

Invasion of Guam by the Coconut Rhinoceros Beetle



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Regional Invasive Species Council, Guam, April 27, 2017

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Legislature of Guam





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

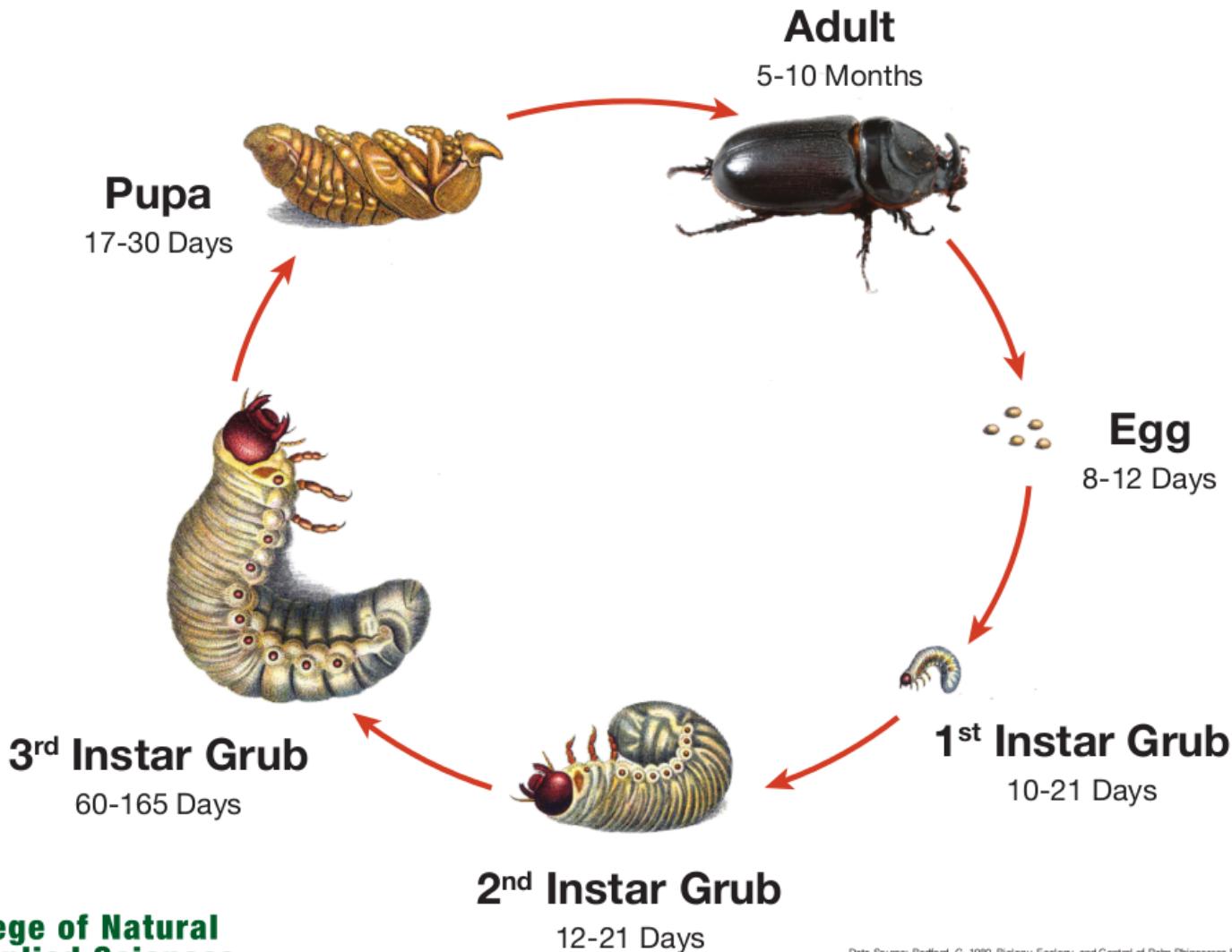
filled circle: population is exclusively CRB-G biotype



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

LIFE CYCLE OF THE COCONUT RHINOCEROS BEETLE

Oryctes rhinoceros



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Data Source: Bedford, G. 1980. Biology, Ecology, and Control of Palm Rhinoceros Beetles. *Annual Review of Entomology* 25: 309-339.

