Comprehensive Statement

in Support of Promotion from Associate to Full Professor

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Contents

1 Preface

I was hired by the University of Guam, College of Natural and Applied Sciences on October 1, 2003 under a limited-term, split appointment (50% extension and 50% research). On June 26, 2008, I started a tenure-track appointment as an extension entomologist with the academic rank of assistant professor. I received tenure and promotion to associate professor during spring term 2013. This comprehensive statement covers my activities from January 2013 through the present (Fall term 2018).

I retain my position as Guam's extension entomologist and I am also a member of the Environmental Science Program Graduate faculty and member of the Western Pacific Tropical Research Center.

I do not have a teaching appointment, but I have been tasked with being an instructor for undergraduate entomology courses. I have chosen to report on my teaching activities under the roll of *University and Community Service*.

I wish to be evaluated for promotion with proportional weight given to the following roles:

- 51% Extension and Community Activities
- 34% Creative / Scholarly Activity and Research
- 15% University and Community Service

1.1 What is Extension?

Not all readers will know what is meant by "extension". Here is concise definition:

"In the US, an extension agent is a university employee who develops and delivers educational programs to assist people in economic and community development, leadership, family issues, agriculture and environment. Another program area provided by extension agents is 4-H and youth activities. Many extension agents work for cooperative extension service programs at land-grant universities. They are sometimes referred to as county agents, or extension educators. Often confused with Extension agents, Extension specialists are subject matter experts usually employed as scientists and university professors in various departments in the land-grant university system. Subjects range from agriculture, life sciences, economics, engineering, food safety, pest management, veterinary medicine, and various other allied disciplines. These subject matter specialists work with agents

(usually in a statewide or regional team environment) to support programs within the cooperative extension system."

Source: https://en.wikipedia.org/wiki/Agricultural_extension#Extension_terminology

1.2 Philosophy and Interests in Research and Extension

- In my opinion, an agricultural scientist should have one hand in the dirt and one hand reaching for the sky. I have a very strong interest in learning about, evaluating, developing, and adapting new technologies. However, I recognize the danger of spending all of one's efforts in developing new tools rather than using them to solve real-world problems. As an extension entomologist, I spend much of my time doing applied research aimed at finding practical solutions to real problems impacting Guam.

- I very much enjoy interacting with and learning from growers and other clients.

- The most fertile place to prospect for new knowledge and technical advancement is at interfaces between sciences. I enjoy working as a member of interdisciplinary teams and I try to keep up to date in several fields of science and technology

- I have a wide range of research interests in integrated pest management (IPM) including development of sustainable crop monitoring systems (simplified monitoring that can be done by the grower, or automated monitoring using instrumentation)., development of least-toxic or non-toxic pest control methods.and development of control methods based on control of insect behavior using chemical or physical attractants and repellents.

- I am interested in using information technology to facilitate access to extension and research information and I have experience in building and maintaining web sites and databases for this purpose. While working at Northern Marianas College during the 1990s, I was very appreciative of the vast amount of extension information becoming available on the World Wide Web and I was able to contribute to this global effort by creating web sites and providing content. After returning to Micronesia in 2003, I continued this effort by creating and maintaining several technical web sites.

- I am skilled in scientific programming. I started programming computers in the mid 1970s and I have used many languages and integrated development environments (FORTRAN, BASIC, APL, Pascal, Delphi, PHP, Drupal, R, and Python). I am also skilled at simulation modeling, database design, technical graphics, and geographical information systems. I enjoy using these tools for extension and applied research and I often share my skills with colleagues.

- I have first-hand experience of the effects of accidental introduction of pests on island ecosystems and economies. (I was the first to discover the silverleaf whitefly and scarlet gourd on Saipan.) Since returning to Guam in 2003, I have been the first detector for more than a dozen invasive species of insects. I spend much responding to problems caused by recently introduced insect pests and I work with colleagues within and outside UOG who are trying to improve Guam's biosecurity.

1.3 Philosophy and Interests in Teaching

- The instructor should act as a filter for the students. She or he should be very explicit in identifying essential core knowledge. I would rather have my students be rock-solid on fundamentals than knowing a lot of details.
- We should give students the tools to build on their foundation of knowledge by teaching them how to use modern information technology including research libraries, on-line databases, and other internet tools.
- Learning (*and teaching*) should be pleasurable.
- Students should be given ample opportunity to improve their skills in scientific communication, both oral and written, aimed at a wide variety of audiences.
- I promote a holistic, systems science approach to problem solving, requiring a high degree of critical thinking and creativity.
- I am a strong proponent of hands-on field work.

