CEPF FINAL PROJECT COMPLETION REPORT

Organization Legal Name:	Secretariat of the Pacific Regional Environment Programme
Project Title:	Restoration of Nu'utele and Nu'ulua Islands (Aleipata Group), Samoa through the management of introduced rats and ants.
Date of Report:	8 May 2012
Report Author and Contact Information	This report was written and compiled by Alan Tye from field, lab and progress reports and published articles written by the project team (see References). All photos by Alan Tye unless otherwise credited. Contact: Dr Alan Tye, BirdLife Cyprus, PO Box 28076, Nicosia, CY-2090, Cyprus. (During the course of this project, Invasive Species Advisor, SPREP.) alantye@gmail.com

CEPF Region: Polynesia-Micronesia

Strategic Direction: Strategic Direction 1: 'To prevent, control and eradicate invasive species in key biodiversity areas' and in particular 1.2. 'Control or eradicate invasive species in key biodiversity areas, particularly where they threaten native species with extinction.'

Grant Amount: US$ 227,898 (amount spent: US$ 222,816).

Project Dates: 1 May 2009 to 31 Dec 2011.

Nu'utele and Nu'ulua Islands on the horizon, seen from the south coast of Upolu Island, Samoa.

Implementation Partners for this Project (please explain the level of involvement for each partner):

The project was managed by SPREP's Invasive Species Advisor (Dr Alan Tye)

Original partners listed in the project proposal

- Ministry of Natural Resources & Environment, Government of Samoa (MNRE) (main staff contributions). MNRE was the main government partner charged with implementing most aspects of the project. MNRE allocated staff mainly from its Environment and Conservation division, who participated in all seven Components of the project, including planning, field work and community liaison. Staff particularly involved in the project included: Moeumu Uili, Czarina Iese, Fialelei, Lesaisaea Niualuga Evaimalo, and Faleafaga Toni Tipama'a (Assistant CEO, Environment and Conservation, MNRE).
- Pacific Invasives Initiative (PII) (training). PII provided biosecurity training to MNRE and Marine Protected Area staff and local communities. PII contributed to the development of a biosecurity manual and visitors' checklist.
- Department of Conservation, New Zealand (aerial operations). DOC provided a helicopter operations supervisor (Malcolm Wylie), who managed the technical aspects of the helicopter operations. DOC also contributed an environmental impact assessment of the rat eradication plan (Scott Hooson), and to project planning and review (DOC Island Eradication Advisory Group). Rose Collen assisted with Ground Dove capture and maintenance in captivity.
- David Butler Associates Ltd (project technical coordination). David Butler managed Components 1 and 2, parts of Component 4, and contributed to the other Components.
- Zoos (Ground Dove work). Wellington Zoo provided specialist aviculture volunteers (Glenn Holland and Bronwyn McCulloch) who supervised Ground Dove capture, maintenance in captivity and release.
- PILN (dissemination, exchanges). PILN disseminated information on the project to a network of more than 400 invasive species workers in the Pacific.
- US Geological Survey (lizard monitoring). Dr Robert Fisher designed and carried out reptile surveys before and after the rat eradication operation.
- JICA (cofinancing aviary design). JICA contributed to the design of the aviaries used to house the Friendly Ground Doves.

Additional partners who contributed significantly to the project

- Aleipata District Marine Protected Area Committee (Chair: Seuala Patone). The village communities of the District were involved in the project since the outset, participating in field activities and discussions within the MPA Committee. They also approved the rat eradication EIA.
- Dr Ben Hoffmann, CSIRO, Darwin, Australia. Designed and implemented the final version of Component 3.
- University of Auckland. Research student Saronna Auina, a Samoan national, was engaged to work with Ben Hoffmann on the Yellow Crazy Ant, under the supervision of Dr Margaret Stanley.

Additional acknowledgments

Glenn Holland, Richard Parrish and Greg Sherley contributed to Component 2 and to bird recording on the islands; Northshore Helicopters (NZ) were contracted to carry out the helicopter operation; rat bait was supplied by Animal Control Products (NZ); Cedric Schuster carried out bird counts (for Component 4).

Conservation Impacts

Please explain/describe how your project has contributed to the implementation of the CEPF ecosystem profile.

The main project description is given in this section.

