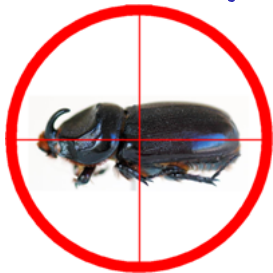


Overview of the Guam Coconut Rhinoceros Beetle Eradication Project



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



Native Range

Bangladesh
Cambodia
China
Indonesia
Laos
Malaysia
Myanmar
Pakistan
Philippines
Sri Lanka
Taiwan
Thailand
Vietnam

Alien Range

Burma 1895
Samoa 1909
Keppel Island (Tonga) 1921
Wallis 1931
Palau ca. 1942
New Britain 1942
West Irian ca. 1942
Vavau (Tonga) 1952
New Ireland 1952
Viti Levu (Fiji) 1953
Pak & Manus (PNG) 1960
Tongatapu (Tonga) 1961
Tokelau 1963
Guam 2007

Interdictions

Cook Islands 2002, 2007
Saipan 2006
Hawaii 2010











Please Don't Do This



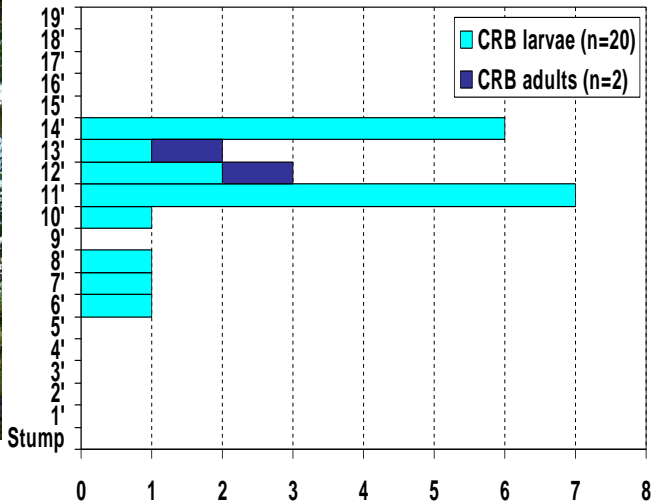
Or This







Vertical Distribution of CRB Larvae & Adults in Standing Dead Coconut Trunk 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
Total	510
Mean per tree	4.21





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



Blue Aster Chapel

Location of Initial Detection

September 11, 2007

Image © 2008 DigitalGlobe

Delimiting Survey

September 2007



Image NASA
Image © 2007 DigitalGlobe

© 2005 Google

Pointer lat: 13.493815° lon: 144.772636° elev: 26 ft

Streaming 100% Eye Alt 26.37m

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



Image © 2007 DigitalGlobe

© 2007 Google™

Pointer lat 13.509068° lon 144.803960° elev 44 ft

Streaming 100%

Navigation icons: Home, Back, Forward, Stop, Refresh, Full Screen, Print, Search, etc.



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/oryctes/upload_site_visit_gpx_3.php

New_guinea_sugarcan... Encyclopedia of Life F... webftp 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

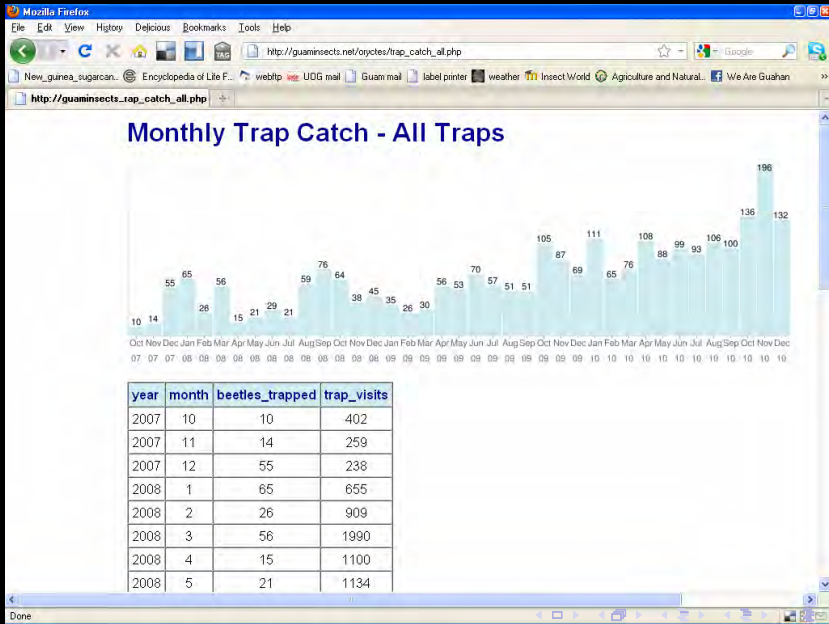
Trapper(s):

Trap Visit Date:

Choose a GPX file to upload:

Done

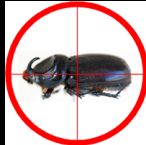
Online Trap Data Report



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

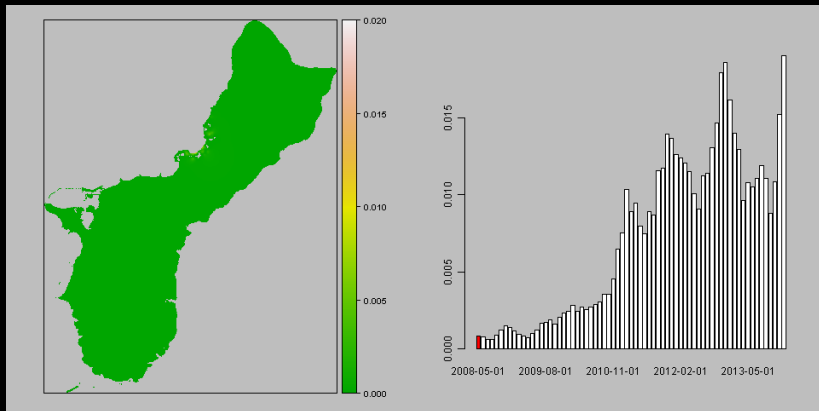
Introduction

- ▶ 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

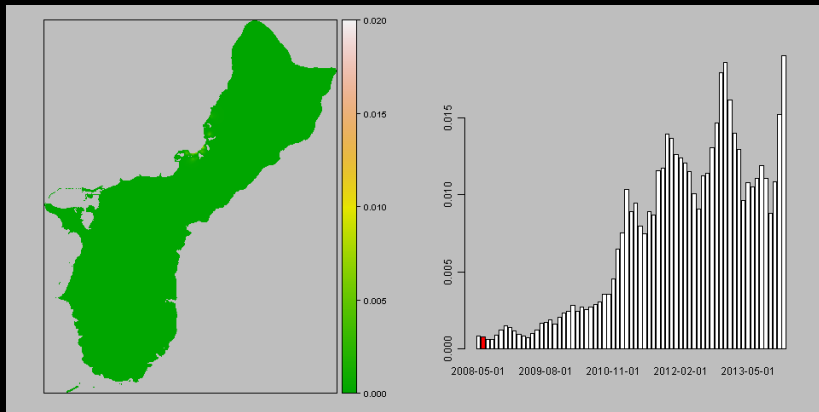
- ▶ Interpolated raster maps were made using an R script which:
 1. Accesses georeferenced data stored in the CRB project's online MySQL database.
 2. Processes the data using the GRASS6 GIS
 3. Writes the \LaTeX code which generated this PDF document.

90 day trapping period ending on 01 May 2008



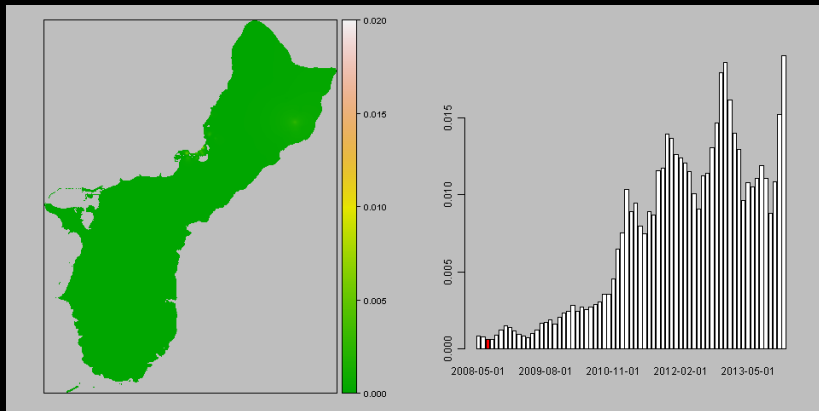
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2008



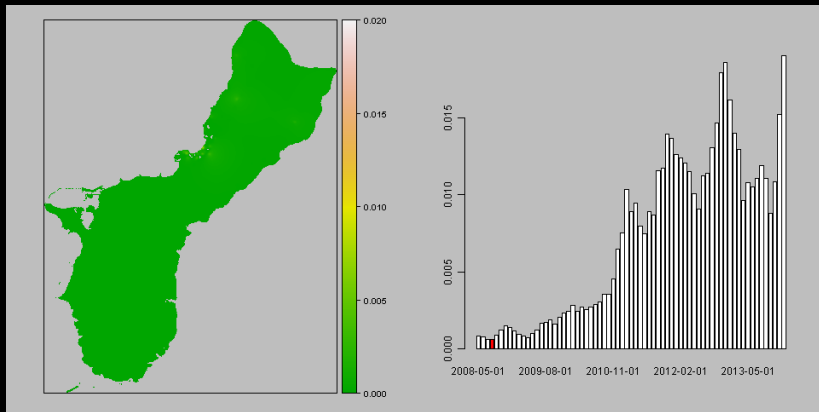
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2008



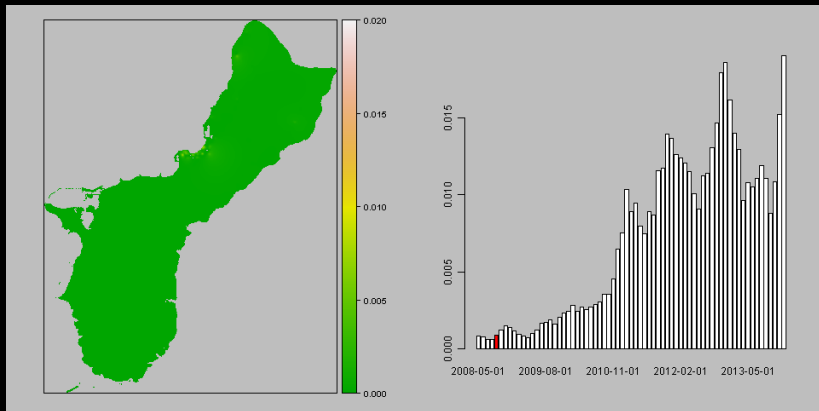
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2008



