

CRB BIOLOGY

Know your enemy.



Aubrey Moore



CNMI CRB Project Teleconference
23 February 2021

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US Dept of the Interior
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Legislature of Guam



US Dept of Agriculture
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Coconut rhinoceros beetle invasion history

native range

first detected in the 20th century

first detected in the 21st century

open circle: population includes CRB-G biotype

filled circle: population is exclusively CRB-G biotype



Data available at <https://github.com/aubreymoore/crbdist>

Screen capture from <http://aubreymoore.github.io/crbdist/mymap.html> 2018-08-05

Coconut rhinoceros beetle invasion history

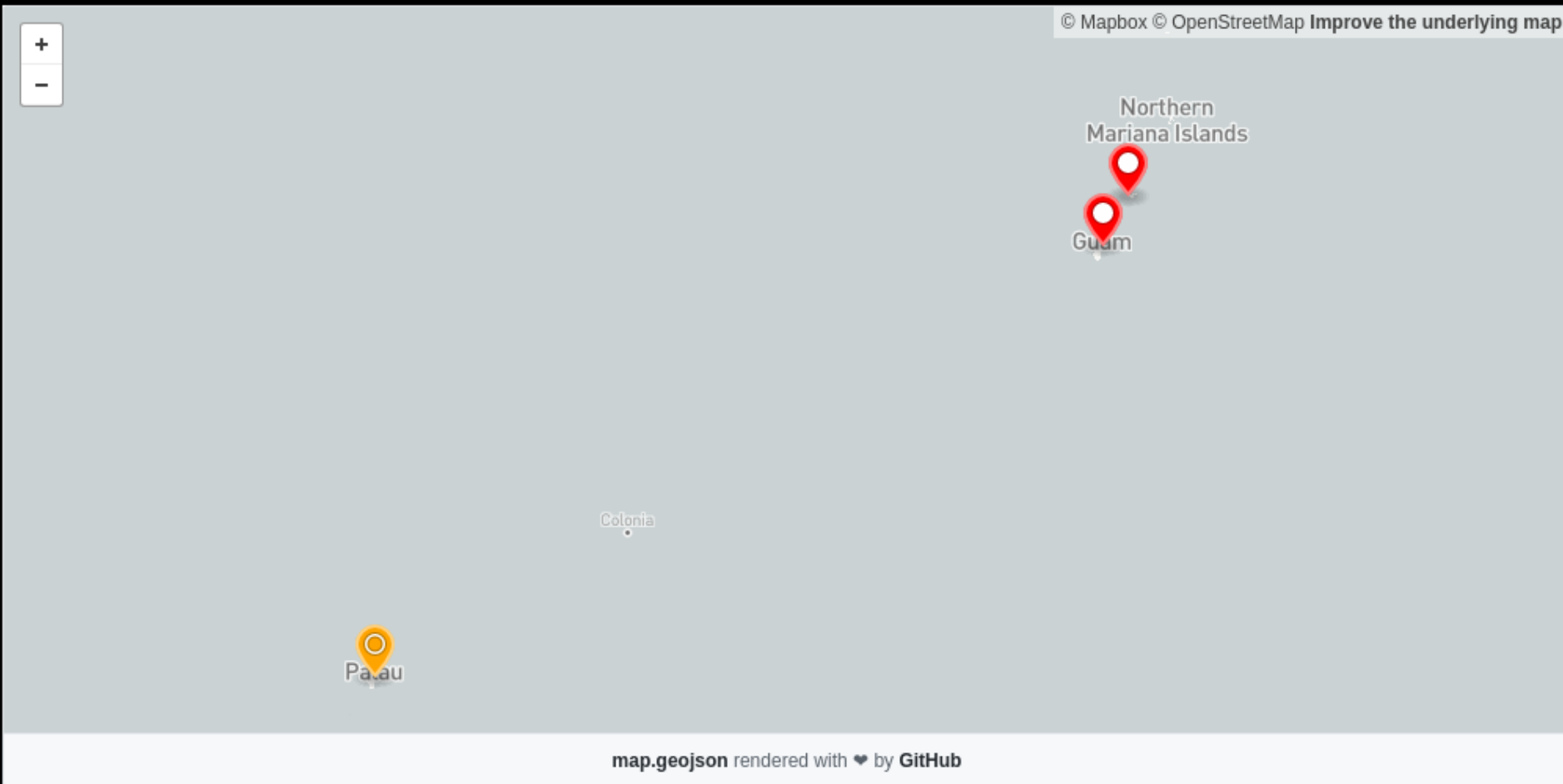
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Discovery of the CRB-G Biotype

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.

