BARD Workshops

Guidelines and Regulations for Applications and Recipients

Workshop Summary Report
Cover Page

Workshop Number **W-106-2017**

Title **THE USE OF BARN OWLS FOR AGRICULTURAL PEST CONTROL:**

An international workshop

Date of Workshop: 5-7 March 2018

Location of Workshop: Davis, California, USA

This Workshop was supported by the United States – Israel Binational Agricultural Research and Development Fund, BARD Workshop No W-106-2017.

Matthew Johnson,
Signature, US Scientist

Motti Charter
Signature, IS Scientist

Sara Kross
Signature, US Scientist

Roger Baldwin
Signature, US Scientist

This workshop report includes:

- ✓ Table of Contents (list abbreviations, if any).
- ✓ A list of participants and their affiliation.
- ✓ The actual program of the workshop.
- ✓ A summary of the presentations (or abstracts of all presentations).
- ✓ A summary of round-table discussions.
- ✓ The details of the workshop Summary Session.
- ✓ Some photographs of workshop activities and participants.

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List of Participants and their Affiliations

Ana Paula Alamo -- Instituto Nacional de Tecnologia Agropecuaria, Argentina
Dr. Roger Baldwin -- University of California at Davis, USA
Ryan Bourbour -- University of California at Davis, USA
Mark Browning -- Barn Owl Box Company, USA
Xerónimo Castañeda -- Humboldt State University, USA
Dr. Motti Charter -- University of Haifa, Israel
Allen Fish -- Golden Gate Raptor Observatory, USA
Sofi Hindmarch -- Fraser Valley Conservancy, Canada
Dr. Josh Hull -- University of California at Davis, USA
Allison Huysman -- Humboldt State University, USA
Dr. Matt Johnson -- Humboldt State University, USA
Dr. Sara Kross -- Sacramento State University, USA
Dr. Dan Malkinson -- University of Haifa, Israel
Ricky Mendoza -- Esparto, California, USA
Stella McMillin -- California Dept of Fish & Wildlife, Wildlife Investigations Lab, USA
Dr. Ran Nathan -- Hebrew University, Israel
Chris Pedemonte -- Napa, California, USA
Ori Peleg -- Israel National barn owl project, Israel
Emily Phillips -- University of California at Davis, USA
Dr. Daniel Putnam -- Davis, California, USA
Dr. Niamh Quinn – Univ. of California Cooperative Extension, Irvine, California, USA
Dr. Rick Raid -- University of Florida, USA
Dr. Paula Rivadeneira -- Univ. Arizona, USA
Krysta Rogers -- Dept of Fish & Wildlife, California, USA
Gabe Rozman -- Hebrew University, Israel
Dr. Aaron Shiels -- United States Dept of Agriculture, Fort Collins, Colorado, USA
Dane St. George -- Humboldt State University, USA
Chris Storm -- Vino Farms, Lodi, California, USA
Mike Turkovich -- Winters, California, USA, Button & Turkovich Ranch
Carrie Wendt – Natural Resource Conserv. Serv. & Point Blue Conservation Sci, USA

Program of the workshop.

MARCH 5

- At hotel: Continental breakfast and shuttle to UCANR conference center.
- 7:30 Start
- 7:30-8:15 Coffee reception
- 8:15-8:30 Opening remarks and workshop objectives (Matt Johnson)
- 8:30-8:45 Icebreaker (Sara Kross)
- 8:45-10:00 "State of projects" Summary Research Presentations
    1. Motti Charter – Barn owls & rodent control in Israel (30 mins)
    2. Carrie Wendt & Sara Kross– Barn owls & rodent control in CA (15 mins)
    3. Sofi Hindmarch – Ecotoxicology and barn owls (15 mins)
    4. Richard Raid – Barn owls & rodent control in Florida's Everglades Agricultural Area (15 mins)
- 10:00-10:30 Coffee/snack break
- 10:30-12:00 Breakout groups (5 groups). **Work to outline current knowledge and research priorities**. Each group has assigned discussion leader & scribe (leader identified below). Participants will be able to rotate to visit, learn about, and add info to other groups.
    - Remaining research needs from farmers' perspective – Led by Mike Turkovich
    - Barn owl diet - Led by Richard Raid
    - Effects on rodents & crop damage – Led by Roger Baldwin
    - Barn owl movement - Led by Ran Nathan
    - Barn owl toxicology – Led by Sofi Hindmarch
- 12:00-1:00 Working lunch in breakout groups
- 1:00-2:30 Breakout group presentations (5 @ 15 minutes each; same groups as above)
- 2:30-3:00 Coffee/snack break
- 3:00-4:30 Summary session, day 1. Work to identify rough outline and agreed authorship contributions for a review manuscript. Sara Kross facilitate.
- 4:30-5:00 Closing discussion and summary of outcomes. Sara Kross facilitate.
- Evening informal dinner & drinks

