Comprehensive Faculty Evaluation System Report 2015

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Associate Professor / Extension Entomologist

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I was hired by the University of Guam 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 extension entomologist (100% extension) with the academic rank of Assistant Professor. I work in the Agriculture and Naturals Resources Unit of the University of Guam Cooperative Extension Service. I am also a faculty member of the Environmental Science Graduate Program and a member of the Western Pacific Tropical Research Center. At the end of the 2012 fall term I applied for tenure and promotion and received both.

My current faculty role allocation is as follows:

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

Note to Reader:

This report is available as an electronic document, in PDF format, which can be downloaded from http://guaminsects.net/doc/MooreCFES2015.pdf. If you are reading the PDF version of the report, you will be able to follow hypertext links to documents I have referenced.

The LaTeX script used to generate this document is available at https://github.com/aubreymoore/CFES2015.

Contents

1 Extension and Community Activities

1.1 Diagnostic Services

As an extension entomologist, a major part of my job is providing insect identification and pest control recommendations to a diverse clientele including commercial growers, gardeners, householders, GovGuam and federal agency personnel, and University of Guam colleagues. Most client contacts are initiated by a phone call or a visit by the client to the ANR 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.

I am not well trained as an insect taxonomist. To improve my skills, I attend insect identification workshops whenever an opportunity occurs. In May, 2014, the US Forest Service sponsored my attendance at the Ambrosia and Bark Beetle Academy at the University of Florida.

1.1.1 Detection and Documentation of Invasive Species

As with any other tropical island, Guam is extremely susceptible to environmental and economic damage by invasive species. Despite this fact, Guam's biosecurity is very weak and invasive species, many of them insects, are arriving at unprecedented rates. Bioinvasions are grossly under-reported for several reasons:

1. Professional capacity is lacking. Twenty years ago, there were 9 PhD level entomologists practising in Micronesia. Only 3 remain (Moore, Miller, Campbell), despite an increased workload largely due to arrival of the cycad scale, coconut rhinoceros beetle and little fire ant and other invasive species of insects. UOG typically has 4 entomologists. We now have 2.

2. We suffer from the *taxonomic impediment*. The three remaining PhD level entomologists are generalists without the skills and resources for species determination. Timely and accurate species determination is a necessary first step in response to a new pest invasion.

3. There is no ongoing biological survey of Guam with the goal of establishing a baseline biodiversity inventory and detecting newly arrived invasive species. Un-

fortunately, CAPS surveys are usually focused on demonstrating absence of specific agricultural pests rather than detecting new invasions.

4. Even when invasive species are detected and properly identified, first island records are not documented and the information is not published in the scientific press.

In an attempt to improve this situation, I have set myself up as a *registrar* for new insect species arriving on Guam with the intent of properly documenting the ongoing bioinvasion of Guam. The procedure I am trying to establish is:

1. First detector sends me a digital image and/or specimen
2. Specimens are prepared and accessioned into the UOG insect collection
3. A fact sheet is prepared using a template for Guam New Invasive Species Alerts
4. The fact sheet is distributed to a list of stakeholders
5. Taxonomic assistance is obtained for an authoritative species determination.
6. A journal article is prepared and published in a refereed scientific journal. At this point the new geographical distribution data become available to the scientific community via the Global Biodiversity Facility (GBIF).

Although I have been able to generate about a dozen invasive species alerts over the past year (Section 2.4), only one new island record has made it into a peer reviewed journal (Moore, G. Watson, and Bamba 2014).

1.1.2 Insect Identification Service for USDA-APHIS / Guam Customs and Quarantine Agency

I am often called upon to identify insect specimens intercepted the Guam Customs and Quarantine Agency. USDA-APHIS has certified me for this service and has provided a very official looking badge to impress people with. (However, it is not quite as impressive as Dr. Millers bright red badge for getting onto the airport runways.)

USDA-APHIS has recently rewarded me for this service. In response to my 2015 Farm Bill suggestion, the agency kindly equipped me with two professional quality microscopes which will facilitate identification of smaller insects and slide-mounted specimens.

1.2 University of Guam Insect Collection

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

To increase my knowledge of collection management, I attend the annual meetings of the Entomological Collections Network, which are typically held in conjunction with annual meetings for the Entomological Society of America.

I have a professional goal of building an online website to share all available information on Micronesian insects. This will include specimen level information for the collection complete with digital images and literature references. I built a digital catalog for the collection is using the BioLink Biodiversity Information Management System from CSIRO, Australia. The catalog currently contains 29,200 specimen records. BioLink is currently being redeveloped as an open source project (http://code.google.com/p/biolink/). In am an active collaborator in this project. In July 2012 I published an article entitled *Hosting a Biolink Database in the Amazon Web Services Cloud (EC2)* on the project's wiki (http://code.google.com/p/biolink/wiki/BioLinkEC2).