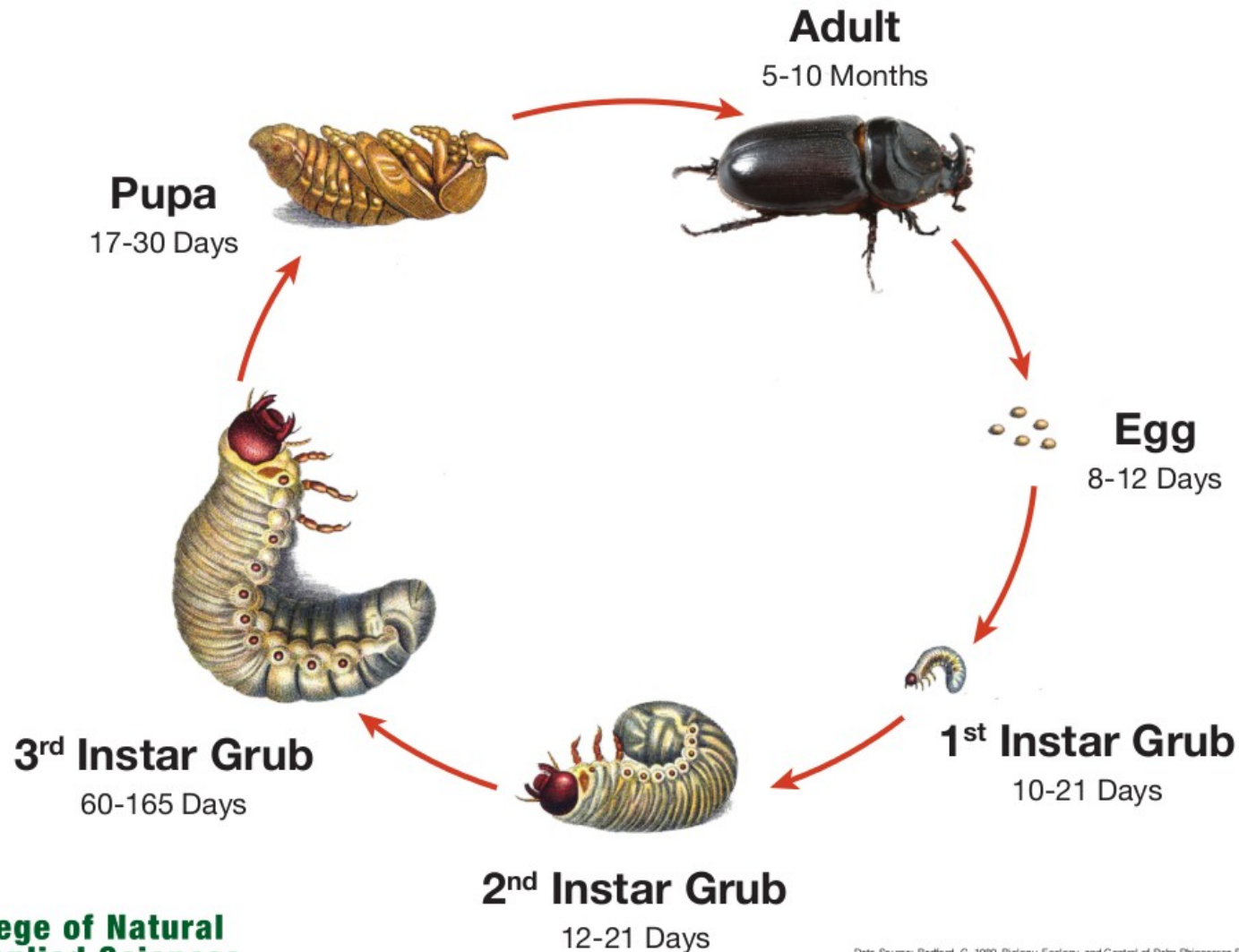
Journal of Invertebrate Pathology, 149, 127–134.
<https://doi.org/10.1016/j.jip.2017.07.006>