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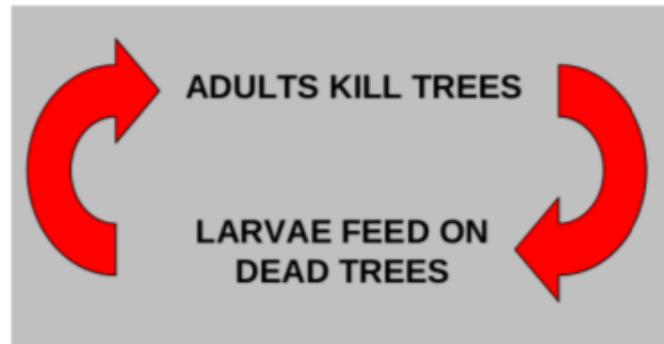
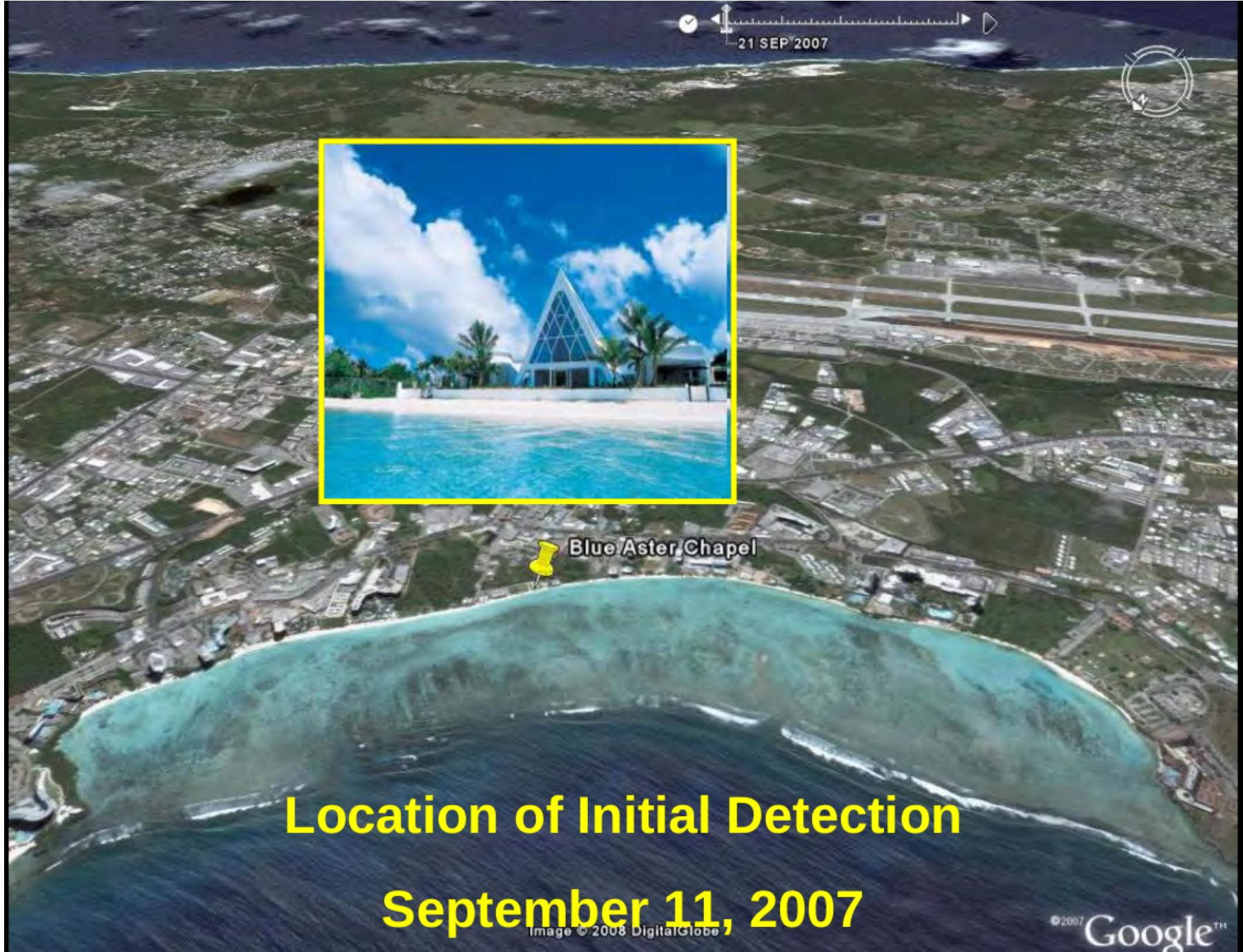


Figure : Coconut palms killed by *Oryctes rhinoceros* in Fiji (photo by Bedford)