1.4 In a Nut Shell

My Activity between 2013 and 2018

Publications: authored or coauthored 8 articles published in peer-reviewed journals. (Section 3.1)

Presentations: authored or coauthored 53 presentations for professional meetings. (Section 3.2)

Technical Reports authored or coauthored 78 technical reports (Section 3.6)

Grants: served as principal investigator for 16 grants with a total budget of $1,443,841. (Section 3.5)

Instruction: taught AG109 *Insect World* during 2 semesters and AG/BI345 *General Entomology* during 4 semesters. (Section 4.1)

1.5 Note to Reader

I have tried to make this report easy to navigate by providing a table of contents and reference lists. Evidence of my work is included in appendices which are available in a digital copy of this report which is in portable document format (PDF). I have provided several memory sticks which contain a PDF of my comprehensive statement with appendices. This PDF contains active links to all sections listed in the table of contents and links to articles of evidence contained in the appendices.

The PDF can also be downloaded from:
http://guaminsects.net/promotionPackage/comprehensive-statement.pdf

2 Extension and Community Activities (51%)

2.1 Insect Diagnostic Services

As an extension entomologist, a major part of my job is providing insect identification and pest control recommendations to diverse clients including commercial growers, gardeners, householders, GovGuam agencies, federal agencies, and UOG colleagues. Most client contacts are initiated by a phone call or a visit by the client to my office. In many cases identification and pest control recommendations require a site visit by me and/or extension associates to collect samples and define the problem.

The number of extension calls requiring my assistance averages approximately three per day during the reporting period. Many of these are documented as postings to iNaturalist [1].

References

[1] My iNaturalist Postings, Jan. 1, 2013 - Nov. 28, 2018. https://www.inaturalist.org/observations?created_d1=2013-01-01&created_d2=2018-11-28&place_id=any&subview=grid&user_id=aubreymoore&iconic_taxa=Arachnida,Insecta

2.2 Detection and Documentation of Invasive Species

Invasive insects are arriving on Guam at a very high rate (estimates range as high as one new species per day). Very few of these invasive species are detected and even fewer are identified because Guam suffers from the taxonomic impediment. Even when reliable species determinations are made, new island records are only rarely documented in the scientific press. Thus, impacts of invasive insects on Guam and elsewhere in Micronesia are grossly underestimated. One of my professional goals is to work towards solving this problem by increasing the detection rate, getting specimens identified by qualified taxonomists, and publishing new island records in the scientific literature.

- 3 new invasive insects documented in iNaturalist posts, 1 new invasive species fact sheet, 1 peer-reviewed journal article.

  - Pacific orange leafwing, *Doleschallia tongana* [1]
  - Lobate lac scale, *Paratachardina pseudolobata* [2, 3]
  - FIX THIS Mango fruit borer, *Citripestis eutraphera* (identification not yet confirmed) [4, 5]

- The International Union for Conservation of Nature (IUCN-ISSG) is building a Global Register of Introduced and Invasive Species. I have volunteered to coordinate building a check list for species on Guam.

- The Guam Invasive Species Council is required to maintain a list on invasive species on Guam. I have volunteered to be "registrar" for this list.

References

[1] Manuel, Jake, W. John Tennent, Donald W. Buden, and Aubrey Moore 2018. First Record of *Doleschallia tongana* (Lepidoptera: Nymphalidae) for Guam Island. F1000Research 7: 366. https://f1000research.com/articles/7-366/v1, accessedApril17,2018.

[2] Moore, Aubrey. 2018. Lobate Lac Scale (*Paratachardina pseudolobata*). iNaturalist.org. 2018. https://www.inaturalist.org/observations/12779405.

[3] 1. Post MS— TGD. New tree pest found at UOG site in Yigo [Internet]. The Guam Daily Post. 2018 [cited 2018 Jul 27]. Available from: https://www.postguam.com/news/local/new-tree-pest-found-at-uog-site-in-yigo/article_9ae0a830-8fa0-11e8-8cb6-c3bd2a08c887.html

[4] Moore A. *Citripestis eutraphera* [Internet]. iNaturalist.org. 2018 [cited 2018 Aug 25]. Available from: https://www.inaturalist.org/observations/15067449

[5] Moore A. *Citripestis eutraphera* [Internet]. iNaturalist.org. 2018 [cited 2018 Aug 25]. Available from: https://www.inaturalist.org/observations/13466275

2.3 University of Guam Insect Collection

The UOG insect collection is a valuable reference collection for extension entomology, teaching and research. I work with Dr. Ross Miller to curate and catalog this collection.

- I ported the digital catalog for the UOG Insect Collection from a CSIRO BioLink database to a more modern web-based Symbiota database which is now online [1].

- I established an internship to train entomology students how to curate an institutional insect collection [2].

- The Benita Laird-Hopkins collection includes more than 5,000 insect specimens reared from seeds of forest plants from Saipan and Guam as part of the Ecology of Bird Loss Project. This collection has been cataloged and accessioned into the UOG insect collection and a publication is being prepared [3].

