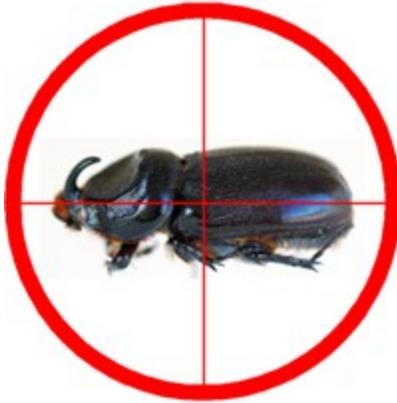


**Guam Coconut Rhinoceros Beetle
Eradication Project**



Guam Coconut Rhinoceros Beetle (CRB) Eradication Program Semi-annual Progress Report

**prepared by
Dr. Aubrey Moore, Entomologist
University of Guam Cooperative Extension Service
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**for
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Coconut palm at Oka Point killed by CRB

Background

During September 2007, an infestation of the coconut rhinoceros beetle was discovered along the beach of Tumon Bay. Without significant control efforts, CRB can be expected to kill at least 50% of Guam's coconut palms and related plants, as it did within a few years of its arrival in Palau during the Second World War. A thorough delimiting survey and risk assessment undertaken by the University of Guam, the Guam Department of Agriculture, and the USDA indicated that the population was localized and could be eradicated before it dispersed to other parts of the island. This progress report outlines the current status of the eradication project which has been in operation for about 18 months. A critical needs assessment, written in February 2009, is attached as an appendix.

Funding. The project is currently supported by a \$198,000 grant from USDA-APHIS and \$254,000 from the USDA Forest Service. Both grants are administered by the University of Guam. Most of the grant money is allocated for temporary hires to staff the project, for pheromone lures, and for fuel and maintenance for project vehicles. A \$500,000 allocation from the Government of Guam is pending.

Project Management. The project is managed as an emergency Incident Command System (ICS) under the command of Dallas Berringer, USDA-APHIS Port Director, and Paul Bassler, Guam Department of Agriculture Director. Dr. Russell Campbell, the Territorial Entomologist, and Dr. Aubrey Moore, UoG Extension Entomologist provide scientific/technical support for the project. Roland Quitugua has been contracted by the University to work as project manager. The ICS holds a planning meeting every Monday morning and participates in a conference call with funding agencies and collaborators every second Thursday.

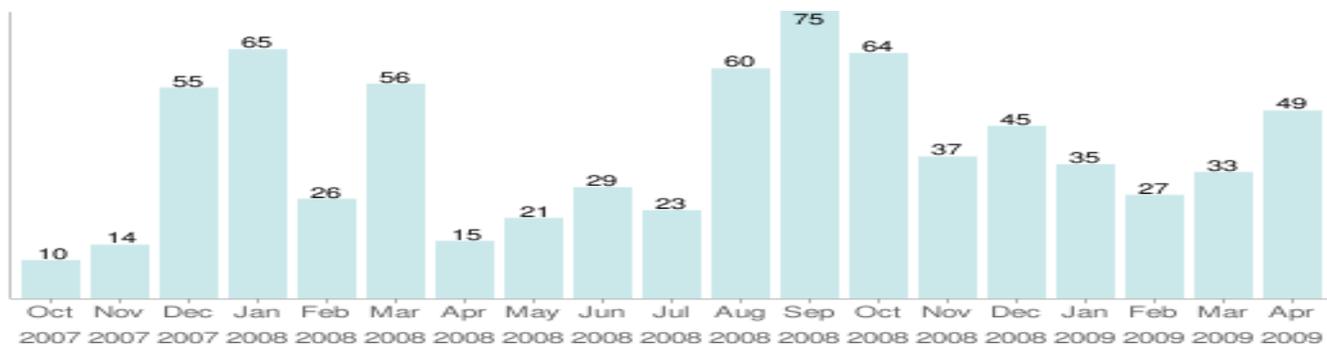
Staffing. A field crew of eight part-time employees has been hired by the University.

