

**Project Title**

Statewide Habitat Fragmentation and Habitat Inventory Assessment for California, Gambel's and Mountain Quails

**Amount Requested**

\$114,820

**Applicant Contact Information**

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**Introduction**

- a. Project type: Research
- b. Background of the issue/problem and need for the project

The three species of quails native to California (California, Gambel's and Mountain quails) are iconic game birds of the American West. Each of these three species attracts the attention of upland game bird hunters, as well as birders across the state. The Mountain Quail is especially important in this regard because bird hunters and bird watchers alike consider this species a trophy bird for their bag or their life list, or both. Each of these three species of quails faces threats related to loss of their habitats from the inexorable impacts of urbanization and industrial development, expanding agricultural land use, and changing forest and rangeland management. None of these three species of quails has received attention from the wildlife research community in many decades.

- c. Specific goals and objectives

The specific goal of this project is to provide a quantitative basis for prioritizing areas for quail population and habitat conservation on a state-wide basis for California. This proposal has three primary objectives for all three species of quails native to California: (1) quantify how changing land uses related to urban development, forest and rangeland management, and agricultural land uses have impacted broad-scale and localized population changes; (2) use broad-scale landscape databases to compile an inventory of habitats that have the potential to sustain populations of these three species of quails, and (3) develop predictive landscape-level models to identify how project increases in urbanization and development are likely to impact quail populations in California over the next 50 years.

## Project Description

### a. Location of the project

Entire state of California with areas specific to the geographic range of each species in the state. Data compilation and analyses will take place at the Geospatial Technologies Laboratory at the Caesar Kleberg Wildlife Research Institute at Texas A&M University – Kingsville, in Kingsville, Texas.

### b. Staffing requirements

Post-doctoral research scientist (to be hired). Data capture, data analysis and interpretation, report and scientific manuscript writing.

Project Principal Investigator: Leonard A. Brennan, Ph.D. Project design and oversight, interpretation of results, report and scientific manuscript co-authorship

Project Co-investigator: Humberto Perotto-Baldivieso, Ph.D. Director of Geospatial Technologies Laboratory, project design and oversight, interpretation of results, report and scientific manuscript co-authorship.

Undergraduate Research Technician (to be hired): under the supervision of the post-doctoral research scientist, the technician needs to assist in data management and data compilation for spatial analysis.

### c. Contractors and subcontractors: none

### d. Implementation plan

Our plan is to capture all required data, analyze these data and deliver a final report and scientific manuscript with all pertinent project results within one year after receipt of award.

### e. Materials and equipment necessary to implement the project, to be provided by the Geospatial Technology Laboratory at Texas A&M University – Kingsville, are listed below:

- a. Breeding bird survey (1966-2015): National database and Data for California will be used for this project. There are no fees associated with data acquisition and this information will be obtained in CSV and prepared to be used in ArcGIS formats (Source: <ftp://ftpext.usgs.gov/pub/er/md/laurel/BBS/DataFiles/Species/> ).
- b. US Census of Agriculture (1969-2012): These data will be downloaded at the county level to provide land use categories. Data is in PDF format and it will be tabulated by undergraduate research technician into an excel file to then convert into a shape file. There is no fee associated with data acquisition (Source: [https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Census\\_by\\_State/California/](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/California/))
- c. Road network data: 200 and 2013 road network to build road density layers. Data will be extracted from the US Census Bureau and there are no fees associated with data acquisition. (source: <https://catalog.data.gov/>).

- d. US population and housing (1980-2010): State, SMSAs, Counties, Minor Civil Divisions, Places, Census Tracts, Block Numbering Areas, Enumeration Districts, Block Groups, Blocks but processed at census tract level. Data has no restriction and it is available through the US Census Bureau (<http://www.census.gov/mp/www/cat/>),
- e. LANDSAT 8 (OLI) coverage every 16 days. This database, at 30-m resolution, will be used to assess land cover at the regional level. Data specifications and use can be found in Roy et al. (2014).
- f. National Agriculture Imagery Program. Digital orthophoto quadrangles (DOQQ – 2 m resolution). Full description of the product available at <http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai>. There are no fees associated or restrictions identified with data acquisition and data use.
- g. Percent impervious surface and housing density projections (2010-2100). This dataset was developed by EPA (2010) and contains projections for housing density and impervious surface through 2100. Data is available through: <https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=257306>.

