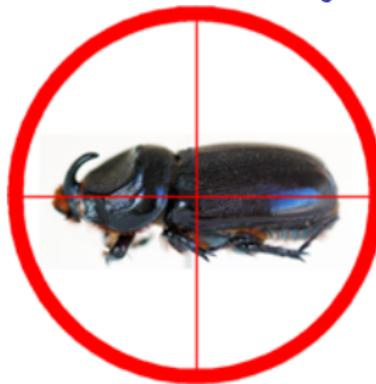


# Overview of the Guam Coconut Rhinoceros Beetle Eradication Project



Hawaii CRB ICS, January 22, 2014

Aubrey Moore and Roland Quitugua  
University of Guam Cooperative Extension Service

First Coconut Rhinoceros Beetle  
Collected on Guam  
11-Sep-2007, Tumon Bay



# *Oryctes rhinoceros* Distribution













# Please Don't Do This



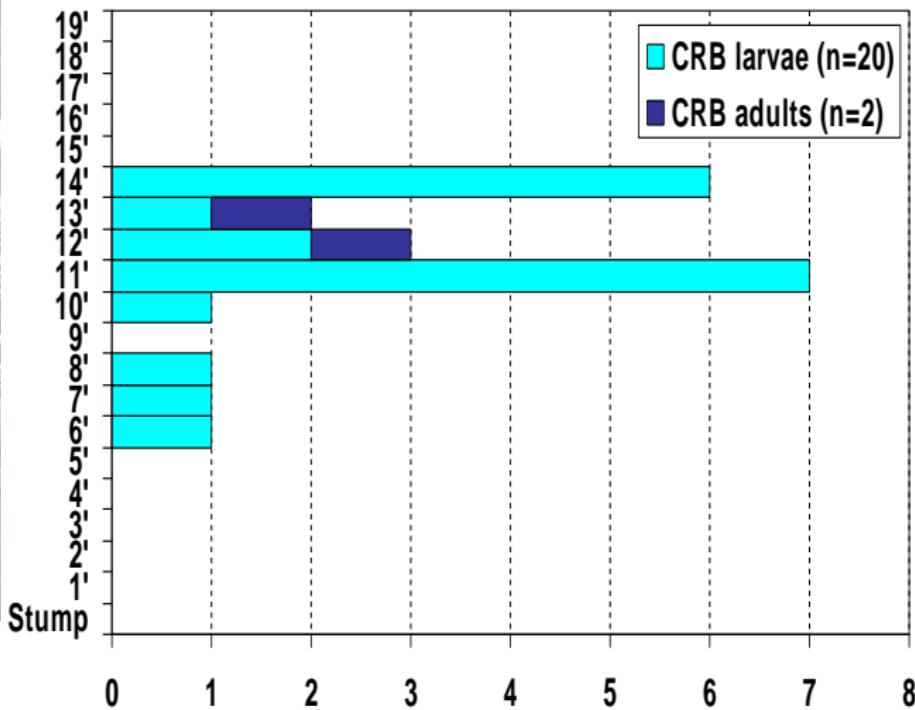
Or This







# Vertical Distribution of CRB Larvae & Adults in Standing Dead Coconut Trankilidat, Guam; 25 Oct 2007



# Novel CRB Behavior on Guam: Arboreal Development

CRB extracted from the crowns  
of 121 felled coconut palms



Eggs	99
L1	40
L2	72
L3	210
Pupae	25
Adult males	34
Adult females	30
<b>Total</b>	<b>510</b>
<b>Mean per tree</b>	<b>4.21</b>

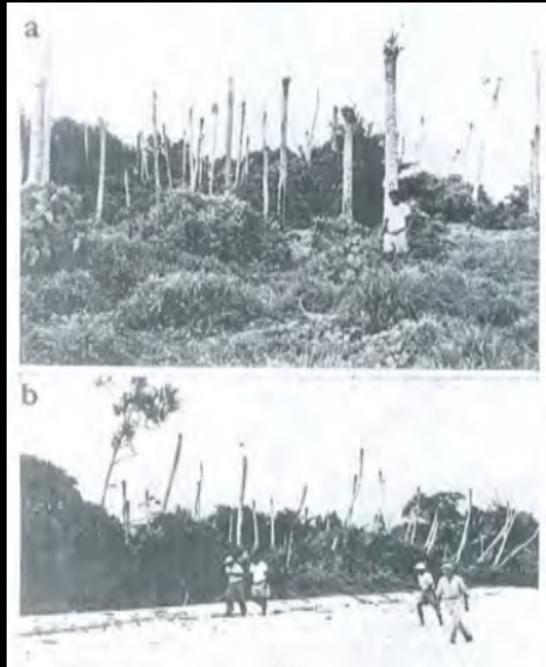


ADULTS KILL TREES

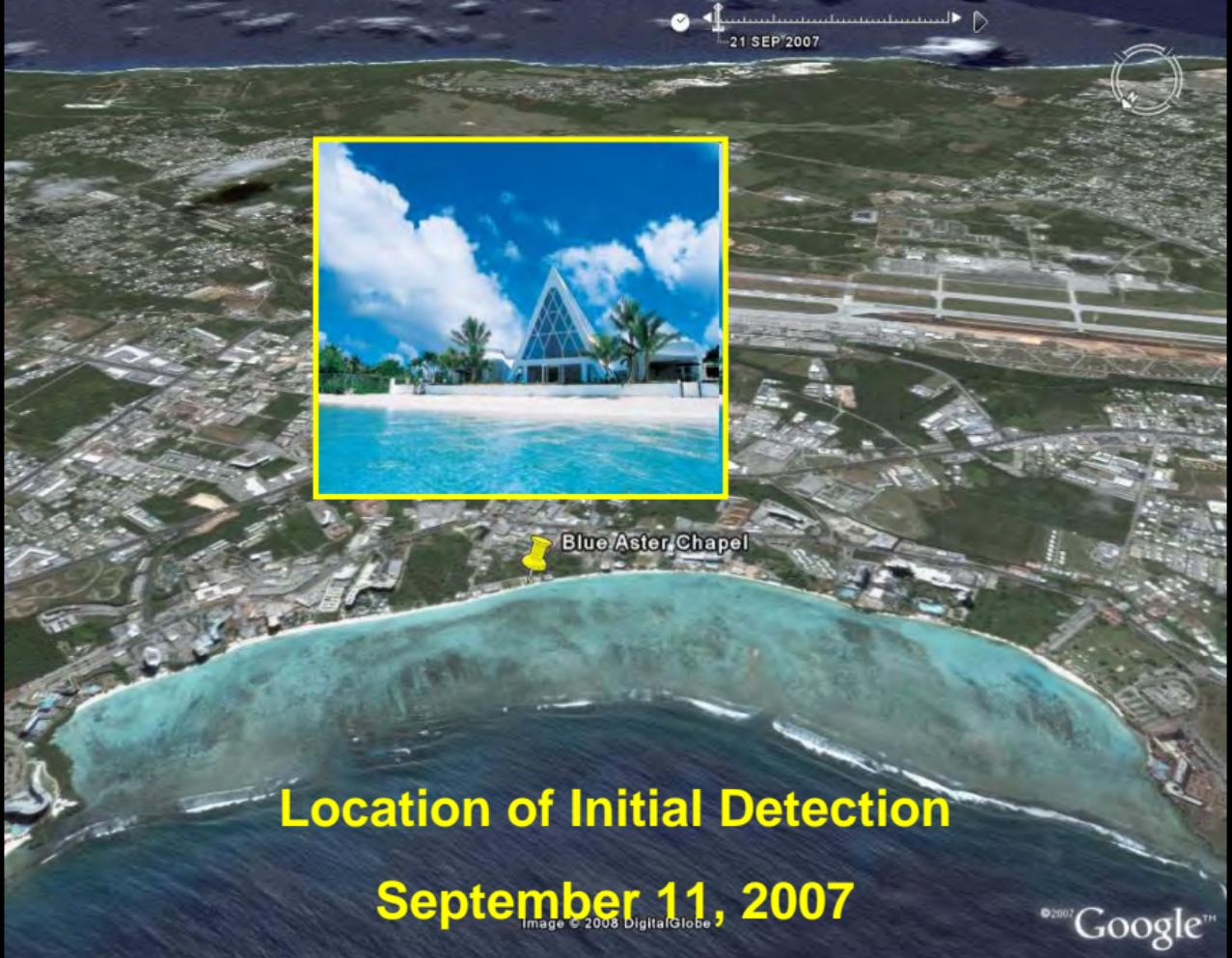
LARVAE FEED ON  
DEAD TREES



Coconut palms killed by *Oryctes rhinoceros*; Viti Levu Island, Fiji; 1973  
Source: ?

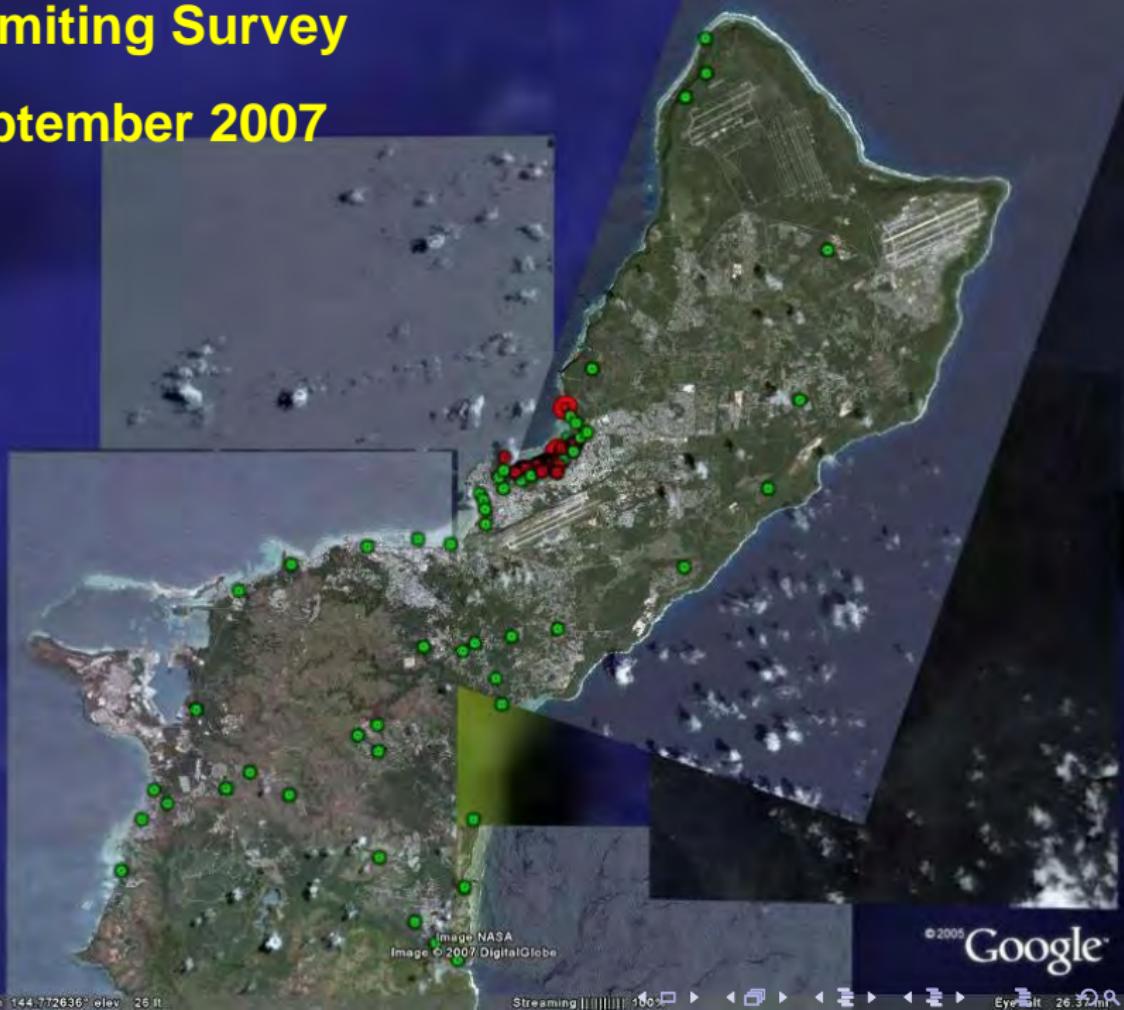


Coconut palms killed by *Oryctes rhinoceros*; Peleliu Island, Palau 1951  
Source: Gressitt 1953



# Delimiting Survey

September 2007



Pointer lat 13.493815° lon 144.772636° elev 26 ft

Image © 2007 NASA  
Image © 2007 DigitalGlobe

Streaming

# Guam Coconut Rhinoceros Eradication Project

## ORGANIZATION

### **Partners:**

USDA-APHIS

Guam Dept. of Agriculture

University of Guam

### **Funding:**

USDA-APHIS

US Forest Service

GovGuam



# Guam Coconut Rhinoceros Eradication Project

## TACTICS

### Quarantine

Limit accidental transportation to uninfested parts of Guam.

### Pheromone Traps

Capture adults and detect spread of the beetle population

### Sanitation

Kill immatures and remove breeding sites

### Detector Dogs

Efficient discovery of breeding sites.

### Chemical Control

Injectable systemics for adults; spot treatments for breeding sites.

### Biocontrol

Autodissemination of *Oryctes* virus



# Initial Quarantine Area

September 2007



# PHEROMONE TRAPS

- Mass trapping unsuccessful
- Traps useful for monitoring



# Trap Data Entry Form

Mozilla Firefox

File Edit View History Delicious Bookmarks Tools Help

http://guaminsects.net/orycles/upload\_site\_visit\_gpx\_3.php

New\_guinea\_sugarcane... Encyclopedia of Life F... webtip UOG mail Guam mail label printer weather Insect World Agriculture and Natural... We Are Guahan

http://guaminsects.e\_visit\_gpx\_3.php

## Upload Trap Visit GPX file to Database

Trapper(s):

Trap Visit Date:

Choose a GPX file to upload:

# Online Trap Data Report



# Visualization of Trap Catch Data

Aubrey Moore

Guam Coconut Rhinoceros Beetle Eradication Project



Generated 2014-01-08 20:23:57

Path: C:/Documents and Settings/Administrator/My Documents/CRB monthly surveillance reports/map dev

R script: makeMaps.R

Brew file: makeBeamer.txt

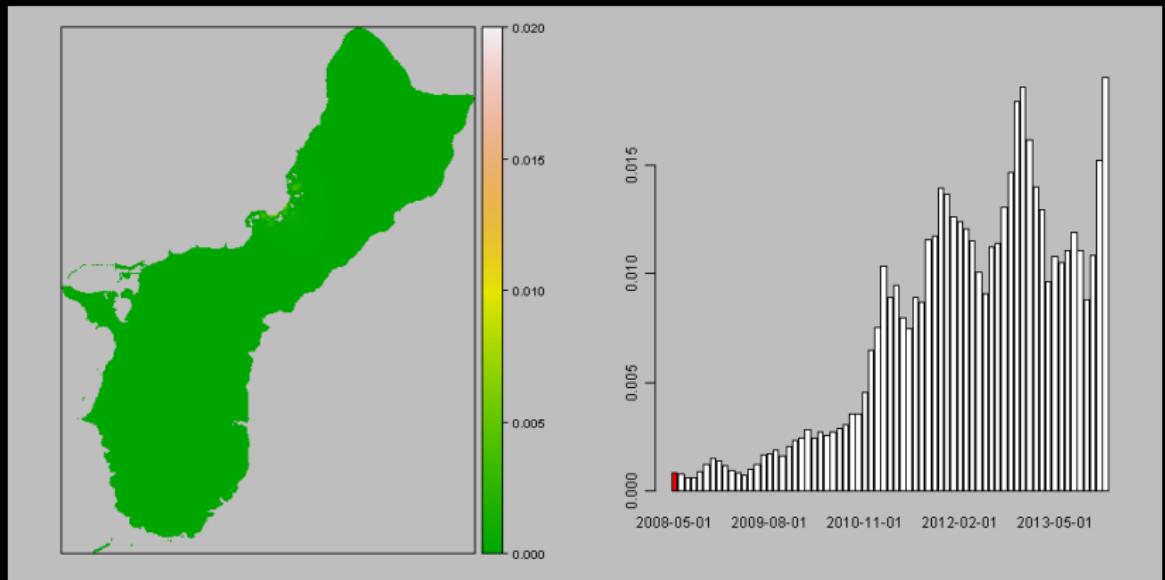
# Introduction

- ▶ The following frames show spatial-temporal changes in numbers of CRB adults caught in pheromone traps.
- ▶ Note that trap catches on Guam are very low: the scale runs from 0 to only 0.02 beetles per trap day, a trap rate of only one beetle every 50 days.

# Methods

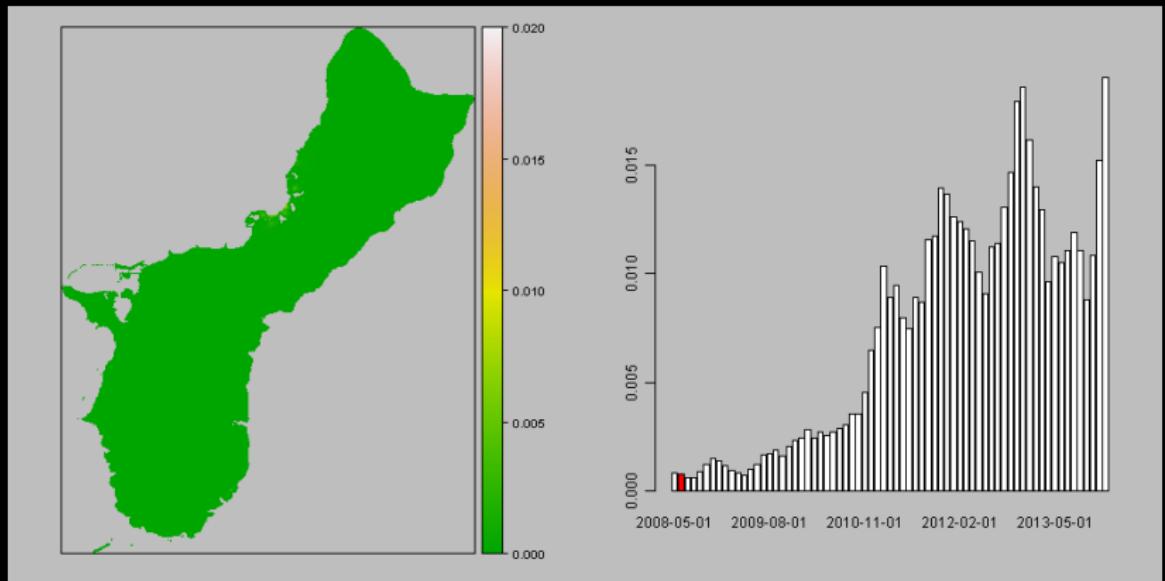
- ▶ Interpolated raster maps were made using an R script which:
  1. Accesses georeferenced data stored in the CRB project's online MySQL database.
  2. Processes the data using the GRASS6 GIS
  3. Writes the  $\text{\LaTeX}$  code which generated this PDF document.

