Effects of vegetation on the behavior of hunting barn owls (*Tyto furcata*) and their prey

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Introduction

- Changes in habitat and vegetation in space and time can strongly affect the behavior of both prey and their predators.
  - Changes shape the outcomes of predator-prey interactions.
- In managed agroecosystems, these changes could mediate the capacity for natural enemies to reduce economically damaging pests.
- Farmers in Napa Valley, CA install nest boxes to attract American barn owls (*Tyto furcata*) to their winegrape vineyards to help control rodent pests.
- However, vineyards exhibit marked spatial and temporal variation in habitat structure due to different viticultural practices regarding cover crops, trellis systems, and pruning.
- How the owls respond to this habitat heterogeneity remains unresolved.

Methods

- From April 3, 2024 to June 28, 2024, we deployed and retrieved GPS tags fitted with accelerometers on adult breeding barn owls in Napa Valley to track their hunting behavior (**Figure 1**).
- Captured owls for study using 2 different methods:
  - Retrieved roosting owl from next box side entrance during the day.
  - Temporarily mounted patio trap to nest box entrance at night.
- Installed Wyze Cam v3 video cameras to the interior and exterior of 4 nest boxes to identify when and what types of prey adults provision to their young.
- Used stratified random sampling to position 16 Bushnell Core S-4K No Glow (model #119949C) in several vineyard blocks at a site. Cameras were baited to obtain an index of rodent activity for deer mice (*Peromyscus* sp.) and California voles (*Microtus californicus*).
  - Vegetation surveys: mown vs. unmown cover crop row, vine canopy cover, veg. height (cm), thatch thickness (cm), and percentage of ground cover.
  - Gopher mound surveys: Used mound count method as an index of Botta's pocket gopher (*Thomomys bottae*) activity.

Figure 1. AxyTrek logger (Technosmart, Italy) fitted onto a SY female barn owl (right) using a 3/8-in. braided elastic backpack-style harness (Clément 2020).

Table 1. Total number of 27 individual barn owls that we retrieved tag data from. Barn owls sorted by age: SY = Second Year, TY = Third Year, ATY = After Third Year.

Sex	SY	TY	ATY	Total
Female	6	5	4	15
Male	3	8	1	12
Total	9	13	5	27

Preliminary Results

- During the field season, we deployed tags on a total of 28 barn owls.
  - Retrieved data from 27 individual barn owls (**Table 1**).
    - Out of the 27 owls, 16 had 2 tag deployments (11 F, 5 M) and 11 had only 1 tag deployment (4 F, 7 M).
  - Owls nested in boxes from 7 different vineyards.
- Tags recorded GPS locations at 1 Hz and continuously recorded acceleration at 50Hz.
- Only collected data during peak barn owl hunting times:
  - 8:00 PM - 12:00 AM (4 hrs.); 1:00 AM - 3:00 AM (2 hrs.) OR
  - 9:00 PM - 1:00 AM (4 hrs.); 2:00 AM - 4:00 AM (2 hrs.)
- Transformed lat and long coordinates to WGS 1984 UTM Zone 10N projected coordinate system (**Figure 2**).

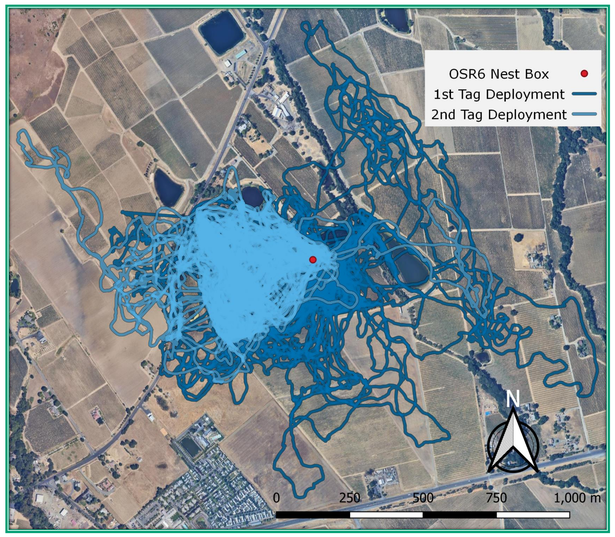

Figure 2. Flight paths for the 1st tag deployment (dark blue) and the 2nd tag deployment (light blue) of a TY male barn owl at Old Sonoma Road (OSR) vineyard in Napa Valley, CA. The 1st tag recorded data from April 26, 2024 to May 4, 2024. The 2nd tag recorded data from May 10, 2024 to May 16, 2024.