Location of Initial Detection

September 11, 2007

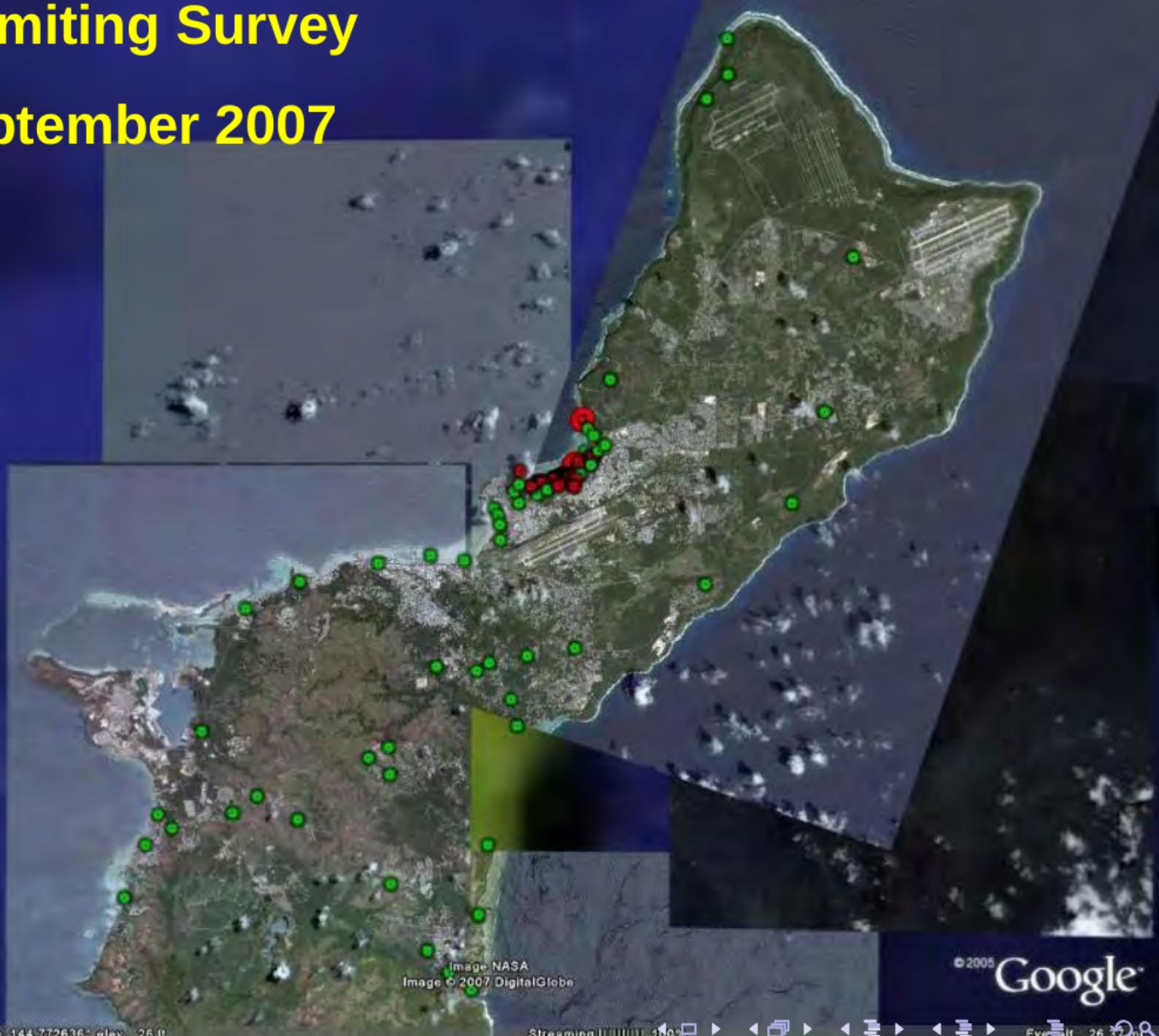
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Image © 2008 DigitalGlobe

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Delimiting Survey

September 2007



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.