Characteristics of CRB-G

- genetically distinct
- resistant to all available isolates of OrNV
- more invasive (except for Vanuata, all recent invasions involve CRB-G)
- behavioral differences ???
 - not highly attracted to oryctalure
 - higher per-capita damage

LIFE CYCLE OF THE COCONUT RHINOCEROS BEETLE

Oryctes rhinoceros



**College of Natural
& Applied Sciences**
University of Guam | Unibetsedât Guåhan

Data Source: Bedford, G. 1980. Biology, Ecology, and Control of Palm Rhinoceros Beetles. *Annual Review of Entomology* 25: 309-339.
Published by the College of Natural & Applied Sciences (CNAS), University of Guam, in cooperation with the U.S. Department of Agriculture, under Dr. Lee S. Yudin, Director/CNAS, University of Guam. CNAS, UOG Station, Mangilao, Guam 96925. Copyright 2016. For reproduction and use permission, contact CNAS-Mktg@uog.edu.gu (501) 735-0000. The University of Guam is an equal opportunity/affirmative action institution providing programs and services to the people of Guam without regard to race, sex, gender identity and expression, age, religion, color, national origin, ancestry, disability, marital status, arrest and court record, sexual orientation, or status as a covered veteran. Find CNAS publications at CNAS-RC.usg.edu.

Potential Population Growth

- Each female lays 60 eggs
- No mortality
- Sex ratio is 1:1

Generation	CRB Population
1	60
2	1,800
3	54,000
4	1,620,000
5	48,600,000
6	1,458,000,000
7	43,740,000,000
8	1,312,200,000,000









Figure : Coconut palms killed by *Oryctes rhinoceros* in Fiji (photo by Bedford)



The current outbreak was triggered by Typhoon Dolphin which visited Guam in May 2015. Adult CRB emerging from abundant breeding sites where numerous enough to start killing mature coconut palms.

Dead standing coconuts are now generating further generations of CRB which are killing even more palms.

How to Eradicate CRB

Sanitation: Locate and destroy all active and potential breeding sites.

Quarantine: Close pathways to prevent re-introduction and accidental transport to uninfested areas.

Note: Only one of many CRB eradication programs has succeeded (Niuatoputapu Is., aka Keppel Is., Tonga; 16 km²)

Research Priorities

- Establishment of effective self-sustaining biological control
- Development of automated detecting and monitoring of CRB damage
- Precision pesticide application using drones
- Improved methods for detecting CRB breeding sites

Establishment of self-sustaining biological control

Reduction in CRB damage after introduction of *Oryctes nudivirus* in Fiji (Bedford 1985)

