Road noise may shift predation of sentinel pests

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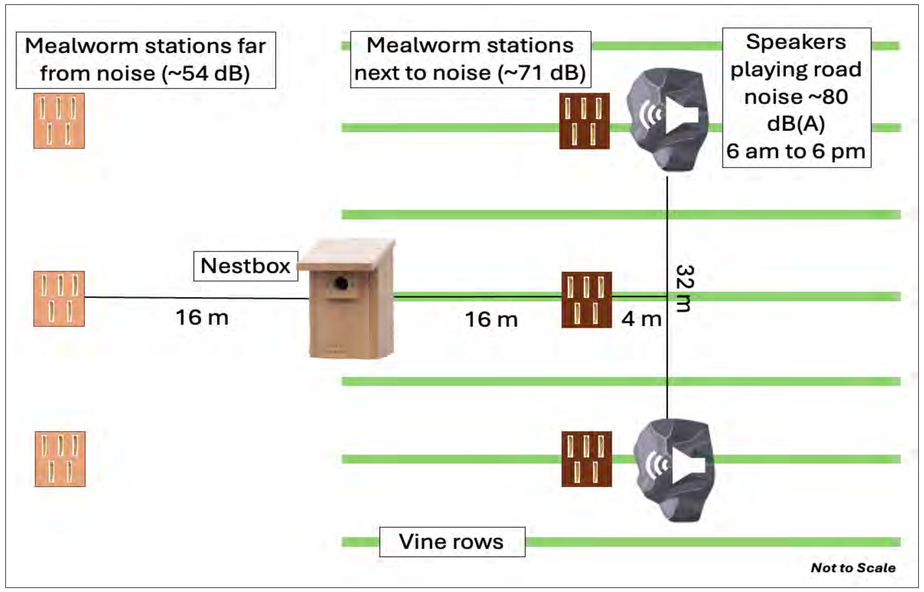
Background

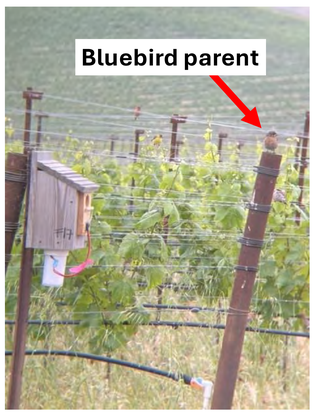
- Nest boxes used in vineyards to attract insectivorous birds & control pests
- Anthropogenic noise is pervasive in vineyards
- Some birds avoid noisy areas
- Noise may disrupt bird-mediated pest control

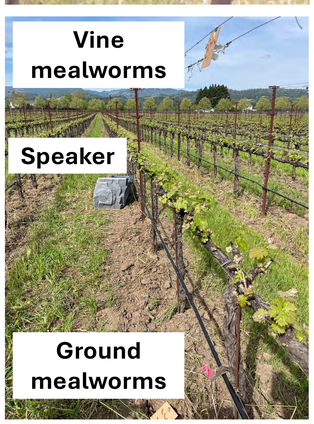
Questions

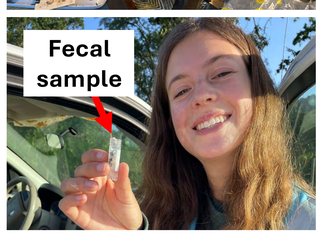
1. **Do birds in vineyards shift their foraging patterns during noise exposure?**
2. Does noise exposure cause shifts in use of habitat?
3. Does noise exposure cause shifts in diet?
4. Does noise cause changes in food provisioning to nestlings?

