UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

II. Academic Program Review Dossier Cover Page | 2024 Cycle

Name, Lived Name: **Preferred Pronoun(s):**	Andrew Mason Sutherland
Academic Title:	Full Cooperative Extension Advisor
County/Program:	San Francisco Bay Area (UCCE Alameda) / UC IPM
Review Type:	Merit
Current Rank/Step:	Full Title II
Requested Rank/Step:	Full Title III
Review Time Period:	October 1, 2020 to September 30, 2023
Thematic Areas:	Pest Management (Urban) • improved water quality • improved community health and wellness • increased workforce retention and competency • improved air quality

Position Description
Andrew Sutherland
March 31, 2015
Area Urban Integrated Pest Management Advisor

I. NATURE AND PURPOSE:

Integrated Pest Management (IPM) combines available pest management technologies including cultural, chemical, and biological controls plus ecology and systems science with the goal of producing an ecologically and economically sound production or maintenance system. IPM stresses an interdisciplinary approach to the science and practice of pest management and is a major focus of ANR's Endemic and Invasive Pests and Diseases Strategic Initiative.

The Urban IPM Advisor is a key member of the UC Statewide IPM Program's (UC IPM) academic team. The Urban IPM Advisor will develop and implement ecologically and economically sound IPM programs. These programs are long term, involving such areas as pest identification, prevention, monitoring, development of thresholds, and the integration of management tactics, including cultural, physical, biological, and chemical controls.

The IPM Advisor is expected to develop new strategies, and adapt or implement strategies already available or being developed in cooperation with CE Advisors, Specialists and AES Faculty. Special emphasis will be given to solving local problems under the UC IPM Statewide Programmatic mission.

The position is headquartered at the Alameda County CE offices and serves the counties of Alameda, San Mateo-San Francisco, Santa Clara, and Contra Costa. However, because IPM Advisors are academic members of a Statewide Special Program, IPM Advisors may serve CE Advisors or other clientele in other counties as needed. In addition to CE Advisors, clientele include structural pest management professionals (PMPs), urban pest control advisers (PCAs), professional landscape managers (PLMs), housing management professionals (HMPs), municipalities, and other related businesses and agencies.

II. ACADEMIC PROGRAM MAJOR RESPONSIBILITIES:

- Conduct IPM programs in the San Francisco Bay region, with emphasis on interdisciplinary projects that affect management of arthropod pests in and around urban structures.
- Conduct and report regular needs assessments to identify priority issues or problems relevant to the local clientele groups being served.
- Work with UC IPM Program headquarters staff to assist in the development of IPM manuals, Pest Management Guidelines, Pest Notes, and web pages, and to promote their use. Attend and participate in UC IPM Planning and Coordinating meetings to communicate field-based IPM perspectives to Program staff and provide expertise in IPM issues.
- Identify and communicate about data gaps and information transfer problems reported by CE Advisors, PCAs, PMPs, PLMs, HMPs, municipalities and agencies to other Cooperative Extension and Experiment Station academics, members of the UCIPM Program, and UC DANR administration.
- Work with regulatory agencies to initiate, contribute to and develop management strategies for invasive species and new or exotic pests in the region.
- Initiate, coordinate, and conduct educational programs and adaptive research projects

to implement IPM and assist clientele in solving pest and pesticide-related problems.

- Initiate, coordinate, conduct, and participate in adaptive IPM research projects of significant importance to the San Francisco Bay region. Of particular emphasis are those that are interdisciplinary in nature and deemed significant by UC IPM, UC Cooperative Extension, Experiment Stations, and/or DANR Workgroups.
- Initiate, coordinate, conduct, and participate in educational programs promoting IPM strategies and tactics. Using accepted or innovative extension techniques, these educational programs will be delivered to clientele groups and other interested parties.

III. PROGRAM LEADERSHIP

- *Local Delivery of Statewide Programs*: Represent UCCE programs locally in a professional manner; ensure clientele needs are assessed, support the development of priority program goals to successfully meet clientele needs, in alignment with ANR's statewide Strategic Vision and initiatives; oversee delivery of UC ANR statewide programs at the local and regional level; work with staff to ensure that outcomes and impacts are measured and communicated; and interact with UC ANR Program Teams, Specialists and others within the research/extension network to develop, strengthen and expand the local delivery of statewide programs.
- Demonstrate concern for all staff; effectively manage all personnel supervision, oversight, annual evaluations, merits and promotions, and invest in improving all staff expertise and support professional development.

IV. AFFIRMATIVE ACTION

- Comply with all applicable federal and state laws and regulations, and all University policies regarding affirmative action, including prohibition of discrimination on the basis of race, color, national origin, religion, sex, sexual orientation, physical or mental disability, age, veteran status, medical condition, ancestry or marital status.
- Promote, in all ways consistent with other responsibilities of the position, accomplishment of the affirmative action goals established by UC ANR.
- Take all measures necessary to assure that any employee or volunteer workers supervised by this position fulfill their affirmative action responsibilities.
- Plan and conduct programs in such a manner as to provide equitable service to all ethnic and gender groups that comprise the potential clientele population for the program.
- Identify any barriers to clientele participation related to ethnicity, gender, or other characteristic of concern under the University's affirmative action policies, and take corrective active as needed to remove such barriers.
- Collect, and keep current, available demographic data identifying the self-reported ethnic and gender distribution of the potential clientele populations for the program and describing other characteristics of the population relevant to the pursuit of the Division's affirmative action goals.
- Complete CASA reporting as required.

V. RELATIONSHIPS

A. Administrative:

The position is headquartered at the Alameda County CE office. The County Director and the UC IPM Program Director are responsible for matters concerning merit and

promotion.

B. Working:

The major responsibility of the Urban Area IPM Advisor is to develop and implement ecologically and economically sound pest management strategies by providing linkages among the urban pest management industry, environmental and community issues, and his/her pest management discipline(s). These IPM implementation programs are presented through CE Advisors to PMPs, PLMs, HMPs, PCAs, agencies and related professional societies or groups, serving educational roles. Close working relationships with other UC IPM Program academics are essential for successful program development.

VI. QUALIFICATIONS

A masters or Ph.D. degree in an area of entomology or applied IPM and several years of practical field experience in pest management are required. A broad understanding of urban pest management principles, including knowledge of cultural, biological, and chemical control is required. Quantitative research skills and experience with experimental design are required.

This position requires the ability to work effectively on an interdisciplinary basis with CE Specialists, CE Advisors, Experiment Station academics, PMPs, PLMs, HMPs, PLMs, agencies, and other related groups as well as the ability to communicate effectively, both verbally and in writing.

The position requires extensive travel within California and occasionally outside the state. The Area IPM Advisor must obtain a Qualified Pesticide Applicator Certificate (QAC) or License prior to applying or supervising the application of any pesticide.

Must demonstrate:

- The ability to communicate and extend technical information in an understandable manner.
- The ability to work with people having a diversity of views and values, to motivate people and to adapt to changing situations.
- Literacy in internet communications and with software to support research and education programs.

Andrew Sutherland, Area IPM Advisor

Rob Bennaton, County Director, Alameda County

Kassim Al-Khatib, Director UC IPM Program

Chris Greer, Vice Provost

Merit (Full Title II to Full Title III):

Dr. Andrew M. Sutherland – SF Bay Area Urban Integrated Pest Management Advisor

My appointment is that of ***Urban Integrated Pest Management (IPM) Advisor***; serving Alameda (30% FTE), Contra Costa (30% FTE), San Francisco (15% FTE), Santa Clara (15% FTE), and San Mateo (10% FTE) counties; and working towards broader geographic impacts within the statewide IPM program (UC IPM). Activities reported here showcase accomplishments during October 1, 2020 – September 30, 2023.

My clientele base includes structural, industrial, and household pest control operators (PCOs); urban pest management professionals (PMPs); government agencies; municipalities; school districts; University of California Cooperative Extension (UCCE) Master Gardeners (MGs); and extenders of integrated pest management (IPM) to the urban public, such as retail store staff, housing and lodging managers, and childcare providers. Urban pests threaten public health and structures and may represent nuisances. Management of urban pests may lead to negative impacts on the local environment and community. Program goals are to provide education, research, and extension of IPM information and resources to mitigate problems associated with urban pests and their management in the SF Bay Area. My program aims to increase provision of effective IPM services by professionals and demand for these services by the public. These shifts will be associated with reductions in unnecessary pesticide applications and improvements in efficacy. These outcomes will lead to important impacts, such as improved environmental quality and improved community health. My work is focused within the ANR Program Area 'Pest Management' and apportioned to the following ANR Condition Changes:

- Improved water quality (50% yearly FTE)
- Improved community health and wellness (25% yearly FTE)
- Increased workforce retention and competency (15% yearly FTE)
- Improved air quality (10% yearly FTE)

Significant accomplishments during this review term:

- **Research:** I have developed a focused research program based on evolving clientele needs and ANR's Strategic Vision. ***I received, as PI, $ 516,119 in competitive funding during this term.***
- **Extension:** I have addressed clientele needs and community issues using varied extension methods, directly reaching thousands of client individuals via organization of meetings (10), delivery of educational presentations (43), collaboration on educational videos (7), creation or collaboration on online training modules (5), engagement and collaboration with mass media (11), trade magazine articles (2), UC ANR blog posts (4), UC IPM newsletter articles (3), and hundreds of consultations.
- **Demonstration of Professional Competence** via maintenance of licenses and certifications; as an invited speaker, reviewer, judge, and editor; and as an elected or appointed committee member.
- **University Service:** I served as ANR's Associate Editor of Pest Management – Urban (October 2016 – ongoing), and as a member of ANR's EIPD Strategic Initiative Panel (April 2018 – ongoing).
- **Public service** via public presentations, guest lectures, mass media publications, mentorship (11 mentees), and ***dissemination of information and resources to 135 members of the residential public***.

Other noteworthy accomplishments during this term included:

- Outreach to 1950 professional followers on LinkedIn via 90 posts, 86 reposts, 460 comments, and hundreds of discussions, totaling 189,057 unique reactions (highest of all UC ANR academics): https://www.linkedin.com/in/andrew-sutherland-phd-bce-84b54212/

- Collaborative creation of an interactive and "gamified" module for tenants in multi-unit housing environments focused on bed bug education and prevention: https://stopbedbugs.org/
- Creation and curation of two video-based on-demand educational modules for initial training of UCCE Master Gardener volunteers, enabling standardized curricula throughout the State.
- Authorship and publication of two peer-reviewed scholarly journal publications, a peer-reviewed UC ANR publication, three scientific proceedings papers, and three scientific abstracts.
- Reception of ***two achievement awards*** (California Department of Pesticide Regulation, International IPM Symposium) and ***one distinguished service award*** (Entomological Society of America).
- As ANR Associate Editor, ***leadership of the review process for 16 UC IPM* Pest Notes**.
- UC ANR service via participation in the Ad Hoc Peer Review Committee, ANR academic and staff search committees, the Pest Management Program Team, and two ANR Work Groups.
- Demonstration of commitment to Affirmative Action mandates; Equity, Diversity, & Inclusion goals.

Statement on overall programmatic outcomes and impacts:

My program's research findings have led to significant changes in pest control practices regionally, statewide, nationally, and globally. My work evaluating bait systems for subterranean termites has helped pest control operators to target optimum seasons for bait system installation. My work demonstrating proactive (based on property wide monitoring) IPM programs for bed bugs has informed national service protocols for the bed bug control industry. My work demonstrating the efficacy of eliminating large populations of outdoor nuisance cockroaches in California has resulted in new protocols established by large pest control companies and has led to global discussions about baits versus sprays for peridomestic cockroach species. These changes in client behavior have already started to improve IPM efficacy, thereby reducing unnecessary pesticide applications, reducing costs, reducing pesticide exposure risks, reducing environmental contamination risks, and improving public health and wellbeing. My emergent impacts on the national pest control industry were recently highlighted in a trade magazine article.

EXTENDING KNOWLEDGE & INFORMATION / APPLIED RESEARCH & CREATIVE ACTIVITY

Theme #1: IPM for termites

Termites cause millions of dollars of damage to wooden structures in CA, resulting in control programs reliant upon pesticides. IPM programs for termites increase efficacy, decrease number of insecticide applications, decrease insecticide exposure, decrease environmental contamination, and increase economic viability for the industry and its stakeholders.
Clientele: Pest management professionals within California's structural pest control industry.
Goals: Evaluate relative efficacy and cost of IPM strategies and tactics, develop new management tools and techniques, and increase adoption of and demand for IPM services relating to termite management.
Methods Used During Review Term (see tables, visit hyperlinks for details): applied field research and demonstrative field research conducted, one peer-reviewed scholarly journal article published, one scientific abstract published, two trade magazine articles published, one blog article published, one popular media video collaboratively produced, three mass media (news) stories contributed, one technical media story contributed, one free online seminar recorded, and ten oral presentations provided.
Outcomes and Impacts: Research outcomes included significant reductions in termite incidence (100% of 15 single-family homes) and development of new monitoring and management strategies for subterranean termites (five pest control operator companies). Increases in knowledge among program participants (100% of five responding companies) were associated with termite biology and ecology,

preventive tactics, monitoring tools, detection techniques, legal roles / responsibilities, and evaluation tactics. Changes in client behavior included increases in monitoring services offered, increases in preventive and nonchemical control services offered, and decreases in unnecessary termiticide applications (anecdotal and testimonial). ***Testimonials and observations indicate acceleration of these behavior changes within California's pest control industry***. Potential impacts include improved control efficacy, reductions in economic losses due to termites, and improved environmental quality**.**

Theme #2: IPM for bed bugs

Bed bugs are serious urban pests that cause physical and emotional harm, resulting in control programs reliant upon insecticides. IPM programs for bed bugs have the potential to increase pest control efficacy, decrease number of insecticide applications, decrease potential for insecticide exposure, increase community well-being, and increase economic viability for the pest control industry and its stakeholders.
Clientele: Pest management professionals within California's structural pest control industry, housing management professionals, others engaged in bed bug prevention and management.
Goals: Evaluate relative efficacy and cost of IPM strategies and tactics, develop new management tools and techniques, and increase adoption of and demand for IPM services relating to bed bug management.
Methods Used During Term (see tables, visit hyperlinks for details): one scientific abstract published, three meetings organized, one virtual educational module created, four oral presentations provided, and one educational web site created and maintained.
Outcomes and Impacts: Research outcomes included significant decreases in bed bug incidence (100% reduction in individual cases, up to 88% reduction property-wide) and infestation severity (up to 99% reduction in individual cases) at demonstration sites as well as development of new monitoring and management strategies, especially in multi-unit housing environments. Increases in knowledge among program participants (75%) have been associated with bed bug biology and ecology, preventive tactics, monitoring tools, detection techniques, legal roles / responsibilities, and evaluation tactics. Changes in behavior included increases in monitoring services offered, increases in preventive and nonchemical control services offered, and decreases in substandard contracting (anecdotal, observational, and limited survey information). These outcomes will drive increases in control efficacy, decreases in unnecessary pesticide applications, decreases in pesticide exposure events, and improved community health.

Theme #3: IPM for cockroaches

Cockroaches represent significant public health and nuisance pests, resulting in control programs reliant upon pesticides. IPM programs for cockroaches have the potential to increase control efficacy, decrease insecticide applications, decrease potential for insecticide exposure, decrease potential for environmental contamination, and increase economic viability for the pest control industry and its stakeholders.
Clientele: Pest management professionals within California's structural pest control industry, public school districts, housing environments, other institutional and industrial environments.
Goals: Evaluate efficacy and cost of IPM strategies and tactics, develop new management tools and techniques, and increase adoption of and demand for cockroach IPM services.
Methods Used During Term (see tables, hyperlinks for details): applied field research and applied lab research conducted, two proceedings articles published, one scientific abstract published, one interactive

hands-on workshop provided, two videos collaboratively produced, two fact sheets collaboratively produced, one new UC IPM info page collaboratively produced, and eight oral presentations provided.
Outcomes and Potential Impacts: Research outcomes included significant reductions in cockroach density (up to 99% reductions at two public school districts and three housing sites), significant new findings about cockroach phenology at demonstration sites, and development of new monitoring and management strategies for cockroaches. Program participants have increased knowledge about cockroach biology and ecology, preventive tactics, monitoring tools, detection techniques, legal roles / responsibilities, and evaluation tactics (82%, via post-program test data). Changes in behavior included increases in monitoring services offered, increases in preventive and nonchemical services, increases in baiting services provided, and decreases in sprays for cockroaches (anecdotal and observational). ***Testimonials and observations indicate acceleration of these behavior changes within the national pest control industry***. Potential impacts include improved pest control, decreases in pesticide applications and pesticide exposure events, increases in stakeholder satisfaction, increases in community health and well-being, increases in environmental health, and increased economic resilience within client industries.

Theme #4: General promotion of IPM strategies and tactics

This overarching program seeks to increase awareness of, demand for, and provision of IPM services, strategies, tactics, and practices for all my clientele. Extension of these messages increases knowledge about IPM and changes behavior surrounding pest management within all of California's residents.
Clientele: Pest management professionals within California's structural pest control industry, professional landscape managers, municipalities, school districts, childcare providers, housing management professionals, UCCE Master Gardeners, and practitioners of urban agriculture.
Goals: Extend research-based information and educational materials designed to drive IPM service offerings by professionals as well as message extenders (such as MGs), driving IPM adoption by all.
Methods Used During Term (see tables, hyperlinks for details): applied field research and evaluation research conducted, one peer-reviewed journal article published, one peer-reviewed UC ANR publication produced, one proceedings article published, two newsletter articles published, blog article published, two new curricula developed, new online training module collaboratively developed, two free online seminars recorded, one newsletter story contributed, four meetings organized, and 15 oral presentations provided.
Outcomes and Potential Impacts: Participants increased knowledge (98% of 86 webinar participants, for example, via post-survey) about pest biology and ecology, preventive tactics, monitoring techniques, and specific IPM strategies and tactics. Observed changes in behavior have included increases in preventive and nonchemical control tactics and decreases in unnecessary pesticide applications. Potential impacts include increases in knowledge of IPM strategies and tactics, increases in use of UC IPM resources, decreases in unnecessary pesticide applications, and decreases in surface water contamination.

PROFESSIONAL COMPETENCE & PROFESSIONAL ACTIVITY

I continue to develop as a professional by augmenting my academic training, learning new practical skills, and participating in professional and disciplinary associations. Maintenance of licenses and certifications showcases my commitment to professional qualification. Important activities this term included participation in meetings of the Entomological Society of America, the National Conference on Urban Entomology, the International IPM Symposium, and the International Conference on Urban Pests.

Sabbatical leave during summer 2022 provided needs assessment of the global pest control industry and significant development in Spanish language skills (see appended Sabbatical Plan / Report).

Several of my activities provide strong evidence of professional competence. I served a one-year term as the elected Director of a national certification board for entomology professionals, culminating in a distinguished service award. I received two more awards for achievements in applied IPM. I also served as a judge for a national student competition and two national awards, a certification exam proctor, peer reviewer for scientific journals (2), and an elected member of national and county based IPM committees.

UNIVERSITY AND PUBLIC SERVICE

During this term, I have continued to provide significant university service. Most notably, I have continued my service as ANR's Associate Editor (Pest Management – Urban), overseeing the review processes and ultimate production of 16 ANR publications. I have served as an ambassador between UC ANR and UC Berkeley, helping to negotiate a new Memorandum of Understanding and a new relationship between local UCCE offices and the UC Berkeley Botanical Garden. I have also continued my service to ANR as an appointed voting member of the Endemic / Invasive Pests and Diseases Strategic Initiative Panel. I have provided guest lectures, guest laboratory practicums, public seminars, and major contributions to mass media. I have actively engaged in mentorship of fellow CE Advisors (3), students (3), and early career professionals (5) in my networks. I have personally provided pest identifications as well as valuable IPM information and resources to hundreds of community members.

AFFIRMATIVE ACTION; EQUITY, DIVERSITY & INCLUSION

My extension programs and outreach activities delivered to clientele groups made all reasonable efforts to reach all clientele members, represent and serve accurate clientele subsamples within programs, and deliver outputs that appeal to a wide range of members within each group. My ability to reach under-served demographic groups has been facilitated due to my proficiency in Spanish as well as high ethnic diversity in the SF Bay Area. My clientele are diverse in nature; black and Latino representation within urban PCOs are both approximately 20%, and MGs are typically about 85% female and of retirement age.

