



2009

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Alfonso Ortega-Sanchez  
*Sul Ross State University*

Louis A. Harveson  
*Sul Ross State University*

Roel R. Lopez  
*Texas A&M University*

Michael R. Sullins  
*Parks and Wildlife Department, Texas*

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### Recommended Citation

Ortega-Sanchez, Alfonso; Harveson, Louis A.; Lopez, Roel R.; and Sullins, Michael R. (2009) "Delineation of Gambel's Quail Habitat in the Trans-Pecos, Texas," *National Quail Symposium Proceedings*: Vol. 6 , Article 13.  
Available at: <http://trace.tennessee.edu/nqsp/vol6/iss1/13>

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# Delineation of Gambel's Quail Habitat in the Trans-Pecos, Texas

Alfonso Ortega-Sanchez<sup>1,4</sup>, Louis A. Harveson<sup>1</sup>, Roel R. Lopez<sup>2</sup>, Michael R. Sullins<sup>3</sup>

<sup>1</sup>Department of Natural Resource Management, Sul Ross State University, Alpine, TX 79832, USA

<sup>2</sup>Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 78343, USA

<sup>3</sup>Parks and Wildlife Department, Alpine, TX 79830, USA

**Gambel's quail (*Callipepla gambelii*) are a common quail species in southwestern states of the United States and the northwestern states of Mexico. In Texas this species occurs in the Trans-Pecos region, are underutilized, and could become an important game bird and source of income for ranchers in the Chihuahuan Desert region of Texas. Salt cedar (*Tamarisk* spp.), introduced from Asia for ornamental and erosion purposes, is invasive in the western part of the Rio Grande corridor that generally creates monocultures that choke out the native vegetation of the region. Knowing this, the objectives of this study were to: (1) delineate salt cedar and native riparian habitats along the Rio Grande corridor in the Trans-Pecos; (2) evaluate those habitats based on the known distribution of Gambel's quail in the Trans-Pecos; and (3) estimate the amount of suitable habitat for Gambel's quail in Trans-Pecos, Texas. Although dominant along the Rio Grande, native riparian vegetation was more prevalent than salt cedar communities when combining primary creeks in all counties. Brewster County was the area with a higher percentage of salt cedar occurrence (21.2%) vs. native riparian vegetation (78.8%). The largest extension of salt cedar occurred in Presidio County with an extension of 6,656.3 ha but this only represented 12.7% of our analyzed area. Hudspeth County had an occurrence of salt cedar of 2,905.2 ha representing 6.8% of the estimated riparian area of the Rio Grande corridor in this county. El Paso County's total urban area-agricultural fields area is a total of 90,682.9184 ha.**

Citation: Ortega-Sanchez A, Harveson LA, Lopez RR, Sullins MR. 2009. Delineation of Gambel's quail habitat in the Trans-Pecos, Texas. Pages 106 - 110 in Cederbaum SB, Faircloth BC, Terhune TM, Thompson JJ, Carroll JP, eds. *Gamebird 2006: Quail VI and Perdix XII*. 31 May - 4 June 2006. Warnell School of Forestry and Natural Resources, Athens, GA, USA.

**Key words:** *Callipepla gambelii*, Gambel's quail, GIS, habitat, riparian vegetation, salt cedar, Texas, Trans-Pecos

## Introduction

Gambel's quail (*Callipepla gambelii*) are a common quail species in the southwestern United States and northwestern states of Mexico which in Texas, occurs exclusively in the Trans-Pecos region (Oberholser 1974, Brown et al. 1998). In Texas Gambel's quail are a game bird and due to populations declines of bobwhite quail (*Colinus virginianus*) (Brennan 1991, 2002, Peterson et al. 2002) could potentially increase in importance as a game bird and serve as an additional source of income for ranchers in the Chihuahuan Desert of Texas.

