

Coconut Rhinoceros Beetle Report (2 parts)

TECHNICAL REPORT

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Coconut Rhinoceros Beetle Report

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Table of Acronyms

| | |
|---------|--|
| CRB | Coconut rhinoceros beetle |
| PHAMA | Pacific Horticultural and Agricultural Market Access Program |
| SE Asia | South East Asia |
| PNG | Papua New Guinea |
| BSI | Biosecurity Solomon Islands |
| FAO | Food and Agriculture Organisation |
| US | United States |
| GDP | Gross Domestic Product |
| GMF | Green muscardine fungus |
| GPPOL | Guadalcanal Plains Palm Oil Limited |
| MAL | Ministry of Agriculture and Livestock |
| ACIAR | Australian Centre for International Research |
| EU | European Union |
| SPC | Pacific Community |
| OPRA | Oil Palm Research Association |

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PART 1: The status of Coconut Rhinoceros Beetle, *Oryctes rhinoceros* (L) Scarabaeidae : Dynastinae, in Solomon Islands

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Abstract

Oryctes rhinoceros, coconut rhinoceros beetle (CRB), was first confirmed as present in Honiara, Solomon Islands in January 2015. Based on initial delimiting surveys it was determined that it had likely been there for at least two generations before it was detected and that consequently eradication was not an option. Soon after, scientists at AgResearch, New Zealand, confirmed it was the 'G' (Guam) strain of the species that is not susceptible to the nudivirus that controls another strain of CRB elsewhere in the South Pacific. An emergency response plan was developed but due to inadequate financing implementation has been inconsistent and weak, consequently it has spread and is now reported on parts of seven islands. More recently some funding has become available and a three—pronged management approach is being implemented: sanitation to reduce populations by destroying breeding sites (rotting palm logs, green manure, compost and chicken manure), restricting spread through internal quarantines on shipping and biological control by identifying effective entomopathogens for the long term. Work to identify strains of *Oryctes Nudivirus* (OrNV) effective against CRB-G is reported elsewhere in this symposium. Some preliminary details of work to introduce the green muscardine fungus, *Metarhizium anisoplaeae*, are reported here.

Background

Coconut rhinoceros beetle (CRB), *Oryctes rhinoceros*, is the most serious insect pest of coconuts wherever it occurs. Estimates of losses vary considerably from 50% palm mortality and significant yield losses to the remaining palms in Palau (Gressitt 1953) to losses of US\$1,100,000 to South Pacific countries from reduced yields in 1968 alone (Catley 1969). Figure 1. provides a clear demonstration of palm mortality in Fiji in the mid 1960s. Similar scenes are seen in Solomon Islands today.

The centre of origin for CRB is thought to be SE Asia particularly; Malaysia, Myanmar, Thailand, Indonesia, Viet Nam, South China and the Philippines. It has subsequently spread more widely to India, Mauritius, Maldives and Reunion (Waterhouse 1987) and the Arabian peninsula. It first entered Oceania in 1909 when it arrived in Samoa with rubber seedlings from Sri Lanka, this infestation subsequently spread to Wallis (1931), Tonga (1951), Fiji (1953) and Tokelau (1963).

A second introduction occurred in 1942 when it arrived in New Britain and Palau and subsequently spread to New Ireland in 1952 (Lever 1969). The third and latest spasm of attacks began in Guam in 2007 and spread to Hawaii (2013), Port Moresby, PNG, (2014), Honiara, Solomon Islands (2015) and Palau and Yap more recently.



Figure 1. Palm mortality in Fiji mid 1960s. Bedford , 2013. Ann. Rev. Ento.