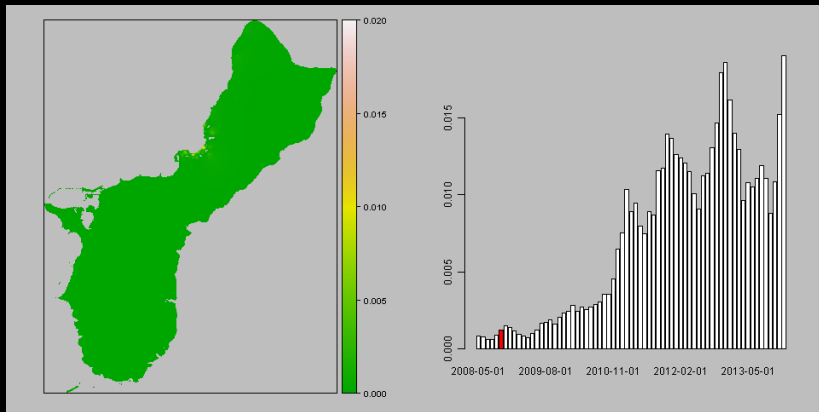
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2008



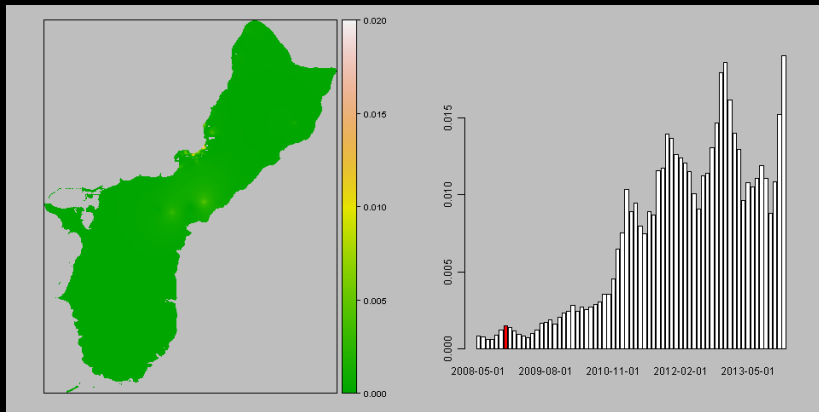
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2008



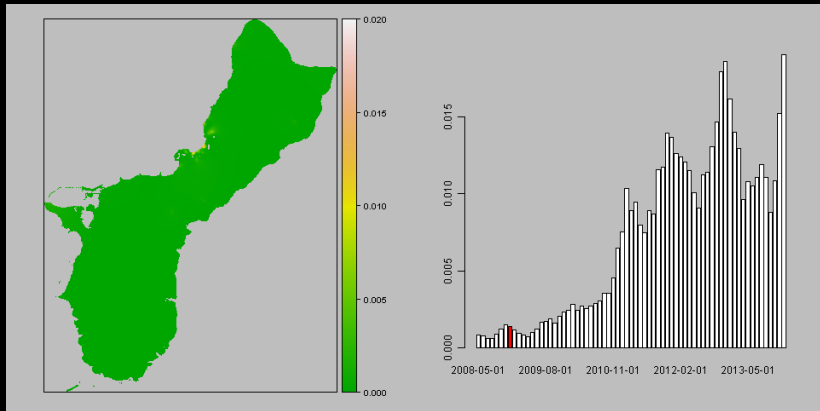
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2008



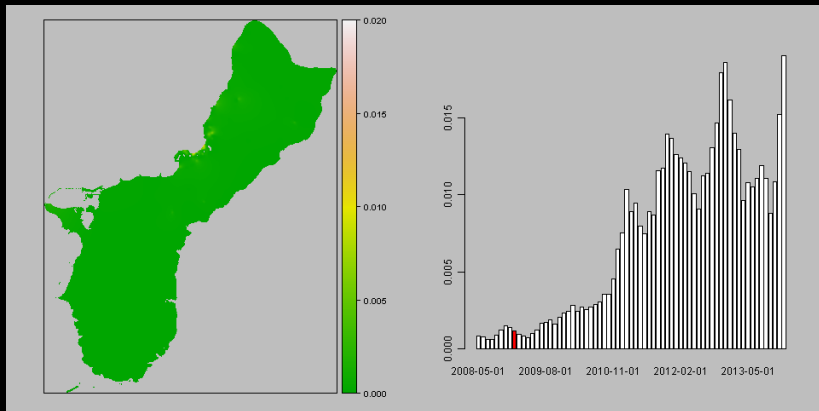
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2008



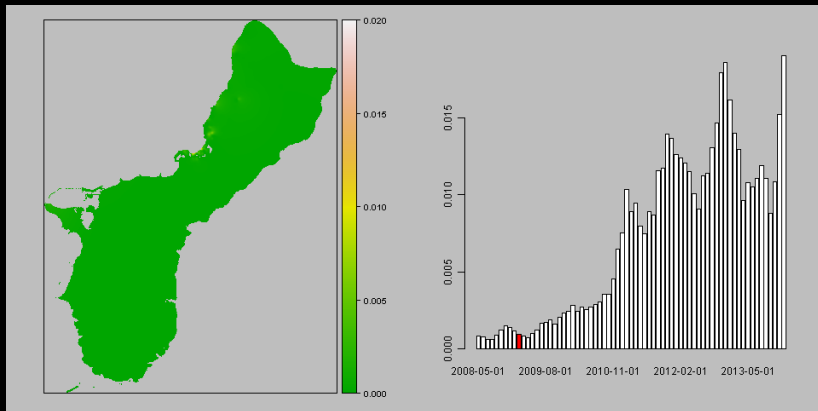
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2009



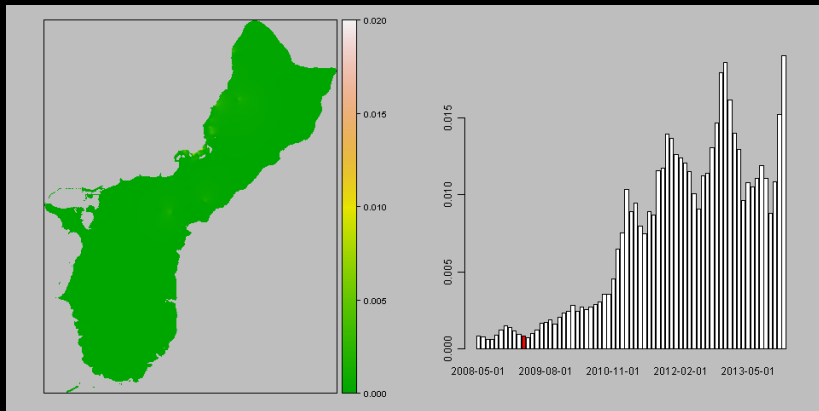
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2009



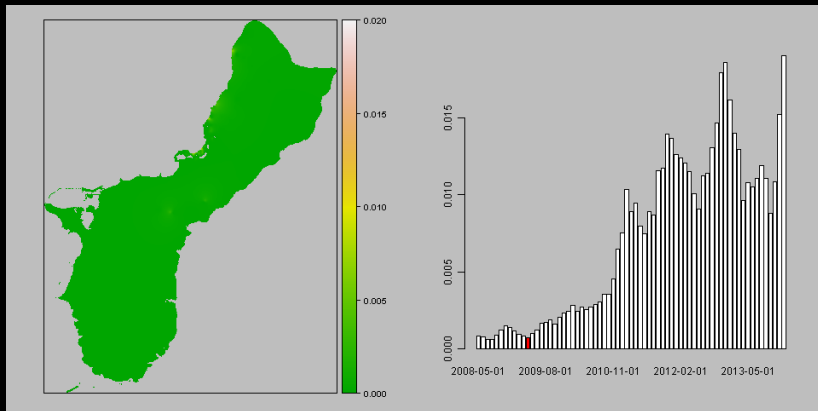
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2009



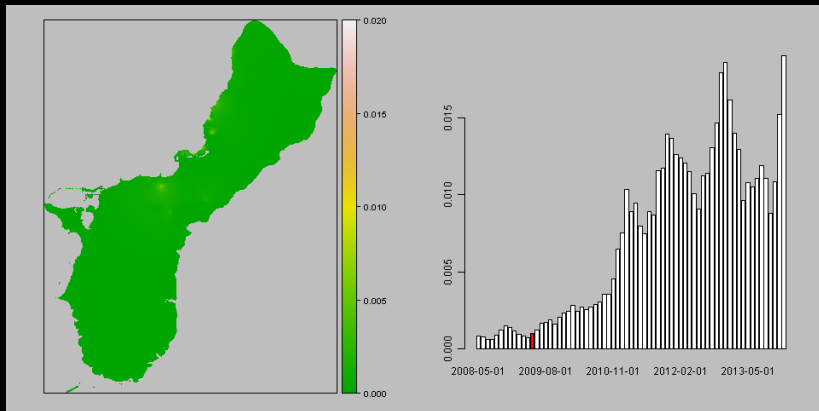
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2009



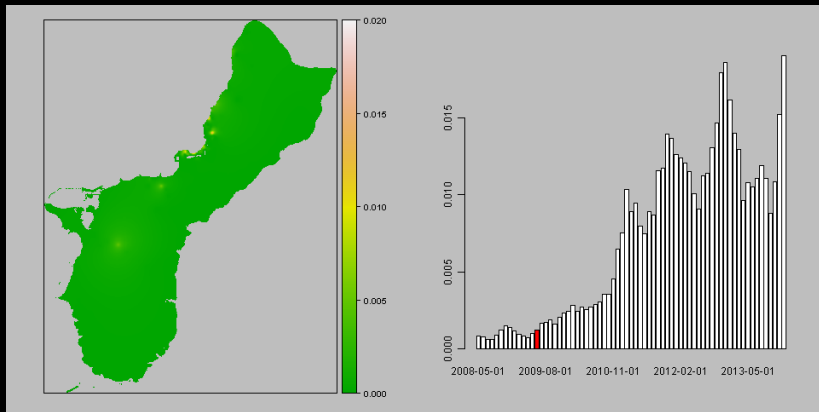
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2009



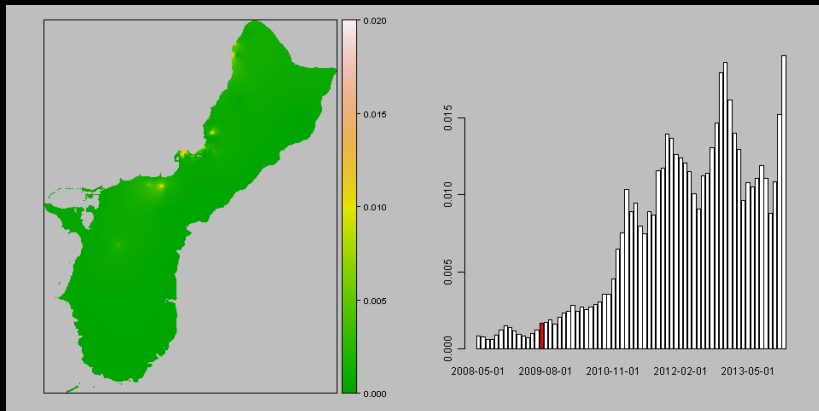
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2009