I have built and evaluated two websites for serving information on Micronesian insect biodiversity, including specimen level data from the collection. One is a Drupal content management system template called LifeDesk provided the Encyclopedia of Life Project and the other is a similar template called ScratchPads provided by the Museum of Natural History in London. I am honored to have been selected as an advocate for ScratchPads as part of the project's Ambassadors program (http://scratchpads.eu/locate-scratchpad-ambassadors). Further information on my websites is provided in the Creative/Scholarly Activities section (2.5).

In March 2014 I travelled to Honolulu to attend the Biodiversity Collections Digitization in the Pacific workshop sponsored by the Integrated Digitized Biocollections (IDigBio). I made an oral presentation entitled Evaluation of a Scratchpad Template as an Online Database for the University of Guam Insect Colletion at this workshop.

In May 2014 I met with Dr. Bob Foottit at the Canadian National Insect Collection in Ottawa to discuss progress and future directions for the UOG collection. Dr. Foottit is a member of the board of directors for the UOG Insect collection.

1.3 Guam Coconut Rhinoceros Beetle Eradication Project

This is currently my largest and most time consuming project.

The coconut rhinoceros beetle (CRB) was first detected on Guam in the Tumon Beach hotel area on September 11, 2007. CRB is avery serious pest of coconut palms. Adult beetles may kill coconuts and other palms when they bore into the crowns to feed on sap. When CRB invaded Palau during the Second World War, it killed about half of all coconuts through the islands and totally exterpated the coconut palm from some of them. A delimitation survey indicated that the Guam infestation was limited to Tumon Bay and the adjacent Faifai Beach. In consultation with the Guam Department of Agriculture (GDOA), USDA-APHIS, and USDA-Forest Survey, it was decided to launch an eradication project.

I wrote the original eradication plan (available on-line at http://guaminsects.net/uogces/kbwiki/index.php?title=Coconut_Rhinoceros_Beetle_Eradication_Plan) and this was funded by USDA and local funds. USDA provided funds under the condition that the poject was to be run under an Incident Command System with the

USDA-APHIS Guam Port Director as the federal commander, and the GDOA Director, or designee, as the local commander.

My original role was to provide scientific/technical support for the project, with the Guam Department of Agriculture (GDOA) providing project management with assistance from USDA-APHIS and USDA-Forest Service. However, it soon became apparent that GDOA had serious bureaucratic impediments which prevented hiring staff and procuring supplies and equipment within a reasonable time frame. The eradication project directors, with the consent of the Dean, agreed to run project staffing, procurement, and fiscal management through the University. As a result, my role was expanded to include much of the project management. I am currently managing two grants which fund the project and supervise about 15 temporary employees. Report writing on current grants and proposal writing to keep the project in business occupies much of my time.

In December 2013, an infestation of CRB was detected on Hickam Air Force Base on Oahu. Roland Quitugua and myself were recruited as subject matter experts and spent a week in Honolulu advising an incident command team set up by APHIS. Later, we were both added to a national technical working group for CRB. My acitivities in support of the Hawaii CRB Eradication project are detailed in the Regional Collaboration section 1.3.3.

1.3.1 Activities:

1. **Monthly Conference Calls.** These teleconferences are with stakeholders, collaborators, and advisers in USDA APHIS and USDA Forest Service.

2. **Project Websites.** I have endeavored to share and archive data and information associated with the Guam CRB Eradication Project on-line. Prior to May 2009, I used a wiki site at http://www.guaminsects.net/uogces/kbwiki/index.php?title=Oryctes_rhinoceros. Afterwards, I used a Drupal site at http://www.guaminsects.net/anr/category/miscellaneous/coconut-rhinoceros-beetle.

   I maintain a bibliographic database of CRB-related journal articles at http://guaminsects.myspecies.info/crb_biblio andresearch results are made available as on-line technical reports at http://guaminsects.net/anr/crb_tech_reports.

3. **Project Database.** Trapping data from a network of about 1200 traps, detections of CRB grubs or adults, and observations of CRB defoliation and bore holes are entered daily into a web-based georeferenced MySQL database which I designed. Data from this database is publicly accessible from a web page at http://www.guaminsects.net/anr/content/public-access-data-collected-guam-coconut-rhinoceros
   Links on this page enable the user to view trap catch data as a spatiotemporal display using a Google Earth animation or a chart of monthly totals. I use this system to produce monthly surveillance reports.

4. **Collaboration.** I have formed two collaborative research groups to do applied research aimed at controlling CRB damage. Dr. Sean Marshall and Dr. Trevor

Jackson at AgResearch New Zealand collaborate with me on biological control using oryctes nudivirus (OrNV) and CRB population genetics. Dr. Matthew Siderhurst and Dr. Eric Jang of USDA-ARS-PBARC collaborate with me on CRB trap improvement and CRB behavior.

1.3.2 Impediment

- My heavy workload does not permit enough time to prepare research results for publication in scientific journals.