Methods

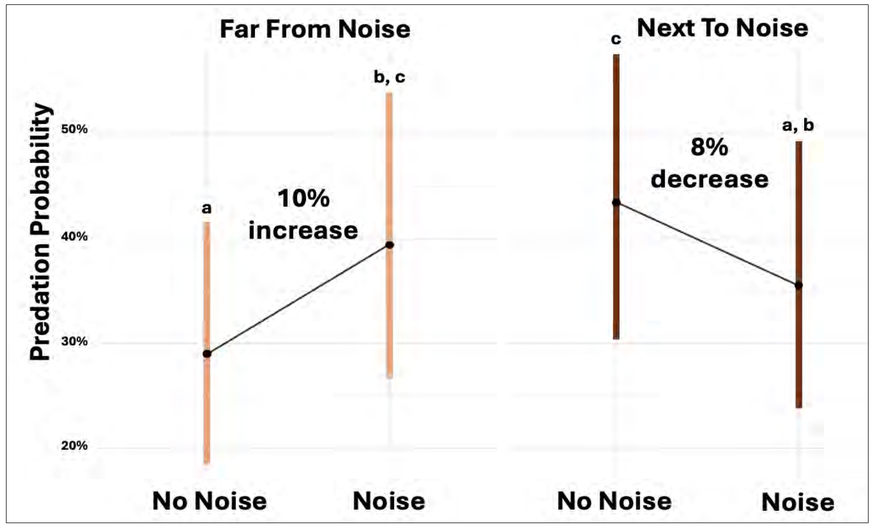




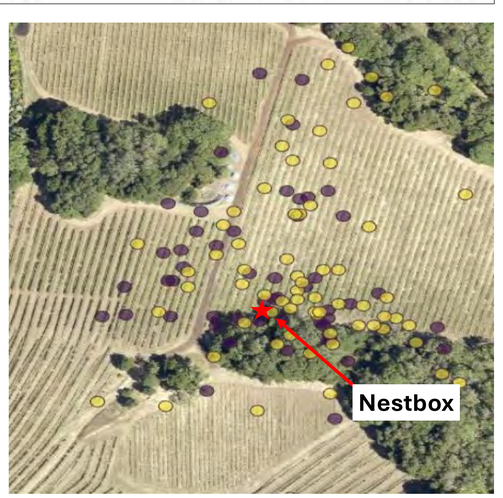




Results



Tagged bluebird parent taking mealworm from station.



Some GPS locations of a female bluebird. Darker points from noise period.

Conclusions

- **Predation pressure shifted with noise**
- **Consider road noise when choosing nest box placement for bird-mediated pest control**
- Future directions: analyze movement data, fecal samples, and perch monitor data. Additional temperature effects?

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Use of social information for prospecting and nest site selection in Western Bluebirds (*Sialia Mexicana*)

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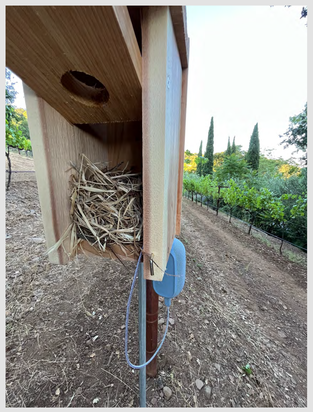
BACKGROUND

- Prospecting is the behavior by which individuals assess candidate sites for breeding.
- Social information gathered from the presence and success of conspecifics can be quickly obtained and used as a decision-making metric in addition to habitat cues[1].
- The use of playback vocalizations to simulate conspecific presence or reproductive success has proven useful both for experimentally investigating prospecting behavior, and for conservation action[2,3].
- Ability to draw birds to specific breeding sites has particular relevance in agricultural systems that could benefit from the presence of birds that provision ecosystem services, such as pest control.
- Western Bluebirds (*Sialia mexicana*) show promise as a pest-eating bird in agricultural systems[4], but whether or not social information plays a role in nest selection has not been examined.
- We conducted an experiment to investigate the hypothesis that prospecting Western Bluebirds use social information and local habitat cues to select nest sites the following year.

STUDY SITES



- 10 vineyards in Napa Valley, California, varying in both local (within-farm) habitat complexity and landscape composition and without a history of nest boxes, received 20 nest boxes in a 3-hectare plot in July 2023.
- 5 experimental vineyards:
  - 12 treatment boxes received an old nest, speaker playing nestling/adult audio, and a camera to film visitation
  - 8 near-treatment boxes on same plot but without nests and calls, 6 of which with camera only
- 5 control vineyards:
  - 20 control boxes without nests and calls, 6 boxes of which with camera only
- Ongoing video analysis of nest prospecting behavior in 2023.
- Here, we report occupancy in 2024 using GLMs: nest box use ~ treatment * local habitat.

PRELIMINARY RESULTS

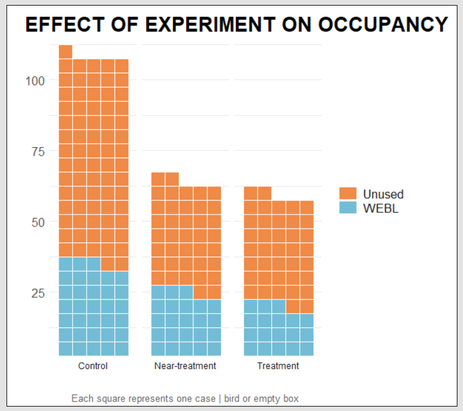


Figure 1: About 33% of boxes within each treatment group and across all boxes were utilized by Western Bluebirds.

