cover height associated with an overstory of oak, such as Arizona white oak (*Quercus arizonica*), Emory oak, (*Q. emoryi*) or pine (*Pinus spp*.). An overstory of trees provide security, thermal cover, and microclimates conducive to forb production. Rarely are Montezuma quail found more than a few dozen yards (yds) from trees. Tall perennial bunchgrass species are most often used for cover and nesting. These grasses are warm season species produced during the summer monsoons of July-September. Montezuma quail depend on hiding cover for defense from predators, nest location, and thermal protection at all stages of their life.

Montezuma Quail Distribution



Food

Habitat selection by Montezuma quail is not only dependent on available cover, but also on the distribution of food plants. Montezuma quail diet studies have determined that the tubers of yellow nutsedge (*Cyperus esculentes*) and Gray's woodsorrel (*Oxalis grayi*) account for the majority of their diet. Both these plants show above-ground growth in summer, but may be invisible in fall and spring. Oak woodlands provide the microclimates conducive to the production of

these and other forbs. Insects and acorns are used in summer and bulbs and tubers are most often used in fall and winter. During the fall in the San Mateo Mountains, the crops of Montezuma quail contained acorns and piñon nuts. During winter in the Magdalena Mountains, birds fed on whitemouth dayflower (*Commelina erecta*) seeds that had accumulated under skunkbush. As with other gallinaceous birds, the diet of young 3 to 12 week old Montezuma quail consists of insects.

Texas, the Montezuma quail is now local and rare because a large percentage of its native range has disappeared due to overgrazing. Heavy grazing reduces tall grass cover and increases patchiness of the remaining cover. Grazing 46-50% of an area produces marginal conditions for Montezuma quail. Heavier grazing eliminates these quail altogether.

NM Dept. of Game and Fish

Typical Montezuma quail habitat

Management Considerations

Spatial arrangement of both grassland and woodland cover types is very important for this species due to its survival strategy, small home range, dispersal distances, and food habits. Adequate horizontal and vertical grass cover must be well distributed across the landscape. The percentage and distribution of suitable habitat patches will determine the amount of use a given pasture receives, and connectivity between suitable patches is essential for dispersal.

Populations of Montezuma quail in undisturbed habitat tend to fluctuate annually. Reproductive success is associated with the amount of summer precipitation in any given year. Any factors reducing the amount of tall grass cover have an adverse effect on Montezuma quail. In western

Reducing oak stands for timber or grazing improvements could reduce habitat value by reducing the thermal cover and acorns available for Montezuma quail and other wildlife species in autumn and winter.

Montezuma quail select areas with higher horizontal cover from 2-20 in. over those provided at random locations. Montezuma quail rely on their cryptic coloration and freezing-in-place as their primary defense from predators. The effectiveness of which is influenced by grass canopy cover and height. One study suggests predation from aerial predators can be significant. This could account for the selection of taller, denser grass cover.

Montezuma quail prefer an overstory canopy of 26-75% with optimal levels occurring between

26-50%. In southeastern Arizona, Montezuma quail were most often found within 20 yds of oak trees, but there are many examples of this quail existing in areas devoid of oaks. Management of Montezuma quail includes maintenance of winter habitat. Winter habitat includes areas where bulbs and acorns are available.

Moderate livestock grazing, where grass cover requirements are met, is consistent with quality Montezuma quail habitat. However, Montezuma quail tend to select the more lightly used patches of a pasture. Higher densities of quail food have been found in lightly grazed areas in comparison to non-grazed areas. It seems reasonable that the foods used by quail grow best where grass competition is reduced, leading some to suggest that light grazing benefits Montezuma quail. Various researchers have documented less food available in areas of very intense livestock grazing.

Regardless of livestock impacts on Montezuma quail food abundance, all studies conducted on habitat stress that diverse, tall grass is an essential critical component of optimal habitat. When grazing reduces grass cover below that required by Montezuma quail (8-10 inches), food becomes unavailable due to a lack of cover. After an area is burned, an increased number of Montezuma quail are often observed, presumably due to an increase in new plant growth.

At higher elevations and in the northern range of Montezuma quail distribution, south facing slopes with adequate cover are vital for survival. Snow cover greater than 3 days increases mortality due to lack of access to food resources.

NM Dept. of Game and Fish

Northern Bobwhite

(*Colinus virginianus*)

Identification

This is a small, short-legged quail with extensive mottling on the back and wings. Males have a white throat and "eyebrow" while females have a buff-colored throat and "eyebrow". The male's song is a clear "bob-WHITE".

Distribution

Bobwhite are found in the eastern third of New Mexico where mixed brush and grassland habitats dominate.

Breeding And Nesting

Bobwhite nesting season occurs from March through September with the peak occurring May through August. Bobwhite nest on the ground using leaf litter collected by both hens and cocks. A single clutch is produced each year averaging 14-16 eggs although double clutches have been reported in some states. Males may occasionally incubate clutches.