To achieve the goals of this project, we will use a hierarchical approach with three scales: state, county, and home range. The state analysis will cover the whole state of California, and will be used to identify statewide analysis of quail population trends. This information will be used to identify areas with stable and declining populations (4 stable and 4 declining counties). We will sample areas at the county level using the values reported by Sands et al. (2012) for areas critical to population persistence. This scale will generate information for wildlife biologists attempting to assess areas relevant to metapopulations, and information for stakeholders and decision makers attempting to delineate strategies and local policies for wildlife habitat planning, restoration, and conservation. The third scale will be conducted at the home range scale for each quail species to assess the spatial structure of vegetation that is important to quail management.

At the state scale, quail population trends will be quantified from 1966 to 2014 using Breeding Bird Survey data (<https://www.pwrc.usgs.gov/bbs/>). We will interpolate the count totals using kriging and inverse distance weighting in ArcGIS (Peterson et al. 2002, Okay 2004, Rho et al. 2015). The resulting maps will be set to a resolution of 4 km<sup>2</sup> to match resolution of other datasets. Quail populations exhibit a boom and bust pattern (Hernández and Peterson 2007, Lusk et al. 2007), therefore we accounted for annual variability by calculating 5-year moving averages. With this data we will compare road density, human population, and land use to quail population trends. To model the effects of changing land use on quail populations, we will use land use data from the Census of Agriculture from 1974, 1978, 1987, 1997, 2002, and 2012 (1978-1997 from Okay 2004). Land use will be grouped into the following categories: pasture and rangeland, total woodland, total cropland, and total other land. We will also determine the proportion of cropland placed in the Conservation Reserve Program (CRP), beginning in 1987. We will calculate the percentage of land for each category by dividing the total land for each

category by the total land for that county. Summarize quail counts by county will be compared to land use trends.

At the county scale, we will select counties with declining and stable quail populations using both the Breeding Bird Survey abundance and trends. We will acquire LANDSAT 8 Imagery from GLOVIS (<http://glovis.usgs.gov/>) and reclassify them following the US Census of Agriculture categories (pasture and rangeland, woodland, cropland, other land [infrastructure, barren, wasteland, etc.]), water, and roads (ERDAS IMAGINE 2015, Hexagon). We will establish 10 random points per county and create buffers at 5000 ha (average requirements for 95% metapopulation persistence, Sands et al. 2012). For each buffered area, we will quantify road density and then used FRAGSTATS v. 4.2.1 (McGarigal et al. 2012) to quantify land cover spatial structure using the following landscape metrics: percent class cover, mean patch area, largest patch index, patch density, edge density, and Euclidean nearest neighbor (Perotto-Baldivieso et al. 2009, Young et al. 2012). We will compare road density and landscape metrics between areas with declining and stable quail abundance in Texas and Oklahoma using Student's t-tests ( $\alpha = 0.05$ ).

At the home-range scale, we will focus on the same counties from the above-scale for the home range-scale analyses. We will generate 5 random points per county in order to select an area corresponding to a 7.5-minute topographic map. Within this area we will randomly select 1 of the 4 National Agriculture Imagery Program (NAIP) 1-m resolution digital orthophoto quarter quads (DOQQ) from 2014. For each quad, we will classify vegetation spatial structure into four classes: woody, herbaceous, bare ground, and water. For each image we will generate random points ( $n = 25$ ) and create a buffer area based on values reported for California, Gambel's and Mountain Quails. For each buffered area, we will quantify vegetation spatial structure using the following landscape metrics in FRAGSTATS v. 4.2.1: percent class cover, mean patch area, largest patch index, patch density, edge density, and Euclidean nearest neighbor (Perotto-Baldivieso et al. 2009, Young et al. 2012). We will compare landscape metrics between areas of declining and stable northern bobwhite abundance in Texas and Oklahoma using Student's t-tests ( $\alpha = 0.05$ ).