Eradication Activities. The eradication project employs two major tactics: sanitation and trapping. Sanitation is focused on detection of breeding sites. CRB breed mainly in dead coconut material. When breeding sites are detected, all potential food for CRB grubs must be removed and sanitized. Pheromone traps are baited with Oryctalure®, a commercially available aggregation pheromone which attracts both sexes. They are used to reduce adult populations in infested areas and to detect geographical spread of the infestation. Currently, about 1,500 traps are deployed and these are visited biweekly.

Data Collection and Record Keeping. A daily log of all activities is maintained and a weekly report is prepared and distributed as per ICS standard operating procedure. Trapping data, detections of CRB grubs or adults, and observations of CRB defoliation and bore holes are entered daily into a web-based georeferenced database. Data from this database is publicly accessible from a wiki page at <http://tinyurl.com/Guam-CRB-DB>. Links on this page enable the user to view trap catch data as a spatiotemporal display using a Google Earth animation, view monthly trap catch as a graph and chart, and prepare trapping data for upload to NAPIS. Other project output including fact sheets, technical reports, media coverage, and images are publicly from a wiki page at <http://tinyurl.com/Guam-CRB-info>.

Progress

The infestation has spread along the northwest coast of Guam. There is an isolated breeding site in Agana and one in Uranao (see map at end of Appendix). The main infestation extends from Tumon Bay to Tanguisson Beach. Breeding sites have not been detected in other parts of Guam. Within Tumon, incidence of RCB damage to coconuts has increased dramatically with the past few months, but only a few trees have been killed by the CRB. The number of beetles caught in traps has not changed significantly since the start of the program, indicating that eradication activities are preventing an expected population explosion. However, current activity is not aggressive enough to depress the population towards extinction.



Monthly trap catch; 739 CRB trapped; 21,354 trap visits

Impediments to Progress

Materials Handling Problem. Proper disposal of rotting coconut material collected from breeding sites by the sanitation crew in addition to handling a continuous stream of potentially infested green waste from hotel landscapes has become a major problem. The original eradication plan called for composting the organic material. The composting process generates enough heat to kill CRB and other insects and quickly converts the rotting coconut into compost which cannot be used as food by the CRB. This compost would then be used to enrich the soil at hotel sites throughout Tumon. The whole operation was to be done without transporting any potentially infested material out of the infested area, thus eliminating the risk of accidentally spreading CRB to other parts of the island. Unfortunately, the project ran into a materials handling problem. The first step in composting is to reduce the material into small chunks using a chipper. Project personnel have not been able to find a chipper on island that is suitable for wet, fibrous coconut. All the machines tried to date clog in much the same way that a lawnmower clogs on a rainy day. A chipper which is designed to handle our material has been sourced and will be purchased using part of the \$500,000 from GovGuam. The current process is very unsatisfactory, very expensive, and very “ungreen”:

- potentially infested material is loaded into roll-off bins and trucked to Oka Point
- material is unloaded, sealed in a tarp, and fumigated with methyl bromide to kill all insects
- material is reloaded, trucked to a hard fill in the north of Guam and buried