Initial Quarantine Area

September 2007



Additional CRB Control Tactics

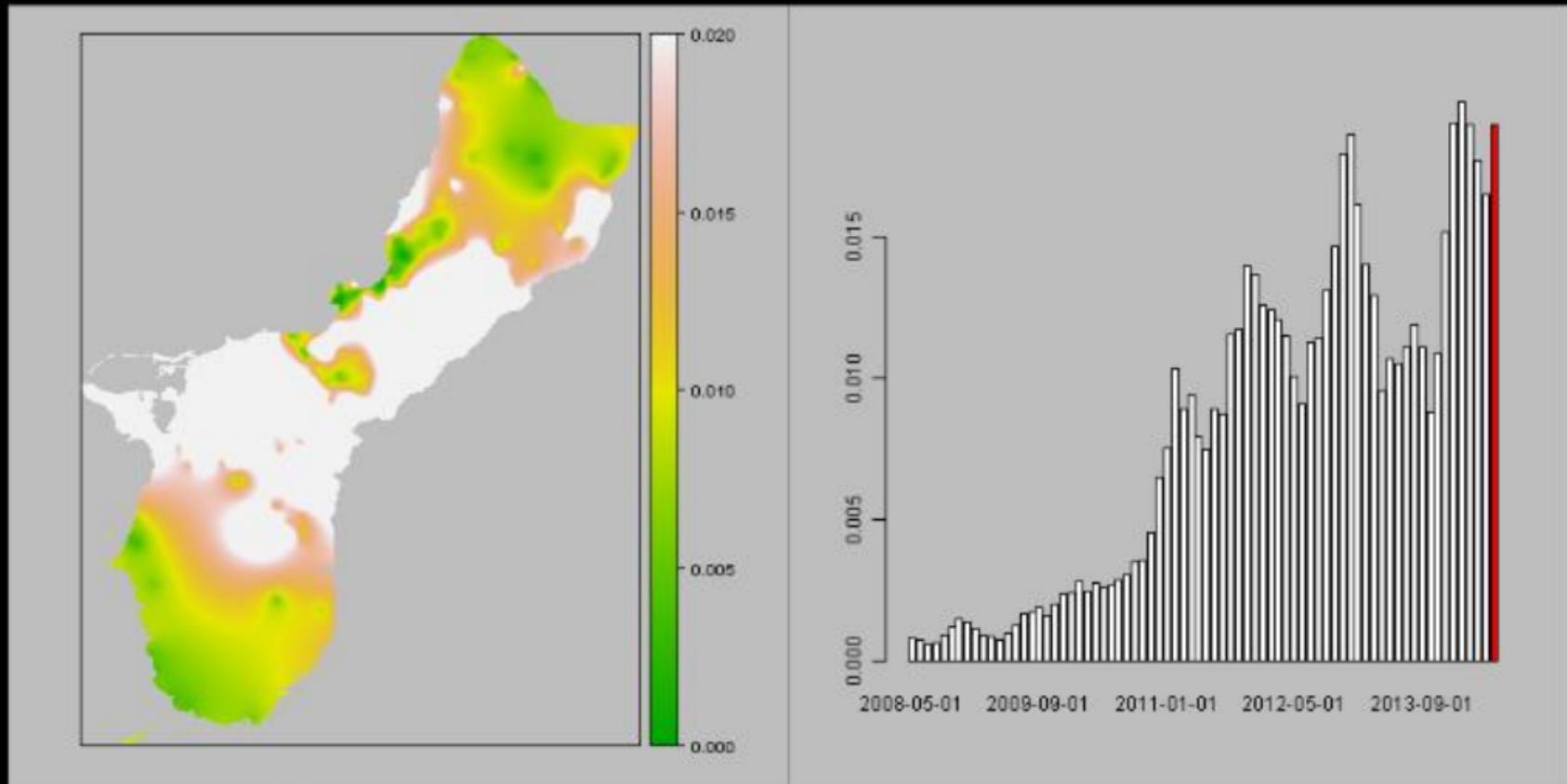
- Sanitation
- Quarantine
- Trapping
- Chemical control
- Biological control

