California State Board of Forestry and Fire Protection Effectiveness Monitoring Committee Program Grant: Initial Concept Proposal

---

a. Date Submitted:
May 19, 2025

b. Project Title:
Evaluating the impact of fuels reduction and timber management operations on the granary trees and nesting success of Acorn Woodpeckers given current California Forest Practice Rules

c. Project #:
(To be assigned by EMC)

d. Principal Investigators (PI):
Dr. Jason Riggio - Principal Investigator
Andrew Engilis, Jr. – co-Principal Investigator

e. Affiliations of PIs and Addresses:
Museum of Wildlife and Fish Biology
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis
One Shields Avenue
Davis, CA 95616

f. Applying Organization:
University of California, Davis

g. Primary Contact Phone Numbers:
Dr. Jason Riggio - [redacted]
Andrew Engilis, Jr. – [redacted]

h. Primary Email Contacts of PIs:
Dr. Jason Riggio - [redacted]
Andrew Engilis, Jr. – [redacted]

i. Name and Affiliation of Collaborator:
Givonne Law, Fuels Reduction Coordinator, East Bay Regional Parks District

---

j. Project Description

i) Project Duration

28 months (December 1, 2025 – March 31, 2028)

---

ii) Background and Justification

Acorn Woodpeckers (*Melanerpes formicivorus*) are a highly social, cavity-nesting bird species found throughout California's oak woodlands. A hallmark of their ecology is the construction and use of communal "granary trees," typically living or dead hardwoods or snags into which they store thousands of acorns (Koenig et al. 2008). These structures are essential for overwinter survival, buffering against seasonal food scarcity, reproductive success, and for maintaining the complex, cooperative social groups characteristic of this species (Hannon et al. 1987). Granary trees are often used across multiple generations, representing critical, persistent habitat features necessary for sustaining local populations (MacRoberts and MacRoberts 1976). Furthermore, foraging distances for acorns are tied to the locations of granary trees, with the majority of acorn collecting trips ranging no father than 100 m from the tree (Thompson et al. 2014).

The importance of granary trees extends beyond food storage. These trees serve as central social hubs, where group members roost, defend territories, and coordinate breeding activities (Mumme & de Queiroz 1985). Loss of granary trees has been shown to destabilize social groups and reduce territory fidelity, with consequences for both survival and reproductive output (Ligon & Stacey 1996). Notably, Acorn Woodpeckers often exhibit strong attachment to specific granary trees, even after the trees die, with documented use persisting for decades (Koenig & Mumme 1987).

Despite their ecological importance, granary trees are not specifically protected under current California Forest Practice Rules (FPRs). While some provisions address snag retention and nest sites in general (e.g., 14 CCR § 919.1[939.1, 959.1] and § 919.2 [939.2, 959.2]), there is no requirement preventing the harvest or cutting of trees actively used as granaries during fuels reduction, timber harvest, or vegetation management projects. This regulatory gap may inadvertently threaten Acorn Woodpecker populations by reducing habitat suitability, compromising essential resources for survival and reproduction, and disrupting breeding group cohesion (Ligon & Stacey 1996).

In recent years, the intensification of wildfire hazard reduction projects on public and private lands, including thinning and removal of dead or decadent trees, has increased potential risks to granary trees. Although dead and dying trees are frequently targeted for

removal due to their perceived fire risk or hazard potential, granary trees, whether living or dead, are a critical, limiting resource for Acorn Woodpeckers (Koenig & Mumme 1987). Preliminary conversations with fuels management practitioners indicate that granary trees may sometimes be cut during vegetation management projects, as well as in conventional timber operations, often due to a lack of awareness or standardized protocols for their identification and rules requiring their retention.

No published studies to date have systematically evaluated the efficacy of existing FPRs or related regulations in maintaining critical wildlife structures like granary trees in the context of fuels management activities. Addressing this knowledge gap aligns directly with Research Themes 7 through 10 related to Wildlife Habitat and several associated Critical Monitoring Questions, including those relating to the protection of wildlife nest sites and habitat structures during forest management activities.

