

## Vineyard Research Shows Pest Management Value of Songbird Nest Boxes

### Integrating songbird conservation and insect pest management in organic California vineyards

During the past decade, an increasing number of winegrape growers in California's North Coast have placed songbird nest boxes in their vineyards, primarily to help conserve cavity-nesting bird species. However, no studies have systematically analyzed the role of these cavity-nesting birds in suppressing vineyard pests such as leafhopper, sharpshooters, and moths.

The objective of this study was to test whether biocontrol of moth, leafhopper and sharpshooter pests is enhanced through conservation of insect-eating birds via the establishment of songbird nest boxes.

This project is informed by previous research and theoretical ecology. Avian biocontrol was a strong area of study within the USDA from 1885 to 1940 before the advent of chemical materials for pest control. During that period, a division of the Bureau of Biological Survey (part of the USDA) called Economic Ornithology was devoted to researching avian biocontrol. Stomach-content analyses, mostly from the early 1900s, indicate that birds may consume key vineyard pest species.

Two certified organic vineyards chosen for this experiment were located in Mendocino County, California, in Hopland and near Ukiah. Both were planted between 1985 and 1988 and managed identically by the same manager, David Koball, of Fetzer Vineyards. Chardonnay grapevines are grown on trellises forming rows. Tilling occurred in every other tractor row, alternating with cultivated cover crops that were 97% clover and 3% Queen Anne's Lace.

#### In Brief:

Songbird conservation in vineyards may be a win-win for both birds and winegrape producers. In this study, establishment of songbird nest boxes in California vineyards led to increased populations of birds, in particular Western Bluebirds. In a sentinel pest study, bluebirds were shown to increase pest predation as a result of providing nesting locations.



*Courtesy of Julie Jedlicka*

*An example of one of the back-to-back songbird nest boxes installed in a California coastal vineyard.*

David Koball was consulted so that vineyard experiments did not interfere with daily management practices. Nest boxes were erected in January and February 2008, and placed back-to-back in pairs within nest box treatments to maximize bird densities. Nest boxes were constructed from redwood following recommendations of the North American Bluebird Society.

Each vineyard was divided in half such that a nest box treatment and control treatment were randomly assigned and located at least 250 m from each other.

At each nest box treatment site, 23 to 24 nest box pairs were established in a grid pattern in 5 to 6 rows. All boxes were cleaned of previous nesting materials in February 2009 and checked weekly for breeding activity from March through July. Once bluebird nests were found to contain eggs, predator guards made of wire mesh hardware cloth were attached to the outside of the boxes. Nest boxes were monitored weekly to assess bluebird reproductive activity.



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## PROJECT SUMMARY

Bird observations of nest box and control treatments were conducted every other week from mid-April through mid-July 2009, between 6:00 am and 10:30 am on days without rain. Observations and species identification were made from a camouflaged ground hunting blind located approximately 10 – 20 m from the entrance hole of occupied bluebird nest boxes. Observations were replicated at five randomly selected points in no-nest box control areas of vineyards.

The 2008 breeding season began four months after the nestboxes were placed in the vineyards. Three bird species were the predominant occupants of the nestboxes: Western Bluebirds, 36.8%, Tree Swallows and Violet-green Swallows, representing 17.8% combined. In 2009, vineyard experiments focused primarily on the territorial Western Bluebirds which forage by perching in low vegetation and strike arthropods on the ground, air, or vegetation.

To evaluate predation activity, larvae of beet armyworm, a vineyard moth pest, were purchased and used



Courtesy of Julie Jedlicka

*Songbirds nestlings occupy a nest box.*

in experiments that mimicked a pest outbreak at each vineyard site in June 2009. Larvae were placed in transects containing five individuals pinned to cardboard squares staked to the ground in vineyard tractor rows. Transects were established at 15 locations: adjacent to five active bluebird nest boxes, at five randomly selected points in the nest box treatment, and

at five randomly selected vineyard control points. Larvae were set out before 7:00 am and recollected about six hours later the same day and were recorded as either

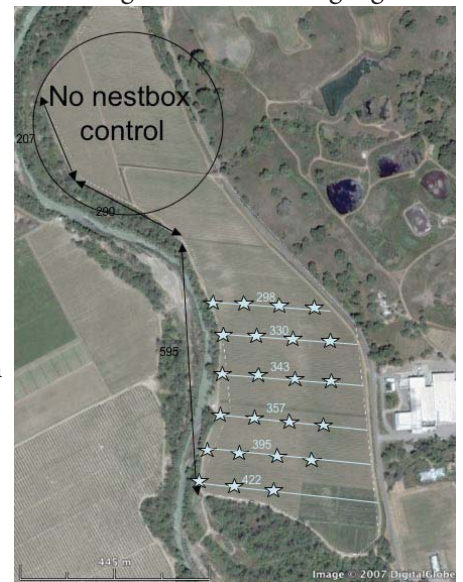
present (dead from sun exposure) or missing, signifying consumption from natural enemies strong enough to remove prey from pins--most likely birds.