SUMMARY

As is expected of ANR Advisors within the Full Title rank, I have clearly made positive contributions to my scientific discipline, demonstrated continued professional growth and leadership, demonstrated excellence in developing educational programs, and served in many activities that further the goals and objectives of ANR and UC. I believe, as evident by the elements of this performance review package, that ***I have demonstrated increasing proficiency at the Full Title Advisor level.*** I am successfully making positive contributions to the discipline of urban entomology and pest management on a global scale. During the term under review, I set long range program priorities based on ongoing assessments of clientele needs, I demonstrated leadership and initiative within my professional and academic networks, I exhibited movement increasing balance among ANR's four academic criteria, and I showed my ongoing commitment to representation of diversity within my clientele. I have a strong understanding of the program delivery and evaluation models needed for effective extension, and I have a firm grasp of the overarching goals and themes of ANR. I will continue to develop my program, realizing increasing outcomes and expanding impacts.

Based on this performance review package, I hope you support my request for merit to the Full Title III rank of UCCE Advisor.

Bibliography: Andrew Sutherland

Urban Integrated Pest Management Advisor: San Francisco Bay Area

Merit (Full Title II to Full Title III)

Review Period: October 1, 2020 – September 30, 2023 (duration since last salary action)

Summary (Organizational Method as per 2023 UC ANR "E-Book" Guidelines)

Publications produced during this review period are shown against a gray field.

Peer-reviewed publications 23 (3)

B. Peer-reviewed scholarly journal publications 12 (2)
C. Other peer-reviewed publications 11 (1)

Patents 1 (0)

Non-peer-reviewed publications 66 (12)

A. Popular press articles 40 (6)
D. Technical reports and other non-reviewed articles 13 (3)
E. Published abstracts 13 (3)

Peer-reviewed scholarly journal publications

1. **Sutherland, A.**, Parrella, M.P., 2009. Biology and co-occurrence of *Psyllobora vigintimaculata taedata* (Coleoptera: Coccinellidae) and powdery mildews in an urban landscape of California. Annals of the Entomological Society of America 102(3): 484-491.
2. **Sutherland, A.M.**, Parrella, M.P., 2009. Mycophagy in Coccinellidae: Review and synthesis. Biological Control 51: 284-293.
3. **Sutherland, A.M.**, Gubler, W.D., Parrella, M.P., 2010. Effects of fungicides on a mycophagous coccinellid may represent integration failure in disease management. Biological Control 54: 292-299.

4. **Sutherland, A.M.**, Parrella, M.P., 2011. Accuracy, precision, and economic efficiency for three methods of thrips (Thysanoptera: Thripidae) population density assessment. Journal of Economic Entomology 104(4): 1323-1328.

5. **Sutherland, A.M.**, Tabuchi, R.L., Moore, S., Lewis, V.R., 2014. Borescope-aided inspection may be useful in some drywood termite detection situations. Forest Products Journal 64(7/8): 304-309.

6. Alkon, A., Nouredini, S., Swartz, A., **Sutherland, A.M.**, Stephens, M., Davidson, N.A., and Rose, R., 2016. Integrated pest management intervention in childcare centers improves knowledge, pest control, and practices. Journal of Pediatric Health Care, November / December 2016, e27 – e41, http://www.sciencedirect.com/science/article/pii/S0891524516301596

7. Romero, A., **Sutherland, A.M.**, Gouge, D.H., Spafford, H., Nair, S., Lewis, V., Choe, D-H., Li, S., and Young, D., 2017. Pest management strategies for bed bugs in multi-unit housing: a literature review on field studies. *Journal of Integrated Pest Management* 8(1): 13; 1-10, https://academic.oup.com/jipm/article/8/1/13/3836010.

8. Hubble-Wirgler, C.W., **Sutherland, A.M.**, 2017. Evaluation of a granular formulation of *Bacillus thuringiensis galleriae* for use against white grubs within municipal turf. *Arthropod Management Tests* 42(1), tsx119, https://doi.org/10.1093/amt/tsx119

9. Choudhury, R.A., **Sutherland, A.M.,** Hengel, M.J., Parrella, M.P., Gubler, W.D. 2020. Imidacloprid movement into fungal conidia is lethal to mycophagous beetles. *Insects* 11(8), 496; https://doi.org/10.3390/insects11080496

10. **Sutherland, A.M.**; Hubble, C.; Barber, M. 2022. Installation season may significantly impact time required for subterranean termites to find and feed on in-ground baits. *Insects* 13(5), 445; https://doi.org/10.3390/insects13050445
    My role: I was the lead author, drafting most text sections and coordinating contributions from other authors. The paper reports on a project where I served as principle investigator, designed experiments, analyzed and summarized data, and interpreted results.

11. Rust, M.K., Lee, C-Y., Park, H.E., Campbell, K., Choe, D-H., Sorensen, M., **Sutherland, A.**, Hubble, C., Nobua-Behrmann, B., Kabashima, J., Tseng, S-P., Post, L. 2023. The potential of fluralaner as a bait toxicant to control pest yellowjackets in California. *Insects* 14(4), 311; https://www.mdpi.com/2075-4450/14/4/311

My role: I was involved for several years in the applied research projects that led to this publication. Furthermore, I participated in drafting text, creating graphics, formatting, reviewing, and revising of this manuscript.

12. Tseng, S-P., Nelson, L.J., Hubble, C.W., **Sutherland, A.M.**, Haverty, M.I., Lee, C-Y. 2023. Phylogenetic analyses of *Reticulitermes* (Blattodea: Rhinotermitidae) from California and other western states: multiple genes confirm undescribed species identified by cuticular hydrocarbons. *Journal of Economic Entomology* 2023, toad182; https://doi.org/10.1093/jee/toad182; https://academic.oup.com/jee/advance-article/doi/10.1093/jee/toad182/7292873?utm_source=authortollfreelink&utm_campaign=jee&utm_medium=email&guestAccessKey=2a95bc98-f1b5-4447-8e53-552428382a74
My role: I was the original convener of this research team, bringing together USDA researchers within my established network and a newly-established UC Riverside research lab to address a fundamental biology and ecology question associated with my applied research and extension programs. I also organized the specimen collection activities of the team and made many of the specimen collections myself. Furthermore, I participated in drafting text, creating graphics, formatting, reviewing, and revising of this manuscript.
Note that this article was published on October 7 (2023) and so has not been counted as an activity for the current review period.

Other peer-reviewed publications

1. **Sutherland, A.M.**, 2005. Evaluation of *Psyllobora vigintimaculata* (Say) (Coleoptera:Coccinellidae) for biological control of powdery mildew fungi (Erysiphales). M.S. thesis, University of California, Davis.
2. **Sutherland, A.M.**, 2009. The feasibility of using *Psyllobora vigintimaculata* (Coleoptera: Coccinellidae), a mycophagous ladybird beetle, for management of powdery mildew fungi (Erysiphales). Ph.D. dissertation, University of California, Davis.
3. **Sutherland, A.M.**, Choe, D-H, Lewis, V.R., 2013. Pest Notes: Bed Bugs. UC ANR Publication 7454, revised May 2013. http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7454.html

4. Lewis, V.R., Moore, S., Tabuchi, R.L., **Sutherland, A.M.**, Choe, D-H, Tsutsui, N.D., 2013. Researchers combat resurgence of bed bug in behavioural studies and monitor trials. *California Agriculture* 67(3):172-178. DOI: 10.3733/ca.v067n03p172. July-Sept 2013.
5. Lewis, V.R., **Sutherland, A.M**., Haverty, M.I., 2014. Pest Notes: Subterranean and other termites. UC ANR Publication 7415, revised May 2014. http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7415.html
6. Lewis, V.R., **Sutherland, A.M**., Haverty, M.I., 2014. Pest Notes: Drywood Termites. UC ANR Publication 7440, revised August 2014. http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7440.html
7. **Sutherland, A.M.**, Harivandi, M.A., Dreistadt, S.H., 2014. Pest Notes: Lawn Insects. UC ANR Publication 7476, revised September 2014. http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7476.html
8. Wilen, C.A., DeBiase, R., Baird, J., Downer, A.J., **Sutherland, A.M.**, Westerdahl, B.B. January 2017 Revision (revised continuously). *UC IPM Pest Management Guidelines Turfgrass.* UC ANR Publication 3365-T. Oakland, CA. http://ipm.ucanr.edu/PMG/selectnewpest.turfgrass.html http://ipm.ucanr.edu/PMG/pmgauthors.html
9. Flint, M.L., **Sutherland, A.**, Windbiel-Rojas, K. 2018. UC ANR card set: 'Vegetable pest identification for gardens and small farms', UC ANR Publication 3553, ISBN # 978-1-62711-005-1, June 2018: https://anrcatalog.ucanr.edu/Details.aspx?itemNo=3553
10. **Sutherland, A.M.,** Choe, D-H, Rust, M.K. 2019. *Pest Notes*: Cockroaches. UC ANR Publication 7467 (revised), published December 2019: http://ipm.ucanr.edu/PMG/PESTNOTES/pn7467.html
11. Taravati, S., Haver, D.L., **Sutherland, A.M.** 2023. *Pest Notes*: Hiring a Pest Control Company. UC ANR Publication 74125 (revised), published August 2023: https://ipm.ucanr.edu/PMG/PESTNOTES/pn74125.html
    My role: I was involved in the revision process from start to finish, with significant involvement in concepts, content development, drafts, revisions, and graphics.

Patents

1. McCabe, K.J., Wingo, R.M., Haarmann, T.K., **Sutherland, A.M.**, Gubler, W.D. US Patent #9210914: 'Method for training honeybees to respond to olfactory stimuli', Issued 12/15/2015.

Non-peer-reviewed publications

A. Popular press articles, videos, online curricula, and educational modules

1. **Sutherland, A.**, Parrella, M.P., 2005. Integration of powdery mildew management tactics: Fungicide toxicity to a mycophagous beetle. Gerbera Pest Management Alliance Newsletter, Issue 3, February 2005.
2. **Sutherland, A.**, 2005. Old World predatory fly may help control various adult insect pests for the California *Gerbera* industry. Gerbera Pest Management Alliance Newsletter, Issue 5, June 2005.
3. **Sutherland, A.M.**, 2012. Integrated thrips management in landscape settings. UC IPM Green Bulletin 2:4, August 2012 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2012.aug.pdf
4. **Sutherland, A.M.**, 2012. *No title: introduction letter to clientele group.* San Mateo County Farm Bureau Newsletter, September 2012. http://sanmateo.cfbf.com/LinkClick.aspx?fileticket=gBFQkFOg2-U%3d&tabid=311&mid=810
5. **Sutherland, A.M.**, 2012. Tiny thrips can cause unsightly damage. UC IPM Retail Nursery and Garden Center IPM News 2:3, September 2012 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailipmnews.2012.sep.pdf
6. **Sutherland, A.M.**, 2012. New restrictions on pyrethroid insecticide applications protect urban surface waters. UC IPM Green Bulletin 3:1, November 2012 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2012.nov.pdf
7. **Sutherland, A.M**., 2012. Bed bug monitors. UC IPM Retail Nursery and Garden Center IPM News 2:4, December 2012 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailipmnews.2012.dec.pdf

8. UC IPM online curricula: Household Pests IPM. Advanced IPM Training for Master Gardeners (UCCE / UC IPM). June 2012. http://www.ipm.ucdavis.edu/FAQ/mghousehold.html
9. **Sutherland, A.M.**, 2013. Bed bug monitors enable early detection. UC IPM Green Bulletin 3:2, February 2013 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2013.feb.pdf
10. **Sutherland, A.M.**, 2013. Mosquito management for ponds, fountains, and water gardens. UC IPM Retail Nursery and Garden Center IPM News 3:2, June 2013 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailipmnews.2013.jun.pdf
11. **Sutherland, A.M**., 2013. Neonicotinoid insecticide use under increasing scrutiny. UC IPM Green Bulletin 3:4, August 2013 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2013.aug.pdf
12. **Sutherland, A.M.**, 2013. Identifying swarming termites. UC IPM Green Bulletin 4:1, December 2013 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2013.dec.pdf
13. **Sutherland, A.M.**, 2014. What's the problem with neonicotinoids? UC IPM Retail Nursery and Garden Center IPM News 4:1, March 2014 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailpmnews.2014.mar.pdf
14. Flint, M.L., **Sutherland, A.M.**, 2014. IPM certification programs for urban pest management professionals. UC IPM Green Bulletin 4:2, April 2014 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2014.april.pdf http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=13547
15. **Sutherland, A.M.**, 2014. Understanding neem-based pesticides. UC IPM Retail Nursery and Garden Center IPM News 4:2, July 2014 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailpmnews.2014.july.pdf
16. **Sutherland, A.M.**, 2014. Understanding neem-based pesticides. UC IPM Green Bulletin 4:3, August 2014 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2014.aug.pdf
17. **Sutherland, A.M.**, 2014. Excluding seasonal nuisance pests from structures. UC IPM Retail Nursery and Garden Center IPM News 4:3, November 2014 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailpmnews.2014.nov.pdf

18. California Department of Pesticide Regulation, 2014. DPR's school IPM video series. Videos published online December 2014: http://apps.cdpr.ca.gov/schoolipm/managing_pests/video_series.cfm https://www.youtube.com/playlist?list=PLgU4sA8HrUfrRUcWSr1ZcXrZL9zXsrJ0e.
19. **Sutherland, A.M.**, 2015. Spring monitoring for turf insects. UC IPM Green Bulletin 5:1, May 2015 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2015.may.pdf
20. **Sutherland, A.M.**, 2015. Preventing lawn insects. UC IPM Retail Nursery and Garden Center IPM News 5:2, July 2015 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/retailipmnews.2015.july.pdf
21. **Sutherland, A.M.**, Choe, D-H., Lewis, V., Young, D., Romero, A., Spafford, H., and Gouge, D., 2015. Survey sheds light on bed bugs in multi-unit housing. *Pest Control Technology*. September 2015, Bed Bug Supplement, pp. 26-36; http://www.pctonline.com/article/pct0915-bed-bugs-multi-unit-housing, http://www.pctonline.com/fileuploads/digital-editions/pct/Digital/201509/index.html
22. Bradman, A., **Sutherland, A.M.**, 2015. Providing IPM services to schools and child care centers. Online curriculum hosted by UC IPM and providing 2.0 continuing education units for professionals licensed by California's Structural Pest Control Board and the Department of Pesticide Regulation. http://ipm.ucanr.edu/training/index.html
23. **Sutherland, A.M.**, 2015. Bed bug management challenges: survey of professional bed bug management in multi-unit housing. UC IPM Green Bulletin 5:3, December 2015 Issue. http://www.ipm.ucdavis.edu/PDF/PUBS/greenbulletin.2015.dec.pdf
24. Campbell, K., **Sutherland, A.**, Lewis, V., and Choe, D-H, 2016. UC Survey: when it comes to bed bugs, know what's happening in your units. *California Apartment Management* Spring 2016, 18-19.
25. Campbell, K., **Sutherland, A.**, Lewis, V., and Choe, D-H, 2016. California multi-unit housing managers answer bedbug survey. https://caanet.org/bed-bug-survey-results/
26. UCSF California Childcare Health Program, **University of California Statewide Integrated Pest Management Program**, and California Department of Pesticide Regulation, 2016. Integrated Pest Management Toolkit for Family Child Care Homes. San Francisco: UCSF School of Nursing. http://cchp.ucsf.edu/content/family-child-care-homes

27. Choe, D-H, and **Sutherland, A.M.** 2017. UC ANR teamed up to investigate effective integrated pest management for bed bugs in low-income, multiple-occupancy housing. *UC Delivers*, February 2017. http://ucanr.edu/delivers/?impact=1015&delivers=1
28. **Sutherland, A.M.** 2017. Do-it-yourself bed bug control? UC IPM Retail Nursery and Garden Center IPM News 7(2), Summer 2017 issue: http://ipm.ucanr.edu/PDF/PUBS/Summer_2017_Retail_Newsletter.pdf
29. **Western IPM Center Bed Bug Work Group**, 2018. Western bed bug extension repository: http://westernbedbugipm.ucanr.edu/. January 2018.
30. Hubble, C., and **Sutherland, A.** 2019. Outdoor cockroach control: new species and new approaches. *PestWorld*, July / August 2019: https://www.pestworldmag-digital.com/npmas/0419_july_august_2019/MobilePagedArticle.action?articleId=1498660
31. **Sutherland, A.M.**, 2019. Effective bait-only control for outdoor cockroaches. UC IPM Green Bulletin 9:2, Summer 2019 Issue. http://ipm.ucanr.edu/PDF/PUBS/greenbulletin.2019.summer.pdf
32. ourwaterourworld.org (collaborative authorship, including **Sutherland, A.M.**, Drlik, T., Agurto, L., Palutke, H., and Hubble, C.W.), 2020. Keep bed bugs out of your home (Mantenga a las chinches fuera de su casa). Our Water Our World fact sheet, published February 2020 in English and Spanish: http://ourwaterourworld.org/Portals/0/Bed_Bugs_2-6-20_web.pdf, http://ourwaterourworld.org/Portals/0/Spanish_Bed_Bugs_2-6-20_web.pdf
33. **stopbedbugs.org,** 2020. State-funded bilingual online training program for tenants living within California's multi-unit housing environments, includes interactive educational "game": https://www.stopbedbugs.org/. May 2020.
34. **Sutherland, A.M.**, 2020. Detecting and controlling biting mites within structures. UC IPM Green Bulletin 10:4, Fall 2020 Issue. http://ipm.ucanr.edu/PDF/PUBS/greenbulletin.2020.fall.pdf
35. **Diagnosing Plant Problems**, 2022. Initial training for UCCE Master Gardener trainees, video-based module with embedded quizzes, group exercises, and homework: https://drive.google.com/drive/folders/1FnEhHqFS95GeuRzU2ucsUXl0TKyax9JN?usp=sharing. January 2022.
36. **Integrated Pest Management**, 2022. Initial training for UCCE Master Gardener trainees, video-based module with embedded quizzes, group exercises, and homework:

https://drive.google.com/drive/folders/1-fXk1Nodg1N3QVMRkqE2k1P36YfnNhVL. March 2022.

37. **Sutherland, A.**, Hubble, C., and Barber, M. 2022. Subterranean termite baiting: system options and seasonal considerations. *Pest Control Technology*. April 2022, pp. 70 – 82: https://www.pctonline.com/article/subterranean-termite-baiting-system-options-and-seasonal-considerations/

    My role: I was the lead author, drafting most text sections and coordinating contributions from other authors. The paper reports on a project where I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results.

38. **Pyrethroid PCO Project Team, UC IPM**, 2022. *Urban Pyrethroid and Fipronil Use* educational module. https://ipm.ucanr.edu/training/ : https://campus.extension.org/course/edit.php?id=2390, https://campus.extension.org/course/view.php?id=2221, https://campus.extension.org/course/view.php?id=2264.

    My role: I was a key team member, participating in all project meetings and providing content development, review, and extension of products created throughout the project.

39. **Sutherland, A.M.**, Kitagawa, B. 2023. Proactive IPM Programs in Multi-Unit Housing Environments. UC IPM Green Bulletin 13:2, Spring 2023 Issue: https://ipm.ucanr.edu/legacy_assets/pdf/pubs/greenbulletin.spring.2023.pdf

    My role: I was the co-PI on the applied research program that generated the data reported in this article. I was the lead author of the manuscript, drafting all text and designing graphics to be used. Finally, I coordinated review and revision with the co-author and then submitted the final draft to the publisher and served as the corresponding author.

40. **Sutherland, A.M.** 2023. Baits eliminate and prevent subterranean termite colonies. UC IPM Green Bulletin 13:4, Fall 2023 Issue: https://ipm.ucanr.edu/legacy_assets/pdf/pubs/greenbulletin.fall.2023.pdf

    Note that this article was published on November 29 (2023) and so has not been counted as an activity for the current review period.

