McIntire-Stennis Progress Report for FY2021

Guam Forest Biodiversity Inventory

Accomplishments

Major goals of the project

1 Goal: Liberate data from biological collections and the scientific literature

1.1 Objective: Complete digitization of the UOG insect collection The UOG insect collection catalog has already been made available online using Symbiota. Note that Symbiota automatically uploads data to GBIF. The next phase of this digitization project will be imaging of all taxa in the collection. Existing images will be uploaded and linked to specimen data. Images will be made for taxa which have not been previously imaged and these will also be uploaded.

1.2 Objective: Complete digitization of the UOG herbarium Digital images are available for all herbarium sheets. The existing herbarium catalog will be converted from a local database to an online database using Symbiota or Specify. Both of these online collection database managers automatically upload to GBIF.

1.3 Objective: Liberate data from the scientific literature The PI will organize extraction of Guam biodiversity information from primary scientific publications, starting with Insects of Guam I and II.

2 Goal: Provide public access to Guam forest biodiversity data

2.1 Objective: Build the Guam Forest Biodiversity Web Site The PI will launch a web site to serve as a portal to Guam forest biodiversity data stored in GBIF. Pages will be developed to dynamically generate lists such as those suggested above.

3 Goal: Foster public interest in Guam's forest biodiversity

3.1 Objective: Outreach and Citizen Science Activities

- The PI will offer annual workshops on the use of iNaturalist, a social networking app used by citizen scientists and naturalists which enables them to record biodiversity observations with images and georeferencing using smart phones. iNaturalist data which is validated as research grade by the community is automatically uploaded to GBIF.

- The PI will continue to maintain an iNaturalist project entitled Insects of Micronesia.
- The PI will work with the UOG Center for Island Sustainability to organize annual bioblitzes. A bioblitz is is an intense period of biological surveying in an attempt to record all the living species within a designated area. Participants in the bioblitzes will be trained to use iNaturalist which will be used to document results.

4 Goal: Foster collaboration to help overcome the taxonomic impediment

4.1 Objective: Collaboration with taxonomists, collectors and the biodiversity informatics community

- Collaboration with taxonomists will be cultivated to help identify a large backlog of unidentified specimens in the UOG insect collection.
- Existing collaboration will be maintained with existing partners list in the Collaboration/Cooperation section of this proposal.
- The PI will participate in at least one scientific meeting per year covering biological collections and/or biodiversity informatics.
- The PI will encourage donation of voucher specimens to the UOG insect collection from biological surveys such as those being conducted by the Ecology of Bird Loss and the baseline surveys being done by military contractors in support of the military buildup.

What was accomplished under these goals?

1 Goal: Liberate data from biological collections and scientific literature We are datamining legacy literature about insects on Guam contained in Insects of Guam I and II. These volumes document insects collected during a comprehensive entomological survey of Guam done in 1936.

All 37 chapters of Guam I and II have been datamined by Plazi with resultant datasets published in Zenodo, Treatment Bank and GBIF (See the *Other products* section for a chapter list). We are currently enhancing materials citations annotation by extracting detailed data for each specimen or series examined in each species treatment section within each chapter. We have completed 12 chapters and are tracking our progress using an online status report at https://aubreymoore.github.io/data-mining-insects-of-guam/MatCitValidator/status_report.html.

Insect occurrence records for Guam continue to accumulate in the Global Biodiversity Information Facility (GBIF). Most records are from data sources being built and maintained by this project.

GBIF.org (28 December 2020) GBIF Occurrence Download https://doi.org/10.15468/dl.yfwjwt

- 18,604 Guam insect occurrence records

- 15,136 records were sourced from the University of Guam Insect Collection online catalog.
- 457 records were sourced from iNaturalist research-grade observations.