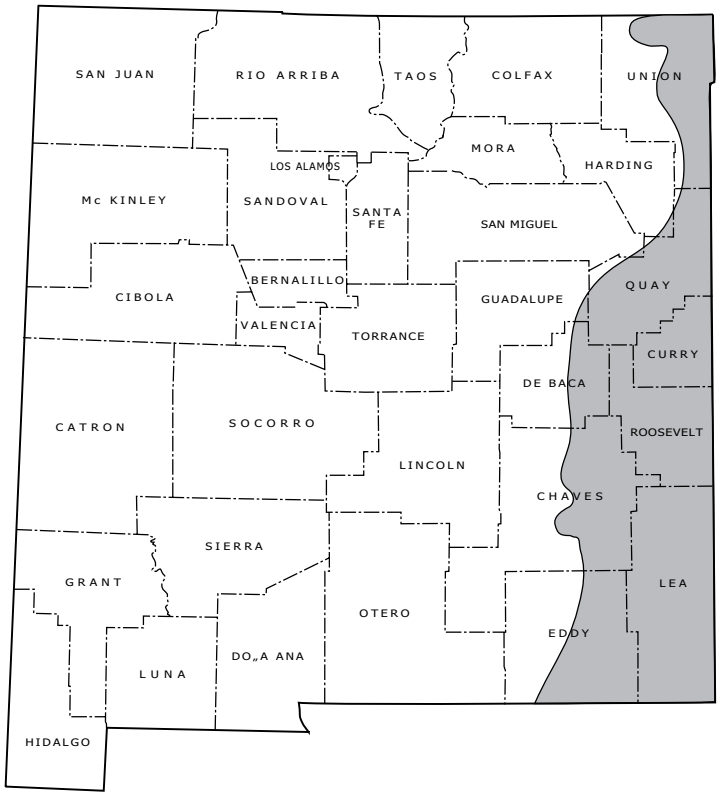
Home Range

The average annual home range size is around 40 ac but, depending on habitat quality, home range size can vary from 10 ac to more than 200 ac.

Habitat Requirements

Northern bobwhite require brushy cover for hiding and resting. However, cover should be open enough to allow birds to move around and still avoid predators. In southeastern New Mexico, shinnery oak is a common component of bobwhite habitat. Additionally, a mature

Bobwhite Quail Distribution



mesquite and wolfberry (*Lycium spp*.) overstory with a grama grass (*Bouteloua spp*.) understory provides ample cover for bobwhite quail. Mesquite mixed with pricklypear cactus (*Opuntia spp*.) and sumac provides good cover. Cover should be 60-80 yds apart and 3 to 10 yds in diameter.

Bobwhites need large expanses of clumped native warm season grasses mixed with annual weeds, legumes, and woody thickets that are thick above but open underneath. The bobwhite prefers areas where half the ground is bare and the remainder contains upright growth of herbaceous and woody vegetation. They depend on dense, brushy areas for food during fall and winter and for escape and roosting cover year round. In New Mexico, bobwhite quail are closely associated with shinnery oak. Other important components include sandsage, sand dropseed (*Sporobolus cryptandrus*), side oats grama (*Bouteloua curtipendula*), bluestems, and skunkbush.

Changing land use practices have simplified the landscape by promoting the abundance of one habitat component (grassland, agricultural crops or shrublands) to the exclusion of others. Consequently, modern agricultural practices that emphasize optimal crop production eliminate the mosaic landscape bobwhite and other native quail species require.

Food

Northern bobwhite quail eat primarily seeds, fruits, and insects, as well as new plant growth in the spring. Some food plants include shinnery oak, mesquite, hackberry, panicgrass, and clover (*Trifolium spp*.). Bobwhites also consume cowpeas (*Vigna spp*.), corn (*Zea mays*), sorghum (*Sorghum spp*.), and other cultivated small grains. These grains are usually gleaned from fields after the harvest. Quail seldom damage growing crops. Insects eaten by northern bobwhite include beetles (*Coleoptera*), grasshoppers (*Orthoptera*), ants (*Formicidae*), bees and wasps (*Hymenoptera*).

Management Considerations

Good northern bobwhite habitat requires good interspersion of food species and cover that is not too dense. Ideal or excellent habitat can support about one bird per ac. Habitats manipulated and planted with forbs and legumes attract insects, an important food for growing chicks. Food patch plantings generally fail to be of long-term value. Habitat improvement projects that include planting food for quail should always include appropriate legumes for eastern New Mexico. Conservation Reserve Program (CRP) fields planted in native grasses and shrubs greatly benefit bobwhite populations. Providing nesting and loafing cover in the unplanted corners of center-pivot irrigated fields is also beneficial. Evidence suggests that late summer fires may

increase food plants, including some legumes. Prescribed burning should only be employed if, after determining quail population limiting factors, fire can improve those limiting factors.

rainy periods but should be reduced during droughts. Whatever method used, bobwhite quail should seldom be more than 60-80 yds from brush.