- In June 2018 I attended the Second Annual Digital Data in Biodiversity Research Conference sponsored by iDigBio (Integrated Digital Biocollections) to attend a workshop entitled Sharing and Mobilization of Massive Specimen Image Databases from Collections of Tropical Island Biodiversity as an invited participant. I made a presentation on building a biodiversity inventory for Guam [2] and discussed ongoing collaboration with Dr. Alex Vandam, University of Puerto Rico, on writing an NSF proposal to support digitization of biological collections on American-affiliated islands [5].

References

[1] Moore A. SCAN University of Guam Insect Collection Collection Profiles [Internet]. 2018 [cited 2018 Aug 23]. Available from: http://scan-bugs.org/portal/collections/misc/collprofiles.php?collid=180

[2] Moore A. Internship: University of Guam Insect Collection Technician [Internet]. 2018. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/internship.pdf

[3] Laird-Hopkins BC, Downey HF, Basset Y, Fricke E, Moore A, Quicke DLJ, et al. [IN PREPARATION] Fruit and seed-eating insect assemblages on island ecosystems. Biotropica.

[4] Moore A. Building a Terrestrial Biodiversity Inventory for Guam [Internet]. Oral presentation presented at: Second Annual Digital Data in Biodiversity Research Conference; 2018 [cited 2018 May 30]; Berkeley, CA. Available from: https://figshare.com/articles/Building_a_Terrestrial_Biodiversity_Inventory_for_Guam/6188315

[5] Moore A. Trip Report: Second Annual Digital Data in Biodiversity Research Conference, Berkeley, CA, June 2018 [Internet]. 2018 [cited 2018 Aug 25]. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/Berkeley_Trip_report.pdf

2.4 Guam Coconut Rhinoceros Beetle Project

This is currently my largest and most important project.

Please see CRB activities in the Creative/Research/Scholarly section

2.5 National Plant Diagnostic Network (NPDN)

I serve as the UOG Coordinator for the National Plant Diagnostic Network.

- Participated in monthly conference calls.
- Prepared an annual work plan and budget [1].
- Prepared annual report [2].
- Served on the NPDN IT Strategic Planning Committee.
- Trained and certified 14 First Detectors as part of my AL/BI 345 General Entomology course, Fall 2017.

References

[1] Moore A. University of Guam: WPDN Funded Budget September 1, 2017 through August 1, 2018 [Internet]. 2018. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/Univ%20of%20Guam%20WPDN%20budget%202017-18-Final.pdf

[2] Moore A. NPDN Accomplishments Survey for University of Guam, April 1, 2017 through April 1, 2018 [Internet]. 2018. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/Guam%20WPDN-Accomplishments%20Summary%20Form%202018%20final.pdf

2.6 Guam Invasive Species Advisory Committee (GISAC) and Guam Invasive Species Council (GISC)

- I am a founding member and regular participant in GISAC.
- President Underwood delegated me to represent UOG as a voting member of GISC.
- During 2018, I served on a GISC Import Data Harmonization Committee. This committee generated recommendations [1] resulting in a bill to amend the Guam Invasive Species Act [2].

References

[1] Guerrero D. Guam Invasive Species Council: Import Data Harmonization Committee Report [Internet]. 2018. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/GISC%20IDHC%20Report%20%26%20Recommendations.pdf

[2] Guerrero D, Santos J. Bill to Amend 5 GCA Chapter 70: Guam Invasive Species Act [Internet]. 2018. Available from: https://github.com/aubreymoore/Miscellaneous-Docs-for-CFES2018/raw/master/5%20GCA%20Chapter%2070%20Bill%20Draft%20D.%20Guerrero%20%26%20Joseph%20Santos%20V.5%202018%20no%20password.pdf

2.7 mosquito committee

2.8 Public Outreach (Guest lectures, presentations, interviews)

References

[1] Google News Search for Stories Containing *Aubrey Moore* and *Guam* Published Since 2013-01-01. https://news.google.com/search?q=%22Aubrey+Moore%22+Guam&from=2013-01-01&hl=en-US&gl=US&ceid=US:en

3 Creative/Scholarly Activities or Research (34%)

3.1 Publications in Refereed Journals

I authored or coauthored 8 articles published in peer-reviewed journals between 2013 and 2018. Note that I have estimated my share of the effort contributed to each publication.

References

[1] Manuel, J., Tennent, W. J., Buden, D. W., & Moore, A. (2018). First record of *Doleschallia tongana* (Lepidoptera: Nymphalidae) for Guam Island. F1000Research, 7, 366. https://doi.org/10.12688/f1000research.14316.1
Evidence: 5.4.1
My effort: 80%

[2] Moore, A., Barahona, D. C., Lehman, K. A., Skabeikis, D. A., Iriarte, I. R., Jang, E. B., & Siderhurst, M. S. (2017). Judas beetles: Discovering cryptic breeding sites by radiotracking coconut rhinoceros beetles, *Oryctes rhinoceros* (Coleoptera: Scarabaeidae). Journal of Environmental Entomology, 46(1), 92-99. https://doi.org/10.1093/ee/nvw152
Evidence: 5.4.2
My effort: 80%