The attack in Solomon Islands

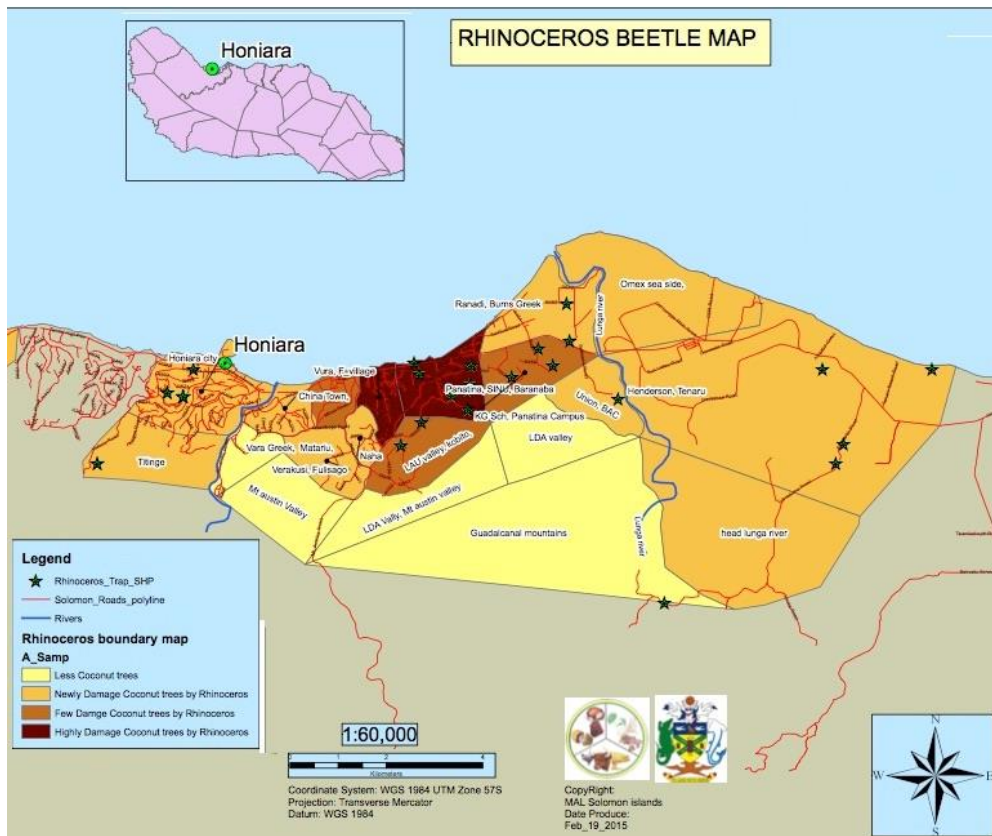


Figure 2: Results of the initial delimiting survey

Symptoms of CRB attack were first reported in Honiara, Solomon Islands, in January 2015 and adults were collected soon after to confirm the identity as *Oryctes rhinoceros*. It was necessary to obtain adults before confirming the identity as there is an indigenous dynastid beetle, *Scapanes australis*, which causes similar damage to young palms. An Emergency Response Plan was immediately put into effect and a delimiting survey carried out based on signs of frond damage. The results of this survey (Figure 2.) clearly demonstrated that the attack had been underway for some time and eradication was impossible.

At the same time specimens were sent to Dr. Sean Marshall of AgResearch in Christchurch, New Zealand, who confirmed it to be the 'G' (Guam) strain of CRB. This strain cannot be controlled by the virus disease which controlled an outbreak of CRB elsewhere in the South Pacific in the 1960s and 70s. The plan switched to containment and population control. Since then the beetle has spread 60+ kms east and west along the north coast of Guadalcanal and to five additional islands, Russell Islands (2 islands), Savo, Ngella, N. Malaita and Ulawa.

CRB is also attacking the commercial oil palm plantation east of Honiara. The situation here is particularly unfortunate as the company had recently begun a replanting programme and hundreds of felled, rotting, thirty—year—old palms were lying on the ground in the replanted plantation as perfect breeding sites for the new beetle. The company has recently begun destroying these dead palms but has had to use insecticides to protect the newly planted palms.

The second strain of CRB, the susceptible, CRB—S, strain is also present in Solomon Islands. This was discovered in the Shortland Islands in the extreme west of the country, but based on anecdotal evidence it is thought likely that this had been there for 10—15 years already. Its presence and identity were only confirmed in mid 2015 after CRB—G was confirmed in Honiara. More recently CRB—S was also confirmed in the capital of the Western Province, Gizo. The campaign against CRB—G is being enlarged to include Gizo and Shortland Islands.

Containment and control

In Solomon Islands the responsibility for response to pest incursions rests with Biosecurity Solomon Islands (BSI) who immediately sought additional emergency funds from central government for the work. No new funds were forthcoming and until this year BSI has had to rely on its normal recurrent budget to mount its response, with predictable results.

The first additional funds BSI was able to obtain came from the Food and Agriculture Organization of the United Nations (FAO) and this was targeted primarily at an awareness campaign and the introduction of the entomopathogens, *Metarhizium anisopliae* and *Oryctes Nudivirus* (OrNV). Elements of the awareness campaign were carried focused on raising awareness of the significance of the problem, the likely consequences and advising farmers on the best actions to take to reduce the impact of CRB in village agriculture. Unfortunately due to the funding requirements of the FAO support it was not possible to implement all the proposed awareness activities.

Potential impact

At this point it is worth emphasising the potential impact of this pest incursion to Solomon Islands. Currently the impact is small but as the beetle spreads to new places the impact will grow and if yield losses reach those of elsewhere the effect will be dramatic. Fifty percent palm mortality and yield losses to the remaining palms as reported elsewhere will significantly impact the country. The direct financial effects are easiest to imagine with copra, coconut oil and palm oil exports currently valued anywhere between US\$300 and 400 million per year or 10–15% of GDP. However the social costs could be much more significant; for example, it is estimated that Solomon Islanders consume on average at least one coconut each per day, i.e. 600,000+ nuts per day. Loss of this will likely lead to increased consumption of poor quality cheap foods such as noodles and sugary soft drinks with the consequent increase in non—communicable diseases. Additionally, village copra production peaks when school fees are due; if copra is not available fewer children will be educated with incalculable consequences for the future of the country. Of course the coconut, the tree of life, is well known to have a myriad of other uses from thatching to building materials, to artifacts and pictures of tropical beaches.