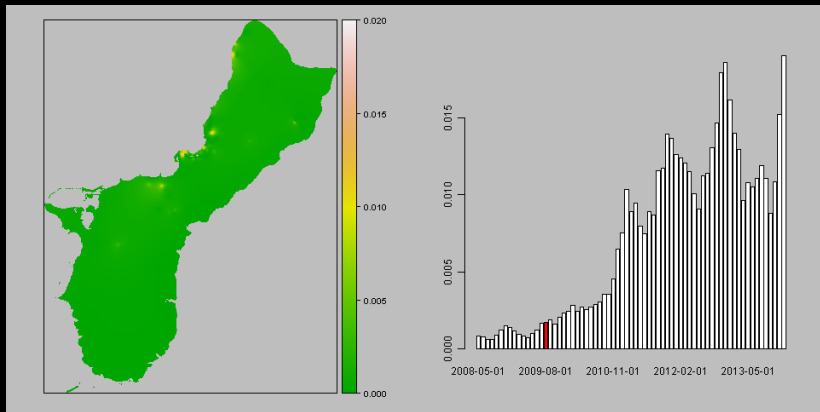
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2009



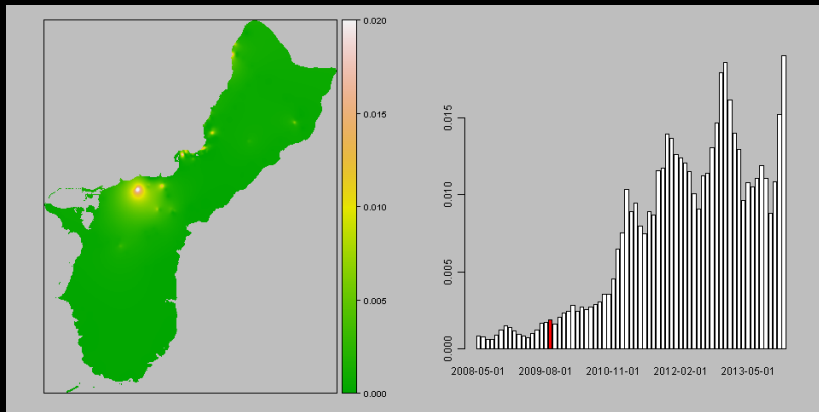
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2009



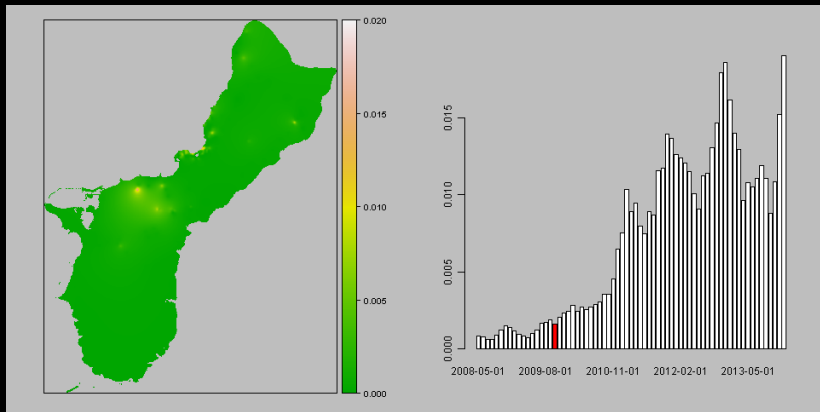
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2009



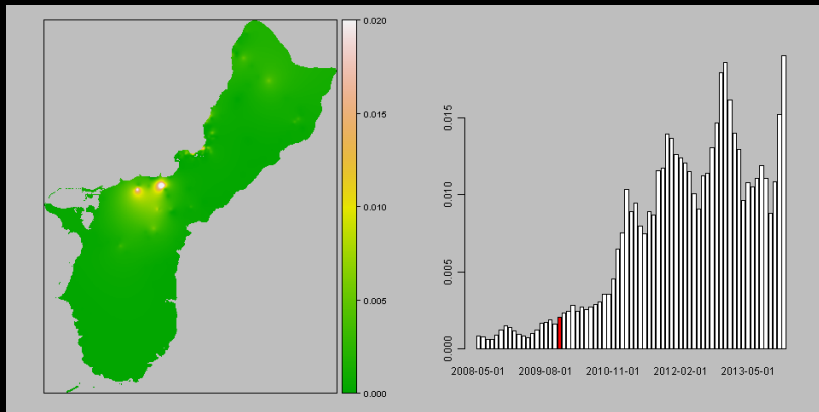
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2009



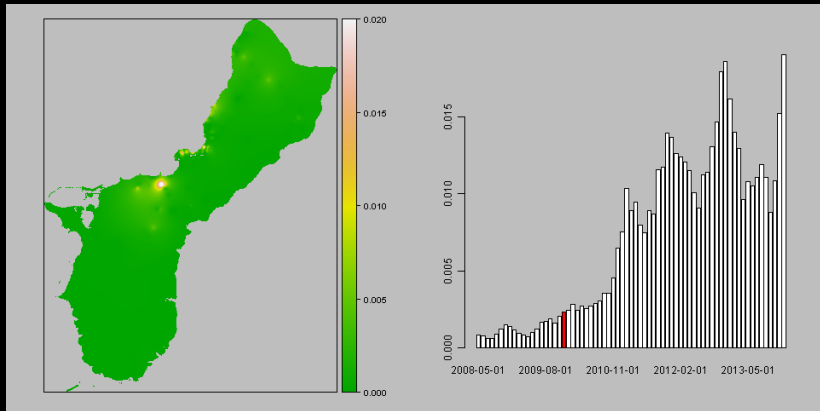
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2009



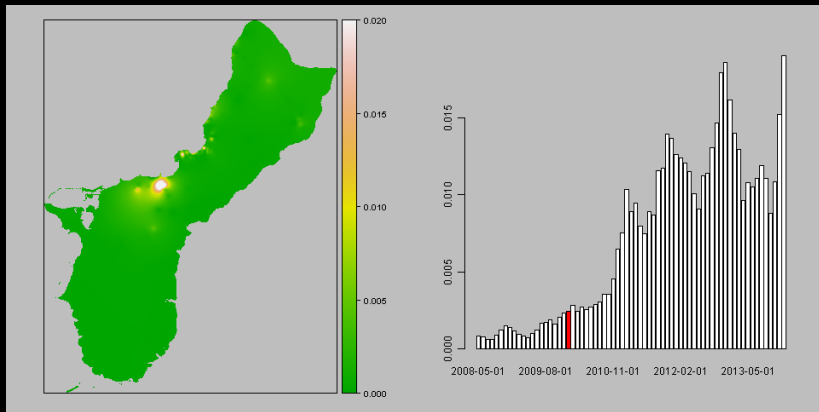
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2009



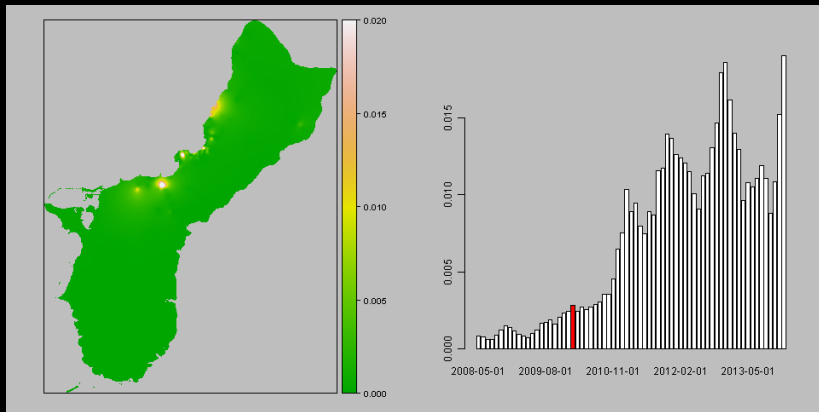
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2010



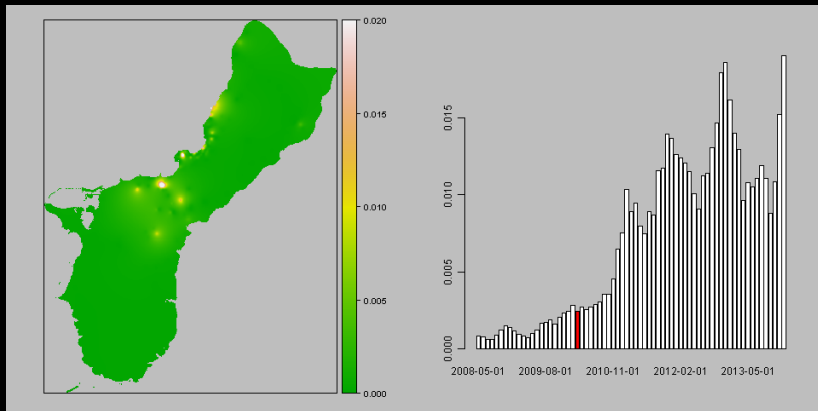
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2010



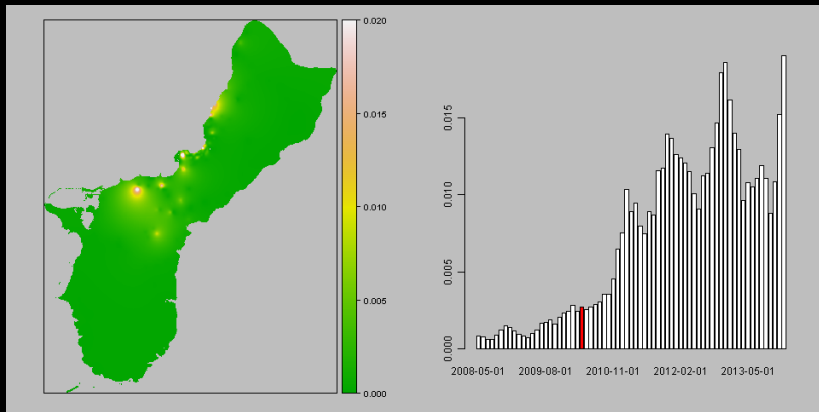
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2010