MARCH 6

- At hotel: Continental breakfast and shuttle to UCANR conference center.
- 7:30 Start

- 7:30-8:00 Coffee reception
- 8:00-8:45 Methodological presentations
    - Owl box monitoring & maintenance (7 mins) – Ori Peleg
    - Rodent monitoring (7 mins) – Roger Baldwin
    - Drones to monitor rodent damage (15 mins)– Dan Malkinson
    - Pellet analysis (15 mins) – Richard Raid
- 8:45-9:30 Travel to first skill-share location (Button & Turkovich Ranch)
- 9:30-12:00 First three skill-share demo
    - Rodent monitoring – Led by Roger Baldwin
    - Owl box monitoring – Led by Motti Charter
    - GPS tags – Led by Xeronimo Castañeda
- 12:00-12:30 Travel to Matchbook tasting room/patio (bathrooms available)
- 12:30-1:30 Boxed lunches
- 1:30-3:30 Three more skill-share demos
    - Necropsy – Led by Krysta Rogers
    - Toxicology – Led by Stella McMillin
    - Video nest monitoring – Led by Dane St. George
- 3:30-4:00 Closing discussion for the day, clarify expectations for group work for the following morning (Matt Johnson)
- 4:00-5:00 Wine-tasting social hour.
- 5:00-5:45 travel back to Davis (dinner on your own)

MARCH 7

- At hotel: Continental breakfast and shuttle to UCANR conference center.
- 8:00 Start
- 8:00-8:30 Coffee reception
- 8:30-10:00 Methods breakout groups. **Work to draft identify core options, areas in need of methodological refinement or experimentation, and recommended best practices**. Each group has assigned leader & scribe (leader identified below). Participants can rotate to visit, learn about, and add info to other groups.
    - Owl box demographic monitoring & maintenance – Motti Charter
    - Rodent monitoring – Niamh Quinn
    - Video monitoring of nest boxes – Dane St. George
    - Pellet analysis – Richard Raid
    - Telemetry and movement – Ran Nathan
    - Toxicology methods – Sofi Hindmarch
- 10:00-10:30 Coffee/snack break
- 10:30-12:00 Breakout group presentations (15 mins each), **each group chooses two presenters**

    - Owl box demographic monitoring & maintenance
    - Rodent monitoring
    - Video & pellet analysis
    - Telemetry and movement
    - Toxicology methods
- 12:00-1:00 Lunch
- 1:00-3:00 Summary session, day 3. Work to identify rough outline and agreed authorship contributions for a report on methodological recommendations. Sara Kross and Motti Charter facilitate
- 3:00-3:30 Closing remarks and adjourn.

MARCH 8

- Local participants will depart workshop at the end of day on 7 March. Depending on travel timing, international and non-local domestic participants may leave late on 7 March or keep lodging for a fourth night and depart on 8 March by air (shuttle to airport) or ground transportation.

A summary of the presentations

There were 8 'conventional' PowerPoint style presentations, and 6 in-the-field presentations/demonstrations. Below, we briefly summarize each of them.

All PowerPoint presentation are available in the workshop webpage to workshop participants (in the "members only" area), and YouTube videos of all the field demonstrations are also available.

PowerPoint presentations:

1. **Current Barn Owl Research in California.** *Sara Kross, Matthew Johnson and Carrie Wendt*. This presentation summarizes the past, current, and ongoing research on barn owls in California agriculture, with a special emphasis on work done in winegrape vineyards. Results on occupancy analyses and telemetry analyses of movement, as well results of a modeling exercise are reported.
2. **National Barn Owl Box Project in Israel.** *Motti Charter***.** This presentation describes the history and evolution of the Barn Owl Box Project in Israel. It also describes how the program has contributed to fundamental and practical research in barn owls and pests in agriculture, and it describes evidence for the efficacy of barn owls in integrated pest management schemes.
3. **Introduction to Barn Owls and Pesticides**. *Sofi Hindmarch*. This presentation describes the major rodenticides used worldwide, how they may get into the ecosystem, and their potential detrimental effects to barn owls and other non-target species. The presentation also briefly described tissue sampling protocols, and sublethal and lethal effects.
4. **Barn Owl Research in Florida**. *Richard Raid*. This presentation summarizes ongoing work on the use of barn owl boxes in southern Florida to help control rats (especially cotton rats and rice rate) in sugar cane plantations.
5. **Owl Box Monitoring**. *Ori Peleg*. This presentation summarizes methods used by the Israeli National Barn Owl Box Program to monitor nest boxes for barn owl occupancy, reproduction, and diet.
6. **Rodent Monitoring**. *Roger Baldwin*. This presentation summarizes methods used to monitor rodent pests. It covers the use of indices, population estimations, and occupancy measures. It includes discussion of the pros and cons of some of the most commonly used methods.
7. **Monitoring with Drones**. *Dan Malkinson*. This presentation summarizes the use of Unmanned Aerial Vehicle (UAVs or "drones") to measure ecological properties relevant to barn owls and rodent pests. In particular, the presentation summarizes what is possible with drones and latest analytical