This proposed research would represent the first focused evaluation of Acorn Woodpecker spatial ecology in relation to granary tree retention outcomes under fuels reduction management in California's urban-interface and oak woodlands. Results will directly inform adaptive management recommendations for regulatory consideration, operational practices for land managers, and species conservation planning.

---

iii) Objectives and Scope

Primary Objective:
To assess how Acorn Woodpecker populations use landscapes surrounding granary trees, and to assess the extent to which existing Forest Practice Rules (FPRs) and related regulations protect granary trees from management activities.

Specific Objectives:

1. Survey, map, and characterize active Acorn Woodpecker granary trees within a defined study region in the Alameda and Contra Costa counties.
2. Document nest site selection in relation to granary tree locations.
3. Deploy GPS tags on a sample of adult birds to assess seasonal movement patterns and home ranges in relation to granary trees at sites before and after management actions and at no management control sites.
4. Model impacts of granary tree loss on Acorn Woodpecker home range fidelity.
5. Develop science-based recommendations for updating or clarifying FPRs to better protect critical wildlife structures like granary trees.

The study will initially focus on the East Bay Regional Park District system as a case study, with findings intended for potential statewide application in comparable oak woodland habitats under the jurisdiction of the Board of Forestry and Fire Protection.

---

iv) Research Methods

Study Area:
The project will be conducted within public lands managed by East Bay Regional Park District in Alameda and Contra Costa counties. The region represents a valuable model system due to its extensive oak woodlands, existing fuels management program, and known Acorn Woodpecker populations.

Year 1 (FY 25/26) – Site Selection, Baseline Survey and Site Mapping:

- Conduct systematic ground surveys of oak woodlands across multiple parks for Acorn Woodpecker populations.
- Identify six management units with planned fuels reduction activities for inclusion in monitoring.
    - Management units will include two fuels reduction treatments where granary trees will not be identified and specifically protected (i.e., business as usual), two fuels reduction treatments where granary trees will be identified and protected, and two controls (i.e., no fuels reduction activities)
- Locate and map active granary trees and potential nest sites (i.e., cavities) in management units using handheld GPS units.

Deliverables: Comprehensive GIS layer of granary tree and potential nest site locations in six management units for the study area.

Year 2 (FY 26/27) – Nest Monitoring, GPS Tagging, and Pre-Management Assessment:

- Deploy lightweight GPS tags (e.g., Lotek PinPoint and PinPoint Argos) on up to 30 adult Acorn Woodpeckers from the six management units (ideally up to five birds for each management unit).
- Conduct nest searches during breeding season (March through June).

- Collect pre-treatment data in management units scheduled for fuels reduction projects and in control plots.
    - Characterize each granary tree and potential nest site (e.g., species, diameter at breast height, live/dead status, cavity count, acorn cache density).
    - Record habitat covariates (e.g., canopy cover, tree density, proximity to management units, distance to nearest trail and/or fire road).

Deliverables: Nest monitoring database and pre-treatment habitat data in six management units for the study area.

Year 3 (FY 27/28) – Post-Management Assessment, Recapture Birds, Data Analysis, and Manuscript Preparation:

- Recapture tagged birds for data retrieval.
- Download and process movement data to identify home range use and granary tree dependency.
- Conduct repeat surveys in treatment areas to document granary tree retention or removal.
- Analyze changes in Acorn Woodpecker seasonal home range use relative to management actions.
- Prepare technical white paper, regulatory briefing, and peer-reviewed manuscripts for publication.

Deliverables: GPS movement datasets, regulatory recommendations, and scientific publications.