Trapping



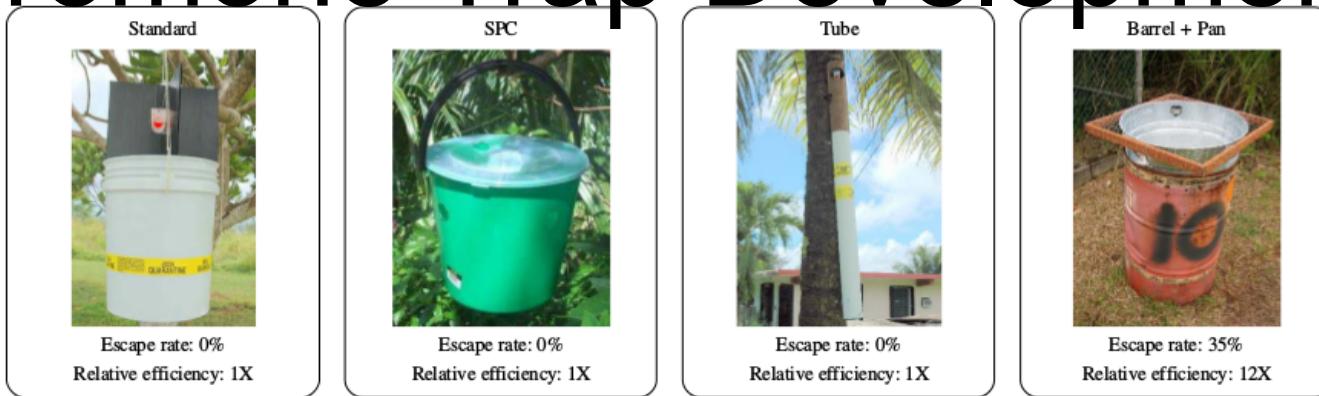
- Pheromone traps baited with oryctalure proved useless for population suppression
- Pheromone traps are useful for detection and monitoring