equipment, including the possibility of monitoring rodent damage or rodents themselves.

8. **Pellet Methods**. *Richard Raid*. This presentation summarizes some of the basic method used to collect, store, and dissect barn owl pellets. It also includes a brief description of how the remains may be effectively identified, how the resulting data can be analyzed and the importance to agrciuture.
9. **Barn Owls as a Case Study of IPM**. *Ran Nathan*. As a presentation, this presentation offered a way of viewing barn owls as case study for larger practical questions – such as IPM – as well as for general ecological theory – such as top-down control.

Field demonstrations or "skill-shares":

1. Roger Baldwin and Niamh Quinn offered a demonstration of common rodent trapping techniques, and the open-hole method for monitoring gopher activity and abundance.
2. Motti Charter and Xeronimo Castaneda offered a demonstration, using a live owl, of how to extract an owl from a nest box, handle and measure it, and how to attach a GPS or other telemetry device to its back.
3. Krysta Rogers demonstrated a necropsy of the barn owl, including what evidence to look for that may indicate possible rodenticide poisoning.
4. Xeronimo Castaneda and Motti Charter demonstrated how to attach telemetry devices, and participants could practice with barn owl carcasses.
5. Dane St. George demonstrated the equipment necessary for, and installation practices to deploy infrared remote video cameras into nest boxes to monitoring prey delivery rates.
6. Carrie Wendt and Allison Huysman demonstrated how to check nest box occupancy using a small video camera.

A summary of the break-out group and other discussions

During the workshop we had two main break outgroup sessions where experts set around a table to work together on specific topics and then presented the results to the whole workshop for further feedback. The first workgroups (research-priorities) were designed to outline current knowledge and research priorities and the second group (methods-related) identified core options, areas in need of methodological refinement or experimentation, and recommended best practices. Photos of all flipcharts and other materials generated during break-out group and other discussions are available on the website (members only area). Typed notes of all discussion are available there as well.

The methods-related discussions have led to the creation of six google documents (still in draft forms) that cover the following topics (links go to the docs):

Nest Box Occupancy
Pellet Analysis
Videography
Rodent Monitoring
Telemetry & Movement
Toxicology

The research-priorities manuscript discussions led to the following draft initial outline of topics:

I. **Introduction** ~ 600 words (each letter is a paragraph's main point….50-200 words each)

   A. Integrated pest management is a form of human-managed trophic cascade. Vertebrate predators may play a role in the control of vertebrate pests and this can be augmented by farmers as part of 'conservation biological control' (Eilenberg et al. 2001).
   B. Empirical evidence for trophic cascades varies; demonstrable cases involving vertebrate predators and vertebrate prey are rare, especially in the context of vertebrate pest control (but see Hafidzi & Mohd 2003; Kross et al. 2012). Cross ecosystem comparisons reveal that the strongest trophic cascades tend to occur in systems with particular ecosystem attributes such as aquatic, insular, simple, etc.
   C. The barn owl-rodent-crop system appears to have several attributes that may [enable...word choice] potential for meaningful trophic cascade (i.e., pest control to benefit farmers), and farmers around the world are deploying boxes in hopes of controlling pests. However, empirical

evidence is spotty, anecdotal, limited in its focus on foundational theory, and varies regionally.

D. This review uses the barn owl-rodent-agricultural system as a case study.
    1. First, we summarize ecological hypotheses for variation in strength of trophic cascades.
    2. Second, we use this theoretical foundation to provide a conceptual framework for the barn owl system as a vertebrate-delivered trophic cascade.
    3. Third, we review evidence for, identifying knowledge gaps in, and set research priorities for an analysis of the potential for barn owls to provide a meaningful trophic cascade to farmers within the context of their economies and other ongoing practices (IPM).