Action in the field

Until the arrival of CRB in Solomon Islands coconut plantation maintenance merely involved keeping the weeds down so fallen nuts could be found easily. Dead palms and green manure could be left to rot in—situ, on the ground or even standing. Now all dead palms will have to be removed from plantations either by using the wood or destroying them, and green manure will have to be spread out, or turned over regularly to expose larvae, or destroyed. These are significant, permanent, changes in behavior that will be essential for infested and non—infested plantations alike.

All publicity now stresses the behaviour changes required. A national campaign is being planned and will be implemented at the start of a New Zealand funded project to clean—up dead and rotting palms in infested and non—infested plantations. This project begins clean—up activities later this month and plans to systematically visit all infested plantations and work with communities to do the initial heavy work of removing dead and rotting palms. The project will run for 18 months, at least, and move into non—infested plantations as time and finance allows.

Release of entomopathogens.

Commercial consignments of the green muscardine fungus (GMF), *Metarhizium anisopliae*, were imported from Malaysia in early 2015 and advice and training under the FAO project were provided to try to bulk up supplies locally and develop techniques to release it in infested plantations. This work has continued but is increasingly focusing on improving the techniques for release as bulking the fungus in sufficient quantity and with sufficient quality control has proved very difficult. Commercial supplies of the fungus are being obtained from Malaysia.

Fungus release techniques have focused on the design/size and content of artificial breeding sites and different inoculation methods. The latter include direct spraying of spores into the breeding site, and

application of infected larvae. At all times care is taken to minimise the exposure of spores to sunlight. Results have been promising, Table 1, with anecdotal reports of reduced damage in treated plantations and the collection of fungus infected larvae from rotting dead standing palms in infected plantations. Work is continuing to refine the design and management of rearing sites with project support from the Solomon Islands Rural Development Programme and the two New Zealand projects.

Table 1: Summary of results for GMF application to artificial breeding sites

| Media Composition | Depth of Media | No of Sites | GMF Spore Application Methods | Infection % after 3 wks |
|---|----------------|-------------|-------------------------------|-------------------------|
| Chicken manure & wood savings | 30 cms | 10 | Dead infected larvae | 85% |
| Chicken manure & empty oil palm fruit bunches | 30 cms | 15 | Spore suspension | 66% |
| | 30 cms | 15 | Dead infected larvae | 72% |

Work on *Oryctes Nudivirus* (OrNV) has been necessarily much slower. Initially FAO support enabled training in laboratory bioassay techniques and the testing of some strains of OrNV held by AgResearch, New Zealand. Some early encouraging positive results were obtained but BSI was not able to sustain the laboratory work on its own and focused instead on building a laboratory for rearing beetle adults of known age ready for more intense virus testing and release later. Subsequently the New Zealand government approved a project aimed at helping Solomon Islands and Papua New Guinea identify, bulk up and release a new virus that would be effective against CRB. This project began in January 2018 and is assisting BSI to test a range of OrNV strains to hopefully identify one that is effective against CRB-G for managed release. Early results are encouraging.

In all this work BSI is collaborating closely with the local commercial oil palm company, Guadalcanal Plains Palm Oil Limited (GPPOL), who are supported by their overseas parent company, Syme Derby. This company has contracted two entomologists, one based on Guadalcanal to test virus strains with BSI and one based in Asia to seek out the centre of origin of CRB-G and any effective entomopathogens that might be there.

Other activities

In addition to the above, BSI is also undertaking activities to manage the movement of CRB around the country particularly by ships and canoes. This relies on publicity campaign but BSI is also investigating the practicality of regulations. BSI is also carrying out monitoring and surveillance to determine spread and identify new incursions as quickly as possible after they occur. For this pheromone traps are being deployed at non-infested ports around the country and monitored regularly by trained village personnel.

The Research Division of the Ministry of Agriculture and Livestock (MAL) is also carrying out studies to test pheromones from different sources plus improve the efficacy of pheromone traps.

The Future

Action against CRB in Solomon Islands has got off to a slow start essentially because national emergency response funds were not forthcoming and now infestations are found at several sites around the country. But this year funding sources have begun to come on stream and significant actions are anticipated including:

- A publicity campaign aimed at changing village community coconut management practices for the long term.
- A campaign to clean—up infested village community coconut plantations free of rotting palm logs and green manure.
- Research into improved methods of green muscardine fungus release and spread.
- Research to identify virus strains lethal to CRB-G.
- Research into the release and spread of an effective virus.
- Monitoring and surveillance of spread within the country.