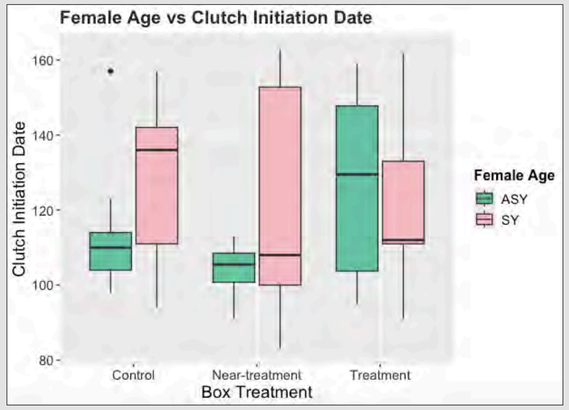


Figure 2: ASY females (green) initiate their clutches earlier in control and near-treatment boxes than SY females (pink).

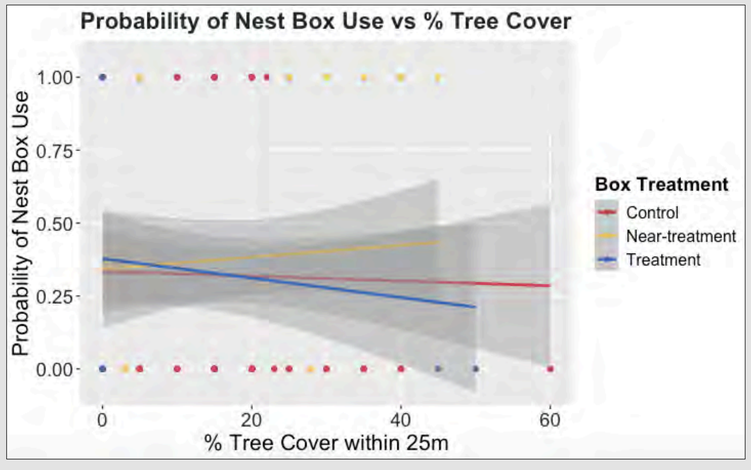


Figure 3: Significant interaction between **treatment * % tree cover within 25 m**. The probability of bluebird nest box use significantly decreased in treatment boxes with increasing local percentage of tree cover; no significant effect of tree cover for control or near-treatment boxes. The colored dots represent occupied (1) and unoccupied (0) boxes.

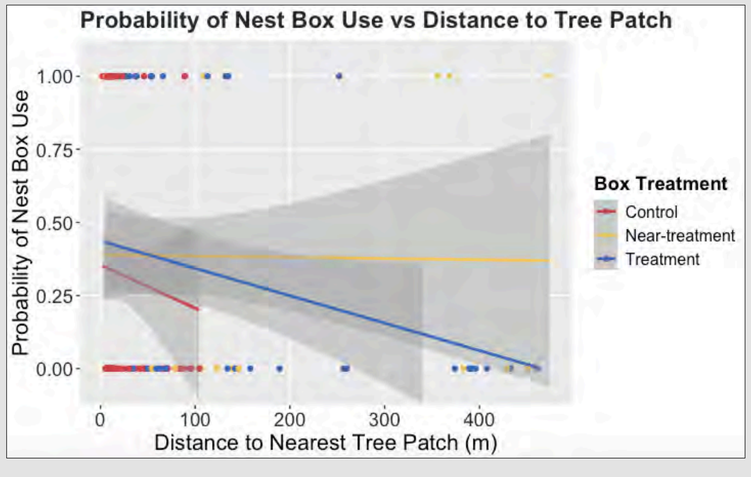


Figure 4: Significant interaction between **treatment * distance to tree patch**. The probability of bluebird nest box use significantly decreased in treatment boxes with increasing distance to nearest tree patch; no significant effect of distance to tree patch for control or near treatment boxes. The colored dots represent occupied (1) and unoccupied (0) boxes.

FIELD METHODS

Figure 5: Aging a second-year male by plumage. SYs identifiable via visible molt limit in coverts; coverts for ASYs appear uniform in color and wear.

Figure 6: Repeated nest box checks over the summer of 2024 to track occupying species, and nest and clutch initiation date.

