FY 2022/23 Upland Game Bird Management Grant Program Proposal Application

1. Project Title: Identifying the Influences of Fire, Climate Change, and Habitat on California's Population of Mountain Quail through Time to Inform Population Management

2. Amount Requested: $159,873

3. Applicant Contact Information

a. Organization Name, 501(c)(3) tax id number, if applicable:

Point Reyes Bird Observatory DBA Point Blue Conservation Science, 94-1594250

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e. Authorized signatory and their contact information:

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4. Project Priority

This is a research project (Solicitation Priority #1) to assess the impacts of habitat, fire, and climate change on Mountain Quail populations over time including estimating the abundance and distribution of Mountain Quail in the Sierra Nevada and Northern California mountains. We will also make recommendations for a California-wide monitoring strategy to inform quail management long-term.

5. Introduction

Mountain Quail are one of the least studied quail in North America (Crawford 2000). As such, basic life history information necessary to inform management decisions, such as population abundance, distribution, trends, and habitat associations, are not well understood across its broad geographic range in California. The montane habitats this species occupies in California are rapidly changing, but it is not clear how climate change, altered fire regimes, insect-driven deforestation, and other factors may be affecting their populations. Understanding the current status of this species and the factors that influence their populations is important to inform data-driven Mountain Quail management approaches, including setting harvest quotas and guiding habitat management and restoration.

While some assessments using Breeding Bird Survey (BBS) data suggest a stable (Church et al. 1993, Ziolkowski 2022) or potentially declining (Miller et al. 2017) Mountain Quail population in California, these data are not suitable for identify important temporal and spatial changes that would be necessary to evaluate the effects of habitat and environmental changes at scales meaningful to inform most management decisions.

The objectives of this project are to:

- Unlock tens of thousands of hours of existing Autonomous Recording Unit (ARU) data by developing a workflow for detecting Mountain Quail from audio recordings.

- Develop Mountain Quail occupancy and abundance estimates and trends from 2010-2021 using existing USFS and CDFW-funded regional monitoring datasets for the Sierra Nevada, Cascades, and northwestern California.
- Use these data to understand the effects of fire, climate change, and habitat attributes on Mountain Quail abundance, and make management recommendations based on the findings.
- Inform approaches for a state-wide monitoring framework to track Mountain Quail populations to guide management of the species across the state.

6. Project Description

Location:

This project will evaluate the current distribution and trends in abundance or occupancy of Mountain Quail populations in the Sierra Nevada, southern Cascades, Klamath, Siskiyou, and northern Coast Range mountains of California (see Figure A1 in Appendix A - Supplemental Information). The vast majority of our data are from the Northern, North Central, and Central CDFW Management Regions.

Personnel:

L. Jay Roberts, Ph.D., Forest Ecologist. Jay will be the principal investigator. He will compile and analyze data, co-develop the algorithm for detecting Mountain Quail from recordings, lead the development of the report, and coordinate with CDFW. He has 13 years of experience in monitoring program design and analysis, occupancy and abundance modeling, spatial ecology, and has authored several publications evaluating the effects of forest management, disturbance, and fire on bird populations.

Brent R. Campos, Principal Scientist. Brent will serve as technical advisor to all aspects of the project and co-author the final report. He has 12 years of experience studying the ecology of the avian community in the Sierra Nevada, including Mountain Quail, and expertise in wildlife-habitat relationships and quantitative ecology.

Leonardo Salas, Ph.D., Quantitative Ecologist. Leo will lead the development of the cloud-based platform for identifying Mountain Quail vocalizations from ARU data, and will be a technical advisor on analyses. Dr. Salas is an expert in machine learning and has authored several publications on bioacoustics-based monitoring as well as identifying wildlife from aerial imagery.

Ryan.D. Burnett, Sierra Nevada Group Director. Ryan will serve as technical advisor to all aspects, coordinate invoicing, project management, and co-author the final report. He has 22 years experience on the ecology and conservation of Sierra birds, including dozens of technical reports, and published manuscripts. He has successfully managed dozens of projects and over $10 million in federal, state, and private funds over the last 15 years.