1.3.3 Support for the Hawaii Coconut Rhinoceros Beetle Eradication Project

In December 2013, an infestation of CRB was detected on Hickam Air Force Base on Oahu. Roland Quitugua and myself were recruited as subject matter experts and spent a week in Honolulu advising an incident command system (ICS) team set up by APHIS. Later, we were both added to a national technical working group (TWG) for CRB. I built and maintain an online, full-text bibliographic for use by the TWG at http://guaminsects.myspecies.info/CRB_biblio.

Frequent requests for scientific/technical information from the ICS, TWG and Hawaii Department of Agriculture (several queries per week) has significantly increased my workload over the past several months.

Early in 2015, the directors of the Western IPM Center at UC Davis asked me to help organize a meeting to prioritize applied research needs for development of CRB IPM. I co-authored an agenda and attendance list with Arnold Hara and Roland Quitugua. The meeting took place at the Hawaii Department of Agriculture on April 3, 2015 and was chaired by WIPM Center Director Kassim Al-Khatib.

1.4 Western Plant Diagnostics Network

I am the UOG coordinator for WPDN. This organization provides financial support for ANR's Plant Diagnostic Laboratory, offers First Detector Training workshops, and organizes identification workshops for important pest groups. As coordinator, I am required to organize First Detector Training workshops, attend monthly conference calls, attend annual meetings, and provide reports. WPDN publishes newsletters for First Detectors, including the Pacific Pest Detector to which I occasionally contribute (Table 1.1).

Table 1.1: Contributions to the Pacific Pest Detector Newsletter

December 2013	coconut termite
March 2014	spotted cucumber beetle
March 2014	brown marmorated stink bug
June 2014	castor hairy caterpillar
In press	Pacific Pests and Pathogens Apps

1.5 Guam Invasive Species Advisory Committee (GISAC)

I am an active, founding member of this informal group of Guam's biologists which meets irregularly about 6 times per year to discuss invasive species and what can be done to keep them out and mitigate the effects of those that do invade the island. I worked with Dr. Russell Campbell and Diane Vice to develop an emergency response plan for invasive species detected on Guam.

A wiki site which I built for for GISAC was quickly adopted by the Western Micronesia Regional Invasive Species Council at http://guaminsects.net/gisac/index.php?title=Main_Page.

1.6 Public Outreach (Guest lectures, presentations, interviews)

During the reporting period I was interviewed numerous times by newspaper reporters, radio talk show hosts, and television news reporters. Most, but not all involved questions about the Guam coconut rhinoceros beetle eradication project. I helped to produce several fact sheets and articles for public print media.

1.7 Public Outreach (Internet)

During the past decade I published a lot of content on various websites. I have evaluated several current technologies for building a web presence for the Agriculture and Natural Resources Unit and the Drupal content management system seems to be a good fit. This allows us to publish information for public access while keeping some documents private for internal use only. My print and online output are discussed in more detail in the Creative/Scholarly Activity section.

I maintain a website for the the UOG Cooperative Extension Service's Agriculture and Natural Resources Program at http://guaminsects.net/ANR. I frequently post blog articles of public interest to this site (Table 1.2). I also maintain a website at http://guaminsects.myspecies.info which is intended to facilitate sharing information on insects in Micronesia. I submit blog articles to this website which are more technical

and are of interest to biologists. To see a list of my blog post on this site, visit http://guaminsects.myspecies.info/blogs/aubrey-moore.

Note that these blogs also contain posts containing information which is not intended for the public. These posts are shared with selected groups of clients and colleagues using a password authentication system.

Table 1.2: Public blog posts on *guaminsects.net/anr* posted 2014-15

Date	Title
2015 Jun 16 - 10:20am	Pacific Pests and Pathogens App for Cell Phones and Tablets
2015 May 30 - 12:20pm	Australian Northern Territory Agricultural Field Guides for Vegetables and Mangoes
2015 Apr 14 - 6:50am	Trap for In-transit Detection of Invasive Species
2015 Apr 10 - 5:55am	Attempts at Keeping Track of Invasive Species in the Marianas
2015 Mar 29 - 8:20am	KUAM News Story by Isa Baza: Funding to combat rhino beetle is lopsided
2015 Mar 28 - 8:21pm	Pacific Daily News Story: LeoPalace nets resort's rhino beetles
2015 Mar 28 - 7:27am	Marianas Variety Newspaper Article: Leo Palace uses nets to capture rhino beetles
2015 Mar 18 - 8:55pm	Pacific Daily News Story: UOG battles rhino beetles
2015 Mar 11 - 12:48pm	K57 Radio Interview: Roland Quitugua and Ray Gibson discuss rhino beetles and little fire ants
2015 Mar 11 - 12:44pm	Marianas Variety Newspaper Article: Rhino Beetle Nets Now on Sale
2015 Mar 11 - 6:55am	Facebook response to sale of tekken by Guam Home Improvement Center
2015 Mar 11 - 6:51am	K57 Radio Interview: Roland Quitugua and Patti Arroyo discuss tekken trap for coconut rhinoceros beetles
2015 Mar 1 - 6:55am	PhysOrg Article: Research to the rescue: Fishing for rhinos with tekken
2015 Feb 26 - 8:54pm	PNC Video: UOG Research to the Rescue
2015 Feb 26 - 4:54am	Hawaii News Now Article: Guam eyes nets to battle rhinoceros beetle
2015 Feb 22 - 10:25am	PNC Video: Family in Yigo finds coconut rhino beetle grubs in store-bought potting soil
2015 Feb 19 - 6:55am	Marianas Variety Newspaper Article: Rhino Beetle Traps Available next Month