D. Technical reports and other non-reviewed articles

1. **Sutherland, A.**, Daroub, S.H., 2004. The addition of clinoptilolite zeolite to a simulated sandy medium to reduce nitrogen leaching. Soil and Crop Science Society of Florida Proceedings 63: 88-91.
2. Carne-Cavagnaro, V., Costamagna, T.P., Starnes, R.L., Kaspi, R., O'Donnell, C.A., Strehl, T., **Sutherland, A.**, Parrella, M.P., 2004. Efficacy of Pedestal against western flower thrips on marigolds. California Ornamental Research Federation News Vol. 8:2
3. **Sutherland, A.**, 2005. Effects of selected fungicides on a mycophagous ladybird (Coleoptera: Coccinellidae): Ramifications for biological control of powdery mildew. Meeting of the International Organization for Biological Control, Working Group: Integrated Control in Protected Crops, Temperate Climate. 10-14 April 2005, Turku, Finland. IOBC/wprs Bulletin 28(1).
4. **Sutherland, A.M.**, Parrella, M.P., 2006. Quantification of powdery mildew removal by the mycophagous beetle *Psyllobora vigintimaculata* (Coleoptera: Coccinellidae). Meeting of the International Organization for Biological Control, Working Group: Integrated Control in Protected Crops, Mediterranean Climate. 14-18 May 2006, Murcia, Spain. IOBC/wprs Bulletin 29(4).
5. **Sutherland, A.M.**, Parrella, M.P., 2006. Quantification of powdery mildew consumption by a native coccinellid: Implications for biological control? Proceedings of the Fifth Annual California Conference on Biological Control (CCBC V). 25-27 July 2006, Riverside, California.
6. **Sutherland, A.M.**, Costamagna, T.P., Melicharek, A., Nagata, M., Parrella, M.P., 2009. A comparison of precision and economic efficiency for three methods of thrips population density assessment. Meeting of the International Organization for Biological Control, Working Group: Integrated Control in Protected Crops, Mediterranean Climate. 6-11 September 2009, Chania, Crete, Greece. IOBC/wprs Bulletin, 161-166.
7. **Sutherland, A.M.**, Gubler, W.D., Wingo, R.M., McCabe, K.J., 2010. Classical conditioning of domestic honeybees to olfactory stimuli associated with grapevine powdery mildew infections. Proceedings of the 6th International Workshop on Grapevine Downy and Powdery Mildew. 4-9 July, 2010, Bordeaux, France, 90-92.

8. **Sutherland, A.M.**, Gubler, W.D. 2011. Reflective particle film applications may alter aphid (Hemiptera: Aphididae) species composition, resulting in lower incidence of mosaic virus transmission in melons. Proceedings of: California Melon Research Board Annual Symposium. January 13, 2011, San Diego, California.
9. **Sutherland, A.M.**, Choe, D-H., Campbell, K., Moore, S., Tabuchi, R., and Lewis, V., 2017. From the lab to the bedroom: translating research-based bed bug management strategies to low-income apartment buildings. In W. Bajwa (Ed.), *Proceedings of the 2016 National Conference on Urban Entomology* (pp. 91-94). Texas A&M University. http://entomology.tamu.edu/ncue/wp-content/uploads/sites/9/2017/08/2016-NCUE-Proceedings-Final-August17.pdf
10. Hubble, C.W., **Sutherland, A.M.** 2019. Common cockroaches of California. Poster presented as part of the 1st Annual Infographics Competition at the Entomological Society of America's Annual Meeting. November 17-20, 2019, Saint Louis, Missouri. Poster was produced in a limited quantity and available for purchase here: https://ucanr.edu/survey/survey.cfm?surveynumber=32459
11. Rust, M.K., Choe, D-H., **Sutherland, A.**, Sorensen, M., Nobua-Behrmann, B., Kabashima, J., Campbell, K., Hubble, C., and Park, H-E. 2022. Controlling yellowjackets in urban recreational areas. In R. Bueno-Marí, T. Montalvo, and W.H. Robinson (Eds.), *Proceedings of the Tenth International Conference on Urban Pests* (pp. 45 – 48). CDM Creador de Motius S.L., Mare de Deu de Montserrat 53-59, 08930 Sant Adrià de Besòs, Barcelona, Spain. https://www.icup.org.uk/conferences/2022/papers/controlling-yellowjackets-in-urban-recreational-areas/

    My role: I was a major contributor to study design, data collection, interpretation of results, manuscript development, and graphics creation. I was a collaborating co-PI on the sponsored project that led to this publication.
12. **Sutherland, A.M.**, Taravati, S., Hubble, C., Rust, M.K., and Choe, D-H. 2022. Outdoor baiting to control Turkestan cockroaches (Blattodea: Blattidae). In R. Bueno-Marí, T. Montalvo, and W.H. Robinson (Eds.), *Proceedings of the Tenth International Conference on Urban Pests* (pp. 116 – 120). CDM Creador de Motius S.L., Mare de Deu de Montserrat 53-59, 08930 Sant Adrià de Besòs, Barcelona, Spain. https://www.icup.org.uk/conferences/2022/papers/outdoor-baiting-to-control-turkestan-

cockroaches-blattodea-blattidae/

My role: I was the lead author, drafting text and coordinating contributions from other authors. The paper reports on a project for which I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results.

13. **Sutherland, A.M.**, Taravati, S., Hubble, C., Rust, M.K., and Choe, D-H. 2023. Outdoor baiting programs for control of Turkestan cockroaches in California. In C. Cottone (Ed.), *The Proceedings of the 2022 National Conference on Urban Entomology and Invasive Ant Conference* (pp. 54-59). Texas A&M University. https://ncue.tamu.edu/wp-content/uploads/sites/9/2023/07/NCUE-2022-Proceedings.pdf

    My role: I was the lead author, drafting text and coordinating contributions from other authors. The paper reports on a project for which I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results.

E. Published abstracts

1. **Sutherland, A.,** Parrella, M.P. 2007. Connections with Pestiferous Fungi: Lady beetles as biological control agents of powdery mildew. Annual Meeting of the Entomological Society of America. December 12, 2007, San Diego, California.
2. **Sutherland, A.M.,** Parrella, M.P. 2008. Biological Control of Plant Pathogens: From Antagonistic Microbes to Arthropod Consumers. XXII Brazilian Congress of Entomology. August 26, 2008, Uberlandia, Brazil.
3. **Sutherland, A.**, 2008. Evaluation of the Possibility for Mechanical Transmission of Powdery Mildew Fungi by a Mycophagous Coccinellid. Annual Meeting of the Entomological Society of America. November 17, 2008, Reno, Nevada.
4. **Sutherland, A.M.**, Gubler, W.D., Parrella, M.P. 2009. Utilization of a native mycophagous coccinellid as an indication and decision support device for management of grape powdery mildew in a commercial vineyard. Annual Meeting of the Pacific Branch of the Entomological Society of America. March 30, 2009, San Diego, California.
5. **Sutherland, A.M.**, Gubler, W.D., Parrella, M.P. 2010. Effects of fungicides on a mycophagous coccinellid may represent integration failure in disease management. Joint Annual Meeting of the American Phytopathological Society and the Canadian Phytopathological Society. June 22, 2010, Vancouver, British Columbia, Canada.

6. **Sutherland, A.M.**, Gubler, W.D. 2010. Aluminosilicate clay suspension treatment as a migrant aphid dissuadant for management of nonpersistent viruses in commercial melons. Annual Meeting of the Entomological Society of America. December 15, 2010, San Diego, California.
7. **Sutherland, A.M.**, Wingo, R.M., McCabe, K.J., Gubler, W.D., 2010. Development of a biological sensor for powdery mildew (Erysiphales) infections via monitoring of the proboscis extension reflex in honeybees. Phytopathology 100(6) (Supplement): S124.
8. Costadone, L., **Sutherland, A.**, Gubler, W.D., 2011. Pycnidial development and pycnidiospore germination of Botryosphaeriaceae species as influenced by temperature. Phytopathology 101(6) (Supplement): S39.
9. Peduto, F., **Sutherland, A.M.**, Hand, E.K., Broome, J.C., Parikh, P.D., Bettiga, L.J., Smith, R.J., Mahaffee, W.F., Gubler, W.D., 2011. Comparing the efficiency of visual scouting, spore trapping systems and a bioindicator for early detection of *Erysiphe necator* in California vineyards. Phytopathology 101(6) (Supplement): S139.
10. **Sutherland, A.M.**, Fiehn, O., McCabe, K., Wingo, R., Gubler, W.D., 2011. Grapevines infected with powdery mildew emit specific volatile organic compounds that can be utilized for pathogen detection. Phytopathology 101(6) (Supplement): S174.

11. **Sutherland, A.M.,** 2020. Using interactive online training to educate and empower tenants in California's multi-unit housing environments to recognize, restrict, and report bed bugs. On-demand presentation and abstract hosted by the Entomological Society of America's 2020 Virtual Annual Meeting: https://www.eventscribe.com/2020/entomology2020/ajaxcalls/PresentationInfo.asp?efp=S0tPTU1SSFc5NTUy&PresentationID=763931&rnd=0.6438216&query=sutherland
12. Hubble, C., **Sutherland, A.M.**, and Barber, M., 2022. Investigating the biology of the introduced cockroach species *Luridiblatta trivittata*. Annual meeting of the Pacific Branch of the Entomological Society of America. April 11, 2022; Santa Rosa, CA: https://esa.confex.com/esa/2022pb/meetingapp.cgi/Paper/156518

    My role: This abstract reports on a project where I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results. I was the direct supervisor of the presenting author and helped to develop and refine abstract text.

13. **Sutherland, A.M.**, Hubble, C., Barber, M., 2022. Seasonal activity patterns may inform baiting programs targeting the western subterranean termite species complex. Annual meeting of the Pacific Branch of the Entomological Society of America. April 11, 2022; Santa Rosa, CA: https://esa.confex.com/esa/2022pb/meetingapp.cgi/Paper/157785

My role: This abstract reports on a project where I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results. I developed the abstract as lead author and presented as the presenting author.

Supporting Documentation: Andrew Sutherland

Urban Integrated Pest Management Advisor: San Francisco Bay Area

Merit (Full Title II to Full Title III)

Review Period: October 1, 2020 – September 30, 2023 (duration since last salary action)

A. Project Summary

Project Title	Role	Collaborators	Support Amount/Duration (if applicable)	Support Source
IPM for bed bugs (2)				
Bed bug IPM education to support multi-unit housing	Principle Investigator	UC IPM, Pestec, Casey Hubble, Contra Costa County, lodging associations, Our Water Our World	$ 59,593 September 1, 2018 – September 30, 2021	California Department of Pesticide Regulation
Using entrapping surfaces to augment non-chemical IPM approaches to bed bug control	Co-Principle Investigator (PI: Catherine Loudon, UC Irvine)	Catherine Loudon, Dong-Hwan Choe	$ 44,474 (subaward) July 1, 2022 – December 31, 2024	California Department of Pesticide Regulation
IPM for subterranean termites (1)				
Evaluation of bait systems for subterranean termite management	PI, Project Leader	Siavash Taravati, Casey Hubble, Molly Barber, manufacturers, companies, property owners	$190,425 October 10, 2018 – August 31, 2022	California Department of Consumer Affairs: Structural Pest Control Board

Project Title	Role	Collaborators	Support Amount/Duration (if applicable)	Support Source
IPM for cockroaches (1)				
Biology and management of an invasive cockroach	PI, project leader	Casey Hubble, Molly Barber, counties and cities	$ 56,913 September 8, 2020 – June 30, 2023	California Department of Pesticide Regulation
General promotion of IPM strategies and tactics (8)				
PCO urban pyrethroid applicator training	Collaborator	Lorence Oki, Karey Windbiel-Rojas, PCOC, UC IPM	in-kind services provided April 1, 2020 – June 30, 2023	California Department of Pesticide Regulation
Assessing the needs of California's structural pest control industry	Project Co-Leader, Participant	Karey Windbiel-Rojas, Niamh Quinn, Siavash Taravati, Vernard Lewis	unsponsored ongoing	unsponsored
Evaluating pest preventive elements in SF's housing units	Collaborator, Experimental Design Co-Leader	City / County of San Francisco, Pestec IPM providers	in-kind services provided July 1, 2019 - ongoing	California Department of Pesticide Regulation
Alternative management for ground squirrels in critical infrastructure	facilitator, collaborator, liaison	Carolyn Whitesell, Roger Baldwin, Lucy Diekmann, county agencies	unsponsored ongoing	unsponsored
Development and production of an educational 'IPM Video Series'	Principle Investigator, Project Leader	UC IPM, Santa Clara County	$ 180,000 Nov 18, 2022 – December 31, 2025	County of Santa Clara (Office of Sustainability – IPM Program)

Project Title	Role	Collaborators	Support Amount/Duration (if applicable)	Support Source
Development of an interactive training facility for California's structural pest management professionals	Principle Investigator, Project Leader	Casey Hubble, Vernard Lewis, The Pest Posse, Pest Control Operators of California, UC Berkeley Richmond Field Station	$ 91,563 October 1, 2020 – June 30, 2023 **and** $ 34,361 March 3, 2023 – December 31, 2023	California Department of Pesticide Regulation
Developing insecticidal baits for pest yellowjacket wasps in CA	Co-Principle Investigator (PI: Michael Rust, UC Riverside)	Kathleen Campbell, Michael Rust, Dong-Hwan Choe, Casey Hubble, Molly Barber	$ 42,730 (subaward) Oct 22, 2018 – Dec 31, 2021	California Department of Consumer Affairs: Structural Pest Control Board
Biting mites in California's homes and other structures	Principal Investigator, project leader, coordinator, collaborator	Casey Hubble, county agencies, pest control operators	$165,721 July 28, 2022 – December 31, 2024	California Department of Pesticide Regulation
IPM for housing (1)				
Expanding IPM adoption among affordable housing developers	Co-Principle Investigator (PI: Brandon Kitigawa, RAMP)	RAMP, Eden Housing, Mercy Housing, pest control providers	$ 12,470 (subaward) Dec 1, 2019 – September 30, 2022	California Department of Pesticide Regulation

B. Professional Competence and Professional Activity

Professional Development and Training

Begin Date - End Date	Location	Name, Description and Occurrence of Activity
Nov 11, 2020 - Nov 25, 2020	virtual	Attended virtual annual meeting of the Entomological Society of America
Jan 12, 2021	virtual	attended training: IPM after the storm-vector considerations (US EPA webinar)
Feb 22, 2021	virtual	CDFA Japanese Beetle Briefing
Mar 9, 2021	virtual	attended International Conference on Urban Pests webinar
Mar 22, 2021 - Mar 24, 2021	virtual	attended UC Riverside Urban Pest Management Conference
Apr 14, 2021	virtual	UC ANR / OPIC Pesticide Training
May 23, 2021 - May 25, 2021	virtual	attended virtual National Conference on Urban Entomology
Oct 30, 2021 - Nov 3, 2021	Denver, CO	Attended Entomological Society of America Annual Meeting
Feb 28, 2022 - Mar 2, 2022	Denver, CO	Attended the International IPM Symposium
Mar 21, 2022 - Mar 22, 2022	Riverside, CA	Attended UC Riverside Urban Pest Management Conference
Apr 11, 2022 - Apr 12, 2022	Santa Rosa, CA	Attended Annual Meeting of the Pacific Branch of the Entomological Society of America
May 15, 2022 - May 17, 2022	Salt Lake City, UT	Attended the National Conference on Urban Entomology

Begin Date - End Date	Location	Name, Description and Occurrence of Activity
Jun 27, 2022 - Jun 30, 2022	Barcelona, Spain	Attended the International Conference on Urban Pests
July 1, 2022 – September 30, 2022	Spain, various	Tour of Spain’s pest management systems (see sabbatical report)
Oct 24, 2022	Bodega Bay, CA	Aggie Enterprise introduction & training
Oct 24, 2022	Bodega Bay, CA	California's Sustainable Pest Management initiative: an introduction
Nov 13, 2022 - Nov 16, 2022	Vancouver, British Columbia; Canada	Attended Entomological Society of America's Annual Meeting
Jan 25, 2023	virtual	attended seminar: "IPM for bed bugs: what is new?", Academic Seminar Series, New York State IPM Program
Feb 28, 2023	virtual	attended CDPR webinar: Sustainable Pest Management Roadmap - Urban
May 1, 2023 - Jul 28, 2023	virtual	completed CliftonStrengths Insight Guide survey and training program
Jun 17, 2023 - Jul 4, 2023	Israel: various locations	tour of Israel's pest management systems

Evidence of Professional Competency

Begin Date - End Date	Location	Name, Description and Occurrence of Award, Recognition, Professional Presentation, Office or Activity
Jun 1, 2012 (Ongoing)	my office	Qualified Applicator License, Category J (license maintenance, CDPR)
Jul 1, 2012 (Ongoing)	my office	Board Certified Entomologist (BCE) (certification maintenance)
Oct 1, 2017 - Dec 31, 2020	my office	ESA Certification Board: voting member (Pacific Branch representative)
Oct 1, 2017 (Ongoing)	Concord, CA	Contra Costa County IPM Advisory Committee: appointed voting member
Jan 4, 2021 - Dec 31, 2021	my office	ESA Certification Board: voting member (Director)
Jan 12, 2021	my office	Provided peer review of manuscript for "The International Journal of Environmental Research and Public Health"
Oct 30, 2021	Denver, CO	Received exceptional service award from the Entomological Society of America's Certification Corporation
Jan 6, 2022	Concord, CA	Proctored exam for the ESA Certification Board
Feb 1, 2022 - Feb 7, 2022	my office	Reviewed manuscript submitted to the Journal of Economic Entomology
Feb 3, 2022	virtual	Received 'IPM Achievement Award' from CDPR (as part of the 4-person group "UC ANR's Urban IPM Advisors")
Feb 28, 2022	Denver, CO	Received "International IPM Award of Excellence" at the 2022 International IPM Symposium

Begin Date - End Date	Location	Name, Description and Occurrence of Award, Recognition, Professional Presentation, Office or Activity
May 17, 2022	Salt Lake City, UT	Served as a judge in the student presentation competition at the National Conference on Urban Entomology
Jun 21, 2022 - Jun 29, 2022	my office	Served as a judge for the Distinguished Service Award to the Certification Board of the Entomological Society of America
Oct 3, 2022 (Ongoing)	various	served as member of the Advisory Council for the UC SF Healthy Children and Environments Study
Oct 24, 2022 - Apr 3, 2023	virtual	invited interview (Pest Control Technology magazine): "Next-Gen Urban Entomologists": https://www.pctonline.com/article/next-gen-urban-entomologists/
Dec 19, 2022	my office	Provided peer review of manuscript for journal "Insects"
Jun 12, 2023 (Ongoing)	virtual	Served as in-kind expert consultant to the State of California and nonprofit legal analysts re: critical uses of sulfuryl fluoride fumigation
Jun 25, 2023 - Jun 29, 2023	Tel Aviv, Israel	provided instruction (as invited lecturer) at Tel Aviv University's "Urban Pest Management" short course
Aug 11, 2023	virtual	Served as in-kind consultant to California's Department of Pesticide Regulation: Decontamination and Eyewash Requirements

C. University Service

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Oct 1, 2016 (Ongoing)	UC ANR Associate Editor - Urban Pest Management	University-wide	editor
Oct 1, 2017 (Ongoing)	ANR Strategic Plan Review	Division-wide	Program team leader, Strategic Initiative panel member
Oct 1, 2017 (Ongoing)	UCCE MG Program Steering Committee	Division-wide	voting member
Apr 15, 2018 (Ongoing)	EIPD SI Panel	Division-wide	panel member
Oct 1, 2019 (Ongoing)	Provided mentorship to (2) new CE Advisors in the SF Bay Area	Division-wide	mentor
Oct 1, 2020 - Sep 30, 2021	individual consultation with campus-based UC academics and staff: 12 instances	University-wide	Consultant, Educator
Oct 1, 2020 - Sep 30, 2021	individual consultation with UCCE Advisors: 9 instances	Division-wide	Consultant, Educator
Oct 9, 2020	IPM Advisors Fall Meeting	Division-wide	Participant
Nov 9, 2020	attended staff meeting: UCCE Santa Clara	County	presenter, participant