The prospect for CRB control in Solomon Islands is improving but considerable work will be required over the next year or so if severe consequences are to be averted.

Acknowledgments

The following are acknowledged for their support to actions against CRB in Solomon Islands.

| Source | Manager/Facilitator | Activity |
|-------------|---------------------|---------------------------------|
| New Zealand | AgResearch | CRB disease studies |
| New Zealand | MAL/SPC | CRB Clean—up and surveillance |
| Australia | PHAMA | CRB Coordinator post |
| Australia | Strongim Bisnis | Design awareness campaign |
| Australia | ACIAR | CRB disease studies |
| FAO | MAL/BSI (completed) | Awareness & disease studies |
| FAO | SPC | Beetle disease studies |
| EU | SPC | Awareness materials |
| Sime Derby | OPRA/GPPOL | Beetle disease studies |
| SI Govt. | MAL/BSI | Begin clean—up and surveillance |

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PART 2: Coconut Rhinoceros Beetle Response Coordinator

Project completion report

August 2018

PHAMA activity SOLS33.6

Report prepared by:

Bob Macfarlane – Coconut Rhinoceros Beetle Response Coordinator

Reviewed by: Andrew Piper – PHAMA Solomon Islands Country Manager

Acronyms

| ACRONYM | Meaning |
|----------|--|
| ACIAR | Australian Centre for International Agriculture Research |
| AUD | Australian Dollars |
| AVI | Australian Volunteers International |
| BSI | Biosecurity Solomon Islands |
| CHOGM | Commonwealth Heads of Government Meeting |
| CRB | Coconut rhinoceros beetle |
| CRB-G | Coconut rhinoceros beetle G strain |
| CRB-S | Coconut rhinoceros beetle S strain |
| DFAT | New Zealand Department of Foreign Affairs and Trade |
| FAO | Food and Agriculture Organization of the United Nations |
| GPPOL | Guadalcanal Plains Palm Oil Limited |
| HC | High Commission |
| IWG | Industry Working Group |
| KPSI | Kokonut Pacific Solomon Islands |
| MAL | Ministry of Agriculture and Lands |
| MoU | Memorandum of Understanding |
| NCD | Non-communicable diseases |
| NGO | Non-Government Organisation |
| NZ | New Zealand |
| NZD | New Zealand Dollars |
| NZHC | New Zealand High Commission |
| PHAMA | Pacific Horticulture and Market Access program |
| PNG OPRA | Papua New Guinea Oil Palm Research Association |
| SBD | Solomon Islands Dollars |
| SI GDP | Solomon Islands Gross Domestic Product |
| SIG | Solomon Islands Government |
| SPC | Secretariat for the Pacific Community |
| ToRs | Terms of Reference |

Background

The Coconut Rhinoceros Beetle (CRB), *Oryctes rhinoceros*, is the most serious insect pest of coconuts wherever it occurs. Estimates of losses vary considerably from 50% palm mortality and significant yield losses to the remaining palms in Palau (Gressitt 1953) to losses of US\$1,100,000 to South Pacific countries from reduced yields in 1968 alone (Catley 1969).

Symptoms of CRB attack were first reported in Solomon Islands in Honiara in January 2015 and adults were collected by Biosecurity Solomon Islands (BSI) soon after to confirm the identity as *Oryctes rhinoceros*. It was necessary to obtain adults before confirming the identity as there is an indigenous dynastid beetle, *Scapanes australis*, which causes similar damage to young palms.