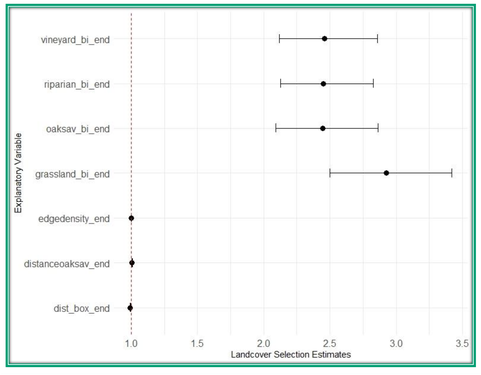

Figure 3. Landcover selection estimates following a step-selection function (SSF) approach. This model contained 7 selection coefficients as well as an interaction between grassland habitat, cos(turning angle), and log(step length) coefficients. The model was run for the 1st tag deployment of a TY male barn owl at Old Sonoma Road (OSR) vineyard in Napa Valley, CA.

Discussion

- Gain a deeper understanding of predator-prey interactions through improved GPS tracking technology, a heterogeneous landscape, and predictable and abrupt changes in vegetation caused by viticultural practices (i.e., mowing cover crops).
- Reveal how owls may contribute to rodent pest management in agroecosystems.

Next Steps

- Step selection functions (SSFs)
  - Use accelerometer data to create a list of different behavioral states (i.e., perching, hunting, travel). Use the determined states in step-selection function (SSF) models.
- Obtain a map of precise locations of where owls kill their prey (i.e., hunting strikes) on a landscape to determine the distribution of hunting strike locations.
- Prepare vegetation structure and rodent/gopher activity covariates for future model analyses.

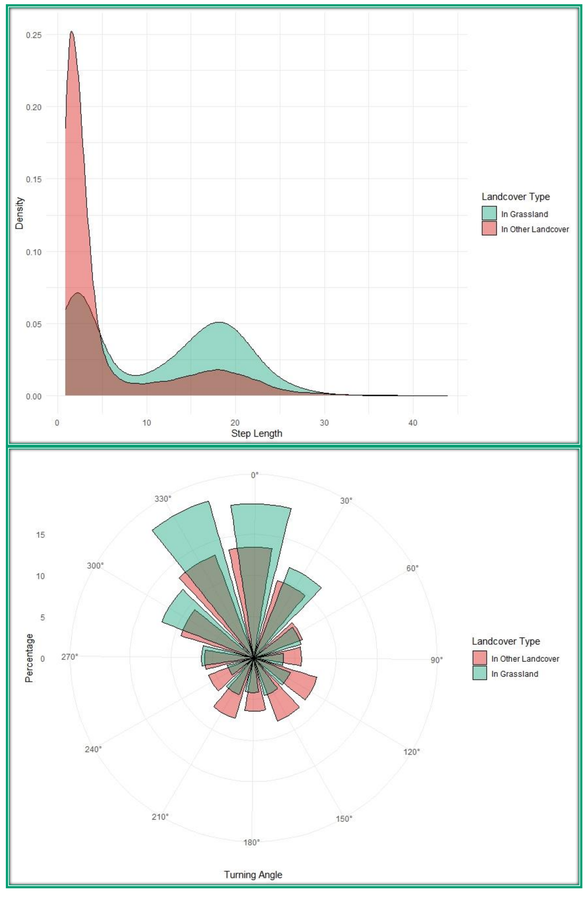

Figure 4. Density plot of step lengths (top) and polar plot of turning angles (bottom) for the 1st tag deployment of a TY male barn owl at Old Sonoma Road (OSR) vineyard in Napa Valley, CA. Tag recorded data from April 26, 2024 at 8:06 PM to May 4, 2024 at 1:31 AM.

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Clément, M. A. (2020). Habitat Features and Behavioral Plasticity Promote Barred Owl Presence in Developed Landscapes (Master's thesis, Clemson University). https://tigerprints.clemson.edu/all_theses/3364