In the Trans-Pecos region Gambel's quail show preference for riparian vegetation (Gray 2005). Salt cedar (*Tamarisk* spp.), a species introduced from Asia as an ornamental plant and for erosion control, has become a dominant vegetative component of ripar-

ian systems along the western part of the Rio Grande corridor (Everitt et al. 1996) and now occupies approximately 460 km of the river corridor (Everitt et al. 2006). Several studies have reported that Gambel's quail show a preference for native riparian vegetation over invasive salt cedar thickets (Engel-Wilson and Ohmart 1978, Gray 2005) and subsequently the objectives of this study were to: (1) delineate salt cedar and native riparian habitats along the Rio Grande corridor in the Trans-Pecos; (2) evaluate those habitats based on the known distribution of Gambel's quail in the Trans-Pecos; and (3) estimate the amount of suitable riparian habitat for Gambel's quail in Trans-Pecos, Texas. This information could aid resource managers in the Trans-Pecos in managing habitats for Gambel's quail in Texas.

<sup>4</sup>Correspondence: alfortega10@tamu.edu

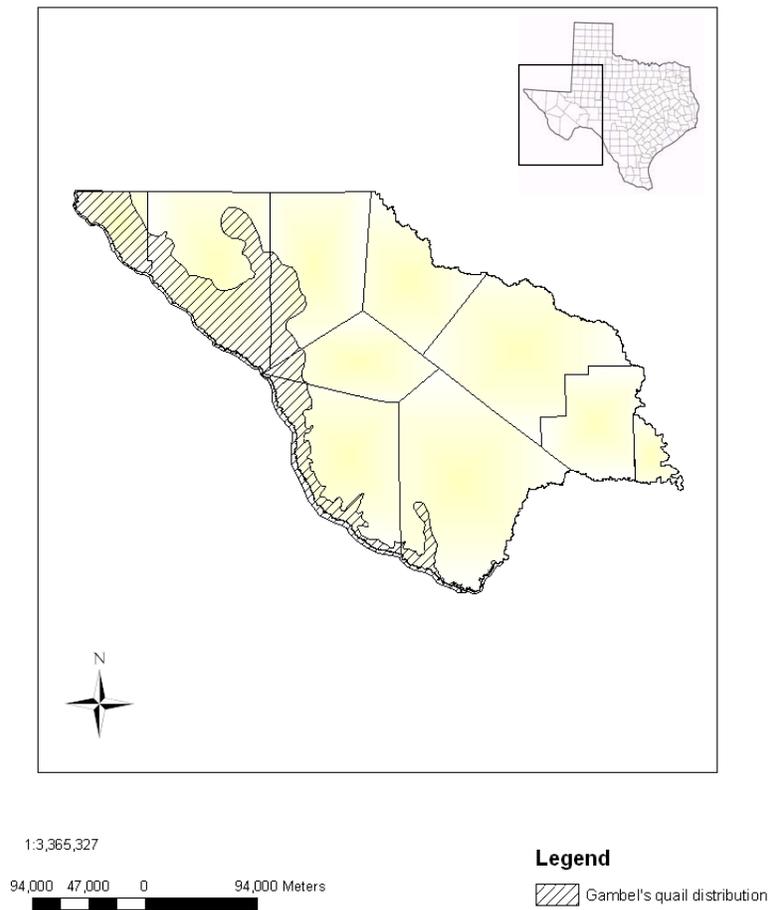


Figure 1: Gambel's quail distribution consists of the Rio Grande corridor and adjacent draws and arroyos in Trans-Pecos, Texas.

## Study Area

Our study area encompasses the Trans-Pecos region of Texas where we restricted our analysis to the most recent distribution area for Gambel's quail according to Sullins (2006) and the Texas Parks and Wildlife Department (Figure 1). Powell (1998) described the native vegetation in this region as Chihuahuan Desert Scrub, which is present at lower elevations (1000-1150) with precipitation ranging from 18 to 31 cm/year and dominated by shrub species such as creosote (*Larrea tridentata*) and semi-succulents such as lechuguilla (*Agave lechuguilla*), sotol (*Dasylirion* spp.), and yucca (*Yucca* spp.).