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Nov 19, 2020	provided laboratory exercise for UC Davis undergraduate class (PLS 105)	University-wide	lab designer, facilitator
Dec 10, 2020	participated in career discussion with UC Davis undergraduate class (PLS 105)	University-wide	presenter
Jan 21, 2021	attended UC IPM urban stakeholder meeting	Division-wide	participant, listener
Mar 25, 2021 - Jun 30, 2021	served on UC ANR search committee: Western IPM Center Director	Division-wide	voting member
Apr 22, 2021 (Ongoing)	Collaborative Discussions with the UC Berkeley Botanical Gardens	University-wide	collaborator, liaison to UCCE
Apr 27, 2021 - Apr 28, 2021	UC IPM Strategic Planning	Division-wide	Participant
Jun 9, 2021	attended Pest Management Program Team meeting	Division-wide	participant
Jun 9, 2021	Presented at the Entomology Work Group meeting	Division-wide	Presenter, participant
Jun 10, 2021	Pesticide Use Reporting Work Group Meeting	Division-wide	Participant

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Jun 14, 2021 (Ongoing)	Negotiated a new Memorandum of Understanding between UCCE and UC B RFS	University-wide	lead negotiator, facilitator, writer
Jun 24, 2021 – Sep 29, 2023	served on review committee, provided review of six chapters of UC ANR book 'Residential, Industrial, and Institutional Pest Control' (ANR Publication 3334)	Division-wide	reviewer, editor
Oct 1, 2021 - Sep 30, 2022	individual consultation with UCCE Advisors: 8 instances	Division-wide	Consultant, Educator
Oct 1, 2021 - Sep 30, 2022	individual consultation with campus-based UC academics and staff: 4 instances	University-wide	Consultant, Educator
Nov 5, 2021	Attended Pest Management Program Team meeting	Division-wide	Participant
Nov 18, 2021	provided laboratory exercise for UC Davis undergraduate class (PLS 105)	University-wide	lab designer, facilitator
Nov 30, 2021	provided guest lecture to UC Davis undergraduate class (PLS 105)	University-wide	lecturer
Dec 2, 2021	participated in career discussion with UC Davis undergraduate class (PLS 105)	University-wide	presenter
Dec 7, 2021 - Apr 1, 2022	Served on an ad-hoc review committee for the 2022 UC ANR academic advancement cycle. Reviewed five PR cases.	Division-wide	Committee Member

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Jan 13, 2022	Provided a UC IPM Info Table at the PCOC Pest Ed seminar series	Division-wide	Host, representative of UC IPM
May 5, 2022 - May 6, 2022	Attended UC IPM Program Planning Meeting	Division-wide	Participant
Oct 1, 2022 - Sep 30, 2023	individual consultation with campus-based UC academics and staff: 16 instances	University-wide	Consultant, Educator
Oct 1, 2022 - Sep 30, 2023	individual consultation with UCCE Advisors: 30 instances	Division-wide	Consultant, Educator
Oct 24, 2022 - Oct 25, 2022	IPM Advisors Annual Fall Retreat	Division-wide	participant
Nov 10, 2022	provided laboratory exercise for UC Davis undergraduate class (PLS 105)	University-wide	lab designer, facilitator
Nov 10, 2022	provided guest lecture to UC Davis undergraduate class (PLS 105)	University-wide	lecturer
Dec 1, 2022	participated in career discussion with UC Davis undergraduate class (PLS 105)	University-wide	presenter
Jan 18, 2023 (Ongoing)	served on UC ANR search committee: Urban IPM Advisor (Capitol Corridor)	Division-wide	voting member

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Feb 21, 2023 - Feb 22, 2023	attended UC IPM Program Strategic Planning Meeting	Division-wide	Participant
Mar 1, 2023	Strategic planning: SF Bay Area CE Advisors	Region	participant
Mar 7, 2023 (Ongoing)	participated as mentor (to Dr. Sandipa Gautam) via UC ANR's Mentorship Program	Division-wide	mentor
Apr 24, 2023 - Apr 27, 2023	attended the ANR Statewide Conference	Division-wide	participant
Apr 24, 2023	attended Pest Management Program Team meeting	Division-wide	participant
Apr 26, 2023	served as co-host / moderator at UC ANR's Statewide Conference	Division-wide	co-host
Aug 2, 2023	attended Pesticide Use Reporting Work Group meeting	Division-wide	participant
Sep 1, 2023 - Sep 29, 2023	served on UCCE hiring committee: Alameda County Master Gardener and Urban Agriculture Coordinator	County	voting member

D. Public Service

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Jan 18, 2018 - Jun 30, 2022	Served as Chair of the Contra Costa County IPM Decision-Making Subcommittee	County	Chair, Facilitator
Oct 1, 2020 - Sep 30, 2021	Individual consultation with members of the residential public via phone, email, in-person discussion: 65 instances	Region	Educator
Oct 20, 2020 - Sep 30, 2021	Contra Costa County IPM Advisory Committee: Grants Subcommittee	County	voting member
Mar 17, 2021	Merritt College Guest Lecture: the principles of integrated pest management	Region	Presenter
Jun 3, 2021 – Nov 10, 2022	Led mentorship pod for the Entomological Society of America's MUVE section	International	leader, mentor
Jun 22, 2021	Consulted with community-based IPM activist group	Region	consultant, connector
Oct 1, 2021 - Sep 30, 2022	Individual consultation with members of the residential public via phone, email, in-person discussion: 33 instances	Region	Educator
Oct 14, 2021	Provided guest lecture to students at Merritt College: termite biology, ecology, diversity, and management	Region	Presenter
June 4, 2022 - ongoing	Organized and participated in the UC Berkeley Botanical Garden's "Sick Plant Clinic" events.	Region	Diagnostic expert, organizer

Begin Date - End Date	Name, Description, and Occurrence of Activity	Org Level	Your Contribution and Leadership Role
Oct 1, 2022 - Sep 30, 2023	Individual consultation with members of the residential public via phone, email, in-person discussion: 37 instances	Region	Educator
Nov 9, 2022	Career Connections: Greener Good: a mentoring and career development networking event hosted by the Cal Alumni Association (UC Berkeley)	Community	mentor, participant
Mar 1, 2023 (Ongoing)	mentorship of vector biologist Wade Lee	Region	mentor
Jun 1, 2023	Served as judge for ESA's Distinguished Achievement Awards	National	judge
Jun 15, 2023	provided public webinar as part of UC IPM's Urban & Community IPM Webinar Series	Community	presenter
Sep 16, 2023	provided educational display table at the "UCCE Open House" event at Elkus Ranch	Region	presenter, extender

E. Extension Activities

Meetings Organized

Begin Date - End Date	Meeting Name and Type	Topic/no. of repetitions	Role	Location(s)	Total No. of Attendees
IPM for bed bugs (3)					
Dec 17, 2019 - Sep 30, 2021	Created and delivered online workshop for landlords and property managers	bed bug IPM, legal aspects, rights & responsibilities / 1	organizer, presenter	virtual	88
Oct 26, 2020	Bed bug management learning and sharing workshop for the California Apartment Association	IPM for bed bugs in multi-unit housing / 1	Organizer, presenter, facilitator	virtual	79
Aug 31, 2021	Bed bug management learning and sharing workshop for the California Apartment Association	IPM for bed bugs in multi-unit housing / 1	Organizer, presenter, facilitator	virtual	66
IPM for cockroaches (1)					
Jun 8, 2022	Provided hands-on training for Alameda County Vector Control: outdoor cockroach baiting demonstration	Outdoor cockroach baiting and other IPM tactics / 1	Organizer, presenter, subject matter expert	Alameda, CA	17

Begin Date - End Date	Meeting Name and Type	Topic/no. of repetitions	Role	Location(s)	Total No. of Attendees
IPM for subterranean termites (1)					
Feb 8, 2023	hands-on training provided as part of the Pest Control Operators of California's Termite Academy	Using monitoring devices and bait systems for subterranean termite control in CA / 1	presenter, organizer	Richmond, CA	55
General promotion of IPM strategies and tactics (5)					
Feb 24, 2021	Contra Costa Master Gardener Initial Training: Diagnosing Problems	Diagnosing Problems / 1	Presenter, facilitator	virtual	83
Mar 18, 2021	Santa Clara County Master Gardeners: Pantry Pests training	Advanced Training: Pantry Pests / 1	presenter	virtual	71
Mar 16, 2022	Designed, developed, and presented initial training for UC Master Gardeners of San Mateo / San Francisco counties: "Integrated Pest Management"	Initial Training: IPM / 1	Designer, developer, presenter, subject matter expert	virtual	47
Mar 30, 2022	Designed, developed, and presented initial training for UC Master Gardeners of San Mateo / San Francisco counties:	Initial Training: Diagnosing Plant Problems / 1	Designer, developer, presenter, subject matter expert	virtual	47

Begin Date - End Date	Meeting Name and Type	Topic/no. of repetitions	Role	Location(s)	Total No. of Attendees
	"Diagnosing Plant Problems"				
Mar 30, 2023	organized discussion with Santa Clara County's UCCE Master Gardener trainees about IPM concepts and the "Diagnosing Problems" video-based educational module	IPM and Diagnosing Problems / 1	Leader, facilitator	virtual	54

Educational Presentations

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
IPM for bed bugs (4)				
Nov 11, 2020	Entomological Society of America: Virtual Annual Meeting 2020	Using interactive online training to educate and empower tenants in California's multi-unit housing environments to recognize, restrict, and report bed bugs / 1	virtual	39
Sep 8, 2021	CDPR APCAC meeting	Developing interactive extension methods for bed bugs in multi-unit housing / 1	virtual	33

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
Nov 18, 2021	CDPR Pest Management Advisory Committee	Bug IPM Education to Support Multi-Unit Housing / 1	virtual	62
Dec 9, 2021	Mosquito & Vector Control Association of California regional meeting	New educational resources from UC for bed bug prevention and management in multi-unit housing / 1	virtual	12
IPM for subterranean termites (10)				
Jan 21, 2021	PCOC Santa Clara Valley District meeting	Evaluation of bait systems for use against subterranean termites in CA / 1	virtual	26
Feb 10, 2021 - Feb 11, 2021	PCOC Termite Academy	How to be successful with bait systems against subterranean termites in CA / 1	virtual	76
May 27, 2021	Washington State University IPM webinar series	Successful use of bait systems for control of subterranean termites / 1	virtual	61
Feb 8, 2022	PCOC Termite Academy	How to successfully use bait stations to manage subterranean termites in California / 1	virtual	36
Mar 17, 2022	Provided presentation as part of the UC IPM Urban & Community IPM webinar series	Understanding Subterranean Termites: the Social Cockroaches Eating Our Homes / 1	virtual	370
Apr 11, 2022	Annual Meeting: Pacific Branch of the ESA	Seasonal activity patterns may inform baiting programs targeting the	Santa Rosa, CA	45

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
		western subterranean termite species complex / 1		
Apr 13, 2022	PCOC Bay Area District Meeting	How to successfully use bait systems for subterranean termite control in CA / 1	San Leandro, CA	27
Nov 16, 2022	Annual Meeting of the Entomological Society of America / Symposium on Soil-dwelling Arthropods	Seasonal phenology considerations may inform management strategies for subterranean termites (the social cockroaches eating your home from the ground up) / 1	Vancouver, British Columbia; Canada	17
Dec 8, 2022	webinar series: Green Shield Certified (The IPM Institute)	IPM for Termites / 1	virtual	33
Mar 9, 2023	Structural Pest Control Board meeting	Final report: evaluation of bait systems for use against subterranean termites in CA / 1	Sacramento, CA	19
IPM for cockroaches (8)				
May 25, 2021	Santa Clara Valley Urban Runoff Pollution Prevention Program	Alternative management strategies for outdoor nuisance cockroaches / 1	virtual	75
Nov 3, 2021	ESA Annual Meeting	First investigations into the biology and ecology of the three-lined cockroach, an invasive	Denver, CO	13

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
		species now established in northern California / 1		
Jan 13, 2022	PCOC Pest Ed Series 2022	Alternative management strategies for outdoor nuisance cockroaches in California / 1	Citrus Heights, CA	48
Mar 22, 2022	UC Riverside Urban Pest Management Conference	First investigations into the biology and ecology of the three-lined cockroach, an invasive species now established in northern California / 1	Riverside, CA	70
May 17, 2022	National Conference on Urban Entomology	Outdoor baiting programs for control of Turkestan cockroaches in California / 1	Salt Lake City, UT	37
Jun 27, 2022	International Conference on Urban Pests	Outdoor baiting programs provide effective control of Turkestan cockroaches / 1	Barcelona, Spain	167
Jun 28, 2022	Spanish Pest Control Workshop at the International Conference on Urban Pests	Gestión integrada de cucarachas peridomésticas / 1	Barcelona, Spain	44
Nov 10, 2022	Pest Management Advisory Committee (CDPR) annual meeting	A novel nuisance: the three-lined cockroach in the San Francisco Bay Area / 1	virtual	59

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
IPM for schools and childcare environments (2)				
Oct 14, 2020	PCOC Bay Area District	Providing IPM services for schools and child care centers / 1	San Leandro, CA	17
Dec 7, 2021	Pesticide Safety Workshops 2021 (UC IPM: PSEP)	Providing IPM services to schools and child care / 1	virtual	12
General promotion of IPM strategies and tactics (15)				
Nov 19, 2020	Contra Costa County IPM Advisory Committee	Assessing pesticide risk: the footprint tool / 1	virtual	19
Mar 2, 2021 - Mar 3, 2021	Urban Pyrethroid Application Training (virtual pilot)	IPM best practices and alternatives to pyrethroid sprays / 1	virtual	35
Apr 29, 2021	City of Concord IPM training	Pesticides and the Public: effective communication is essential / 1	virtual	25
May 12, 2021	UC IPM Pest Insight webinar	Biting Mites in Homes and other Structures / 1	virtual	63
May 20, 2021	Provided presentation as part of the UC IPM Urban & Community IPM webinar series	Springtime Pests / 1	virtual	290
Nov 9, 2021	Mosquito & Vector Control Association of California regional meeting	UC research summary: bait development for yellowjacket wasps / 1	virtual	120

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
Mar 1, 2022	International IPM Symposium	Extension to Urban IPM Clientele: why are low-hanging fruit so difficult to pick? / 1	Denver, CO	34
Oct 17, 2022	SF Bay Area IPM Coordinators Group	The Global Urban IPM Needs Assessment Sabbatical Project / 1	Oakland, CA	21
Feb 15, 2023	PCOC Silicon Valley District / monthly meeting	A virtual tour of the pest control strategies and tactics used in Spain / 1	San Jose, CA	41
Mar 28, 2023	provided extension presentation at UC Riverside's Urban Pest Management Conference	A virtual tour of the pest control strategies and tactics used in Spain / 1	Riverside, CA	160
Apr 27, 2023	provided presentation and served as panelist in the EIPD program of UC ANR's Statewide Conference	Solutions to California's Pest Problems - Urban IPM Outcomes and Impacts / 1	Fresno, CA	52
May 10, 2023	PCOC Bay Area District / monthly meeting	A virtual tour of the pest control strategies and tactics used in Spain / 1	San Leandro, CA	21
Jun 15, 2023	presented as part of UC IPM's Urban & Community IPM Webinar Series	Summertime Household Pests: https://www.youtube.com/watch?v=-XisPBUC2ic / 1	virtual	86
Jun 19, 2023	Association of Israeli Pest Control Operators: continuing education meeting	The principles and practices of urban IPM / 1	Tel Aviv, Israel	49

Begin Date - End Date	Meeting Name/Event	Presentation Topic/no. of repetitions	Location(s)	No. of Attendees
Aug 3, 2023	San Francisco IPM Technical Advisory Committee meeting	A virtual tour of the pest control strategies and tactics used in Spain / 1	virtual	36
IPM for housing (4)				
Nov 17, 2020	Alameda County Healthy Homes IPM Training	Introduction to IPM for multi-unit housing providers / 1	virtual	36
Dec 7, 2020	IPM Team meetings for RAMP	Introduction to IPM for multi-unit housing providers / 1	virtual	24
Oct 26, 2022	Affordable Housing Conference: Non-Profit Housing Association of Northern California	Preventing pest infestations: lessons learned using IPM in affordable housing: https://www.youtube.com/watch?v=Q2EVamc3ByE / 1	virtual	230
Nov 29, 2022	California Healthy Housing Coalition Webinar Series	Preventing pest infestations: lessons learned using IPM in affordable housing / 1	virtual	42

Other (including websites, social media, blogs, collaborations with other agencies, organizations, policy engagement)

Begin Date - End Date	Description	No. of Instances
IPM for bed bugs (2)		
Oct 2, 2018 - Sep 30, 2021	Created interactive virtual training module for multi-unit housing tenants about bed bug prevention and management	1

Begin Date - End Date	Description	No. of Instances
May 1, 2020 - Sep 30, 2021	Created and managed online module for residents of multi-unit housing: https://stopbedbugs.org/	1
IPM for subterranean termites (4)		
Apr 5, 2021	Contributed to trade magazine article "UCR entomologists collecting swarming termite specimens": https://www.pctonline.com/news/ucr-entomologists-collect-termite-swarmers/	1
Oct 21, 2021	Published blog article 'Swarming termites looking for love': https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=50724	1
Apr 19, 2022	Published trade magazine article "Subterranean termite baiting: system options and seasonal considerations": https://www.pctonline.com/article/subterranean-termite-baiting-system-options-and-seasonal-considerations/	1
Mar 9, 2023	Attended Structural Pest Control Board (CDCA) meeting to discuss regulations surrounding termite baiting service offerings	1
IPM for cockroaches (2)		
Jul 1, 2021 - Oct 29, 2021	Worked with CDPR and Sacramento County to create new outreach videos and other materials for Turkestan cockroach management (in English and Spanish): https://youtu.be/_j98nSQbfTI, https://youtu.be/PjSMzUw3D58, https://www.cdpr.ca.gov/docs/schoolipm/school_ipm_law/bmp_cockroach.pdf,	1

Begin Date - End Date	Description	No. of Instances
	https://www.cdpr.ca.gov/docs/schoolipm/school_ipm_law/spanish/bmp_cockroach_sp.pdf	
Oct 1, 2021 - Oct 29, 2021	Contributed to new UC IPM web page: https://ucanr.edu/sites/ccurbanipm/Turkestan_cockroach/	1
General promotion of IPM strategies and tactics (15)		
Oct 1, 2017 (Ongoing)	Created and updated program web site: https://ucanr.edu/sites/urbanIPM/	1
Apr 1, 2020 (Ongoing)	Worked with UC Davis, UC ANR, PCOC, and CDPR team to create new interactive curriculum "Urban pyrethroid and fipronil use: runoff and surface water protection": https://ipm.ucanr.edu/training/, https://campus.extension.org/course/view.php?id=2221	1
Apr 2, 2020 (Ongoing)	Ground squirrel alternatives: discussed research ideas and funding opportunities with UC and county-based collaborators	1
Oct 1, 2020 - Sep 30, 2021	Interacted with clientele using LinkedIn networking media (https://www.linkedin.com/in/andrew-sutherland-phd-bce-84b54212/): 23 posts, 126 comments, 20,586 views	23
Oct 16, 2020	needs assessment: Regional IPM Coordinators Meeting	1
Dec 17, 2020	Blog article published: Detecting and controlling biting mites within structures: https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=44344	1

Begin Date - End Date	Description	No. of Instances
Oct 1, 2021 - Sep 30, 2022	Interacted with clientele using LinkedIn networking media (https://www.linkedin.com/in/andrew-sutherland-phd-bce-84b54212/): 37 posts, 34 reposts, 233 comments, 1,929 reactions, and 92,570 views	37
Oct 6, 2021 (Ongoing)	SF RAD research project: Analyzed and summarized project data, assisted in manuscript preparation	1
Jan 7, 2022 (Ongoing)	Created and maintained "Diagnosing Plant Problems": video-based on-demand training module for UC Master Gardeners	1
May 13, 2022 (Ongoing)	Created and maintained "Integrated Pest Management": video-based on-demand training module for UC Master Gardeners	1
Oct 1, 2022 - Sep 30, 2023	Interacted with clientele using LinkedIn networking media: 30 posts, 52 reposts, 101 comments, 1,238 reactions, and 75,901 views	30
Oct 12, 2022	UC Invasive Species / Pest Management Advocacy Meetings	1
Nov 1, 2022	interactive online module: Urban Pyrethroid and Fipronil Use	0
Jan 31, 2023	Created continuing education activity for Structural Pest Control Board licensees 'A virtual tour of the pest control strategies and tactics used in Spain'	0
Aug 2, 2023	led UC ANR Pest Management Program Team discussion about pesticide use reporting requirements and conventions	1