90 day trapping period ending on 01 Jun 2014



Mean number of beetles caught per trap-day

Pheromone Trap Development



Standard Reduced Release Rate



Escape rate: 0%
Relative efficiency: 1X

Standard UVLED



Escape rate: 0%
Relative efficiency: 3X

AlphaScents



Escape rate: 0% ?
Relative efficiency: 1X

Barrel + Minibucket



Escape rate: 0%
Relative efficiency: 1X

Barrel + Pan + Cone



Escape rate: 0%
Relative efficiency: 16X

AlphaScents + UVLED



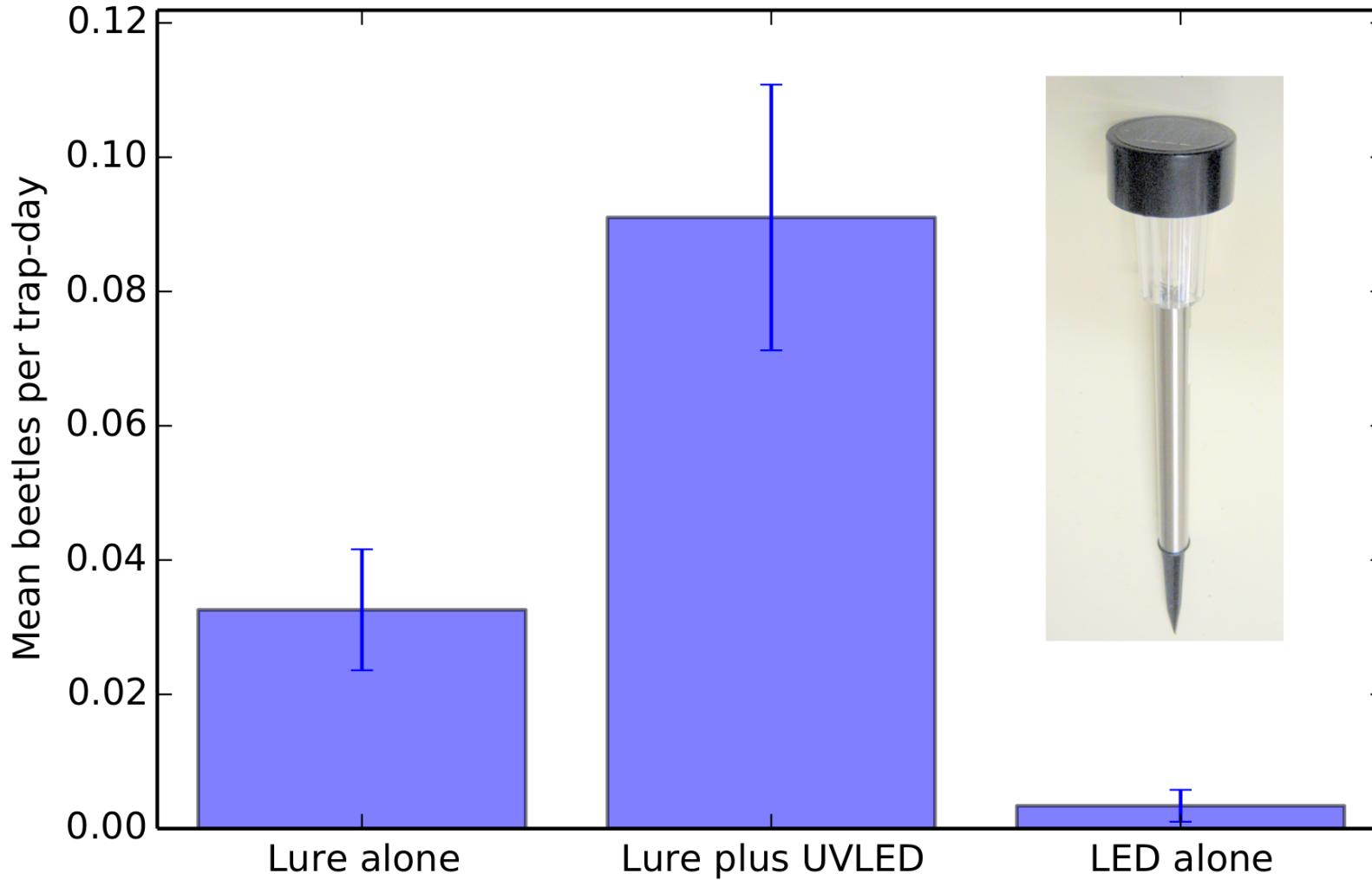
Escape rate: 0%
Relative efficiency: 3X

Barrel + Pan + Cone + Substrate



Escape rate: 0%
Relative efficiency: 16X

UV LED increases Trap Catch



Tekken Trap



Tekken Trap



DeFence Trap



DeFence Trap



DeFence Trap Instruction Manual

For capturing
Coconut Rhino Beetles



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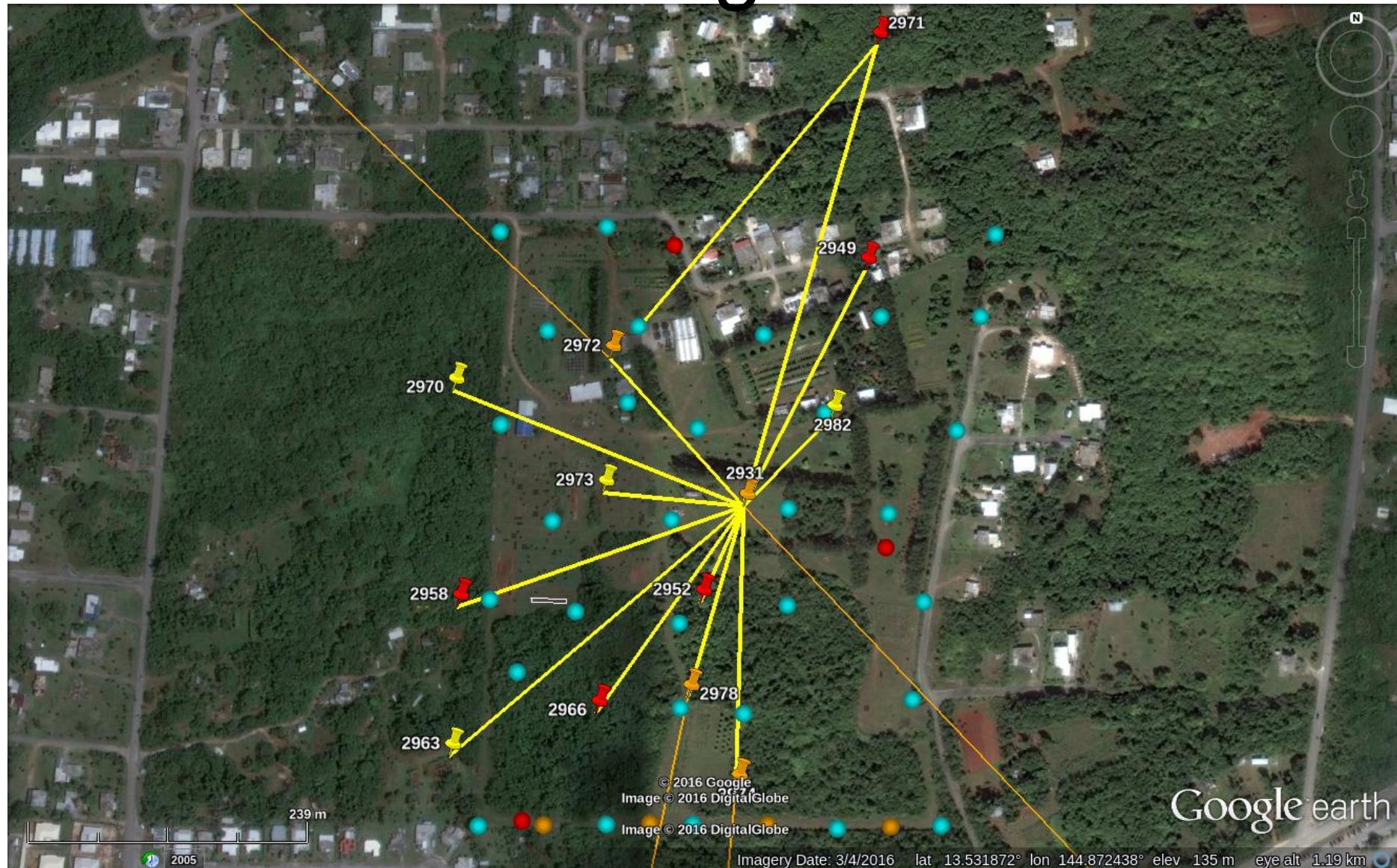
Detector Dogs for Locating Breeding Sites