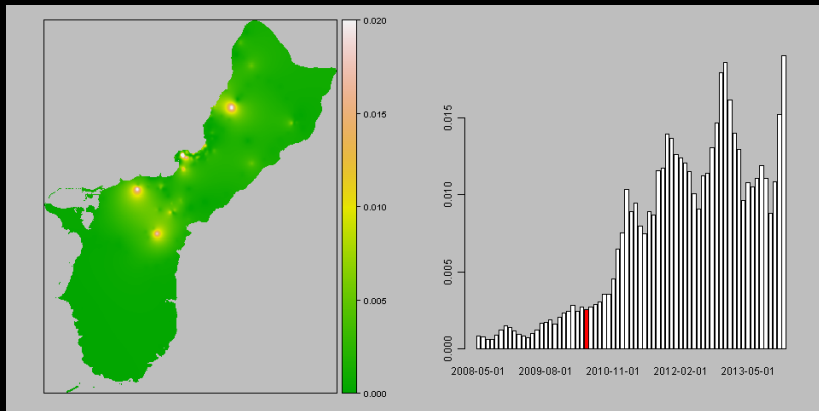
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2010



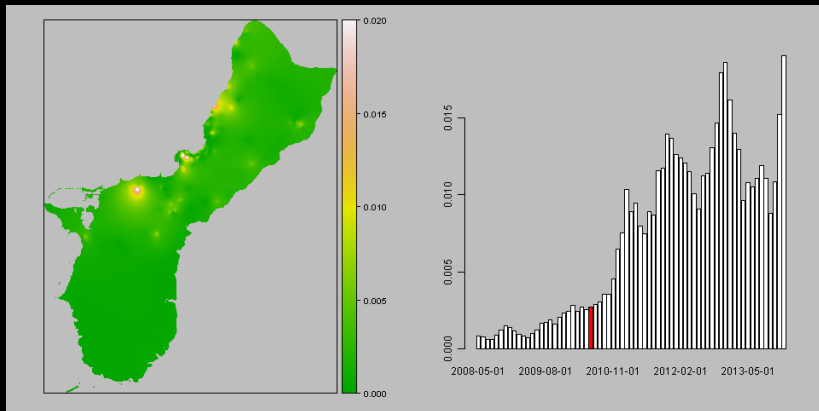
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2010



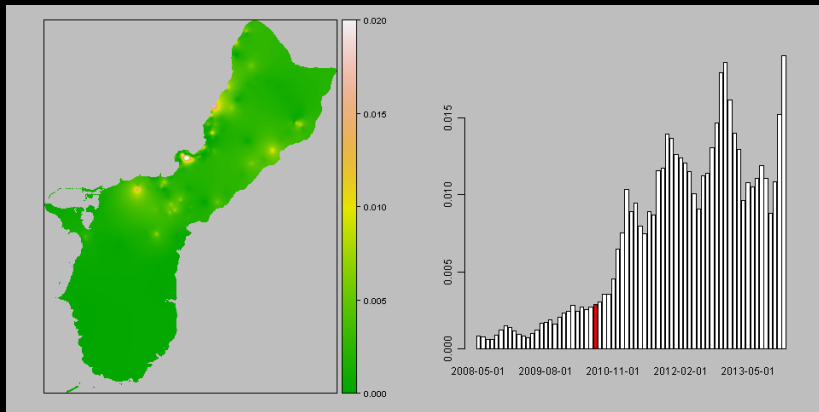
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2010



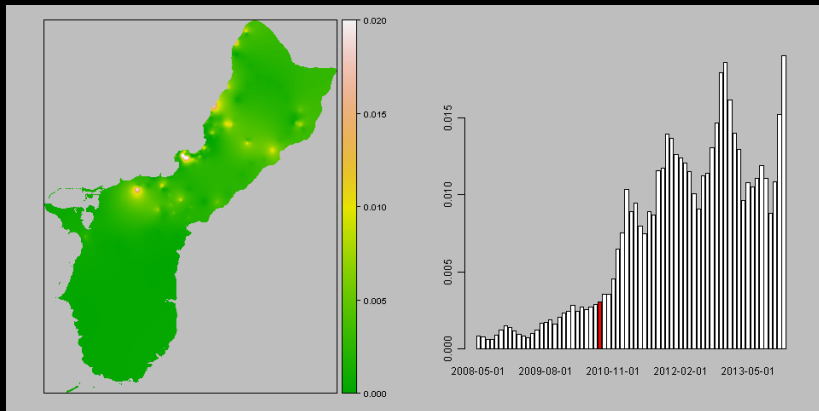
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2010



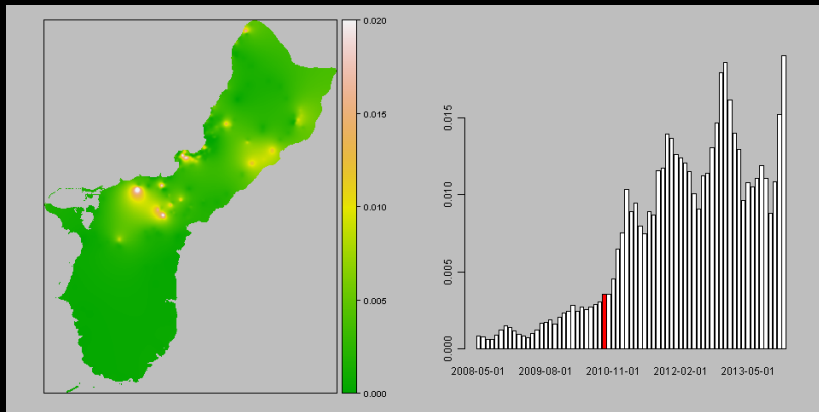
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2010



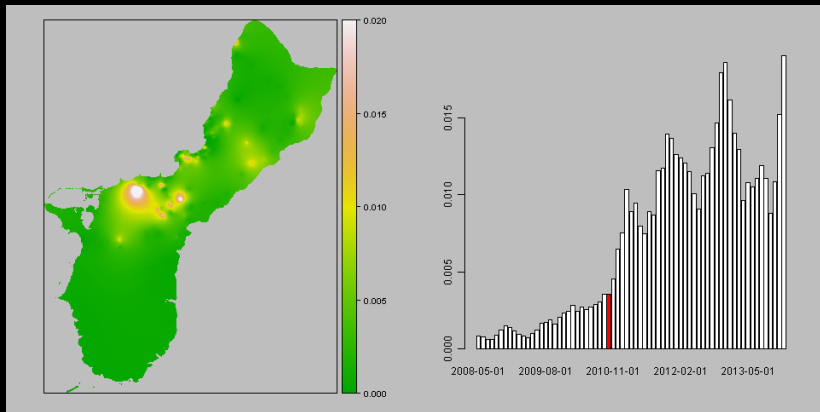
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2010



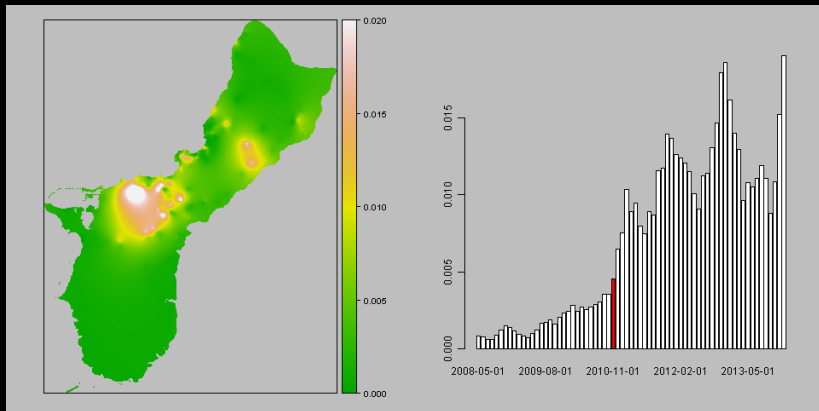
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2010



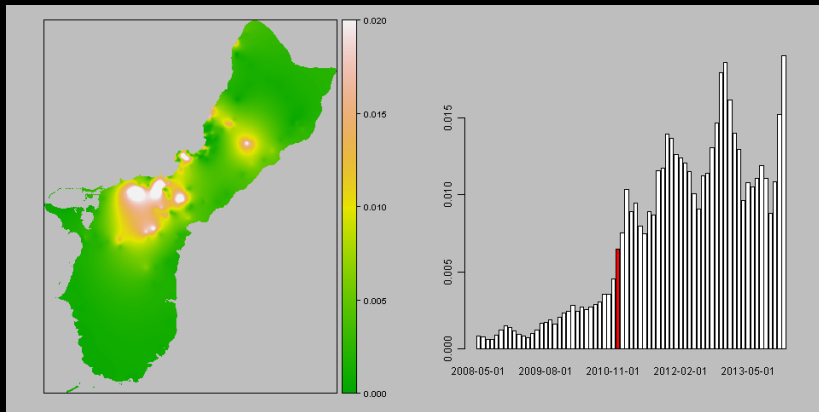
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2010



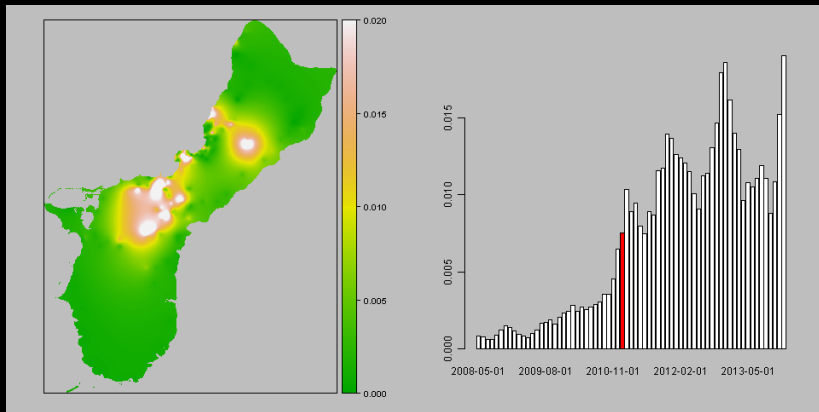
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2010



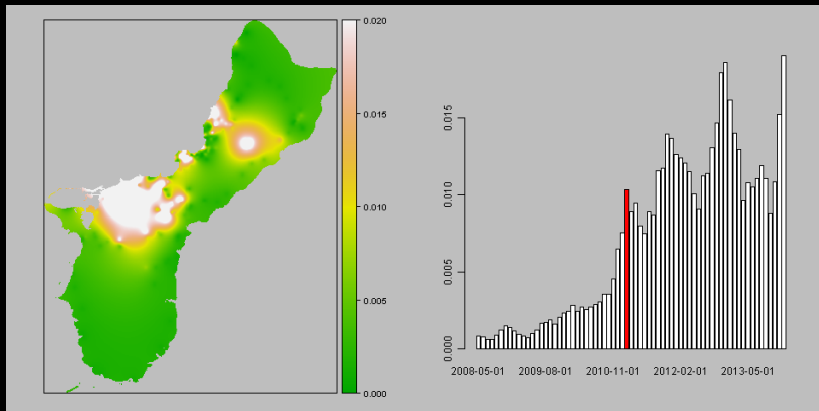
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2011