---

v) Scientific Uncertainty and Geographic Application

Despite the well-documented ecological importance of granary trees to Acorn Woodpeckers, substantial scientific uncertainty remains regarding the effectiveness of current California Forest Practice Rules (FPRs) and related regulatory frameworks in protecting these critical wildlife habitat structures during fuels reduction and timber management activities. While certain provisions of the FPRs address general wildlife habitat elements such as snag retention and cavity-bearing trees (e.g., 14 CCR §

919.1[939.1, 959.1] and § 919.2 [939.2, 959.2]), there has been no systematic evaluation of whether these regulations adequately identify and safeguard actively used granary trees from removal during vegetation management operations. This represents a significant knowledge gap, as the removal of these structures can disrupt overwinter survival and reproductive success of Acorn Woodpecker groups, potentially impacting local population viability. The absence of targeted monitoring or performance assessments further compounds this uncertainty, limiting managers' ability to adaptively refine practices or regulatory standards to maintain habitat quality.

While this study will be conducted in Alameda and Contra Costa counties, its findings will have broad applicability to oak woodland and mixed hardwood-conifer landscapes statewide throughout California where Acorn Woodpeckers occur and where fuels reduction activities are implemented. Results will generate science-based evidence to inform policy adjustments, management guidelines, and conservation planning efforts statewide, reducing regulatory uncertainty and improving habitat protection outcomes for Acorn Woodpeckers. Management and regulatory recommendations developed through this work will be directly transferable to state and federal land management agencies, private landowners conducting Timber Harvest Plans (THPs), Nonindustrial Timber Management Plans (NTMPs), and Vegetation Management Program (VMP) projects. The project's design aligns with the Board of Forestry's statewide jurisdiction over forest and rangeland management, and benefits may extend to regions outside the state where similar management conflicts occur (e.g., Arizona, New Mexico).

---

vi) Collaborations and Project Feasibility

This project will be led by Jason Riggio, PhD, at the University of California, Davis, in collaboration with East Bay Regional Park District staff and/or the staff of a similar Bay Area land management agency. Discussions with EBRPD staff before the final proposal will confirm feasibility and support for field activities on District lands or make necessary modifications. If a permit to conduct research within EBRPD lands is not approved, the focus of the proposal will be shifted to another California land management agency. Additional collaborators may include biologists from California Department of Fish and Wildlife (CDFW) and University of California researchers specializing in avian ecology and oak woodland management.

The project team brings extensive experience in avian field ecology (including the capture and GPS tagging of birds), geospatial analysis, and applied conservation research. The availability of skilled technicians from the UC Davis Museum of Wildlife and Fish Biology

ensures staffing feasibility. The budget allocation is structured to scale effort based on available funding in each fiscal year, prioritizing critical early-season work in Year 1, expanded fieldwork and tagging in Year 2, and data-intensive analysis and synthesis in Year 3.

---

k. Critical Question Theme and Forest Practice Rules or Regulations Addressed

This proposed study addresses Theme 7: Wildlife Habitat – Species and Nest Sites, Theme 8: Wildlife Habitat – Seral Stages, Theme 9: Wildlife Habitat – Cumulative Impacts, and Theme 10: Wildlife Habitat – Structures.

Theme 7: Wildlife Habitat – Species and Nest Sites

- Critical Monitoring Questions:
    - *Are the FPRs and associated regulations effective in protection of nest sites following general protection measures in 14 CCR § 919.2 [939.2, 959.2] (b)?*
- Justification:
  Acorn Woodpeckers depend on the long-term persistence of large, living and dead hardwoods, particularly native oaks, for their unique communal granary structures and nest sites. This study will directly evaluate whether current Forest Practice Rules (FPRs) are effective in protecting these essential nest structures and associated wildlife trees during fuels reduction and timber management operations. Field data on granary tree abundance, distribution, and retention outcomes will inform whether operational plans and on-the-ground practices are meeting the intent of 14 CCR § 919.2 [939.2, 959.2] (b) to conserve functional nesting and wildlife habitat.

Theme 8: Wildlife Habitat – Seral Stages

- Critical Monitoring Questions:
    - *Are the FPRs and associated regulations effective in maintaining or increasing the amount and distribution of late succession forest stands for wildlife?*
- Justification:
  Granary trees frequently occur as residual legacy hardwoods or late-seral features within mixed-conifer and hardwood stands. This study will document the seral characteristics and habitat context of granary trees across operational areas, providing data to evaluate whether current rules and retention practices under 14

CCR § 912.9 [932.9, 952.9] are maintaining these critical late-seral habitat components, alongside protected snags and den trees, downed trees, large woody debris, etc.

