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August 16, 2019

David Kratville
California Department of Food and Agriculture
1220 N Street
Sacramento, California, U.S.A. 95814

Proposal entitled: “An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards”
Principal Investigator:..... Roger Baldwin

Dear Dr. Kratville:

On behalf of The Regents of the University of California, Davis Campus, it is our pleasure to present for your consideration the above-referenced proposal in response to the Vertebrate Pest Control Research Advisory Committee.

In the event that our supplemental proposal is selected for funding, we will expect to agree to general terms and conditions as allowed in previous contracts between UC Davis and the California Department of Food and Agriculture.

Please do not hesitate to contact me if you have any questions. We request that correspondence pertaining to this proposal be sent via email to proposals@ucdavis.edu or mailed to the Office of Research Sponsored Programs Office, 1850 Research Park Drive, Suite 300 Davis, CA 95618-6153.

We look forward to working with you on this important project.

Sincerely,

Chris D. Dye-Hixenbaugh
Contracts and Grants Officer

**Please refer to Proposal No 20-0526 on all future correspondence.*

Send Award Notice to:

Office of Research, Sponsored Programs
1850 Research Park Drive, Suite 300
University of California
Davis, California 95618
awards@ucdavis.edu

Send Checks (Payable to The Regents of the University of California) to:

Cashier's Office
University of California Davis
PO BOX 989062
West Sacramento, California 95798-9062

STATE OF CALIFORNIA
STANDARD AGREEMENT

STD 213 (Rev 03/19)

AGREEMENT NUMBER
REGISTRATION NUMBER

- This Agreement is entered into between the State Agency and the Contractor named below:

STATE AGENCY'S NAME	California Department of Food and Agriculture, hereinafter referred to as "State"
CONTRACTOR'S NAME	The Regents of the University of California, hereinafter referred to as "University"
- The term of this Agreement is: 01/01/2020 through 12/31/2020
- The maximum amount of this Agreement is: \$ 79,314
- The Parties agree to comply with the terms and conditions of the following Exhibits, which by this reference are made a part of the Agreement.

Exhibit A – A7: A–Scope of Work; A1–Deliverables; A2–Key Personnel; A3–Authorized Representatives; A4–Use of Intellectual Property & Data; A5–Resumes/Biosketch; A6–Current & Pending Support; A7-Third Party Confidential Information (if applicable)	page(s)
Exhibit B – B–Budget; B1–Budget Justification; B2– Subawardee Budgets (if applicable); B3– Invoice Elements	page(s)
Exhibit C* – University Terms and Conditions	UTC-319

- Check mark additional Exhibits below, and attach applicable Exhibits or provide internet link:
- Exhibit D** – Additional Requirements Associated with Funding Sources page(s)
 - Exhibit E** – Special Conditions for Security of Confidential Information page(s)
 - Exhibit F** – Access to State Facilities or Computing Resources page(s)
 - Exhibit G** – Negotiated Alternate UTC Terms page(s)

Items shown with an Asterisk (*) are hereby incorporated by reference and made part of this agreement as if attached hereto.
 These documents can be viewed at <https://www.dgs.ca.gov/OLS/Resources/Page-Content/Office-of-Legal-Services-Resources-List-Folder/Model-Contract-Language>.

IN WITNESS WHEREOF, this Agreement has been executed by the Parties hereto.



CONTRACTOR		California Department of General Services Use Only
CONTRACTOR'S NAME (if other than an individual, state whether a corporation, partnership, etc.)		
BY (Authorized Signature)	DATE SIGNED (Do not type)	
		
PRINTED NAME AND TITLE OF PERSON SIGNING		
ADDRESS		
STATE OF CALIFORNIA		
AGENCY NAME		
BY (Authorized Signature)	DATE SIGNED (Do not type)	
		
PRINTED NAME AND TITLE OF PERSON SIGNING		
ADDRESS		
		<input type="checkbox"/> Exempt per:

Exhibit A – Scope of Work

Project Summary & Scope of Work

Contract Grant

Does this project include Research (as defined in the UTC)? Yes No

PI Name: Roger A. Baldwin

Project Title: An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards

Project Summary/Abstract

Briefly describe the long-term objectives for achieving the stated goals of the project.

Roof rats can cause extensive damage in a number of tree crops including citrus. Roof rat populations seem to be expanding and growing throughout many agricultural regions in CA, yet management options for limiting this damage have been largely unsuccessful. The development of an integrated pest management (IPM) program could greatly reduce this damage, but such a program is challenging to develop without at least a basic understanding of the general biology and ecology of the pest species within the target system. As such, we propose a project using new cellular-tracking technology to gain a better understanding of roof rat movement patterns to better target management programs. We also plan to test the utility of tracking tunnels and remote-triggered cameras to serve as quantitative indexing tools to track changes in population size following the implementation of various management tools. Collectively, this information will serve as the foundation for a subsequent study designed to assess the utility of potential control options for reducing roof rat numbers in citrus and related orchard cropping systems in CA.

If Third-Party Confidential Information is to be provided by the State:

- Performance of the Scope of Work is anticipated to involve use of third-party Confidential Information and is subject to the terms of this Agreement; **OR**
- A separate CNDA between the University and third-party is required by the third-party and is incorporated in this Agreement as Exhibit A7, Third Party Confidential Information.

Scope of Work

Describe the goals and specific objectives of the proposed project and summarize the expected outcomes. If applicable, describe the overall strategy, methodology, and analyses to be used. Include how the data will be collected, analyzed, and interpreted as well as any resource sharing plans as appropriate. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the goals and objectives.

Rats (*Rattus* spp.) are a common and very damaging invasive pest found throughout much of the world, with one projection of damage caused by rats in the U.S. estimated at \$19 billion annually (Pimentel et al. 2005). Although much of the damage they cause occurs in residential areas, they are also common agricultural pests. In particular, nut and tree fruit crops can incur substantial damage from rats when present. For example, roof rats (*Rattus rattus*) cause an estimated 5–10% loss in developing macadamia nut crops in Hawaii each year (Tobin et al. 1997). Furthermore, roof rats cause frequent damage to citrus crops (Worth 1950), with anecdotal information suggesting roof rat damage is on the rise in citrus orchards in CA. Effective management options for these invasive rodents are needed to minimize losses in these orchard systems, yet little seems to work for roof rats in citrus orchards (Sun Pacific, pers. comm.). The development of an integrated pest management (IPM) program for roof rats in citrus is needed to better mitigate losses. However, to develop an IPM program, we need some general understanding of pest biology and ecology, yet such information is lacking for roof rats in

agricultural systems in CA. Whisson et al. (2007) assessed roof rat movements in riparian areas in CA and found that male and female home-range sizes were ~ 1.04 and 0.39 ha, respectively. However, food and cover resources are substantially different across citrus orchards and riparian areas, making comparisons between the two tenuous at best. Knowledge of roof rat movement patterns in citrus orchards would greatly assist in the development of a management program for roof rats. For example, movement patterns can often be used to identify features likely conducive to rat populations in adjacent habitats, thereby allowing for targeted management efforts to reduce potential invasion into orchards. Likewise, information on home range size and daily movement patterns can help identify proper spacing for bait stations and traps to maximize both efficacy and cost effectiveness. A better understanding of movement patterns of roof rats is likely requisite given the current difficulty in managing this invasive species in citrus and other orchard crops throughout CA and beyond.

Once we have a better understanding of how roof rats are moving throughout an orchard landscape, we can then implement targeted removal programs, but we need effective monitoring tools to identify potential reductions in rat populations following treatment. Development of simple, quantitative indexing techniques is important for managing a variety of wildlife species. To be practical, such an index should be simple and easily applied in the field, while being sensitive to population changes. A general paradigm with good quantitative properties for indexing animal populations has been developed and applied to many species using many observation methods (e.g., European rabbit, *Oryctolagus cuniculus* [Latham et al. 2012] and wild pigs, *Sus scrofa* [Engeman et al. 2007; Bengsen et al. 2011]). In particular, this approach has served well for rodents (Whisson et al. 2005; Engeman and Whisson 2006; Baldwin et al. 2014; Engeman et al. 2016). The basic requirements include placing observation stations throughout the area of interest, with observations made on consecutive days at each indexing occasion (e.g., before and after a treatment; Engeman 2005). The development of such an approach for roof rats would fit this paradigm and would allow us to test the efficacy of selected management tools. Therefore, our specific goals were as follows: 1.) develop an index of roof rat activity, and 2.) assess movement patterns of roof rats to better formulate a potential management program. It bears noting that we plan to build off of results from this study with a future project targeted at determining strategies for effectively controlling roof rats in citrus orchard systems. Collectively, this information should allow us to develop an IPM program for effective management of roof rats in citrus and other similar cropping systems.