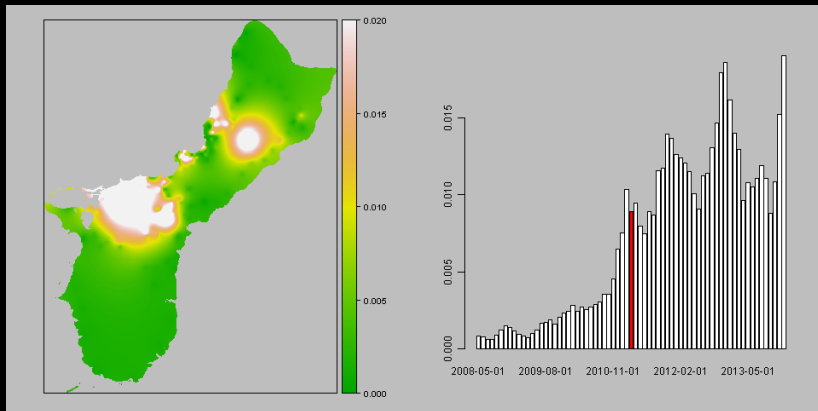
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2011



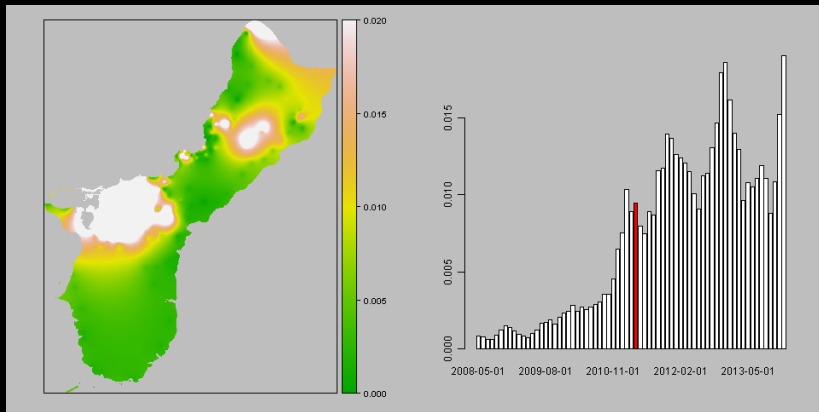
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2011



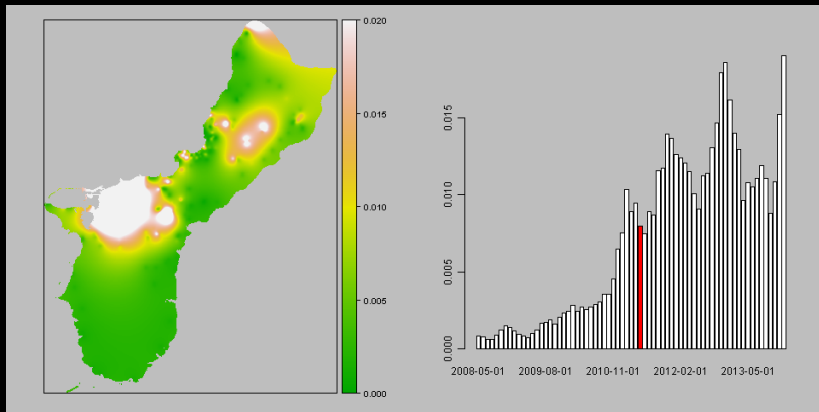
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2011



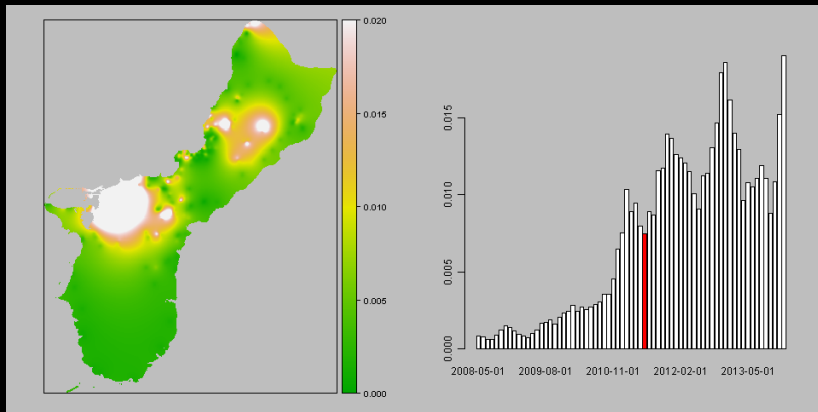
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2011



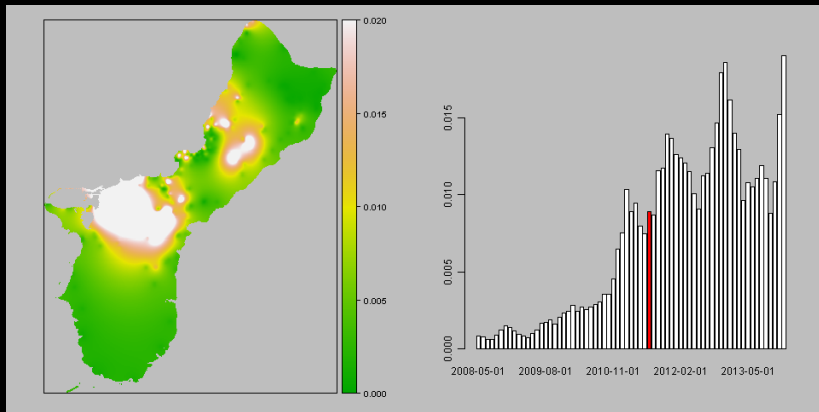
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2011



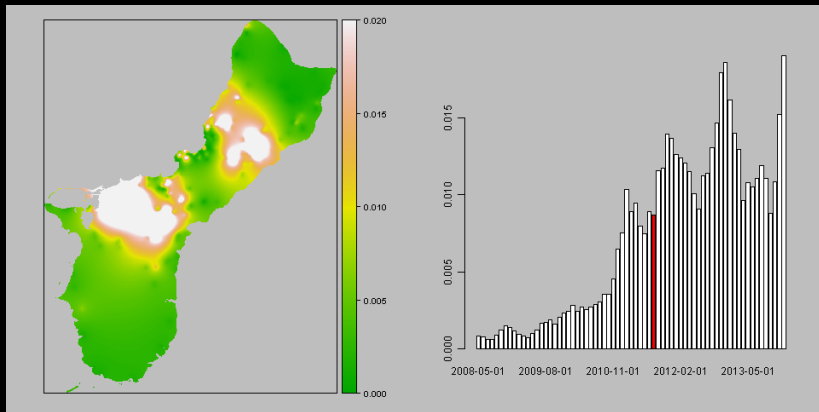
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2011



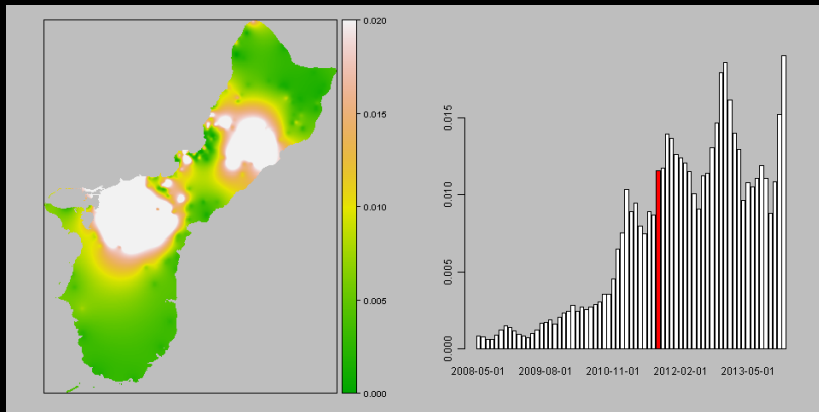
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2011



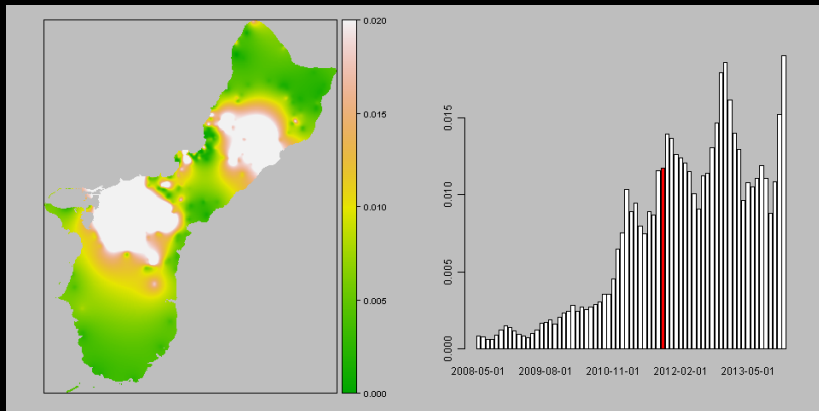
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2011



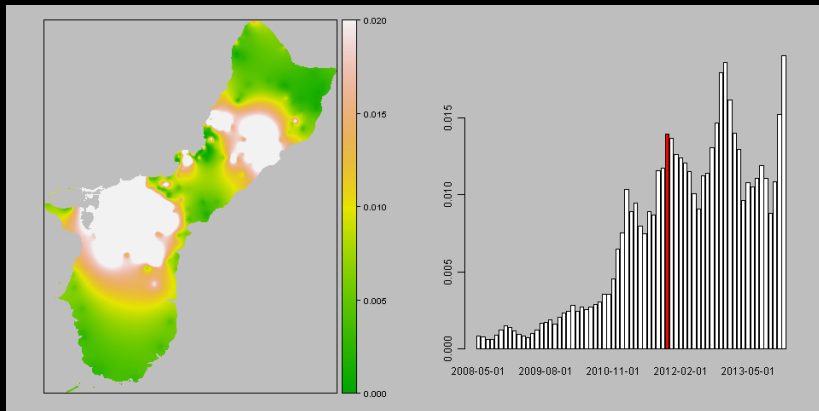
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2011