## Methods

To delineate native and exotic riparian habitats for our study site, we used Digital Ortho Quarter Quadrangles (DOQQs [1-m resolution]) obtained from the Texas Natural Resource Information System (TNRIS [<http://www.tnr.is.state.tx.us>]). When delineating salt cedar using remote sensing techniques, Everitt et al. (1996) recommended using imagery obtained in fall-winter. During this time, salt cedar provides a unique signature because of the coloration of its foliage being different from that of native vegetation. Based on this we used from the fall of 1995 corresponding to an area within 1-km from the Rio Grande. In the event of a missing DOQQ

## Gambel's Quail Habitat

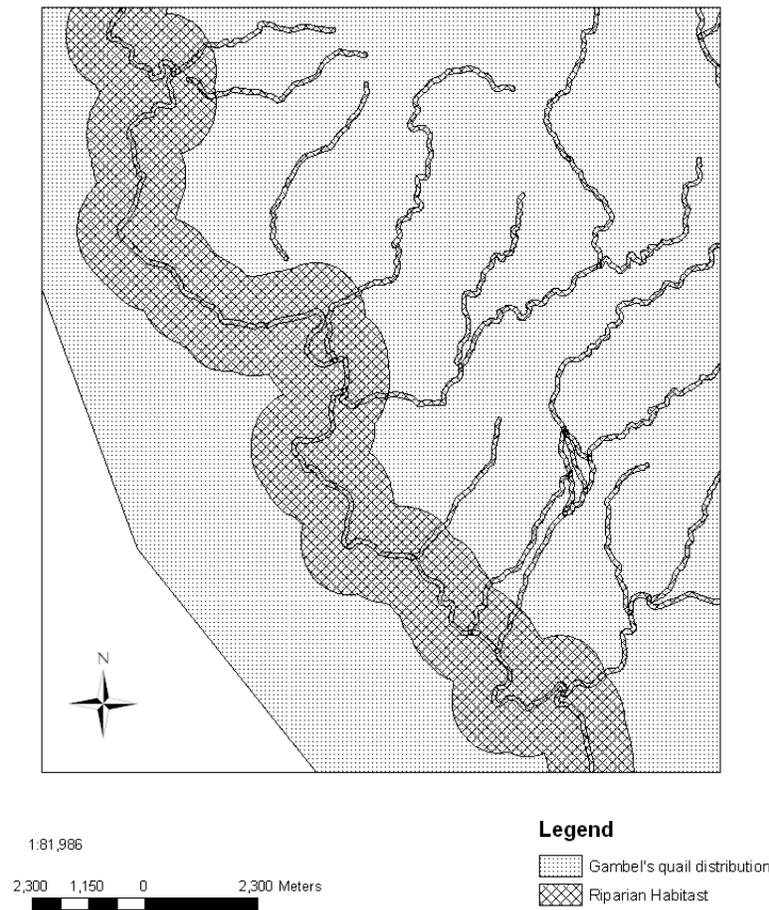


Figure 2: The Rio Grande corridor was represented by a 1,000-m buffer and adjacent draws and arroyos were represented by a 50-m buffer.

from 1995 we substituted 2004 images for the analysis.

Using the Mosaic Tool from the ERDAS Imagine 9.0© software (Leica Geosystems, GIS & Mapping, LLC) we mosaiced the DOQQs for the counties of Brewster, Presidio, El Paso, and Hudspeth (Jeff Davis and Culberson Counties were included with Hudspeth County because of the small amount of DOQQs required for their area). The 4 resultant mosaics were classified with unsupervised classification under the classifier function in ERDAS into 3 classes; native riparian, salt cedar, and scrubland. Scrubland was described as any area within Gambel's quail distribution that did not fall into

the riparian habitat buffer zones. We obtained medium resolution hydrography files from the National Hydrography Dataset from U. S. Geography (<http://nhdgeo.usgs.gov/>). As recommended by Gray (2005) we buffered all flow-line shapefiles within the Gambel's quail distribution map using a 50-m buffer in ArcGIS 9.0 ©(ESRI, Inc., Redland, CA). Similarly, the Rio Grande corridor was assigned a 1,000-m buffer (Figure 2) which encompassed most riparian habitats (Gray 2005).