Begin Date - End Date	Description	No. of Instances
IPM for housing (1)		
Jun 20, 2023	Published blog article 'Proactive IPM programs in multi-unit housing environments': https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=58442	1

Other (including TV and/or radio interviews/programs, newspaper/trade magazine interviews)

Begin Date - End Date	Interviewed/Written By (optional)	Topic	Name of Media or Publication
IPM for subterranean termites (6)			
Oct 30, 2020	Josh Cassidy, Producer	Subterranean termite biology and ecology	KQED Deep Look
Oct 1, 2021 – Feb 1, 2022	Gabriela Quiros, Producer	Flying termites take a dangerous journey to a new life	KQED Deep Look: https://www.youtube.com/watch?v=1yI5DXH6z88
Oct 21, 2021	*Redwood City Pulse* reporter	Termite swarm awareness and education	Redwood City Pulse: https://www.rwcpulse.com/redwood-city-news/a-biblical-plague-or-a-winged-love-story-the-truth-about-californias-annual-termite-swarms-4532107
Oct 22, 2021	Luz Peña (reporter, news anchor)	Swarming termites after recent rains	ABC7 News: https://abc7news.com/termites-after-rain-termite-alate-

Begin Date - End Date	Interviewed/Written By (optional)	Topic	Name of Media or Publication
			swarm-swarming/11157954/
Oct 22, 2021	*SF Chronicle* reporters	Swarming termites after rains	SFGATE / San Francisco Chronicle: https://www.sfgate.com/local/article/Flying-termites-swarm-Bay-Area-after-rains-16554701.php
Mar 17, 2022		Understanding Subterranean Termites: the Social Cockroaches Eating Our Homes	UC IPM Urban & Community IPM YouTube channel: https://youtu.be/EKF3oYJYmcI
IPM for cockroaches (1)			
Sep 19, 2023	*Pest Control Technology* reporters and editors	IPM for Turkestan Cockroaches	Pest Control Technology
IPM for drywood termites (1)			
Jan 3, 2022	*Eos* reporters	Fumigation for termites and other structural pests	Eos, published by American Geophysical Union: https://eos.org/articles/termite-fumigation-in-california-is-fueling-the-rise-of-a-rare-greenhouse-gas

Begin Date - End Date	Interviewed/Written By (optional)	Topic	Name of Media or Publication
General promotion of IPM strategies and tactics (3)			
May 20, 2021		Springtime Pests	UC IPM Urban & Community IPM YouTube channel: https://youtu.be/4HLneBvG880
Dec 10, 2021 - Jun 30, 2022		Certification programs for pest management professionals	News to Grow By / The Latest Dirt (UC Master Gardener Program of Contra Costa County): https://ccmg.ucanr.edu/News_to_Grow_By/?story=2477
Apr 3, 2023	*Pest Control Technology* reporters and editors	Next-gen Urban Entomologists	Pest Control Technology

Other (extension activities entered by Staff)

Begin Date - End Date	Name / Description	Role	Total No. of Attendees
IPM for cockroaches (2)			
Apr 11, 2022	SRA delivered presentation at the annual meeting of the Pacific Branch of the ESA	Principal Investigator, supervisor, mentor	40
Nov 1, 2022	Exhibit Hall participation: Green Build San Francisco	collaborator	320

UC ANR ACADEMIC HUMAN RESOURCES (AHR)
Sabbatical Leave – Request Form

Employee Name: Andrew Sutherland Employee ID#: 10205192

Title and Rank: CE Advisor (Urban IPM) / Full Title II

Leave Period: July 1, 2022 - September 30, 2022

# of Sabbatical Credit Used: 9 Suspend County Director Stipend? ☐ Yes ☒ No

☒ **Sabbatical Plan Attached**

Primary County Director Approval: Frank McPherson Digitally signed by Frank McPherson Date: 2022.04.07 10:15:29 -07'00' Date:

Secondary ~~County~~ SVP Director Approval: James Jay Farrar Digitally signed by James Jay Farrar Date: 2022.04.07 10:12:50 -07'00' Date:
(if applicable)

This sabbatical request was reviewed by Academic Human Resources (AHR). It meets the criteria and expectations required to be considered for sabbatical leave.

Reviewed by:

Tina Jordan Tina Jordan 4/7/2022
Academic HR Manager Signature Date

Vice Provost Signature Date

Approved by:

Wendy Powers Wendy Powers 5/3/2022
Associate Vice President Signature Date

Attachment

Rev. 11/22/2019

SABBATICAL LEAVE PROPOSAL

Date Requested: March 29, 2022

Name: Andrew Sutherland

Title/Rank: CE Advisor / Full Title II

Proposed Leave Dates: July 1, 2022 – September 30, 2022

I. **Describe Sabbatical Project** ***(including a brief history and any preparation work completed to date):***

My primary clientele group is comprised of professionals working in the pest control service industry. Over the past few years, I have extended my professional network internationally using the online business and networking service LinkedIn. Through this process, I have begun to learn how pest control operations differ throughout the world, insights that help me to consider how best to help my clientele evolve in the face of increasing regulations and changing customer demands. To accelerate this "global needs assessment", I have approached my LinkedIn network with an offer to contribute to their technical services and training development in exchange for their hosting me during my sabbatical leave. I have since received various offers from companies and government agencies across the globe. Most of these groups are facing unique pest issues and are embracing alternative methods and technological advancements that may provide effective pest control while minimizing harms to the environment and surrounding communities. In order to experience and understand these innovations, I plan to embed myself in up to four companies or agencies in separate sabbatical "tours" of three to four months in duration. The findings from this sabbatical project; such as observations of new IPM protocols, unique regulatory challenges, shifts in consumer demand, and specific IPM tactics being used by my international hosts; will be extended to my local clientele as futurist possibilities for their industry. Focus interviews with my hosts that capture their perceptions about industry challenges and opportunities will supplement my observations. Ultimately, I plan to capture my findings in a long-form peer-reviewed publication, such as a book. I have approached other researchers in urban pest management with this idea and already have received interest from potential contributors and co-authors of this proposed resource. Other outputs planned, to be delivered to my local clientele, include educational presentations, trade magazine articles, newsletter articles, blog posts, and LinkedIn posts. Potential outcomes of this work include increases in knowledge and changes in behavior within the local pest control industry. Adoption of IPM strategies, reduced-risk tactics, and nonchemical tactics will lead to decreased events of environmental contamination and pesticide exposure. Potential impacts include increased economic prosperity, increased workforce competence, improvements in environmental quality, and improvements in public health.

Rather than to arrange for all these sabbatical tours at once, I have opted to focus on one at a time, though I have initiated and maintained planning discussions with several groups. The first proposed tour, for which I have substantial interest and commitment from my international host, will be as an embedded technical representative for Lokímica, a pest control company serving the country of Spain. As detailed below, I propose to spend about one month each at three of Lokímica's branch offices (delegaciones): Madrid, Alicante / Valencia, and Barcelona. At each location, I will visit field sites, assist in technical aspects of day-to-day work, and learn about specific pest problems and control methods being used. From this experience, I will help Lokímica to improve their integrated pest management (IPM) protocols and enhance training materials for their staff and customers.

An added benefit and secondary goal of this sabbatical tour is the opportunity to practice and improve my Spanish speaking and reading comprehension skills. Though semi-fluent in conversational Spanish, I hope to improve my technical and professional Spanish through this tour. This improvement will help me to increase engagement with Spanish-speaking clientele and collaborators once I return to my CE Advisor appointment in the San Francisco Bay Area.

II. List begin and expected completion dates for the project:

The larger project in mind for my sabbatical leave is the aforementioned publication and series of presentations reporting on the status, trends, and needs of the global pest control industry. This sabbatical tour, the first step in this needs assessment journey, will officially begin on July 1, 2022 and will be completed on September 30, 2022.

III. Name(s) of the location(s) or institution(s) where the project will be completed:

I will be hosted by Lokímica Laboratorios (https://lokimica.com/en/; https://lokimica.com/ca/home-ca/), a 40-year old private pest control company serving Spain from 14 regional offices and specializing in service to public agencies and industrial clientele. Lokímica provides comprehensive IPM services to municipalities such as La Ciudad de Barcelona, focusing on public health, nuisance, and structural pests such as mosquitoes, cockroaches, rodents, termites, blackflies, ants, bed bugs, and pigeons. Lokímica is hosting this year's International Conference on Urban Pests, in Barcelona during June 27 – 29 (https://www.icup2022.com/). The Conference organizers have invited me to present my applied research on outdoor baiting protocols for nuisance cockroaches, and Lokímica has invited me to present (in Spanish!) on peridomestic cockroach biology and ecology as part of a workshop for pest control operators during the Conference. Based on ongoing discussions with the operational and executive leaders at Lokímica, my itinerary will approximately follow as below:

- June 27 – June 30, 2022: Attendance and participation at the International Conference on Urban Pests, in Barcelona (note that this activity will not be part of the official sabbatical but will instead be professional development and evidence of

professional competence, elements of academic performance under my current assignment and review term.

- July 1 – July 3: surface travel, sightseeing.
- July 4 – July 27: technical assistance, protocol review and education of representatives and technicians within Lokímica's Madrid delegacion. Project ideas include development of IPM protocols for key cockroach species (*Blatta orientalis*, *Periplaneta americana*) in sanitary sewers, and help with rodent (*Rattus rattus*) monitoring and control programs.
- July 28 – 31: surface travel, sightseeing.
- August 1 – August 24: technical assistance, protocol review and education of representatives and technicians within Lokímica's Alicante and Valencia delegaciones. Project ideas include monitoring and oviposition trapping for mosquitoes (*Aedes albopictus*), development of English-language educational and marketing materials, and further development of IPM protocols for cockroaches.
- August 25 – August 28: surface travel, sightseeing.
- August 29 - September 20: provide technical assistance, protocol review and education of representatives and technicians within Lokímica's Barcelona operation center. Project ideas include monitoring and nest treatments for Asian hornets (*Vespa velutina*), development of English-language educational and marketing materials, and further development of IPM protocols for cockroaches.
- September 21 – September 30: return to the United States and my home, settle in and adjust to time and culture differences, prepare for return to UC ANR programs.
- October 3: return to work at UC ANR.

IV. **Assurances of Cooperation:**

I have already met several times with technical, operational, and executive representatives from Lokímica. They are very excited to have me this summer and have helped me to develop the plan and potential project ideas outlined above. They have pledged to provide airfare, other travel costs, local lodging accommodations, and local contacts during the 90-day tour. In some cases, and if possible, they have offered to host my family and I at homes of staff members in the various locations discussed. They have also pledged to provide a company-owned vehicle or other means of transportation to facilitate my transitions from location to location. As mentioned above, they have added me as a presenter to a Spanish-language extension-style educational workshop to be held during the International Conference on Urban Pests.

I have attached a letter from my Lokímica contacts in which they confirm their commitments and the timelines so far proposed.

Spain, as a European country in the *Schengen Area*, allows American citizens with valid passports to enter visa-free for periods of up to 90 days (see https://es.usembassy.gov/u-s-citizen-services/local-resources-of-u-s-citizens/information-for-travelers/traveling-to-spain/). The proposed itinerary, as detailed above, spans 89 days in Spain. My family

members and I all have valid US passports. Spain currently requires all American citizens 12 years or older to show proof of vaccination upon entry. My family members and I are all fully vaccinated or are under 12. Driving in Spain by travelers requires an International Driving Permit and a valid driver's license issued from the country of residence. I will secure these items before my trip.

V. Financial Support:

Travel, lodging, transportation, and local connections will be provided by the host company. Salary and benefits will be provided by UC ANR, as per my existing appointment, rank, and step. Vacation and other leave benefits accrued during the three-month period will be entirely used before returning to work on October 3, 2022.

VI. Program Coverage:

I will do my best to provide continuity of service to my programmatic clientele and continued efforts towards sponsored projects and other commitments as follows:

- Client requests for information: Most of these requests are made via email or LinkedIn, while some are via text or phone call. Requests received email or LinkedIn will be met with an automatic response, explaining my short-term absence and redirecting, when possible, to programmatic colleagues at UC ANR and other networks. I will continue to monitor these requests for serious or emergency items, and I may be able to respond using email, LinkedIn, and other online platforms.
- Continuing education for clientele: Pest management professionals have many opportunities for continuing education, including programs and presentations offered by UC ANR colleagues. My short absence as a provider of these units will not significantly impact client training and continuing education endeavors.
- Sponsored projects: I currently manage four sponsored projects. Two of these will end on June 30, 2022, and one will end on September 30, 2022. The remaining project is currently under discussion with the sponsor for a no-cost extension, likely with an end date of December 31, 2022. All procedures and tasks associated with the projects ending June 30 will be completed before beginning this sabbatical tour. My staff research associate (SRA), listed as Key Personnel on all four projects, will complete the procedures and task associated with the project ending September 30 during my absence, except for the final report, which will be completed by me upon my return. The project being extended will be managed by my SRA during my absence, and we have already proposed shifting due dates for major project deliverables to before or after my absence. We will satisfy all terms and conditions of these sponsored projects. We currently are awaiting to hear whether a proposal for research funds submitted in December will be successful. This project, if funded, and as proposed, will begin during October 2022, after my return from Spain. We are also in negotiation for a contract that would require creative activity and project

management from my SRA during my absence. We are prepared to complete all deliverables identified in the scope of work for that contract; work will begin during my absence and will be completed upon my return.

- University service: My only current major university service role is Associate Editor (Pest Management – Urban) for ANR Communication Services. In this role, I process, on average, two ANR manuscripts per month, organizing and overseeing the peer review process and guiding publication through UC IPM and other production outlets. About one month before my sabbatical leave, I will venture to complete all ongoing review processes, with the goal of entirely clearing my "queue". At this time, I will also communicate with the Communication Services Director and request that publications in my category (Pest Management – Urban) be temporarily routed to another Associate Director during my leave. Beginning October 1, I will once again be able to receive and lead processes for manuscripts.

VII. Additional Information:

I have already discussed these sabbatical leave plans with my Regional Director of Cooperative Extension (Frank McPherson) and the Director of UC IPM (Jim Farrar). I have also met with Academic Human Resources Manager Tina Jordan to discuss my overarching plan to complete four different tours as part of a global needs assessment project. All have assured me that my plan is feasible, provided I complete and submit a detailed proposal.

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29/03/2022

Dear Dr. Sutherland,

My Lokímica colleagues and I are very excited to host you and your family this summer as part of your sabbatical leave from the University of California. We look forward to fruitful collaboration with you as part of our team.

There are several projects we have in mind for your trip. First, we hope you'll be able to help our technical staff reviewing the design and implementation of experimental pest management programs for peridomestic cockroaches in Spain. Also, we hope you can work with operational staff at our Madrid, Alicante, Valencia, and Barcelona offices, helping us to evaluate and improve our existing protocols for key pests. Finally, we may use your help to develop English-language training materials for staff and outreach materials for our clients. We envision lots of opportunities for mutual benefit during your stay.

As discussed in our virtual meetings and email exchanges, Lokímica is prepared to provide financial support to help fund your travel expenses. We will purchase or reimburse roundtrip airfare for you. We will provide local accommodations or a housing stipend at all locations proposed, and we will provide a car or a transportation stipend to allow for ease of movement between our locations.

We look forward to this exciting collaboration. Please let us know of anything else required of us at this time.

Sincerely,

53387650G MANUEL GARCIA (R: A03063963)
Firmado digitalmente por 53387650G MANUEL GARCIA (R: A03063963)
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UC IPM | UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | Statewide Integrated Pest Management Program

From the Desk of Dr. Andrew M. Sutherland, Principle Investigator with the San Francisco Bay Area Urban IPM Program

Observations and Recommendations from an Embedded Technical Apprenticeship

- **a detailed report associated with an 89-day sabbatical leave experience and collaboration with Lokímica Laboratorios pest control company during summer 2022 –**

Executive summary: I have immensely enjoyed my time spent with the teams and individuals of Lokímica this summer. In almost all cases, I was impressed by the knowledge and experience of the company's teams and the passion and congeniality of its individual técnicos. I will forever be grateful for the time these individuals took to educate me on their jobs, the culture of their regions, and the rich language of Castellano. I have also learned a lot about the Spanish pest control industry and how it provides service to government agencies and communities while considering local regulations and cultures. Some of the pest systems encountered were very similar to those we face in California, while others were entirely new to me. Likewise, most of the environmental concerns and public health concerns associated with pest control were the same or very similar to those in California, but a few were different. A few standard treatments used in the United States were apparently absent in Spain, and there were several treatments observed in Spain that would be illegal or extremely uncommon in California or the United States. I intend to provide more detailed information and specific examples of these differences in the pages that follow. The organization scheme used in this report is mostly chronological, focused on time spent at specific Lokímica delegaciones and specific activities while embedded there. For quick and easy reading, I have provided specific recommendations in ***bold italics***. After this chronological account, however, I have also included ideas and recommendations regarding pest control programs for specific pest species or groups of pest species. A table of contents (page 2) will hopefully simplify navigation through this document.

A mis amigos y colegas de Lokímica:
¡Los extrañaré a todos y cada uno de ustedes! Por favor, ven a visitarme algún día.

Sinceramente,

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July 5 – July 28: Madrid

This was my first experience with the professionalism and expertise within the teams and individuals of Lokímica. Commonly, in the United States, each regional office of a pest control company will have one highly educated technical director or representative, usually with a Bachelor of Science degree (equivalent in Spain: título de grado) in Ecology, Entomology, or Environmental Science. This person typically helps design pest-specific control programs, provides internal quality control services, identifies pest specimens, and helps troubleshoot difficulties in the field. The rest of the team usually consists of salespersons, technicans who initially assess and prescribe treatments, and applicators who carry out treatments. I was pleased to find that, in Spain, many of the técnicos have college-level training in biology and ecology and are usually capable of technical activities such as pest identification and treatment prescription in the field. In this way, the Spanish pest control industry seems superior to that in the United States. I was further impressed when introduced to the *norma española: Calidad Ambiental en interiores – Buenas prácticas en los planes de Desinfección, Desinsectación y Desratización*. This document is extremely thorough, and the processes and practices described within are very much in line with the central tenets of integrated pest management (IPM) as understood in the United States. Adherence to these norms places Spain ahead of most states in the United States when considering holistic and integrated pest control systems. Most notably, the focuses on prevention, pest identification, justification of treatments, and consideration of nonchemical control tactics are forward thinking, exemplary, and commendable.