Research Design

- I. Develop indexing tools to monitor roof rats in citrus orchards. Starting in January 2020, we will identify 5 citrus orchards with substantial roof rat populations, likely in Kern or Tulare Counties, to test the value of tracking tunnels and remote-triggered cameras as indexing tools. Within each orchard, we will establish a 210 m x 210 m monitoring plot. Tracking tunnels will be spaced in a 6 x 6 grid pattern separated by 30 m. Tracking tunnels will be operated for two days. Track cards will be checked for presence of rats and used as an index of activity following protocols established by Engeman (2005). Immediately following the completion of the tracking tunnel protocol, we will operate remote-triggered cameras that will be placed in a 5 x 5 grid, similar to a design used by Baldwin et al. (2014). Cameras will be baited with nontoxic wax blocks to serve as an attractant. Cameras will be operated for 2 days, with a subsequent index of activity developed following that outlined by Baldwin et al. (2014). We will follow this with 4-6 days of live-trapping to determine a minimum number known value (roof rats will be ear tagged to identify individuals) to compare to the index values we derived using the tracking tunnels and the remote-triggered cameras. This process will be repeated at all 5 sites, ultimately allowing us to assess the validity of the two general indexing approaches.
- II. Assess movement patterns of roof rats. Within three of the above listed plots, we will collar 45 roof rats (15 per plot) with a cell-tracking transmitter. Rats will be released to allow us to track their movements for up to 3 months. Rat locations will be determined through triangulation by detection of signals from nodes placed throughout the study area. These locations will be automatically downloaded to a sensor station that will collate data for periodic retrieval. Locations can be detected every few seconds using this technology to provide a very accurate picture of where the rats are, and what kind of movements they are involved in during the study period. This information will be instrumental in determining spacing of bait stations or traps for future management programs. This information can also be used to identify where rat activity is greatest, potentially allowing for identification of potential invasion points in an orchard. This would allow for targeted monitoring and management efforts, ultimately lowering management costs while increasing efficacy of management programs. Dr. Justine Smith is an expert on wildlife habitat use and spatial ecology and will be instrumental in assisting with this study objective.

We would also like to make note that Liphatech, Inc. has agreed in principle to provide \$15,000 in support of this project should it be funded. We have taken those funds out of the supplies section to help defray the cost of the project.

Literature Cited

- Baldwin, R. A., N. Quinn, D. H. Davis, and R. M. Engeman. 2014. Effectiveness of rodenticides for managing invasive roof rats and native deer mice in orchards. *Environmental Science and Pollution Research* 21:5795–5802.
- Bengsen, A. J., L. K.-P. Leung, S. J. Lapidge, and I. J. Gordon. 2011. Using a general index approach to analyze camera-trap abundance indices. *Journal of Wildlife Management* 75:1222–1227.
- Engeman, R. 2005. Indexing principles and a widely applicable paradigm for indexing animal populations. *Wildlife Research* 32:203–210.
- Engeman, R. M., R. A. Baldwin, and D. I. Stetson. 2016. Guiding the management of an agricultural pest: indexing abundance of California meadow voles in artichoke fields. *Crop Protection* 88:53–57.
- Engeman, R. M., A. Stevens, J. Allen, J. Dunlap, M. Daniel, D. Teague, B. Constantin. 2007. Feral swine management for conservation of an imperiled wetland habitat: Florida's vanishing seepage slopes. *Biological Conservation* 134:440–446.
- Engeman, R., and D. Whisson. 2006. Using a general indexing paradigm to monitor rodent populations. *International Biodeterioration & Biodegradation* 58:2–8.
- Latham, A. D. M., G. Nugent, and B. Warburton. 2012. Evaluation of camera traps for monitoring European rabbits before and after control operations in Otago, New Zealand. *Wildlife Research* 39:621–628.
- Pimentel, D., R. Zuniga, and D. Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics* 52:273–288.
- Tobin, M. E., A. E. Koehler, and R. T. Sugihara. 1997. Effects of simulated rat damage on yields of macadamia trees. *Crop Protection* 16:203–208.
- Whisson, D. A., R. M. Engeman, and K. Collins. 2005. Developing relative abundance techniques (RATs) for monitoring rodent populations. *Wildlife Research* 32:239–244.
- Whisson, D. A., J. H. Quinn, and K. C. Collins. 2007. Home range and movements of roof rats (*Rattus rattus*) in an old-growth riparian forest, California. *Journal of Mammalogy* 88:589–594.
- Worth, C. B. 1950. Field and laboratory observations on roof rats, *Rattus rattus* (Linnaeus), in Florida. *Journal of Mammalogy* 31:293–304.

Exhibit A2 – Key Personnel

KEY PERSONNEL

List Key Personnel as defined in the Agreement starting with the PI, by last name, first name followed by Co-PIs. Then list all other Key Personnel in alphabetical order by last name. For each individual listed include his/her name, institutional affiliation, and role on the proposed project. Use additional consecutively numbered pages as necessary.

Last Name, First Name	Institutional Affiliation	Role on Project
PI:		
<i>Baldwin, Roger</i>	<i>UC Davis</i>	<i>Responsible for all aspects of the project</i>
Co-PI(s) – if applicable:		
<i>Smith, Justine</i>	<i>UC Davis</i>	<i>Assist with animal movement analysis</i>
Other Key Personnel (if applicable):		
<i>Meinerz, Ryan</i>	<i>UC Davis</i>	<i>Primary research assistant</i>
<i>Swift, Katie</i>	<i>Liphatech, Inc.</i>	<i>Assist with project logistics and design</i>

Exhibit A3 – Authorized Representatives

AUTHORIZED REPRESENTATIVES AND NOTICES

The following individuals are the authorized representatives for the State and the University under this Agreement. Any official Notices issued under the terms of this Agreement shall be addressed to the Authorized Official identified below, unless otherwise identified in the Agreement.

State Agency Contacts	University Contacts
Agency Name: <Agency Name>	University Name: The Regents of the University of California, Davis Campus
<i>Contract Project Manager (Technical)</i> Name: <Name> <Title> Address: <Department> <Address> <City,State,Zip> Telephone: <Telephone#> Fax: <Fax#, if available> Email: <EmailAddress>	<i>Principal Investigator</i> Name: Roger Baldwin Cooperative Extension Specialist Address: Dept. Wildlife, Fish, & Conservation Biology One Shields Ave. Davis, CA 95695 Telephone: 530-752-4551 Fax: <Fax#, if available> Email: rabaldwin@ucdavis.edu Designees to certify invoices under Section 14 of Exhibit C on behalf of PI: <ol style="list-style-type: none"> 1. <Name>, <Title>, <EmailAddress> 2. <Name>, <Title>, <EmailAddress> 3. <Name>, <Title>, <EmailAddress>
<i>Authorized Official (contract officer)</i> Name: <Name> <Title> Address: <Department> <Address> <City,State,Zip> Telephone: <Telephone#> Fax: <Fax#, if available> Email: <EmailAddress> <i>Send notices to (if different):</i> Name: <Name> <Title> Address: <Department> <Address> <City,State,Zip> Telephone: <Telephone#>	<i>Authorized Official</i> Name: Grace I. Liu J.D. Associate Director, Research Administration Address: Sponsored Programs 1850 Research Park Drive, Suite 300 Davis, CA 95618 Telephone: (530) 754-7700 Fax: (530) 752-0333 Email: awards@ucdavis.edu <i>Send notices to (if different):</i> Name: [expected SPO Awards Analyst] Contracts and Grants Analyst Address: Sponsored Programs 1850 Research Park Drive, Suite 300 Davis, CA 95618 Telephone: (530) 754-7700

<p>Email: <EmailAddress></p>	<p>Fax: (530) 752-0333 Email: awards@ucdavis.edu</p>
<p>Administrative Contact</p> <p>Name: <Name> <Title></p> <p>Address: <Department> <Address> <City,State,Zip></p> <p>Telephone: <Telephone#></p> <p>Fax: <Fax#, if available></p> <p>Email: <EmailAddress></p>	<p>Administrative Contact</p> <p>Name: [expected SPO Awards Analyst] Contracts & Grants Analyst</p> <p>Address: Sponsored Programs 1850 Research Park Drive, Suite 300 Davis, CA 95618</p> <p>Telephone: (530) 754-7700</p> <p>Fax: (530) 752-0333</p> <p>Email: proposals@ucdavis.edu</p>
<p>Financial Contact/Accounting</p> <p>Name: <Name> <Title></p> <p>Address: <Department> <Address> <City,State,Zip></p> <p>Telephone: <Telephone#></p> <p>Fax: <Fax#, if available></p> <p>Email: <EmailAddress></p>	<p>Authorized Financial Contact/Invoicing</p> <p>Name: James Ringo Division Manager</p> <p>Address: Contracts & Grants Accounting 1441 Research Park Drive Davis, CA 95618</p> <p>Telephone: (530) 757-8523</p> <p>Fax: (530) 757-8721</p> <p>Email: jaringo@ucdavis.edu</p> <p>Designees for invoice certification in accordance with Section 14 of Exhibit C on behalf of the Financial Contact:</p> <ol style="list-style-type: none"> 1. <Name>, <Title>, <EmailAddress> 2. <Name>, <Title>, <EmailAddress> 3. <Name>, <Title>, <EmailAddress>

Exhibit A4 – Use of Intellectual Property & Data

USE OF INTELLECTUAL PROPERTY & DATA

If either Party will be using any third-party or pre-existing intellectual property (including, but not limited to copyrighted works, known patents, trademarks, service marks and trade secrets) "IP" and/or Data with restrictions on use, then list all such IP/Data and the nature of the restriction below. If no third-party or pre-existing IP/Data will be used, check "none" in this section.