Detector Beetles for Locating Breeding Sites



Detector Beetles for Locating Breeding Sites



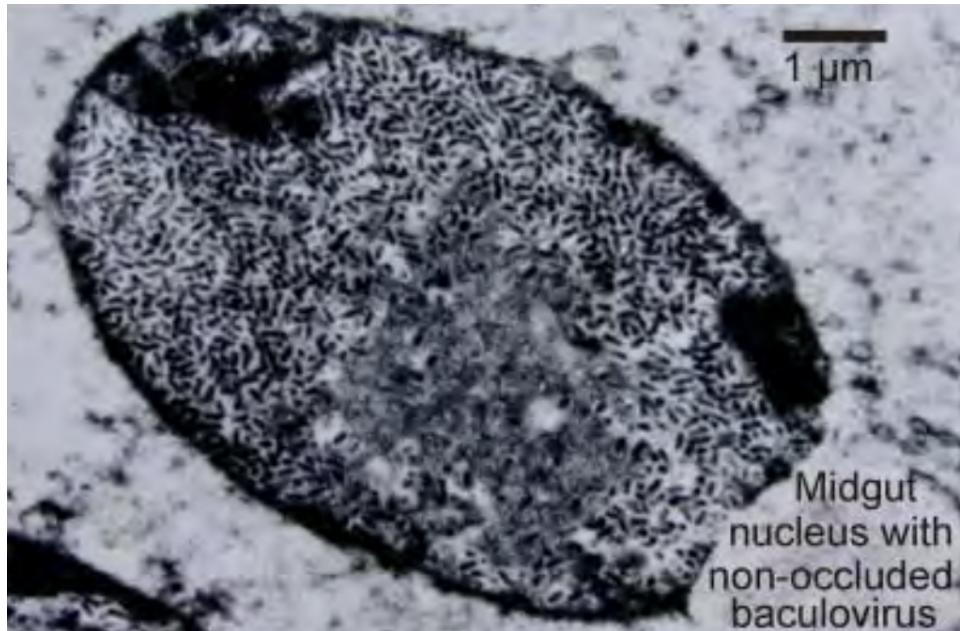
Chemical Control

Spraying Crowns with DEMON MAX (Cypermethrin)



Biocontrol

Oryctes rhinoceros nudivirus
(OrNV)