Mark Gruber photo

A mix of grasses, weeds and woody thickets makes good bobwhite habitat

Grazing management can be used to maintain and/or change range condition. Flexibility of the stocking rate (number of livestock per unit area) is the primary method of attaining a target range condition class. Range condition is an ecological measurement of potential range productivity without regard to grazing influences expressed as range condition classes—excellent, good, fair, and poor.

Higher stocking rates benefit quail habitat on a productive site because cattle consume and trample dense plant growth. Moderate or low stocking rates are better on less productive sites because maintenance of ground cover is a primary concern. Flexibility in stocking rates is the key to successful bobwhite management. The ideal cattle stocking rate varies from year to year and season to season because of variable annual rainfall. Cattle numbers can be increased during

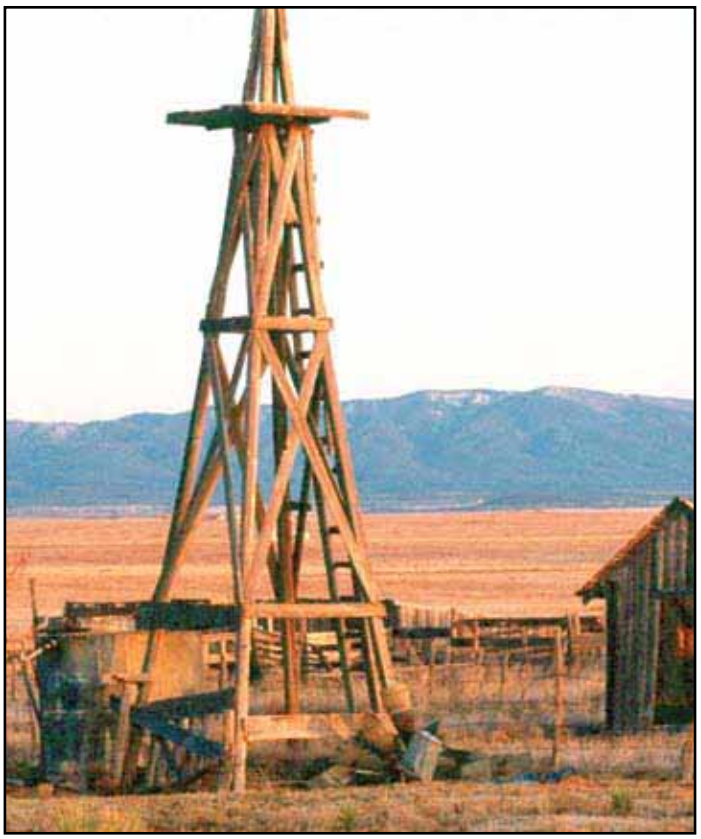
Recommended General Management Practices

Livestock Management

Proper grazing management can do more for quail habitat than any other management practice. Western quail species occupy a wide variety of rangeland types, with an equally wide variety of precipitation levels and livestock carrying capacities. Adjust livestock levels so that needs (cover, food, etc.) of the various species are met year-round. Reduce levels during periods of drought because required cover heights for quail species do not change during dry years. Additionally, the minimum cover heights for quail may not be met in the growing season during a drought. In this instance, residual cover from wet years is extremely important for most western quail species.

Grass cover requirements for quail, especially

Montezuma quail, remain consistent from year to year, while environmental conditions and grazing intensity may not. Percent utilization, a typical measure of livestock grazing pressure, is not a good gauge of habitat condition since in years of poor grass production, even light utilization by cattle may reduce grass height below the level needed by quail. Direct measure of grass height, percent cover, and species diversity would be the most effective means of assessing the grassland component of quail habitats.



Practices of the "Old West" are changing

Within grassland habitats, a portion should be managed to provide maximum cover from predators, particularly from aerial predators such as Cooper's hawks. Escape cover is a large area that contains grasses 8-20 inches in height year-round. A mosaic of grass heights from 8 - 20 inches with horizontal grass canopy greater than 50% is most similar to habitat selection patterns of Montezuma quail but also can be applied to scaled or bobwhite quail.

This component may occur in areas naturally protected from grazing, or could be provided by set-asides within grazed areas or refuges established adjacent to grazed areas. Distance to and frequency of this cover type will influence habitat suitability. Since daily movements of quail are relatively small, this component should occur at regular intervals throughout grazed habitats. Patch size should be large enough to prevent concentrating quail, making them more vulnerable to predators.

Deferment schedules regarding any state or federal allotment grazing program should be strictly adhered to by the leaseholder. Conversely, regulating agencies should employ an adaptive management approach allowing for the reduction of stocking rates or changes in livestock management, particularly during drought periods, if cover requirements during nesting and brood rearing periods are not met. Habitats vary across the landscape. These guidelines should be used to develop site specific standards or objectives with the local knowledge of biologists and landowners using site specific information. At a minimum, grazing should be deferred 1 out of 3 years on range in poor condition and 1 out of 5 years on range in good condition.