A. State: Preexisting IP/Data to be provided to the University from the State or a third party for use in the performance in the Scope of Work.

None or List:

Owner (Name of State Agency or 3 rd Party)	Description	Nature of restriction:

B. University: Restrictions in Preexisting IP/Data included in Deliverables identified in Exhibit A1, Deliverables.

None or List:

Owner (Name of University or 3 rd Party)	Description	Nature of restriction:

C. Anticipated restrictions on use of Project Data.

If the University PI anticipates that any of the Project Data generated during the performance of the Scope of Work will have a restriction on use (such as subject identifying information in a data set) then list all such anticipated restrictions below. If there are no restrictions anticipated in the Project Data, then check "None" in this section.

None or List:

Owner (University or 3 rd Party)	Description	Nature of Restriction:

Exhibit A5 - RÉSUMÉ/BIOSKETCH

RÉSUMÉ/BIOSKETCH

Attach 2-3 page Resume/Biosketch for the PI and other Key Personnel listed in Exhibit A2, Key Personnel.

ROGER ALLEN BALDWIN
Department of Wildlife, Fish, and Conservation Biology
One Shields Ave
University of California, Davis
Davis, CA 95616
Business Phone (530) 752-4551
E-mail: rabaldwin@ucdavis.edu

EDUCATION

Ph.D. Wildlife Science/Range Science, Department of Animal and Range Sciences
New Mexico State University, Las Cruces, NM 88003. February 2008.

M.S. Biology, Emphasis on Vertebrate Zoology
The University of Memphis, Memphis, TN 38152. August 2003.

B.S. Wildlife Biology, Secondary Major in Natural Resource and Environmental Science
Kansas State University, Manhattan, KS 66506. May 2000.

PROFESSIONAL APPOINTMENTS

Assistant (July 2013 to June 2015) and Associate (July 2015 to present) Cooperative Extension Specialist—Human-Wildlife Conflict Resolution

University of California Cooperative Extension, Division of Agriculture and Natural Resources; and Department of Wildlife, Fish, and Conservation Biology, University of California, Davis.

Assistant (June 2008 to June 2011) and Associate (July 2011 to June 2013) Cooperative Extension Advisor—Wildlife Pest Management

University of California Cooperative Extension, Integrated Pest Management Program, Division of Agriculture and Natural Resources.

PUBLICATIONS

Selected Peer-Reviewed Journal Publications:

Baldwin, R. A., H. Halbritter, R. Meinerz, L. K. Snell, and Steve B. Orloff. 2019. Efficacy and nontarget impact of zinc phosphide-coated cabbage as a ground squirrel management tool. *Pest Management Science* 75:1847–1854.

Baldwin, R. A., D. I. Stetson, M. G. Lopez, and R. M. Engeman. 2019. An assessment of vegetation management practices and burrow fumigation with aluminum phosphide as tools for managing voles within perennial crop fields in California, USA. *Environmental Science and Pollution Research* 26:18434–18439.

Baldwin, R. A., B. G. Abbo, and D. A. Goldade. 2018. Comparison of mixing methods and associated residual levels of zinc phosphide on cabbage bait for rodent management. *Crop Protection* 105:59–61.

Baldwin, R. A., R. Meinerz, G. W. Witmer, and S. J. Werner. 2018. The elusive search for an effective repellent against voles: an assessment of anthraquinone for citrus crops. *Journal of Pest Science* 91:1107–1113.

Sellers, L. A., R. F. Long, M. T. Jay-Russell, X. Li, E. R. Atwill, R. M. Engeman, and **R. A. Baldwin**. 2018. Impact of field-edge habitat on mammalian wildlife abundance, distribution, and vectored foodborne pathogens in adjacent crops. *Crop Protection* 108:1–11.

Wolf, K. M., M. A. Whalen, R. P. Bourbour, and **R. A. Baldwin**. 2018. Rodent, snake, and raptor use of restored perennial native grasslands is lower than use of unrestored exotic annual grasslands. *Journal of Applied Ecology* 55:1133–1144.

- Baldwin, R. A.,** R. Meinerz, and G. W. Witmer. 2017. Novel and current rodenticides for pocket gopher *Thomomys* spp. management in vineyards: what works? *Pest Management Science* 73:118–122.
- Baldwin, R. A.,** R. Meinerz, and G. W. Witmer. 2016. Cholecalciferol plus diphacinone baits for vole control: a novel approach to a historic problem. *Journal of Pest Science* 89:129–135.
- Baldwin, R. A.** 2014. Determining and demonstrating the importance of training and experience for managing pocket gophers. *Wildlife Society Bulletin* 38:628–633.
- Baldwin, R. A.,** N. Quinn, D. H. Davis, and R. M. Engeman. 2014. Effectiveness of rodenticides for managing invasive roof rats and native deer mice in orchards. *Environmental Science and Pollution Research* 21:5795–5802.
- Baldwin, R. A.,** T. P. Salmon, R. H. Schmidt, and R. M. Timm. 2014. Perceived damage and areas of needed research for wildlife pests of California agriculture. *Integrative Zoology* 9:265–279.
- Baldwin, R. A.,** T. P. Salmon, R. H. Schmidt, and R. M. Timm. 2013. Wildlife pests of California agriculture: regional variability and subsequent impacts on management. *Crop Protection* 46:29–37.
- Baldwin, R. A.,** and L. C. Bender. 2012. Estimating population size and density of a low-density population of black bears in Rocky Mountain National Park, Colorado. *European Journal of Wildlife Research* 58:557–566.
- Baldwin, R. A.** 2009. Use of maximum entropy modeling in wildlife research. *Entropy* 11:854–866.
- Baldwin, R. A.,** and L. C. Bender. 2008a. Den-site characteristics of black bears in Rocky Mountain National Park, Colorado. *Journal of Wildlife Management* 72:1717–1724.
- Baldwin, R. A.,** and L. C. Bender. 2008b. Distribution, occupancy, and habitat correlates of American martens (*Martes americana*) in Rocky Mountain National Park, Colorado. *Journal of Mammalogy* 89:419–427.
- Baldwin, R. A.,** A. E. Houston, M. L. Kennedy, and P. S. Liu. 2004. An assessment of microhabitat variables and capture success of striped skunks (*Mephitis mephitis*). *Journal of Mammalogy* 85:1068–1076.

Selected Extension Publications

- Baldwin, R. A.** 2019. Pest Notes: Pocket Gophers. University of California, Statewide Integrated Pest Management Program, Division of Agricultural and Natural Resources, Publication 7433.
- Zalom, F. G., E. Núñez, and **R. A. Baldwin.** 2017. Almond pests. Pages 375–406 in R. Socias i Company and T. M. Gradziel, editors. *Almonds: botany, production and uses*. CAB International, Oxfordshire, UK.
- Baldwin, R. A.** 2016a. Pest Notes: Tree squirrels. University of California Statewide Integrated Pest Management Program, Division of Agriculture and Natural Resources, Publication 74122.
- Baldwin, R. A.** 2016b. Vertebrate Pests. In: UC IPM Pest Management Guidelines—Citrus. University of California Division of Agriculture and Natural Resources, Publication 3441.
- Baldwin, R. A.,** and T. P. Salmon. 2016. Vertebrate pest management. Pages 295–309 in L. Ferguson and D. R. Haviland, editors. *Pistachio Production Manual*. University of California Division of Agriculture and Natural Resources, Publication 3545.
- Quinn, N., **R. A. Baldwin,** and M. Dimson. 2016. Ground squirrel best management practices. Division of Agriculture and Natural Resources Publication <http://www.groundsquirrelbmp.com/>.
- Baldwin, R. A.** 2014. Vertebrate pest management. Pages 237–252 in J. P. Newman, editor. *Container nursery production and business management manual*. University of California Division of Agriculture and Natural Resources Publication 3540.
- Quinn, N., and **R. A. Baldwin.** 2014. Managing roof rats and deer mice in nut and fruit orchards. Division of Agriculture and Natural Resources, Publication 8513.

Baldwin, R. A. 2013. Vertebrate Pests. In: UC IPM Pest Management Guidelines for Asparagus. University of California Division of Agriculture and Natural Resources, Publication 3435.

Baldwin, R. A. 2011. What do new changes in aluminum phosphide labels mean for burrowing mammal control? *Citrograph* 2:16–18.

Baldwin, R. A., and T. P. Salmon. 2011. The facts about rodenticides. *The Wildlife Professional* 5:50–53.

PRESENTATIONS

Extension Presentations

Over 245 presentations to various commodity groups, advisory committees, Master Gardener groups, universities, and private organizations.

Professional Presentations

Over 65 presentations at a variety of professional meetings and conferences, including The Wildlife Society National Conference, the Vertebrate Pest Conference, and the American Society of Mammalogists.