The classified mosaics were then clipped to the river buffer. Zonal statistics function from Spatial Analyst (ESRI, Inc., Redland, CA) package was run for the classification clipped to the river buffer to de-

Table 1: Total area and occurrence (%) of habitats delineated from an unsupervised classification of DOQQs imagery within Gambel's quail distribution in the Trans-Pecos, Texas, 2005.

County	Habitat Class								Total ha
	Scrubland		Native riparian		Salt cedar		Urban/Ag.		
	ha	% area	ha	% area	ha	% area	ha	% area	
Brewster County	66,503	75.9	16,623	18.9	4,490	5.2			87,615
Presidio County	140,770	73.1	45,516	24.1	6,656	2.6			192,942
Hudspeth County*	162,321	80.2	39,811	19.4	2,905	1.4			205,037
El Paso County	70,733	42.7					90,683	57.3	165,416

\*Jeff Davis and Culberson Counties included

termine area. Although most Gambel's quail habitat in the Trans-Pecos has not been affected by urban sprawl, much habitat has been lost in El Paso County (Harveson 2007), subsequently for El Paso County, we additionally delineated cover classes to include agriculture fields and urbanized areas. However, because of the complexity and similarity in color, shadow, and texture of these 2 habitats they were combined to form 1 cover class (urban-agriculture).

## Results

Within the distribution of Gambel's quail in Texas, native riparian habitat was predominant in riparian corridors compared to salt cedar within all counties (Table 1). Brewster County contained the highest percentage of salt cedar (21.2%), followed by etc, (Table 1). The contiguous area of salt cedar occurred in Presidio County with 6,656.3 ha and Hudspeth County 2,905.2 ha representing 12.7% and 6.8% of the estimated riparian area of the Rio Grande corridor. El Paso County's urban-agriculture area totaled 90,682.9 ha, comprising 57.3% of the potential Gambel's quail habitat in the county. Brewster County presents the highest salt cedar:native riparian habitat 1:3.5 ratio. The river corridor that borders Brewster County is relatively smaller compared to what borders Presidio and Hudspeth Counties.

## Discussion

Engel-Wilson and Ohmart (1978) and Gray (2005) reported that Gambel's quail prefer native riparian habitat; this could be an influencing factor for Gambel's quail not to expand their distribution in this county even in good years as were 2004 and 2005. The extended drought that the Trans-Pecos has had for the past 10 years (Simpson 2005) could have affected the dispersion of salt cedar and Gambel's quail for this county. The salt cedar habitat in both Presidio and Hudspeth Counties was less than native riparian habitat. But the areas that these 2 counties represent are larger than the area in Brewster County which is similar to the findings of Everitt et al. (1996). Because of El Paso County's complex urbanization format it is very difficult to distinguish classes between urban areas and agriculture from aerial photography. From observation of the DOQQs and personal communication with people familiar to the area, the pattern that these areas have is plantings of different crops with occasional salt cedar wind barriers. In our study we decided to report the entire urbanized area along with the agricultural fields that and the total area of the county. We decided to report this information because the distribution map we used showed that the entire county formed part of Gambel's quail distribution.

## Management Implications

Further studies need to be conducted on the impacts of salt cedar on Gambel's quail. Additionally, the distribution of Gambel's quail has declined in Brewster County, where salt cedar has increased. Salt cedar encroachment along with other factors could be affecting the existing range of Gambel's quail. Salt cedar should be controlled with brush management practices in order to increase suitable habitat for Gambel's quail. Further research should be conducted on alternatives to separate salt cedar from agricultural fields and urban areas to better refine our delineation of cover classes in El Paso County. Further, a better understanding of the impact urbanization and fragmentation has on quail populations is needed for the Rio Grande corridor. Although Gambel's quail are known to be present in these areas, there is a lack of information on the behavior and movements of Gambel's quail in these habitat types. Knowing the areas with higher probability of Gambel's quail occurrence will aid ranchers and natural resource managers to direct their management practices towards these target areas. Considering salt cedar is a possible threat to suitable quail habitat, control practices we believe should be applied for its' control.

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