Brush Management

When considering brush treatment, the appropriate method and scale should be to maintain brush in a suitable quantity and pattern. Methods used for brush management are very important and are different for different quail species. Considerations should include brush species composition, density, soil, climate, and management goals and costs. A range in poor condition may require broadcast mechanical treatments and seeding. Higher condition ranges may need only maintenance practices.

Shrub cover is also needed to meet quail habitat requirements during weather such as extreme heat, heavy snow cover, and hail storms.

Quail are not found in areas without this component. For Mearns' quail, shrubs may be oak, juniper, or skunkbush sumac. Shrubs for scaled quail may include little leaf sumac, four-winged saltbush, mesquite, and Apache plume. Gambel's quail use Apache plume, mesquite, four-winged saltbush, and oak, while Bobwhite prefer shinnery oak or mesquite.

Before beginning brush management, the technique, size of the area to be treated, and spatial arrangement when completed should be given careful consideration. Additionally, proposed vegetation treatments should be based on monitoring if warranted by range or ecological conditions and not on schedules, targets, or quotas. If livestock grazing occurs in the proposed area, deferment should occur following vegetation treatments for a minimum of two growing seasons. Lastly, vegetation treatments should not be undertaken unless land use activities such as grazing can be managed after the treatment ensuring that habitat objectives are met.

Various methods may be used to encourage woody vegetation. Skunkbush and four-wing saltbush plantings can be used to establish vegetation in areas lacking this cover type. Plantings may require irrigation and protection from browsers until established. New techniques that incorporate weed barrier cloth and water harvesting have been very successful at establishing woody plantings on the high plains of Texas. Creating brush piles is a method used to provide loafing and protective cover, although maintenance is usually required to maintain effectiveness.

"Half-cutting" is another option in places where shrubs such as mesquite are the dominant woody species. Half-cutting is used to alter the growth form of shrubs making them more attractive as loafing sites. The property manager selects multi-stemmed trees with smooth bark. Using a limb saw, lower limbs are cut halfway through the top surface. They are then bent downward to the ground developing a bush or shrubby growth form (see http://teamquail.tamu.edu for a video clip of this procedure). Half-cutting is best done during April and May when the limbs are more flexible.

Nesting And Brood Habitat

Generally, perennial grasses provide excellent nesting cover. Dormant standing grasses, pricklypear cactus, and yucca are important, especially during dry years. Cover height and diameter should be roughly 8 by 12 in. respectively. Chicks need cover that allows freedom of movement at ground level while providing overhead concealment. Ideal plants would be single stem forbs such as croton, broomweed, or ragweed. Diverse grass communities with a varied forb component and scattered mixed shrubs provide many needed habitat components for most quail species.

Mark Gruber photo

Dog field trials using quail are popular in New Mexico

Water

Water projects aimed at maximizing benefits to the habitat and not a single species are the most advantageous. Seeps, windmills with overflows, or stock ponds should be created rather than "guzzlers". These provide moisture to the surrounding soil and vegetation, promoting green plant and insect growth rather than concentrating the water source to a single area. Additionally, these moist areas should be fenced from livestock and a separate drinker installed if grazing is to occur in the area. Escape cover should always be available nearby. In addition, water sources on leased land should be allowed to flow year round rather than shutting them off when cattle are removed.

Although quail use freestanding water, it does not appear to be essential to their survival. In New Mexico, some experts consider guzzlers for gallinaceous birds ineffective and impractical. Repair and maintenance of existing watering sites should be emphasized before implementing new projects. If water projects are constructed, incorporate access and escape ramps to allow for easier use and prevent drowning of wildlife.

The use of waterspreading systems can reduce sediment delivery by trapping sediments. This can be highly effective in improving vegetative cover and forage production. The topography of the spreading area should be relatively flat, smooth and free of gullies or channels that would tend to concentrate water flows. Soils should have a moderate to high water holding capacity. The combination of soils, slopes and plant cover should be such that spreading floodwaters will not create erosion problems. Sites without adequate plant cover should be properly revegetated.

Fire

Fire is an important tool for habitat enhancement projects. As the importance of fire on the landscape becomes increasingly apparent, managers are faced with crucial decisions regarding timing and intensity. Quail (as well as many wildlife species) respond favorably to a mosaic of burns and fire intensities. Prescribed fires of low intensity rather than burns of medium to high intensity may generate more vegetative production useful to wildlife in the shortest amount of time. Fire stimulates the sprouting of Gambel's oak and sedges, species important in Montezuma quail diets. In addition, prescribed fires maintain pine-oak or pine-grasslands in an open condition, improving habitat for Montezuma quail.