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Date	Title
2015 Feb 18 - 5:54pm	PNC News Article by Clynt Ridgell: UOG Unveiles New Tekken Trap For Coconut Rhino Beetle
2015 Feb 4 - 12:56pm	Marianas Variety Newspaper Article: Community-based rhino beetle program holds Guam workshop
2015 Jan 22 - 4:35am	Check List of Micronesian Insects
2014 Sep 28 - 12:37pm	Pacific Daily News Opinion: Fully implement the law to better combat invasive species
2014 Jun 12 - 1:20pm	PNC News Story: DoAG and UOG Team Up to Get Rid of the Little Fire Ant
2014 Jun 11 - 3:28pm	Visualization of Coconut Rhinoceros Beetle Trap Data
2014 Mar 31 - 3:39am	Public opinion on invasive species issues
2014 Mar 26 - 5:13am	iDigBio presentation - Honolulu, March 2014
2014 Feb 20 - 7:18pm	PNC News Story: Guam is Running Out of Options to Stop the Spread of Rhino Beetles and Save Guam's Coconut Trees
2014 Feb 10 - 11:47am	CNN Article by Matt Smith: Meet the beetles: Hawaii mobilizes to fight bug invasion
2014 Feb 9 - 7:17pm	Pacific Daily News Nespaper Article: Mayors voice concerns over rhino beetle
2014 Feb 5 - 1:18pm	Pacific News Center Story: University of Guam Experts Help Hawaii with Rhino Beetles
2014 Jan 22 - 5:48pm	KITV4 Hawaii TV Story: Experts Brought to Hawaii to Battle the Rhino Beetle
2014 Jan 10 - 9:33pm	iNaturalist: Guam CRB Citizen Science
2014 Jan 10 - 7:56pm	KUAM News Story: Invasive species threaten local crops
2014 Jan 10 - 12:52pm	Coconut Rhinoceros Beetle Infestation Discovered at Hickam Air Force Base, Oahu, Hawaii
2014 Jan 10 - 7:25am	Video: Little Fire Ant in Hawaii
2014 Jan 9 - 8:47am	Relative Attractiveness of White and Ultraviolet Light Emmitting Diodes for Rhino Beetles
2014 Jan 9 - 6:05am	Arnold Hara's Rhino Beetle Images Taken During his Trip to Guam
2014 Jan 4 - 5:47am	No Rhino Pamphlet

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Table 1.2 – *Continued from previous page*

Date	Title
2014 Jan 1 - 7:15pm	Pacific News Center Includes Invasive Species Issues in Top 10 Stories of 2013

1.8 Regional Collaboration

1.8.1 Regional Invasive Species Council Website

I maintain a website for the Western Micronesia Regional Invasive Species Council (RISC) at http://www.guaminsects.net/gisac/. I attend RISC meetings whenever they are held on Guam and I make presentations at these meetings.

1.8.2 Insect Diagnostics for Micronesia

I am often contacted with requests for help with identifying pests from throughout Micronesia and suggesting solutions to the problems they cause. This workload has increased because the number of practicing PhD-level entomologists in Micronesia has dropped from 9 to 3 within the last two decades.

2 Creative/Scholarly Activities or Research

2.1 Refereed Scientific Journal Articles

1. Fisher, Nicole, Aubrey Moore, Bradley Brown, Matthew Purcell, Gary Taylor, and John Salle (2014). "Two new species of Selitrichodes (Hymenoptera: Eulophidae: Tetrastichinae) inducing galls on Casuarina (Casuarinaceae)". In: *Zootaxa* 3790.4, 534–542. ISSN: 1175-5334. URL: http://biotaxa.org/Zootaxa/article/view/zootaxa.3790.4.2/7933.

2. Moore, Aubrey, Chas Apperson, John McLaughlin, and Philipp Kirsch (In Preparation). "Automated classification of female Culex pipiens (Diptera: Culicidae) and Cx. quinquefasciatus from optically sensed wingbeat waveforms". In: *Journal of Medical Entomology*. in preparation.

3. Moore, Aubrey and Donald Bright (In Preparation). "Three new island records for bark beetles (Curculionidae: Scolitinae) on Guam from a single coffee berry borer trap". In: in preparation.