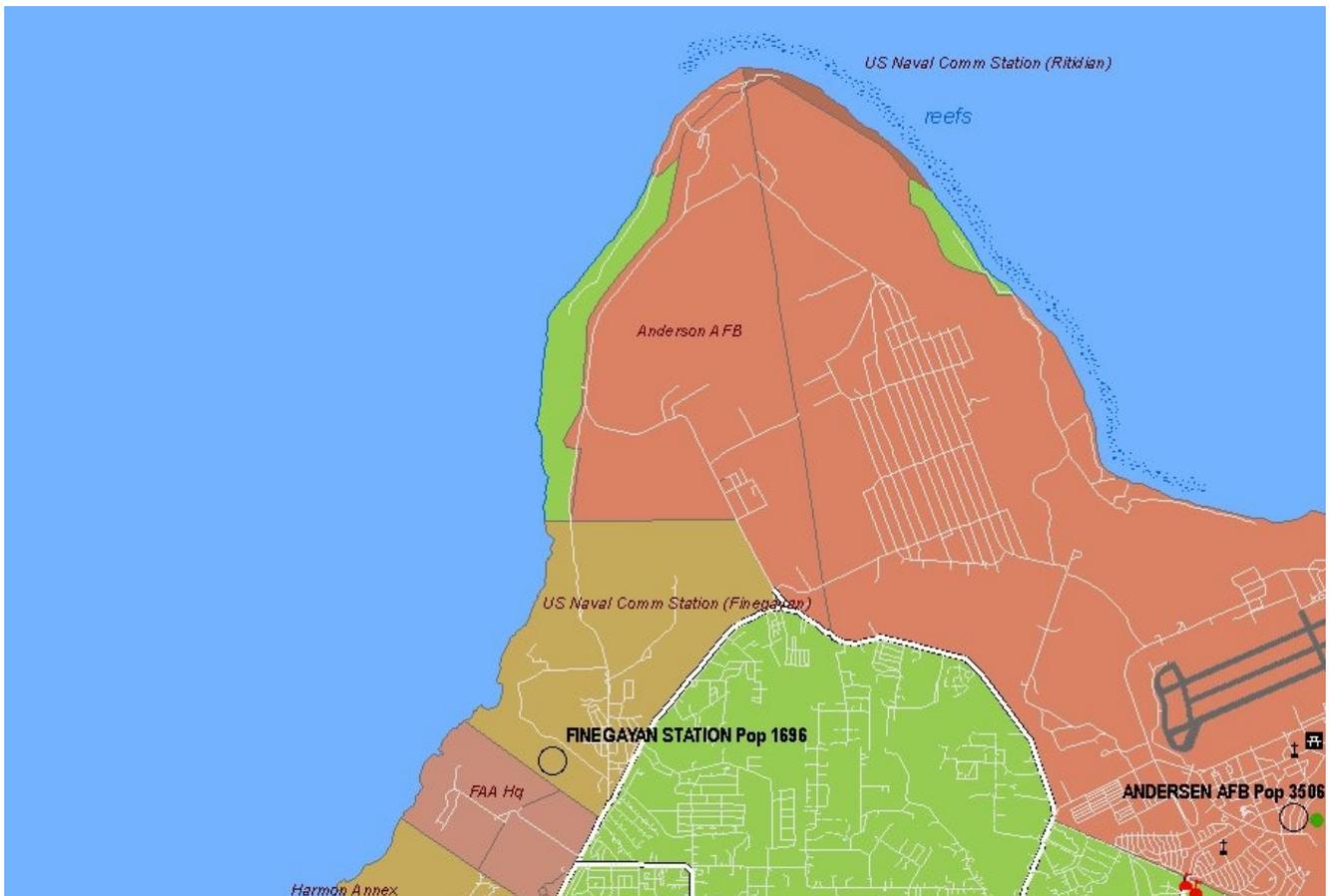
Acquisition of suitable equipment for establishment of a composting operation will eliminate the need for fumigation. Chipping will greatly reduce the volume of material to be handled, and the valuable organic material will be returned to the community instead of adding to unnecessary solid waste in the hard fill. If successful, the composting operation could become a model for dealing with green waste after typhoons.

Low Trap Efficacy. Surveys of CRB damage to coconut palms in Tumon Bay hotel landscapes indicate that trees are not being adequately protected despite a very high density of traps intended to intercept adult beetles before they attack trees. In addition, none of six marked adult males released in the middle of the mass trapping were trapped. We have tried augmenting attractiveness of the pheromone traps by adding rotting coconut vegetation, and by trap design changes including addition of battery operated lights. None of our trap modifications have resulted in a significant increase in trap rate.

Low Insecticide Efficacy. We had originally planned to protect high value trees using prophylactic insecticide applications. We tried crown applications of granules and liquids and also injected several systemic insecticides into trunks and petioles. Lab bioassays of plant tissue samples did not result in any significant mortality. Nor did bioassays in which systemic insecticides were pipetted directly into the mouths of beetles.