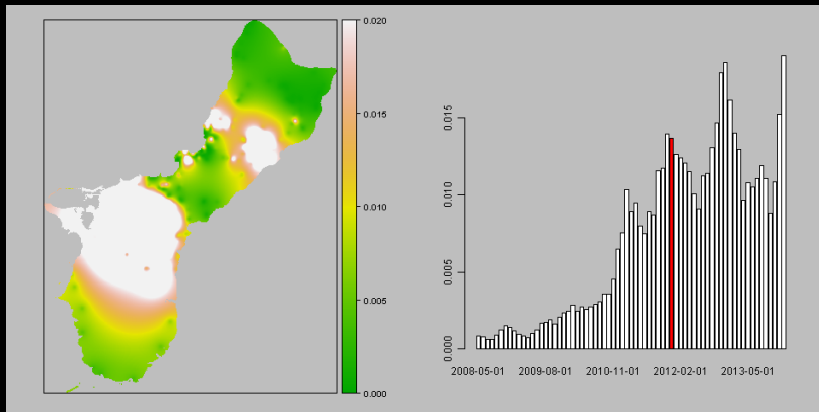
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2011



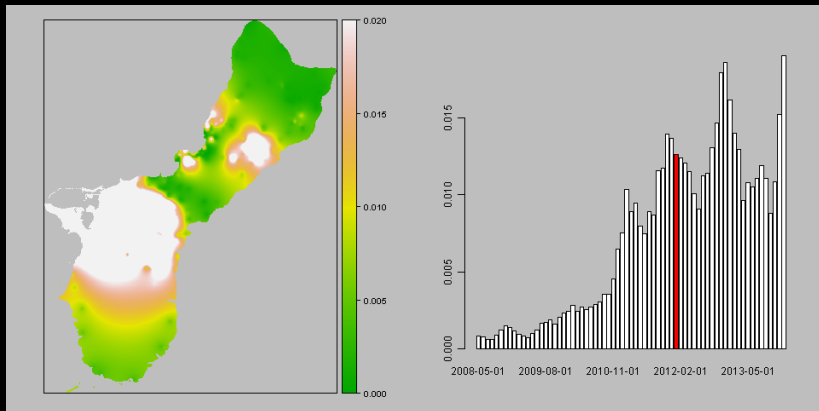
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2011



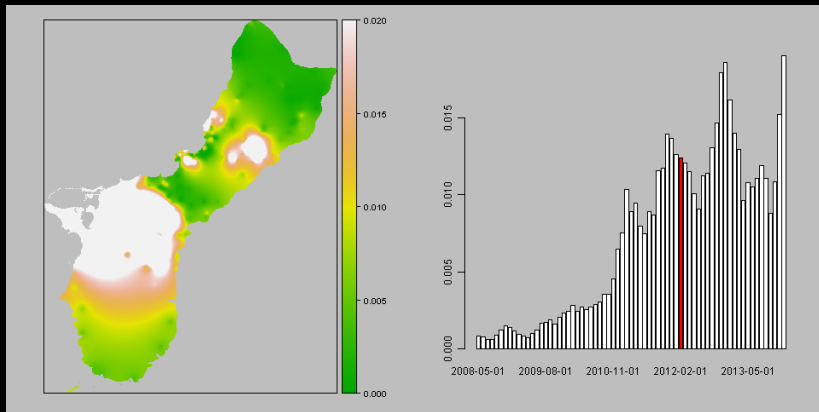
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2012



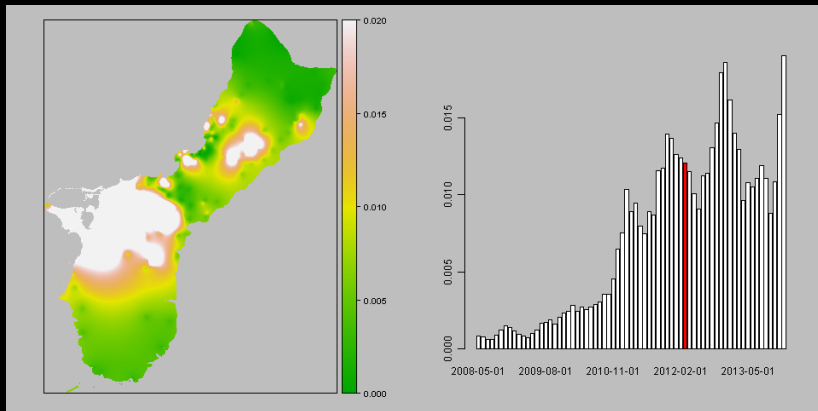
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2012



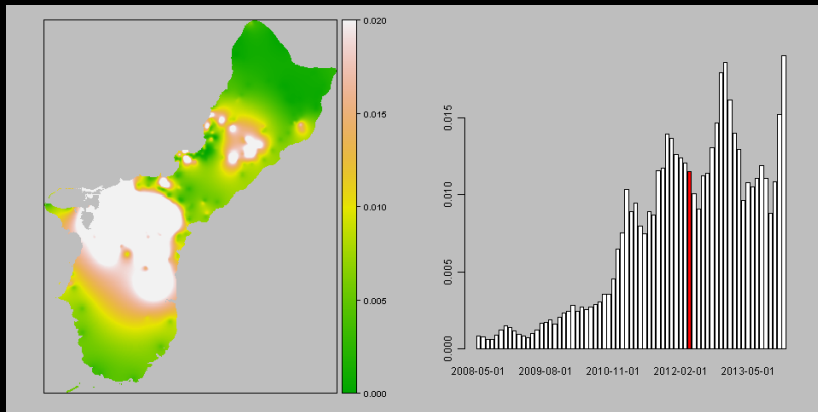
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2012



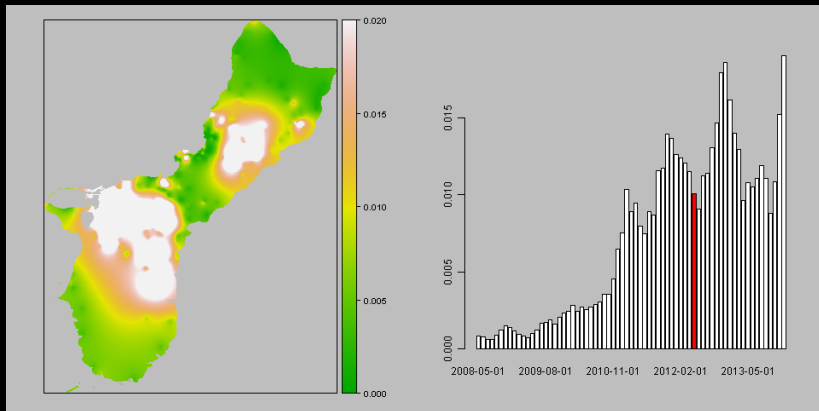
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2012



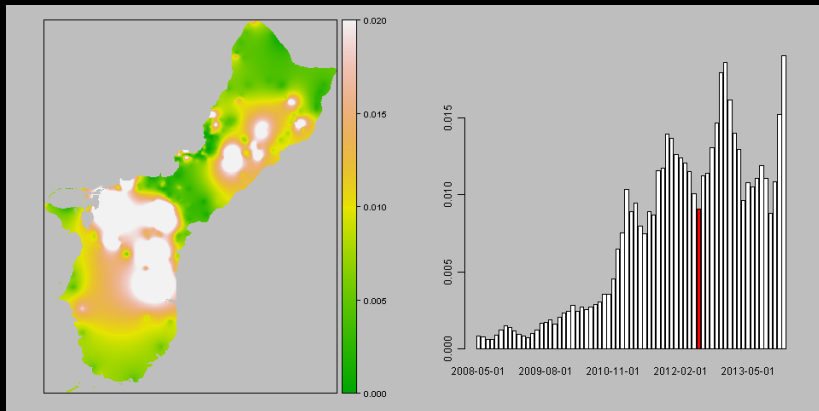
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2012



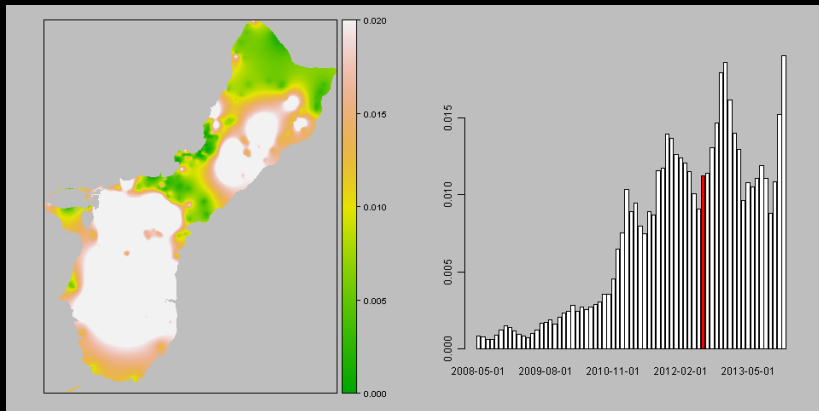
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2012



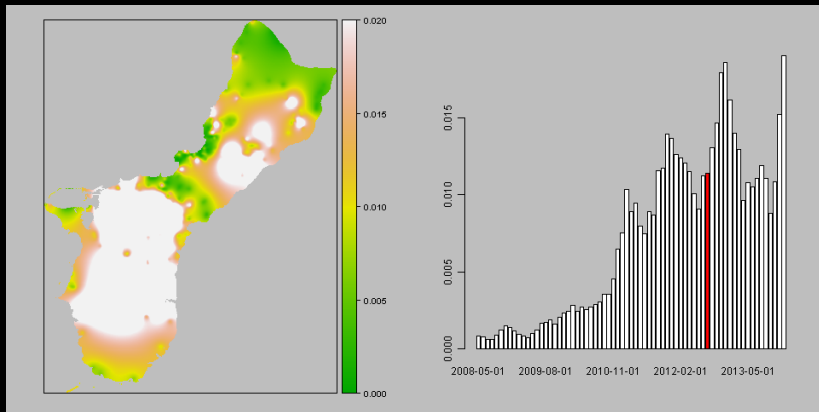
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2012



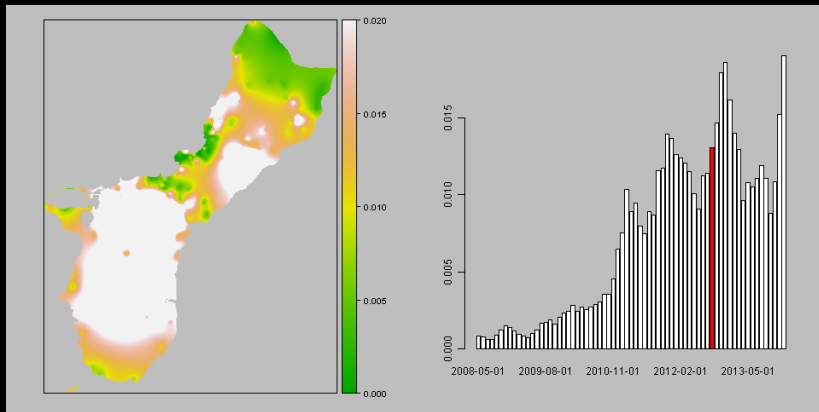
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2012