4. Moore, Aubrey, Trevor Jackson, Roland Quitugua, and Paul Bassler (In Press). "Coconut rhinoceros beetle, Oryctes rhinoceros (Coleoptera: Scarabaeidae), grubs develop in live coconut palms on Guam". In: *Florida Entomologist*. in preparation.

5. Moore, Aubrey, N-Y Su, and Leonard Sigrah (In Preparation). "First record of the coconut termite, *Neotermes rainbowi* (Isoptera: Kalotermes) from Micronesia". In: in preparation.

6. Moore, Aubrey, Gillian Watson, and Jesse Bamba (2014). "First record of eggplant mealybug, *Coccidohystrix insolita* (Hemiptera: Pseudococcidae), on Guam: Potentially a major pest". In: *Biodiversity Data Journal* 2. DOI: 10.3897/BDJ.1.e1042. URL: http://biodiversitydatajournal.com/articles.php?id=1042.

2.2 Presentations at Professional Meetings

1. Moore, Aubrey (2014b). "Biological invasion of forests on Guam and other islands of Micronesia". In: *65th Western Forest Insect Work Conference*. oral presentation. Sacramento, California.

2. Moore, Aubrey (2014n). "Evaluation of a Scratchpad template as an online database for the University of Guam insect collection". In: *iDigBio Biodiversity Collections Digitization in the Pacific Workshop*. oral presentation. Honolulu, Hawaii.

3. Moore, Aubrey (2014p). "Insects Attacking *Serianthes nelsonii*". In: *2014 Island Sustainability Conference*. Guam.

4. Moore, Aubrey (2015d). "Pacific Entomology Conference 2015 Oral Presentation: Failure Analysis of the Guam Coconut Rhinoceros Beetle Eradication Project". In: URL: http://guaminsects.net/anr/sites/default/files/pec2015-crb-failure(10).pdf.

5. Moore, Aubrey and Roland Quitugua (2014d). "Overview of the Guam coconut rhinoceros beetle eradication project". In: *Hawaii CRB Incident Command Meeting*. Honolulu, Hawaii. URL: http://guaminsects.net/presentations/CRB-Hawaii-ICS-Jan-2014.pdf.

6. Moore, Aubrey and Roland Quitugua (2014e). *Rhino Beetle Presentation for Hawaii ICS - January, 2014*. CRB Technical Report. URL: http://guaminsects.net/presentations/CRB-Hawaii-ICS-Jan-2014.pdf.

7. Moore, Aubrey and Roland Quitugua (2015c). "Pacific Entomology Conference 2015 Oral Presentation: Coconut Rhinoceros Beetle Trap Improvements". In: URL: http://guaminsects.net/anr/sites/default/files/pec2015-improved-traps.pdf.

8. Moore, Aubrey, Roland Quitugua, Mattew Siderhurst, and Eric Jang (2014). "Improved traps for the coconut rhinoceros beetle, *Oryctes rhinoceros*". In: *Entomological Society of America*. Portland, OR. URL: http://guaminsects.net/anr/sites/default/files/Moore_1957_2.pdf.

2.3 Technical Reports Documenting Applied Research in Support of the Guam Coconut Rhinoceros Beetle Project

1. Iriarte, Ian, Roland Quitugua, Olympia Terral, Aubrey Moore, and Mariana Sanders (2015a). *Fact Sheet: Coconut Rhinoceros Beetle Behavior and Biology*. CRB Technical Report. URL: http://guaminsects.net/anr/sites/default/files/Behavior%20and%20Biology%20Ian.pdf.

2. Iriarte, Ian, Roland Quitugua, Olympia Terral, Aubrey Moore, and Mariana Sanders (2015b). *Fact Sheet: Coconut Rhinoceros Beetle trapping Methods*. CRB Technical Report. URL: http://guaminsects.net/anr/sites/default/files/Trapping%20Final.pdf.

3. Marshall, Sean and Aubrey Moore (2014a). "DNA analysis of Hawaii CRB". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-02-12.pdf.

4. Marshall, Sean and Aubrey Moore (2014b). "Hawaii beetle dissections". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-17A.pdf.

5. Moore, Aubrey (2014a). "APHIS biocontrol semiannual report". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-05-04_0.pdf.

6. Moore, Aubrey (2014f). "Chicken wire escape test". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-12A_0.pdf.

7. Moore, Aubrey (2014g). "Chicken wire vs plastic top". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-15.pdf.

8. Moore, Aubrey (2014h). "CRB dispersal by flight". In: URL: http://guaminsects.net/anr/content/2014-02-19a-crb-dispersal-flight.

9. Moore, Aubrey (2014i). "CRB heat tolerance". In: URL: http://guaminsects.net/anr/content/2014-02-19-crb-heat-tolerance.

