Title: Guam Forest Biodiversity Inventory			
Accession No.		**Sponsoring Institution**	National Institute of Food and Agriculture
Project No.	GUA0930	**Project Status**	DRAFT
Funding Source	Mcintire Stennis	**Multistate No.**	
		DUNS Number	779908151
Start Date	10/15/2018	**End Date**	09/30/2022
Submitted By	Aubrey Moore	**Date Submitted to NIFA**	

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Collaborating Departments
Cooperative Extension Service

Collaborating/Partnering States
{NO DATA ENTERED}

Collaborating/Partnering Countries
{NO DATA ENTERED}

Collaborating/Partnering Organizations
{NO DATA ENTERED}

Non-Technical Summary

The main goal of this project is to build and maintain a Guam Forest Biodiversity Inventory. In its simplest form, a biodiversity inventory is a checklist of animals and plants inhabiting a geographic area or habitat of interest. In this case, the habitat of interest is Guam's forests. This project will be a major component of a larger project aimed at building a Guam Terrestrial Biodiversity Inventory to include all life forms found on the island.
Guam's forest ecosystems are rapidly being degraded by invasive insect species and habitat destruction. Impacts of bird extinctions caused by the brown tree snake predation on Guam's forests are well known. But these impacts are rivaled by contemporary ecological disasters:

- In 2002, Guam's endemic cycad, Cycas micronesica, was the most abundant tree (DBH > 5 inches) in Guam's forests (Donnegon et al., 2002). In 2003 the Asian cycad scale (Aulacaspis yasumatsui) was detected on Guam infesting ornamental cycads. The scale quickly spread to wild cycads and started killing them. Within only three years, Cycas micronesica was placed on the IUCN Red List of Threatened Species and in 2016, this plant was placed on the US national endangered species list. It is estimated that 90% of Guam's cycads have been killed and there is no sign of recovery.
- Coconut (Cocos nucifera), is Guam's second most abundant tree species. Guam's palms are rapidly being killed by coconut rhinoceros beetle (Oryctes rhinoceros) which was first detected on the island in 2007. It is likely that 50% or more of the island's coconut palms will be lost.

Despite rapid destruction of Guam's forests, there is not even a basic checklist which can be used to document changes in biodiversity. A biodiversity inventory is needed:

- to document changes in Guam's ecosystems
- to document detection of and impacts caused by invasive species which are arriving at a rapid rate
- to provide free, open access to information on Guam's flora and fauna (including images and occurrence maps) to the global scientific community, policy makers, and the public
- to act as a digital repository for data from biological surveys and biological collections
- to provide links to scientific literature about taxa which occur on Guam

- to document ecological relationships among taxa such as hosts, predators, parasites and diseases

Goals / Objectives

1 Goal: Liberate data from biological collections
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 useiNaturalist 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.

Methods

The Guam Forest Biodiversity website will use the Global Biodiversity Information Facility as its backend database. Existing GBIF taxon occurrence records for Guam will be augmented from biological collection data extracted from digital catalogs of the UOG insect collection and the UOG herbarium, and from the scientific literature. Input to and output from GBIF will be facilitated by the use of modern biodiversity data standards, namely Darwin core archives. The website will be constructed using a Web2Py Python web framework.

Target Audience

The audience for results of this project is broad, including researchers, extension agents, resource managers, policy makers and the general public. An example of a specific client is the Guam Invasive Species Council (GISC). The Guam law which founded GISC requires the council to maintain a comprehensive list of invasive species on Guam. This project will provide this list.

Products

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Website and database
The major product of this project will be the Guam Forest Biodiversity Inventory Website. This website will use the Global Biodiversity Information Facility (GBIF) as a repository and back-end database. The website will facilitate automatic generation and updates to lists such as:

- Specimen level data for the UOG insect collection and the UOG herbarium.
- All invasive species on Guam with year of the first record
- New species described from specimens collected on Guam
- Observation data for Guam's endangered species
- Guam's forest plants with associated herbivores and pathogens
- Forest pests and associated biological control agents
- A literature reference list and links to images for all taxa in the database
- Customizable checklists and field guides with images

Activities
Some project funding will be used to continue an existing student internship program. Interns will assist in the curation and digitization of the University of Guam insect collection. The next step in digitization is to create images for all taxa in the collection.

Events
Annual bioblitzes to document Guam's forest biodiversity will be organized. These will be open to public participation. Participants in the bioblitzes will be trained to use iNaturalist which will be used to document results.

Expected Outcomes

This project will:

- Significantly increase the number of taxon occurrence records for Guam in the GBIF database.
- Document the extremely high establishment rate for invasive species on Guam. Currently, the arrival rate, establishment rate, and impacts of invasive species on Guam are grossly under-reported.
- Improve access to information on native and non-native animals and plants which live on Guam. At present, there are no comprehensive check-lists for most taxa.
- Improve access to Guam biodiversity information for use by researchers, extension agents, resource managers, policy makers and the general public.

Keywords

biodiversity ~invasive species ~endangered species

Estimated Project FTEs For The Project Duration

Role	Non-Students or Faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	0.0	0.0	0.0	0.1	0.1
Professional	0.0	0.0	0.0	0.0	0.0
Technical	0.0	0.5	0.0	0.0	0.5
Administrative	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0
Computed Total	0.0	0.5	0.0	0.1	0.6

Animal Health Component 0 %

Activities		**Research Effort Categories**	
Research	30 %	**Basic**	0 %
Extension	60 %	**Applied**	75 %

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Education 10 % **Developmental** 25 %

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
136	699	1070	100

Knowledge Area

136 - Conservation of Biological Diversity

Subject Of Investigation

0699 - Trees, forests, and forest products, general

Field Of Science

1070 - Ecology

Assurance Statements

1. Are Human Subjects Involved? ◉ No ○ Yes

If YES to Human Subjects
Is the Project Exempt from Federal regulations?

○ Yes

If yes, select the appropriate exemption number.

○ No

If no, is the IRB review Pending?

○ Yes

○ No IRB Approval Date

Human Subject Assurance Number

2. Are Vertebrate Animals Used? ◉ No ○ Yes

If YES to Vertebrate Animals
Is the IACUC review Pending?

○ Yes

○ No IACUC Approval Date

Animal Welfare Assurance Number

Project Proposal:

Filename	Size	Type
Moore_ms_proposal_July31_2018-edited-Adrian.	267506	application/pdf

Accession No.	**Project No. GUA0930**

Project Signature Panel

Adrian Ares

Associate Director

UOG Station, CNAS

Assurance Statement Panel

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