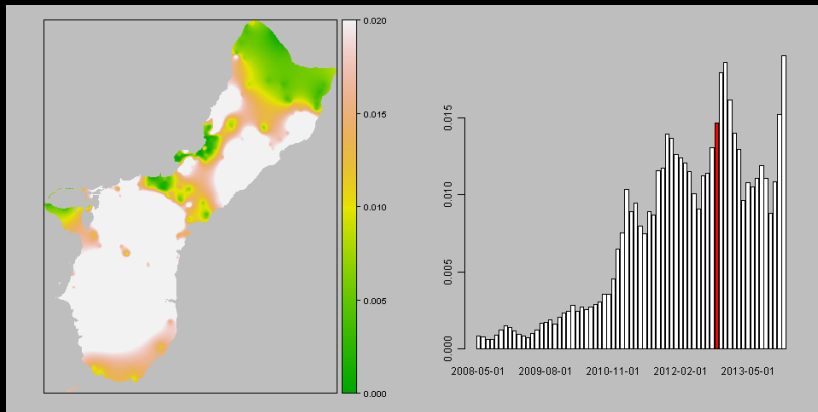
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2012



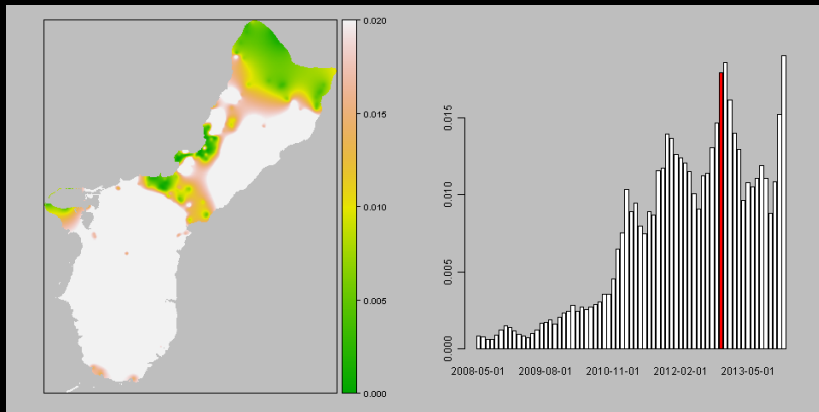
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2012



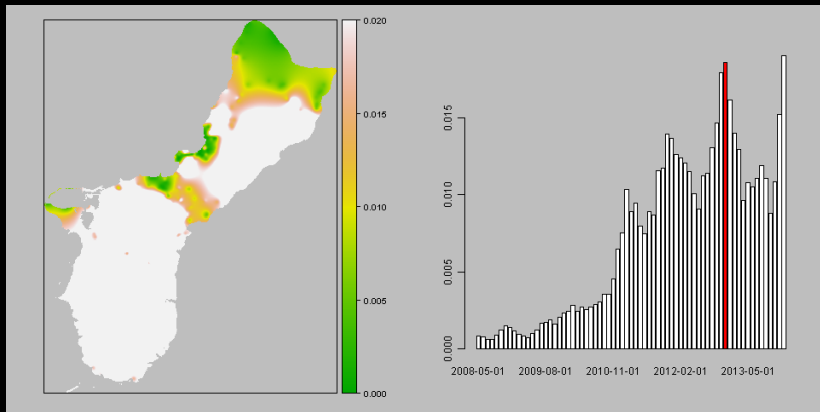
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2012



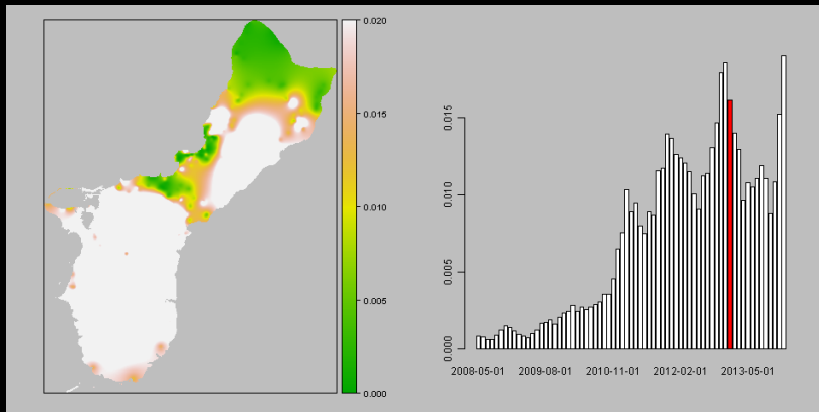
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Dec 2012



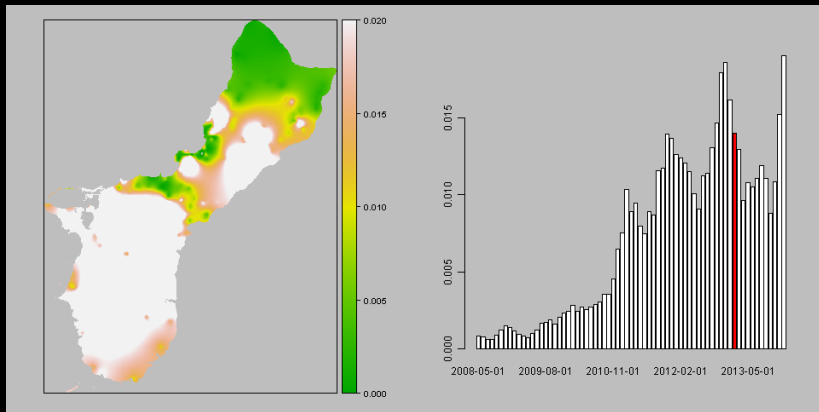
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jan 2013



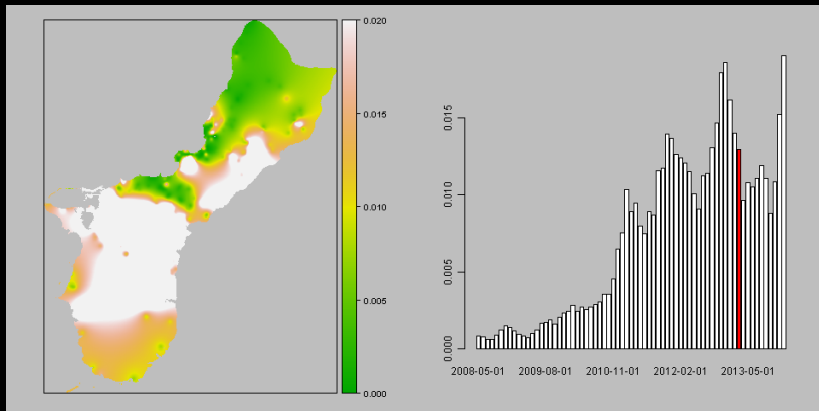
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Feb 2013



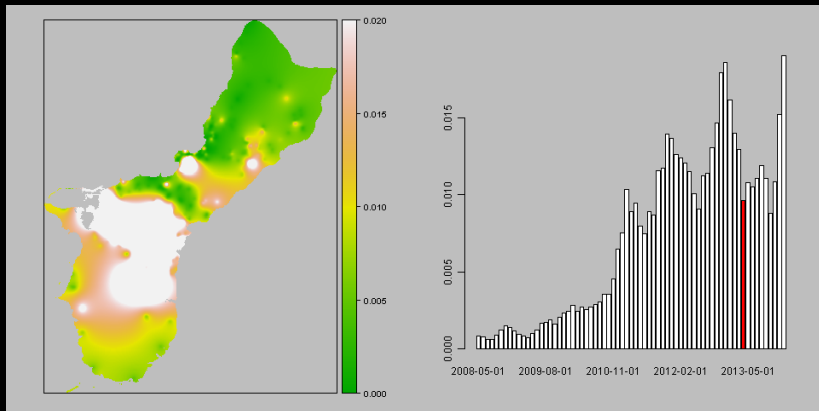
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Mar 2013



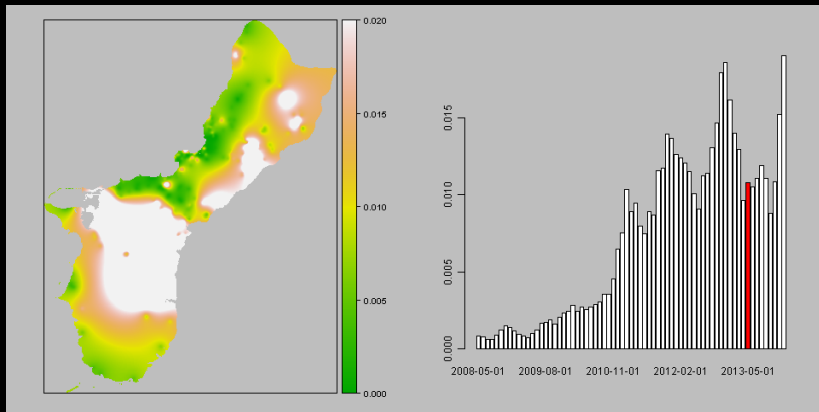
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Apr 2013



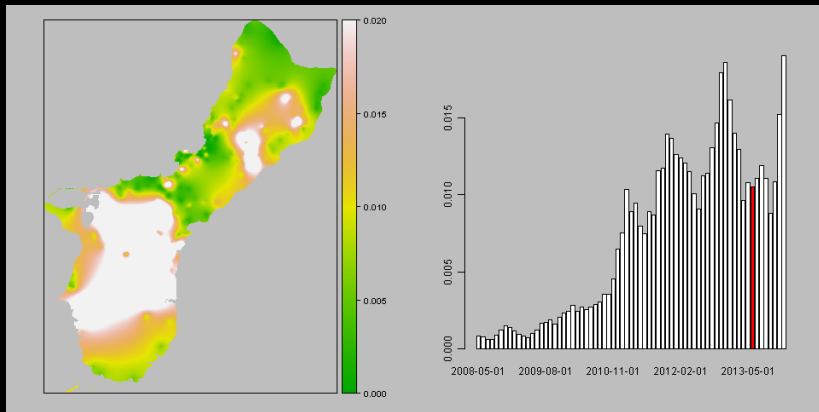
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 May 2013