Background

This project was a key step towards a long-term goal of the restoration of Nu'utele (108 ha) and Nu'ulua (25 ha) islands, two of the four islands of the Aleipata group, off the eastern end of Upolu Island, Samoa. Nu'utele and Nu'ulua are major sites for the conservation of Samoa's indigenous biodiversity. They hold what are probably the largest remaining populations of the threatened (IUCN Vulnerable) Friendly Ground Dove *Gallicolumba stairi* in the Samoan archipelago, large populations of the Coconut Crab *Birgus latro*, nesting Hawksbill Turtles *Eretmochelys unbricata*, and several species of breeding seabird. Nu'ulua also contains the most intact lowland coastal forest assemblage in Samoa.

These are the only uninhabited islands in Samoa that are large enough and far enough offshore (Fig. 1) to be considered as potential refuges for several of the nation's species that are threatened by introduced mammalian pests. Threatened birds for which the islands could become a refuge include the Tooth-billed Pigeon *Didunculus strigirostris*, Ma'oma'o *Gymnomyza samoensis*, Island Thrush *Turdus poliocephalus* and Samoan White-eye *Zosterops samoensis*, while other organisms such as land-snails and native plants should also benefit from restoration. No burrow-nesting seabirds remained on the islands and it is likely that these were killed off by rats. They may return subsequent to rat eradication, or may require re-introduction or further intervention to encourage their re-colonization. The islands thus have the potential to play a key role in sustaining the future of Samoa's biodiversity.

Figure 1. Nu'utele Island, as seen from the nearby shore of Upolu, shortest distance 1.3 km. Nu'ulua lies behind Nu'utele, 3.3 km from Upolu.

The project was designed to address the threats to this ecosystem posed by two invasive alien species Pacific Rat *Rattus exulans* and Yellow Crazy Ant *Anoplolepis*. Pacific Rat was probably a Polynesian introduction, or an accidental human-facilitated introduction from neighbouring Upolu. Yellow Crazy Ant had spread throughout Nu'ulua in recent years, threatening invertebrates, birds and reptiles, including turtle hatchlings, and could lead to irreversible vegetation changes. A small infestation was detected on Nu'utele in 2007 and its spread has been monitored since then, with some new sites detected but contractions or disappearance at others.

Both islands are customarily owned and involve at least four families or traditional titles from the villages of Aleipata District.

Project rationale

As a step towards island restoration, the project aimed to eradicate Pacific Rat from both islands through aerial delivery of baits from a helicopter. The project originally proposed to control or eradicate Yellow Crazy Ant by ground and aerial delivery of baits but, following expert advice, this objective was changed to obtain further information considered necessary for the design of a long-term management plan.

The local people who own and use the islands gave their support to the rat eradication as part of a larger, successful Aleipata Islands Marine Protected Area (MPA) project. The project thus involved working very closely with the community, through an MPA Committee involving representatives of all the villages in the District. Community members joined expeditions to the islands, were involved in the control operations and will have a key role in preventing pests from reaching the islands.

The project was designed as a demonstration project with the Pacific Invasives Initiative, and with the Pacific Invasives Learning Network facilitating the involvement of others from the region in the operation and the wide dissemination of its results.

SPREP signed a grant agreement with the Critical Ecosystem Partnership Fund on 1 May 2009 to deliver this project, with seven Components:

1. Eradication of Pacific Rat using aerial delivery of poison
2. Protection of Friendly Ground Dove from the poisoning operation
3. Management of Yellow Crazy Ant
4. Monitoring the response of the ecosystem to rat removal
5. Work with the local community to maintain support for the project and raise awareness of the need to protect the islands
6. Establishment of a biosecurity programme for the islands
7. Dissemination of results.

Component 1: Eradication of Pacific Rats

The feasibility of eradicating the Pacific Rat from the islands was initially investigated in 2000 (Bell 2000). Since then there have been a range of studies on the islands and feasibility assessments, carried out mainly by New Zealand scientists, including David Butler, who drafted an eradication proposal in 2003.

Detailed planning for the project was undertaken with a small grant to SPREP from CEPF through the Regional Natural Heritage Programme in 2006. NZ DOC provided Scott Hooson to develop an Environmental Impact Assessment (EIA) for both rat and ant management and an operational plan. The EIA was modified to cover the rat operation alone in 2008, and this was approved by the Aleipata District MPA Committee and the Government of Samoa through its Planning and Urban Management Authority (PUMA). The Samoa Pesticides Board permitted the use of the rat toxin brodifacoum and the Civil Aviation Authority licensed the helicopter operation. The Operational Plan was developed by Malcolm Wylie, a DOC staff member highly experienced in aerial operations, again as part of DOC's in-kind support. The plan was updated in 2009 at the start of the present project. As part of the planning process, the Operational Plan was reviewed by the NZ DOC Island Eradication Advisory Group, a committee of people highly experienced with rat eradications.