90 day trapping period ending on 01 May 2008



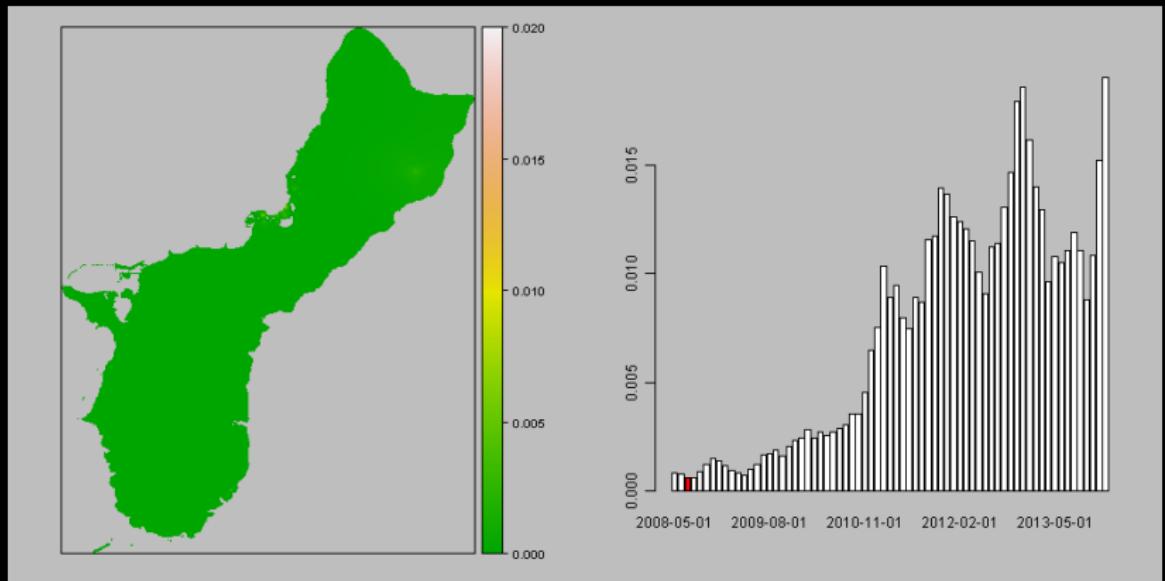
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2008



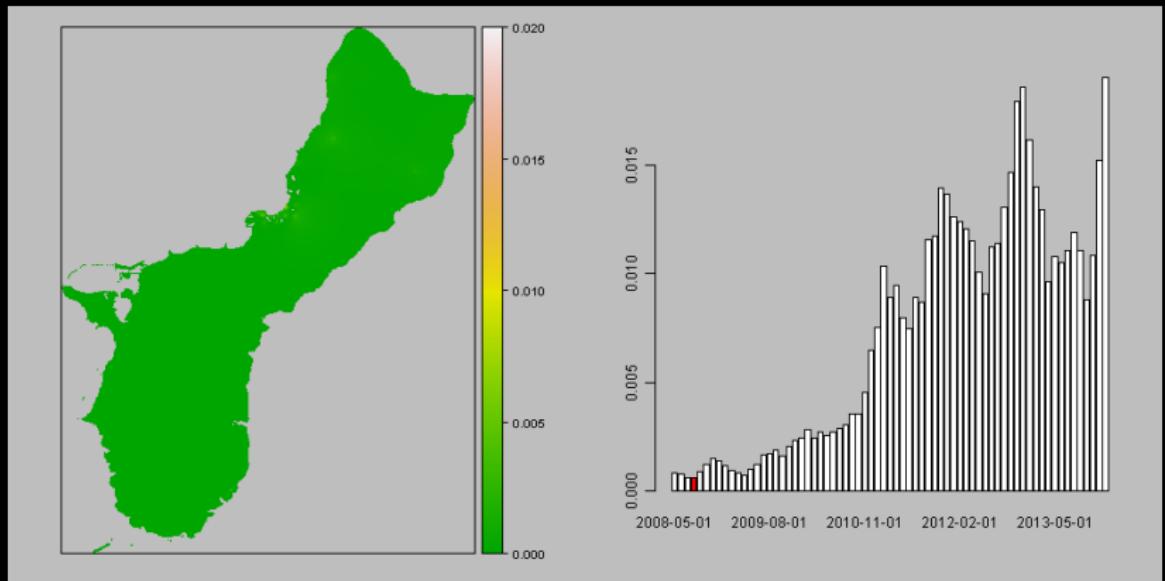
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2008



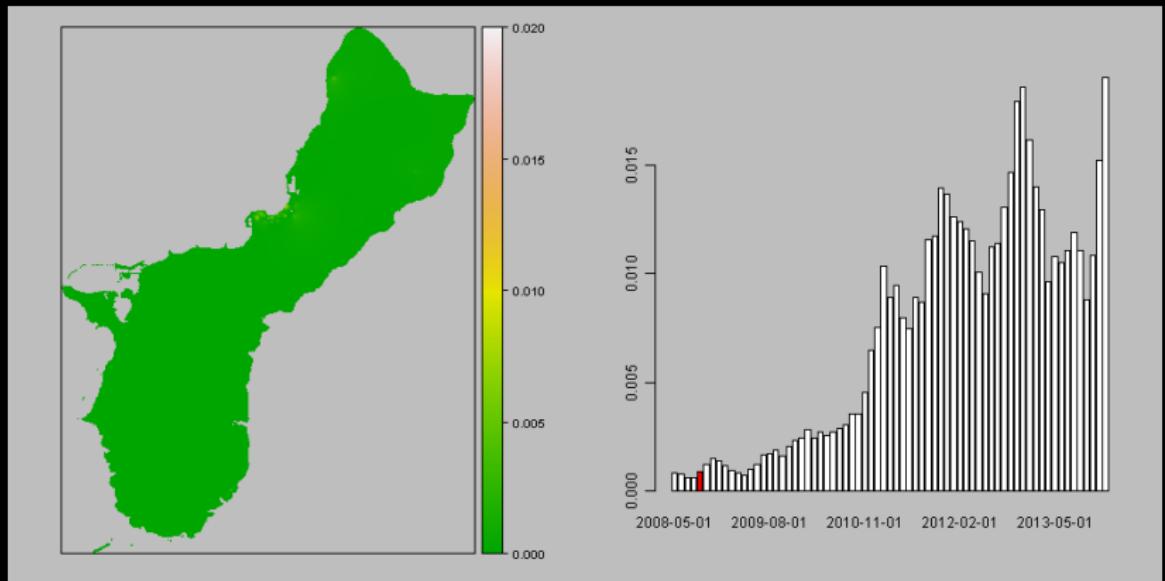
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2008



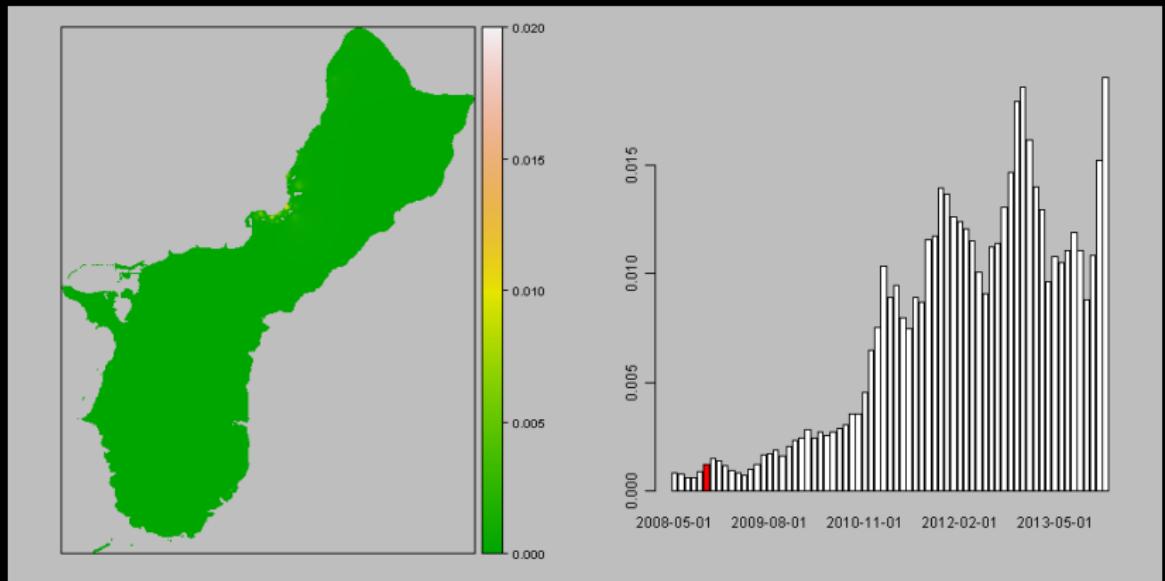
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2008



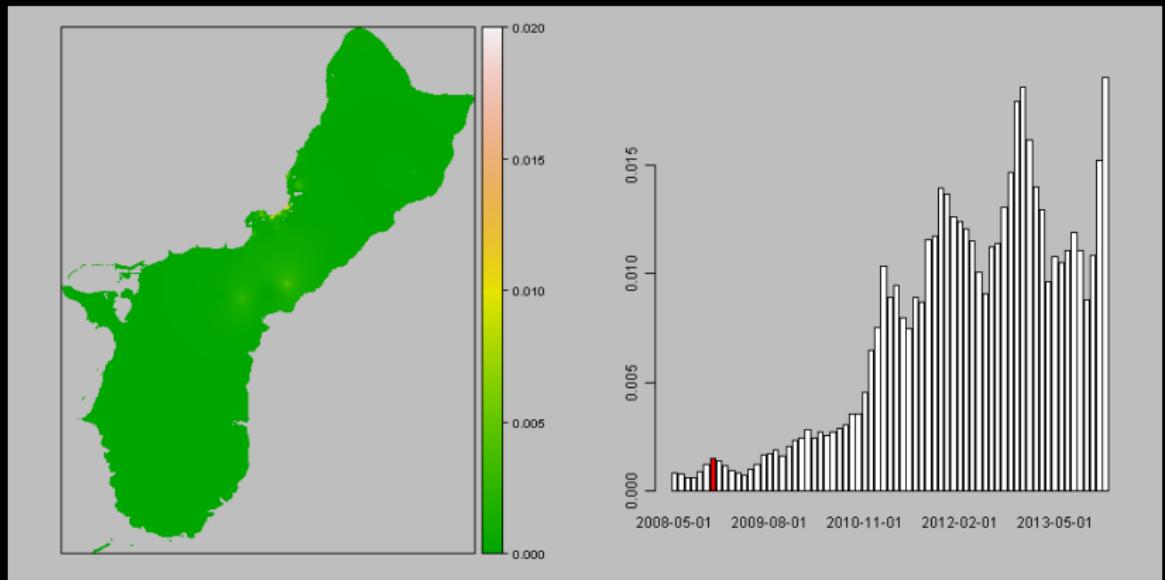
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2008



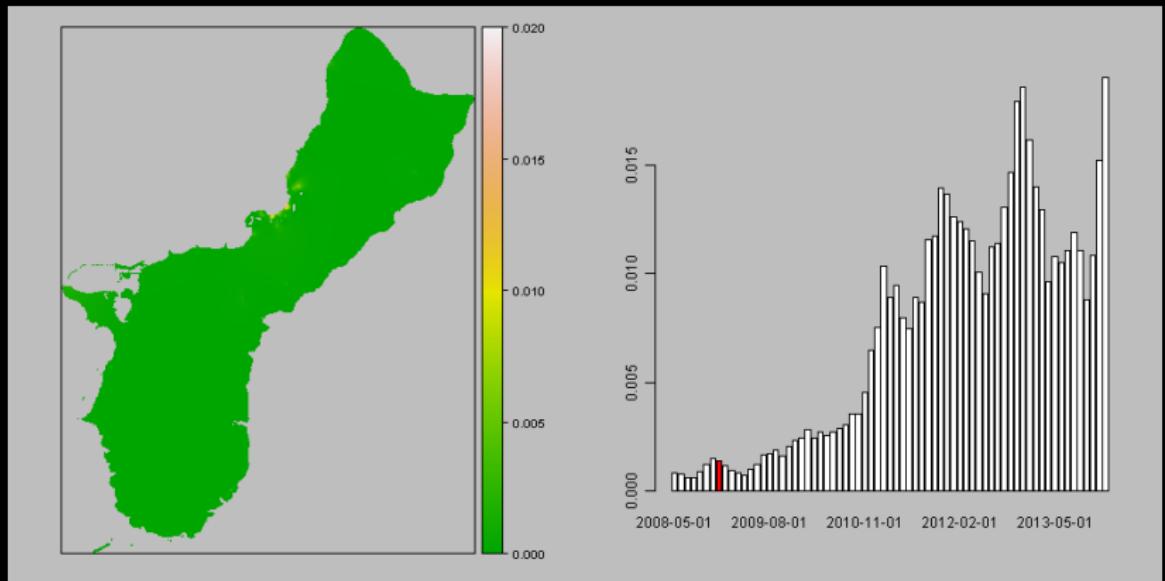
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2008



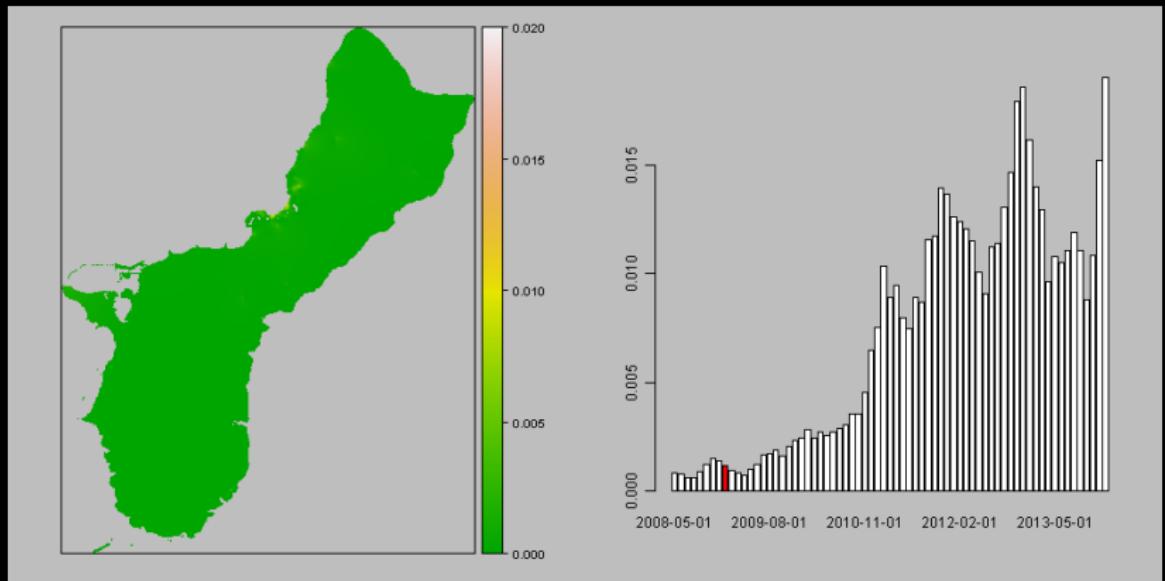
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2008



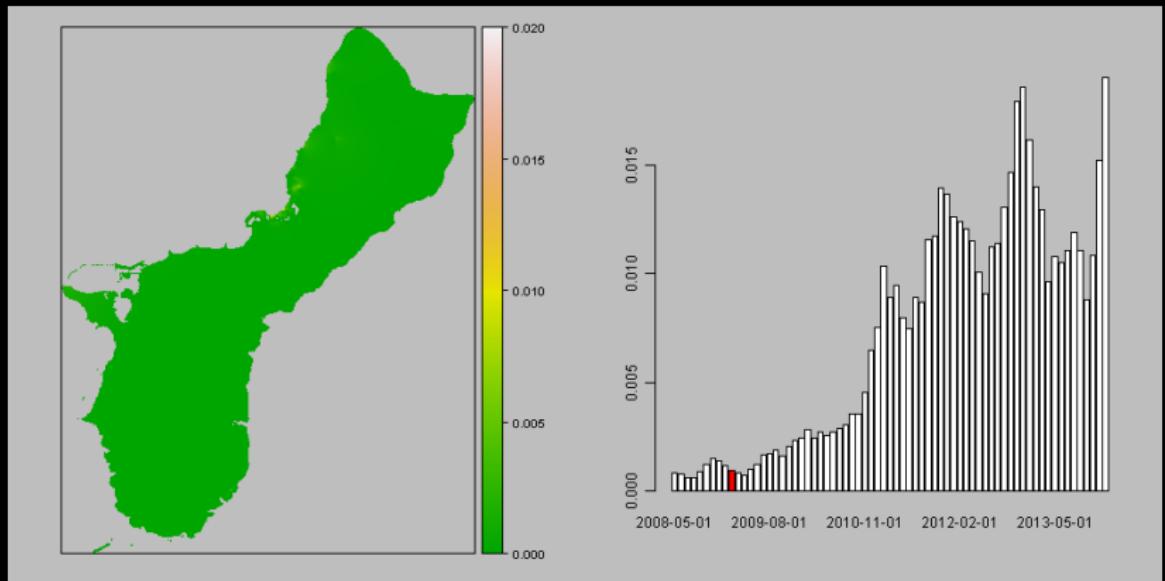
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2009



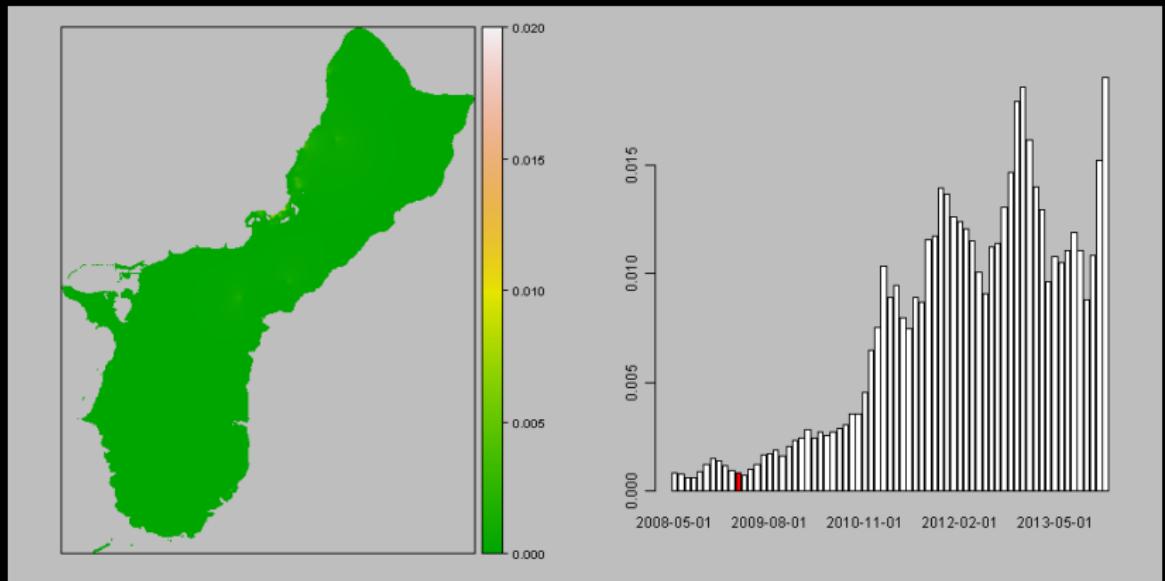
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2009



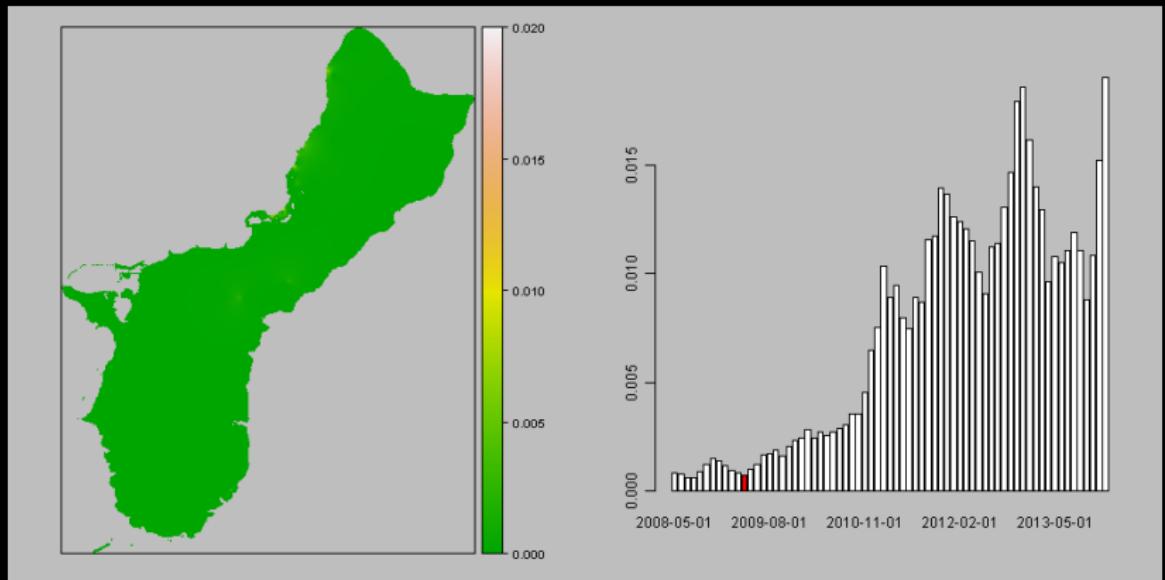
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2009