Brett Furnas, Ph.D., Quantitative Ecologist, CDFW. Brett has led design and modeling of large scale wildlife monitoring projects for nearly two decades and has authored over 30 publications including 10 pertaining to acoustic monitoring. He will oversee sharing and packaging of CDFW ARU data and collaborate on data processing and pattern matching analyses.

CDFW Research Data Analyst. This person will develop a data sharing agreement with Point Blue, prepare and package the data share, and process code or results Point Blue provides.

Implementation Plan:

We will develop a cloud-based workflow for processing automated recording unit (ARU) data with a customizable and extendable (to other species and geographies) machine-learning model to identify Mountain Quail vocalizations with high accuracy (Snyder et al. 2022). This workflow will allow us to unlock tens of thousands of hours of recordings that have been collected by CDFW over the last decade in our study region, from which it would otherwise take tens of thousands of hours of human effort to extract Mountain Quail detections (Furnas and Callas 2015, Darras et al. 2018). The methods and workflow we develop can subsequently be used to identify vocalizations of other species, increasing the value of this CDFW dataset to other upland game species (e.g. Mourning Dove, Band-tailed Pigeon, Sooty Grouse). Initial stages of the machine-learning model development and training data compilation are underway. In collaboration with CDFW we have already identified over 500 Mountain Quail example vocalizations, which will be used to train the machine-learning model. We will build upon methods developed by the Soundscapes to Landscapes (https://soundscapes2landscapes.org/) program which include additional training data for Mountain Quail that were collected from over 13,000 hours of ARU recordings captured between 2017-2022 at ~1,200 locations in Sonoma County. These recordings will also fill an important gap in MOUQ data from the southern end of the northern coast range mountains.

We will then compile relevant data for use in modeling Mountain Quail occurrence, abundance, trends, and habitat associations from Point Blue's Sierra Nevada Avian Monitoring Program (Roberts et al. 2020). This program has approximately 30,000 Mountain Quail records from point counts and call playback surveys conducted by human observers at over 2,300 locations from 2010-2021 (see Figure A1 in Appendix A - Supplemental Information). The survey locations are a balanced random sample spanning every national forest in the Sierra Nevada planning region, from the Modoc to the Sequoia, designed to assess bird populations at a bioregional scale. We will combine these data with the CDFW ARU data described above. We will also utilize Point Blue ARU data from the central Sierra Nevada recorded in 2021 at a subset of our point count locations, giving us a unique dataset of synchronous ARU and human observer point counts at more than 100 locations. These data will allow us to evaluate potential biases in ARU vs. point count survey methodologies that could inform decisions about how best to monitor this species in the future.

As part of this modeling framework we will evaluate the effects of multiple environmental covariates on Mountain Quail populations. We will compile available habitat data including both locally collected and remotely sensed data, fire history and severity data (Miller et al. 2009), and climate data (e.g. Flint et al. 2014, Daly et al. 2000). We will use these covariates to inform models predicting Mountain Quail occurrence and abundance, and from those results infer the most important influences on population vital rates (e.g. Roberts et al. 2019, Roberts et al. 2021). A new model has recently been developed to integrate both point count and ARU data to accurately estimate abundance from recordings while also accounting for imperfect detection probability (Doser et al. 2021), which until recently has not been feasible.

We will then use the results of this modeling effort to evaluate how the factors that influence population change differ across CDFW management zones, and develop data-driven management recommendations for the species. Finally, we will provide recommendations for

monitoring the species across the state going forward, including identifying gaps in geography, scale of sampling units, and methodology (e.g. ARU vs. passive point counts vs. call playback).

Materials and Equipment:
Equipment needed will include significant data storage and processing resources, which will be provided through a combination of the Point Blue IT network and Amazon Web Services (AWS). All data used in this analysis has already been collected so no field data collection materials or equipment are required.