[3] Marshall, S. D. G., Moore, A., Vaqalo, M., Noble, A., & Jackson, T. A. (2017). A new haplotype of the coconut rhinoceros beetle, *Oryctes rhinoceros*, has escaped biological control by *Oryctes rhinoceros* nudivirus and is invading Pacific Islands. Journal of Invertebrate Pathology, 149, 127-134. https://doi.org/10.1016/j.jip.2017.07.006
Evidence: 5.4.3
My effort: 25%

[4] Moore, A., Quitugua, R., Iriarte, I., Melzer, M., Watanabe, S., Cheng, Z., & Barnes, J. M. (2016). Movement of Packaged Soil Products as a Dispersal Pathway for Coconut Rhinoceros Beetle, *Oryctes rhinoceros* (Coleoptera: Scarabaeidae) and Other Invasive Species. Proceedings of the Hawaiian Entomological Society, 48, 21-22. Retrieved from http://scholarspace.manoa.hawaii.edu/handle/10125/42743

Evidence: 5.4.4
My effort: 80%

[5] Moore, A., Jackson, T., Quitugua, R., Bassler, P., & Campbell, R. (2015). Coconut rhinoceros beetles (Coleoptera: Scarabaeidae) develop in arboreal breeding sites in Guam. Florida Entomologist, 98(3), 1012-1014. Retrieved from http://journals.fcla.edu/flaent/article/download/84794/84044
Evidence: 5.4.5
My effort: 80%

[6] Moore, A., Watson, G., & Bamba, J. (2014). First record of eggplant mealybug, *Coccidohystrix insolita* (Hemiptera: Pseudococcidae), on Guam: Potentially a major pest. Biodiversity Data Journal, 2. https://bdj.pensoft.net/articles.php?id=1042
Evidence: 5.4.6
My effort: 80%

[7] Cave RD, Chao JT, Kumashiro B, Marler T, Miles J, Moore A, et al (2013). Status and biological control of cycad aulacaspis scale. Biocontrol News Inform [Internet]. 2013;34(1):1N4N. Available from: https://www.researchgate.net/publication/235793052_Status_and_biological_control_of_Cycad_Aulacaspis_scale
Evidence: 5.4.7
My effort: 20%

[8] Marler, T.E., Miller, R., and Moore A. (2013). Vertical stratification in predation of armored scale on *Cycas micronesica* seedlings. HortScience 48(1) 60-62. http://hortsci.ashspublications.org/content/48/1/60.full
Evidence: 5.4.8
My effort: 20%

3.1.1 Citations

According to Google Scholar, my journal articles have been cited 325 times since 2013.

References

[1] Google Scholar Citations Web Site. Accessed 2018-11-29.
https://scholar.google.com/citations?hl=en&user=LGb4OLwAAAAJ
file:evidence/pubs/GoogleScholarCitations.png

3.2 Presentations

I authored or coauthored 53 presentations for professional meetings between 2013 and 2018:

References

[1] Moore, Aubrey; Miller, Ross H.; Marler, Thomas E. 2013. Biological control of cycad scale, *Aulacaspis yasumatsui*, attacking Guams endemic cycad, *Cycas micronesica*. Entomological Society of America Annual Meeting. Austin, Texas. [BM8ZXEC9] http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/CycadScaleBiocontrolAustin.pdf
Evidence: 5.5.1

[2] Moore, Aubrey; Marler, Thomas; Miller, Ross H.; Yudin, Lee S. 2013. Biological Control of Cycad Scale, *Aulacaspis yasumatsui*, Attacking Guam s Endemic Cycad , *Cycas micronesica*. 4th International Symposium on Biological Control. Chile. [JNP25SBG] http://guaminsects.net/anr/sites/default/files/Mooreetal.-2013-BiologicalControlofCycadScale,Aulacaspisyasumatsui,AttackingGuamsEndemicCycad,Cycasmicronesica.pdf

[3] Moore, Aubrey; Miller, Ross H.; Marler, Thomas E.; Lee S. Yudin 2013. A coalition of invasive species attacks Guams native cycads. Entomological Society of America Annual Meeting. Austin, Texas. [RU2K64VV] http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/cycas_poster_2013_0.pdf
Evidence: 5.5.3

[4] Terral, Olympia; Quitugua, Roland; Moore, Aubrey 2014. Poster: Life Cycle of the Coconut Rhinoceros Beetle, *Oryctes rhinoceros*. [8WRWWMET] http://guaminsects.net/anr/sites/default/files/rhinofinal_0.pdf
Evidence: 5.5.4

[5] Moore, Aubrey; Quitugua, Roland 2014. Overview of the Guam coconut rhinoceros beetle eradication project. Hawaii CRB Incident Command Meeting. Honolulu, Hawaii. [HE7PH8N9] http://guaminsects.net/presentations/CRB-Hawaii-ICS-Jan-2014.pdf
Evidence: 5.5.5