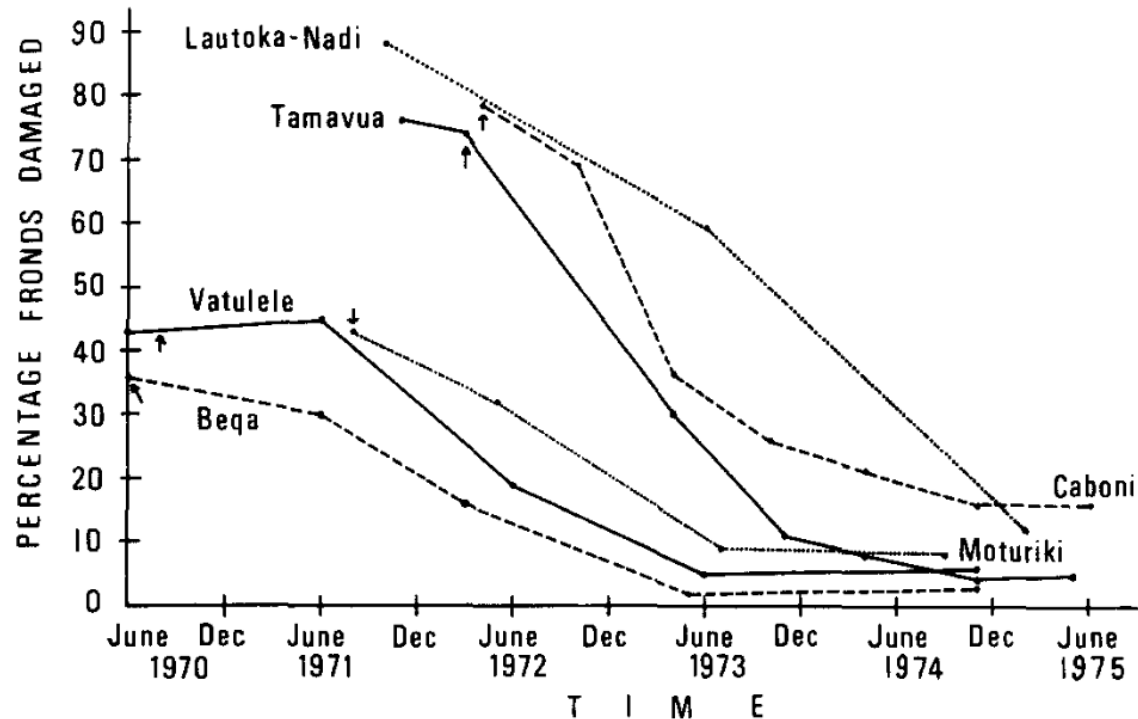
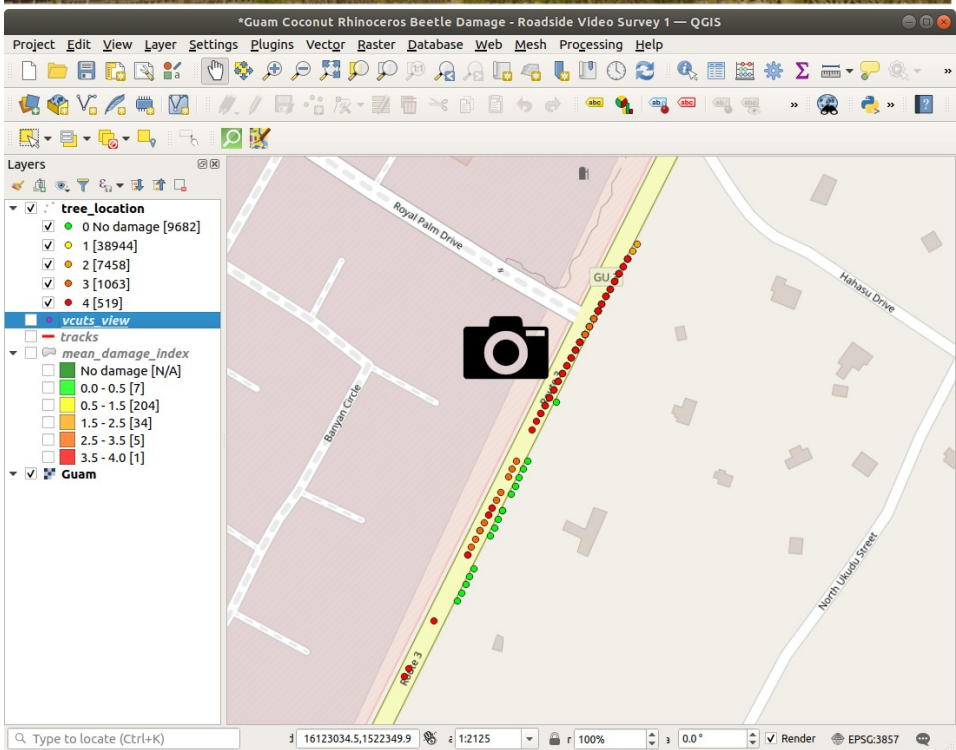