Solicitation Priorities:
This project will address Solicitation Priority 1 - research that will evaluate the precision and cost-effectiveness of methods to estimate abundance of native upland game birds, and impacts of wildfire (and other environmental factors) on quail habitat, occupancy, and abundance over time. We will incorporate three datasets that have taken over a decade and millions of dollars to acquire, and leverage work by CDFW and Point Blue over the past year to label and process Mountain Quail detections from CDFW collected data. Here we propose to utilize these valuable investments to better understand Mountain Quail population dynamics, responses to wildfire and other environmental stressors, and to inform long-term management strategies across California during this period of rapid environmental change. In addition, we will use this new information and our expertise in avian field sampling methodologies and avian ecology to make recommendations for a cost effective strategy for monitoring Mountain Quail across California.

This project does not require any environmental permitting.

7. Expected Management Benefits

The proposed project will provide wildlife managers with the best available data, extendable analysis tools, and an initial set of recommendations for managing Mountain Quail populations in California. Understanding current population status, recent trends in distribution and abundance, and the primary factors influencing these patterns is needed to guide effective management of the species in a rapidly changing California. The results from this project can be vital for informing harvest limits and development of habitat restoration and management priorities and plans, ultimately guiding effective management and restoration of thousands of acres of habitat for this species.

8. Schedule and List of Deliverables

Task	Description	Start Date	Completion Date
1	Project management	January 2023	Ongoing
2	Develop a machine learning cloud-based workflow to detect species in ARU recordings	January 2023	August 2023
3	Compile bird, habitat, fire, and climate datasets	March 2023	August 2023
4	Develop occupancy and abundance models and analyze data	August 2023	November 2023
5	Develop final technical report describing methods,	December 2023	March 2024

	results, and recommendations for Mountain Quail monitoring in California, and future research needs		
6	Present results	February 2024	March 2024

9. Budget Narrative (costs rounded to nearest thousand)

Task 1 - $7,000 - Project management and invoicing. Quarterly updates to CDFW. Regular team meetings.

Task 2 - $55,000 - Develop an algorithm to detect Mountain Quail in ARU data from CDFW, Point Blue, and Soundscapes to Landscapes datasets. Includes Amazon Web Services (AWS) resources for cloud computing and data storage.

Task 3 - $30,000 - Extract data from multiple sources to build spatially explicit environmental data and bird occurrence and counts for use in analyses. QA/QC of compiled data.

Task 4 - $30,000 - Team development of model parameterization, run and iterate models, team reviews of model results, team alignment on final models, produce visualizations for report.

Task 5 - $35,000 - Report preparation, team reviews, revisions based on reviews.