[6] Marshall, Sean; Moore, Aubrey; Campbell, Russell; Quitugua, Roland; Jackson, Trevor 2014. *Oryctes rhinoceros* population diversity and potential implications for control using *Oryctes* nudivirus. Mainz, Germany. [SZXP65PV] http://www.sipweb.org/docs/Program%20and%20Abstracts%202014.pdf
Evidence: 5.5.6

[7] Moore, Aubrey; Quitugua, Roland; Siderhurst, Mattew; Jang, Eric 2014. Improved traps for the coconut rhinoceros beetle, *Oryctes rhinoceros*. Entomological Society of America. [UAPDC4QV] http://guaminsects.net/anr/sites/default/files/Moore_1957_2.pdf
Evidence: 5.5.7

[8] Moore, Aubrey; Quitugua, Roland 2014. Rhino Beetle Presentation for Hawaii ICS - January, 2014. [RSQ3HD7H] http://guaminsects.net/presentations/CRB-Hawaii-ICS-Jan-2014.pdf
Evidence: 5.5.8

[9] Moore, Aubrey; Quitugua, Roland; Siderhurst, Mattew; Jang, Eric 2014. Improved traps for the coconut rhinoceros beetle, *Oryctes rhinoceros*. Entomological Society of America. Portland, OR. [NFTUN65F] http://guaminsects.net/anr/sites/default/files/Moore_1957_2.pdf
Evidence: 5.5.9

[10] Moore, Aubrey 2014. Biological invasion of forests on Guam and other islands of Micronesia. 65th Western Forest Insect Work Conference. Sacramento, California. [T2TTTDKN]
Evidence: **??**

[11] Moore, Aubrey; Quitugua, Roland; Siderhurst, Matthew; Jang, Eric 2014. Improved traps for coconut rhinoceros beetle, *Oryctes rhinoceros*. Portland OR. [HU58QP3C] https://zenodo.org/record/165763

[12] Moore, Aubrey 2014. Insects Attacking *Serianthes nelsonii*. [A7CWDRUT] https://github.com/aubreymoore/presentations/raw/master/SerianthesInsectPests/SerianthesInsectPest.pdf
Evidence: 5.5.11

[13] Moore, Aubrey 2014. Evaluation of a Scratchpad template as an online database for the University of Guam insect collection. iDigBio Biodiversity Collections Digitization in the Pacific Workshop. Honolulu, Hawaii. [G3SIFRAJ] https://www.idigbio.org/wiki/images/a/aa/Scratchpads_iDigBio-part1.pdf
Evidence: 5.5.12

[14] Moore, Aubrey; Quitugua, Roland 2015. Coconut Rhinoceros Beetle Trap Improvements. Pacific Entomology Conference. [WKHSGUNZ] http://guaminsects.net/anr/sites/default/files/pec2015-improved-traps.pdf
Evidence: 5.5.13

[15] Ares, M. A.; Meneses, N.; Smith, A.; Moore, Aubrey; Benford, R. 2015. Molecular Identification of a Lepidopteran Herbivore on a Critically Endangered Tree. Northern

Arizona Undergraduate Symposium 2015. [7ZIBWAMK] http://guaminsects.net/anr/sites/default/files/SerianthesHerbivoreAres2015final(1).pdf
Evidence: 5.5.14

[16] Marshall, Sean David Goldie; Vaqalo, Maclean; Moore, Aubrey; Quitugua, Roland; Jackson, Trevor A 2015. A new invasive biotype of the coconut rhinoceros beetle (*Oryctes rhinoceros*) has escaped from biocontrol by *Oryctes rhinoceros* nudivirus. International Congress on Invertebrate Pathology and Microbial Control and the 48th Annual Meeting of the Society for Invertebrate Pathology. [IQF6CDPQ] http://www.sipmeeting.org/van1/SIP2015-FullProgram.pdf
Evidence: 5.5.15

[17] Moore, Aubrey 2015. A report on the Guam coconut rhinoceros beetle infestation. Pacific Plant Protection Organization. [2NZ8B8AE]
Evidence: **??**

[18] Moore, Aubrey; Quitugua, Roland 2015. Pacific Entomology Conference 2015 Oral Presentation: Coconut Rhinoceros Beetle Trap Improvements. [2KX3B9ID] http://guaminsects.net/anr/sites/default/files/pec2015-improved-traps.pdf
Evidence: 5.5.16

[19] Moore, Aubrey 2015. Biosecurity for Guam in the New Millenium: Are We More Secure?. Honolulu, Hawaii. [6I9UTQ5D] https://zenodo.org/record/165694

[20] Moore, Aubrey 2015. Failure Analysis of the Guam Coconut Rhinoceros Beetle Eradication Project. Honolulu, Hawaii. [JC2ATRNC] https://zenodo.org/record/165762

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[22] Moore, Aubrey 2015. Update on the Guam Coconut Rhinoceros Beetle Situation for the Guam Invasive Species Council. [UGDT4EUJ] http://guaminsects.net/GISC_NOV2015/GISC_NOV2015/