MAIN TAKEAWAYS

- The effectiveness of social information on nest selection was mediated by habitat.
- The probability of box use for treatment boxes increased with proximity to tree patches, but decreased with increasing percentage of woodland and riparian habitat around the box.
- Bluebirds appeared to select nest boxes close to isolated tree patches, but without extensive tree cover within 25 m, suggesting a possible trade-off between benefits (shade, foraging) and costs (predation risk).
- Older female bluebirds identified and selected ideal box and habitat earlier than younger females.

NEXT STEPS

- Examine reproductive and fledging success to identify successful nesting pairs and their choice of habitat.
- Review ~1800 hours of footage to quantify box visitation and create an index of prospecting behavior during the experiment run in summer 2023.
- Test whether visitation/prospecting behavior at boxes in 2023 is associated with nest box use in 2024.

ACKNOWLEDGEMENTS

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Examining the effects of songbird nest boxes and land use on avian community composition and functional diversity in Napa Valley vineyards

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INTRODUCTION

- Birds consume up to 28 million metric tons of insect prey per year globally in croplands.[5]
- Insectivorous birds can provide important pest control services in agricultural systems[1,3], potentially reducing reliance on harmful insecticides.
- Winegrapes are vulnerable to insect pests and grown in Mediterranean regions marked by high biodiversity, extensive agriculture, and comparatively little habitat protection.
- Sustaining insectivorous birds within agricultural landscapes could benefit biodiversity and farm productivity alike.[2,4]
- The addition of songbird nest boxes and local habitat on the abundance of these insectivorous birds within vineyards remains unresolved.
- Objectives here are to conduct preliminary analyses of point counts in Napa Valley winegrape vineyards (not accounting for imperfect detection probability).

HYPOTHESES

1. The addition of songbird nest boxes to winegrape vineyards attracts insect-eating bluebirds and swallows, and this effect is mediated by local and/or landscape habitat heterogeneity.
2. Avian community diversity, richness, and insectivore abundance increases with local and landscape habitat heterogeneity.

STUDY DESIGN

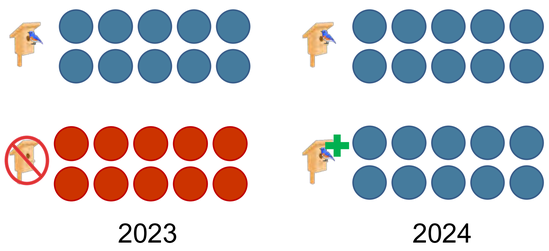


Figure 1. Survey birds & insects on 20 vineyards before & after addition of nest boxes to 10 of them. BACI-design experiment

STUDY SITES

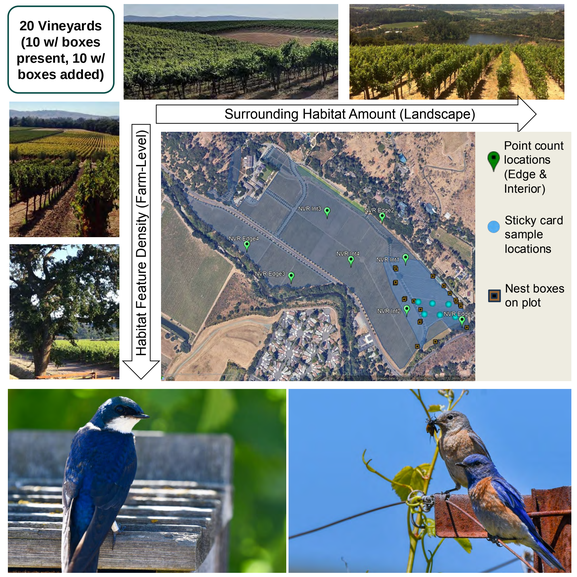
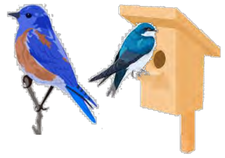


Figure 2. Study design schematic. Point counts distributed to capture variation in habitat heterogeneity. Birds that utilized nest boxes in the vineyards. Bottom right: Male and Female Western Bluebirds, Bottom left: Tree Swallow.

METHODS

- Point counts April – July 2023 & 2024, 10 with existing nest boxes and 10 with nest boxes added between field seasons (BACI design, Figure 1).
- GLMs of mean Western Bluebird and Tree Swallow abundance (# detections per point count) with year x treatment x habitat heterogeneity.
- Landcover (urban, vineyard, grassland, oak savannah, riparian, forest) was assessed at local (25m radius, visual estimate) and at landscape levels (200 m radius, GIS 4-m raster).
- Calculated landcover heterogeneity (Shannon Diversity) at the local and landscape levels at each point count location.
- Calculated avian Shannon Diversity, species richness, and insectivore abundance.
- GLMs to examine relationships between avian species richness, diversity, and insectivore abundance with the association of landcover heterogeneity at the local and landscape scale.