Green muscardine fungus (GMF)
Metarhizium majus



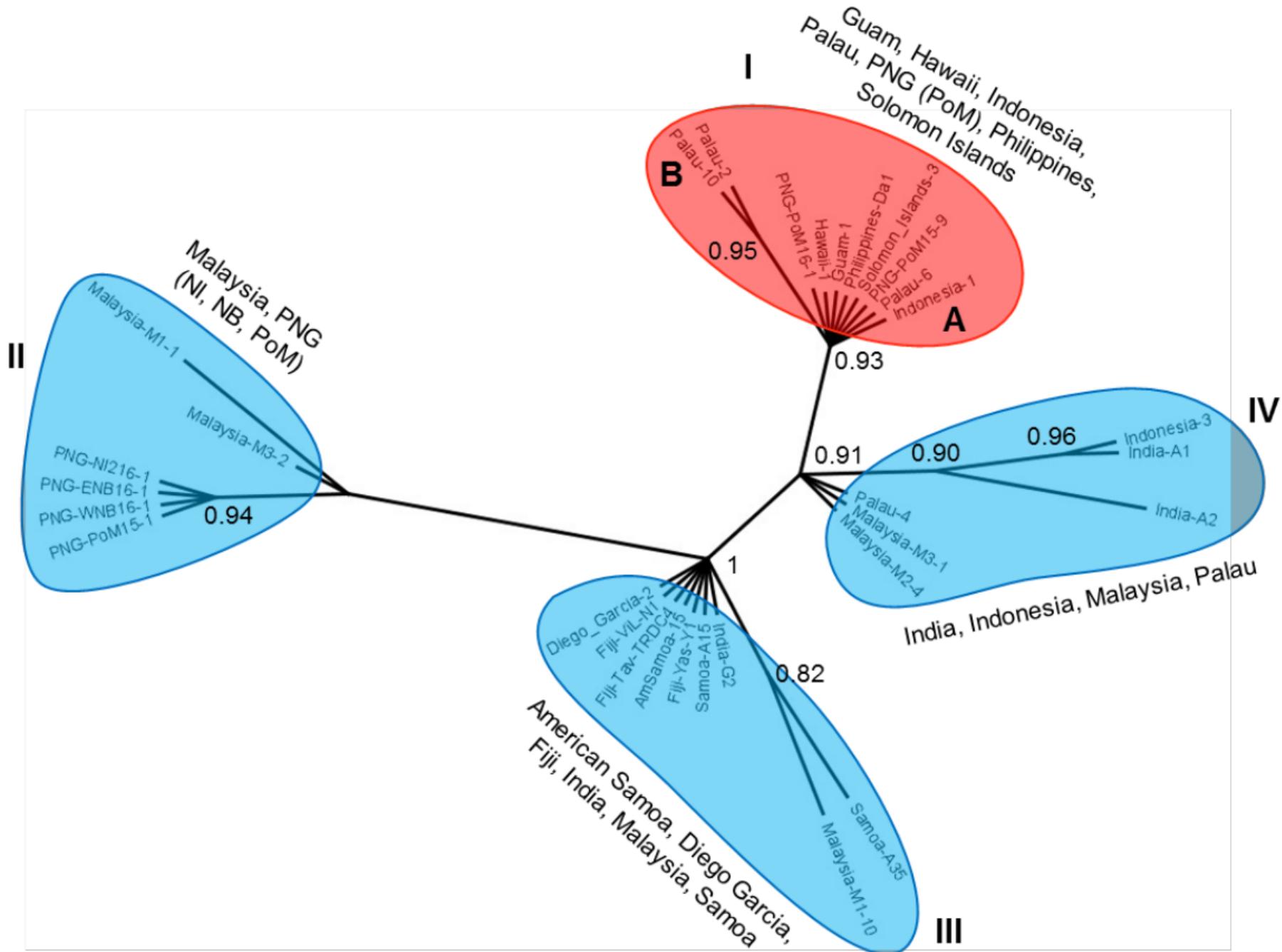
Discovery of the CRB-G Biotype

Marshall, Sean, Maclean Vaqalo, Aubrey Moore, Roland Quitugua, and Trevor Jackson (2015). **A new invasive biotype of the coconut rhinoceros beetle (*Oryctes rhinoceros*) has escaped from biological control by *Oryctes rhinoceros nudivirus*.**

Presented at the International Congress on Invertebrate Pathology and Microbial Control and the 48th Annual Meeting of the Society for Invertebrate Pathology, Vancouver, BC, August 2015.

Characteristics of CRB-G

- genetically distinct
- resistant to all available isolates of OrNV
- more invasive (all 4 recent invasions involve CRB-G)
- behavioral differences ???
 - not highly attracted to oryzalure
 - higher per-capita damage



Current CRB Situation on Guam

An uncontrolled CRB outbreak is killing large numbers of coconut palms.





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

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

Current Prognosis for Guam

Current tactics of sanitation, trapping, application of *Metarhizium* may reduce local damage, but will do little to protect palms on an island-wide basis because most breeding sites are inaccessible (in jungle and/or on military bases).

Based on historical data from Palau and elsewhere, it is likely that Guam will lose 50% or more of its coconut palms.

Risk of accidental export of CRB to other islands is high.

What Can Be Done?

Effective biocontrol is probably our best chance of saving Guam's coconut palms on an island wide basis.

There is an urgent need to find an effective biocontrol agent for CRB-G. This will probably be an isolate of OrNV from an endemic CRB-G population in Asia.

CRB-G is a Regional Problem

Jackson, Trevor (2015).

Need for emergency response for a new variant of rhinoceros beetle (Guam biotype).

International Association for the Plant Protection Sciences Newsletter (XI). November, 2015.

Available on-line at

Vaqalo, Maclean, Sean Marshall, Trevor Jackson, Aubrey Moore (2015).

An Emerging Biotype of the Coconut Rhinoceros Beetle Discovered in the Pacific.

Secretariat of the Pacific Community, Land Resources Division.

Available on-line at



Link to Climate Change