[23] Moore, Aubrey; Quitugua, Roland; Jackson, Trevor A; Marshall, Sean David Goldie; Siderhurst, Mattew S. 2016. The rhinoceros beetle invasion of Guam: An unprecedented disaster. Orlando, FL. [9J7KNX9T] https://aubreymoore.github.io/CRB-G-ICE2016/Paper94967.html

[24] Aubrey Moore 2016. Guam Report. Washington, D.C.. [9KHDQ9B5]
Evidence: **??**

[25] Aubrey Moore 2016. Discovery of the Coconut Rhinoceros Beetle Guam Biotype and Implications for Global Control. Suva, Fiji. [7J52PP8T] http://guaminsects.net/GISC_NOV2015/GISC_NOV2015/Moore_ESA_PB_APR2016.html

[26] Marshall, Sean David Goldie; Vaqalo, Maclean; Moore, Aubrey; Quitugua, Roland; Jackson, Trevor A 2016. Detection of an invasive biotype of Oryctes rhinoceros (L.) in the Pacific. Orlando, FL. [224SF3UD] https://aubreymoore.github.io/CRB-G-ICE2016/Paper95540.html

[27] Moore, Aubrey 2016. Update on the Guam Coconut Rhinoceros Beetle Infestation. Washington, D.C.. [7A5G3ZXB]
Evidence: ??

[28] Moore, Aubrey 2016. Biological Invasion of Guam. Guam. [BWVWM7N9]
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[29] Moore, Aubrey 2016. Update on the Guam Coconut Rhinoceros Beetle Infestation. Guam. [7SEPPCQ4]
Evidence: ??

[30] Moore, Aubrey 2016. Discovery of the Coconut Rhinoceros Beetle Guam Biotype and Implications for Global Control. Honolulu, Hawaii. [QCW42GFF] http://guaminsects.net/GISC_NOV2015/GISC_NOV2015/Moore_ESA_PB_APR2016.html

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Evidence: ??

[32] Moore, Aubrey 2017. Impact of climate change on coconut rhinoceros beetle outbreaks in the Pacific. Guam. [ZUT2TYC8] https://github.com/aubreymoore/crb-climate-change/blob/master/crb-climate-connection.pdf
Evidence: ??

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[35] Moore, Aubrey 2017. Using free Cell Phone Apps for Forest Pest Surveys. Tumon Bay, Guam. [SVGUC2BE]
Evidence: ??

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Evidence: 5.5.25

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3.3 Coconut Rhinoceros Beetle (CRB) Biocontrol

This is currently my largest and most important project. Funding for outreach and applied research is currently provided by three grants: USDA-APHIS FY17 Farm Bill, USDA-Farm FY18 Bill, and a grant from the Department of the Interior-Office of Island Affairs for FY18-19.

I have submitted a proposal for FY19 Farm Bill Fundings. The abstract from this proposal serves as a description of this ongoing project:

A newly discovered biotype of coconut rhinoceros beetle (CRB-G) is rapidly killing coconuts and other palms on Guam and on other Pacific islands. Following a failed eradication attempt on Guam, CRB-G proved hard to control because it is resistant to *Oryctes*

rhinoceros nudivirus (OrNV), which was previously used as the preferred biological control agent for control of CRB outbreaks on Pacific Islands and elsewhere. Previous to the discovery of CRB-G, all OrNV releases on Pacific Islands resulted in immediate and sustained suppression of CRB damage to low levels and prevented tree mortality.

Guam is currently experiencing an uncontrolled and unmonitored island-wide CRB-G outbreak which was triggered by abundant CRB-G breeding sites in the form of dead and dying vegetation left in the wake of Typhoon Dolphin which occured in May 2015. of a recent typhoon. Most of these breeding sites are inaccessible to sanitation efforts, being either in the jungle or on military land (which covers one third of Guam). A positive feedback cycle has begun whereby large numbers of adult beetles are killing large numbers of palms which become breeding sites which generate even higher numbers of adults. Severe damage to Guam's palms prompted the Governor of Guam to declared a state of emergency in July 2017.

The main objective of this project is to stop the uncontrolled outbreak on Guam. Entomologists working on the CRB-G problem on several Pacific islands agree that the most feasible tactic to halt tree mortality and suppress damage to tolerable levels is establishment of biological control using an isolate of OrNV which is highly effective as a biological control agent for CRB-G. We are working with collaborators to identify populations of CRB-G throughout the Asia-Pacific region. We will sample these populations for biological control agent candidates which will be evaluated in laboratory bioassays performed at UOG. Promising candidates will be field released using autodissemmination as per a USDA-APHIS import and release permit.

Concurrent with establishment of CRB-G biocontrol, success of the project will be monitored in a quarterly, island-wide tree health survey and incidence of OrNV infection will be monitored in a subsample of all field collected CRB-G.