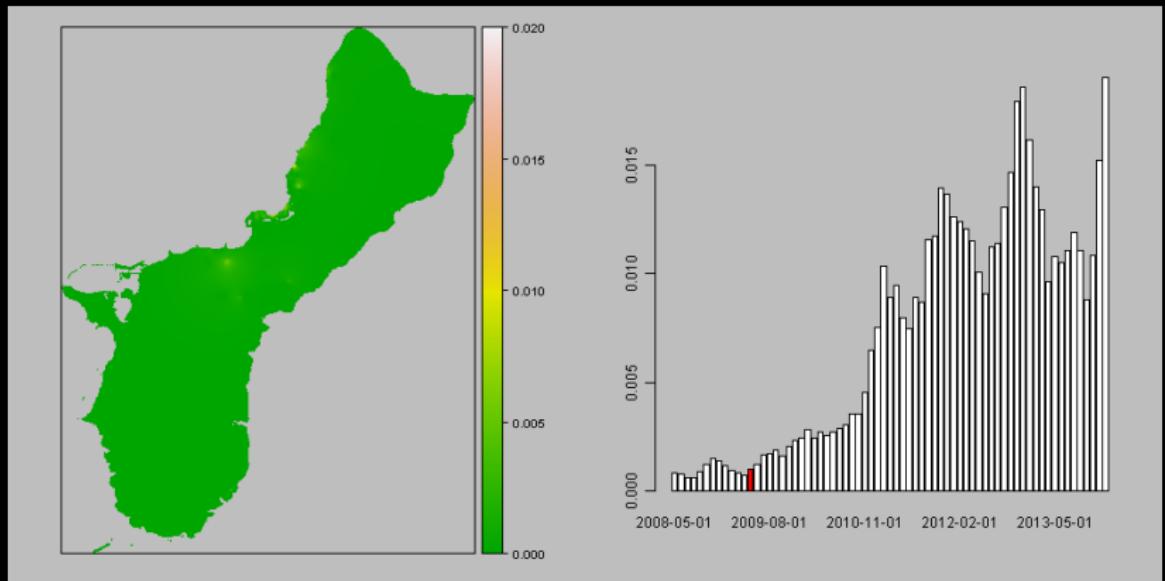
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2009



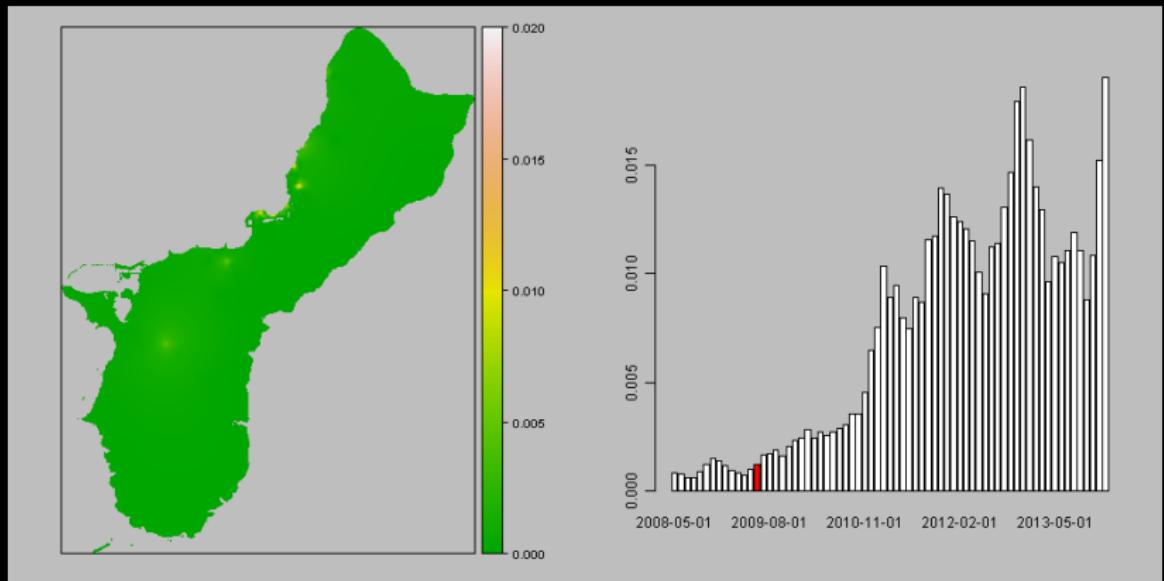
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2009



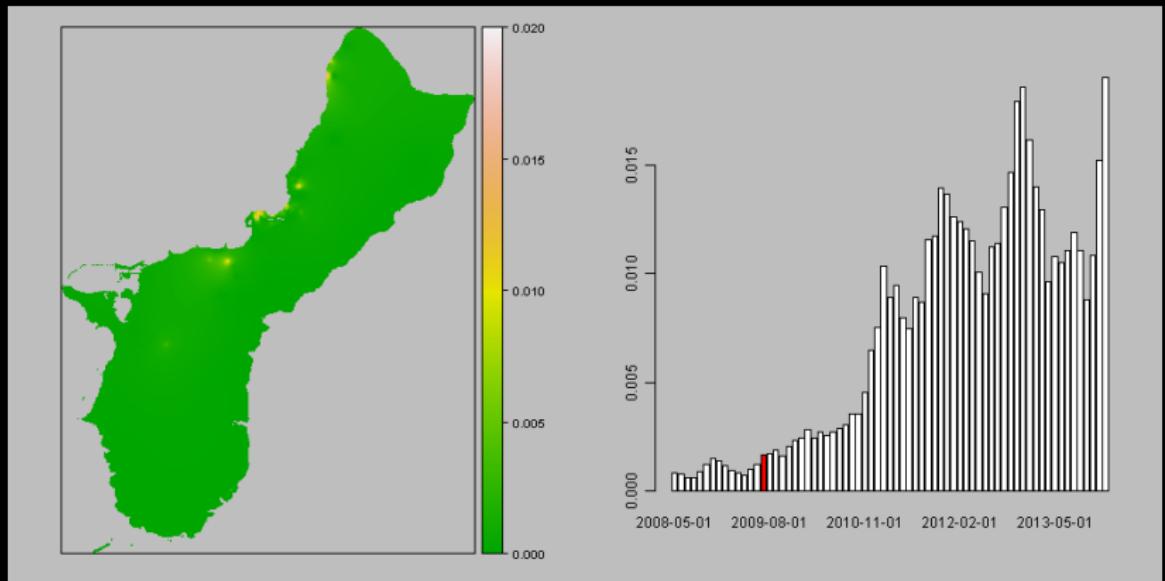
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2009



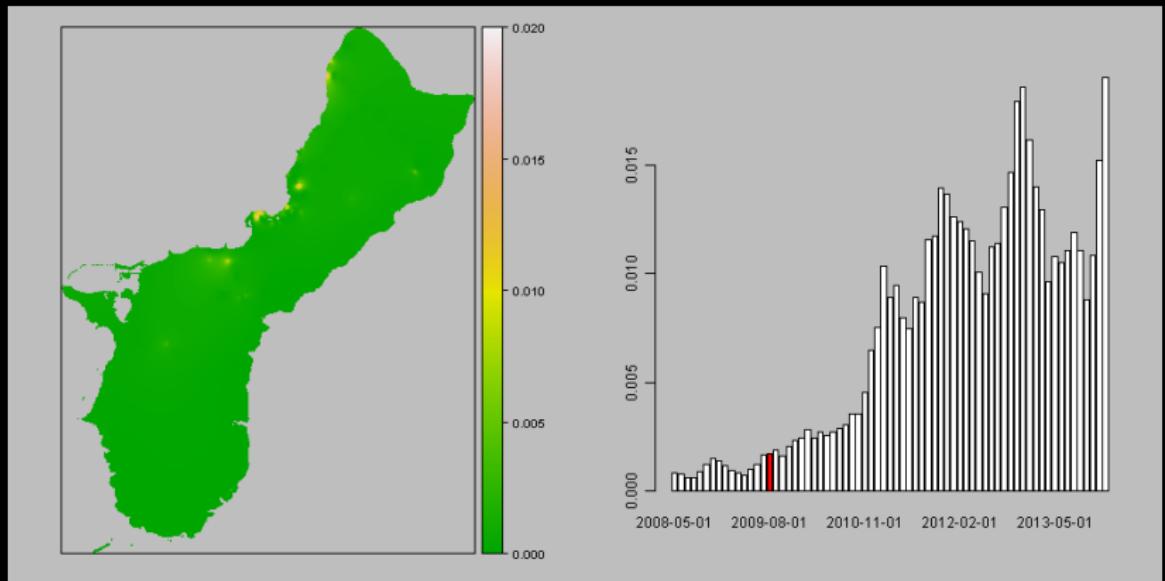
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2009



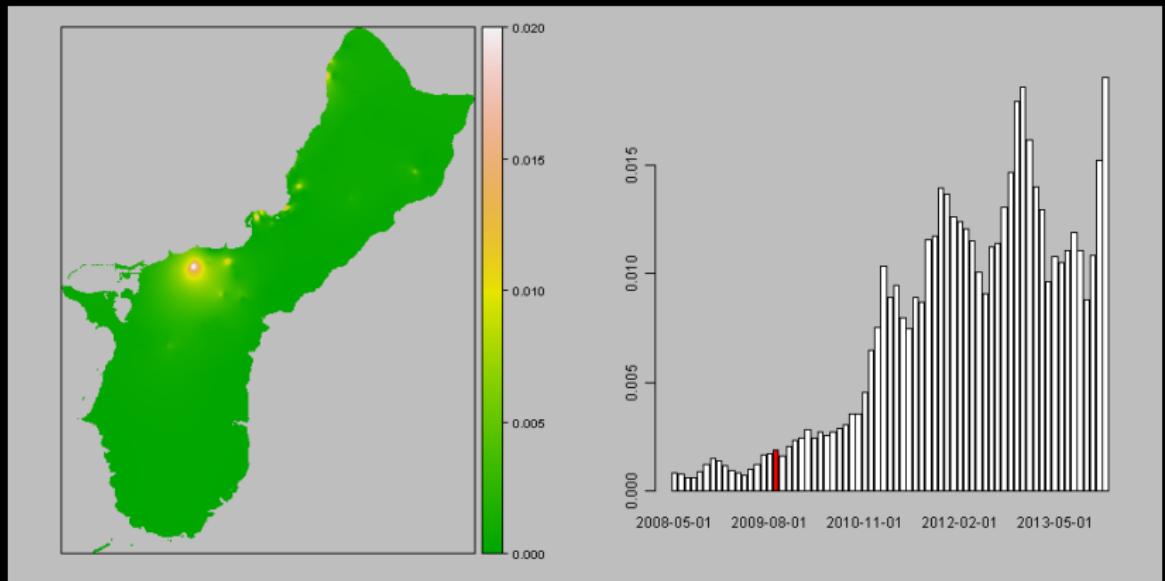
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2009



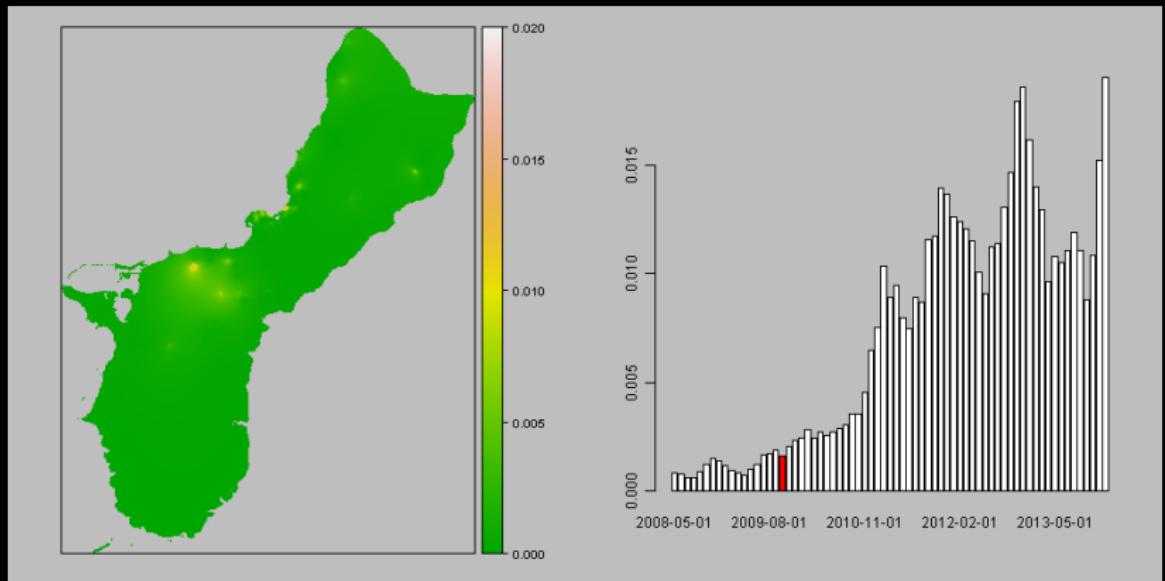
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2009



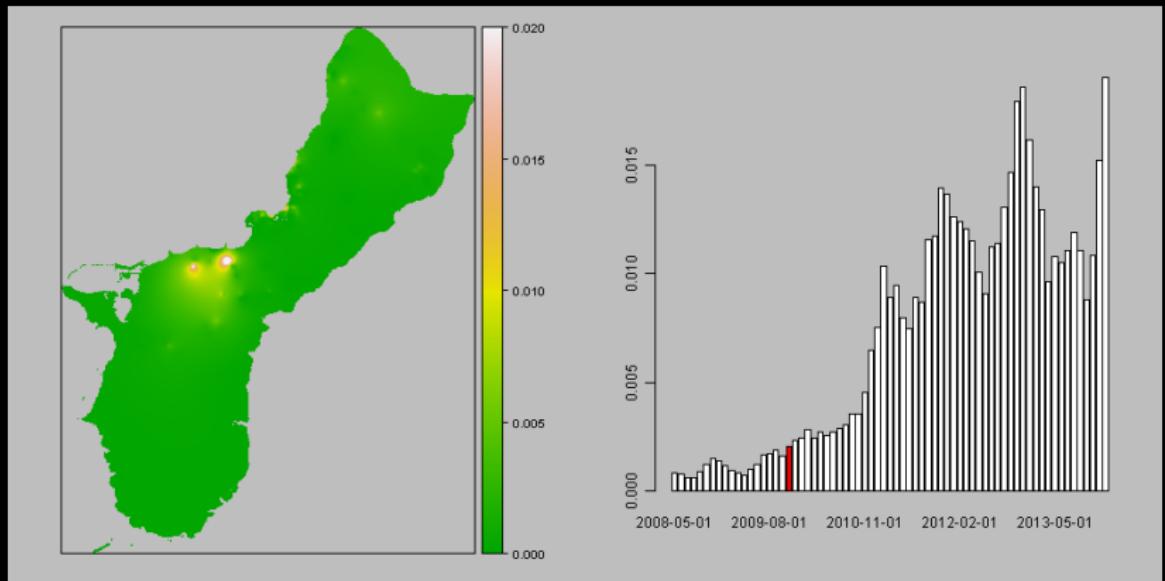
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2009



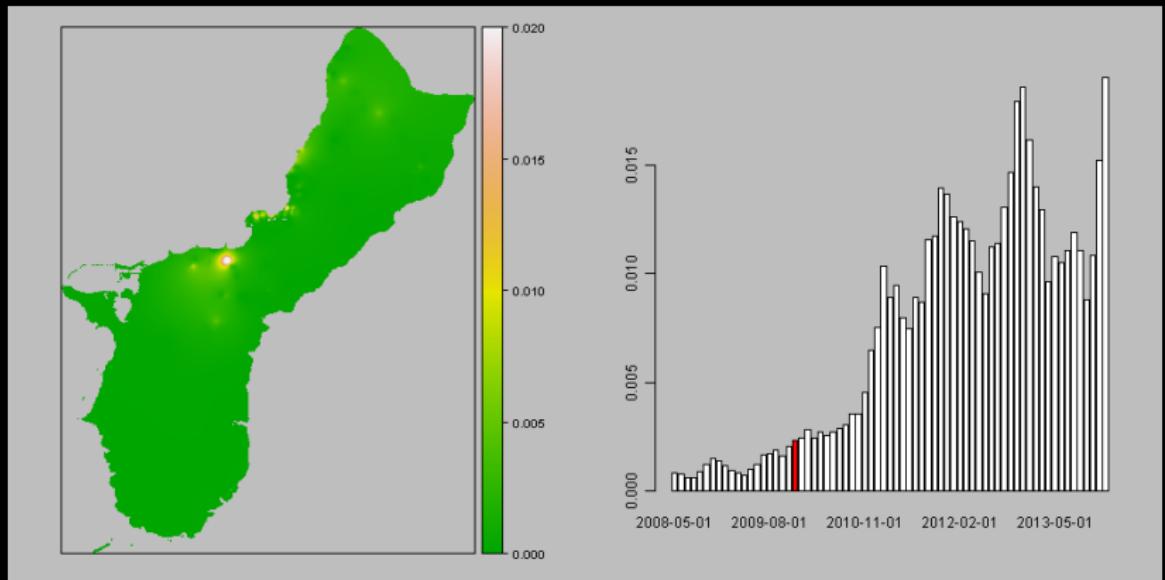
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2009



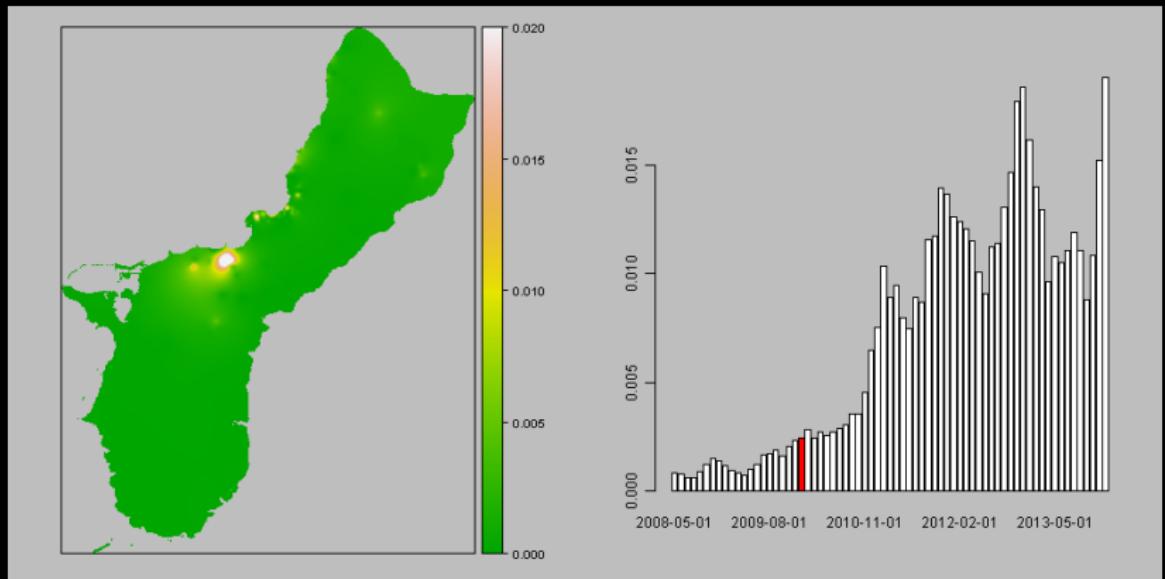
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2009



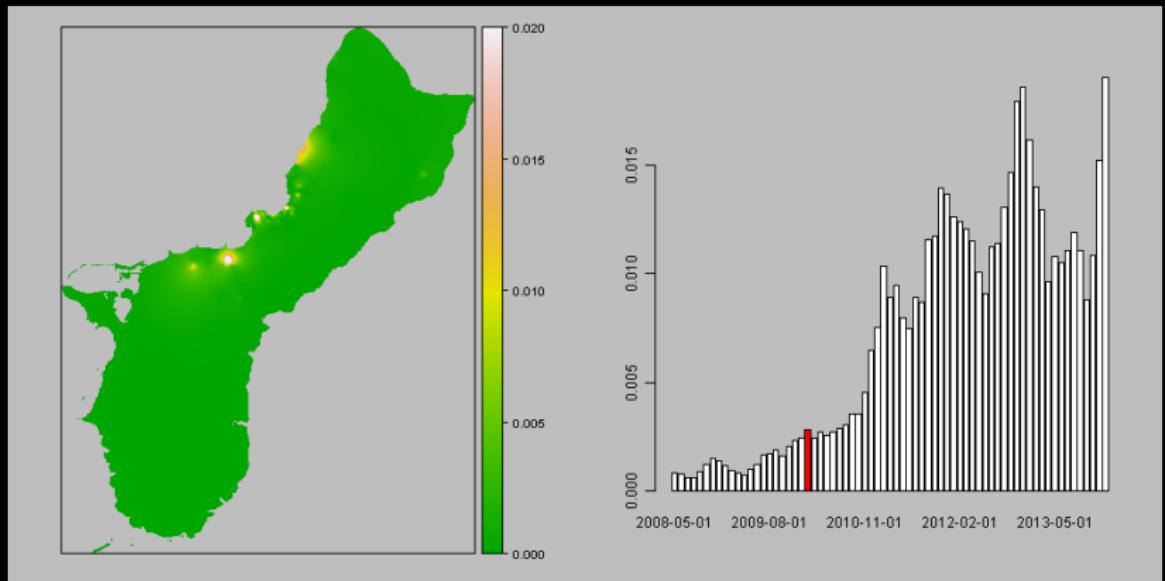
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2010