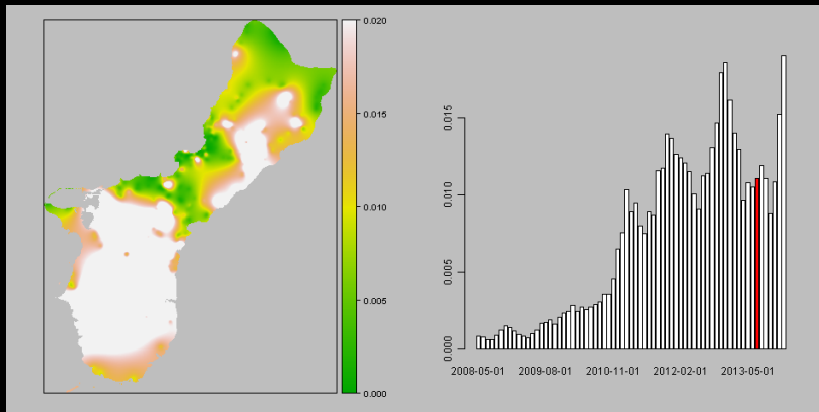
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jun 2013



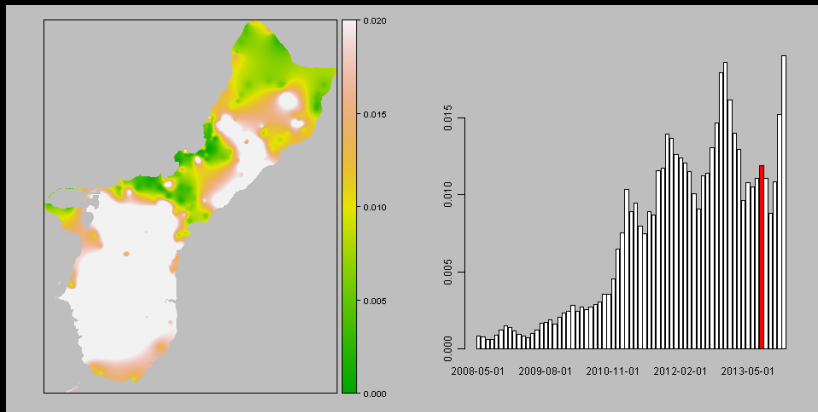
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Jul 2013



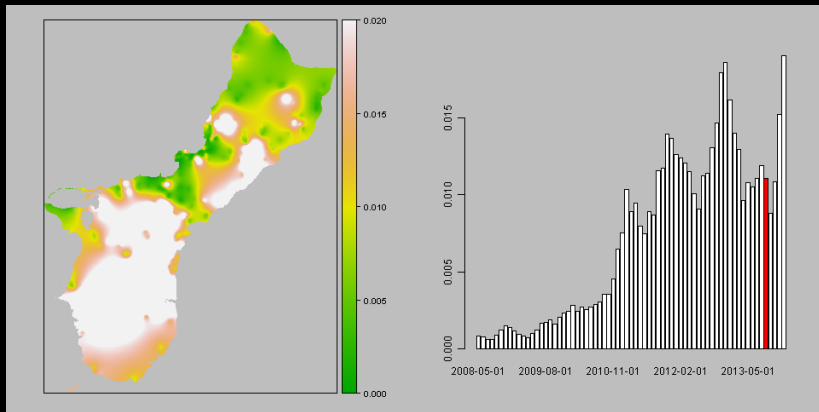
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Aug 2013



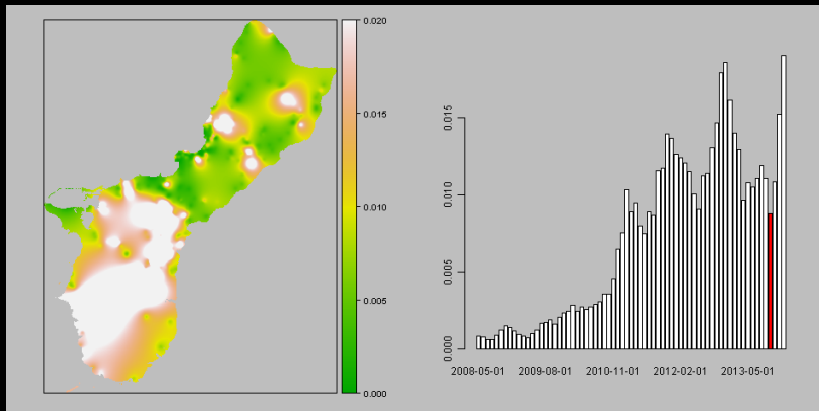
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Sep 2013



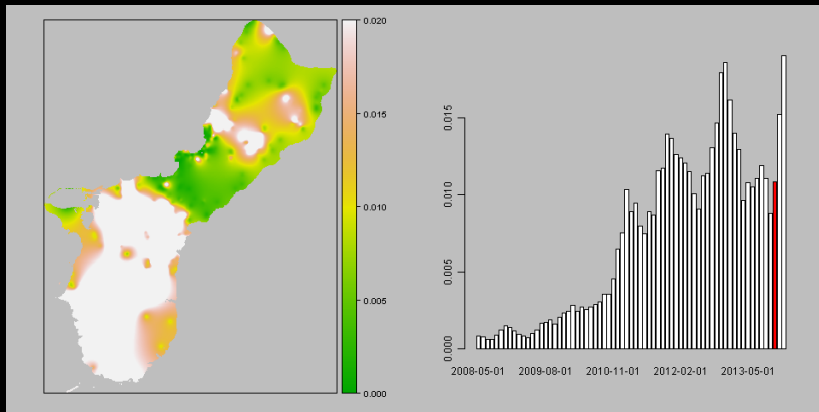
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Oct 2013



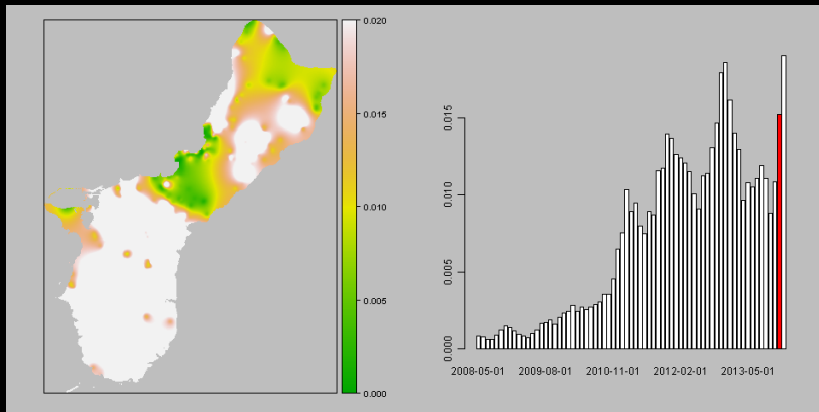
Mean number of beetles caught per trap-day

90 day trapping period ending on 01 Nov 2013



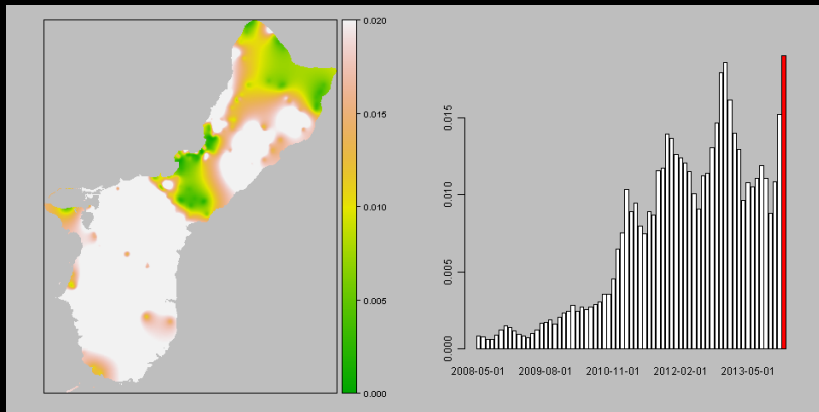
Mean number of beetles caught per trap-day

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)



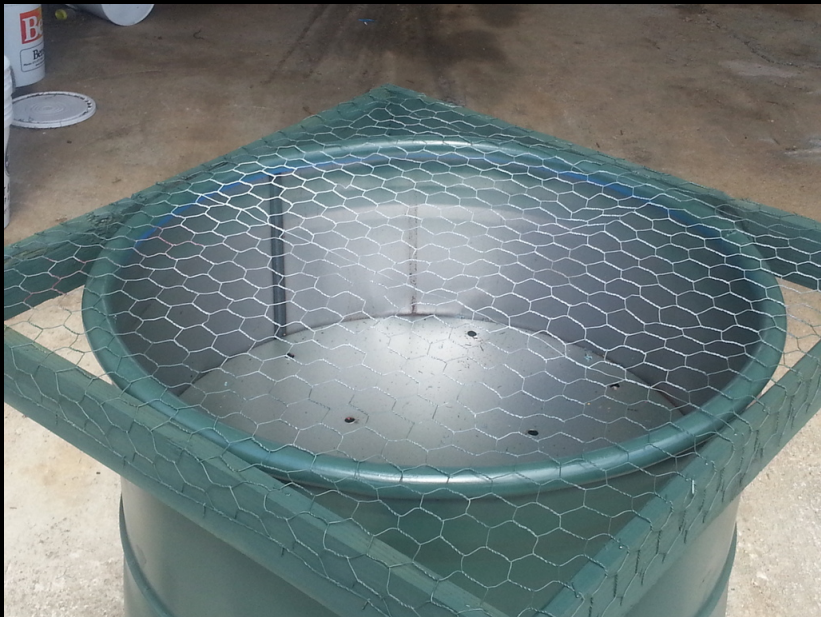
Development of the Hotel California Trap



“Beetles Check In But Can Never Leave”







Enhanced Pheromone Trap: >3X Standard Trap Catch



Barrel Trap V2: $>10X$ Standard Trap Catch




A man wearing a white polo shirt with pink trim on the collar and sleeves, black shorts, and a white cap with a dark brim is standing in a dense tropical forest. He is looking down at the ground. In the foreground, a large, thick, weathered log lies horizontally across the frame. The forest is filled with various green plants, including palm trees and broad-leafed shrubs. The background shows more trees and a glimpse of a building on a hillside under a bright sky.

Sanitation







GRUBS – 296
PUPAE – 41
ADULTS - 15



DANGER
RESTRICTED
AREA

2007/12/09

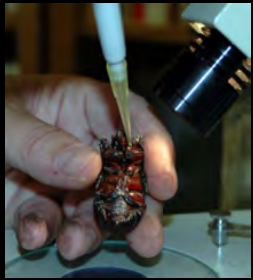


2007/12/11

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

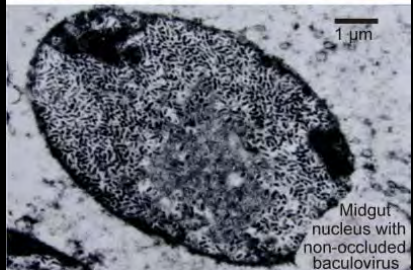
Spraying Crowns with DEMON MAX (Cypermethrin)



Efficacy of Crown Spraying



BIOCONTROL









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