Finally, we will use EPA percent impervious surface and housing density projections for 2020, 2030, 2040, and 2050 from the Integrated Climate and Land-use Scenarios (ICLUS) project (U.S. Environmental Protection Agency 2010) to determine the potential losses of habitat for the three species of quail in California. These activities will provide new information on the broad-scale population dynamics of three species of wild quails in California with statewide anthropocentric fragmentation, habitat loss, and an inventory of remaining habitat that can support these populations.

f. Timeline for completion of each task

First three-month quarter; September through November 2017: Data capture and compilation

Second three-month quarter; December 2017 through February 2018: Initial data analysis

Third three-month quarter; March 2018 through May 2018: Complete data analysis and interpretation

Fourth three-month quarter; June through August 2018: Final report and scientific manuscript compilation

g. Explanation of how this work addresses items in the Introduction

To our knowledge, this proposed research will be the first such effort of its kind with respect to linking the broad-scale population dynamics of three species of wild quails in California with statewide landscape metrics related to anthropocentric fragmentation, habitat loss, and an inventory of remaining habitat that can support these populations.

The investigation we are proposing here is an extension of our recent work along similar lines where we quantified a multi-scale assessment of habitat fragmentation effects on Northern Bobwhite populations for four decades across the entire states of Texas, Oklahoma and Louisiana (Miller et al. 2017).

Landscape level analyses related to Northern Bobwhite habitat inventory in Texas (Brennan 2014) recently resulted in two large areas (the South Texas Rio Grande Plains Ecoregion [10 million acres] and the Rolling Plains Ecoregion [5 million acres]) being designated as National Legacy Landscapes for Northern Bobwhite Conservation by the National Technical Committee of the Northern Bobwhite Conservation Initiative. The study proposed here has clear potential to identify such places in California as well.

### **Expected Benefits**

Our results will provide wildlife managers, and others interested in the conservation of wild quails in California with spatially-explicit information on places throughout the state where stewardship of these populations will most likely be successful. It will also provide a forecast into the future whereby quail conservation efforts, and well as such efforts for other grassland-shrubland birds that share similar habitats, will also most likely be successful. Our results will also provide upland game bird hunters with spatially-explicit information on places---especially public lands and wildlife management areas, but also private lands as well---where they are most likely to maximize their chances of hunting success and satisfaction.

## Budget

### Statewide Habitat Fragmentation and Habitat Inventory Assessment for California, Gambel's and Mountain Quails

#### Personnel

Post-doctoral research Scientist (\$3,500 per month)	\$42,000
Undergraduate Research Technician (\$10/hour; 19 hours/week fall and spring)	\$6,270
<b>Total Salary</b>	<b>\$48,270</b>

#### Benefits

Post-doctoral research Scientist (Insurance @ \$993.47/month + fringe benefits @ 18.35%)	\$19,629
Undergraduate Research Technician (Fringe benefits @ 3.1%)	\$194
<b>Total Personnel Expenses</b>	<b>\$68,093</b>

#### Operating Expenses

6TB external hard drive (1 unit)	\$300
Geospatial Technologies Laboratory use (as per CKWRI pricing schedule FY 2016-2017)	\$1,500
Poster printing for Scientific meetings	\$250
Travel to Study areas (2 trips to California x 2 people; Per diem \$59; lodging \$119)	\$7,060
Travel to National Conference meetings (lodging and per diem TBD; 3 trips)	\$6,000
<b>Total Operating expenses</b>	<b>\$15,110</b>

**Subtotal Personnel and Operating expenses** **\$83,203**

Overhead is calculated at 38% \$31,617

**Total project cost** **\$114,820**

It may be necessary to move funds between line items to complete this project.

#### Budget justification

We are requesting funds to hire a Post-doctoral research scientist for 12 months (\$42,000) and an undergraduate research technician for fall 2017 and spring 2018 (\$6,270). Medical and fringe benefits for both are \$19,823. The total amount requested for personnel is \$68,093. Data will be compiled and stored in a 6 terabyte external hard drive unit (\$300). Geospatial Technologies Laboratory use will cost (1,500) for the duration of the project and monies are also being allocated for poster printing (\$250). Travel to California to meet with California Department of Fish and Wildlife personnel at the beginning of the project (\$3,530) and at the end of the project to discuss methodological details to present results and report (\$3,530) are being requested. These funds include funds for airplane tickets, 5 days of per diem, lodging, car rental and gas for

two people per trip. Additionally, we are requesting funds to attend 2-3 national meetings to present the results and findings of the project. Overhead is calculated at 38% (\$31,617).

## References

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