Access to Military Land. Approximately one third of Guam's land is controlled by the U.S. Military. To date, we have not received permission to enter land controlled by the navy or the Air Force for the purpose of surveying for CRB. The project has an active collaboration with civilian biologists working for the Navy. These biologists maintain and check about 15 traps for us on the naval base at Apra Harbor and on the Naval Communications Station. We do not have a similar arrangement with the Air Force to help with monitoring traps.

Two areas controlled by the military of immediate concern. The Naval Communication Station sits between two areas where we have found and removed CRB breeding sites, namely Tanguissan Beach and Urunao (indicated by the two northernmost clusters of blue points on the map at the end of the Appendix). The other area is the western part of Andersen Air Force Base which is adjacent to the known infestation at Urunao. To date, we have been unable to secure permission to do a ground survey of these areas. It is probable that breeding populations of CRB will be found in one or both areas.



Map of northwestern Guam showing land controlled by the U.S. Military

New Initiatives

Dogs for Rapid Detection of Breeding Sites. It is likely that dogs can be readily trained to detect CRB breeding sites quickly and efficiently. APHIS is cooperating with the Guam Customs and Quarantine Canine Unit to select and train dogs for this purpose.

Acoustic Detection. A Western IPM Special Issues grant brought Dr. Richard Mankin , USDA-ARS-CMAVE to Guam in May 2008 to investigate the feasibility of using acoustic detection to find CRB adults and grubs. Two weeks of field study showed that the sensitive equipment used by Mankin could readily detect feeding sounds and stridulation communication sounds of both larvae and adults by a skilled operator when ambient noise levels are low during periods of no rain and low wind. One journal article on this study has already been published and a second is in preparation.

Testing of Potential Attractants. A CRB damage survey of coconut palms growing on the grounds of the Pacific Islands Club Resort in Tumon discovered a cluster of badly damaged trees centered on an outdoor spa where aromatherapy is practiced and were several types of body lotions are used. Moore hypothesized that one or more of the products may have attracted CRB adults into the area and mentioned this swag to a high school student in search of an interesting science fair project. The student purchased an assortment of chemicals from the spa, built a crude four-armed ambulatory olfactometer and tested adult beetles with it using the commercial available aggregation pheromone as a positive control. One of the lotions, “Body Butter” was highly attractive to the beetles; about half as attractive as the pheromone. Plans are to refine the experiment and determine the attractiveness and chemical identity of the active ingredient in the “Body Butter”.

APPENDIX

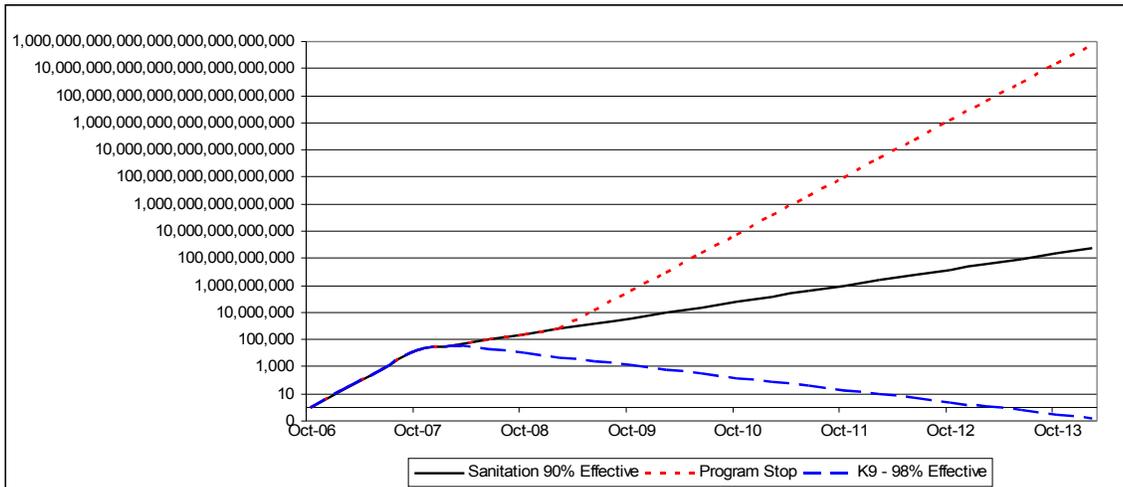
Guam Coconut Rhinoceros Beetle Program Critical Needs Assessment February 2, 2009