If the Guam CRB-G infestation cannot be controlled, it is expected that most palms on the island will be killed and CRB-G will continue to spread to other islands and beyond. If CRB-G invades smaller islands and atolls where coconut is the tree of life, a human tragedy will ensue. On larger islands, coconut and oil palm industries will be severely impacted. Attempts to organize a regional project in response to CRB-G are underway.

Recent Activity in this Project

- Coauthored a peer-reviewed journal article documenting discovery of CRB-G [1].
- Wrote a magazine article for the Guam Invasive Species Awareness week. This was published by the Pacific Islands Times [2]. A similar article was archived in Zenodo [3].
- Recruited Dr. James Grasela, an insect pathologist, to work on the project for two years using funding from the US Department of Interior - Office of Island Affairs. Grasela's initial task will be to perform laboratory bioassays to evaluate OrNV isolates as candidates for biocontrol of CRB-G (Job announcement: [4]).

- Recruited Ian Iriarte as a research assistant using funds from Farm Bill grants. Ian is also my graduate student. He is working with me on development of an automated coconut rhinoceros beetle damage monitoring system using computer vision and deep learning. This project is likely to be the topic of his master's thesis.

- In August 2018, Moore, Grasela, Iriarte and Quitugua participated in the 51st Annual Meeting of the Society for Invertebrate Pathology and International Congress on Invertebrate Pathology and Microbial Control held at the Gold Coast, Australia. This conference provided a venue for was a symposium and a meeting to plan and promote collaboration among Pacific entomologists working on the CRB-G problem [5, 6].

- Created a private wiki site to facilitate sharing scientific/technical information among scientists working on the CRB-G problem [7].

- Laboratory bioassays of an OrNV isolate propagated from a virus-infected CRB-G adult we collected on Negros Island, Philippines in 2017 produced no response when applied to CRB-G adults [8, **?**]

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3.4 Guam Biodiversity Inventory

I consider this to be my second most important project.

A biodiversity inventory is essentially a database containing a comprehensive check list of all taxa known occur within a defined area.

A terrestrial biodiversity inventory for Guam is needed to document rapid changes to Guam's ecosystems, to provide free and open access to information on Guam's flora and fauna, and to share Guam biodiversity information with the global scientific community, policy makers and the public.

The Guam Biodiversity Inventory will facilitate automatic generation and updates to lists such as: a list of all invasive species on Guam with year first recorded, a list of new species described from specimens collected on Guam, a list of observations for Guam's endangered species, a list of Guam's native plants with associated herbivores and pathogens, and a list of crops grown on Guam and pests and pathogens which attack them.

Recent Activity in This Project

- I made a couple of presentations on my plans for the Guam Biodiversity Inventory [1, 2].
- I designed data model for the Guam Biodiversity Inventory and created a prototype web site.

- I requested the Bishop Museum to publish primary entomological literature for Guam on-line and sponsored this using grant funding. Both volumes of *Insects of Guam* are now available for free download as PDFs from http://hbs.bishopmuseum.org/pubs-online/pdf/bull172.pdf and http://hbs.bishopmuseum.org/pubs-online/pdf/bull189.pdf.

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3.5 Grants

Between 2013 and 2018 I was the Principal Investigator for 16 grants with a total budget of $1,443,841.

Title	Funding source	Start date	End date	Budget
CRB FS 2011	USDA Forest Service	2011-05-23	2013-12-31	$200,000
CRB Biocontrol 2012	USDA-APHIS	2012-06-01	2014-05-31	$40,000
WPDN 2013	NIFA via UC Davis	2013-04-11	2014-06-30	$7,550
Management of the CRB	USDA Forest Service	2013-07-01	2015-06-30	$150,000
CRB Biocontrol 2013 [42]	USDA-APHIS	2013-09-01	2015-08-31	$40,000
Octocula	USFWS via GDOA	2014-05-13	2016-09-30	$21,212
WPDN 2014-15	NIFA via UC Davis	2014-07-01	2015-06-30	$10,672
Guam Forest Insect Survey	NIFA - McIntire-Stennis	2014-11-01	2018-09-30	$12,302
WPDN 2016-17	NIFA via UC Davis	2016-09-01	2017-08-31	$9,754
WPDN 2018	NIFA via UC Davis	2016-09-01	2018-08-31	$9,754
Biological Control of Coconut Rhinoceros Beetle Guam Biotype in Micronesia	DOI Office of Island Affairs	2017-07-21	2019-09-30	$176,553
Biological Control of Coconut Rhinoceros Beetle, Guam Biotype FB17	USDA APHIS; Farm Bill FY2017	2017-08-01	2019-07-31	$200,000
Extension Core Funding FY2018	Extension Core Funds	2017-10-01	2018-09-30	$4,000
Biological Control of Coconut Rhinoceros Beetle, Guam Biotype FB18	USDA APHIS; Farm Bill FY2018	2018-08-01	2019-07-31	$200,000
Guam Forest Biodiversity Inventory	NIFA - McIntire-Stennis	2018-10-01	2023-10-30	$80,000
Biological Control of Coconut Rhinoceros Beetle, Guam Biotype FB19 [PENDING]	USDA APHIS; Farm Bill FY2019	2019-08-01	2020-07-31	$282,044