Invasive Plants And Noxious Weeds

Approximately 390 invasive plant species occur in New Mexico. They have the potential to seriously affect quail habitat. Lehman's lovegrass (spp.) has been implicated in reduced habitat quality and use by scaled quail in southeastern Arizona. Invasive plants deprive native plants, microorganisms and animals of their habitats and ultimately diminish biodiversity. However, quail have adapted to various established invasive plants such as Russian olive, and Russian thistle and will likely continue to use these as a common food source. Habitat projects should always incorporate locally native vegetation and avoid use of invasive plants.

Residential And Commercial Development

Wildlife managers should be involved in the early stages of residential and commercial zoning to ensure the needs of quail and other wildlife species are met. Issues include connectivity of habitats and movement corridors. Managers should strive to maintain or enhance quail related recreational opportunities.

Off-Highway-Vehicle (OHV) Use

Off-highway-vehicle use is increasing, particularly in desert states like New Mexico. These activities may disturb quail throughout the year. OHV use is increasingly fragmenting and degrading quail habitats, particularly in Gambel's quail range, where habitats are fragile and disturbances are long lasting. OHV users should be provided with "sacrifice areas" that have low value as wildlife habitat. These areas may concentrate OHV activities and reduce the scope of disturbance to quail populations and other wildlife.

Quail Feeding

Feeding has generally been found not to be beneficial or cost effective. However, if one chooses supplemental feeding, the following guidelines are offered. Feeding may be most effective during drought. With the proper habitat, an appropriate feeding program can carry quail through a drought. The following feeding program has been recommended for ranches in Texas with good habitat structure, proper grazing and moderate hunting:

1. If April to July rains total less than 5 inches, feed a high energy supplement November through January.
2. If September and November rains are less than 5 inches, feed a high protein supplement during February and March.
3. Feed energy supplements year round during a prolonged and severe drought.
4. Place feeders near water sources and adequate cover.

Monitoring Vegetation Treatment

There are myriads of techniques for monitoring vegetation over time although most techniques target localized areas. Since shrubs are a vital component of quail habitat, monitoring techniques should be adapted to quantify this aspect of a rangeland. Additionally, monitoring should occur throughout the year to measure the availability of food sources for quail. The U.S. Forest Service outlines several techniques in Interagency Technical Reference: Sampling Vegetation Attributes. Contact your nearest agricultural extension office to determine the proper technique for your area.

Monitoring Quail Populations

Techniques used to assess populations include flush counts, brood counts, call counts of males during the breeding season, winter covey counts, and wing collection barrels to determine age ratios from hunter harvest. Assuming hunter success is a measure of quail population size, hunter success can provide a means of tracking populations through time.

Summary

It should be apparent that many options are available when considering habitat enhancement or restoration for quail. Each species requires subtle, yet important differences in optimal habitat. Whatever the target species, the concept of "diversity" should be the ultimate goal for any habitat project for quail. With any habitat project, planning and widespread treatment followed by patience is the key. High quality quail habitat will ameliorate the affects of adverse weather conditions moderating fluctuating populations. Habitat conditions that maximize production and reduce mortality will be the most beneficial in maintaining New Mexico's quail populations.

In the end, timing and amount of precipitation is the dynamic feature affecting quail production in New Mexico and throughout the West. We can only enhance or restore habitat to provide quail safe haven in the interlude between storms. Quality habitat can maximize the effects of moisture when it does arrive. Therefore, landowners and managers should strive to prepare habitat, because no matter what technique is applied or how extensive the area treated, we still must wait for rain.

This document provides only a sample of information, techniques and programs available. Landowners and land managers seeking further information and guidance may contact any of the qualified biologists and habitat managers at the New Mexico Department of Game and Fish or other agencies and organizations dedicated to the enhancement of habitat and associated wildlife.

Scaled Quail Requirements

Habitat Types

- Scaled quail inhabit most of the state in varying densities except for higher elevations. Scaled quail are found in semi-arid rangelands and desert grasslands with mixed scrub (shrubs, grass, and bare ground).

- Interspersed bare ground also appears to be an important habitat component, since this species prefers to run, rather than fly, when disturbed.

Key Plant Species

- Common vegetation includes mesquite, prickly pear cactus, and scattered grasses. Scaled quail and Gambel's quail often occur together, although scaled quail use areas with more grass cover.

- They tend to avoid pure grasslands, particularly stands of introduced Lehman's lovegrass and areas that lack shrubs, grasses and forbs.

- Quail numbers often are greater in areas of high plant species diversity.

Food

- Seeds from forbs make up the largest portion of the scaled quail's diet. Seeds of woody plants like mesquites, acacias, and spiny hackberry are frequently consumed. Grass seeds, particularly from bristlegrasses (*Setaria spp.*), are important as food.