- July 5: Jornada ANECPLA, Facultad de Veterinaria (UCM): This was a great introduction to the breadth of public health pest systems in Spain and the Madrid region, with presentations on ticks, mosquitoes, and rodents. I was able to learn a lot and begin practicing my technical Spanish conversation skills. One presenter discussed ***the reduviid assassin bug Zelus spp***., an invasive species in Spain that is very common in California and the western United States. ***I believe the consideration of this insect as a biting pest is unfounded***; though individuals may bite defensively when handled or caught in clothing, they are not aggressive and should be regarded as beneficial predators in agricultural and urban landscapes. These bugs were encountered in several regions this summer, including Valencia, where a técnico has begun keeping them in an insectary cage in the laboratory.
- July 6: Inspection of the grounds and surrounding environment of an outdoor school (Aula de Ambiental) for ticks. Reports of ticks, bites, and associated dermatitis (picaduras). Only one tick specimen (*Hyalomma* spp.: https://photos.app.goo.gl/pCz3quK7LeU9NtYB7) was detected after one hour of active monitoring with flags and sheets (https://photos.app.goo.gl/qjUnMzvP7WvA2Ssd8). Presence of multiple nests of stinging ants (species undetermined) may have contributed to reports. Presence of many rabbit burrows may provide alternate hosts for ticks. The team plans to return in autumn, when tick populations are predicted to be higher. ***I suggest the team develop some specific protocols for tick monitoring at sites with reoccurring problems. Management will require habitat modification (removal of alternate hosts, vegetation reduction) and preventive education for clients on site (frequent "tick checks", use of repellents). Pesticide applications to the environment may be available, but they are almost never warranted in the case of ticks and will not be effective unless the target species is present in large numbers.***
- July 7a: Bed bug treatment at a "casa ocupada" within a private building (service provided by local government as part of social services). Two breeding aggregations were observed. Sofas and other upholstered furniture were wrapped and discarded. Steam treatments were applied to bed frames, wooden furniture items, and all structural joints and holes. Insecticidal paste (laca) was applied around all electrical plugs, doorframes, and window frames. An insecticidal spray was then applied to all wall-floor joints and corners. This was a very labor-intensive treatment to a site with many potential harborage locations. Residents had applied fresh paint to walls, obscuring fecal spots and making detection much more difficult. ***I suggest the team embrace less labor-intensive treatment protocols, such as the low-prep or no-prep treatments being used in the United States. Typical protocols require***

application of desiccant dust to cracks, crevices, and holes in every perimeter surface; temporary sealing of all these cracks, crevices, and holes with tape; and then elevation of the temperature in the room (including all belongings of the resident) to 50ºC for four hours duration. I understand that, given the "ocupada" nature of this unit, such treatments were not physically nor financially feasible, but, if Lokímica plans to do more residential bed bug treatments, more attention should be paid to such low-prep and nonchemical treatments. The treatment observed presented potential pesticide exposure and insecticide resistance problems. After this treatment, the resident continued to call the técnico responsable, complaining that bugs and picaduras were still present. ***I recommend use of pitfall traps, such as "ClimbUp Interceptor*: https://www.insect-interceptor.com/*" or "Blackout Bed Bug Detector*: https://www.bedbugcentralstore.com/Blackout-BedBug-Detector-4-Pack_p_138.html*" to confirm presence or absence of bed bugs following treatments or when visual inspections detect nothing in suspected cases.***

- July 7b: Inspection of street and sewer manholes in response to a complaint of "rats in the street". Bait applied within sewer was entirely consumed, and the braided synthetic tether was gnawed. Apparent "runways" were also seen in ivy and vegetation in nearby landscaping. Both *Rattus* species were likely present at this site. ***I suggest use of wildlife cameras (or nighttime inspections) at problem sites like this to determine the rat species associated with complaints and to allow for design of effective pest management programs.***
- July 12a: Rat inspections and treatments at large urban park (El Parque Juan Carlos I). Observed: burrows, holes in rock retaining walls, feces on ground, multiple runways and feeding sites. Both species were present, but most signs were from *R. rattus*. ***I suggest Lokímica increasingly utilize physical trapping methods at sites with R. rattus;*** experiences in California suggest that baits are not as effective with this species and may lead to increased incidence of secondary wildlife poisoning. Several large bait stations are available that can accommodate multiple snap traps. Other physical action traps, such as the Good Nature traps in use by the Barcelona delegación, may also be useful. In all cases, such traps require more frequent inspection and maintenance, and attractant items will vary from site to site.
- July 12b: Research project with "Ecorex Disk One", targeting *Blatta orientalis* living in irrigation valve service boxes in a large urban park (El Retiro). Observations will be detailed in a collaborative report associated with the research project. Generally, baits containing the biocide (0.23% cypermethrin) were not consumed by the target species, though they were often consumed by ants (https://photos.app.goo.gl/tyVPTNSdCbhghxRM8), mollusks, and collembola. Placebo baits (no active ingredient) were often completely consumed, suggesting that the active ingredient is somewhat repellent. No control with this product was observed, and populations remained high (https://photos.app.goo.gl/yEKxwiRnwp1gbmkLA). ***I do not think this product will be useful for Blatta orientalis.***
- July 12c: More rat inspections at a large public park (La Quinta de los Molinos). Almost all activity observed was associated with *R. rattus*: arboreal nest, runways in ivy, feeding sites with snail shells and seed husks. Also observed: millions of mosquito larvae (*Culex* and *Culiseta*) in stagnant fountains and pools towards back of park: https://photos.app.goo.gl/87iZeVCUScCZcE8s5. ***It's a great idea for Lokímica to work with local biologists and park staff at these sites when such populations are discovered, even if mosquito control is not part of the contract, to ensure public health is maintained and the reputation of Lokímica is not damaged in the public eye due to negative association (people in park see the uniforms of the técnicos and may think Lokímica is responsible for the poor mosquito control at the site).***
- July 13a: Biting insect reported by visitors to a shopping center (this was a client of the local Rentokil office, and Lokímica was assisting). Several specimens of simulid black flies (adults: https://photos.app.goo.gl/QhuGFBR15Yj24EzB9) were collected. A large river (Rio Manzanares: https://photos.app.goo.gl/zo53YrCihfsLc3uP7) was located about 1.5km from this site. An inspection of the river revealed very large populations of biting adults but very few larvae or pupae on submerged

vegetation. Since adults can fly long distances, it is likely that the river is the source of the problems at the shopping center. Given the depth, breadth, and current of the river, together with the apparent absence of simulid larvae, ***it seems unlikely that any pesticide treatment would be able to alleviate the problem. The sometimes futile nature of black fly control will be discussed later in this document under the "Black Flies" pest-specific recommendations section.***

- July 13b: Return to La Quinta de los Molinos with park staff and biologists from Madrid Salud. Discussion on how best to manage *R. rattus* on site included ideas such as signs for public outreach, detailed mapping for documentation of activity and concentration of efforts, use of Harmonix pre-baiting and cholecalciferol systems, baiting on tops of walls and within vegetation, concrete pads for permanent bait station installations, camouflaged bait stations, physical traps, and digital alerts. ***I think that the public outreach signs (what, why, and how are we doing this rat control?) are great ideas. As before, I think efforts will need to focus on physical traps and other nonchemical tactics to prevent poisonings of nontarget wildlife and pets (dogs) present in park.***
- July 13c: visit to urban park in southern district (Leganés) in response to complaints of biting pests. Both black fly and mosquito larvae present in small stream flowing through park. It is unclear which entity will have responsibility (and ability) to treat these aquatic systems with a biocide (probably *Bti*). Footprints of the American mink were observed in the mud. It was shared with me that such wildlife, even if an invasive species, cannot be managed in Spain.
- July 14: review of research project involving birth control treatments of urban birds (pigeons: target). Many other bird species were captured on video visiting these stations. Bird treatments like this are not legal for general use in the United States, to my knowledge. ***It is interesting that invasive wildlife such as minks and raccoons are not managed but that native birds (pigeons and doves) are sometimes captured, killed, or managed as pests. This topic will be discussed in more detail under "Birds".***
- July 15: First formación en español provided, for técnicos responsables: https://docs.google.com/presentation/d/1VFGcxDtfNGN3jzijvhqrAs-67C3kfPDO/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- July 19a: Inspection and treatment of wasps on roof of university building following reports of stings. Multiple (20+) *Polistes dominula* nests were present within unused air conditioning ducting and ventilation fan covers. Nests were sprayed (jet-foam pyrethroid) and removed: https://photos.app.goo.gl/EveYoqJv13bh8siA7. This treatment was justified. ***Physical exclusion (screening) and habitat modification (removal of old equipment) should be performed at this site to prevent problems next year and beyond.*** A detailed discussion of wasp treatments and their justification is provided in the "Social Wasps" section below.
- July 19b: Canine detection (https://photos.app.goo.gl/W5CMivTNCgxAWKZd7) of bed bug infestations at a medium-sized (20 units) apartment complex. Visual inspections were provided in series with the canine service. Two units were heavily infested and were easy and straightforward to identify (no dog was needed in this case: https://photos.app.goo.gl/EgJaj5HLW5Amd6XLA). In one case, the canine team recorded one alert but only one dead adult bed bug was found. This potential false alert was in a unit that had been previously treated. Canine teams need to be trained to only respond to live bed bugs and / or live eggs. Otherwise, false alerts will lead to apparent treatment failures and unnecessary pesticide treatments. Other observations: Tyvek body suits ("monos") are probably not necessary in these inspections and may lead to increased stress and preoccupation in residents. Inspectors should instead visit known infestations last, wear shoe covers, and avoid sitting on or placing items on beds or upholstered furniture. Good rechargeable flashlights are needed for all technicians performing bed bug work; these need to be operable and ready to use at the beginning of all bed bug site visits. As noted above, bed bug interceptor devices can be used to confirm presence or absence of bed bugs during initial inspections and / or after treatment. I recommend placement in contact with a vertical sleeping surface (bed leg or platform) and an adjacent wall, preferably in a corner near the head, for two weeks.

- July 20: Further inspection of Ecorex Disk One trial at El Retiro with representatives from Mylva. Many adults of *Evania appendigaster*, a parasitoid wasp that attacks oothecae, were present: https://photos.app.goo.gl/UtoheQCY6wjMtypt9. These wasps were also observed attacking oothecae of *Periplaneta americana* in sewer manholes in Valencia, Alicante, and Barcelona. I recommend that technicians learn how to identify these wasps and conserve their biological control activity by avoiding insecticide sprays during the period of adult activity. Studies suggest that parasitism rates may approach 30% in some systems, and this activity should not be affected by cockroach baits. Note that some baits, and especially pyrethroids, such as "Ecorex" products, may still kill adult wasps due to contact with residues and / or repel adult wasps from certain areas.
- July 21a: Rat inspection at public park adjacent. Culprit in this case was *R. norvegicus*, with hundreds of rats living in burrows protected by dense vegetation and supported by numerous nut and fruit trees. Bait consumption was low at the site, and many juveniles were observed running about, suggesting that the population is continuing to grow. This is another type of site (outdoor burrow-based Norway rat infestation with lots of competing food items) where physical traps may work better than baits. Terrier services, increasingly common in the United States and United Kingdom (https://pmpest.co.uk/hunting-rats-with-terriers/), may also be useful at reducing populations.
- July 21b: Toledo: inspection of research project involving Ecorex Disk One against *Periplaneta americana* in sewer system: https://photos.app.goo.gl/Ud36Lr3WEybynohh6. Discs mounted / hung on a nail hammered into manhole wall. In some cases, bait appears to have fallen and data were missing. ***Overall, much better consumption of bait was observed with P. americana than with B. orientalis, and an apparent reduction in treated manholes was observed. Ecorex Disk One may be used to maintain lower cockroach populations but may not be effective at alleviating major cockroach infestation problems at specific sites.***
- July 21c: also in Toledo: Observed pheromone traps for processionary moths, a native species. I understand that wandering caterpillars can cause dermatitis, especially in dogs***. I wonder, however, about the efficacy of these traps, especially considering the high density of hosts (Pinus spp., in this case) in the surrounding environment. I also wonder whether residents should bear some personal responsibility and worry about nontarget effects and pesticide exposure issues with tree canopy treatments, should they be deemed necessary.*** This issue may include cultural aspects that drive irrational thresholds in urban communities. I will discuss this global problem below in the "Pest Culture and Pest Thresholds" section.
- July 22a: Residential bed bug inspection for a "friend of the company". House has history of moderate infestation. Evidence detected in several rooms. Reproducing foci observed. Resident had ClimbUp traps in the room where she was sleeping, as an attempt to detect spread from the other rooms. This is an excellent candidate site for the low-prep desiccant + heat treatment discussed above.
- July 22b: Cockroach-specific formación en español delivered to técnicos hosted by Madrid Salud: https://docs.google.com/presentation/d/1Islahr2CVdl2lmjIk9tB-ZChBBh5NOlW/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- July 26a: Visit to merchant center (MercaMadrid) to check monitoring devices. Bat feces observed along warehouse wall. Potential roosts noted. ***Wildlife abatement may be required given the sensitive nature of the site (food storage and distribution), though I am unfamiliar with associated laws.***
- July 26b: Retail space (Alehop) in central Madrid. Very large and longstanding indoor infestation of *Periplaneta americana*. Thousands of dead adults present throughout building (https://photos.app.goo.gl/UtuDznZN7b4knw5m6). Entry was from faulty plumbing drains, probably in ground floor bathroom, which was unused or underused during pandemic (https://photos.app.goo.gl/cdry2JoshevUgw8k6). Subsequent dispersal throughout building occurred via ducting, false ceilings, and false walls. Gel bait has been liberally applied for months, but population persists. ***Vacuum and cleaning is required to detect new activity and identify areas where***

populations persist. Glue traps need to be dated and changed regularly to detect trends and new activity. Sanitary exclusion and structural isolation will be needed to completely solve the problem.

- July 27a: Inspections for mosquitoes and larval sites following reports within a large public library in Leganés. Thousands of adults (*Culex* spp.: https://photos.app.goo.gl/UrKNoqEmBtfhSuR5A) observed within ground floor hallways near access doors to underground drainage system (https://photos.app.goo.gl/6buFiXAzw7CebgkE9), which was suspected as the larval breeding site but inaccessible for sampling due to depth of water surface (~ 3m below floor). Exterior inspection revealed faulty grade (water flowing towards building), heavy irrigation, chronic landscape wetness, and presence of adult mosquitoes. ***Underground drainage system can be treated with larvicide, but the problem will likely persist until excess irrigation problem is fixed outside. This seems like a great site for demonstration of a dry or xeric landscape and an associated public education program.***
- July 27b: Visit to a daycare facility for young children with complaints of wasps in playground burrowing in the sand. Inspections revealed a solitary burrowing species (https://photos.app.goo.gl/tNc7aR3YnemKhygC7) utilizing sand substrate in one small area. Using shovels on site, we destroyed existing burrows and explained that this wasp species is not usually aggressive. ***This is a great site for educational signage for the children, staff, and visitors to explain that these insects are beneficial predators and will not likely sting unless handled or provoked.***
- July 28: three-hour formación en español delivered to técnicos responsables at Rentokil Initial in Madrid. Many versions of this same talk have now been provided in Valencia, Alicante, A Coruna, and Barcelona: https://docs.google.com/presentation/d/1g_n999yJyacq8okrREmhMzT02fBrUb9g/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true

August 2 – August 12: Valencia

This location had very different pest problems than did Madrid. Mosquitoes were prominent pests; *Culex* in agricultural areas and *Aedes* in both urban and agricultural areas. American cockroaches were very common and very abundant in the sewer system. Rats seemed less problematic than in Madrid, though both *Rattus* species were apparently present. The team here was centralized, where in Madrid the team was divided between those working with Madrid Salud and those working at the central office on more varied tasks. This central team allowed for standardized transmission of information during meetings and trainings.

- August 2: Monitoring for mosquitoes in agricultural acequias and coastal zonas inundatas. Treatments (Vectobac: *Bti*: https://photos.app.goo.gl/7MGc4ygZ93eBP1LMA) were necessary in a few cases. *Gambusia* fish were present in most areas and had apparently maintained populations below pest levels. Another inspection and treatments involved rejillas and acequias in the central park (Antic Llit Fluvial del Riu Turía). It was noted that, in many parts of the United States, there are vector control districts that are responsible for such inspections and treatments. ***With so many potential larval sites, this is an never-ending full-time job that will only get much more difficult following rain, when billions of Aedes albopictus eggs hatch.***
- August 3: Monitoring and treatment of black fly (*Simulium* spp.) larvae in El Rio Turía. Vectobac was applied in large volume to five points along the river (https://photos.app.goo.gl/1Jxk4WweFpzfvjwt8), though very large populations persisted (https://photos.app.goo.gl/tc6QorqaS9bjCzsL7). ***Treatment efficacy is undoubtedly affected by large water volume and high flow rate (https://photos.app.goo.gl/GDqowiMcoxJWmkun9), likely diluting treatments to ineffective levels. Coupled with the fact that the target species (Simulium pseudequinum, as per morphological characters on pupae: https://photos.app.goo.gl/mSCSYv2AwZUZbTkf6) is primarily a livestock parasite and only a nuisance to people, this control program seems futile. To confound the issue, Lokímica does not have control of upstream reaches of the river, ensuring a steady untreated***

reservoir population that can always erase any apparent gains made downstream. It is always difficult to please the client in cases like this, and cultural shifts in thresholds may be more sustainable.

- August 4: Participation in https://www.nescotiger.com/ project with research staff. Door-to-door visits in wealthy suburb of Torrent to check monitoring devices, educate residents, and locate potential larval development sites. Since these visits were unannounced "surprises", we always found larval sites, including one flooded pool pump housing container that included thousands of *Aedes* larvae, potentially providing the entire neighborhood with mosquitoes: https://photos.app.goo.gl/4GFDYjuUedjjSvsF8. ***This project demonstrates the inability of government or private industry to successfully manage large populations of Aedes mosquitoes without education programs and participation by the local community. It is doubtful that residents is less affluent communities would be as willing or able to help with such projects, unfortunately.***
- August 5: Help with an ongoing *campaña* in public streets in Quart de Poblet targeting cockroaches (*P. americana*) and rats (*R. norvegicus*). ***A permethrin product (Larvigen) was liberally applied to manholes with cockroaches, and populations were very high. There is danger here from potential insecticide resistance. As well, cockroaches repelled by the active ingredient are likely to escape the sewer system to affect nearby shops and restaurants.*** In fact, this happened while we were there, with many cockroaches escaping and entering the outdoor dining area of a café. Staff at the café were very upset and demanded that we seal the treated manhole. Cockroaches continued to escape from adjacent manholes, of course. Another observation: parasitoid *Evania appendigaster* was present in large numbers and were likely killed by these applications during this visit. ***I recommend that the Valencia delegación move towards bait as the primary treatment used in these campaigns.***
- August 8: formación en español provided, for técnicos responsables and laboratory staff: https://docs.google.com/presentation/d/1-5CNsbbVNVU8CAVYACc3guIxxMNfjbpP/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- August 9: More help with the nescotiger project. As before, sources of larval reproduction were always found. Also observed: *P. americana* entering private properties and buildings through old "arquetas": https://photos.app.goo.gl/oEPBUL2VtosaCn9j7. ***This is another situation that seems to call for a bait-only approach rather than a spray program that will not kill these populations on private properties and may even drive more cockroaches into homes and other structures.***
- August 10: two-hour formación en español delivered to técnicos, excerpted from files shared above.
- August 11: Mass trapping of pigeons in public parks and squares. Use of pressurized "net guns" to capture large groups of birds led to sites by grain feeding: https://photos.app.goo.gl/tfpuTrEmfokcY7gy9. After 10 collection points, it was estimated that we collected 700 birds. It is unclear what will happen to the birds after collection. ***I believe this method would not be legal in most parts of the United States. There is a very large probability that a video like this will end up on the news, especially considering that these sites are frequented by international tourists. Considering that 700 birds is the very tip of the pigeon population in Valencia, this seems like a very risky and futile program.*** More information below under "Birds".
- August 12: "Avisos" in a nearby pueblo. We made several visits to public interior spaces where we changed out monitoring devices and noted presence or absence of pests. In several cases, there were devices left there by other companies, perhaps during past services and previous contracts. The technician explained that instructions were to not touch devices from other companies, even though it seemed clear these were very old. ***I recommend technicians remove such devices for two important reasons:*** 1) they may give old information, indicating a pest problem (to the client or other) that no longer exists. 2) they may give people on site the impression that the other company is still providing service, conflating results from Lokímica's service with those from the other company's service; this can be especially bad if someone on site incorrectly refers a new client to the competition after observing the excellent service provided by Lokímica. Also observed: a major *Reticulitermes*

subterranean termite infestation at a historic public building: https://photos.app.goo.gl/v6hjraBjTSwSPk7C9, https://photos.app.goo.gl/BuZu3rHE2ajjirPE9. ***Technicians should be trained to identify clear cases of termite damage so that supplementary services can be provided to such clients. Termite services are not usually included in Lokímica's municipal contracts, but they can be very lucrative.***

August 17 – August 19: Alicante

It was a pleasure to visit the headquarters of Lokímica. I was very impressed with the beauty of the office, the technological capabilities of the office, and the organization of the garage and warehouse there. In the short time I spent there, I learned from the técnicos that cockroaches (*P. americana*) constituted the majority of their avisos during the summer. It also seemed apparent that mosquitoes and wasps (*Polistes*) were very important.