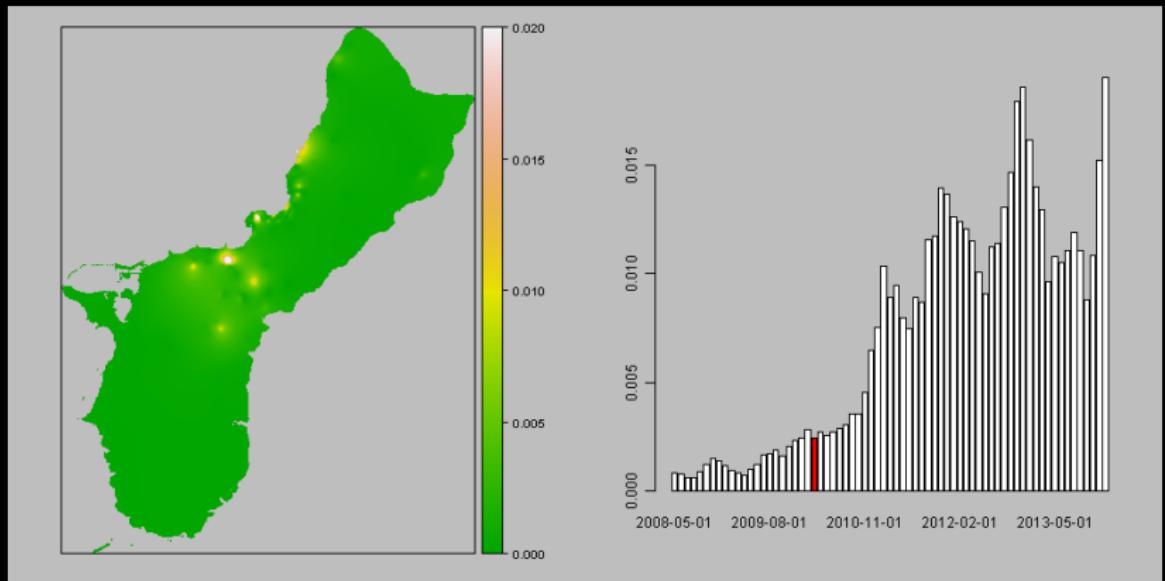
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2010



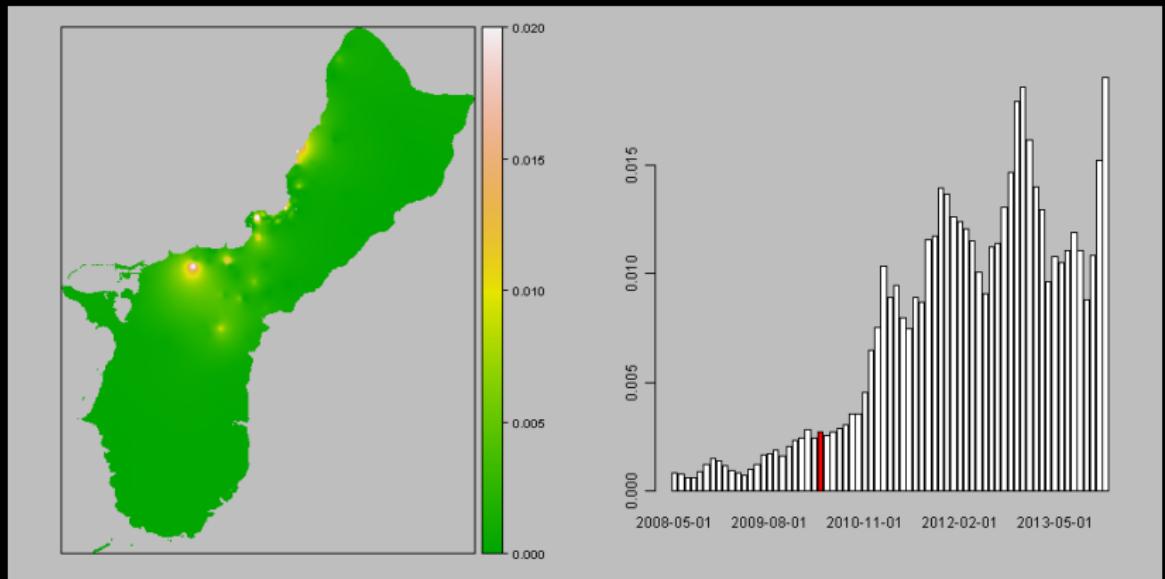
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2010



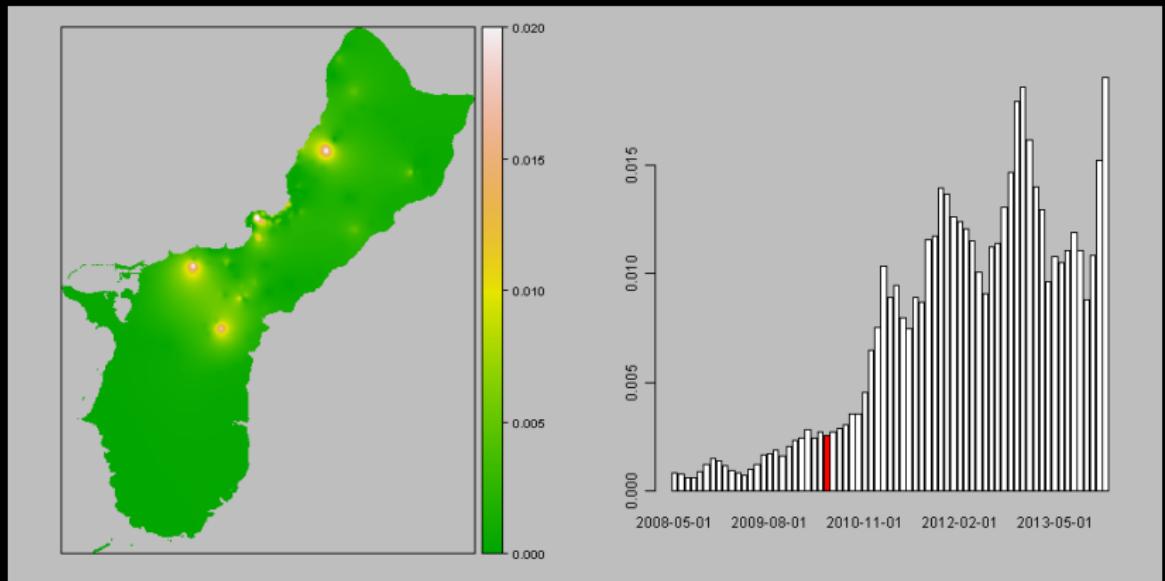
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2010



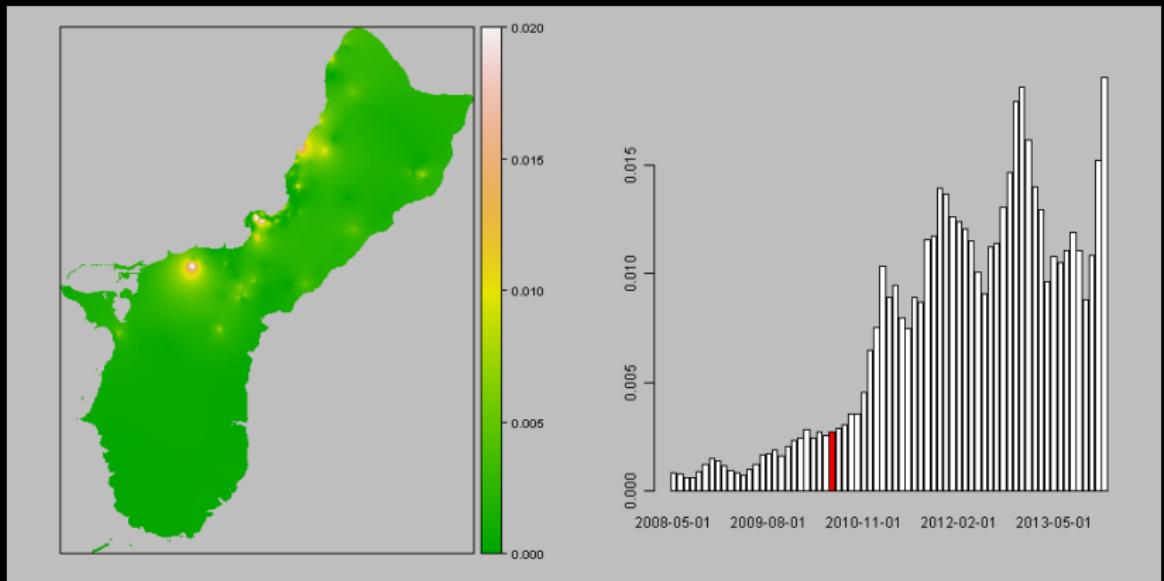
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2010



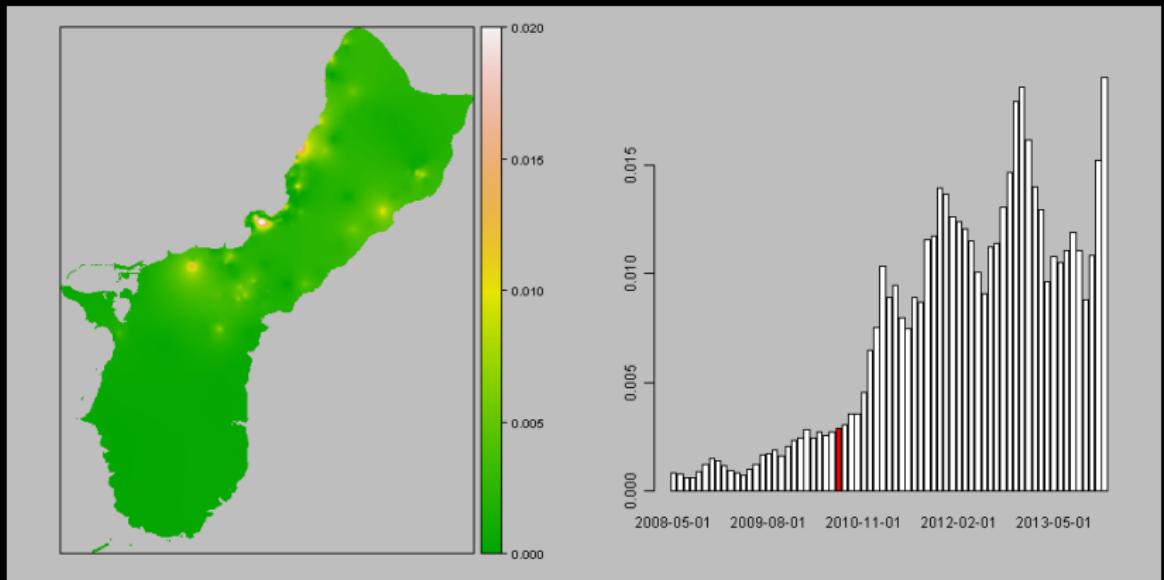
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2010



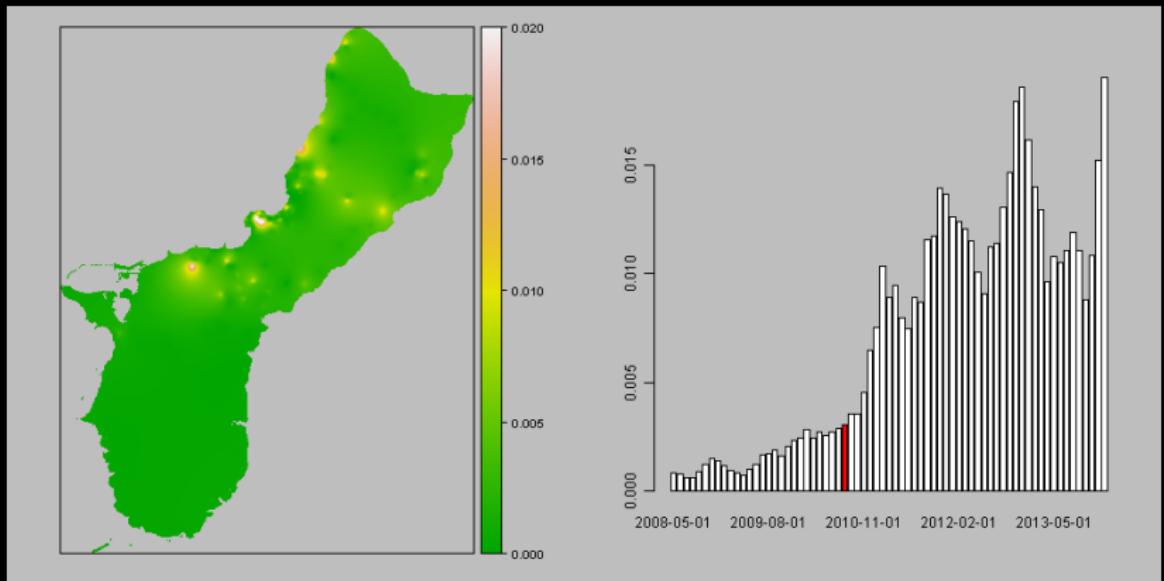
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2010



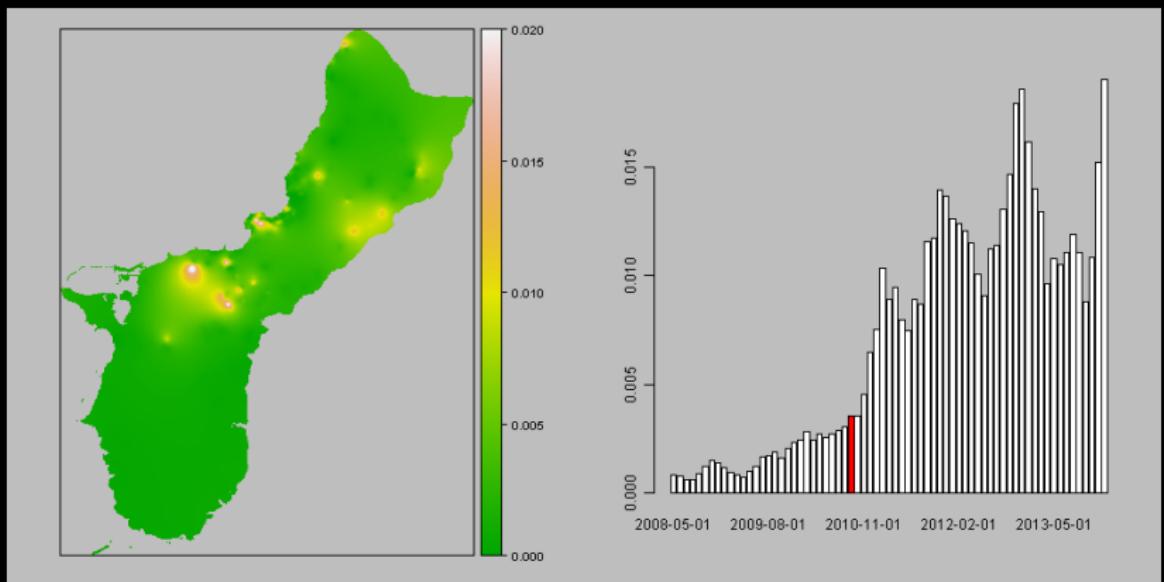
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2010



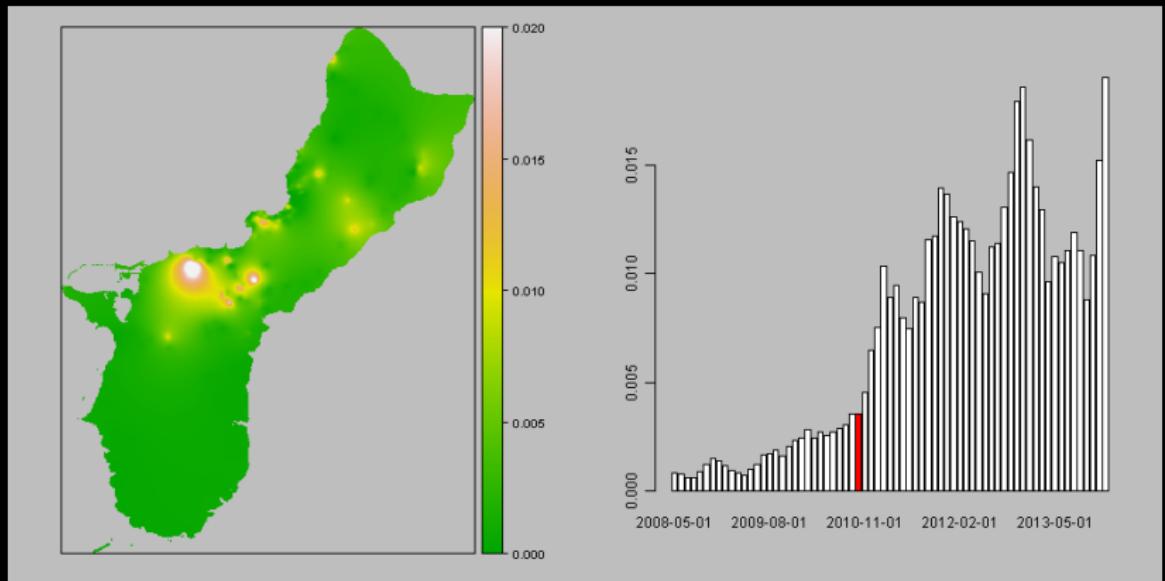
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2010



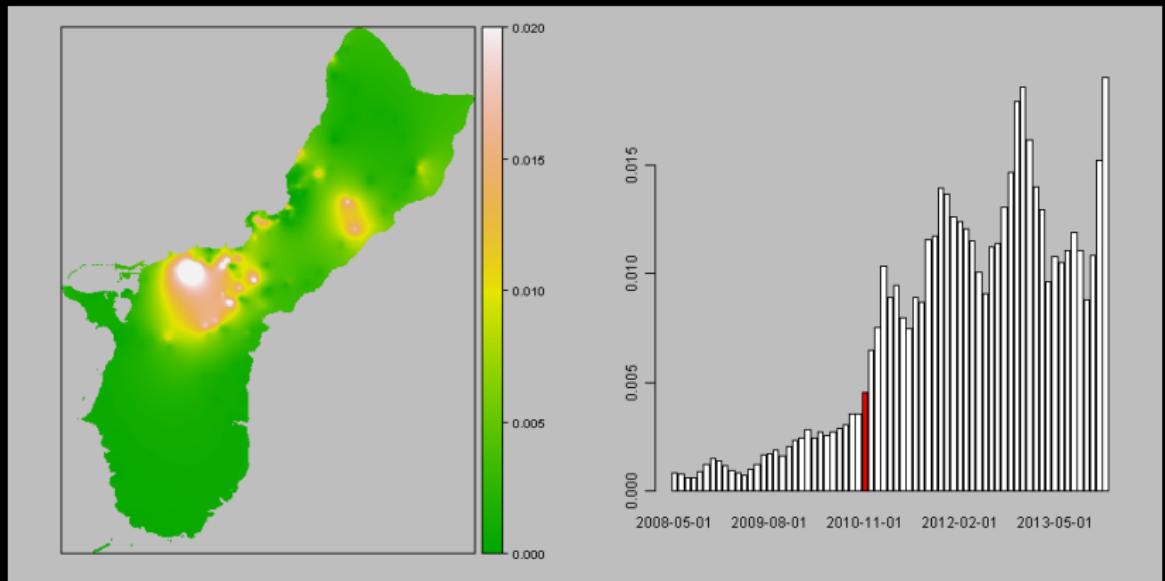
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2010



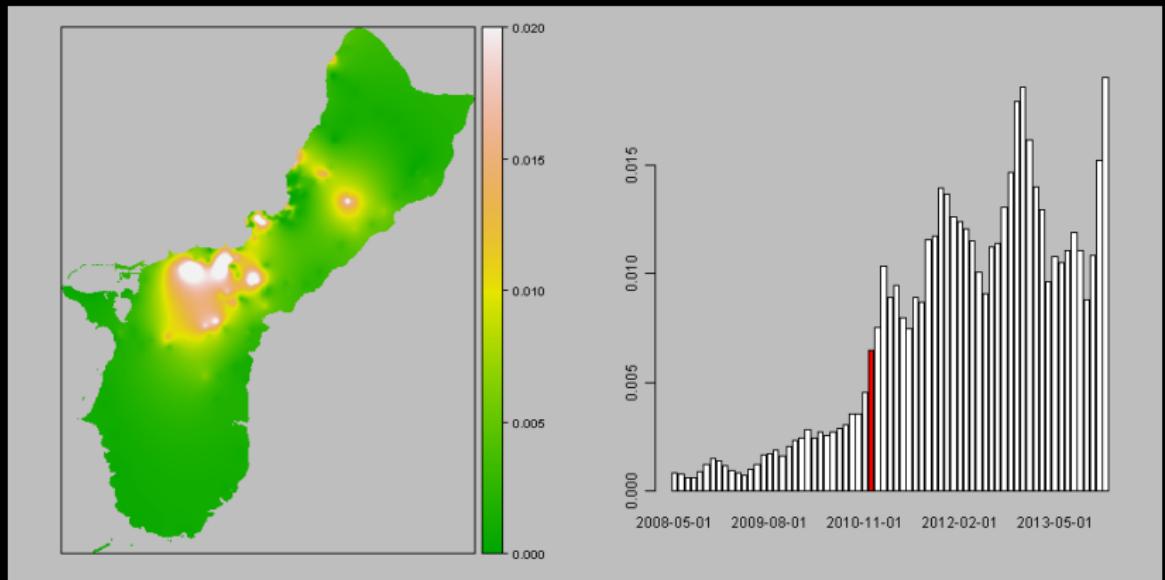
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2010