## Project Results

**Bird observations.** Numbers of birds doubled in nest box areas early in the season and there was a 2.6 factor increase late in the breeding season when fledglings were seen foraging with adults throughout the vineyard. The increase in total avian abundance was mostly due to one species, Western Bluebird, which significantly increased by a factor of 9 in nest box treatments throughout the breeding season.

**Bluebird foraging distance.** In nest box treatments, bluebirds were observed close to active nests and seen traveling long distances (over 65 m) to return with prey items for nestlings. While there is some variability (early in the season bluebirds were more commonly observed close to the nest than later on), bluebird observation distance from the nest box is relatively consistent and demonstrates active foraging both close and far (over 65 m) from nest boxes.

**Avian biocontrol experiment.** Number of larvae removed by birds was consistent across sites and varied by treatment. Transects in front of active bluebird nest boxes experienced the highest predatory effects with 83% of larvae removed, on average. This removal rate did not significantly differ from the 58% of larvae removed from randomly selected areas within the nest box treatment. However, removal rates from both nest box treatments were significantly greater than the 24% of larvae removed from control vineyard points.



Courtesy of Julie Jedlicka

*One vineyard site illustrating treatments and nest box spacing. Stars indicate one pair of nest boxes mounted back-to-back. All numbers are distance in meters.*

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### Conclusions

Conservation practices may be a win-win scenario for organic winegrape growers. Providing songbird nest boxes in vineyards increased the abundance of insectivorous birds, most notably the Western Bluebird. Bluebirds maintain large territories that they actively patrol, increasing pest control services in vineyards. Data from

the mimicked pest outbreak indicate significant predatory effect of insectivorous birds not only immediately adjacent to occupied nest boxes but at randomly selected points throughout the nest box treatment of the vineyard. Consequently the presence of occupied nest boxes benefits the vineyard and is providing ecosystem services to winegrape growers.

### IN CONTEXT

#### Julie Jedlicka and David Koball share post-project perspectives

Project investigator Julie Jedlicka hand-built the 200 or so nest boxes that were installed at Fetzer Vineyards for this project. She said what was most gratifying was the response of the birds once the boxes were set in place.

"I guess what I was most overwhelmed and excited about was the response the birds had to putting up the boxes," Jedlicka says. "It felt good to be able to provide the grower with this resource."

Overall, 54% occupancy rates were achieved in the 2008 breeding season which began only four months after the nest boxes were placed in the vineyards. As a "thank you" to Fetzer Vineyards for their cooperation in this project, Jedlicka has donated the boxes for their continued use in the vineyard.

Jedlicka continues to investigate ways to evaluate the birds' pest management effect in the field, in particular using new methods to evaluate bird fecal samples to identify what birds are eating. Jedlicka is working with a lab at UC-Berkeley to molecularly identify insect remains in bird fecal samples through DNA extraction. This method more accurately identifies which insects birds have eaten than is possible solely through a visual identification. Jedlicka notes that visual identification of fecal samples is biased by what the researcher can actually see, which can be limited and vary among insect species. "This is a really new field. I've looked through the literature and very few biological studies are using this extraction method," says Jedlicka, who also says she hopes to continue DNA extraction work in her post doctoral studies.

David Koball of Fetzer Vineyards, who worked closely with Jedlicka on the study, says he's glad to have the nest boxes in the vineyard. "From my standpoint, there are more birds in the field," which he says is rewarding from a conservation perspective.

However, leafhopper pressure has been high this year, and the presence of birds has not replaced the need for use of organic materials to help manage the insect pressure. Koball says he hopes that further systems research will help vineyard producers implement multiple biocontrol strategies for pest management.

"What I'd like to see is someone put it all together, so we can look at using nest boxes and cover crops and other insect habitat and be able to say something like: 'With this density of birds, this density of minute pirate bugs and this density of green lacewings, etc., we can expect x-amount of leafhopper control in a normal year.' Because we know it's not about depending on one element to provide all the control we need," says Koball.

Koball says that outside of a research project he would definitely continue to use nest boxes in organic vineyard management but is not sure he would have them at the density or in the arrangement implemented in this study, noting that they can get in the way of machinery in the field. He noted that locating nest boxes on field perimeters might be a preferred arrangement.



Courtesy of Julie Jedlicka

Julie Jedlicka with Western Bluebird in hand.