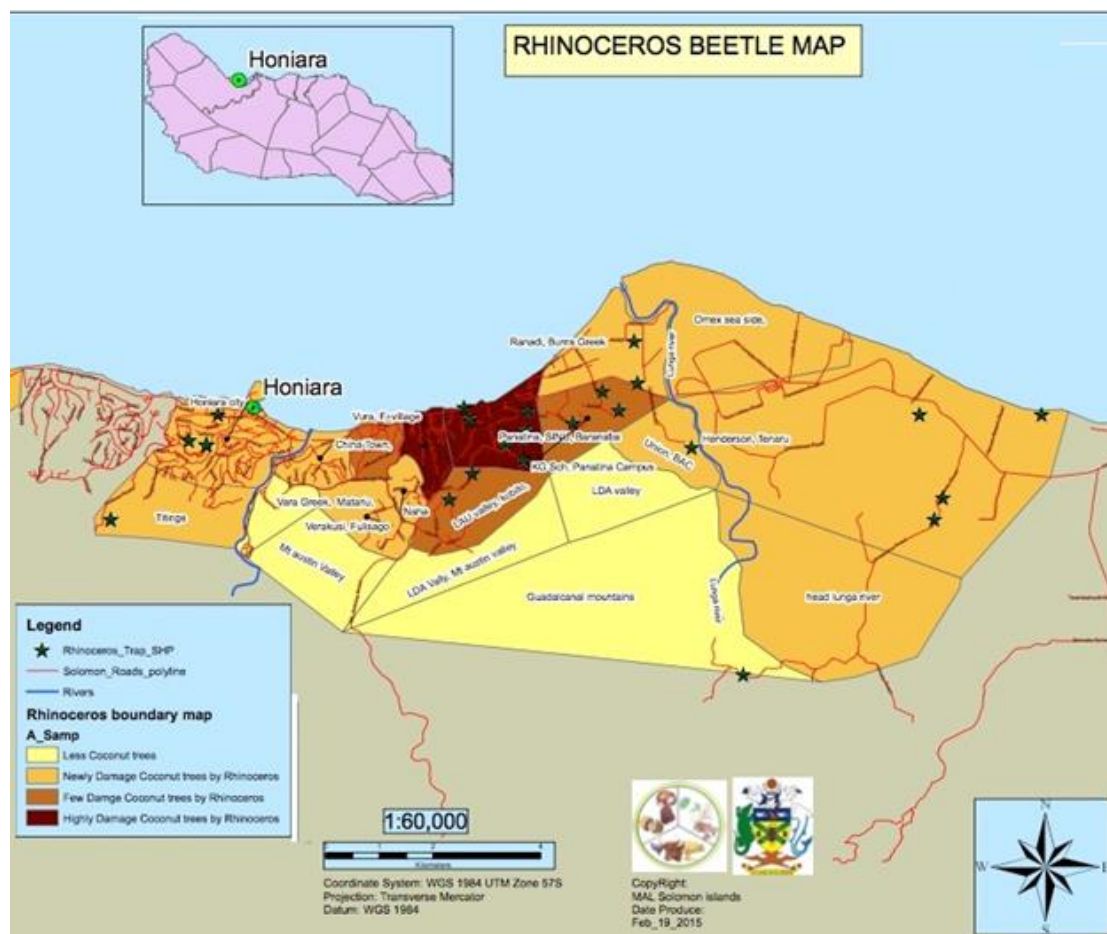


Figure 1: Results of the initial delimiting survey of CRB in 2015 (Source: Biosecurity Solomon Islands)

An Emergency Response Plan was immediately put into effect and a delimiting survey carried out based on signs of frond damage in coconut palms. The results of this survey (Figure 1.) clearly demonstrated that the attack had been underway for some time and eradication was impossible. At the same time specimens were sent to AgResearch in Christchurch, New Zealand, who confirmed it to be the 'G' (Guam) strain of CRB. This strain cannot be controlled by the virus that controlled an outbreak of CRB in the South Pacific in the 1960s and 70s. As a result the response plan switched to containment and population control.

Subsequently the beetle spread 60+ kms east and west along the north coast of Guadalcanal and to three additional islands, Savo, Ngella, and N. Malaita. Crop damage and financial losses were incurred by the coconut and oil palm industries and by the thousands of people that depended on them for their livelihoods.

It was recognized that CRB-G was a significant biosecurity threat to Solomon Islands and failure to contain its spread would have severe detrimental impacts on the Solomon Islands economy and its people, consequences of the CRB incursion include:

- Reduced yields of copra, palm and virgin coconut oil.
 - At least \$300 million of exports earnings lost (palm oil alone is 12% of Solomon Island (SI) Gross Domestic Product (GDP)).
 - Copra is a major source of income for villagers and pays many school fees.
 - Guadalcanal Plains Palm Oil Limited (GPPOL) is the biggest employer in the country
- Reduced availability of eating and drinking nuts to 100% of population.
 - One nut per person per day (600,000 nuts per day)
 - Need to replace with imported foods and drinks.
 - Reduction in quality of nutrition will lead to more diabetes and other non-communicable diseases (NCDs).
- Reduced availability of coconut, pandanus and sago building materials etc.
 - Need to replace with local sawn timber or imported roofing materials.
- Decline in the Pacific paradise image of the country.
 - Fewer tourists.

Over the following three years 2015-2018 BSI sought additional emergency funds from central government but nothing was forthcoming. BSI, using only its recurrent budget, and industry (particularly GPPOL) implemented a number of measures to address the threat, culminating in the declaration of a state of emergency by the Solomon Islands Government (SIG) during 2017. Throughout, despite this progress, management efforts have been hampered by unavailability of funds and weak collaboration between public and private sectors.

Introduction

During 2017 stakeholder consultations confirmed broad agreement on priority steps for the:

1. Formation of a public-private sector CRB Taskforce and,
2. Appointment of a Coordinator to support the Taskforce and assist government agencies to plan and oversee the management response.