The purpose of this brief is to identify critical elements needed to support the CRB program. These elements are considered essential for successful eradication of this pest. This assessment is a product of collective agreement by Dallas Berringer, USDA APHIS; Dr. Russell Campbell, Guam Department of Agriculture; Dr. Aubrey Moore, University of Guam; and Roland Quitugua, Guam Northern Soil and Water Conservation District.

Summary

The window of opportunity to eradicate CRB from Guam is rapidly closing. Indeed it may be only a matter of a few months until it is closed unless significant effective support is provided. There are one major infested area and three minor infested areas known on Guam. CRB attacks on secondary hosts (fan palms) were discovered within the past two weeks. Undiscovered infestations are highly probable between Faifai Beach and Urunao. There are immediate needs of \$139,000 to train and maintain two detector dog teams and \$50,000 for treatment of backlog infested materials. Detector dogs are necessary for success in eradication; without efficient detector methodology eradication is improbable.

The chart below illustrates three possible scenarios for CRB population growth displayed on a log scale: (1) sanitation program that is 90% effective, an estimate of the past year's effort; (2) program that is stopped due to lack of support; and (3) implementation of a detector dog unit that improves sanitation to 98% effectiveness. All three scenarios use assumptions of a four month life cycle for CRB, 100 eggs per female, 50:50 male/female ratio, and 50% natural mortality.



Three alternatives are presented with associated costs (1) Fund and support the CRB Program to perform all monitoring and sanitation work - \$910,000 declining. (2) Fund the CRB Program to monitor and detect infestations and turn over sanitation work to landowners and/or village Mayors - \$154,000. (3) Do nothing - \$23,000.

Background

An infestation of the coconut rhinoceros beetle (CRB), *Oryctes rhinoceros*, was detected on Guam on September 12, 2007. Delimiting surveys indicated that the infestation was limited to Tumon Bay and Faifai Beach, an area of approximately 900 acres. The quarantine area was expanded to about 2,500 acres in October 2007 when additional discoveries were detected and expanded again to about 28,360 acres a year later. See attached map.

Actions, based upon available literature and professional concurrence, designed to lead to eradication of CRB from Guam were: (1) sanitation - the removal of breeding sites, (2) trapping adults, and (3) prophylactic tree treatment. Refer to the *Coconut Rhinoceros Beetle Eradication Project, Environmental Assessment, December 2007* and the *Coconut Rhinoceros Beetle Cooperative Eradication Program Strategic Plan, December 2007 Draft* for specific details of actions. It was predicted that all three of these actions would need to work in unison for eradication to be successful. Applied research during the first year proved that traps were not as effective as initially thought and were disregarded as a significant factor for eradication; although significant for monitoring CRB movement. Prophylactic tree treatments also proved ineffective as no pesticide tested caused significant mortality in adult CRB at field application rates. Sanitation alone cannot result in eradication without an efficient method to detect breeding sites followed by an effective method to detect adult CRB in live trees.

The inability of the Government of Guam to process payments to contractors performing sanitation work resulted in a stoppage of work for a period of about four months. Funding from the U.S. Forest Service was acquired and allocated through the University of Guam to hire a temporary work force to continue the sanitation work. Problems of Government of Guam delays in processing agreements with APHIS and releasing funds to the project resulted in other significant work delays.

Despite a declaration of emergency signed by Governor Camacho there was very little support from Guam agencies for the project. Only one Guam employee was available for full time leadership assignment, two additional leaders were hired, and two were detailed in from off-island. The shortage of human resources, especially for leadership positions, had significant impact on the project's ability to coordinate involvement from stakeholders and to improve program effectiveness.