- The most often eaten forbs are considered "undesirable" range plants. These include small-flowered milk vetch (*Astragalus nuttalianus*), morning-glory (*Ipomoea eriocarpa*), foothill deer vetch (*Lotus humistratus*), lupine (*Lupinus sparsiflorus*), snakeweed (*Gutierrezia sarothrae*) and Russian thistle. Green vegetation is an important source of Vitamin A which is necessary for reproduction.

- Insects are eaten seasonally by both adults and young.

Management Considerations

- Scaled quail are more tolerant of grazing than other quail. However, heavy livestock use can be detrimental. In well-watered localities, moderate grazing may have a beneficial effect on quail habitat by encouraging forb and weed growth that provide a large portion of the scaled quail diet.

- Grasslands without shrub cover are much less suitable for scaled quail.

- Mesquite and broom snakeweed reduction projects may have an adverse effect on winter food availability for scaled quail. Reduction of saltbush cover reduces the scaled quail carrying capacity of the range.

- Scaled quail populations fluctuate widely and are adversely affected by drought or by prolonged flooding.

- Establishing natural cover is preferable to construction of artificial cover. However, brush, and post and board piles are inexpensive and readily used by scaled quail.

- Good scaled quail habitat consists of successional stages of annual and perennial forbs and some food-producing shrubs. A patchwork of short grasses, tall grasses and forbs and woody cover is ideal.

Gambel's Quail Requirements

Habitat Types

- Gambel's quail are residents of brushy and thorny vegetation in parts of the Chihuahuan desert, as well as adjoining natural and cultivated communities.
- Favorite habitats within these ranges are river valleys and drainages, especially those adjacent to cultivated fields.
- The bird is particularly abundant along mesquite-lined rivers, creeks, and arroyos below an elevation of 5,800 ft.
- Mesquite-choked springs, seeps, and stock tanks are also favored focal points for this quail species.

Key Plant Species

- Key indicator plants include: desert hackberry (*Celtis pallida*), catclaw acacia (*Acacia greggii*), skunkbush (*Rhus sp.*) pricklypear cactus (*Opuntia phaeacantha*), chollas (*Opuntia spp*.), scrub oak (*Quercus turbinella*), and any of several desert thorns (*Lycium spp*.).
- Dominant understory plants may include brittlebush (*Encelia farinosa*), triangle-leaf bursage (*Ambrosia deltoidea*), bear grass (*Nolina microcarpa*), shrubby buckwheat (*Eriogonum wrightii*), burroweed (*Haplopappus tenuisectus*), jimmyweed (*H. pluriflorus*), turpentine bush (*H. laricifolius*), or snakeweed (*Gutierrezia sarothrae*).
- Dominant overstory plants include: Texas honey mesquite (*Prosopis glandulosa*), white-thorn acacia (*Acacia constricta*), one-seed juniper (*Juniperus monosperma*), allthorn (*Koeberlinia spinosa*), littleleaf sumac (*Rhus microphylla*), catclaw acacia, condalia (*Zizyphus obtusifolia*), and various yuccas (*Yucca spp.*), dense thickets of salt cedar (*Tamarix spp.*), arrowweed (*Pluchea sericea*), screwbean mesquite (*Prosopis pubescens*), saltbush, quail bush (*Atriplex lentiformis*) and four wing saltbush (*A. canescens*).

Food

- Gambel's quail diet consists of seeds of forbs, grasses, shrubs, trees, and cacti. Seeds from legumes are also important throughout the species range. Mesquite seeds and leaves, mustards (*Brassicaceae*), ragweeds (*Ambrosia sp*), tumbleweed and a host of other seed producing shrubs and forbs are eaten if available.
- Fruits from shrubs and cacti (particularly prickly pear, *Opuntia spp*.) are heavily used seasonally.
- Green vegetation, especially deer vetches (*Lotus spp.*) and filaree (*Erodium cicutarium*), are very important during winter and early spring prior to reproduction, and provide much of the species moisture requirements.
- Insects are important seasonally, especially for the growing young quail.

Management Considerations

- The clearing of mesquite trees in an effort to increase the productivity of western rangelands for cattle can also be detrimental to Gambel's quail.
- Grazing can be a useful tool for Gambel's quail management when conducted at the right intensity under the right conditions. Leaving enough unburned grass cover for refuge can greatly increase the survivability of quail.

Montezuma Quail Requirements

Habitat Types

- Montezuma quail occur in the Gila National Forest, southwestern portions of the Cibola National Forest, San Andres Mountains, Sacramento Mountains, and associated sky islands in the extreme southwestern portion of the state.

- Montezuma quail are found in pine-oak and oak scrub highland habitats, especially in open woodland with grass understory and do not occur in areas without an adequate grassland component.

Key Plant Species

- Montezuma quail are found in areas with high grass diversity and grass cover associated with a tree overstory of oak such as Arizona white oak (*Quercus arizonica*) or Emory oak (*Q. emoryi*), or pine (*Pinus spp.*). Rarely are Montezuma quail located more than a few dozen yards from trees.

- Montezuma quail are occasionally associated with other "overstory" species including catclaw and mesquite.