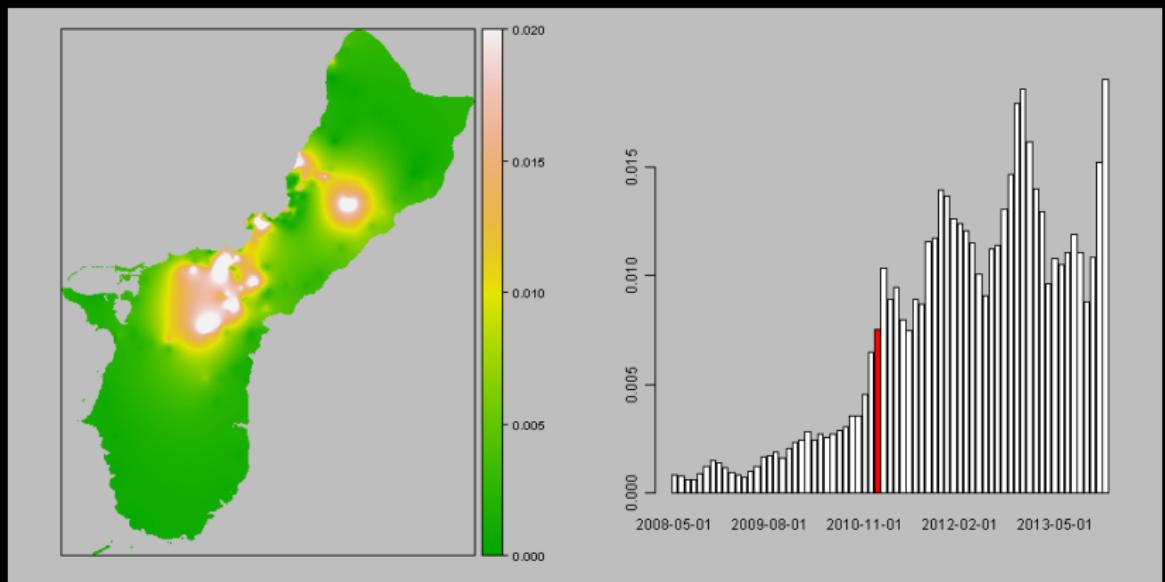
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2010



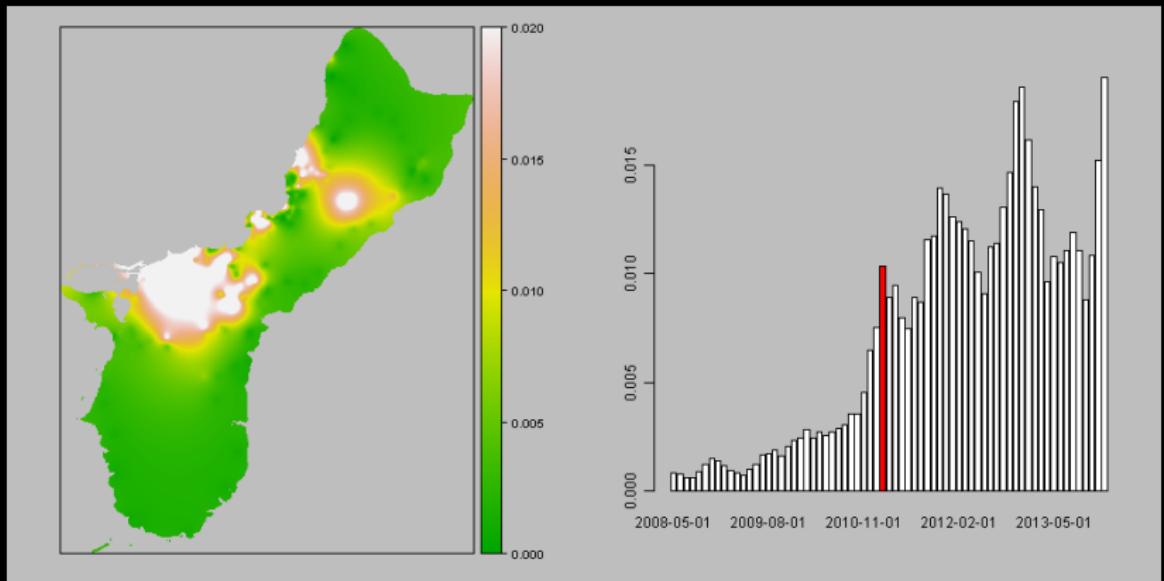
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2011



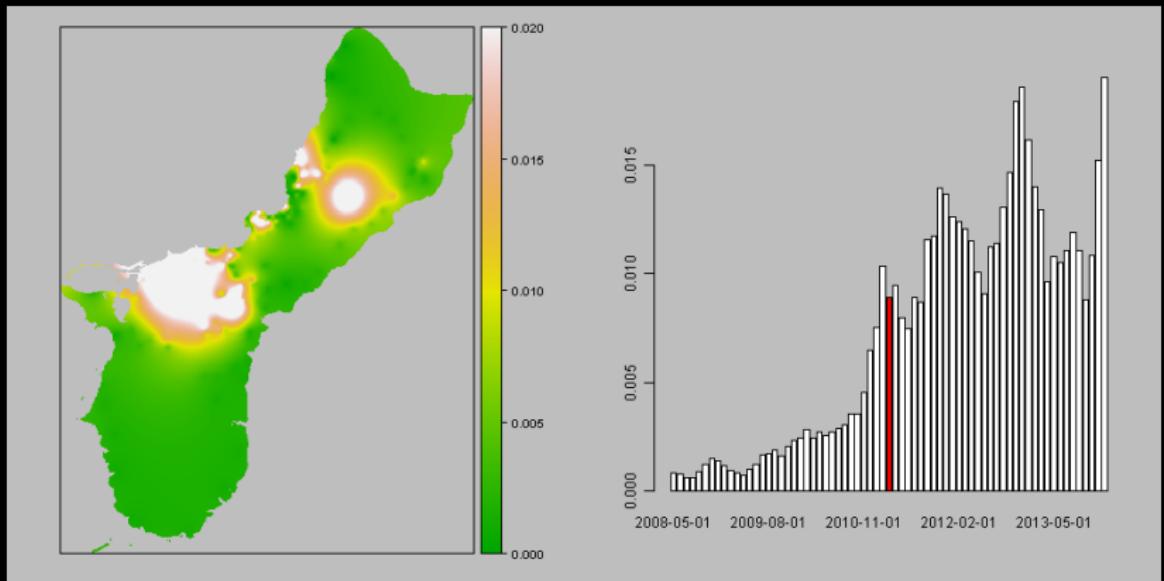
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2011



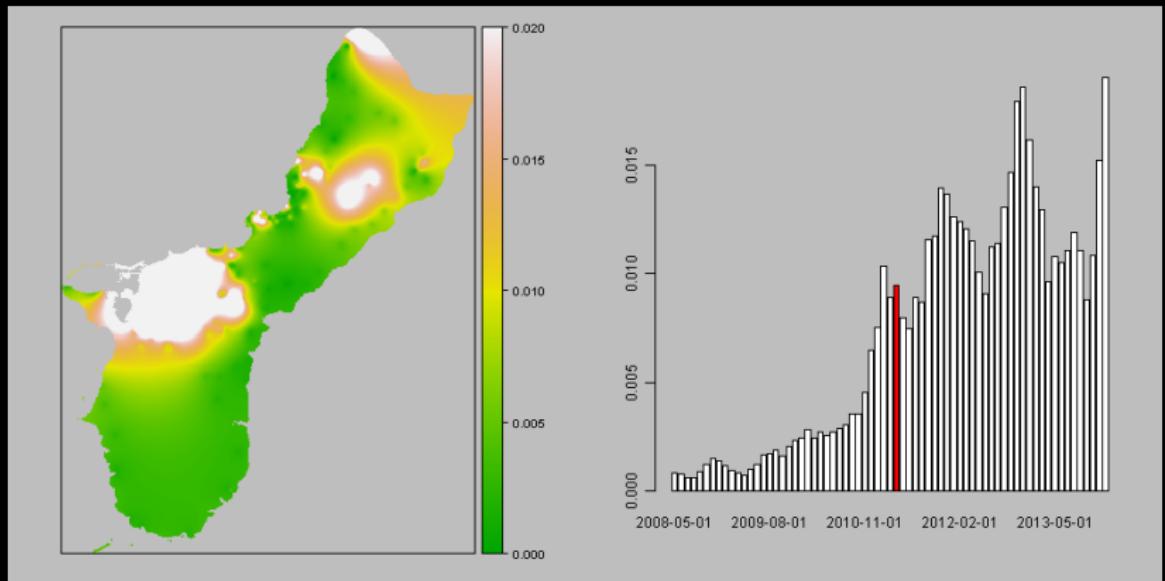
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2011



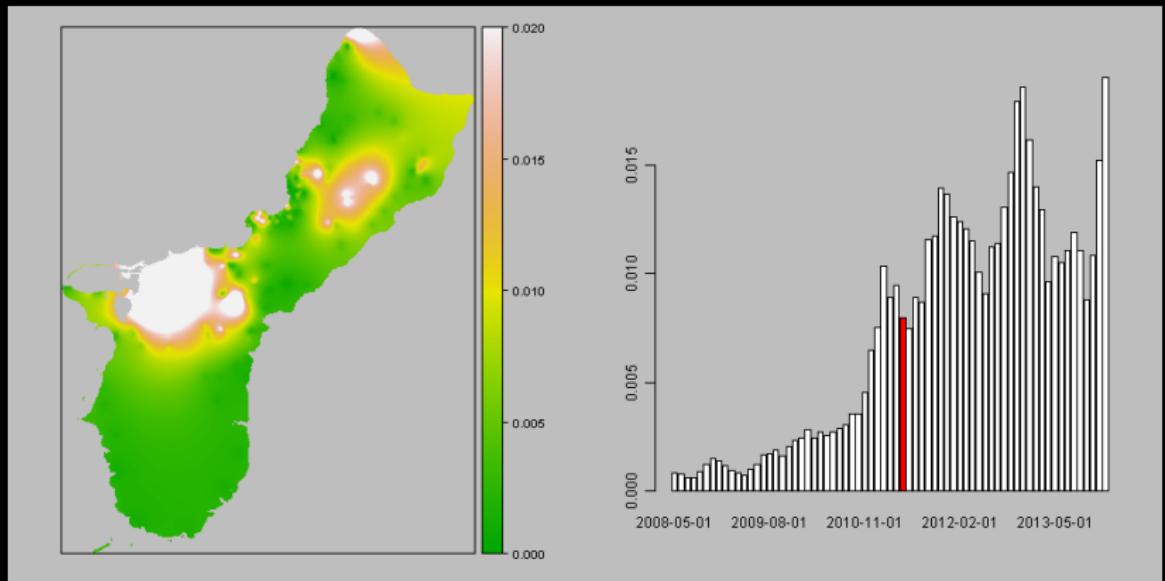
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2011



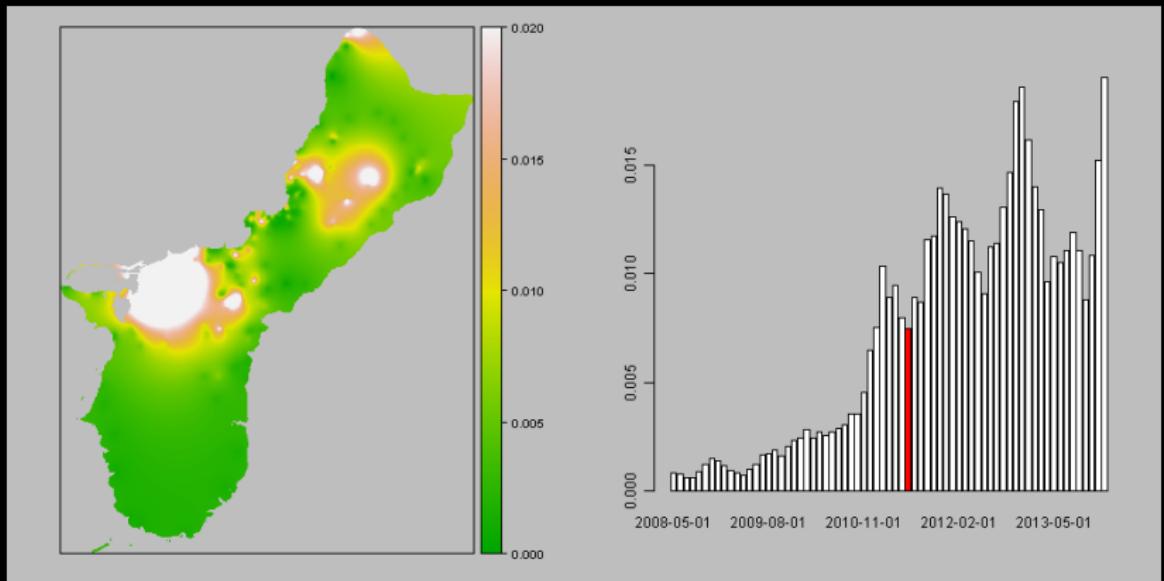
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2011



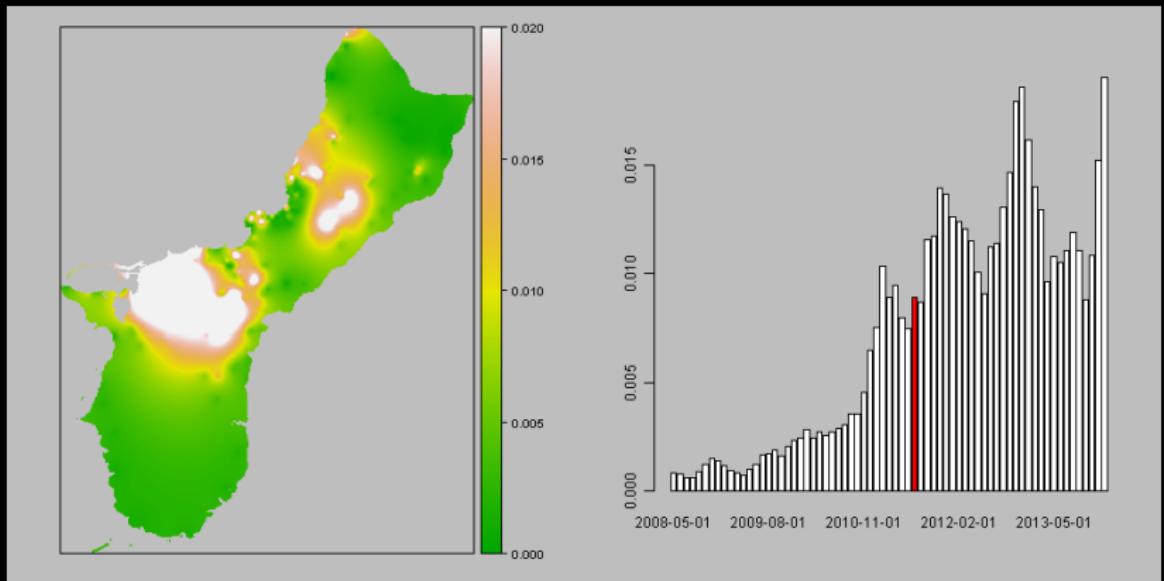
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2011



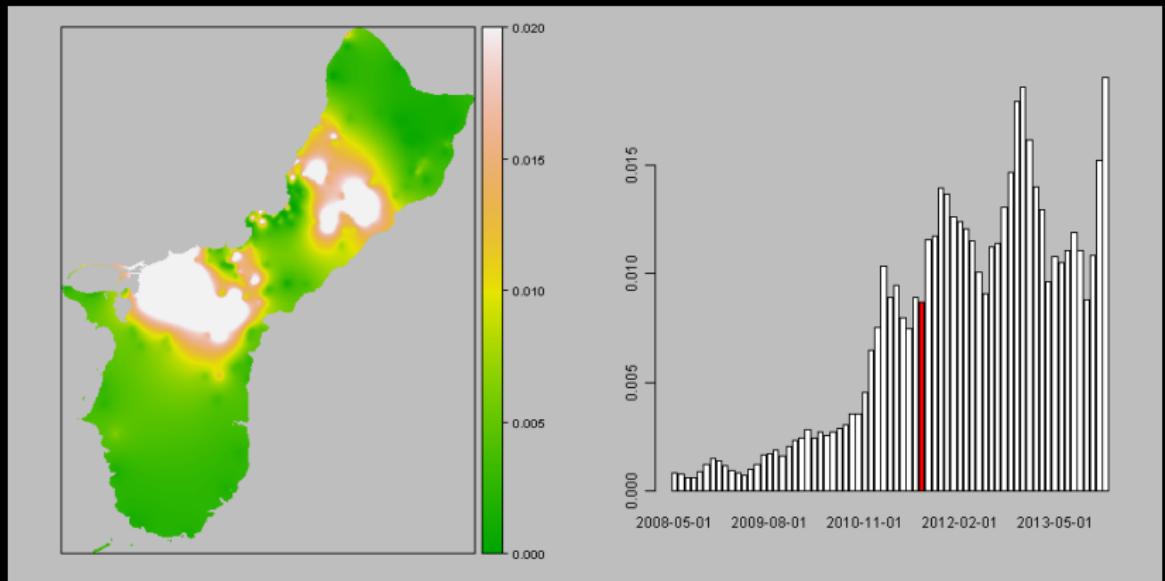
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2011



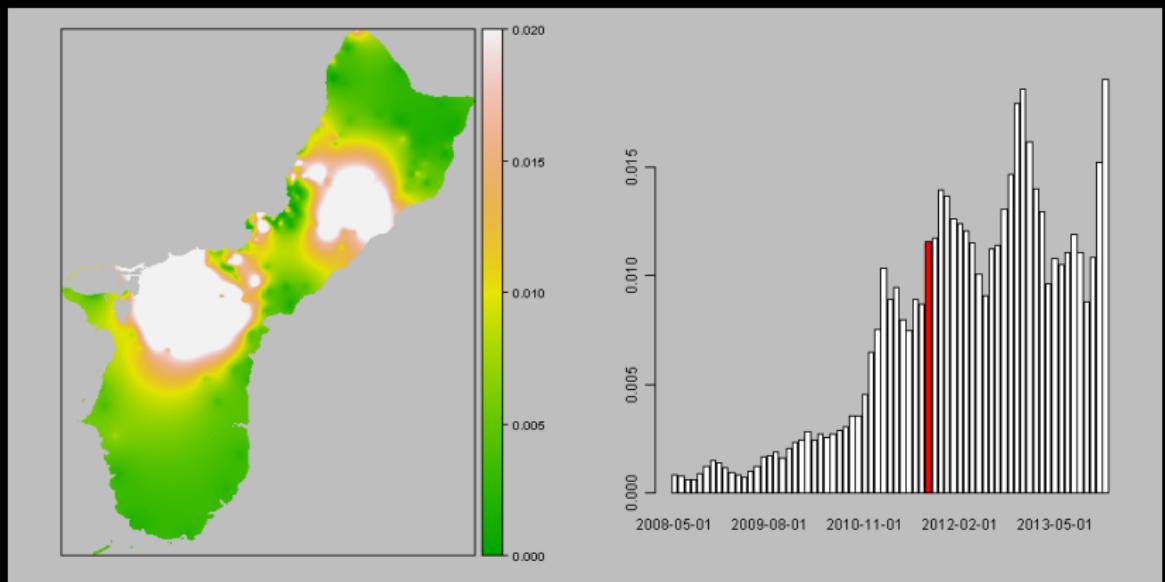
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2011