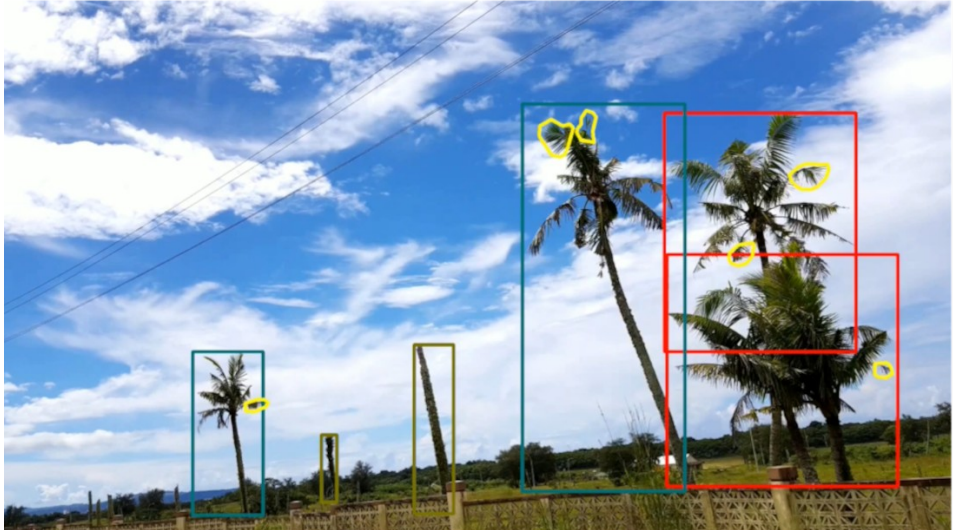
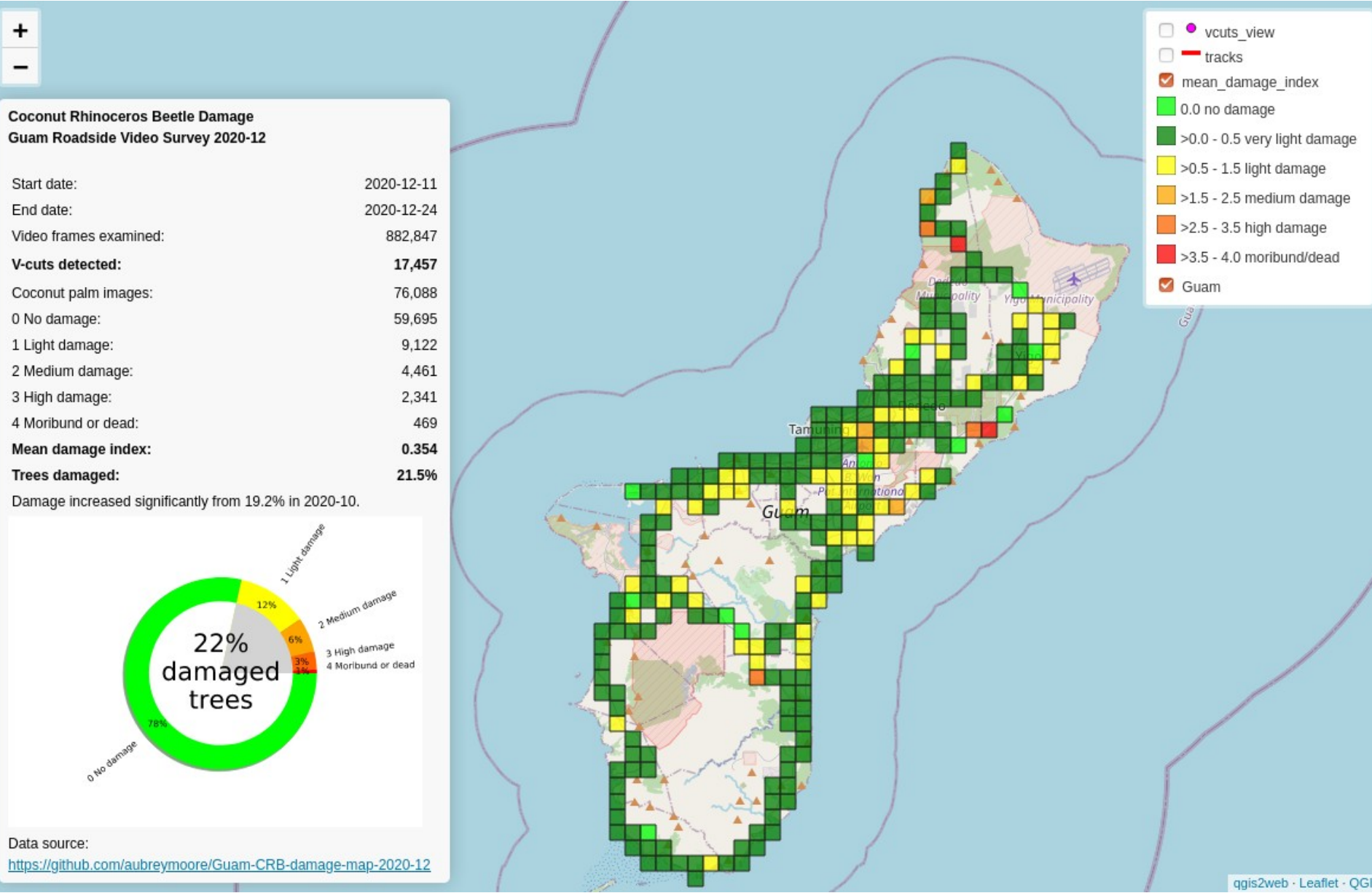