GBIF.org (17 December 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.34ugmb

- 19,187 Guam occurrence records
- 15,147 records were sourced from the University of Guam Insect Collection online catalog.
- 776 records were sourced from iNaturalist research-grade observations

2 Goal: Provide public access to Guam forest biodiversity data Please see the section entitled *How have the results been disseminated to communities of interest*

3 Goal: Foster public interest in Guam's forest biodiversity The PI participated in a workshop for educators sponsored by the Guam Soil and Water Conservation districts entitled *Healthy Forests, Healthy Communities.*

The PI participated in making a video recording about Guam's forests:

Ares, Adrian. 2021. Video: Forests of Guam. Presentation for the 15th World Forestry Conference. Western Pacific Tropical Research Center, University of Guam. Accessed July 27, 2021. https://www.youtube.com/watch?v=27D-ovSzLBk.

4 Goal: Foster collaboration to help overcome the taxonomic impediment Nothing to report.

What opportunities for training and professional development has the project provided?

Plazi provided online training sessions specifically for this project. Topics covered where *Introduction to Golden Gate Imagine Software* and *Enhancing Material Citations.* See https://osf.io/f498p/wiki/home/ for details.

How have the results been disseminated to communities of interest?

Data from the Scientific literature For each chapter we annotate, the Plazi workflow creates a journal article published in Zenodo. This is essentially a republished copy of the original chapter with links to files containing extracted data. Links are provided for a GBIF checklist dataset which may be downloaded in several formats including Darwin core archive (DwCA). In addition, a dataset for each taxon within the chapter is created and stored in the Plazi Treatment Bank.

For example, here are the publicly accessible online data products which were automatically appeared on the internet after we annotated the *Bees of Guam*

chapter:

Zenodo article: Cockerell, T. D. A. (1942). Bees of Guam. In Insects of Guam I (pp. 188–190). Bernice P. Bishop Museum. https://doi.org/10.5281/zenodo.5160372

GBIF dataset: Cockerell T D A, carolina (1942). Bees of Guam. Plazi.org taxonomic treatments database. Checklist dataset https://doi.org/10.5281/zenodo.5160372 accessed via GBIF.org on 2021-12-17. This dataset can be downloaded in several formats including Darwin core archive. Note that information within this dataset will be accessed whenever GBIF is queried.

Taxon treatments: A page is available for each taxon which appears in the chapter:

- Cockerell, T. D. A. (1942). Apis mellifera Linnaeus. In Bees of Guam, pp. 188-190 in Insects of Guam I (p. 188). Bernice P. Bishop Museum. https://doi.org/10.5281/zenodo.5211876
- Cockerell, T. D. A. (1942). Megachile laticeps Smith. In Bees of Guam, pp. 188-190 in Insects of Guam I (p. 188). Bernice P. Bishop Museum. https://doi.org/10.5281/zenodo.5164364
- And so on for the 7 species in this chapter.

Data from the University of Guam insect collection Data and images for each specimen accessioned by the UOG insect collection are uploaded to a publicly available online database at https://scanbugs.org/portal/collections/misc/collprofiles.php?collid=180 which is hosted by the Symbiota Collections of Arthropods Network. All records are then automatically published on GBIF in a dataset at https://www.gbif.org/dataset/56e311e3-43c6-4b99-aa21-af396074d5e3.

What do you plan to do during the next reporting period to accomplish the goals?

In the last year of this project annotation of materials citations in Insects of Guam I and II will be completed and a journal article will be prepared documenting progress that has been made towards realization of a terrestrial biodiversity inventory for Guam.

Participants

For Objective 1.3, *Liberate data from the scientific literature*, we are collaborating with Plazi (https://en.wikipedia.org/wiki/Plazi) a Swiss-based international nonprofit association supporting and promoting the development of persistent and openly accessible digital bio-taxonomic literature. We work closely with data scientists at the Plazi office in Brazil: Marcus Guidoti, Carolina Sokolowicz, and Tatiana Ruschel. They have provided online training, specialized software, server access, and technical support.

Annette Kang, a PhD student studying entomology at Cornell University, was hired as a project intern to work on Objective 1.3.