Treatment and disposal of infested or potentially infested material resulting from sanitation cleanup proved problematic as burning was of limited use, no deep burial sites were available, and composting was logistically not possible. Despite the expense, fumigation was the principle method of treating infested material collected from breeding sites, followed by disposal at a hard fill site.

Project scientists consider that eradication is still possible so long as CRB infestations remain in open beach areas and CRB inhabit only primary host (coconut) feeding and breeding material and the number of infestation sites remains limited. Abandonment of the eradication effort and implementation of a control strategy would be prudent if any of the following conditions occurred: (1) infestation was discovered within inland jungle areas, (2) CRB moved to secondary hosts such as pandanus, or (3) more than one significant infestation or four minor infestations became established.

The CRB program received funding in fiscal year 2008 from USDA APHIS - \$386,000; US Forest Service - \$100,000; and Government of Guam - \$100,000.

Current Situation and Need

USDA APHIS has been the sole source of new money thus far for fiscal year 2009, contributing \$107,000.00 under a continuing resolution limit. These funds are estimated to run out about May 1, 2009 when an additional \$143,000.00 is anticipated from APHIS. The US forest Service has indicated additional support.

An efficient detection method must be implemented immediately for efficient discovery of breeding sites. The use of detector dogs has the highest probability to fulfill this objective. Guam Customs and Quarantine Agency and APHIS Wildlife Services both have the capability to select and train canine teams. Funding to support detector dogs is needed. C&QA estimated the cost to be about \$73,000 to source and maintain two teams and an additional \$70,000 for C&QA personnel salaries to provide training. Six months would elapse from the moment funds are available until dog teams were trained and working.

Equally important and most urgent is the need for funding treatment of infested material collected from breeding sites. There is currently a backlog of about 53,000 cubic feet of infested material that requires some form of treatment. This is about 75% of the total amount fumigated last fiscal year by the program at a cost of about \$37,000 and the total volume is estimated to be significantly greater this year. Hotel property owners have recently complained of the cost of fumigation and disposal citing reduced tourism revenue. Composting is being reviewed as a viable alternative to chemical treatment and could also provide a source of revenue to help fund the program. The ability of program personnel to perform sanitation is limited. Heavy equipment and personnel is needed to load and haul material for treatment and disposal. A request for \$250,000 was made to Guam for funding this need and treatments. No funding has been allocated from Guam for fiscal year 2009 to date.

In collaboration with USDA-ARS, the program conducted research on development of acoustic detection methodology that enables effective detection of adult CRB in live trees. This technique will only be beneficial toward the latter stage of eradication.

Human resource availability is at a critical stage. No permanent employees are assigned full time to the project. Only two contract persons are working full time in leadership positions. Two trap checkers and seven laborers are the only other full time temporary personnel working on the project. If full time leadership people cannot be assigned to the project then an alternative to delegate the coordination and work must be implemented as the scope of work exceeds program capabilities.

Consequences of Failed Eradication

Based on historical data from CRB infestation of Palau, it is estimated that approximately 50% of all coconut palms on Guam will be killed. One conservative estimate indicates about 2,000 economically important palm trees in Tumon alone would be lost. If half of those trees were replaced at an average cost of \$2,500 each, the total cost of replacement would be two and one half million dollars. Supply and demand for replacement trees could easily push that figure to ten million dollars. This would be a direct cost within this single important area. Direct costs from other areas and indirect costs will substantially increase the order of magnitude of loss to Guam.

Coconut palms are a major element in preventing beach erosion during heavy rains and typhoons. The loss of coconut palms would significantly increase the incidence of soil erosion on Guam and lead to a decline in marine ecosystem quality.

Additionally, if left unchecked, there will be a CRB population explosion that will pose a significant risk for CRB spreading to Hawaii through various pathways. Even if eradication fails, continued

indefinite support for a control program will be necessary to mitigate the risk of spread to other islands and beyond. The annual cost of an island wide control program would be potentially more expensive than the annual cost of the eradication program and continue indefinitely. A well supported eradication program could result in eradication within four years.

The picture below provides a visual depiction of damage occurring in the Tumon area. Remember that this area has received extensive eradication effort and damage in an uncontrolled scenario could be much greater.