II. **Hypotheses for variation in strength of trophic cascades** ~ 800 words, with one table (basically all in the table, so need fewer words).

III. **Conceptual model for pest control services** ~ 500 words, with a figure in a box (~500 words in box)

IV. Case Study: Trophic Cascade from Barn Owls: a case study of Integrated Pest Management

A. What we need to know ~800 words

B. What we already know ~400 words. Barn owls have been lauded by farmers for generations (Fisher 1983).

C. Research priorities ~ 600 words

V. **Conclusion** How barn owl-agriculture systems can propel understanding of trophic cascades ~200 words

VI. **Acknowledgements** ~ 100 words

Total = 4000-5000

VII. **Literature Cited** ~50

Details of Workshop Summary Session & Next Steps

The summary session included a group discussion of nest steps, Ran Nathan's presentation of barn owls as a case study, and resolution of tasks and assignments for next work.

We are working on two outputs from each work group: (1) a manuscript that conceptually reviews rodent pest control with barn owls as a case study & identifies next research priorities -- refer to this as BARD BARN OWL RESEARCH PRIORITIES, and (2) a report that summarizes some methodological principles and offers core options and suggestions; this will live on the website as a report in the short term, perhaps morphing into a different outlet later -- hereafter we'll refer to this output as BARD BARN OWL METHODS REPORT.

For the BARD BARN OWL RESEARCH PRIORITIES, we agreed that we'll task each research topic group leader to draft a document that provides full sentences and references that respond to three prompts: (a) a list of the essential information needed to evaluate the potential for barn owls to provide meaningful pest reduction, (b) assessment of whether we currently know this information or not, and (c) identification of the next research priorities. This document was built largely from the notes and photos of the flipcharts. The core team (Matt Johnson, Sara Kross, Motti Charter, Roger Baldwin) will then take this information, assemble an outline and draft initial figures and tables. The aim is to submit a manuscript to a high-impact journal in summer 2018.

For the BARD BARN OWL METHODS REPORT, Matthew Johnson's lab curated the notes and posted them to the workshop webpage. Each method group leader communicated with her/his group for input/revision before sending back to the core team (Matt Johnson, Sara Kross, Motti Charter, Roger Baldwin). Each team has already uploaded relevant scientific papers to a shared google drive (with folders for each topic and instructions for a naming convention).

We made a "members only" area of the barnowlpestcontrol.com website to facilitate this work and to house documents, presentations, and YouTube videos.

A group picture near the Matchbook vineyards during a field excursion.

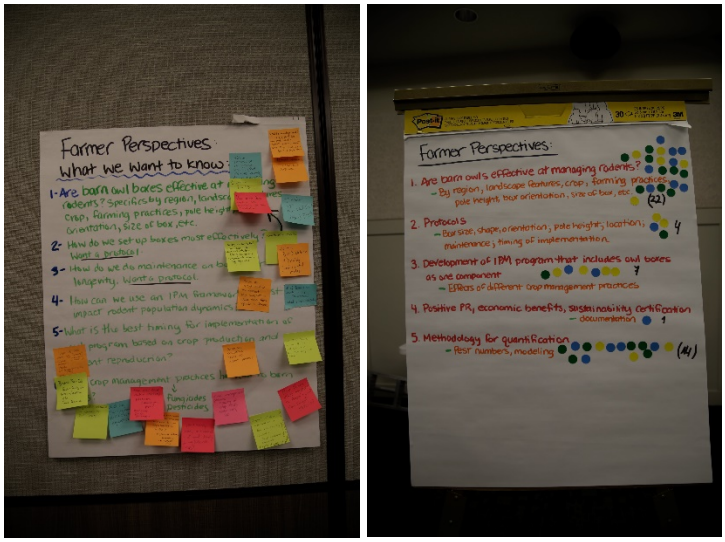
Matthew Johnson and Motti Charter leading discussion of research priorities.

Sara Kross explaining a new model for pest populations in the presence of barn owl predators.

Break-out discussion group with farmers on how research agenda can address issues important for agricultural production.

Another break-out discussion group on the topic of quantifying barn owl diet.

Important themes emerge from group discussion on day 2.



Break-out group work included feedback from the entire group, and exercises to reveal the most important emergent ideas, such as “dot-voting.”

Graduate student Dane St. George summarizing some research priorities.

Roger Baldwin demonstrating the best research method for trapping rodent pests.