- Perennial bunchgrass species are most often used for cover and nesting. These grasses are warm season species produced during periods of summer monsoon moisture (July-September).

Food

- Montezuma quail feed extensively on the bulbs and tubers of yellow nutsedge (*Cyperus esculentes*) and Gray's woodsorrel (*Oxalis grayi*) in summer.

- During the summer and fall, Montezuma quail feed upon insects, acorns, piñon nuts, grass and forb seeds.

- The primary diet of young Montezuma quail is insects.

Management Considerations

- Spatial arrangement of both grassland and woodland cover types is very important for this species due to its survival strategy, small home range, dispersal distances, and food habits.

- Adequate horizontal and vertical grass cover must be well distributed across the landscape. Montezuma quail select areas with tall (up to 20 inches) grass and forb cover.

- Moderate livestock grazing, where remaining grass cover requirements are met, is associated with good Montezuma quail habitat, although these quail tend to select more lightly used patches of a pasture.

- Reducing oak stands for timber or grazing improvements reduces habitat value by removing canopy cover and acorns. Overstory canopy cover should be maintained at no less than 20%.

- Burning may be an importat component of habitat management for Montezuma quail.

Bobwhite Quail Requirements

Habitat Types

- Bobwhite are found in the eastern third of New Mexico where mixed brush and grassland habitats dominate.

- In spring and summer, the bobwhite needs grasslands, drainage ditches and roadside and pond edges for nesting, feeding and roosting cover.

- In summer and fall, they may use croplands for feeding, loafing, dusting and roosting. Bobwhites depend on dense, brushy areas for food during fall and winter and for escape and roosting cover year round.

Key Plant Species

- Bobwhites require brushy cover for hiding and resting, although cover should be open enough to allow the birds to move about and see predators. The bobwhite prefers areas where half the ground is exposed and the remainder contains upright growth of herbaceous and woody vegetation.

- A mature mesquite and wolfberry (*Lycium spp.*) overstory with grama grass (*Bouteloua spp*.) in the understory provides ample cover for bobwhite quail. Shinnery oak (*Quercus havardii*) mixed with pricklypear cactus (*Opuntia spp*.), and sumac (*Rhus spp*.) provide good cover.

- Bobwhites need large expanses of clumped native warm season grasses mixed with annual weeds, legumes, and woody thickets that are dense on top but open underneath.

Food

- Northern bobwhite eat primarily seeds, fruits, and insects, as well as new plant growth in the spring.

- Food plants include: acorns, mesquite, hackberry (*Celtis spp*.), panicgrass (*Panicum spp*.), and clover (*Trifolium spp.*). Bobwhite quail consume cowpeas (*Vigna spp.*), corn (*Zea mays*), sorghum (*Sorghum spp.*), and other cultivated grains.

- Bobwhite eat insects including: aphids, mosquitoes, beetles, grasshoppers, and ants.

Management Considerations

- Changing land-use practices have simplified the landscape by promoting the abundance of one habitat type (grassland, agricultural crops or shrublands) to the exclusion of others. Consequently, modern agricultural practices that emphasize optimal crop production or establish former agricultural lands with exotic grass species, eliminate the mosaic landscape bobwhite and other quail species require.

- Northern bobwhite habitat requires an interspersion of food species and cover that is not too dense. Good habitat can support about one bird per acre.

- Habitats manipulated and planted with forbs and legumes can encourage insects, an important food for chicks.

- Food patch plantings generally fail to be of any long-term value. Habitat improvement projects that do include planting food for quail should always include legumes appropriate for eastern New Mexico climate conditions.

A Sample of Available Programs And Information Sources

Below are a sample of the available programs and information sources available to the public land manager or private landowner.

Bureau of Land Management (BLM) – New Mexico - http://www.blm.gov/nm/st/en.html

Comprehensive Wildlife Conservation Strategy (CWCS) – A proactive plan developed by the New Mexico Department of Game and Fish to examine the health of wildlife and prescribe actions to conserve wildlife and vital habitat before they become more rare and more costly to protect. http://www.wildlife.state.nm.us/department_info/documents/strategic_plan_06-10.pdf

Conservation of Private Grazing Land Program (CPGL) - (NRCS) - A voluntary program that helps owners and managers of private grazing land address natural resource concerns while enhancing the economic and social stability of grazing land enterprises and the rural communities that depend on them.

Conservation Reserve Program (CRP) - The Conservation Reserve Program provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with federal, state, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing land eligibility determinations, conservation planning, and practice implementation.

Conservation Security Program (CSP) – (NRCS) – A voluntary conservation program that supports ongoing stewardship of private agricultural lands by providing payments for maintaining and enhancing natural resources.

Environmental Quality Improvement Program (EQIP) – Administered by the USDA Natural Resources Conservation Service, EQIP provides landowner incentives for quail and wildlife management.