Target Audience

The target audience for data resulting from this project is anybody interested in Guam's biodiversity. This includes biologists, invasive species specialists, ecologists, resource planners, biosecurity officials, students, and the general public.

Citation

Moore, Aubrey and Annette Kang 2021. Datamining Insects of Guam. Open Science Framework. https://osf.io/f498p/

Moore, Aubrey 2021. Datamining Insects of Guam. GitHub repository. https://aubreymoore.github.io/data-mining-insects-of-guam/

Moore, Aubrey 2021. Insects of Guam Datamining Project Status Report. https://aubreymoore.github.io/data-mining-insects-of-guam/MatCit-Validator/status_report.html

Other Products

Chapters of Insects of Guam I and II which have been datamined with resultant datasets published in Zenodo, Treatment Bank and GBIF.

1. Cockerell TDA. Halictine Bees from Rota Island. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 191–4. Available from: https://zenodo.org/record/5160456
2. Moulton D. Thysanoptera: Thrips of Guam. In: Insects of Guam I [Internet]. Bernice P. Bishop Museum Bulletin; 1942 [cited 2021 Dec 13]. p. 7–16. Available from: https://zenodo.org/record/3634035
3. Swezey OH. Lepidoptera, Geometridae, Arctiidae, Agrotidae,and Pyralidae of Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum Bulletin 189; 1942 [cited 2021 Dec 13]. p. 163–85. Available from: https://zenodo.org/record/5165313
4. Swezey OH. Orthoptera And Related Orders Orthoptera And Related Orders Of Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1946 [cited 2021 Dec 13]. p. 3–8. Available from: https://zenodo.org/record/5160233
5. SWEZEY OH, WILLIAMS FX. ODONATA, DRAGONFLIES OF GUAM. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum, Bulletin 172; 1942 [cited 2021 Dec 13]. p. 3–6. Available from: https://zenodo.org/record/5159515
6. Mailoch JR. Trypetidae, Otitidae, Helomyzidae, And Clusiidae of Guam (Diptera). In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice

P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 201–10. Available from: https://zenodo.org/record/5163626
7. Johannse OA. Some New Species Of Nemocerous Diptera From Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1946 [cited 2021 Dec 13]. p. 187–93. Available from: https://zenodo.org/record/5169292
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9. Van Zwaluwenburg RH. Elaterid And Eucnemid Beetles Of Guam. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 53–5. Available from: https://zenodo.org/record/5159555
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11. Swezey OH. Notes On Some Fulgoroidea Of Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1946 [cited 2021 Dec 13]. p. 149–56. Available from: https://zenodo.org/record/5164064
12. Fullaway DT. Ichneumonidae, Evaniidae, And Braconidae Of Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1946 [cited 2021 Dec 13]. p. 221–7. Available from: https://zenodo.org/record/5156759
13. Usinger RL. Hemiptera Heteroptera of Guam. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum, Bulletin 189; 1946 [cited 2021 Dec 13]. p. 11–103. Available from: https://zenodo.org/record/5173934
14. Fullaway DT. Hymenoptera, New Species Of Guam Chalcidoidea. In: Insects of Guam II [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1946 [cited 2021 Dec 13]. p. 201–10. Available from: https://zenodo.org/record/5169330
15. Blair KG. Coleoptera Heteromera From Guam. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 56–60. Available from: https://zenodo.org/record/5159673
16. Swezey OH. Miscellaneous Families of Guam Coleoptera. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 150–71. Available from: https://zenodo.org/record/5167701
17. Swezey OH. Aphididae and Aleurodidae Of Guam. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 23–4. Available from: https://zenodo.org/record/5159809
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https://zenodo.org/record/5127686
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22. CockerellL TDA. Bees of Guam. In: Insects of Guam I [Internet]. Honolulu, Hawaii: Bernice P. Bishop Museum; 1942 [cited 2021 Dec 13]. p. 188–90. Available from: https://zenodo.org/record/5160372
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Changes/Problems

The University of Guam insect collection has been mothballed in a small storage room with poor environmental conditions and insufficient work space.