RESEARCH FUNDING

Extramural grants: Total funding \$2,055,624

Selected titles:

Rangeland forage loss from California ground squirrels. Vertebrate Pest Control Research Advisory Committee (January 2019 – June 2021).

An assessment of secondary toxicity risk for 0.005% diphacinone treated grain via three application strategies for California ground squirrels. Vertebrate Pest Control Research Advisory Committee (July 2017 – June 2019).

Assessing efficacy of zinc phosphide-coated cabbage for Belding's ground squirrel control. Vertebrate Pest Control Research Advisory Committee (January 2016 – July 2016).

Testing efficacy of anthraquinone as a vole repellent in citrus. Specialty Crop Block Grant (December 2015 – May 2018).

Ground squirrel best management practices website: expansion of passive extension capacities. Vertebrate Pest Control Research Advisory Committee (July 2015 – June 2017; Co PI).

Field efficacy trial of an artichoke bract-treated cholecalciferol + diphacinone bait for California vole control. Vertebrate Pest Control Research Advisory Committee (December 2012 – June 2014)

Reregistration of CDFA baits for control of roof rats and deer mice in agricultural fields. Vertebrate Pest Control Research Advisory Committee (April 2010 – March 2012).

Development of an integrated pest management program for vole control in artichokes. Specialty Crop Block Grant (October 2009 – September 2011).

Intramural grants: Total funding \$257,071

Industry/programmatic funding and in-kind support: Total funding \$182,394

PROFESSIONAL ACTIVITIES

Member of Vertebrate Pest Council since 2008; Executive Board member since 2012; Conference Chair for 2016 Vertebrate Pest Conference.

Peer reviewer of 109 manuscripts for Journals and Proceedings.

Professional society memberships:

The American Society of Mammalogists (2004), The International Bear Association (2003), Pesticide Applicators Professional Association (2008), The Southwestern Association of Naturalists (2001), and The Wildlife Society (1999).

Justine A. Smith

Postdoctoral Scholar
University of California, Berkeley
Mulford Hall, Berkeley, CA 94720
jsmith5@berkeley.edu • smithecology.net

Education

PhD 2017 University of California, Santa Cruz: Environmental Studies
BA 2010 University of Colorado, Boulder: Ecology and Evolutionary Biology, Anthropology

Academic Appointments

2020 University of California, Davis: Wildlife, Fish, and Conservation Biology
Assistant Professor
2017 – 2019 University of California, Berkeley: Environmental Science, Policy, and Management
Postdoctoral Scholar

Publications

13. **Smith, JA**, E Donadio, JN Pauli, MJ Sheriff, OR Bidder, and AD Middleton. 2019. Habitat complexity mediates the predator-prey space race. *Ecology*. **Featured on cover.**
12. Sebastián-González, E. et al. 2019. Scavenging in the Anthropocene: human impact drives macroecological patterns of vertebrate scavenger richness. *Global Change Biology*.
11. **Smith, JA**, E Donadio, JN Pauli, MJ Sheriff, and AD Middleton. 2019. Integrating temporal refugia into landscapes of fear: prey exploit predator downtimes to forage in risky places. *Oecologia* 189(4):883-890.
10. **Smith, JA**, TP Duane, and CC Wilmers. 2019. Moving through the matrix: promoting permeability for large carnivores in a human-dominated landscape. *Landscape and Urban Planning* 183:50-58.
9. **Smith, JA**, AC Thomas, T Levi, Y Wang, and CC Wilmers. 2018. Human activity reduces niche partitioning among three mesocarnivores. *Oikos* 127:890-901. **Altmetric: 186**
8. Wang, Y, **JA Smith**, and CC Wilmers. 2017. Residential development alters behavior, movement, and energetics in an apex predator, the puma. *PLoS ONE* 2(10):e0184687.
7. **Smith, JA**, JP Suraci, M Clinchy, A Crawford*, D Roberts, LY Zanette**, and CC Wilmers**. 2017. Fear of the human “super predator” reduces feeding time in large carnivores. *Proceedings of the Royal Society B: Biological Sciences* 284(1857):20170433. **Featured on cover, Altmetric: 216.**
**undergraduate author; **authors contributed equally*
6. Suraci, JP, M Clinchy, B Mugerwa, M Delsey, DW Macdonald, **JA Smith**, CC Wilmers, LY Zanette. 2016. A new Automated Behavioural Response system to integrate playback experiments into camera trap studies. *Methods in Ecology and Evolution* 8:957-964.
5. **Smith, JA**, Y Wang, and CC Wilmers. 2016. Spatial characteristics of residential development shift large carnivore prey composition. *Journal of Wildlife Management* 80(6):1040–1048.
4. Allen, ML, HU Wittmer, P Houghtaling, **JA Smith**, LM Elbroch, and CC Wilmers. 2015. The role of scent marking in mate selection by female pumas (*Puma concolor*). *PLoS ONE* 10(10):e0139087.
3. Wilmers, CC, B Nickel, CM Bryce, **JA Smith**, RE Wheat, and V Yovovich. 2015. The golden age of bio-logging: how animal-borne sensors are advancing the frontiers of ecology. *Ecology* 96(7):1741–1753. **Featured on cover.**
2. **Smith, JA**, Y Wang, and CC Wilmers. 2015. Top carnivores increase their kill rates on prey as a response to human-induced fear. *Proceedings of the Royal Society B: Biological Sciences* 282(1802):20142711. **Altmetric: 212**
1. **Smith, JA**, and LP Erb. 2013. Patterns of selective caching behavior of a generalist herbivore, the American pika (*Ochotona princeps*). *Arctic, Antarctic, and Alpine Research* 45(3):396–403.

Outreach Publications

How humans threaten pumas just by being nearby. 2016. *The Conversation*. (*Invited*)
 Pumas increase kill rates when disturbed by development. 2015. *Urban Wildlife News* 11(1):10-11.
 Large-scale foraging behavior of the American pika: linking behavior and environment. 2013. *Mountain Views* 7(2):14-17. (*Invited*)

Select Fellowships and Awards

2016 American Association of University Women: **American Dissertation Fellowship**
 2016 UC Santa Cruz, Social Sciences Division: **Dissertation Quarter Fellowship**
 2015 Phi Beta Kappa: **Norall Graduate Scholarship**
 2015 UC Santa Cruz, Graduate Division: **Three Minute Thesis® Grad Slam Winner**
 2014 UC Santa Cruz, Environmental Studies Department: **Teaching Assistant of the Year Award**
 2013 National Science Foundation: **Graduate Research Fellowship Program**
 2011 Phi Beta Kappa: **Crisp Graduate Fellowship**

Grants

Grants

Proposed	NSF IOS – Animal Behavior (co-wrote full proposal, listed as collaborator) Title: Collaborative Research: Risk and the Ecology of Scavengers
Pending	Prince Albert II of Monaco Foundation (co-wrote proposal, listed as collaborator)
\$291,298	Title: Conserving Puma-Camelid-Scavenger Interactions and their Ecosystem Effects in the Patagonian and High Andean Steppe. PI: Dr. Arthur D. Middleton.

Select Competitive Event, Travel, and Student Research Grants

The Wildlife Society: Wildlife Damage Management Working Group (2018) • Society for Conservation Biology (2016, 2017) • UCSC: Graduate Student Association (2016) • The Wildlife Society: Sac-Shasta Chapter (2014) • UCSC: Environmental Studies Department (2013 – 2016) • Indian Peaks Wilderness Alliance (2009) • University of Colorado: Undergraduate Research Opportunity Grant (2008 – 2009)

Presentations

Invited Seminars and Conference Presentations

2020 (*Scheduled*) Gordon Research Conference on Predator-Prey Interactions, Ventura, CA.
 2019 Annual Meeting of the Society for Experimental Biology, Seville, Spain.
 2019 Animal Behavior Seminar Series, University of California, Davis, CA.
 2018 Annual Conference of The Wildlife Society, Cleveland, OH.
 2017 Biological Sciences Department Seminar, Cal Poly, San Luis Obispo, CA.
 2017 Centro de Ecología Aplicada del Neuquén, Junín de los Andes, Argentina.
 2016 Wildlife, Fisheries and Conservation Seminar, UC Berkeley, CA.
 2016 Annual Conference of The Wildlife Society, Raleigh, NC.