Alternatives for Eradication

1. Full Program. Fund and support the CRB Program to perform all monitoring and sanitation work. Under this alternative leadership personnel would be assigned to the project or hired under temporary authority. Two detector dog teams would be trained and maintained for detection of breeding sites. Adequate labor, equipment, vehicles, and supplies would be funded to perform all monitoring, sanitation, and treatment work. Guam Department of Agriculture would have direct control of all actions. Estimated cost for this alternative is about \$910,000 for the first year declining annually for four years as the CRB approaches eradication.

Alternative 1 - Full Program		
Personnel		
	\$ 217,984.00	cost for 16 sanitation/treatment personnel at \$6.55/hr
	\$ 54,496.00	Cost for four trap checkers at \$6.55/hr
	\$ 13,624.00	cost for 1 administrative assistant/GIS at \$6.55/hr
	\$ 100,000.00	Cost for two professional level leaders
	\$ 56,160.00	Cost for three technical level leaders at \$9.00/hr
	\$ 35,381.12	fringe benefit cost at 8%
	\$ 477,645.12	Subtotal
Supplies		
	\$ 22,100.00	Pheromone lures
	\$ 5,000.00	trap replacement
	\$ 18,000.00	fuel for vehicles
	\$ 2,500.00	Insecticides
	\$ 2,500.00	Personal protection equipment
	\$ 5,000.00	Tool replacement
	\$ 2,000.00	Office supplies
	\$ 6,000.00	Public outreach material
	\$ 63,100.00	Subtotal
Vehicle/Equipment Maintenance		
	\$ 6,000.00	maintenance
Services		
	\$ 150,000.00	Fumigation and disposal cost (4/month)
	\$ 144,000.00	Backhoe/truck rental
	\$ 294,000.00	Subtotal
Canine Unit		
	\$ 75,000.00	maintenance for two handlers salary and dogs
	\$ 909,745.12	Total

2. Stakeholder Involvement. Fund the CRB Program to monitor and detect infestation and turn over sanitation work to landowners and village Mayors. Under this alternative, two detector dog teams would be trained and maintained for detection of breeding sites. Island wide monitoring and detection work would be performed by the CRB Program. When an infestation is discovered the landowner and village Mayor, or Navy if on DoD lands, would be notified. The Mayor’s office or Navy would secure any needed funding and coordinate sanitation work and treatment. This alternative would provide the most stakeholder involvement and limit control from the Department of Agriculture. Estimated CRB program cost is about \$154,000.00 annually for 6 years.

Alternative 2 - Stakeholder Involvement		
Personnel		
	\$ 27,248.00	Cost for two trap checkers at \$6.55/hr
	\$ 13,624.00	cost for 1 administrative assistant/GIS at \$6.55/hr
	\$ 3,269.76	fringe benefit cost at 8%
	\$ 44,141.76	Subtotal
Supplies		
	\$ 22,100.00	Pheromone lures
		trap
	\$ 5,000.00	replacement
	\$ 4,000.00	fuel for vehicles
	\$ 2,000.00	Office supplies
	\$ 33,100.00	Subtotal
Vehicle/Equipment Maintenance		
	\$ 1,500.00	maintenance
Canine Unit	\$ 75,000.00	maintenance for two handlers salary and dogs
	\$ 153,741.76	Total