- August 17: Monitoring for stored product and food pests at chocolate factory (Valor). UV light traps used for flies and other flying insects, sticky traps used for cockroaches, and pheromone traps used for India mealmoths. ***One insect found seasonally inside, the elm leaf beetle (Xanthogaleruca luteola), likely has its source in nearby elm trees, and its presence can be reduced or eliminated by keeping windows closed or properly screened and by eliminating outdoor lighting at night.*** A major drainage problem was identified outside the factory that likely provides harborage and entry for *P. americana* from the sewer system.
- August 18: Cockroach and rat avisos in central Alicante. Sewer manholes nearest complaints were opened and inspected. If cockroaches were found, Massocide Alpha Plus (cypermethrin + diflubenzuron) was liberally sprayed. In many cases, as with the Larvigen product, this resulted in repellency and mass escape from the treated manhole and, often, adjacent manholes: https://photos.app.goo.gl/qNRX2fdwoTp2aWTt9. This meant that the technician often tried to seal crevice around the manhole cover with tape: https://photos.app.goo.gl/fF3saaMoVcAzV2di6. ***This tape includes the Lokímica logo and is now associated with hundreds of cockroaches littering the street around the treatment. This seems like another situation for bait rather than a repellent spray.*** When rats were reported, there often was not enough information to determine whether the pest species was *R. norvegicus* or *R. rattus*. This common problem will increase as populations of *R. rattus* grow and spread. ***Systems where a photo can be submitted by residents or where direct communication with the complaining resident (text or email) can be established may help to provide the information the technician needs to move forward with the pest control service.*** We also visited a public park where *Polistes* nests had been established inside large metal statues. Physical removal was not possible due to the size and shape of the statue's metal components, so a pesticide application was made to kill all adults. In talking to the regular visitors to the park who had made the complaint, it became clear that no stings had yet occurred and that this was a case of low thresholds for stinging pests. It is unclear whether this application was justified. More on this concept below.
- August 19a: Large scale perimeter spray targeting *Polistes* wasps around a bodega in Jumilla with a truck-mounted air blast sprayer: https://photos.app.goo.gl/UA9GemJNmMQqHNHb7. ***Product applied was Blaticida Concentrado EC (15% cypermethrin), and the application frequency was once per every three weeks. I do not think this application was justified.*** A trapping program (Trappit attractant) indicated a very low population of wasps (2 *Polistes* trapped over 3-week period), and no nests were observed. What's more, the hollow parts of the roof where nests had been seen in the past were about 4m above the ground, posing little to no risk to folks below even if filled with nests. In this case, guests to the bodega apparently do not want to see any wasps at all. This is strange, because wine is a natural product, and wasps such as these are predators of insects such as caterpillars that may be significant pests of the grape vines used to make the wine. In this case however, we now have a death zone around the building, and we likely have residues of a pyrethroid insecticide on every surface

around and even inside this bodega. ***This seems like it would have been a great opportunity for the bodega owner to educate their clients with a sign and photos and then to market their wine as "environmentally friendly", taking advantage of natural biological control agents. I understand that the client in this case also contracts for more important public health pest management and is considered very important, but the treatment is unnecessary and potentially hazardous. Such applications are illegal in California.***

- August 19b: Another treatment, in a nearby town, was also for *Polistes*. In this case, however, ***the application was absolutely necessary, since large nests were present inside containers for recyclables and trash in a public street***: https://photos.app.goo.gl/kknZTRByfhLRwVP5A, https://photos.app.goo.gl/zFnjjXhNebY58MBn7. Furthermore, the treatment was accomplished with very little insecticide and minimal exposure to the surrounding environment: https://photos.app.goo.gl/4UQMWDy9fHnPFHhd7. Another interesting observation at this site were hollow tubes used a decorative fence around a public park that, once filled with water, had historically served as excellent breeding sources for *A. albopictus*: https://photos.app.goo.gl/pZVdAEyFcSs561H28, https://photos.app.goo.gl/J6waNiXnueXgEcey6. ***Understanding the various sites where such mosquitoes can breed will be very important for Lokímica's technicians moving forward.***

August 22 – August 26: A Coruña

This brand new delegación is just getting started. Nevertheless, I was very impressed with the team of técnicos. Many of these individuals have come from other pest control companies after the municipal contract changed hands to Lokímica recently. As such, they have incredible knowledge of the city, local customs and culture, the specific sites to be served, and the pest history of all. The major pest in A Coruña is definitely the rat (*R. norvegicus*), constituting the target pest in the majority of continuing campaigns as well as isolated complaints. It is unclear whether *R. rattus* is present in the city; no clear signs of this species were observed during my time there. Secondary pests include subterranean termites (*Reticulitermes* spp.) and Asian hornets (*Vespa velutina*), both of which were very common within the city and in surrounding pueblos.

- August 22: four-hour formación en español delivered to all técnicos. Subjects included subterranean termites, social wasps, peridomestic cockroaches, and bed bugs. Presentation delivered was very similar to this one: https://docs.google.com/presentation/d/1g_n999yJyacq8okrREmhMzT02fBrUb9g/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- August 23a: Spent a few hours in the office with the delegados, learning the geographic positioning system (iGEO) used to track routes, special services, avisos, and the history of everything. ***This system was clearly very useful, but users will need to find a balance, since lots of information can be provided (sometimes too much), costing technicians precious time in the field.***
- August 23b: Avisos. It became clear that rats (*R. norvegicus*) are the primary target pests in A Coruña. All avisos involved rats. We visited a residential multi-unit site with a long history of rats burrowing under and around buildings https://photos.app.goo.gl/kJYRRFjPVYfWLFgM6. All structures were in disrepair, providing hundreds of entry points (https://photos.app.goo.gl/VAxaxN875tDk5riQ6) and harborage areas. Established cat colonies (https://photos.app.goo.gl/DtT17zs5MdJmULrr6) provided food and water. The abundance of available food may have made baits noncompetitive since baits were often untouched. The technician photographed these "conducive conditions" and uploaded them to the iGEO system. This marks an important function of this program: ***photo evidence can be shared with the client and used as explanation for failing pest control problems, especially when conducive conditions have not been addressed.*** Sites like this, with long history of major problems without any control, need change. The program used there for many years has not worked, so why should it work in

the future? ***Physical traps, with restriction components to exclude cats and other nontarget animals, should be considered.*** Of course, without addressing the conducive conditions, no lasting control will be possible. We also visited an institutional building with a rat found indoors. We tracked the entry along the electrical cable pathway, poorly sealed with expanding foam. Bait was applied within an exterior electrical conduit port: https://photos.app.goo.gl/iDDBHk4rWRtY28tV7. Entry along these foam-sealed conduits (https://photos.app.goo.gl/Rn4f9EtGfq8NyUet7) became a common theme in A Coruña, encountered many times, and especially common with newer construction. ***Electrical conduits should always be inspected when rats are entering buildings. Clients, electricity providers, and contractors need to be involved in the process and provide access for pest control. Better construction practices and materials will help prevent rat problems in new buildings.***

- August 24a: We visited a municipal mercado with a *Blattella germanica* problem. Trapping had isolated one breeding population to a single fish stall that is adjacent to the public bathroom. We observed one medium-sized aggregation within the plastic casing around the controls of a freezer unit: https://photos.app.goo.gl/YkRiYxePWQpyX8vt9. Gel (Goliath) was applied previously, and several dead cockroaches were observed. This infestation appears to have been detected early enough that eradication may be possible. More bait needs to be applied near the breeding population, in the private stall. ***Equipment will need to be removed and cleaned for a proper application. This is a recurring theme at these markets: pest control often will require periodic removal and cleaning of equipment within stalls.*** In some cases, the stalls themselves provide cracks and crevices (harborage for cockroaches and mice) and need to be renovated with pest prevention in mind. Stall owners are reluctant to perform this kind of maintenance, since they do not want to lose money, but they are creating a public health hazard. There will certainly be perceived liability on the parts of the municipality and Lokímica should a health problem ever be traced back to an ongoing and unresolved pest problem. In the United States, food service businesses are closed immediately when cockroaches or mice are found by health inspectors. The owners are then unable to open for business until they can prove pests have been managed; this period is a minimum of 30 days.
- August 24b: Trapping program for *Vespa velutina* at municipal cemetery south of town using Trappit wasp attractant and Trappit Wasp Dome: https://photos.app.goo.gl/K5mUjmSBX7E57ZEi7. This product appears to be working very well, with > 150 *V. velutina* caught during a two-week period: https://photos.app.goo.gl/TWX53FqiXJVHeUVn6. ***I recommend Lokimica try a perimeter protection program for sensitive sites concerned about V. velutina stings.*** These traps can be located around the site to be protected, forming a perimeter of traps every 50 m to reduce the number of wasps entering the protected area. We have used a similar program to protect zoos and parks from high *Vespula pensylvanica* populations in California.
- August 24c: More rat avisos, this time in an upscale residential neighborhood with detached homes. Several homes were abandoned or under repair, providing access to the street from sewer systems and providing harborage and burrow sites on the unused properties. It is unclear whether roof rats (*R. rattus*) have colonized A Coruña, but many of these sites appeared to provide adequate habitat (trees, fences, rock walls), and some of the avisos (rats in trees) suggest they are already there.
- August 25: initial campaign of rat inspection and treatment around a large municipal park. It became clear that a very large population of rats was present and had gone untreated for a little while: https://photos.app.goo.gl/G3rM27hpikiVB4NX9. Several delays occurred because the iGEO system was down. It was observed again that this system needs to be balanced with technician time in the field.
- August 26a: Large and very touristic public market with a very large *B. germanica* infestation. Focus of problem was in one stall, but several stalls contained breeding populations, and cockroaches could be found in every stall inspected. Very high numbers of cockroaches were observed within electrical equipment: https://photos.app.goo.gl/CKW9wRATgQGxBKH17. ***This infestation will not be controlled until the market can close for at least one day for cleaning and treatment.*** As mentioned before, equipment will need to be removed from stalls and cleaned (vacuum, scrub with foaming

degreaser). Gel will need to be applied in sufficient volume, probably at the maximum rate allowed, to cracks and crevices in the stall before equipment is reintroduced. If possible, structural cracks within stalls should be eliminated: https://photos.app.goo.gl/eyPXCjxuDd5Bu4Hb9.

- August 26b: An isolated infestation of *Periplaneta americana* in the sewer system near Rua Real was inspected. This population appears to be new. It is still small enough and concentrated enough that it can likely be eradicated using an aggressive baiting program. Although Ecorex Gel is used throughout Spain and appears to be somewhat effective, I recommend that another (non-pyrethroid) gel product be used in cases like this where it is imperative to achieve a high level of control. I reviewed the available products for use in Spain with the delegado here, and we identified an imidacloprid product that may be used, though it would cost substantially more than Ecorex. ***It is rare that a pest control company has the ability to prevent widespread colonization of a city by a new pest; it appears that Lokimica has this opportunity with American cockroaches here in A Coruña.***
- August 26c: Government building with a long history of subterranean termites (*Reticulitermes* spp.). Severe damage to wood members throughout structure was observed. An ancient artesian well was located on the ground floor and provided soil access in the middle of the building (https://photos.app.goo.gl/kzj9Sh1FRMLYNTJp9). Interviews with the staff revealed that the infestation was at least eight years old. The team detected several old Exterra bait stations installed by a previous pest control company: https://photos.app.goo.gl/DekAR1RL54jvb77J8. Many of the baits within the stations found had been totally consumed, and the infesting colony (or colonies) appear to have been exterminated years ago. These bait systems work very well, even in old and complex structures with many inaccessible wooden components. ***It is imperative that Lokimica establish a termite inspection and control service for this municipality. This will require special training for technicians and may require a license agreement with Dow-Corteva to use the Sentritech system. It is possible that this licensing process will be facilitated by existing Rentokil agreements*.**

September 6 - September 19: Barcelona

This delegación is the largest of all Lokímica's locations, but it also appears to be one of the newer, with only nine years in operation. I believe this team has experienced some growing pains, having expanded very rapidly. Several técnicos expressed disappointment with the training and leadership provided. Many members of the team are new, and it was expressed to me that the new folks may not know their jobs very well and were not properly trained in safe and effective use of their tools before beginning a route. There was also a labor union (sindicato) meeting while I was there, with the major topics of discussion poor salary, understaffing, too high workloads, poor training, and poor leadership. To address these issues, I suggest the leadership team at Lokímica establish standardized training for new hires, ongoing training for established workers, rotating assignments to allow técnicos to learn from each other in many different roles and assignments, and ride-along participation by leaders with técnicos in the field so that communication and shared awareness of the job may be achieved. Another major finding at this location was that site-specific records are often not available to técnicos in the field. Not all are using the tracking software, and not all historical data for treatment points is available. This makes pest control difficult and confounds the evaluation process. Barcelona has many pest issues, including very high mosquito populations, terrible pest conditions (mice and German cockroaches) in public markets, very high American cockroach populations in the sewer system, many urban nests of *Vespa velutina*, and high incidence of both rat species.

- September 6: Subsuelo treatments for *P. americana*. Ecorex gel applications were liberally applied. ***Much of the product applied was observed to fall from treated surfaces into the flowing water and waste. I recommend that this delegación find a better application method, such as applying gel within rodent bait stations, plastic tubes, or some other container that will contain gel and prevent it from falling while allowing access for cockroaches***. Furthermore, the cockroach populations appear to

be very high, perhaps unaffected by the gel treatments. In areas with recurring avisos, or when cockroaches are regularly exiting the sewer system to forage in streets, ***another, more effective, tactic, such as the imidacloprid product, will need to be used to achieve control***. Entering and treating the subsurface is a major undertaking with major inputs required (https://photos.app.goo.gl/WRNgafRgwH4fN4Fs5), so ***high efficacy should be the goal***.

- September 7: Rentokil formación in Madrid. Three-hour training provided: https://docs.google.com/presentation/d/1g_n999yJyacq8okrREmhMzT02fBrUb9g/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- September 8: Inspection of treated and untreated manholes in L'Hospitalet de Llobregat, as part of the research investigation into the new Mylva product, Ecorex Disk One. Populations in treated manholes was steady and much lower than those within untreated manholes (untreated example: https://photos.app.goo.gl/pEEzuaHq2L8nawEd8). ***My impression was that this product may be used to maintain low population levels but that it will be difficult to use it to eradicate or significantly reduce problem infestations.*** The application method, using a plastic rodent bait hook (gancho) to suspend the disk (https://photos.app.goo.gl/cA5aSubgVtTAnfMS8), was excellent and allowed for easy observation of activity and no loss of product to falling. ***More than one disk could be suspended when populations are high, but this may depend on product requirements and local regulations*.**
- September 9a: Initial installations of rodent bait stations at two different urban parks. Evidence of both *Rattus* spp. was observed. Bait was applied directly within rat burrows, as well. I'm not a rodent management expert, but it seems ***nonchemical tactics (traps, habitat modification) will be required to manage difficult rat problems in Barcelona***, especially when *Rattus rattus* is present, landscapes provide competing food sources, and nontarget animals (domestic dogs, wild pigs) are present. The in-burrow application seemed especially risky, from a nontarget animal consumption point-of-view. As you all may know, second-generation anticoagulant rodenticides cannot be used like this in California due to concerns about direct consumption and secondary poisoning of nontarget animals and wildlife. Wild pigs had also caused extensive landscape damage at the park in the northern suburbs (Trinitat Vella). ***Physical exclusion of pigs from parks is very important, but this may not be within the purview of Lokímica's contract. Communication with other entities may be necessary*.**
- September 9b: Aviso at public grounds surrounding low-income apartment buildings: rats, cockroaches, ants. ***Infrastructure problems (numerous structural entry points, trash accumulation, excess vegetation) contributed greatly to pest issues at this site***. An outdoor population of *Blatta orientalis* was observed. A pest problem with Argentine ants (*Linepithema humile*) was reported. Numerous trailing ants were observed, but they were *Lasius* spp. and other unidentified ant species; not Argentine ants. A nest treatment was made to a *Lasius* colony that was probably not justified, since this genus of ants does not readily enter structures. ***I recommend an ant identification unit within Lokímica's initial (or advanced) training materials for técnicos.*** Spain has very rich ant diversity. I experienced a lack of ant species knowledge at all delegaciones. Most species are not pests and do not require treatment, while others invade structures and / or are medically important because they have venomous stings. Pest control operators need to know the different species most likely to be encountered in their regions.
- September 9c: 120-minute formación: introduction to gestión integrado and cucarachas peridomésticas: (portions of this file) https://docs.google.com/presentation/d/1g_n999yJyacq8okrREmhMzT02fBrUb9g/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- September 12: Regular visits with the "edificios públicos" team. Interior monitoring services focused on mice, German cockroaches, and occasionally-invading American cockroaches. Silverfish (lepisma) were very abundant at several sites and were observed to be eating the rodent baits. ***Silverfish, though not significant pests, are important signs of high humidity and excess water in buildings. Their presence should always be noted and shared with building managers for this reason*.** New research

(see ICUP 2022 Proceedings) suggests they can be managed with interior-use cockroach gel baits. In some cases, ***old gel applications were still present at these sites, presenting aesthetic damage and potential for pesticide exposure to building inhabitants***. In one case, a large volume had been applied to manage an invading population of *Periplaneta*, and the old deposit was stained dark with mold: https://photos.app.goo.gl/1Jsd3cnamP7WHZqC7. This problem is another reason *to* ***limit gel applications, especially large volumes like this, to self-contained stations***, such as mouse bait stations. ***Recommendation: bed bug pitfall monitors ("interceptors") could be used when visiting interior spaces***, especially when residents or building inhabitants may sleep or rest inside (such as appeared to be the case at one senior living facility we visited). ***Bed bug detection at these facilities will help prevent serious problems and will create extra service revenue.***

- September 13: *Vespa velutina* nest treatments. First, a large nest about 15m up in a tree was targeted with a paintball rifle and pyrethroid-impregnated paintballs. This application, though potentially very efficient and effective, raises several questions. ***How many direct hits are required for an effective treatment?*** This information will help Lokímica to limit labor, time, and pesticide product used at treatment sites. Also, ***when shots fired do not lodge within or explode on the surface of the nest, they must be retrieved*** to prevent pesticide contamination of the environment and unnecessary exposure to humans and nontarget wildlife. Our team always tried to retrieve missed shots, but we could not find them all. Better storage and handling of insecticide-impregnated paintballs will also help to limit time and product used on site. ***Use of a -80ºC freezer (instead of a conventional -20ºC) will help to freeze the paintballs in a more solid state and ensure they remain frozen on site***. Insecticide was observed leaking out of thawing paintballs on site, and several thawing paintballs did not fire correctly and jammed up the rifle's magazine. We next visited another site where a *velutina* nest had been reported, but we were unable to find it after almost an hour of searching. The técnicos explained that this was a common occurrence. ***One suggestion is to try an infrared scope or similar device to find nests.*** Wasp nests will be warmer than the air temperature in the morning and cooler than the air temperature in the afternoon. Finally, we visited another park where we physically removed a small (primary?) *velutina* nest that was in the ground, under the root mass of landscape plants. This was a very important and justified treatment since it removed a nest that posed a significant health threat to visitors of the public park. Not all nests pose this problem. ***Many nests, especially those high up in trees and far from public recreation or outdoor dining facilities may be left untreated. I believe that this invasive species is established in Barcelona (it is definitely established in Galicia). Therefore, management goals should shift from eradication (futile) to prevention of stings.***
- September 14: regular service at the Barcelona Zoo. The primary pests at this site were rats. Both species of *Rattus* were apparently present. Large quantities of rodenticide bait were consumed (https://photos.app.goo.gl/BeKn9GvVByyVCBcN7), but significant rodent activity and damage continued. Due to the old wooden infrastructure of the zoo, competing food sources everywhere, and concerns about using baits in certain areas, it will be very difficult to effectively manage rats at this site. Lots of established rat pathways and entry points were observed: https://photos.app.goo.gl/tTVbURyhhcNQ1tDe7, https://photos.app.goo.gl/Ra2bXJRYvS74hcwY9. Another problem: the tenebrionid larvae given to many of the birds in the zoo readily feed on rat baits as adults: https://photos.app.goo.gl/qLmyG9QAUwZqUhqaA. ***It seems that nonchemical rat control tactics may be more effective than baits in many parts of this facility.*** I observed one Goodnature physical kill trap, but it was located in an area seldom visited by rats: https://photos.app.goo.gl/wCKXS3dFb28EzrJ4A. ***Physical traps need to be located near or directly within rat feeding sites and travel routes. Various attractants should be considered and tried, with the goal of competing with all the other food available to the rats. The zoo staff and Lokímica need to use wildlife cameras to detect entry points and travel routes. Then they need to help seal these old structures and prevent entry into new exhibits.*** A brodifacoum gel was used within rat burrows in a bird enclosure (https://photos.app.goo.gl/beMi5SQbfEtSQRWeA); this application would not be legal in California, and ***I wonder why there is no concern that birds will not dig into burrows and consume***

bait. We treated one *Vespula* nest within a hollow-brick wall: https://photos.app.goo.gl/DTKsctYBZMCSLVwX9, https://photos.app.goo.gl/sqXVfXwmpPmfJbzf9. ***Extreme caution should be included in such applications to ensure zoo animals do not come into contact or ingest pesticide residues after treatment***. We also observed *Vespa velutina* and *Vespula germanica* workers foraging on food items that were available for birds and other animals within exhibits: https://photos.app.goo.gl/D7pxrNJa2APTCxg47. A fabric netting appeared to serve as an effective barrier to flying *velutina*; they did not seem to be able to cross it while in flight: https://photos.app.goo.gl/CToUy7gMZobRZ31V6. ***It may be that nets like this one could be used as exclusion devices in other areas, preventing wasps from entering sensitive sites***. Numerous *Periplaneta* wings were seen discarded within and above animal cages: https://photos.app.goo.gl/KXqLMuVSmsUE9T2RA, https://photos.app.goo.gl/Pb5YxuvdQ2MeSfaP7. This indicates two things: ***there may be a breach or opening to a sewer or drain system that is allowing cockroaches to forage in the zoo, and rodents are eating them. Further inspection is required. I suggest técnicos use inspection mirrors at this site to better inspect behind complicated infrastructure in close quarters.***