The Australian and New Zealand funded Pacific Horticultural and Agricultural Market Access (PHAMA) program agreed to contract a Coconut Rhinoceros Beetle Management Coordinator to work with Biosecurity Solomon Islands (BSI) and other stakeholders to assist with coordination of the CRB management response.

The agreed Terms of Reference (ToR) for the Coordinator are provided in Appendix 1. The Coordinator was appointed in mid-December 2017 to work two days per week until 30 June 2018. Accommodation was kindly provided, gratis, by GPPOL at Ngalimbiu.

Around the same time New Zealand approved a new project aimed at identifying a new strain of virus to control CRB and to help Solomon Islands, PNG and the region to implement integrated control mechanisms. The project would be lead by AgResearch of New Zealand who had, in 2016, already begun similar work in Solomon Islands funded by Food and Agriculture Organisation (FAO).

This report describes work completed by the CRB Management Coordinator and partners during the period from December 2017 to June 2018. Recommendations are made for continuing work on CRB management.

Activities Completed

Workshops and Meetings Conducted or Attended

CRB TaskForce ToR workshop, 7 December 2017

Before even starting the contract we attended a meeting to help draft the ToR for the Government/Palm Industry CRB Response TaskForce. During the meeting and early in the consultancy we prepared draft ToRs and during January finalized the version that is presented in Appendix 2.

NZ AgResearch CRB Project planning meeting

In late January I assisted the NZ CRB project with its first planning meeting in Honiara attended by experts, government officials and private sector from Australia (ACIAR), New Zealand (AgResearch, New Zealand High Commission {NZHC}), Solomon Islands (Ministry of Agriculture and Land (MAL), GPPOL and coconut private sector) and Papua New Guinea Oil Palm Research Association (PNGOPRA). Outcomes of the meeting are presented in Appendix 3.

Awareness Workshop 8 March 2018

Early in the contract it became clear that significant behavioural changes were required in the management systems used in coconut plantations throughout the country. In both infested areas and non-infested areas equally. Also it was necessary to improve the delivery of messages about CRB nationally. A one day meeting was held to discuss this with a cross section of involved stakeholders (25). Some suggestions from the workshop include:

- Adopting incentive-based strategies to motivate people in rural communities to clear and destroy dead palms;
- Lobbying for government support with the help of non-government organisations;
- Communicating the economic and social impacts of the CRB threat through the media from a human interest perspective;
- Planning events such as a CRB Clean-Up Day to actively engage the public and decision makers in efforts to control the pest;
- Communicating potential losses and impact on profits to stakeholders in the supply chain (businesses) and relevant industries;
- Commercialising the CRB larvae as a feed for chickens and pigs as a way to control the CRB spread; and
- Introducing fines and penalties for failure to comply with sanitation requirements and on companies that do not practice due diligence in preventing the spread of the beetle.

A full report was prepared and circulated. A major outcome from this meeting was the subsequent identification of AUD150,000 from within the Australian funded project “Strongim Binis” to design, formulate and implement a behavioural change project on CRB management systems.

Workshop for Shipping Companies 27 March 2018

CRB continued to spread during the first half of the contract. None of the new outbreak areas had nearby airports but were too far from the main outbreak areas for adults to fly. It was agreed therefore that further action was needed to stem the flow of beetles by ships and canoes. A one day meeting was held with representatives of major shipping companies and some canoe operators to discuss how best to implement movement controls. Voluntary systems were preferred but the option of imposing formal regulations remained on the table. Some useful suggestions for future action included:

- Loading and departure from Honiara to be in daylight hours,
- Training of crew in identification of CRB and risk cargoes.

- A MoU between MAL/BSI and ship-owners to cooperate in slowing the spread of CRB.

Since that meeting it has become increasingly clear that chicken manure is very attractive to CRB and that movement of this should be carefully monitored and regulated. It is quite clear that the infestation on North Malaita originated from chicken manure and circumstantial evidence suggests that this may have been the case for other sites too.

Monthly TaskForce meetings

Meetings of the TaskForce were held monthly either in the last week or the first week of each month from January to June. The meetings were well attended throughout and provided a forum to share information on CRB management, the meetings generated constructive ideas for future initiatives. Minutes were prepared and circulated for each meeting.

Fortnightly meetings of the Response Oversight Committee

I presented reports to the fortnightly BSI Response Oversight Committee, the unit within MAL responsible for the CRB management response, and participated fully in the discussions. These meetings of the Directors of different MAL Divisions authorized the detailed activities funded by Solomon Islands Government (SIG) and NZ. They also formed the basis for united MAL responses to SPC draft project proposals. All meetings were fully minuted.