3-min video about our work in Napa!



RESULTS

- We detected 13,522 individuals of 96 bird species during 891 point counts at 161 point count locations across 20 vineyards over two seasons.
- Abundance of Western Bluebirds increased on sites with added nest boxes, but not control sites with existing boxes (Figure 3). This affect was not mediated by local or landscape heterogeneity.
- Addition of nest boxes did not significantly increase the abundance of Tree Swallows, which remained more abundant at control sites.
- Tree Swallow abundance was positively associated with local heterogeneity but not landscape heterogeneity.
- Shannon diversity, species richness, and insectivore abundance were positively associated with local and landscape heterogeneity (Figure 5).

NEST BOXES INCREASED BLUEBIRDS

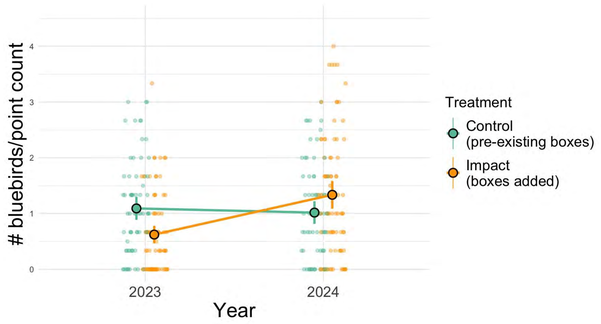


Figure 3. Mean abundance of Western Bluebirds at each point count location by year and nest box treatment (Control or Impact) fit with 95% confidence intervals.

SWALLOWS INCREASED VALLEY-WIDE

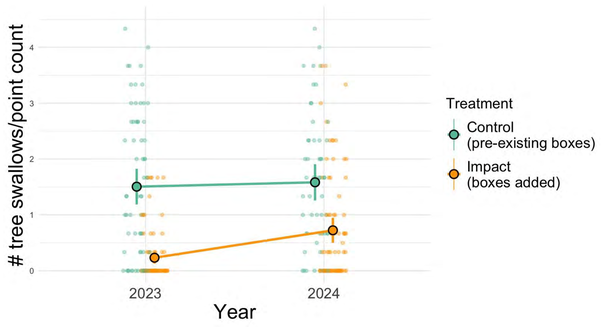


Figure 4. Mean abundance of Tree Swallows at each point count location by year and nest box treatment (Control or Impact) fit with 95% confidence intervals.

LANDCOVER ANALYSES

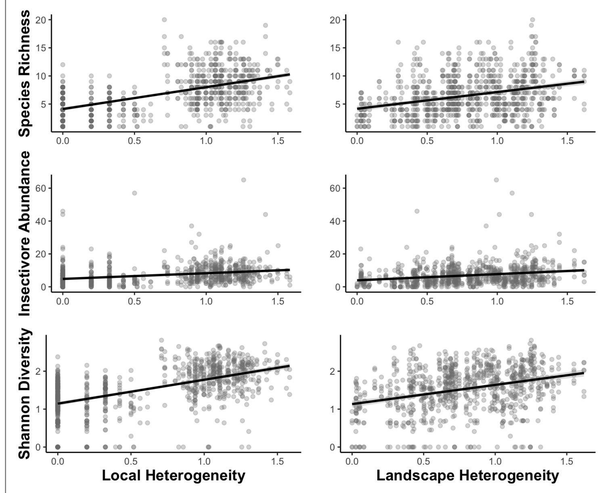


Figure 5. Linear regression models with log-transformed Shannon Diversity, insectivore abundance, and species richness plotted against landscape and local heterogeneity. Line shows fit with 95% confidence intervals.

DISCUSSION

- Adding nest boxes to winegrape vineyards can increase abundance of Western Bluebirds in just one year; this affect was not dependent on nearby natural habitat heterogeneity.
- Farms with more heterogeneity at both the local and landscape level may have a greater capacity to support avian biodiversity and insectivores for biocontrol, but nest boxes may be more essential to attract Western Bluebirds.
- Local heterogeneity may be important when attracting Tree Swallows to farms for biocontrol.
- Future steps include occupancy and N-mixture modeling for imperfect detection and will assess nest box effects on insect pests.

ACKNOWLEDGEMENTS

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