Contributed Conference Presentations

Animal Behavior Society (2013) • American Society of Mammalogists (2016) • Bay Area Conservation Biology Symposium (2015, 2016) • Ecological Society of America (2014, 2018) • Gordon Research Conference on Predator-Prey Interactions (2014, 2016, 2018) • International Congress for Conservation Biology (2013) • North American Congress for Conservation Biology (2012, 2014, 2016) • North American Pika Conference (2010) • The Wildlife Society (2015, 2016, 2017, 2018, 2019)

Teaching and Mentoring

Co-Instructor

2019 (*Scheduled*) UC Berkeley: ESPM 290 – Seminar: Animal Movement Ecology and Analysis

2018 UC Berkeley: ESPM 290 – Seminar: Human Effects on Carnivore-Prey Interactions

Teaching Assistant

2013 UC Santa Cruz: ENVS 190 – Senior Capstone: Environmental Problem Solving
 2012 UC Santa Cruz: ENVS 100 – Ecology and Society
 2012 UC Santa Cruz: ENVS 120 – Conservation Biology
 2012 Wildlands Studies: Disappearing Glaciers & Endangered Wildlife

Invited Guest Lectures

UCSC ENVS 123: Animal Ecology and Conservation (2016) • UCSC ENVS 100: Ecology and Society (2015,2016) • UCSC BIOE 124: Mammalogy (2015) • West Valley College BIO 14: California Plants and Animals • UCSC ENVS 120: Conservation Biology

Mentoring

2017 – 19 UC Berkeley Graduate Research Mentor (4 PhD students, 1 MS student)
 2017 – 18 UC Berkeley Undergraduate Research: Internship Mentor (1 intern)
 2015 – 16 Santa Cruz Puma Project Undergraduate Internship: Internship Director/Mentor (18 interns)
 2015 Science Internship Program: High School Internship Mentor (1 intern)
 2012 – 16 Small Mammal Undergraduate Research Internship: Internship Director/Mentor (26 interns)

Professional Service

Organized Meetings, Events, and Symposia

2018 **Symposium:** *The Ecology of Fear: Linking Theory to Management Practice*, The Wildlife Society, Cleveland, OH.
 2017 **Conference:** *Bay Area Conservation Biology Symposium*, Society for Conservation Biology: Santa Cruz Chapter.
 2016 **Round Table:** “Going Beyond Diversity: Addressing Inequity and Exclusivity in Environmental Sciences”, Presenter: Cynthia Malone. Society for Conservation Biology: Santa Cruz Chapter.
 2016 **Panel:** “Diversity in Conservation”, Society for Conservation Biology: Santa Cruz Chapter.
 2016 **Seminar Series:** “Santa Cruz Conserves”, Society for Conservation Biology: Santa Cruz Chapter.

Service Positions

Wild Felid Research and Management Association: **California State Representative** (2015 – present)
 The Wildlife Society, Urban Wildlife Working Group: **Board Member** (2017 – present); **Web Manager** (2012 – present)
 Society for Conservation Biology, Santa Cruz Chapter: **Founder; President** (2015 – 2017)
 UC Santa Cruz Department of Environmental Studies, Undergraduate Curriculum Committee: **Graduate Student Representative** (2014 – 2016)

Media Appearances and Research Highlights

Radio and Podcasts

NPR: [Live from the Poundstone Institute](#) (2017) • NPR: [All Things Considered](#) (2017) • KABC (2017) • KSCO (2016, 2017) • KZSC (2015) • University of Cambridge: [The Naked Scientists](#) (2015) • BBC: [Science in Action](#) (2015)

Select Media Coverage

CBC World News	LA Times	Outside Magazine	Scientific American
Conservation Magazine	National Geographic	PLoS Ecology	SF Gate
Eureka! Lab	Nature	Popular Science	Smithsonian Magazine
Forbes	New Scientist	San Jose Mercury News	The Washington Post
High Country News	Newsweek (2X)	Science Magazine	The Wildlife Society (3X)

Ryan Meinerz 2908 Baronet Way Sacramento, CA 95833 Ph.(530)219-0687
rmeinerz@ucdavis.edu

WORK EXPERIENCE

Staff Research Associate II, (Jan 2013-Present)

University of California

Duties:

Implement experimental field studies to develop management strategies for controlling wildlife pests. Enter, analyze, and evaluate data collected and developed as part of the research effort and prepare reports to the Principal Investigator as appropriate. Provide timely communication to the Principal Investigator, cooperators, and others about projects using web-based list servers, newsletters, reports, presentations, publications, and personal communication. Supervise additional workers and volunteers during field activities. Assist in the design of experimental field studies of wildlife pests. Other duties as assigned.

Snail Kite Technician, (May 2012-Sept 2012)

Florida Cooperative Fish and Wildlife Research Unit

Duties:

Conducted, nest searches, banding, and band re-sight activities on the locally endangered Snail Kite; collected and disseminated information about the fauna to regional scientists; monitored behaviors of, and sampled vegetation used by Snail Kites; used GPS to navigate to, and map, locations of remote Snail Kite nesting areas; uploaded and maintained daily observation data; daily operation of airboats.

Ecologist/Consultant, (Jan 2009-Feb 2012)

Birdstrike Control Program, Willis, TX

Duties:

Lead consultant of the Bird Aircraft Strike Hazard (BASH) program at MacDill AFB and Houston Executive Airport; participated in the recommendations for, and establishment of, various wildlife-related projects through evaluation of information and data on damage hazards caused by various wildlife species; maintained wildlife observation and activity database; conducted daily wildlife monitoring and harassment (through dogs, pyrotechnics, firearms, remote-controlled vehicles etc.) to ensure optimal aircraft safety; ensured that wildlife damage management objectives are accomplished in keeping with applicable federal, state, and local laws and regulations; proper disposal of biohazards; provided monthly detailed professional reports to various military entities; used GPS and corresponding software to create maps of wildlife locations and area vegetation; coordinated meeting with various department heads to collectively solve wildlife issues.

Veterinary Technician, (Oct 2006-Jan 2009)

Buckhead Animal Clinic, Atlanta, GA

Duties:

Obtained and recorded patient histories; collected specimens and performed laboratory procedures; exposed and developed radiographs, assisted in diagnostic, medical, and surgical procedures; performed dental prophylaxes, provided animal care (feeding and cleaning).

Research Team Technician, (May 2004-Aug 2004)

University of Wisconsin-Stevens Point, Stevens Point, WI

Duties:

Assisted in the capture and processing (weights, measurements, sample taking) of both black bears and white-tailed deer; use of radio telemetry to determine locations of black bears; collected and disseminated information about the fauna to regional scientists; administered ear tags and radio collars on both black bears and white-tailed deer.

PUBLICATIONS

Peer-Reviewed Journal Publications

Baldwin, R. A., H. Halbritter, **R. Meinerz**, L. K. Snell, and Steve B. Orloff. 2019. Efficacy and nontarget impact of zinc phosphide-coated cabbage as a ground squirrel management tool. *Pest Management Science* 75:1847–1854.

Baldwin, R. A., **R. Meinerz**, G. W. Witmer, and S. J. Werner. 2018. The elusive search for an effective repellent against voles: an assessment of anthraquinone for citrus crops. *Journal of Pest Science* 91:1107–1113.

Baldwin, R. A., **R. Meinerz**, and G. W. Witmer. 2017. Novel and current rodenticides for pocket gopher *Thomomys* spp. management in vineyards: what works? *Pest Management Science*. 73:118-122.

Baldwin, R. A., **R. Meinerz**, and S. B. Orloff. 2016. Burrow fumigation versus trapping for pocket gopher (*Thomomys* spp.) management: a comparison of efficacy and cost effectiveness. *Wildlife Research* 43:389–397.

Baldwin, R. A., **R. Meinerz**, and G. Witmer. 2016. Cholecalciferol plus diphacinone baits for vole control: a novel approach to a historic problem. *Journal of Pest Science* 89: 129-135.

Baldwin, R. A., **R. Meinerz**, H. Jantz, and G. Witmer. 2015. Impact of capture and transportation methods on survival of small rodents during relocation events.. *The Southwestern Naturalist* 60(4): 385-389.

Baldwin, R. A., and **R. Meinerz**. 2015. Use of external characteristics for rapid identification of gender of pocket gophers. *Western North American Naturalist* 75(3): 251-258.

Baldwin, R. A., A. Chapman, C. P. Kofron, **R. Meinerz**, S. B. Orloff and N. Quinn. 2015. Refinement of a trapping method increases its utility for pocket gopher management. *Crop Protection* 77:176-180

Baldwin, R. A., **R. Meinerz**, and S. B. Orloff. 2014. The impact of attractants on pocket gopher trapping. *Current Zoology* 60(4): 427-428.

Symposia Proceedings

Baldwin, R. A., H. Halbritter, **R. Meinerz**, L. K. Snell, and S. B. Orloff. 2017. Zinc phosphide-coated cabbage for managing Belding's ground squirrels. In: Proceedings, 2017 Western Alfalfa Forage Symposium, Reno, NV.

Baldwin, R. A., **R. Meinerz**, and G. W. Witmer. 2016. Are cholecalciferol plus anticoagulant rodenticides a viable option for field rodents? Proceedings of the Vertebrate Pest Conference 27:407–410.

Baldwin, R. A., **R. Meinerz**, and S. B. Orloff. 2013. An update on tools for effective management of pocket gophers in alfalfa. Pages 119–124 *in* Proceedings, 2013 Western Alfalfa and Forage Symposium, Reno, NV.

Selected Non Peer-Reviewed Technical Publications

Baldwin, R. A., and **R. Meinerz**. 2016. Assessing the efficacy of carbon monoxide producing machines at controlling burrowing rodents. University of California, Davis. Final Report to CDFA.

Baldwin, R. A., and **R. Meinerz**. 2015. Field efficacy of 0.005% diphacinone pellets for control of California ground squirrels via spot treatment application. University of California, Davis. Final Report to Bell Laboratories, Inc.