10. Moore, Aubrey (2014j). "CRB mitigation for conservation of rear snails and butterflies at Haputo Beach". In: URL: http://guaminsects.net/anr/sites/default/files/2014-02-17%20Haputo.pdf.

11. Moore, Aubrey (2014k). "CRB rearing". In: URL: http://guaminsects.net/anr/sites/default/files/CRB%20Rearing_0.pdf.

12. Moore, Aubrey (2014l). "CRB Sanitation at the University of Guam Yigo Agricultural Experiment Station". In: URL: http://guaminsects.net/anr/sites/default/files/2014-06-26-YigoSanitation.pdf.

13. Moore, Aubrey (2014m). "Cypermethrin applied to coconut palm crowns as a prophylactic treatment for prevention of CRB damage". In: URL: http://guaminsects.net/anr/sites/default/files/crownSpray.pdf.

14. Moore, Aubrey (2014o). "Guam CRB project payroll simulation". In: URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/CRB%20Payroll.ipynb.

15. Moore, Aubrey (2014s). "Minibucket escape test". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-17.pdf.

16. Moore, Aubrey (2014t). "Minibucket test". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-16.pdf.

17. Moore, Aubrey (2014u). "Plastic top catch test". In: URL: http://guaminsects.net/anr/sites/default/files/CRB2014-01-12B.pdf.

18. Moore, Aubrey (2014v). "Progress Report: Development of Integrated Pest Management for Coconut Rhinoceros Beetle on Guam". In: URL: http://guaminsects.net/anr/sites/default/files/FS-CRB-Report-Sep-2014.pdf.

19. Moore, Aubrey (2014w). "Relative attractiveness of white and ultraviolet light emitting diodes plus oryctalure". In: URL: http://guaminsects.net/anr/sites/default/files/LEDcolor_0.pdf.

20. Moore, Aubrey (2015a). "Best Way to Access Data in the Guam Coconut Rhinoceros Project Database". In: URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/bestWaySQL.ipynb.

21. Moore, Aubrey (2015b). "Generating a Trap Map Animation". In: URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/trapMapViz.ipynb.

22. Moore, Aubrey (2015c). "Harvesting data from the EpiCollect crb-yigo-barrel-epicollect Project". URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/crb_yigo_barrel_epicollect.ipynb.

23. Moore, Aubrey (2015d). "Pacific Entomology Conference 2015 Oral Presentation: Failure Analysis of the Guam Coconut Rhinoceros Beetle Eradication Project". In: URL: http://guaminsects.net/anr/sites/default/files/pec2015-crb-failure(10).pdf.

24. Moore, Aubrey (2015e). "Standard CRB Pheromone Traps Catch More Females Than Males". In: URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/CRB-sex-ratio.ipynb.

25. Moore, Aubrey (2015f). "Trap Thinning". URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/Trap%20Thining.ipynb.

26. Moore, Aubrey (2015g). *Yigo Palm Image Album 2015-01-04*. CRB Technical Report. URL: http://nbviewer.ipython.org/url/guaminsects.net/anr/sites/default/files/Yigo%20Palm%20Image%20Album%202015-01-04.ipynb.

27. Moore, Aubrey and Sean Marshall (2014). "Final Report for APHIS Biocontrol Grant: Entomopathogenic Virus for Biological Control of Coconut Rhinoceros Beetle on Guam". In: 20140709. URL: http://guaminsects.net/anr/sites/default/files/final_July14-CRB%20APHIS%20Biocontrol.pdf.

28. Moore, Aubrey and Sean Marshall (2015). "Efficacy of Entomopathogenic Fungus for Biological Control of Coconut Rhinoceros Beetle (CRB) on Guam and DNA Profiling of Asia/Pacific CRB Populations with Respect to Virus Susceptibility". URL: http://guaminsects.net/anr/sites/default/files/semiannual-report-April2015.pdf.

29. Moore, Aubrey and Roland Quitugua (2014a). "Adding CRB Breeding Site Material to Barrel Traps Does Not Increase Trap Catch". In: URL: http://guaminsects.net/anr/sites/default/files/barrelSubstrate.pdf.

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2.5 Web Sites Designed and Maintained by Me

For the past several years, I have been searching for the "right" technology for providing on-line extension information. The features I want include:

- Ease of use, including immediate, on-line editing, so that colleagues and collaborators can create content
- Ability to display digital images at several resolutions
- Full text search

- Methods for handling on-line and offline references
- Fine grained security which protects client confidentiality and allows for both protected, internal and public information sharing

My current technology of choice is Drupal, a free, open source contents management system.