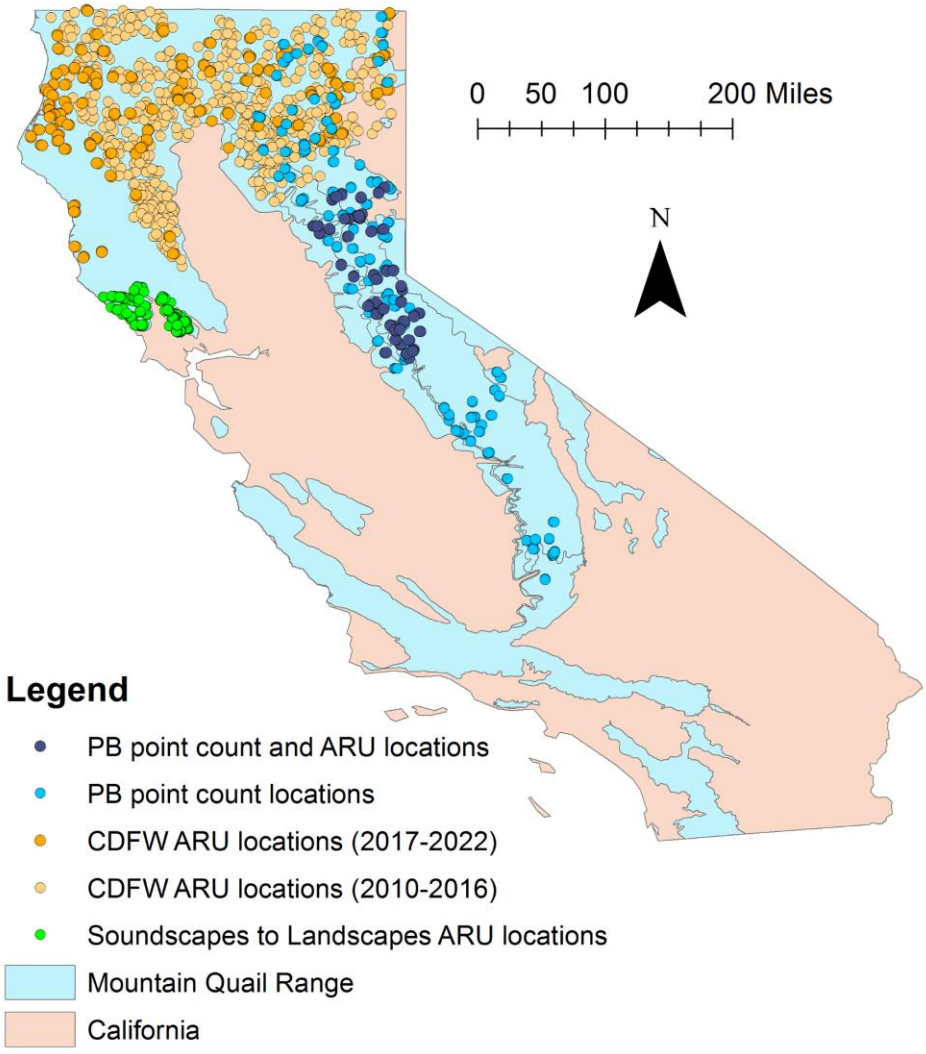
Task 6 - $3,000 - Present results to CDFW and at one science conference.

10. Itemized Budget:

A. PERSONNEL SERVICES *(Ensure that all personnel are described in the project)*			
Project Role	**Hours**	**Rate**	**Amount Requested**
Burnett - Project Coordinator, Technical Advisor, Report Author	60	$ 63.55	$ 3,812.76
Roberts - Project Lead, Modeler, Report Lead Author	866	$ 41.55	$ 35,981.00
Campos -Technical Advisor, Report Author	260	$ 46.81	$ 12,170.34
Salas - Machine Learning Expert, Report author	260	$ 51.66	$ 13,431.60
		Subtotal Personnel Services	$ 65,395.70
Staff Benefits		50.80%	$ 33,221.02
		SUBTOTAL A : PERSONNEL SERVICES	$ 98,617
B. OPERATING EXPENSES: GENERAL			
Information Technology			$ 10,000
Travel (Meetings, Presenting results)			$ 1,400
Conference Fees			$ 1,000
		SUBTOTAL B : OPERATING EXPENSES: GENERAL	$ 12,400
C. INDIRECT CHARGES			
		Indirect Rate	
Indirect Charges = (Subtotal A + Subtotal B) * (Indirect Rate)		35.00%	$ 38,856
		SUBTOTAL C : INDIRECT CHARGES	$ 38,856
D. OPERATING EXPENSES: SUBCONTRACTORS			
CDFW - Research Data Analyst II			$ 10,000
		SUBTOTAL D : OPERATING EXPENSES: SUBCONTRACTORS	$ 10,000
E. OPERATING EXPENSES: MATERIALS/EQUIPMENT**			
<Insert or delete line items as needed>			$ -
		SUBTOTAL E : OPERATING EXPENSES: MATERIALS/EQUIPMENT**	$ -
		F. GRAND TOTAL (A + B + C + D + E)	$ 159,873

Appendix A. Supplemental Information

Figure A1: Locations of existing Point Blue (PB, 2010-2021), California Department of Fish and Wildlife (CDFW, survey years listed in legend), and Soundscapes to Landscapes (2017-2021) survey data in Northern California and Sierra Nevada. Point Blue point count and ARU locations were surveyed using both methods in 2021 only.



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