Other Activities Completed

Drafting of Operational Plan

Significant time was spent with senior BSI staff drafting operational plans for activities to clean-up infested plantations and extend the work eventually to non-infested areas. These plans provided overall descriptions of the work to be done and detailed GANTT charts of the work flow needed at different sites. Cost estimates were also developed. These documents now provide a single framework for the management of CRB in Solomon Islands, which did not previously exist. They are being actively used to guide the activities of MAL and of donor and private sector partners.

Liaise with NZHC re the Pacific Community (SPC) project

The Operational Plans developed above were used as the foundation for MAL discussions with SPC and New Zealand in preparation of a CRB project to be facilitated by SPC. These discussions were beneficial as they led to agreement among SPC, NZHC and MAL that the project would be implemented under the framework of the MAL Operation Plans, with MAL leading implementation of the work and SPC providing technical and project management support. The project document valued at NZD1 million, was signed off in the last week of June in time to meet the New Zealand annual budget deadline.

Meetings with GPPOL to review their programme

I met with GPPOL on several occasions and at their invitation attended a visit by the parent company pest control expert who wanted to impose a chemical solution on CRB on oil palm in Solomon Islands. I was asked to comment on this and did so pointing out that the wide-scale use of pesticides at GPPOL had always been resisted and that this should continue as much as possible. I supported the use of pesticides to protect young palms but recommended against its use to kill larvae in rotting palms. My suggestions have very largely been followed by GPPOL.

Establish links with Strongim Bisnis

A few weeks after the awareness workshop Strongim Bisnis approached us and advised they were keen to support the CRB Response awareness programme to the tune of AUD150,000. They wanted to design a programme for long-term behavior change, i.e. so that villagers would continue to destroy dead and rotting palm logs and manage rotting green waste and compost as part of normal plantation management in future. A number of meetings were held and the BSI Media Officer brought in to ensure continuity with ongoing BSI initiatives. The project began with two consultancies, one to prepare draft messages with a constant theme and one shorter consultancy to test these drafts and advise on refining the theme. Draft messages were prepared and tested in villages, recommendations from this testing were subsequently incorporated into the

eventual programme that will include a range of media formats. The funds may not be sufficient for the consultancies plus all the media recommended, consequently it was suggested that the funds earmarked for Solomon Islands from the European Union regional coconut project be used to top up the Strongim Bisnis support as needed.

Selection of demonstration sites

We had discussions with the Solomon Islands Coconut Industry Working Group (IWG) and the MAL Research Division about demonstration sites for CRB management. MAL Research has chosen a site near Doma and is in negotiation with the owners to clarify land use and consequences. The IWG chose a site at St Martins, Tenaru, and BSI staff helped map it. Unfortunately while the IWG Chair was out of the country problems arose with the landowners at Tenaru and the programme there has been shelved.

Testing of drones

While the mapping of the Tenaru demonstration site was underway contact was made with SkyEye, a local aerial mapping company, to see if drones could be used to spot new incursions and map the extent of existing incursions. The company volunteered their time and equipment and flew several sorties over the Tenaru and other sites (Appendix 4). Unfortunately it proved difficult to spot damaged palms from above unless damage was old (> 4 months) and extensive. The use of drones has been abandoned.

Use of satellite data

Private sector individuals in Australia and Kokonut Pacific Solomon Islands (KPSI) were interested in determining if there would be enough salvaged dead coconut palms to make a charcoal business worthwhile. They wanted to know how many such palms would be available in the Honiara environs. We were not able to provide that data so they approached OZIUS, a company in Australia, to analyze before and after high resolution European satellite photos of the Honiara area to count how many palms were in the area in 2014 (before CRB) and how many in 2017/8 (post CRB). They found that several thousand palms had been lost but could not differentiate between CRB killed palms and palms cut to make way for buildings and other development. Ground truthing of the data is now required.

Pheromone Project (India)

In April the Prime Minister's Office requested a project proposal on CRB that the Prime Minister could hand over to his Indian counterpart at this year's Commonwealth Heads of Government Meeting (CHOGM) meeting in London in May. After discussion with BSI and the Research Division it was agreed that we should ask for help in improving pheromone efficacy. A project briefing was developed and the Prime Minister did hand it to his Indian counterpart who advised to send it through formally. This was done via the Indian High Commission in Port Moresby (Appendix 5). No response has been forthcoming yet.

Recruit replacement

Towards the end of the contract I was involved in the recruitment of the individual to take over for the next 1+ years. I helped with the drafting of the ToR and prepared comprehensive Handing Over Notes (See Appendix 6)

Media Releases and Communications Materials

Press releases 14+

At the start of the contract it was hoped to issue at least one Press Release per week about CRB. In the end this proved difficult to find enough new topics each week and some weeks it was not possible but 14 Press Releases from the office of the CRB Response Coordinator were sent to the media. We had excellent cooperation from the media and most were published within 24 hours. The public response was first class. These Press Releases were also posted on to a Facebook page, "Solomon's Farmers Corner", and provoked considerable positive discussion.