Baldwin, R. A., **R. Meinerz**, and G. Witmer. 2015. A field test of rodenticides for pocket gopher (*Thomomys* spp.) control. University of California, Davis. Final Report to CDFA.

Baldwin, R. A., **R. Meinerz**, and G. Witmer. 2014. Field efficacy trial of cholecalciferol + diphacinone baits for California vole control. University of California, Davis. Final Report to CDFA.

Holsman, R. H., and **R. Meinerz**. 2004. A preliminary report on hunter effort and attitudes in Wisconsin's chronic wasting disease eradication zone: Results from the 2003 extended deer season. Stevens Point: University of Wisconsin-Stevens Point College of Natural Resources

EDUCATION

Master of Science program (Human Dimensions of Wildlife Management emphasis)

University of Wisconsin, Stevens Point (2003-2005)

- Focus on how the presence of Chronic Wasting Disease Impacted Hunter Effort in Wisconsin's Chronic Wasting Disease Eradication Zone through the design, implementation, and analysis of wildlife surveys.

Bachelor of Arts in Conservation and Environmental Science, and Classical Civilizations

University of Wisconsin, Milwaukee, (2003)

Catherine (Katie) E. Swift
412 Hao Street
Honolulu, HI 96821
Cell: (808) 284-8322 Work: (414) 410-7258
email: swiftk@liphatech.com

EDUCATION

Thesis: Laboratory Bioassays with Wild-caught Black (*Rattus rattus*) and Polynesian (*R. exulans*) Rats to Determine Minimum Amounts of Ramik® Green (0.005% diphacinone) and Exposure Times for Field Broadcast Applications in Hawaii (GLP Study)

M.S., Zoology, University of Hawaii (1998)

B.S., Geology, California Institute of Technology (1990).

EXPERTISE

- Federal and state pesticide regulations (FIFRA, Clean Water Act)
- Generating data (including GLP) for pesticide registrations
- Registration of pesticides under FIFRA (section 24c, section 3, section 18)
- Use of pesticides, including Integrated Pest Management (IPM)
- Small mammal control techniques
- Rodent biology, ecology and behavior
- Ecotoxicological assessments and ecological risk assessments
- Symptoms and treatment of rodenticide poisoning for humans, pets, and wildlife
- National Environmental Policy Act (NEPA), Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Animal Welfare Act
- Federal government contracting and grant management policies and procedures

SPECIALIZED EXPERIENCE

Manager of Regulatory Compliance 2016 -- present, Liphatech, Inc., Milwaukee, WI

- Maintains current registrations and obtains new rodenticide registrations in the U.S., Canada, Latin America, and the Middle East.
- Ensures compliance with Federal and state laws and regulations for pesticides.
- Conducting Registration Review with EPA for chlorphacinone, bromadiolone, and difethialone.
- Coordinates Registrants' Consortium for bromadiolone.
- Coordinates Registrants' Consortium for Avian Studies.
- Ensures compliance with export and import regulations for pesticides.
- Oversees response to pet and human exposures to company products.
- Provides expertise and technical assistance on rodent control issues.
- Represents the company to industry groups on regulatory affairs and endangered species issues.
- Supervises Quality Assurance Unit (QAU) for Good Laboratory Practices (GLP) compliance.
- Coordinates research for field efficacy data to support Federal and state rodenticide registrations.
- Ensures compliance with Endangered Species Act (ESA) requirements for product registration and use.

Invasive Species Biologist 2008–2016, U.S. Fish and Wildlife Service, Honolulu, HI

- Maintained current and obtained new rodenticide registrations for conservation uses in Hawaii.
- Coordinated eleven Federal and state agencies on rodent and mongoose control.
- Identified product registrations needed for rodent and mongoose control to protect native species and developed the strategies to obtain them.
- Funded research and prepared reports and publications for data packages for product registrations.
- Developed pesticide labels and worked with manufacturers, researchers, EPA, and the Hawai'i Pesticides Branch to obtain registrations.
- Oversaw the use of vertebrate pesticide labels in Hawai'i.
- Ensured compliance with Federal and state laws and regulations related to rodent and mongoose control.
- Maintained knowledge of current and new pesticide regulatory policies and decisions.
- Oversaw a multiagency team, interns, and contractors in project management, document writing and public outreach.
- Led presentations about rodent and mongoose control to agencies, regulators, users, and the public.
- Organized workshops, symposia, and other forums on pesticide uses, registrations, and rodent control.
- Partnered with USDA-WS to conduct two aerial broadcast operations with diphacinone to eradicate rats from two offshore islands in Hawai'i, obtaining compliance with all required state and Federal regulations.
- Coordinated the Toxicant Registration Working Group (Federal, state, and private wildlife managers).
- Detailed to agency headquarters (Arlington, VA) to draft USFWS guidelines for the use of rodenticides.
- Represented USFWS on Hawaii's interagency working group on Clean Water Act coverage of pesticide applications.

CONFERENCES AND PRESENTATIONS

Co-organizer:

- 1) Symposium on Rodenticide-Based Opportunities for Protection of Agriculture, Ecosystems and Public Health. International Chemical Congress of Pacific Basin Societies, Honolulu, HI. Dec. 15-20, 2010.
- 2) Also Moderator, Panel Discussion – Regulatory and policy issues around non-target mortality and environmental fate of rodenticides (Panel members: Meredith Laws, EPA, Office of Pesticide Programs; Rory Stark and Gary Young, USFWS, Office of Law Enforcement; Will Meeks, USFWS, National Wildlife Refuge System; Mark Tobin, USDA-WS-NWRC). 24th Vertebrate Pest Conference, Sacramento, CA. Feb. 22- 25, 2010.
- 3) Workshop on the Environmental Impact of Anticoagulant Rodenticides, 4th Pan Pacific Conference on Pesticide Science, Honolulu, HI. June 1-5, 2008.
- 4) 2nd National Rodent Summit, National Wildlife Research Center, Fort Collins, CO, Oct 19-21, 2004.

Session Chair:

- 1) Predator Control. Wetlands and Waterbird Workshop, The Wildlife Society, Kaneohe, HI, Oct. 4-5, 2011.
- 2) Special Symposium – Field Rodenticide Uses. 24th Vertebrate Pest Conference, Sacramento, CA. Feb. 22-25, 2010.

Invited Speaker:

- 1) "Rodent and mongoose control to protect native species". Hawai'i Conservation Alliance Public Lecture Series, Waikiki, HI. Aug. 29, 2012.
- 2) "A holistic approach to ecologically based invasive rodent management", Symposium on New Developments for Managing Invasive Species: What IPM has to offer Conservation in Hawai'i." Hawai'i Conservation Conference, Honolulu, HI, Jul. 31-Aug. 2, 2012.
- 3) "Innovative conservation in Hawai'i and other Pacific Islands: building support for broadscale use of rat poison for rodent and mongoose control." Biology Department seminar, Colgate University, Hamilton, NY. Apr. 17, 2012.
- 4) "Bait Station Use for Maximum Effectiveness", Predator Control in the Hawaiian Islands, Annual Workshop, The Wildlife Society, Honolulu, HI, Nov. 4-5, 2004.
- 5) "Bait Stations for Dummies: An Update and Review of Rodent Control in Conservation Areas", Hawai'i Conservation Conference, Honolulu, HI, Jul. 29-30, 2004.

Panelist:

- 1) "Invasive Slugs and Snails in Natural Areas: Their Impacts and Control", Hawai'i Conservation Conference, Honolulu, HI, Jul. 25-28, 2006.
- 2) "Predator Control Needs in Hawaii", Predator Control in the Hawaiian Islands, Annual Workshop, The Wildlife Society, Kaneohe, HI, Nov. 4-5, 2004.
- 3) "Broadcast Application of Rodenticides for Endangered Species and Ecosystem Restoration", Hawai'i Conservation Conference, Honolulu, HI, Jul.10-11, 2003.