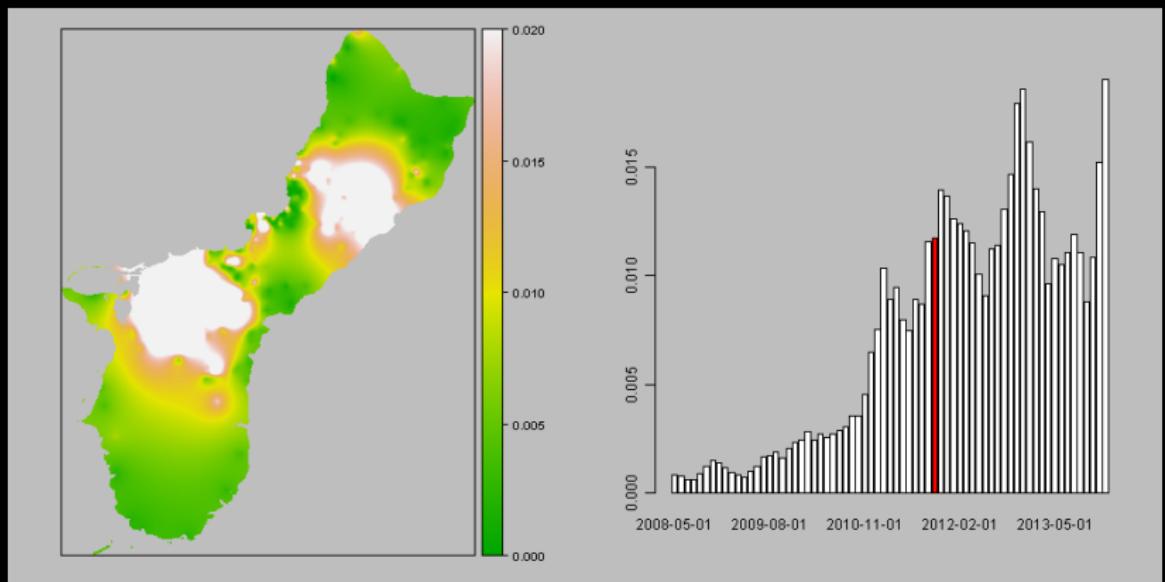
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2011



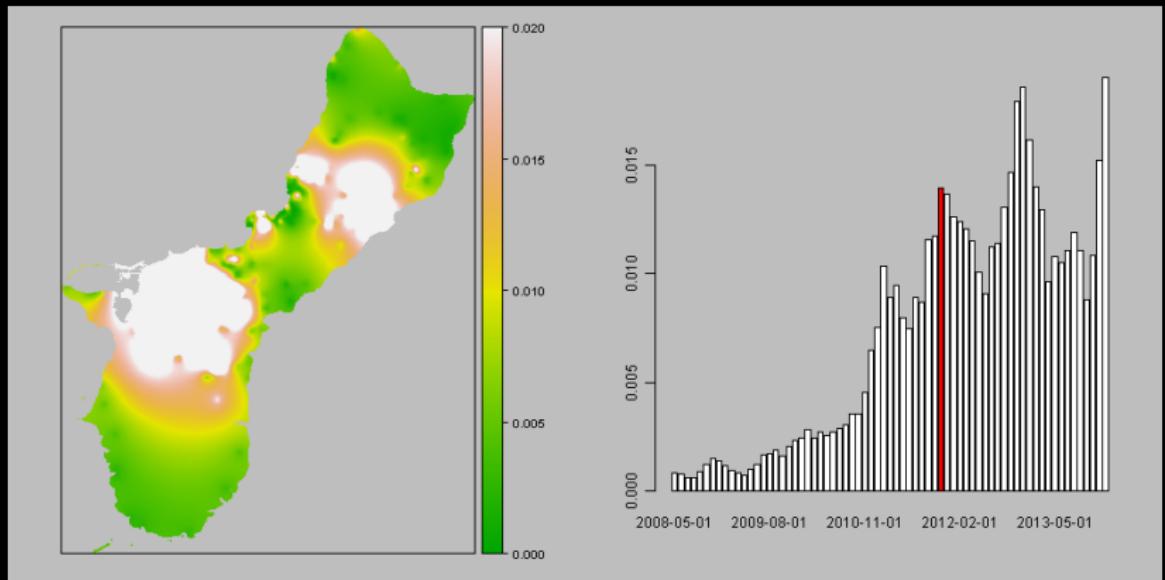
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2011



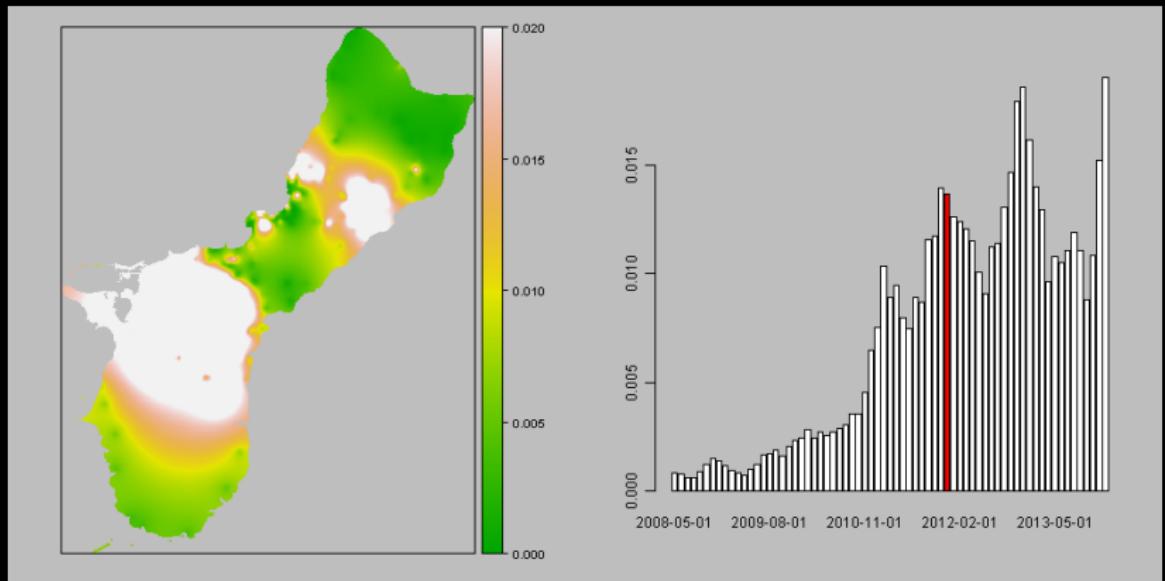
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2011



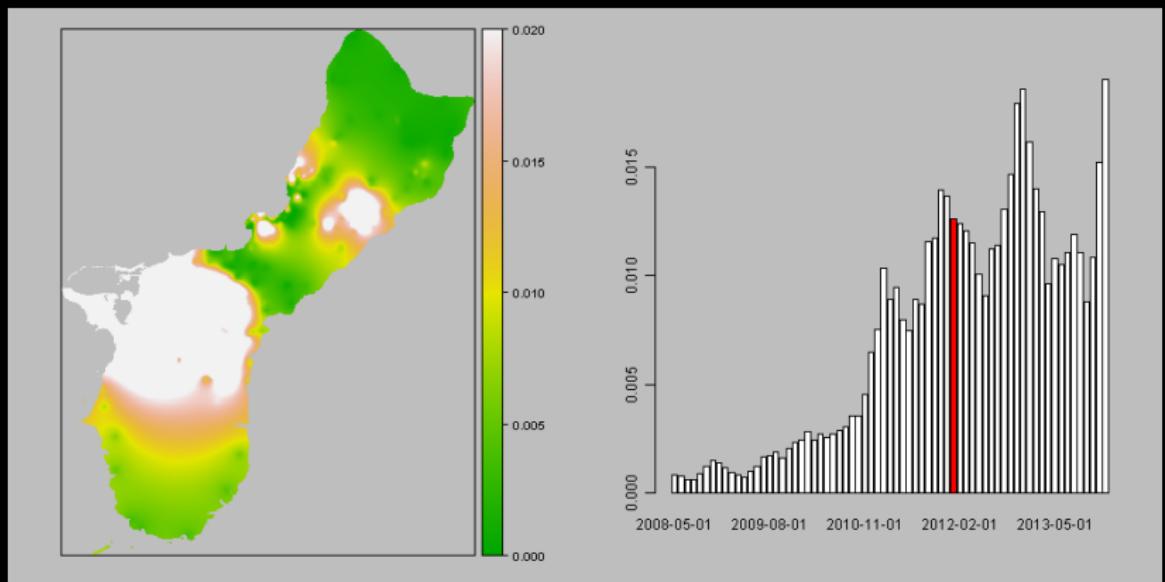
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2011



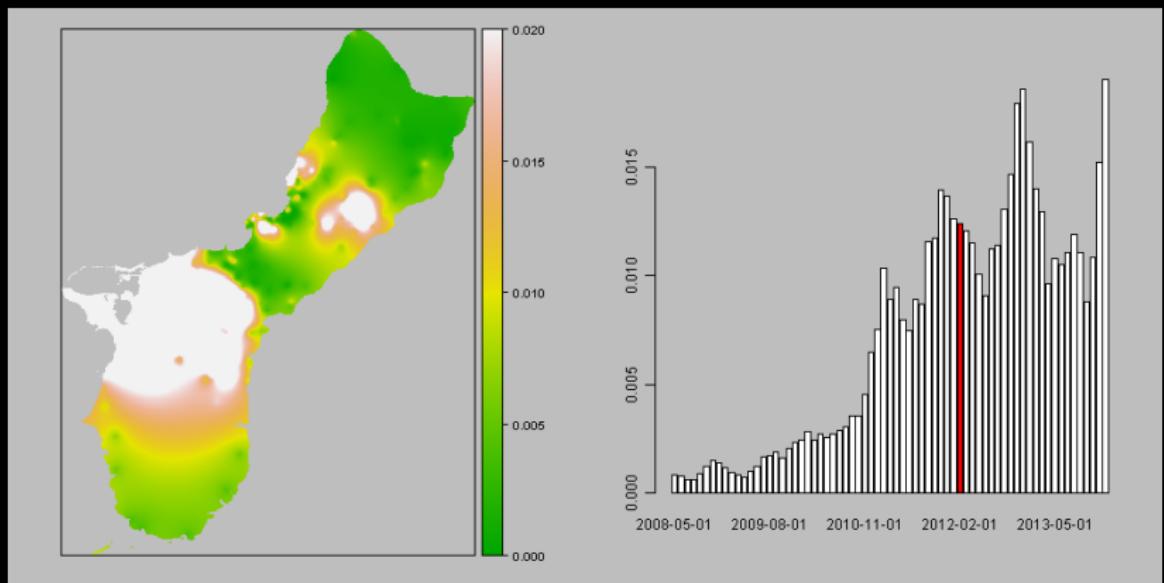
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2012



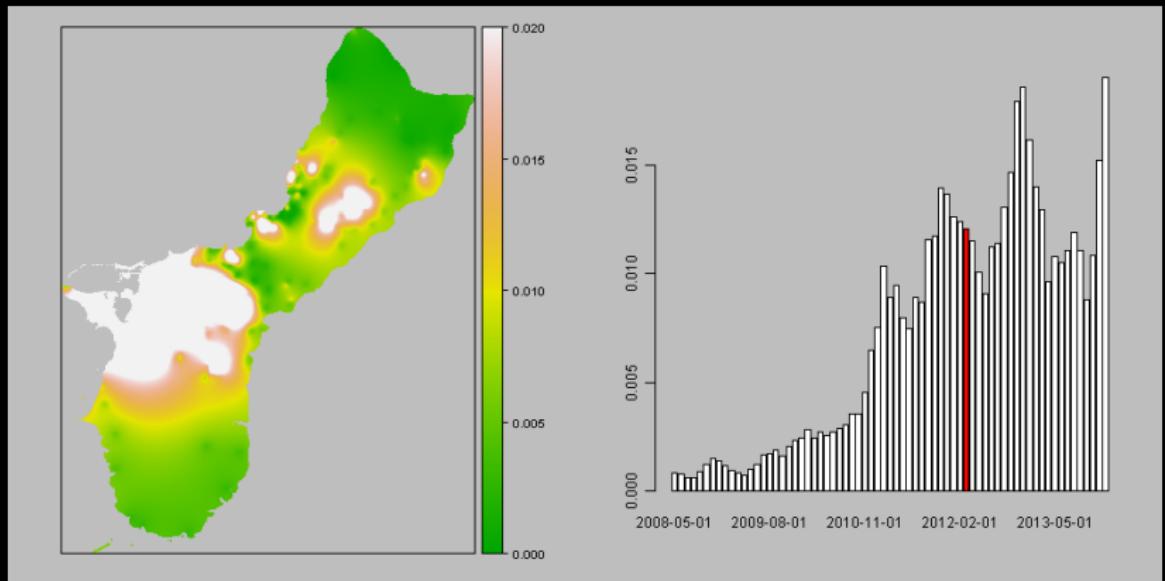
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2012



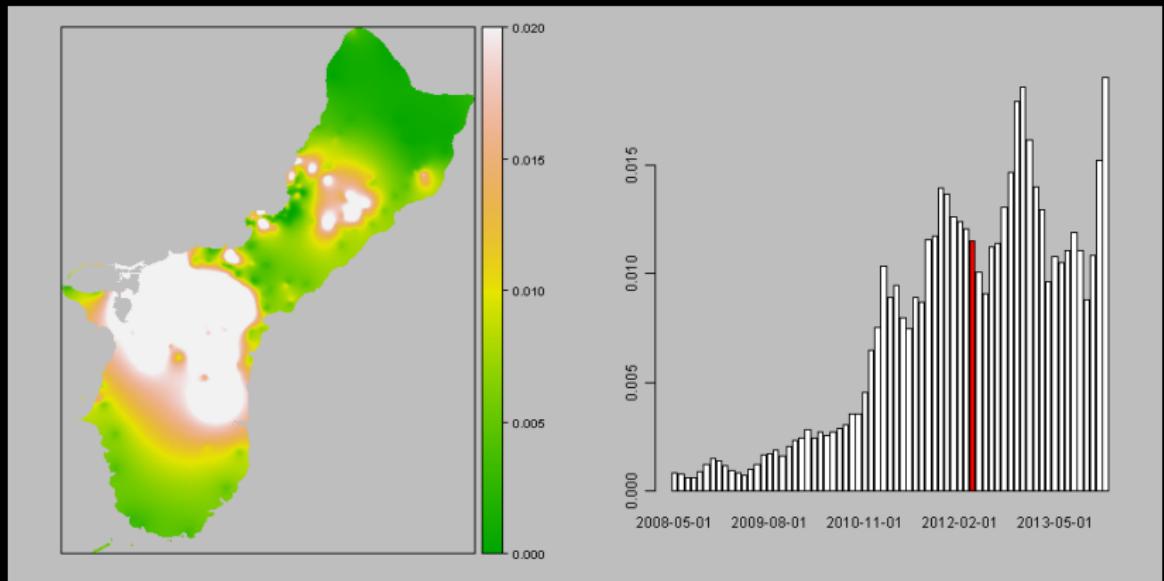
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2012



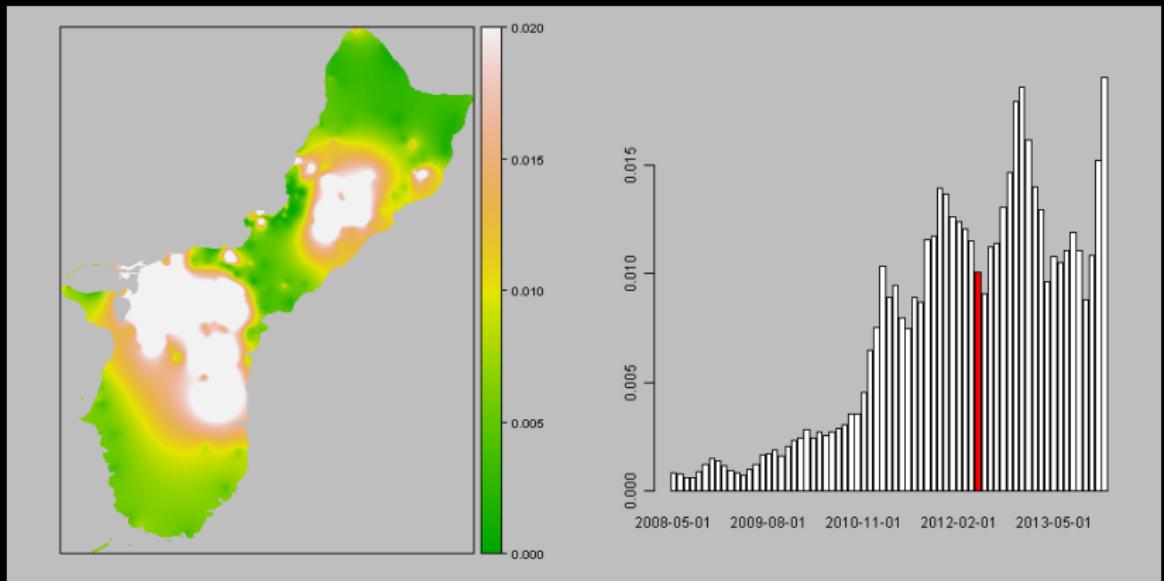
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2012



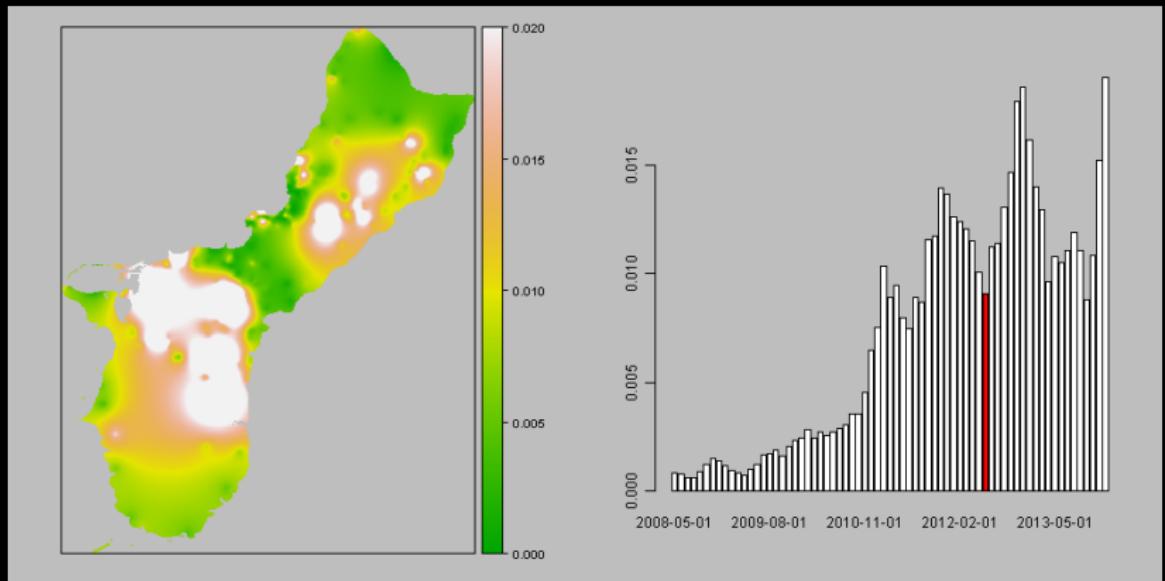
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2012



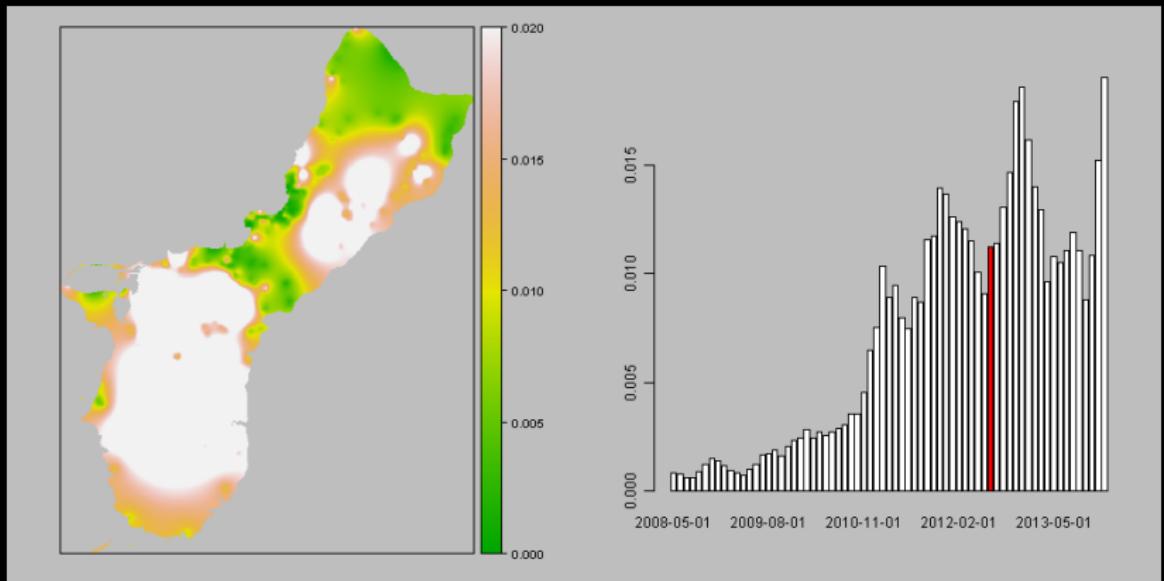
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2012