Habitat Stamp Program – Administered by the New Mexico Department of Game and Fish, a joint venture between sportsmen and agencies that manage wildlife and their habitat. Each year, licensed hunters, anglers, and trappers, on Bureau of Land Management (BLM) or US Forest Service (USFS) lands, are required to purchase the stamp or validation from the New Mexico Department of Game and Fish. The federal Sikes Act authorizes the program. Each year, sportsmen purchase about $1 million worth of Stamps.

Intermountain West Joint Venture (IWJV) - Facilitates the long-term conservation of key avian habitat including planning, funding, and developing habitat projects that benefit all biological components of Intermountain ecosystems. The IWJV promotes the restoration and maintenance of all bird populations; fosters the protection, restoration, and enhancement of wetlands, riparian habitats, and the widely diverse uplands characteristic of the region. http://www.iwjv.org/about.htm

New Mexico Department of Game and Fish http://www.wildlife.state.nm.us/

New Mexico Department of Game and Fish Wildlife Habitat Handbook - Provided in an effort to encourage incorporation of conservation practices in the earliest possible stages of project development. It contains conservation measures, with respect to specific land use practices,

targeted toward minimizing impacts of projects on wildlife and wildlife habitats. (http://www.wildlife.state.nm.us/conservation/habitat_handbook/index.htm)

New Mexico Energy, Minerals, and Natural Resources Department - http://www.emnrd.state.nm.us/main/index.htm

New Mexico Plant Materials Center (NRCS) - The New Mexico Plant Materials Center is located in Los Lunas, New Mexico and develops, tests, and transfers native plants that can help solve conservation problems.

New Mexico State Land Office – http://www.nmstatelands.org/Default.aspx

Playa Lakes Joint Venture (PLJV) - Facilitates the long-term conservation of key avian habitat including planning, funding, and developing habitat projects that benefit all biological components of playa lakes and shortgrass prairie ecosystems. The PLJV promotes the restoration and maintenance of all bird populations; fosters the protection, restoration, and enhancement of wetlands, riparian habitats, and the widely diverse uplands characteristic of the region. - http://www.pljv.org

Quail Forever - Quail Forever is dedicated to the protection and enhancement of quail, pheasant and other upland wildlife through habitat improvement, public awareness, education and advocacy for sound land management policy. - http://www.quailforever.org/page/home.jsp

Quail Unlimited - Quail Unlimited® founded in 1981 to address the problem of dwindling quail populations and declining wildlife habitat. It is the oldest national, nonprofit conservation organization dedicated to the wise management of America's wild quail. Known as "America's Leader In Quail Conservation," their overall vision is to restore America's quail populations for future generations. – http://www.qu.org/.

Rangeland Ecological Services Program (RESP) – NM State Land Office - designed to promote natural resource conservation through sound stewardship of state trust lands. In partnership with its agricultural lessees, the State Land Office encourages range management activity that benefits both native species and livestock.

Resource Conservation and Development Program (RC&D)- The RC&D program was authorized by Congress with the passage of the Food and Agriculture Act of 1962. The act expanded opportunities for state and local units of government, local nonprofit organizations, tribes, conservation districts, and individuals to improve their communities through this program of the US Department of Agriculture.

Team Quail - Texas Cooperative Extension - http://teamquail.tamu.edu/ - A resource rich Web site founded by Dale Rollins of the Texas Cooperative Extension.

Upland Habitat Buffers Program (CP33) – Administered by the USDA Farm Services Agency, allows up to 20,000 ac (8094 ha) of crop field edges to either be planted in native vegetation or allowed to regenerate naturally.

USDA Forest Service - http://www.fs.fed.us/

USDA Natural Resource Conservation Service - http://www.nrcs.usda.gov/

Wildlife Habitat Incentives Program (WHIP) – (NRCS) - The Wildlife Habitat Incentive Program offers opportunities to landowners to improve and protect wildlife habitat on private and Tribal lands. Persons interested in entering into a cost-share agreement with the US Department of Agriculture to develop wildlife habitat may file an application at any time. Participants voluntarily limit future use of the land for a period of time, but retain private ownership. In addition, NRCS works with the participant to develop a wildlife habitat development plan.

Recommended Reading

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Contributors

Doug Burkett - White Sands Technical Services

Mark Hakkila - Bureau of Land Management

David L. Heft - Cibola National Forest

Rob Hoffman - Quail Unlimited

Ernie Jaquez - Bureau of Land Management

Ray Lister - Bureau of Land Management

Pat Mathis - NM Department of Game & Fish

Myra Meyers - NM State Land Office

John Moen - Quail Unlimited

Andrew Ortiz - Farm Service Agency

George Richards - Turner Enterprises

Sanford D. Schemnitz - Southwest Consolidated Sportsmen

Oscar Simpson - NM Wildlife Federation

Nathan Small - NM Wilderness Alliance

Art Telles - Gila National Forest

Notes