PUBLICATIONS and REPORTS

- D'Alessio, M., T. Wang, **C.E. Swift**, M.S. Shanmungam, and C. Ray. 2018. A Tier-I leaching risk assessment of three anticoagulant compounds in the forested areas of Hawai'i. *Science of The Total Environment*, 630, pp.889-902.
- Dunlevy, P., and **C.E. Swift**. 2010. Nontarget risk and environmental fate of the broadcast application of a diphacinone rodenticide at Mokapu and Lehua Islands, Hawai'i. *Proc. 24th Vertebrate Pest Conference*: 140-145.
- Eisemann, J.D., **C.E. Swift**, P.A. Dunlevy, W.C. Pitt, and G.W. Witmer. 2010. Panel Discussion – Regulatory and policy issues around non-target mortality and environmental fate of rodenticides. *Proc. 24th Vertebrate Pest Conference*: 208-212.
- Eisemann, J.D. and **C.E. Swift**. 2006. Ecological and human health hazards from broadcast application of 0.005% diphacinone rodenticide baits in native Hawaiian ecosystems. *Proc. 22nd Vertebrate Pest Conference*: 413-433.
- Hess, S.C., **C.E. Swift**, E.W. Campbell III, R.T. Sugihara, and G.D. Lindsey. 2009. Controlling small mammals. Pp. 425-447 in T.K. Pratt, C.T. Atkinson, P.C. Banko, J.D. Jacobi, and B.L. Woodworth, editors, *Conservation Biology Hawaiian Forest Birds*. Yale University Press; New Haven, CT. 707 pp.
- Pitt, W.C, J.D. Eisemann, **C.E. Swift**, R. Sugihara, B. Dengler-Germain, and L. Driscoll. 2005. Diphacinone residues in free-ranging wild pigs following aerial broadcast of a rodenticide bait in a Hawaiian Forest. Unpublished Report QA-1077, National Wildlife Research Center; Fort Collins, CO. 37 pp.
- Swift, C.E.** 1998. Laboratory bioassays with wild-caught black (*Rattus rattus*) and Polynesian (*R. exulans*) rats to determine minimum amounts of Ramik Green (0.005% diphacinone) and exposure times for field broadcast applications in Hawai'i. University of Hawai'i, Manoa, Honolulu, HI.

Exhibit A6

CURRENT & PENDING SUPPORT

University will provide current & pending support information for Key Personnel identified in Exhibit A2 at time of proposal and upon request from State agency. The "Proposed Project" is this application that is submitted to the State. Add pages as needed.

PI: Roger Baldwin					
Status (currently active or pending approval)	Award # (if available)	Source (name of the sponsor)	Project Title	Start Date	End Date
Proposed Project	NA	CDFA	An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards	1/1/2020	12/31/2020
CURRENT	17-0218-000-SA	CDFA	An assessment of secondary toxicity risk for 0.005% diphacinone treated grain via three application strategies for California ground squirrels	7/1/2017	12/31/2019
CURRENT	18-0488-000-SA	CDFA	Rangeland forage loss from California ground squirrels	1/1/2019	6/30/2021
CURRENT	18-0433-000-SA	CDFA	An assessment of secondary impacts of anticoagulant rodenticides on predators	11/1/2018	6/30/2021
CURRENT	NA	Western IPM Center	Rodent management workgroup	12/1/2018	6/30/2020
PENDING	NA	CDFA	Determination of impact of pocket gophers on grape production	11/1/2019	4/30/2022
Justine Smith					
Status	Award #	Source	Project Title	Start Date	End Date
Proposed Project	NA	CDFA	An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards	1/1/2020	12/31/2020
CURRENT	NA	Prince Albert of Monaco Foundation	Conserving puma-camelid-scavenger interactions and their ecosystem effects in the Patagonian and high Andean steppe	1/1/2018	12/31/2020
Ryan Meinerz					
Status	Award #	Source	Project Title	Start Date	End Date
Proposed Project	NA	CDFA	An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards	1/1/2020	12/31/2020
CURRENT	17-0218-000-SA	CDFA	An assessment of secondary toxicity risk for 0.005% diphacinone treated grain via three application strategies for California ground squirrels	7/1/2017	12/31/2019
CURRENT	18-0488-000-SA	CDFA	Rangeland forage loss from California ground squirrels	1/1/2019	6/30/2021
CURRENT	18-0433-000-SA	CDFA	An assessment of secondary impacts of anticoagulant rodenticides on predators	11/1/2018	6/30/2021
PENDING	NA	CDFA	Determination of impact of pocket gophers on grape production	11/1/2019	4/30/2022

Katie Swift					
Status	Award #	Source	Project Title	Start Date	End Date
Proposed Project	NA	CDFA	An assessment of quantitative indexing tools and movement patterns in invasive roof rats in citrus orchards	1/1/2020	12/31/2020
CURRENT	NA	Western IPM Center	Rodent management workgroup	12/1/2018	6/30/2020
CURRENT	NA	Structural Pest Control Board	Investigation of Rodenticide Pathways in an Urban System Through the Use of Isotopically Labelled Bait	9/1/2018	11/30/2020

Exhibit A7

Third Party Confidential Information

Confidential Nondisclosure Agreement

(Identified in Exhibit A, Scope of Work – will be incorporated, if applicable)

If the Scope of Work requires the provision of third party confidential information to either the State or the Universities, then any requirement of the third party in the use and disposition of the confidential information will be listed below. The third party may require a separate Confidential Nondisclosure Agreement (CNDA) as a requirement to use the confidential information. Any CNDA will be identified in this Exhibit A7.

N/A

Exhibit B - Budget

Budget for Project Period

Principal Investigator (Last, First):

Baldwin, Roger

Exhibit B

COMPOSITE BUDGET FOR ENTIRE PROPOSED PROJECT PERIOD					
07/01/2016 to 06/30/2019					
	From: To:	01/01/2020 12/31/2020			
BUDGET CATEGORY		Year 1	Year 2	Year 3	TOTAL
PERSONNEL: <i>Salary and fringe benefits.</i>		\$31,117	\$0	\$0	\$0
TRAVEL		\$15,972	\$0	\$0	\$0
MATERIALS & SUPPLIES		\$18,721	\$0	\$0	\$0
EQUIPMENT		\$0	\$0	\$0	\$0
CONSULTANT		\$0	\$0	\$0	\$0
SUBRECIPIENT		\$0	\$0	\$0	\$0
OTHER DIRECT COSTS (ODC)	<i>Subject to IDC Calc</i>				
ODC #1	Y	\$2,200	\$0	\$0	\$0
ODC #2	Y	\$4,094	\$0	\$0	\$0
ODC #3	Y	\$0	\$0	\$0	\$0
ODC #4	Y	\$0	\$0	\$0	\$0
ODC #5	Y	\$0	\$0	\$0	\$0
ODC #6	Y	\$0	\$0	\$0	\$0
TOTAL DIRECT COSTS		\$72104	\$0	\$0	\$0
Indirect (F&A) Costs	<u>F&A Base</u> <i>Rate 10%</i>				
	<u>TDC *</u>	\$72104	\$0	\$0	\$0
		\$7210	\$0	\$0	\$0
TOTAL COSTS PER YEAR		\$79,314	\$0	\$0	
TOTAL COSTS FOR PROPOSED PROJECT PERIOD					\$0

* MTDC = Modified Total Direct Cost

JUSTIFICATION. See Exhibit B1 - Follow the budget justification instructions.

Funds Reversion Dates: Unless otherwise specified, fund reversion dates are three years from fiscal year end of year funded

Annual Budget Flexibility (lesser of % or Amount)

Prior approval required for budget changes between approved budget categories above the thresholds identified.

%	10.00%
	<i>Or</i>
Amount	\$10,000

Exhibit B1

Budget Justification

The Budget Justification will include the following items in this format.

Personnel

Name. Starting with the Principal Investigator list the names of all known personnel who will be involved on the project for each year of the proposed project period. Include all collaborating investigators, individuals in training, technical and support staff or include as “to be determined” (TBD).

Role on Project. For all personnel by name, position, function, and a percentage level of effort (as appropriate), including “to-be-determined” positions.

Salary costs use fiscal year 2019/2020 (July 1, 2019 through June 30, 2020) rates.

Ryan Meinerz (Staff Research Associate II): Ryan will largely lead coordination of data collection. This will include travel to field sites to conduct all aspects of this study. Extensive lab time will be required for analyzing data as well. Effort is estimated at 870 hours at an hourly rate of \$23.24 (PY1 = \$20,219).

Fringe Benefits.

In accordance with University policy, explain the costs included in the budgeted fringe benefit percentages used, which could include tuition/fee remission for qualifying personnel to the extent that such costs are provided for by University policy, to estimate the fringe benefit expenses on Exhibit B.

Employee Benefits are based on Federally Approved Composite Benefit Rates. The University of California’s current Composite Benefit Rates have been federally reviewed and approved through June 30, 2020.

Ryan Meinerz (Staff Research Associate II): Fringe benefits calculated at 53.1% for 6 months and 54.7% for 6 months of salary (PY1 = \$10,898).

Travel

Itemize all travel requests separately by trip and justify in Exhibit B1, in accordance with University travel guidelines. Provide the purpose, destination, travelers (name or position/role), and duration of each trip. Include detail on airfare, lodging and mileage expenses, if applicable. Should the application include a request for travel outside of the state of California, justify the need for those out-of-state trips separately and completely.

Trip 1: From Jan 15 to Jan 31, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with site establishment and initiation of sampling protocol. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,790 miles round trip). Mileage is for a rental vehicle (\$0.26/mile). The trip is anticipated to be 17 days/16 nights in duration with hotel (\$75/night for 16 nights) and meals (\$15/day x 17 days per trip) associated with this trip (PY1 = \$1,920).

Trip 2: From Jan 15 to Jan 22, 2020, PI will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with site establishment and initiation of sampling protocol. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,160 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 8 days/7 nights in duration with hotel (\$75/night for 7 nights) and meals (\$15/day x 8 days per trip) associated with this trip (PY1 = \$1,318).