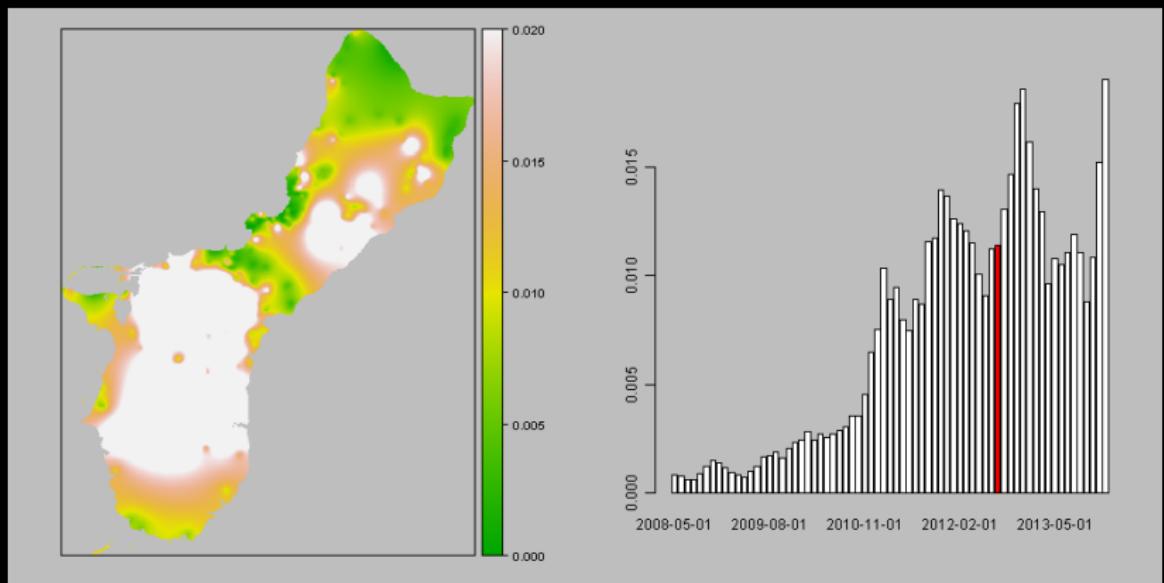
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2012



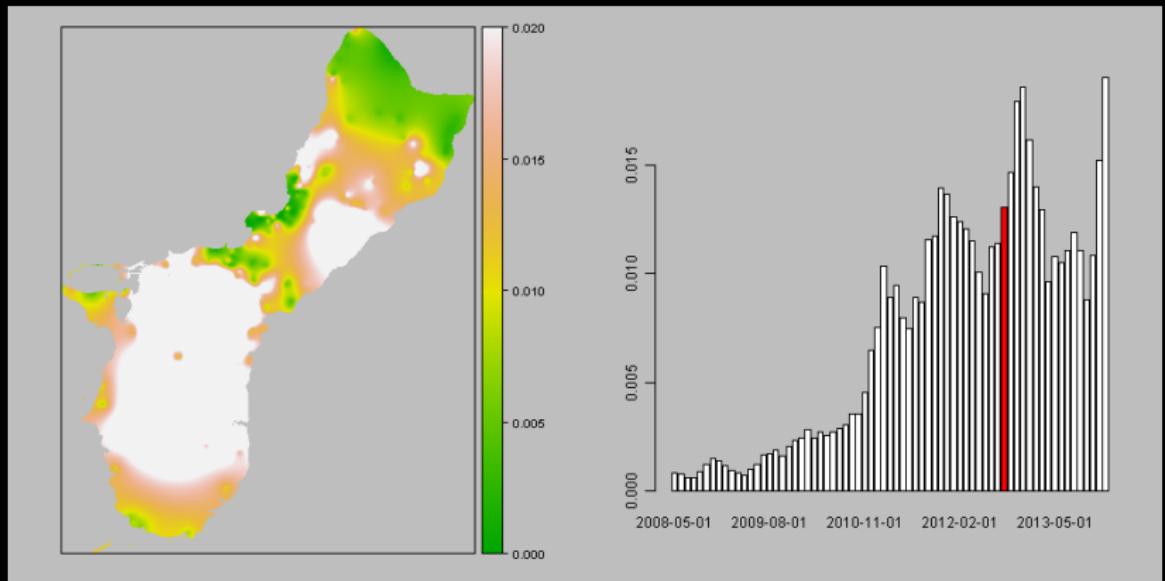
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2012



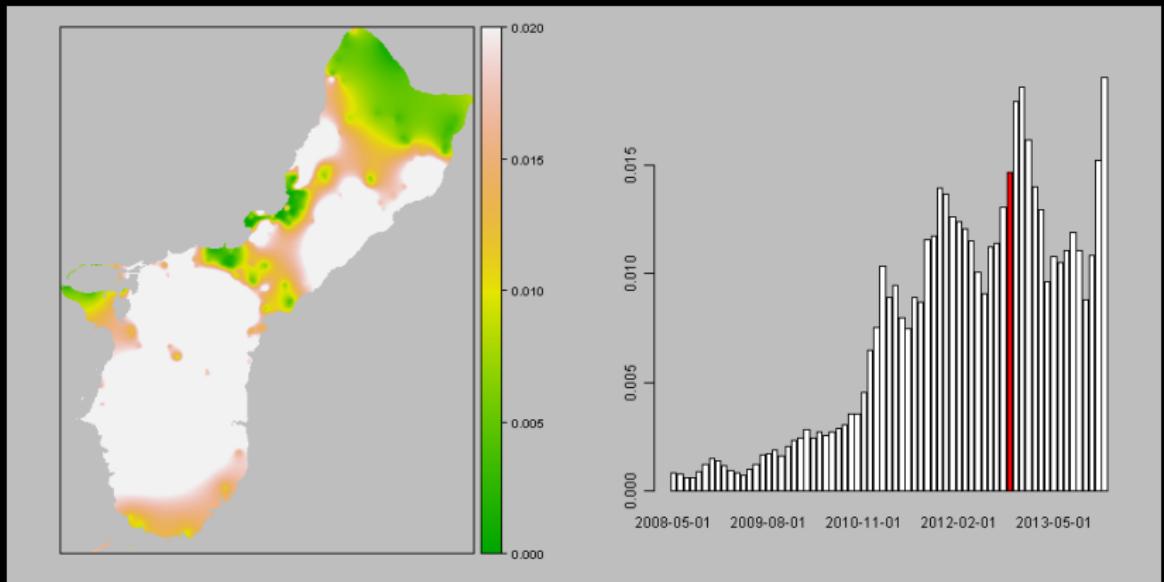
Mean number of beetles caught per trap-day

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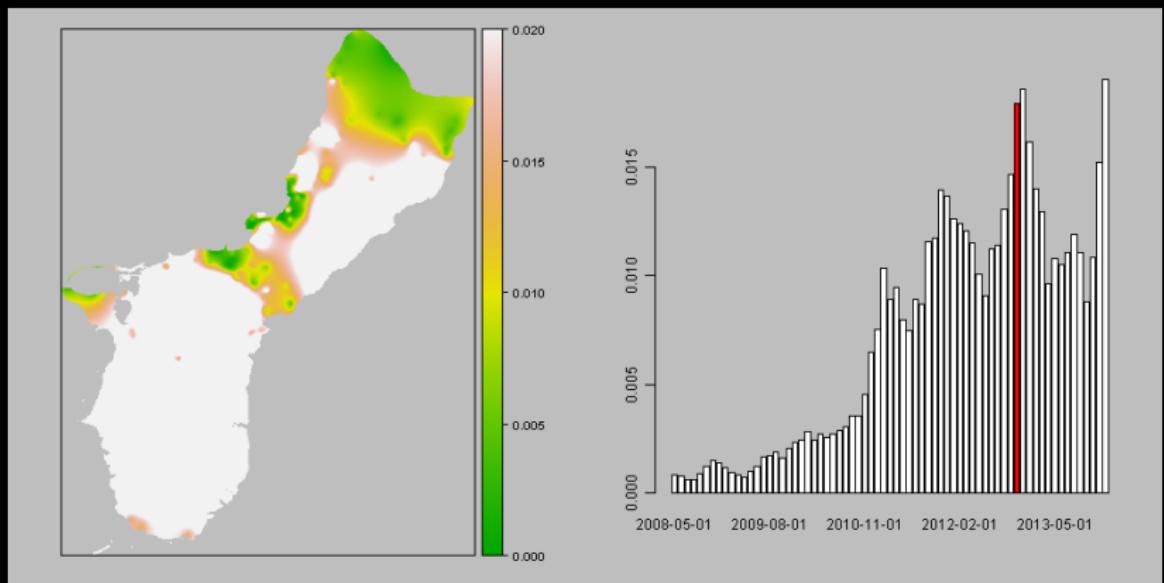
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2012



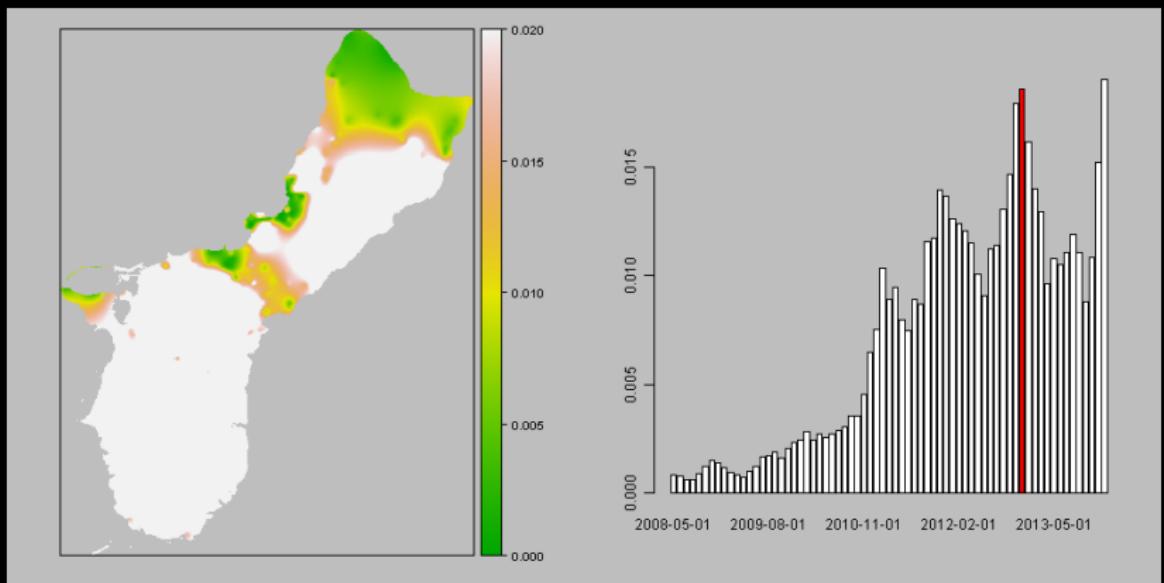
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2012



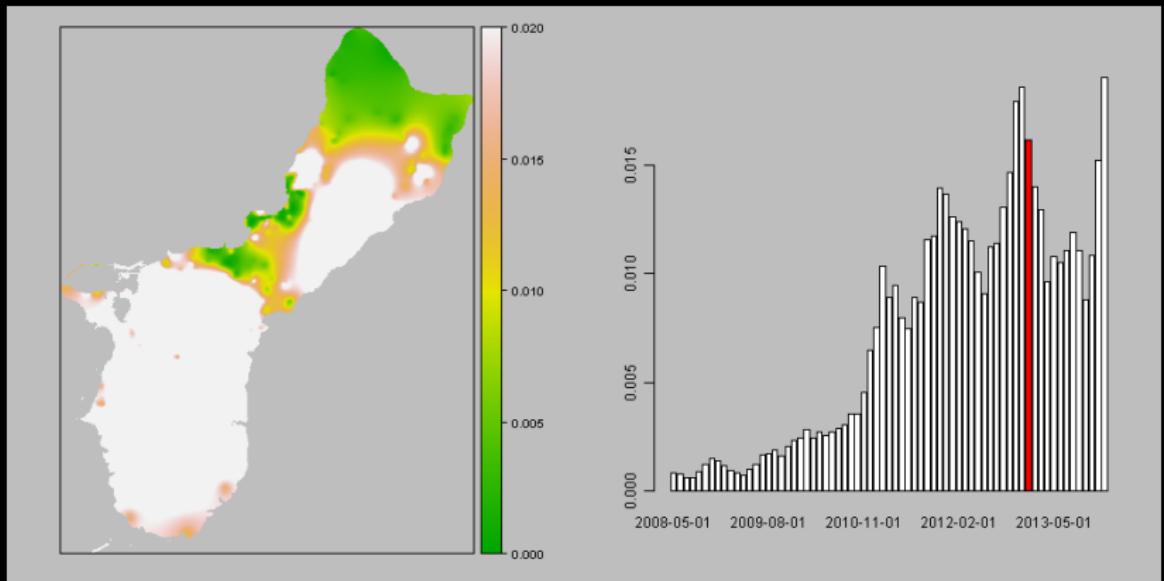
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2012



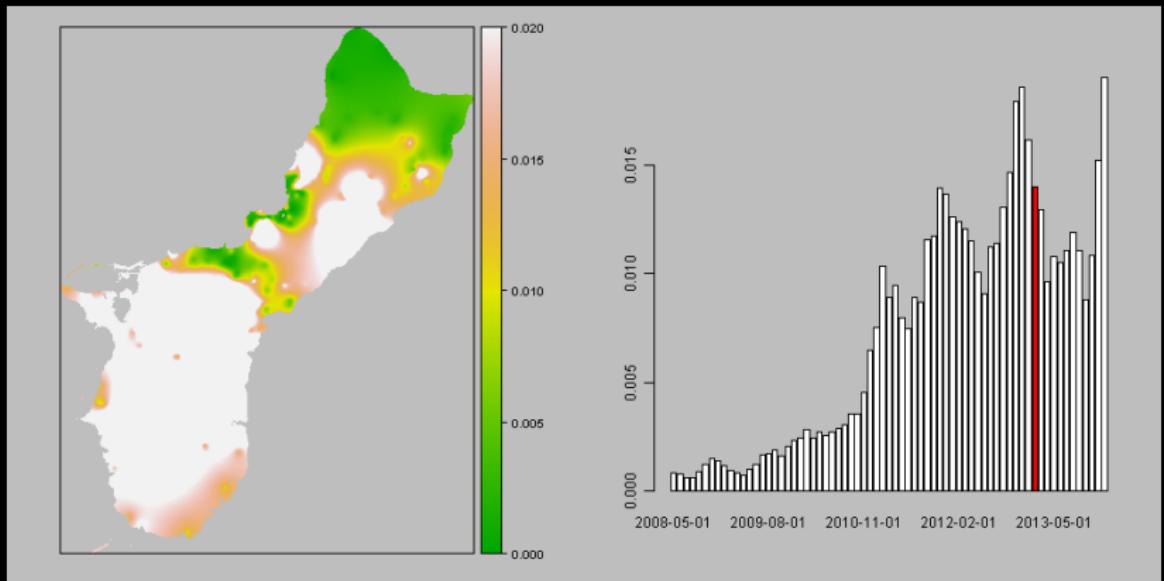
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2013



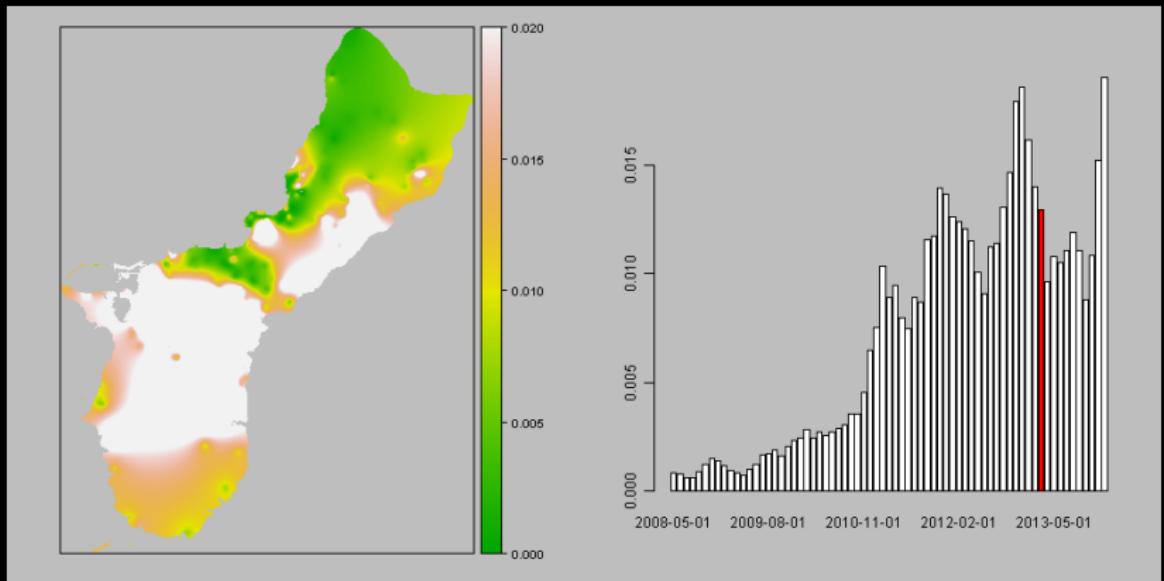
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2013



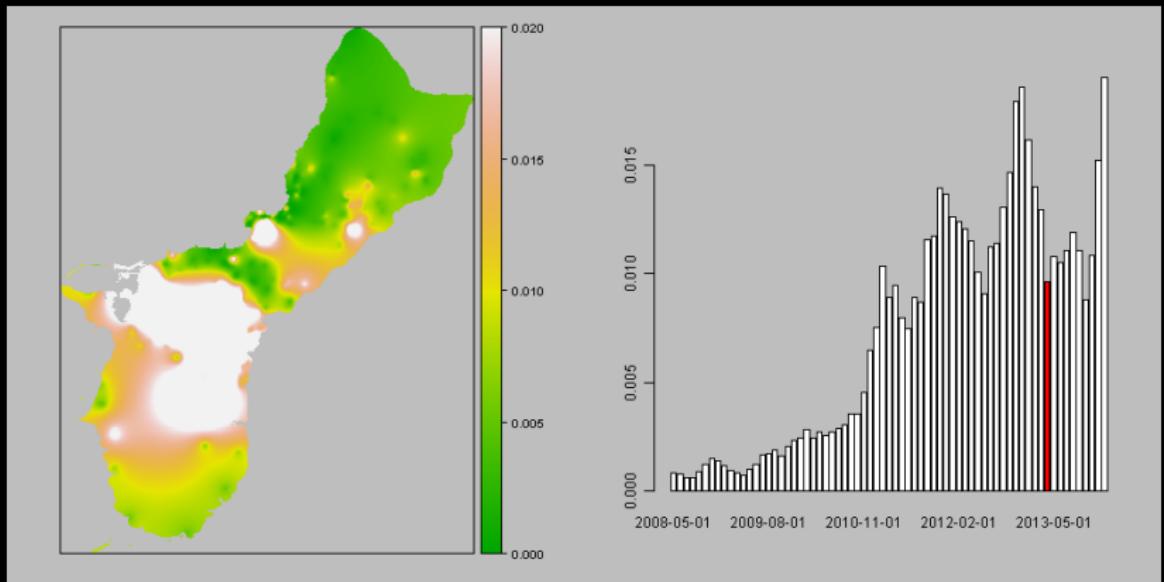
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2013