Theme 9: Wildlife Habitat – Cumulative Impacts

- Critical Monitoring Questions:
    - *Are the FPRs and associated regulations effective in protecting wildlife habitat and associated ecological processes?*
    - *Are the FPRs and associated regulations effective in avoiding significant adverse impacts to wildlife species?*
- Justification:
  The potential cumulative effects of fuels treatments and harvest operations on Acorn Woodpecker social groups, reproductive success, and habitat quality may extend beyond individual plans. This project will generate spatial data on the distribution and status of granary trees relative to treatment areas, providing insight into cumulative impacts to wildlife habitat components as addressed under 14 CCR § 898 and informing landscape-level habitat continuity and legacy tree retention strategies.

Theme 10: Wildlife Habitat – Structures

- Critical Monitoring Questions:
    - *Are the FPRs and associated regulations effective in retaining native oaks where required to maintain wildlife habitat (14 CCR § 959.15)?*
- Justification:
  Native oaks are ecologically essential for Acorn Woodpeckers, both for nesting and as the primary substrate for granary sites. This study will assess whether current implementation of retention standards for native oaks under 14 CCR § 959.15 is effective in preserving sufficient wildlife structures for this keystone species (i.e., granary trees), contributing to broader evaluations of the effectiveness of structural retention guidelines for terrestrial wildlife habitat.

---

l. Requested Funding:

Total requested funding from the EMC is $297,519 over three fiscal years:

- FY 2025/26: $62,696

- FY 2026/27: $123,382
- FY 2027/28: $111,440

Justification:
Funds will support personnel (PI and field crew), travel, equipment, data analysis, publications, and outreach for monitoring Acorn Woodpecker granary trees and spatial ecology in relation to fuels reduction and timber operations. Year 1 funds ($62,696) will support field crew and travel for baseline field surveys. Year 2 ($123,382) expands field operations to monitor treatment and control areas, initiate nest monitoring, and deploy GPS tags. Year 3 ($111,440) supports recapture surveys, spatial analysis, technical reporting, conference presentation, and manuscript preparation. Travel funds cover fieldwork across the East Bay Regional Park District. Supplies include GPS tags and survey equipment. This funding structure ensures a phased, scalable approach aligned with project objectives and EMC monitoring priorities.

Literature Cited:

Hannon, S. J., R. L. Mumme, W. D. Koenig, S. Spon, and F. A. Pitelka (1987). Acorn crop failure, dominance, and a decline in numbers in the cooperatively breeding Acorn Woodpecker. Journal of Animal Ecology 56:197–207.

Koenig, W. D., J. P. McEntee, and E. L. Walters (2008). Acorn harvesting by Acorn Woodpeckers: Annual variation and comparison with genetic estimates. Evolutionary Ecology Research 10:811–822.

Koenig, W. D., and R. L. Mumme (1987). Population Ecology of the Cooperatively Breeding Acorn Woodpecker. Princeton University Press, Princeton, NJ, USA.

Ligon, J.D., and P. B. Stacey (1996). Land use, lag times and the detection of demographic change: the case of the Acorn Woodpecker. Conservation Biology 10(3): 840-846.

MacRoberts, M. H., and B. R. MacRoberts (1976). Social organization and behavior of the Acorn Woodpecker in central coastal California. Ornithological Monographs 21:1–115.

Mumme, R. L., and A. de Queiroz (1985). Individual contributions to cooperative behaviour in the Acorn Woodpecker: Effects of reproductive status, sex, and group size. Behaviour 95:290–313.

Thompson, P. G., P. E. Smouse, D. G. Scofield, and V. L. Sork (2014). What seeds tell us about birds: a multi-year analysis of acorn woodpecker foraging movements. Movement Ecology 2:1-10.