2.5.1 ANR Web Site.

Home page: http://guaminsects.net/anr
This Drupal site is intended to facilitate sharing both internal and external information generated by the Agriculture and Natural Resources Unit of the University of Guam Cooperative Extension Service. This site is currently being used heavily by the Guam CRB Eradication Project. I also use this site for documenting ny diagnostics work. I provide a recent example web page documenting discovery of thrips in anthurium flowers.
(Evidence 2.5.1; available on-line at http://guaminsects.net/anr/content/thrips-damaging-anthu

2.5.2 Insects of Guam Web Site

Home page: http://guaminsects.myspecies.info
This Drupal site is being evaluated for sharing information on Micronesian insects. Information will include include specimen level information from the UOG insect collection complete with digital images and literature references. It was built using a template developed by the Scratchpad project http://scratchpads.eu/ is sponsored by the European Institute of Distributed Taxonomy (EDIT) and the Natural History Museum in London . The ScratchPad project is celebrating the International Year of Biodiversity by highlighting a different Scratchpad taxon every week. I was honored to have one of my pages, describing the indigenous bug, *Leptocoris vicinus*, highlighted during the week of April 18 to 24, 2010.
(Evidence 2.5.2)

2.5.3 Micronesia Biosecurity Plan Review Web Site

Home page: MBP.GuamInsects.net
This is a secure, private Drupal site developed to facilitate sharing information among those reviewing the Micronesia Biosecurity Plan.

2.5.4 Moodle Site for my AG 109 Insect World Course

Home page: http://campus.uogdistance.com/course/view.php?id=286
This site was my first experence with Moodle, a content management system designed for teachers. I originally built it to provide on-line resources for my students, but later decided to open a few wikis to promote collaboration on laboratory exercises. I also

kept track of grades using Moodle. Examples from this site include the course resource page (Evidence 2.5.3a; available on-line at http://campus.uogdistance.com/mod/resource/view.php?id=7349) and a small PHP program I wrote to facilitate printing pinned insect specimen labels (Evidence 2.5.3b; available on-line at http://tinyurl.com/insect-labels).

2.5.5 Knowledgebase Wiki for the UOG Cooperative Extension

Home page: http://www.guaminsects.net/uogces/kbwiki/index.php
This was my first attempt at building an extension website to facilitate collaborative content creation. Digital copies of all of ANR's pest fact sheets can be found on this site. There is also a list of insect pests found on all major crops grown in Micronesia. I stopped maintaining this site in May, 2009 because the ANR site built with Drupal has more of the features I need.
(Evidence 2.5.4)

2.5.6 Western Micronesia Regional Invasive Species Council Wiki

Home page: http://www.guaminsects.net/gisac/index.php
Originally built for the Guam Invasive Species Advisory Council, this site was quickly adopted fo sharing regional information on invasive species by the Western Micronesia Regional Invasive Species Council.
(Evidence 2.5.5)

2.5.7 Guam Insects Blog Site

Home page:http://blog.guaminsects.net/
I ran into recurring technical problems with this site which uses the WordPress content management system and have mor or less abandonded development and maintenance.

2.5.8 Life Desk Site for Micronesian Insects

Home page: http://micronesianinsects.lifedesks.org/
This site uses a Drupal template being developed by the Encyclopedia of Life Project. I evaluate it for sharing information on Micronesian insects, but decided that the Scratchpad template (number 2, above) had a better feature set for what I wanted to do.

2.6 Grants

During 2014 and 2015, I managed 8 grants totalling $345,040 (listed below). These grants partially or fully supported 14 staff positions (Table 2.1).

2.6.1 Support for the Guam Coconut Rhinoceros Beetle Eradication Project

Funding Source US Forest Service

Amount $150,000

End Date 2015 Jun 30

Description The objective of this project its to develop an integrated pest management (IPM) program for coconut rhinoceros beetle on Guam.

Project Documents http://guaminsects.net/anr/content/crb-biocontrol-2013

2.6.2 Efficacy of Entomopathogenic Fungus for Biological Control of Coconut Rhinoceros Beetle (CRB) on Guam and DNA Profiling of Asia/Pacific CRB Populations with Respect to Virus Susceptibility

Funding Source USDA-APHIS

Amount $40,000

End Date 2015 Aug 31

Description This project has two objectives:

1. To measure the impact of *Metarhizium majus*, green muscardine fungus (GMF), as a biological control agent for the Guam CRB population
2. To survey and map the extent of the Guam CRB genotype. This work is done in collaboration with Sean Marshall at AgResearch New Zealand.

Project Documents http://guaminsects.net/anr/content/crb-biocontrol-2013

2.6.3 Microscopes for UOG Extension Entomology Lab and Guam Customs and Quarantine Agency

Funding Source USDA-APHIS

Amount $80,000

Description Proposal submitted as a 2015 Farm Bill suggestion. However, APHIS decided to fund this equipment grant from AQI funds. Professional grade equipment including a Nikon stereozoom microscope, a Nikon compound microscope, a digital microscope camera, and camera control were delivered to UOG in June 2015. The grant also provided a stereozoom for the Guam Customs and Quarantine Agency.