Fig. 1. Effect of baculovirus on palm damage by *Oryctes rhinoceros* at localities in the Fiji Islands. Arrows indicate time of virus introduction. Virus had spread naturally into the Lautoka-Nadi area by mid-1973.

Automated detection and monitoring of CRB damage



Automated detection and monitoring of CRB damage



Automated detection and monitoring of CRB damage

iNaturalist

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Identify


More

Coconut Palm

Cocos nucifera

Research Grade

Edit



CC BY

+

aubreymoore

358 observations

Observed:

Oct 29, 2020 · 12:26 PM ChST

Submitted:

Feb 14, 2021 · 11:22 AM ChST

+

-

Map

Satellite

Google

Map Data 500 m Terms of Use

Rota Island, CNMI

Details

Lat: 14.183718 Lon: 145.268185 Accuracy: Not recorded Geoprivacy: Open

Encompassing Places

Standard:

Oceania (Continent)

Commonwealth of the Northern Mariana Islands (Municipality)

Rota, MP (State)

Community Curated:

Mariana Islands (Region)

Micronesia Region (Region)

Tropical Asia (Unknown)

View on

Google · OpenStreetMap

Notes

Probable coconut rhinoceros beetle damage detected during a roadside video survey performed Manglona, Rota DLNR.

Activity

aubreymoore suggested an ID

Improving

Screenshot of <https://www.inaturalist.org/observations/69534809>

Precision pesticide application using drones

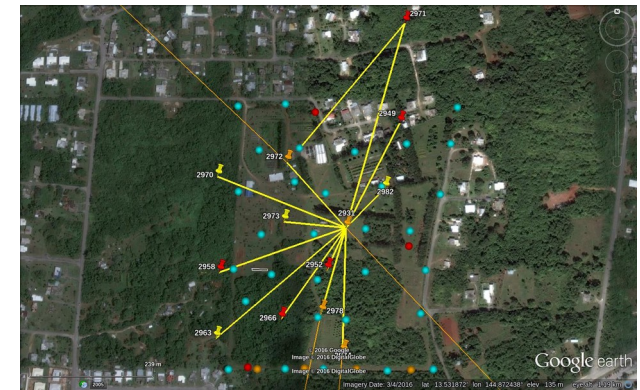
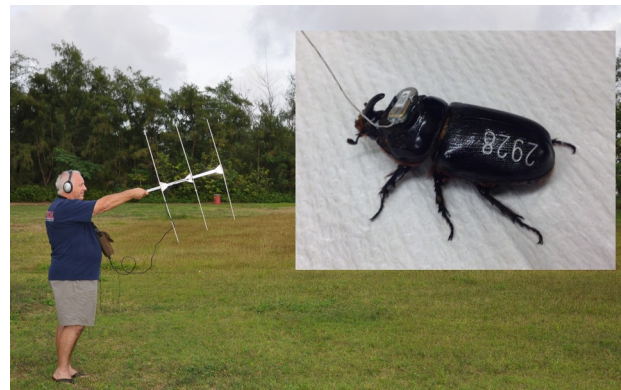
- Get precise location of coconut palms with v-shaped cuts using drone imagery and AI
- Program an applicator drone to apply pesticide to crowns of damaged palms

Improved methods for detecting CRB breeding sites

Detector dogs



Detector Beetles
(radio-tracking)



Detector Beetles
(harmonic radar)