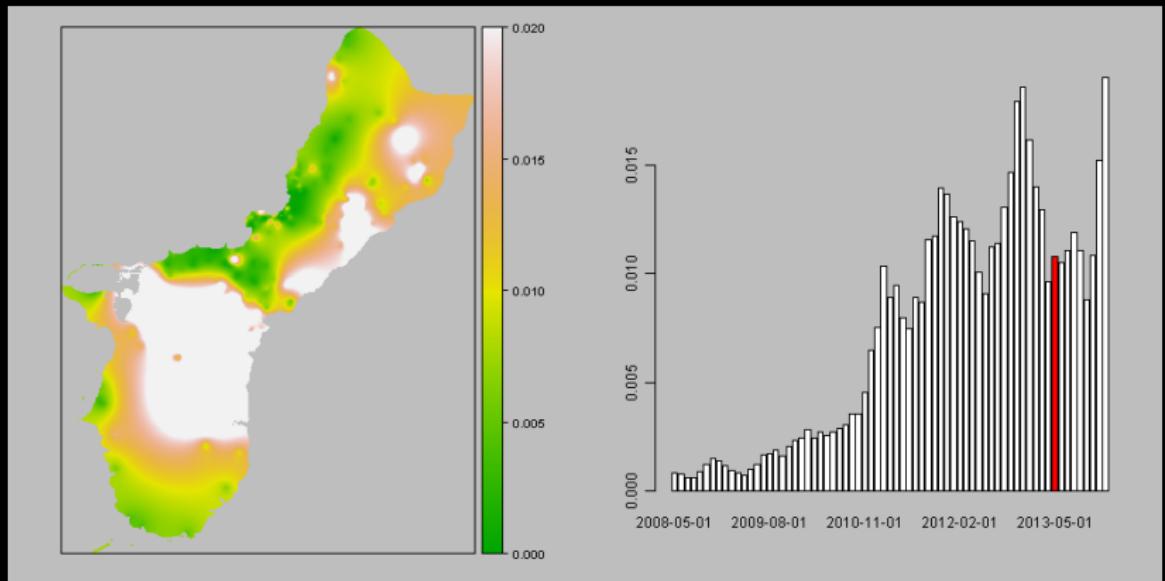
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2013



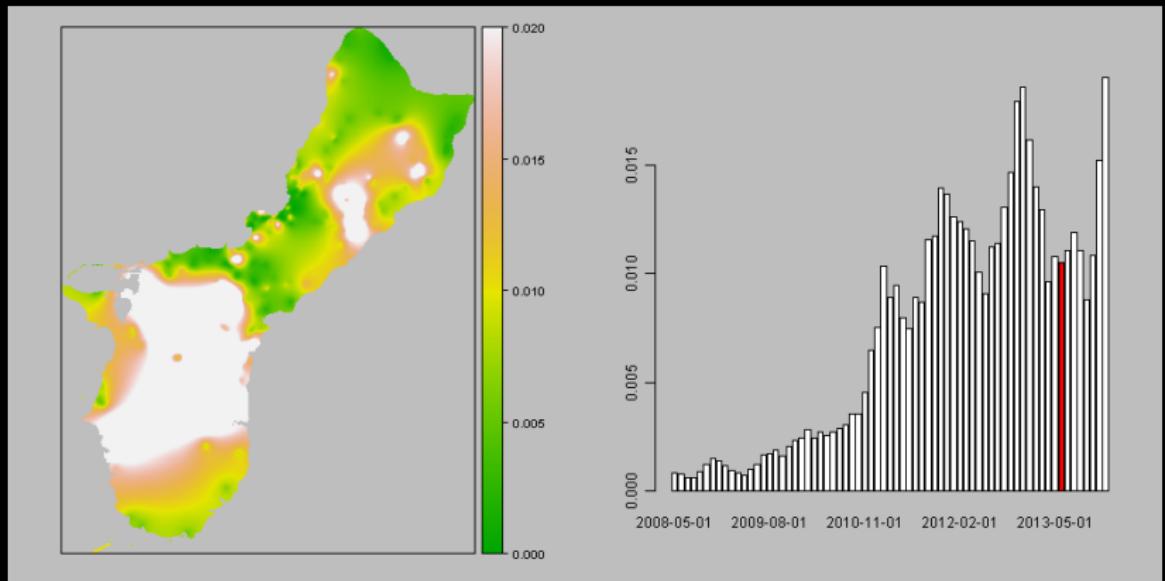
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2013



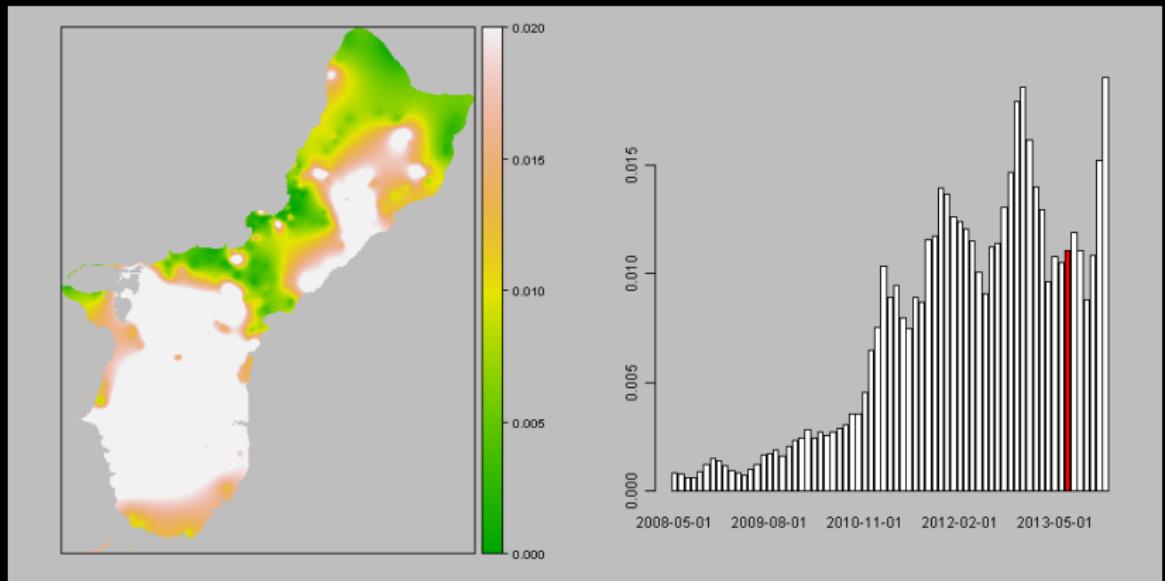
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2013



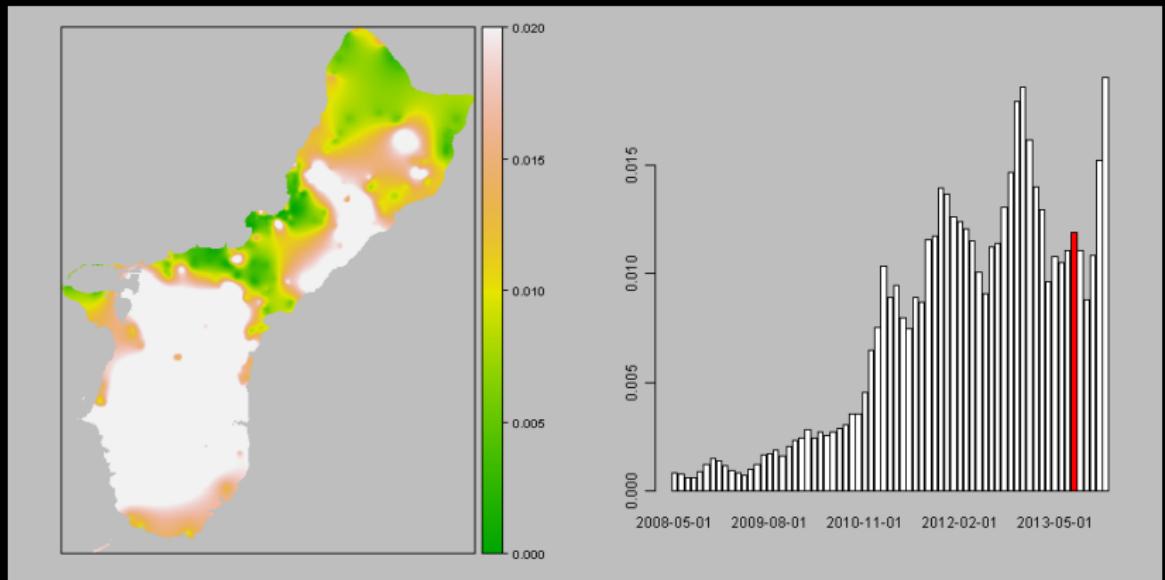
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2013



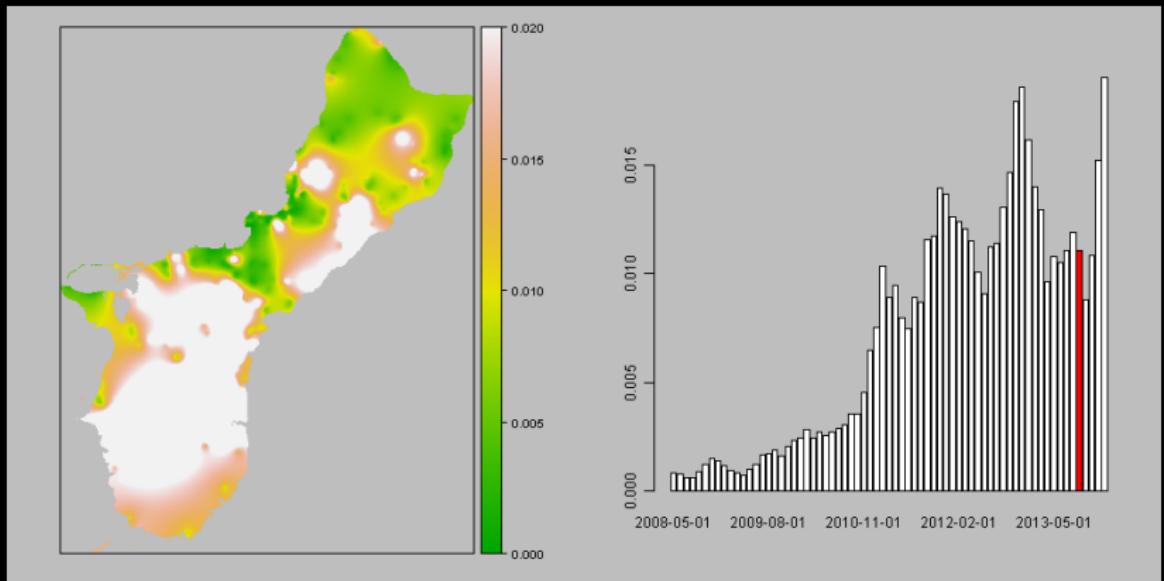
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2013



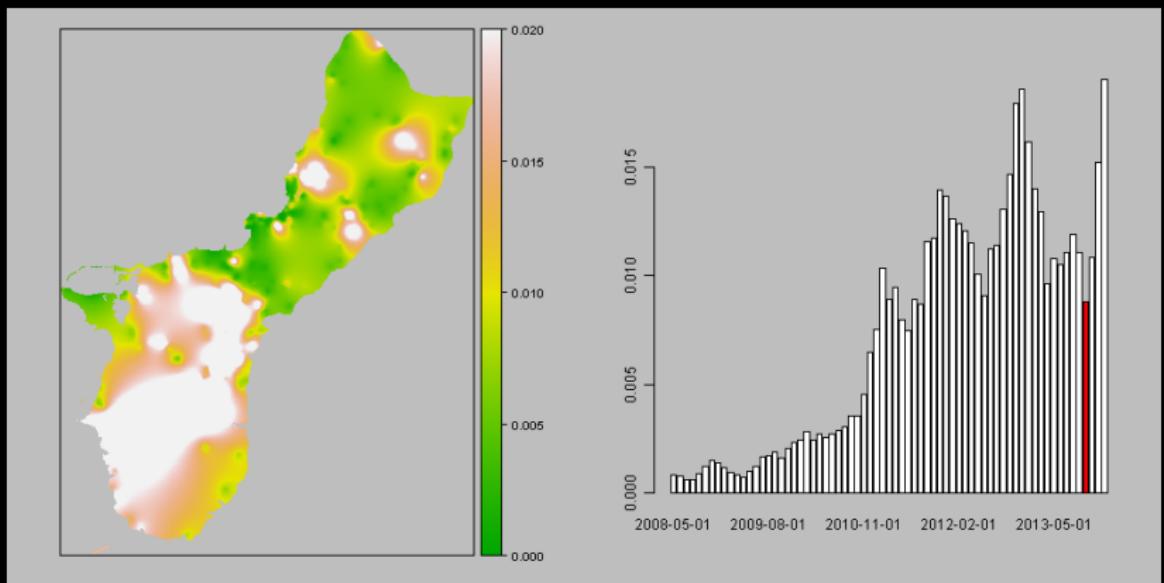
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2013



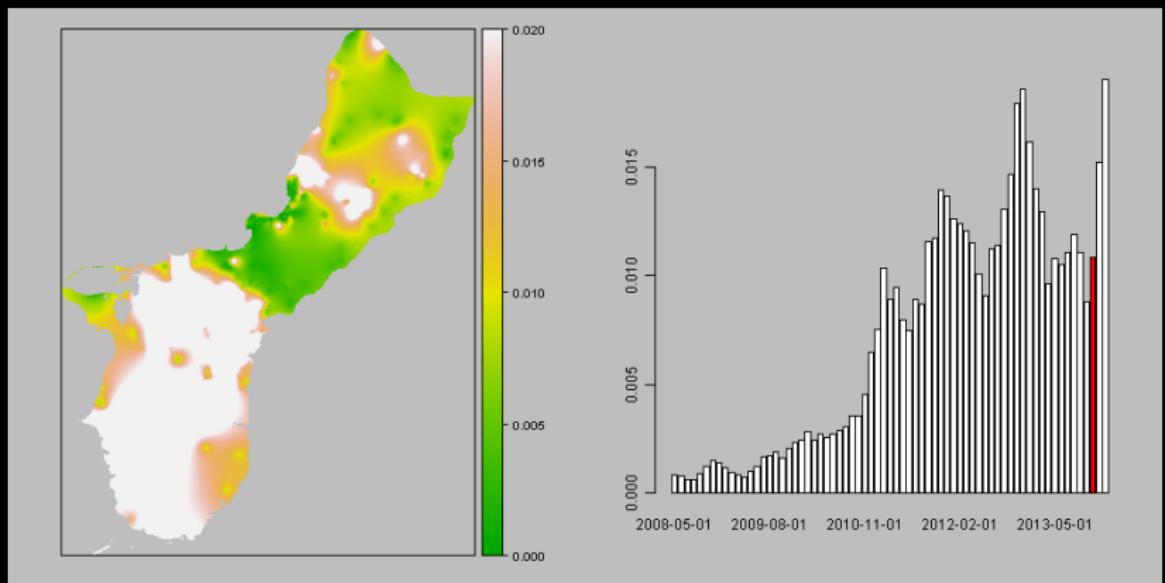
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2013



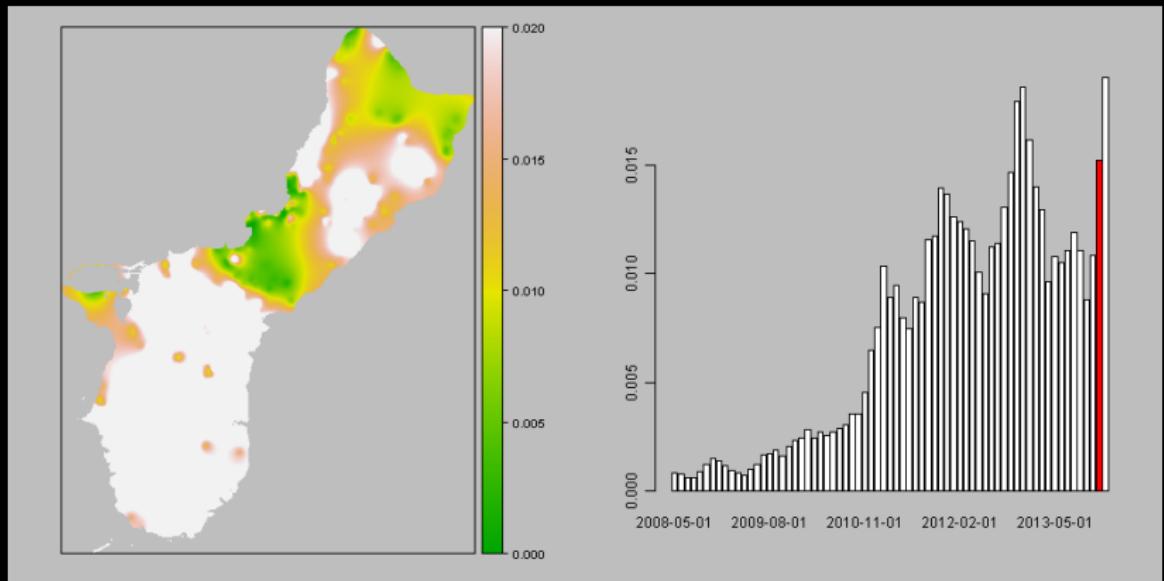
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2013



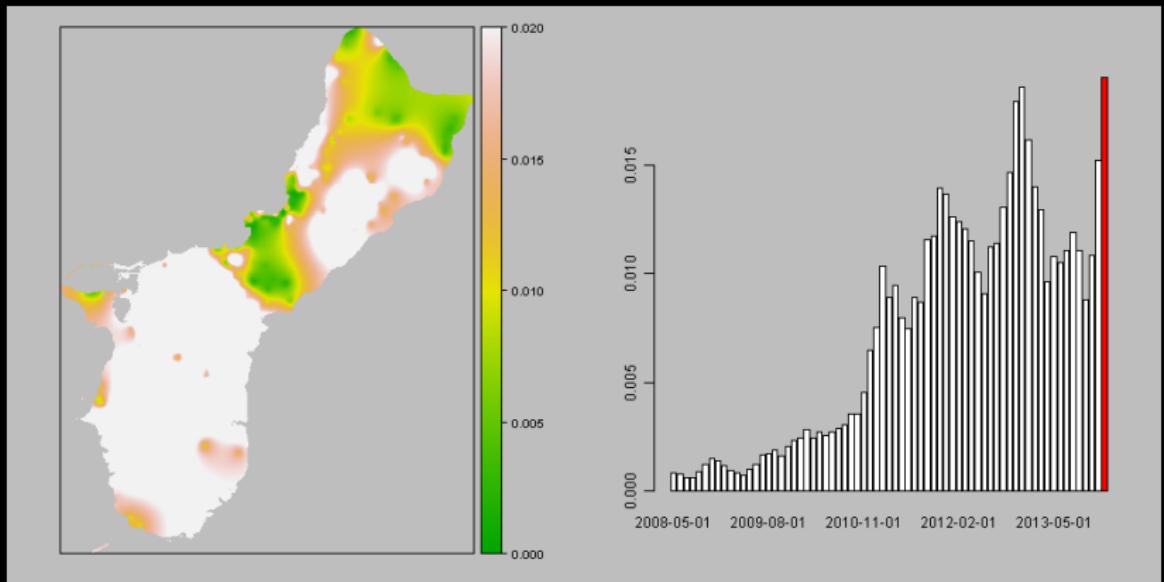
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2013



Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2014



Mean number of beetles caught per trap-day

## Reduced Release Rate



# Ultraviolet Light Emmitting Diodes (UVLED)



# Development of the Hotel California Trap



"Beetles Check In But Can Never Leave"







# Enhanced Pheromone Trap: >3X Standard Trap Catch



# Barrel Trap V2: >10X Standard Trap Catch



# Sanitation









**GRUBS – 296**  
**PUPAE – 41**  
**ADULTS - 15**

**DANGER**  
**RESTRICTED  
AREA**

2007/12/09





2007/12/11

# DETECTOR DOGS



# CHEMICAL CONTROL



## Insecticides Being Evaluated

- ▶ CYPERMETHRIN: quick knockdown of all stages; not persistent
- ▶ PYRIPROXIFEN (NYGARD®): insect growth regulator; prevents production of adults
- ▶ SPLAT RB® + CYPERMETHRIN: experimental attracticide; adults only

# Spraying Crowns with DEMON MAX (Cypermethrin)



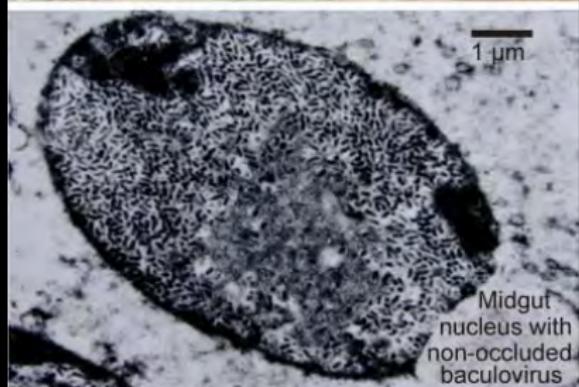
# Efficacy of Crown Spraying



# BIOCONTROL



Palm rhinoceros beetle









## *Metarhizium* for Biological Control

- ▶ a USDA import and release permit was obtained for *Metarhizium* which is being produced for biocontrol of CRB by the Philippines Coconut Authority
- ▶ 15 kg of spores were imported on September 10, 2011 and December 10, 2011
- ▶ following lab bioassays, field releases were started by incorporation into breeding sites and autodissemination by adult males
- ▶ *Metarhizium* appears to be working well: we are finding dead grubs with fungus even in areas where we did not apply spores

# Biological Control of the Coconut Rhinoceros Beetle