2.6.4 Establishment of Captive and Managed Populations of the Mariana Eight-spot Butterfly, *Hypolimnas octocula marianensis*

Funding Source USFWS via an MOU with GDOA-DAWR

Amount $21,212

End Date 2015 Sep 30 (1 year no cost extension requested)

Description This project will investigate the feasability of rearing and breeding *H. o. marianensis* and also in field sites where ungulates are excluded.

Project Documents http://guaminsects.net/anr/content/octocula

2.6.5 Western Plant Diagnostic Network FY2015

Funding Source UC Davis

Amount $10,672

End Date 2015 Jun 30

Description WPDN provides first detector training and support of diagnosis of plant pests and pathogens.

Project Documents http://guaminsects.net/anr/content/wpdn-2014-15

2.6.6 Western Plant Diagnostic Network FY2016

Funding Source UC Davis

Amount $10,854

End Date 2016 Jun 30

Description WPDN provides first detector training and support of diagnosis of plant pests and pathogens.

2.6.7 Guam Forest Insect Survey

Funding Source NIFA-McIntire-Stennis

Amount $12,302 per year

End Date 2018 Jun 30

Description The objective of the survey is to build a knowledge-base on insects associated with plants in Guam's forests. The survey will result in a reference collection of Guam's forest insects and a publicly available online database to facilitate sharing of specimen data, images and ecological associations among plants and insects. The knowledge base will be useful to natural resource managers responsible for maintaining the health of Guam's forests and to biologists trying to understand Guam's terrestrial ecosystems in the wake of major biological invasions.

Project Documents http://guaminsects.net/anr/content/guam-forest-insect-survey

2.6.8 Detector Beetles: Radio-tracking Coconut Rhinoceros Beetles to Discover Breeding Sites

Funding Source US Forest Service

Amount $20,000 (additional $20,000 pending)

End Date 2016 Apr 30

Description This project is a feasability study to see if CRB adults equipped with glue-on miniature radio transmitters can be tracked to cryptic breeding sites.

Project Documents http://guaminsects.net/anr/content/detector-beetles

Table 2.1: Staff support by my grants in 2014-2015.

1	Bob Bourgeois
2	Roger Brown (partially)
3	Roland Quitugua (partially)
4	Ian Iriarte
5	Vincent Benavente
6	John Diego
7	Ken Leon Guerrero
8	Roland Cabrera
9	Derrick Diego
10	Marty Hara
11	Ken San Nicolas
12	Jessica Gross
13	Cris Crisostimo
14	Raymondo San Miquel

3 University and Community Service

3.1 Teaching

In addition to my job as an extension entomologist, I am required to teach a four credit course every year. My student evaluations are consistently above average (Tables 3.1 and 3.2).

3.1.1 AG-109 Insect World

Table 3.1: Student evaluation for AG109, *Insect World*.

Term	My Evaluation	College Average	University Average
Fall 2009	3.659	3.565	3.552
Spring 2011	3.986	3.519	3.617
Spring 2012	3.863	3.570	3.612
Spring 2013	3.659	3.552	3.627
Fall 2014	3.645	3.471	3.553

3.1.2 AG/BIO-345 General Entomology

Table 3.2: Student evaluation for AG/BIO-345, *General Entomology*.

Term	My Evaluation	College Average	University Average
Fall 2013	3.875	3.522	3.586

3.2 Service as a Reviewer

- I served as an external examiner and reviewed Maclean Vaqalo's PhD dissertation entitled *Biology and ecology of Nisota basselae on Abelmoschus manihot Medicus in Solomon Islands* for the University of Queensland.

- I reviewed the manual *New Pest Response Guidelines for Coconut Rhinoceros Beetle* for USDA-APHIS.
- I reviewed a scientific note for publication in the Proceedings of the Hawaiian Entomological Society.

3.3 Music

As an amateur horn player I play regularly, and often very badly, with the Guam Symphony Orchestra and occasionally with the Guam Territorial Band. I have played for UOG graduations and for concerts arranged by the UOG music department.

3.4 Collaboration on CESU Rare Butterfly and Snails Survey Grant

I am collaborating with Dan Lindstrom, John Benedict, Frank Camacho, and Curt Fiedler (UOG Biology), Alex Kerr (UOG Marine Lab), Brent Holland and Dan Rubinoff (UH Manoa) on a DOD funded survey of rare butterflies and snails. My contribution is a literature review of *Hypolimnas octocula marianensis* for publication in Micronesica, design and maintenance of project website and development of butterfly camera traps.

3.5 Collaboration on Biocontrol of Cycad Aulacaspis Scale

I am working with Tom Marler on introduction of parasitoids for biocontrol of the *Aulacaspis yasumatsui*.

3.6 University Technical Advisory Committee

I serve on UTAC as the representative for the College of Natural and Applied Sciences.

3.7 Undergraduate Curriculum Review Committee (UCRC)

In the April 2013 Faculty Elections, I was elected to serve on the UCRC. I served for two years on this committee, 2013-14, and 2014-15.