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4 University and Community Service (15%)

4.1 Undergraduate Instruction

Course	Semester	Student evaluations
AG109 Insect World	Spring 2013	5.3.1
AG345 General Entomology	Fall 2013	5.3.2
AG109 Insect World	Fall 2014	5.3.3
AGBI345 General Entomology	Fall 2014	5.3.4
AGBI345 General Entomology	Fall 2015	5.3.6
AGBI345 General Entomology	Fall 2017	5.3.7, 5.3.8, 5.3.9, 5.3.10

During the reporting period I taught AG 109 *Insect World* and AL/BI 345 *General Entomology*. Both courses consist of 2 one-and-half hour lectures per week and one three hour laboratory session per week. I prefer to teach both the lecture and lab sections because I think this results in delivery of a more integrated science instruction package. The syllabi for AG 109 [11] and AL/BI 345 [12] are provided in the appendices.

For each course I teach, I build and maintain a web site which I populate with online resources and tools. I have used several frameworks for building these sites including Drupal, Moodle [13] and Pelican. The current AL/BI 345 web site [14] was built using Nikola. Nikola uses a python script to generate static HTML pages hosted on GitHub pages.

References

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Evidence: 5.3.1

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[4] Student evaluations for AG-345 (Lecture and lab sections) Fall 2014
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Evidence: 5.3.5

[6] Student evaluations for AG-345 (Lecture and lab sections) Fall 2015
Evidence: 5.3.6

[7] Student evaluations for AL-345 (Lecture section) Fall 2017
Evidence: 5.3.7

[8] Student evaluations for AL-345L (Lab section) Fall 2017
Evidence: 5.3.8

[9] Student evaluations for BI-345 (Lecture section) Fall 2017
Evidence: 5.3.9

[10] Student evaluations for BI-345L (Lab section) Fall 2017
Evidence: 5.3.10

[11] Syllabus for AG 109, *Insect World*, last updated Fall 2014.
Evidence: 5.7.4

[12] Syllabus for Al/BI 345, *General Entomology*, last updated Fall 2017.
Evidence: 5.7.5

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Screenshot of home page: Evidence: 5.7.1

[14] AL/BI 345 Fall 2017 static web site built with Nikola. `https//aubreymoore.github.io/ALBI345F17`
Screenshot of home page: Evidence: 5.7.2
Screenshot of resources page: Evidence: 5.7.3

4.2 Graduate Instruction

- I am the major faculty advisor for Mr. Ian Iriarte who is pursuing a Master's degree in Environmental Science.
- Although I am not the instructor of record for any EV courses, I am often invited to give guest lectures.
- I served on thesis committee for Trent Hamada's EV masters degree.

4.3 Faculty Committees

4.3.1 Undergraduate Curriculum Review Committee

I was elected to serve on this committee in April 2013 and served for 2 years.

4.3.2 University Technical Advisory Committee

I was appointed by the Dean to serve on this committee and did so until it was disbanded.

4.3.3 Faculty Building Facilities Committee

This committee was formed by the Agriculture and Life Sciences Division to provide advice to the Dean on facilities problems within the Agriculture and Life Sciences Building. During the reporting period, I was re-elected as chair of this committee and I am joined by Dr. Jim McConnell and Dr. LaJoy Spears as the other members.

- Plans for improvements to the ALS124 teaching lab have been only partially achieved. For the past three years, faculty have asked for a dedicated computer and modern audiovisual equipment to facilitate science teaching. During the reporting period, lab tables were equipped with power sockets to replace those removed during a previous renovation.
- We continue to struggle with finding solutions to chronic air conditioning problems.

4.3.4 Search Committee: Extension Animal Scientist

I chaired this committee and was joined by Mari Marutani, LaJoy Spears, Bob Schlub, and Tom Poole, Guam's Territorial Veterinarian.

- Position announcement written [**?**] and advertisment placed on the web site of the American Association of Animal Scientists [**?**].

4.3.5 Search Committee: Extension Agricultural Economist

I am a member of this committee and I am joined by Bob Barber (chair), LaJoy Speers, and John Brown.

4.3.6 Search Committee: Research Associate II (CRB Project)

I chaired this committee and was joined by Jim Grasela, Roland Quitugua, and Jesse Bamba.

4.3.7 Continuing Employment Committee: Austin Shelton

I chair this committee and I am joined by Ross Miller and Hui Gong.

4.3.8 Continuing Employment Committee: Andrea Blas

I served on this committee with Ross Miller and Frank Camacho.

4.3.9 Extension Publications Committee

I served as a member of this committee.