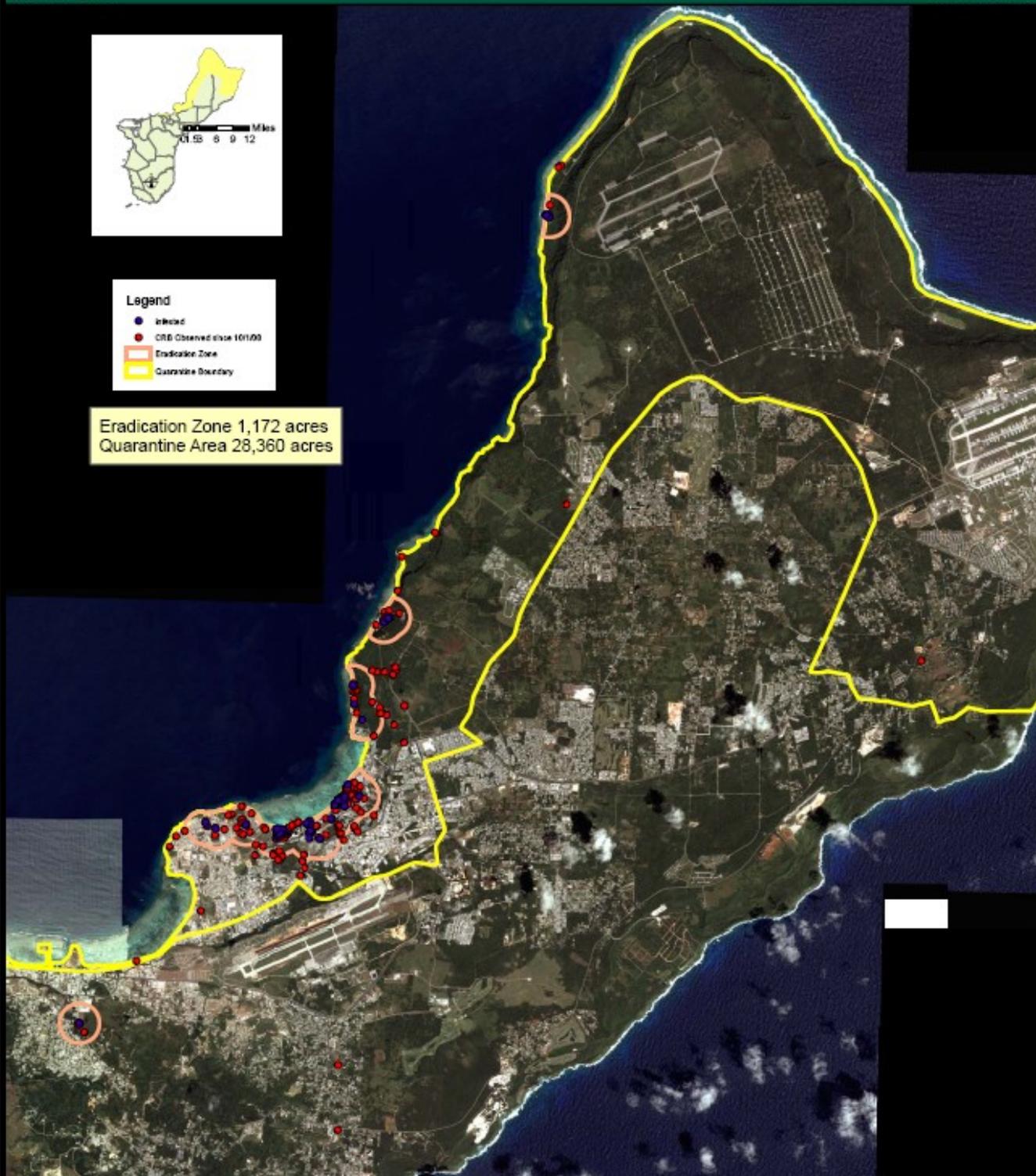
3. Do Nothing. Under the “Do nothing” alternative the CRB program would close down. Any control effort would be the responsibility of the landowner. CRB populations would exceed one trillion in number by 2011. Limited monitoring would continue, costing about \$23,000.00 per year.

Alternative 3 - Do Nothing		
Personnel		
	\$ 13,624.00	Cost for one trap checker at \$6.55/hr
	\$ 1,089.92	fringe benefit cost at 8%
	\$ 14,713.92	Subtotal
Supplies		
	\$ 5,525.00	Pheromone lures
	\$ 200.00	trap replacement
	\$ 2,000.00	fuel for vehicles
	\$ 400.00	Office supplies
	\$ 8,125.00	Subtotal
	\$ 22,838.92	Total

Guam Coconut Rhinoceros Beetle Incident



Eradication Zone 1,172 acres
Quarantine Area 28,360 acres



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