Trip 3: From Jan 29 to Mar 13, 2020, SRA will travel from Lindcove Research and Extension Center to field sites to assist SRA II with trapping, collaring, and indexing protocols. We anticipate 23 trips being made at 35 miles roundtrip (anticipated at 805 total miles). Mileage will be reimbursed at a rate of \$0.58/mile (PY1 = \$467).

Trip 4: From Feb 3 to Feb 20, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with indexing protocols and trapping. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,860 miles round trip). Mileage is for a rental vehicle (\$0.26/mile). The trip is anticipated to be 18 days/17 nights in duration with hotel (\$75/night for 17 nights) and meals (\$15/day x 18 days per trip) associated with this trip (PY1 = \$2,029).

Trip 5: From Feb 3 to Feb 10, 2020, PI will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with indexing protocols and trapping. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,160 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 8 days/7 nights in duration with hotel (\$75/night for 7 nights) and meals (\$15/day x 8 days per trip) associated with this trip (PY1 = \$1,318).

Trip 6: From Feb 23 to Mar 13, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with indexing protocols and trapping. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 2,000 miles round trip). Mileage is for a rental vehicle (\$0.26/mile). The trip is anticipated to be 20 days/19 nights in duration with hotel (\$75/night for 19 nights) and meals (\$15/day x 20 days per trip) associated with this trip (PY1 = \$2,245).

Trip 7: From Feb 23 to Mar 1, 2020, PI will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond with indexing protocols and trapping. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,160 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 8 days/7 nights in duration with hotel (\$75/night for 7 nights) and meals (\$15/day x 8 days per trip) associated with this trip (PY1 = \$1,318).

Trip 8: From Mar 20 to Mar 22, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond to data collection from rat movements. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 810 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 3 days/2 nights in duration with hotel (\$75/night for 2 nights) and meals (\$15/day x 3 days per trip) associated with this trip (PY1 = \$665).

Trip 9: From Apr 1 to Apr 3, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond to data collection from rat movements. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 810 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 3 days/2 nights in duration with hotel (\$75/night for 2 nights) and meals (\$15/day x 3 days per trip) associated with this trip (PY1 = \$665).

Trip 10: From Apr 14 to Apr 16, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond to data collection from rat movements. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 810 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 3 days/2 nights in duration with hotel (\$75/night for 2 nights) and meals (\$15/day x 3 days per trip) associated with this trip (PY1 = \$665).

Trip 11: From Apr 27 to Apr 29, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond to data collection from rat movements. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 810 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 3 days/2 nights in duration with hotel (\$75/night for 2 nights) and meals (\$15/day x 3 days per trip) associated with this trip (PY1 = \$665).

Trip 12: From May 10 to May 22, 2020, SRA II will travel from Davis to anticipated field site in the Bakersfield area (TBD). This travel will correspond to data collection from rat movements, removal of collars from rats, and removal of remaining equipment. Mileage will include travel to closest hotel locations, as well as to field sites in each area (anticipated at 1,510 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). The trip is anticipated to be 13 days/12 nights in duration with hotel (\$75/night for 12 nights) and meals (\$15/day x 13 days per trip) associated with this trip (PY1 = \$1,971).

Trips 13-14: Travel from Davis to VPCRAC meeting sites (TBD) to provide updates on project. Mileage will include travel to closest hotel locations, as well as to meeting location (anticipated at 350 miles round trip). Mileage is for a personal vehicle (\$0.58/mile). Trips are anticipated to be 2 days/1 night in duration with associated hotel (\$100/night) and meals (\$30/day x 2 days per trip) associated with each trip. Total cost per trip estimated at \$363. Two trips are anticipated during the project period. Travel reimbursement will be claimed by either R. Baldwin or R. Meinerz (PY1 = \$726).

Materials and Supplies

Itemize materials supplies in separate categories. Include a complete justification of the project's need for these items. Theft sensitive equipment (under \$5,000) must be justified and tracked separately in accordance with State Contracting Manual Section 7.29.

Bait for traps, cameras, and tracking tunnels (\$175)

Miscellaneous field items (e.g., flags, flagging tape, data notebooks, etc. = \$200)

PowerTag transmitters (\$220/tag × 30 tags = \$6,600)

Collars for PowerTags (\$7.70/tag × 30 tags = \$231)

Sensor stations (\$428/station × 2 stations = \$856)

Sensor station cases (\$66/case × 2 cases = \$132)

Readable displays for sensor stations (\$33/display × 2 displays = \$66)

Data plans for sensor stations (\$333/station × 2 stations = \$666)

Sensor nodes (\$137.50/node × 56 nodes = \$7,700)

Shipping costs for Cell Tracking items (\$100)

Solar panels and mounting kits to operate sensor stations ($\$225/\text{station} \times 2 \text{ stations} = \450)

12-volt marine batteries to power sensor stations ($\$90/\text{battery} \times 2 \text{ batteries} = \180)

Antennas for sensor stations ($\$40/\text{antenna} \times 2 \text{ stations} = \80)

Coaxial cables for sensor stations ($\$33/\text{cable} \times 2 \text{ cables} = \66)

Tripods for mounting sensor stations ($\$50/\text{tripod} \times 2 \text{ sensor stations} = \100)

1-1/4 inch conduit for mounting nodes ($\$19/\text{section} \times 26 \text{ sections} = \494)

1 inch conduit for mounting nodes and antennas ($\$11/\text{section} \times 55 \text{ sections} = \605)

Screws for attaching conduit ($\$10/\text{pack} \times 2 \text{ packs} = \20)

Equipment

List each item of equipment (greater than or equal to \$5,000 with a useful life of more than one year) with amount requested separately and justify each.

Consultant Costs

Consultants are individuals/organizations who provide expert advisory or other services for brief or limited periods and do not provide a percentage of effort to the project or program. Consultants are not involved in the scientific or technical direction of the project as a whole. Provide the names and organizational affiliations of all consultants. Describe the services to be performed, and include the number of days of anticipated consultation, the expected rate of compensation, travel, per diem, and other related costs.

Subawardee (Consortium/Subrecipient) Costs

Each participating consortium organization must submit a separate detailed budget for every year in the project period in Exhibit B2 Subcontracts. Include a complete justification for the need for any subawardee listed in the application.

Other Direct Costs

Itemize any other expenses by category and cost. Specifically justify costs that may typically be treated as indirect costs. For example, if insurance, telecommunication, or IT costs are charged as a direct expense, explain reason and methodology.

A rental truck will be needed to haul supplies around for project. The rental truck also comes with a lower mileage rate which will help offset rental costs. The cost of the rental truck is \$1,100/month. We will need the rental truck for 2 months.

Staff Research Associate (SRA): SRA from UC ANR Lindcove Research and Extension Center will be used to assist SRA II with trapping, collaring, and indexing activities. SRA will provide assistance for 178 hours at a recharge rate of \$23/hour (PY1 = \$4,094). No fringe benefits are required for SRA from Lindcove Research and Extension Center. These benefits are included in the recharge rate.

Rent

If the Scope of Work will be performed in an off-campus facility rented from a third party for a specific project or projects, then rent may be charged as a direct expense to the award.

Indirect (F&A) Costs

Indirect costs are calculated in accordance with the budgeted indirect cost rate in Exhibit B.

Per the agreement between the University of California and the California Department of Food and Agriculture, indirect costs have been calculated at 10% Total Direct Cost (TDC) for the project (PY1 = \$7,210).

Exhibit B3 – Invoice Elements

Invoice and Detailed Transaction Ledger Elements

In accordance with Section 14 of Exhibit C – Payment and Invoicing, the invoice, summary report and/or transaction/payroll ledger shall be certified by the University’s Financial Contact and the PI (or their respective designees).

Invoicing frequency

Quarterly Monthly

Invoicing signature format

Ink Facsimile/Electronic Approval

Summary Invoice – includes either on the invoice or in a separate summary document – by approved budget category (Exhibit B) – expenditures for the invoice period, approved budget, cumulative expenditures and budget balance available¹

- Personnel
- Equipment
- Travel
- Subawardee – Consultants
- Subawardee – Subcontract/Subrecipients
- Materials & Supplies
- Other Direct Costs
 - TOTAL DIRECT COSTS (if available from system)
- Indirect Costs
 - TOTAL

Detailed transaction ledger and/or payroll ledger for the invoice period ²

- University Fund OR Agency Award # (to connect to invoice summary)
- Invoice/Report Period (matching invoice summary)
- GL Account/Object Code
- Doc Type (or subledger reference)
- Transaction Reference#
- Transaction Description, Vendor and/or Employee Name
- Transaction Posting Date
- Time Worked
- Transaction Amount

¹ If this information is not on the invoice or summary attachment, it may be included in a detailed transaction ledger.

² For salaries and wages, these elements are anticipated to be included in the detailed transaction ledger. If all elements are not contained in the transaction ledger, then a separate payroll ledger may be provided with the required elements.

Exhibit C – University Terms and Conditions

CMA (AB20) State/University Model Agreement Terms & Conditions UTC-319

<https://www.dgs.ca.gov/OLS/Resources/Page-Content/Office-of-Legal-Services-Resources-List-Folder/Model-Contract-Language>