Awareness poster

READ SI is a domestic NGO that promotes literacy, particularly for village women. The leader of the organization, Joyce Boykin, approached us and asked how they could be involved. We agreed that they would

produce a poster that could be distributed in rural areas particularly among rural women. Their artist produced a draft poster and the PHAMA graphic designer refined it (Appendix 7). Funding for printing was sourced from PHAMA and GPPOL. 1500 copies were printed and distributed.

Improved communications for BSI

The Director of BSI sought assistance in drafting ToRs for the recruitment of an Australian Volunteers International (AVI) volunteer to mentor BSI communications staff in the development of improved communications from BSI. I was happy to do this and help with the negotiations with AVI. Draft ToRs and presented in Appendix 8.

Letters to MPs

The TaskForce noted that MPs had access to significant sums of money through their Rural Constituency Development Funds (approx. SBD7 million per MP) and requested that we write to them individually to advise them that their constituents needed help in managing CRB. These letters were sent out on 18 April, see Appendix 9 and 10.

Letter to the Minister of Finance

The TaskForce noted that most initiatives by BSI were slow in implementation. We were advised that this happened because of the slow release of funds for the payment of casual labour etc. despite CRB being officially designated an emergency. The TaskForce asked the Coordinator to write to the Minister of Finance advising him of this problem and asking that he help in improving the flow of payments. No response had been received by the end of contract.

A summary of all activities and funding sources at the end of the contract is provided in Appendix 11.

Recommendations

The following recommendations are made for the continued good management of the CRB Response.

| Recommendation | Description | Who involved |
|--|--|--|
| Continue CRB Response Coordinator role | Role to be recruited from July 2018 on full-time basis | PHAMA, BSI, DFAT |
| Urgently implement the clean-up programme | Work closely with BSI, SPC and partners involved in the clean-up | MAL Ext & Res, BSI, SPC |
| Promote virus and fungus control of CRB | Continue work to improve efficacy of fungus and identify and release a new virus. | BSI, MAL Res, AgResearch, GPPOL/OPRA, ACIAR |
| Implement media/CRB awareness campaign | Facilitate output from Strongim Bisnis and secure EU funds for publications etc. | BSI, Strongim Bisnis, SPC, EU regional coconut project |
| Strengthen internal controls for movement of CRB | Work with BSI and Attorney General's office to develop any needed regulations | BSI, SI Attorney General |
| Control movement of chicken manure | Investigate how best to manage the CRB risk from the movement of chicken manure | BSI, Kastom gaden |
| Improve surveillance | Ensure establishment of early warning pheromone traps in non-infested domestic ports | BSI, SI Port Authority, Attorney General if needed. |
| Improve communications capacity within BSI | Engage an AVI volunteer to work with BSI | DFAT, AVI, BSI |

Conclusion

The role of CRB Response Coordinator has been successful in its objectives of increasing awareness of the CRB and facilitating improved public private partnership in the management response. Partly as a result, there has been positive response from donors and there is now significant funding being made available for the management of CRB in Solomon Islands. The total funding currently being considered for Solomon Islands and the wider region is in the order of AUD 4 million. A summary of current and planned programs is provided below.

| Donor Source | Manager/ Facilitator | Activity | Approx. Funding |
|--------------|----------------------|---|----------------------------|
| New Zealand | AgResearch | CRB disease studies | NZD1.5 M |
| New Zealand | MAL/SPC | CRB Clean-up and surveillance | NZD 1.0 M |
| Australia | PHAMA | CRB Coordinator post | AUD200 K |
| Australia | Strongim Bisnis | Design awareness campaign | AUD150 K |
| Australia | ACIAR | CRB disease studies | ? |
| Australia | DAWR | Solomon Islands Biosecurity Development Program | In kind time and expertise |
| FAO | MAL/BSI (completed) | Awareness & disease studies | USD75 K |
| FAO | SPC | Beetle disease studies | ? |
| EU | SPC | Awareness materials | EU 150 K |
| Sime Derby | OPRA/GPPOL | Beetle disease studies | USD 1.5 M |
| SI Govt. | MAL/BSI | Begin clean-up and surveillance | SBD 900 K |

This level of support is encouraging and a positive reflection of the work of MAL, the CRB Taskforce and the CRB Response Coordinator. It does also present an on-going challenge to coordinate and manage these activities to ensure that:

- (1) They align with and help to address the BSI CRB Operational Plan and
- (2) Do not replicate each other.

Significant good progress has been made since the appointment of the CRB Response Coordinator in December 2017; it is necessary to continue the role to ensure the efficient communication and collaboration among partners. CRB remains a significant threat to the livelihoods of thousands of Solomon Islanders and to people throughout the Pacific.

References

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