- September 15a: Another *Vespa velutina* nest treatment with rifle and paintballs. This treatment was in a busy urban intersection. We cordoned off the site, and no members of the public entered the zone during treatment. After treatment, however, we found several paintballs that missed the target or ricocheted off and ended up outside of our contained zone. ***Lokimica should refine such treatments to limit time spent at the site, limit the number of paintballs, fired, limit the number of direct hits required for effective control, and limit the visibility of the treatment***. As stated before, ***many nest treatments may not be justified; this one was probably not necessary*** (no reports of stings, nest was 20+ m above ground. ***Eradication of this invasive species no longer seems feasible and should not be the goal of the local government.***
- September 15b: Visits to homes of people infected with dengue (travel cases). Monitoring devices for adult mosquitoes were placed on patios and near homes of infected people to check the infection status of *Aedes* in the area. This work is very important. ***In the United States, this is usually done by a governmental vector or public health agency. When done correctly, the time required, and expertise needed for such programs will be a financial and operational drain on private companies. If any of the Aedes-transmitted arboviruses become established in Spain, then it will be imperative for the government to form such dedicated public services.***
- September 15c: 120-minute formación: avispas sociales, termitas, chiches de cama: (portions of this file) https://docs.google.com/presentation/d/1g_n999yJyacq8okrREmhMzT02fBrUb9g/edit?usp=sharing&ouid=114980821805913012004&rtpof=true&sd=true
- September 16a: More visits with the "edificios públicos" team. We visited a public lab with a small fly problem that had been happening there for more than one year. The flies, originally identified as *Drosophila* vinegar flies, had been contaminating specimen plates used to test samples for *Legionella* and other pathogens. Vinegar traps designed for these flies showed reductions over time and yielded very few flies within the labs and specimen rooms where the original problem occurred. Ultraviolet light traps in those rooms, however, contained hundreds of trapped flies, mostly humpbacked phorids (Diptera: Phoridae, maybe *Megaselia scalaris*: https://photos.app.goo.gl/7gm3J3iYgsjboevV8). These flies are known to breed in sewer and drain slime (https://extension.psu.edu/phorid-flies), explaining their interest in selective petri plates for legionella. The ingredients of this selective media were shared with us; these may further show why *Drosophila* was not a likely target pest. ***The source of these "filth flies" must be determined and eliminated before control can be expected at this site. This is an example of long-term poor control caused by misidentification at the site.***
- September 16b: Regular service at the Mercado de La Boqueria. This large market (https://photos.app.goo.gl/ZthdWhP7hkN23P5G7) with hundreds of stalls, has serious pest problems,

especially with mice and German cockroaches (https://photos.app.goo.gl/RSffJVpRmYsD94v37). Discarded cockroach wings (from rodent feeding) were observed on dining surfaces in several areas: https://photos.app.goo.gl/gnjbhtRcs2L2QM6v8. Drains in the ground (subsuelo) floor were open (no water barriers, sin rejillas), allowing for entry of *Periplaneta americana*: https://photos.app.goo.gl/WGdkjuapnUW3Tksz8. ***A larger team is needed to provide adequate service. Stall owners and market managers need to be willing to close sections of the market or the entire market to remove equipment and stall structures, vacuum, and deeply clean hidden surfaces to remove pests, feces, discarded food items, etc. The pest populations at this site are so bad, and the (tourist) visibility so high, it is only a matter of time before a high-profile pest sighting, pesticide exposure event, or pest damage (sickness, bite event) occurs, potentially damaging the reputation of Lokímica. The contract value and manpower dedicated to this site need to be greatly increased.***

Pest-Specific Observations and Recommendations:

Peridomestic cockroaches: Of the cockroaches that fall into this category, the primary target for Lokímica, given the public contracts held and the public infrastructure included, is the American cockroach, *Periplaneta americana*. These insects will always be present within sewer systems. In fact, their feeding may help to clean underground systems by removing excess organic debris, thereby increasing flow of water and waste. Pest problems occur when their populations are very high and / or when infrastructure allows them to exit the sewers and forage in stormwater systems, old residential drainage systems (arquetas), and urban streets. The biggest problems occur, of course, when they can enter homes and other structures, either via faulty drainage systems or from the building exterior. To reduce populations in sewer systems, I suggest continued use of baits in locations with high densities. In most cases, I suggest gels within tamper-proof stations or, at the least, containers that prevent contamination of water. I am skeptical that Ecorex Gel One provides adequate control, and I suggest using another gel product when managing high-value or sensitive sites. I know the registration for such products is limited, so you may not have many options. The pyrethroid sprays I witnessed in Valencia and Alicante are not likely to produce good control, usually result in cockroaches being repelled from the subsuelo, and will surely contaminate water resources. The Ecorex Disk One product may help to maintain populations that are already low, but I do not believe it can be used to solve major problems. Many of the *Periplaneta* issues I experienced were caused by infrastructure (holes, gaps, lack of sufficient water). Lokímica needs to better document these problems and communicate with clients and partners that pest control will not be sustainable until the problems are fixed. I also saw several problem-level populations of *Blatta orientalis* in the public parks of Madrid. These cockroaches are certainly foraging nearby at night and may enter restaurants, homes, or other structures. In some cases, baiting with gels or granules within tamper-proof stations may be justified. It is very likely that populations of *Blatta lateralis* will continue to be found in Spain. While I was there, I was made aware of two high-density populations, in Barcelona and in Tarragona. If they become established, they will displace *B. orientalis* to become the most common landscape species, often causing pest problems in nearby structures. Our research shows that they, too, can be effectively managed with baits.

In cases of major problems with peridomestic cockroaches, I recommend nighttime inspections. I know that Spanish culture does not usually include nighttime work, but it would be much easier to locate problems, breeding populations, and points of access at night than during the day. Most pest control companies in the United States include “nocturnal teams” for cockroach or rat inspections.

German cockroaches: All the problems I saw with German cockroaches were associated with public markets. These infestations should be considered very serious, as we know this species to be an important public health

pest. Sustainable control of these infestations will not be possible without cooperation from the stall owners and market managers in these cases. In the United States, such infestations would lead to business closures and, if left unresolved, litigation. The good news is that they can easily be controlled with gel baits. The trick is always to apply enough product. Bait application volume should always be according to the population density, as determined by monitoring. Several small deposits may be the norm but will not be adequate when large populations exist. We often use up to 60g of gel in single apartments when we trap hundreds on glue boards, such as I observed in A Coruna and Barcelona.

Social wasps: Wasps are beneficial insects until they sting someone, may reasonably sting someone or are nesting in or on a structure, in my opinion. They serve as predators of caterpillars, spiders, and other soft-bodied arthropods. They serve as pollinators of many plant species. The most significant wasp pests in the United States are the *Vespula* spp., but only because they readily scavenge human foods and because they have subterranean nests that can easily be disturbed by passing people (resulting in significant stings). When nests are found to be causing problems, they can be directly treated or removed. Many of the *Polistes* applications I observed in Spain seemed unnecessary, in my opinion. Some of the *Vespa velutina* treatments I observed in Barcelona seemed unnecessary and futile. As already stated, the species cannot be eradicated. If it's not causing pest problems, it should be left alone. I know this is sometimes difficult to say, since your clients expect all nests to be treated. I think this program will continue to evolve. One day, nest treatments will be limited to those situations where an actual problem has been documented.

Bed bugs: Providing good quality bed bug control is a very specialized service. Without proper tools and training, it is simply too expensive for many pest control operations to provide. The bed bug program I observed in Madrid seemed to rely on residual insecticides and steam. It was very labor intensive and created potential for pesticide exposure that would not be legal in most parts of the United States. Most bed bug populations in the world exhibit some level of resistance to pyrethroid insecticides, so use of such products should be limited. Alternative active ingredients include neonicotinoids and chlorfenapyr. As mentioned already, most specialized companies in urban parts of the USA are using silica-based desiccants (in crevices and voids only), room sealing, and whole-room electric heat treatments. Monitoring tools, especially the "interceptor" style traps, should be sued to confirm infestations and to evaluate treatments. These often work better than canine detection services, though they must be left in place for two weeks and then revisited.

Subterranean termites: I think *Reticulitermes* spp. subterranean termites are much more common in Spain than people realize, and they may certainly be threatening many wooden structures. I observed significant damage in Galicia as well as Valencia. Special surveillance should be established during swarm season, usually spring, to locate mature colonies that may be infesting public buildings. Baits such as Sentritech are very effective and should be considered as primary tactics.

Mosquitoes: I'm not an expert on mosquito control, but I was surprised to see the mosquito density and associated widespread pest problems in Spain, especially in Valencia, Barcelona, and A Coruna. Countless breeding habitats exist within unmaintained parks and gardens, not to mention clogged street drainage and stormwater systems. In southern Spain, I observed *Aedes albopictus* to be very common. If arboviruses such as dengue or chikungunya arrive one day, there will be major problems. I believe the local governments need to invest more in mosquito prevention (clearing drains and gutters, education of residents). Without reducing these breeding locations, it will be impossible for service providers such as Lokímica to control problems.

Black flies: These biting insects are not considered major pests in the Unites States, and they are never managed in the way I observed in Valencia (high-volume *Bacillus thuringiensis israelensis* sprays made to local rivers and streams). They do not vector pathogens in Spain, and some of the targeted species do not even bite humans. It is difficult to justify such *Bti* programs, and they are not likely to reduce populations very much. Unfortunately, clients may demand such services.

Rodents: I am not an expert in rodent control. My observations suggest that both *Rattus* species are present in almost all locations I visited in Spain. We have had very poor results with anticoagulant baits against *Rattus rattus* in California, probably because of its reported huge foraging range (500m radius from nest) and its ability to feed on fruits and nuts in urban landscapes and gardens. Furthermore, our problems with anticoagulant rodenticides entering the food web and directly or indirectly harming wildlife (hawks, owls, other raptors, coyotes, domestic dogs, mountain lions) are not unique. I believe that the EU will increasingly look to limit or eliminate uses of anticoagulants in urban landscapes. I suggest Lokimica begin experimenting with various nonchemical tactics for *R. rattus*, such as tamper-proof stations containing snap traps or well-placed Goodnature traps. Dogs (terriers) are also being used in the USA and the UK to nonchemically control nesting populations of rats in urban landscapes. Anticoagulants are probably the best and only tactics for use against *Rattus norvegicus* in sewer systems, however, so I hope the EU will continue to allow such uses.

For difficult rat problems, better surveillance and inspection may be required to determine access points, breeding sites, and travel routes. For this, it may be best to consider wildlife cameras or nighttime inspections.

Summary of Publication Examples: Andrew Sutherland

Urban Integrated Pest Management Advisor: San Francisco Bay Area

Merit (Full Title II to Full Title III)

Review Period: October 1, 2020 – September 30, 2023 (duration since last salary action)

1. **Peer-reviewed scholarly journal article example:**

   Sutherland, A.M., Hubble, C., Barber, M. 2022. Installation season may significantly impact time required for subterranean termites to find and feed on in-ground baits. *Insects* 13(5), 445; https://doi.org/10.3390/insects13050445
   I was the lead author, drafting most text sections and coordinating contributions from other authors. The paper reports on a project on which I served as principal investigator, designed experiments, analyzed and summarized data, and interpreted results.

2. **Other peer-reviewed publication example:**

   Taravati, S., Haver, D.L., **Sutherland, A.M.** 2023. *Pest Notes*: Hiring a Pest Control Company. UC ANR Publication 74125 (revised), published August 2023: https://ipm.ucanr.edu/PMG/PESTNOTES/pn74125.html
   I was involved in the revision process from start to finish, with significant involvement in concepts, content development, drafts, revisions, and graphics.

3. **UC IPM newsletter example:**

   Sutherland, A.M., Kitagawa, B. 2023. Proactive IPM Programs in Multi-Unit Housing Environments. UC IPM Green Bulletin 13:2, Spring 2023 Issue: https://ipm.ucanr.edu/legacy_assets/pdf/pubs/greenbulletin.spring.2023.pdf
   I was the co-PI on the applied research program that generated the data reported in this article. I was the lead author of the manuscript, drafting all text and designing graphics to be used. Finally, I coordinated review and revision with the co-author and then submitted the final draft to the publisher and served as the corresponding author.

Goals and Objectives for the Coming Year:

For the Period October 1, 2023 - September 30, 2024

Name:	Andrew M. Sutherland
Title:	Urban IPM Advisor – Full Title II
County/Program:	Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, UC IPM

Part 1. GOALS & OBJECTIVES FOR THE COMING YEAR:
October 1, 2022 - September 30, 2023

Note: all programmatic "Themes" have been combined since many objectives overlap or otherwise apply to all themes.

Specific Goals	Anticipated Collaborators	Anticipated Outcomes and Impacts
Perform formal needs assessment survey within structural / industrial PCO industry.	Pest Control Operators of California (PCOC), Structural Pest Control Board (SPCB), UC ANR colleagues	The UC ANR continuum will be better informed as to the specific needs of this heretofore under-served clientele group.
Secure additional funding to conduct collaborative research and extension activities with each primary clientele group.	PCOC, SPCB, Pesticide Applicators Professional Association (PAPA), California Department of Pesticide Regulation (DPR), UC IPM, county IPM personnel, MGs	Funding will allow for research activities and development of new educational materials and products by providing supplies, equipment, travel resources, production costs, and in some cases, personnel support.

Specific Goals	Anticipated Collaborators	Anticipated Outcomes and Impacts
Conduct research on efficacy of IPM tactics (sampling, monitors, alternative tactics, and pesticidal materials).	UC Berkeley Urban Pest Management Center, UC ANR colleagues, DPR, UC IPM, PLMs, PCOs	Clientele will have increased knowledge of efficacy of new and existing IPM tactics. Findings will be disseminated via various methods.
Develop online resources for professional clientele within new UC IPM web platforms.	UC IPM staff and subject-area experts, PCOC, PAPA, MGs	Professional clientele will increasingly view UC IPM as a valuable source for information and resources pertaining to urban professional pest management.
Develop specific IPM curricula for specific urban settings (schools and child care settings, public housing, multi-unit housing).	UC IPM, UC Berkeley Center for Environmental Research and Childrens Health (CERCH), UCSF, DPR, county IPM personnel, county public housing authorities	New resources will be realized for urban pest management professionals. Increases in knowledge and changes of behavior within the affected clientele groups will occur.
Produce curricula for MGs to use in extension to the public regarding household pests, invasive species, and water quality issues.	UC IPM, MG Program Director, county MG Coordinators, MGs	MGs will have new tools with which to educate the general public about these important and timely urban issues.
Continue to develop and maintain website ‘Urban IPM’, and associated web pages.	UC ANR Communication Services, UC IPM	Clients will utilitze information and resources pertaining to urban IPM, increasing knowledge.
Develop statewide standardized reporting forms for MG Help Desk / Hotline services.	MG Program Director, ANR Communication Services, UC IPM, MG Coordinators, MG Help Desk / Hotline volunteers	MG program will be able to determine nature and frequency of requests for information from the general public by topic, region, season, etc. This will serve program-wide needs assessment, development, and impact reporting.

Specific Goals	Anticipated Collaborators	Anticipated Outcomes and Impacts
Produce three peer-reviewed publications presenting applied research activities and outcomes in the area of urban IPM.	Various	Scientific community will recognize UCCE and UC IPM as contributors to the growing body of urban IPM literature.
Produce five clientele / trade magazine / newsletter articles.	Various	Clientele will be informed as to new IPM strategies and tactics, will value UC IPM as source for pertinent applied information.
Perform ongoing needs assessment research within all clientele groups.	Various	I will be able to design and develop my programs to address the specific needs of distinct clientele.

General Program Goals:

- Continue serving Bay Area structural / industrial pest control operators (PCOs) and individual pest management professionals (PMPs) through *Project Board* "Themes" 'IPM for bed bugs', 'IPM for subterranean termites', 'IPM for cockroaches', 'IPM for drywood termites', and 'IPM for schools and child care environments'.
- Continue serving Bay Area professional landscape managers (PLMs) through *Project Board* "Themes" 'IPM for schools and child care environments' and 'IPM for cockroaches.
- Continue serving all professional client groups, extenders to the public [such as UCCE Master Gardeners (MGs)], and the general public (via extenders) through broad *Project Board* "Theme" 'General promotion of IPM strategies and tactics'.
- Provide ongoing contributions to the statewide UC IPM program, by way of collaborative production of various resources, including but not limited to *Pest Notes*, *Pest Alerts*, newsletters, continuing education modules, web pages, videos, and electronic materials for mobile device users.
- Continue to develop as a professional via attendance at scientific meetings and other subject area clearinghouse venues, online courses and webinars, and specific training courses developed by UC ANR.
- Continue to support the science and community of IPM through ongoing contributions such as editorial services and subject expert committees.
- Continue to serve UC ANR as Associate Editor (Urban & Community IPM).
- Continue to support the goals of UC ANR by participating in and contributing to Program Teams, Work Groups, and other Strategic Initiative groups.

- Continue to serve the University through committees involved in program steering, program evaluation, and recruitment of new academics.
- Continue to provide services to the general public whenever possible.
- Continue to be mindful of the Affirmative Action mandates, and to make all reasonable efforts to include under-served and under-represented communities within research, extension, and outreach activities.
- Continue to demonstrate programmatic balance with regards to the academic performance expectations consistent with the Full Title Advisor rank.

Part 2. ANTICIPATED BARRIERS or OBSTACLES IN ACCOMPLISHING THESE GOALS & OBJECTIVES

- Structural pest control operators may regard pesticide application as the primary service they provide, garnering income for their industry. For this key reason, it may be challenging to motivate structural and industrial clientele to adopt IPM practices that reduce pesticide use.
- Sectors of the residential public in the Bay Area may demand a pest-free environment without tolerating any pesticide applications.
- Invasive pests will continue to be problematic in the SF Bay Area due to the urban reservoir created by landscapes and due to poor understanding within the public regarding routes of introduction and the severity of negative impacts associated with invasive pests.
- As an Advisor spearheading an evolving program in a very large urban area, it is important to continue to introduce myself to key clientele contacts: they may not know I am here, serving them, and therefore may be difficult to engage.

Part 3. SUPPORT from SUPERVISORS

My program is self sufficient and sustainable, only requiring general support from my county-based and statewide supervisors, such as:

- General knowledge of my programs and projects as well as key outcomes and impacts, so they may be shared with county partners and community members.
- General understanding of the regional nature of the program, meaning that my staff and I will not always be available for activities and functions focused on only one county in the region.
- General understanding that my program directly serves professional clientele and extenders to the general public. Direct service to the residential public will not usually be possible but will always be valued and considered as a vital public service.