Building a Terrestrial Biodiversity Inventory for Guam

Status: ORG REVIEW

Project Director

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Organization Project Number

GUA0930

Accession Number

1018014

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Organization

University of Guam

To Project / Program

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Primary Critical Issue

Fiscal Year

2022

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The goal of this project was to build a sustainable biodiversity inventory for Guam. In its simplest form, a biodiversity inventory is essentially a database containing a comprehensive check list of all taxa known occur within a defined geographic area. Data are keyed to a taxonomic hierarchy commonly referred to as the *tree of life*.

The numbers and identities of terrestrial species on Guam are largely unknown. For example, the Global Biodiversity Information Facility (GBIF) currently lists only 1,095 insect species for Guam, whereas it is estimated that there are about 5,000 species.

A biodiversity inventory for Guam is needed to:

- To document rapid changes to Guam's ecosystems including arrival of invasive species
- To provide free, open access to information on Guam's flora and fauna
- To share Guam biodiversity information with the global scientific community, policy makers and the public

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Design Considerations

Data for biodiversity inventories are commonly extracted from labels attached to specimens in biological collections and occurrence records in the scientific literature. In recent years, biodiversity data have become available via online sources such as iNaturalist, a citizen science social networking site where users record images and data from biological observations, and the Barcode of Life Data System (BOLD), a repository for DNA barcoding sequences.

Instead of building, maintaining and hosting a custom online database for the Guam Terrestrial Biodiversity Inventory, I decided to use GBIF as the online database and then build a set of custom tools to access Guam specific data. This design simplified the work tremendously. The major task for this project was to automate importation of Guam data into GBIF. Development of taxonomic data standards, especially the Darwin Core Archive data format, have made it relatively easy to develop automated workflows for sharing biodiversity data among different systems. In my final report for this project I describe methods used to push Guam data from biological collections, scientific literature and iNaturalist to GBIF.

I used free, open source software (FOSS) for this project. All code and documentation is stored in public GitHub repositories.

Data Extraction Activities

Biodiversity data were extracted from the University of Guam insect collection labels, from legacy scientific literature (namely the 38 chapters of Insects of Guam I and II published by the Bernice P. Bishop Museum in 1942 and 1946) and iNaturalist.

Automated workflows were developed to publish these data in GBIF.

For details please see my final report for this project.

Briefly describe how your target audience benefited from your project's activities.

The target audience for this project is broad, including anyone interested in accessing information about the flora and fauna of Guam. This includes the general public, environmental policy makers, and the global scientific community. This projects activities significantly increased the number of Guam insect occurrence records in the GBIF database. Data for the current Darwin core archive for Guam insect occurrences is sourced from 91 GBIF datasets. This project contributed data to 40 of these datasets which contain 85% (19,481 of 22,802) insect occurrence records for Guam.

For details please see my final report for this project.

Briefly describe how the broader public benefited from your project's activities.

I have used iNaturalist for years as a tool to document insect observations complete with images and pest control recommendations made during my work as an extension entomologist. I encourage clients to insect image identification requests via iNaturalist.I also use iNaturalist as a teaching tool. Students in my entomology courses use iNaturalist to catalog their insect collections. Many iNaturalist observations of insects on Guam are added to the iNaturalist Insects of Micronesia Project. This project currently includes 3605 observations of 438 species made by 154 people. It should be noted that several newly arrived invasive species were first detected and documented by this iNaturalist project.

For details please see my final report for this project.

Comments (optional)

This project concentrated on improving access to knowledge about Guam's insects. However, the methods which were developed can be used to build a comprehensive biodiversity inventory for all taxa. To test this concept, the current Darwin core archive for all occurrence records from Guam was downloaded from GBIF and used as a source to build an interactive *tree of life* for Guam. This is a simple static web page hosted for free on GitHub. It will be updated weekly using a Jupyter notebook. There are currently 160,024 Guam occurrences records in GBIF (8 kingdoms | 92 phyla | 232 classes | 670 orders | 2012 families | 4946 genera | 6123 species).

GBIF.org (24 February 2023) GBIF Occurrence Download https://doi.org/10.15468/dl.xswb7x