The project adopted a proven technique developed in New Zealand and used to eradicate rats from islands up to 12,000 ha, using brodifacoum anticoagulant baits made to precise specifications to maximize effectiveness and specificity, spread from a helicopter using differential GPS and a specialist pilot to ensure complete coverage.

Contracting a helicopter company to undertake the operation proved difficult. When the costing was undertaken for the CEPF proposal, a Fiji-based company was considered best placed to undertake the work. They had undertaken an aerial eradication operation in Fiji for Birdlife International and their pilot had been trained by an experienced New Zealand operator. They were licensed to fly in Samoa and potentially cost-effective as ferry charges could be shared with other work they had scheduled. A New Zealand-based company, Northshore Helicopters, keen to establish in Samoa, was also in contact with the project team.

Once funding was approved and the two companies were asked for a quote, the Fiji one was ruled out as it could no longer supply a suitable helicopter until October. By the time another quote was obtained to satisfy CEPF requirements, there was a very tight time-frame to finalise contracts with Northshore and arrange shipping of a helicopter and spreader bucket from New Zealand (Fig. 2). This time-frame was one factor behind subsequent difficulties with the aerial drops.

Figure 2. Robinson 44 helicopter, pilot Paul Trapski, with bait spreader bucket ready for loading, all supplied by Northshore Helicopters, New Zealand.

The boat carrying the equipment from New Zealand then made an unscheduled visit to American Samoa, delaying its arrival in Apia by several days. Its unloading was further delayed by a public holiday. This created problems for the helicopter reassembly by an engineer, flown specifically from New Zealand for this purpose, and reduced testing time.

Brodifacoum baits were supplied by Animal Control Products (ACP) in New Zealand. The company only manufactures these baits for a few months each year, so needed a confirmed order by early May to avoid a 1-year delay. In this case the tight time-frame following approval of funding meant that we were only one week away from failing to meet the company's deadline for ordering and payment.

Shipment and storage of baits went smoothly under ACP's guidance. Six pallets of 20-kg bags of bait (Fig. 3) were shipped in a container with a black condensation sheet hanging on the inside. The door of the container was opened during the day and closed at night every few days while it was in storage in Samoa, to optimize storage conditions. Shrink wrap was left on the pallets until the operation, as there was no sign of condensation.

Figure 3. Brodifacoum bait awaiting loading into bait spreader.

The aerial operation took place over three days 15, 22 and 26 August 2009 (Fig. 4). There were challenges with MNRE support, the operation of the helicopter and spreader bucket, and with weather forecasting. Two drops were scheduled. The first was completed successfully on 15 August, but the second drop, on 22 August, had to be abandoned part-way through treating Nu'utele, owing to failure of the spreader motor (Fig. 5). A new motor was flown from New Zealand and a replacement second drop was carried out successfully on 26 August.

Further details of the operation may be found in Wylie (2009) and Butler *et al.* (2011).

Figure 4. Helicopter heading from the operation site on Upolu to the islands, with loaded bait spreader. Nu'ulua is the further island in the centre of the photo, with Nu'utele to the right.

Figure 5. The bait spreader mechanism, with drive motor on the left.

Both islands were visited a few days after the operation in August 2009, to monitor rat sign and ecosystem effects. No rats or rat sign were detected on either island.

Both islands were visited in December 2009 by a team surveying reptile populations. The 4-person team undertook day and night surveys and set out 500 glue traps on each visit at a variety of locations. No glue traps had rat hair compared with 75% of traps showing evidence of rats in a pre-operational lizard survey in June 2009. However, one team member subsequently reported seeing a rat at Vini Beach. Two lines of traps were set up there in February 2010, but caught nothing.

A specific survey for rats to Nu'utele took place in March 2010 (Butler 2010). Poor weather prevented access to Nu'ulua. Kill traps, cage traps, bait stations, wax tags and tracking tunnels were deployed for a week on grids or transects covering different parts of the island. Fallen fruit was checked for any signs of chewing. No rats or rat sign were detected.

Both islands were visited again in August 2010 by the team surveying reptile populations, using the same techniques as in December 2009. Once again no rat sign was detected.

In late 2010, the team studying the Yellow Crazy Ant on Nu'utele recorded no rats. However in May 2011 a member of this team saw a rat on Nu'utele towards the top of the climb up from Vini Beach. A specific survey in July caught eight Pacific Rats in that area and two at the northern end of Vini Beach (Butler 2011a). A brief trapping session on the coast of Upolu opposite the islands caught one Pacific Rat, three Norway Rats *Rattus norvegicus* and two Black Rats *Rattus rattus*.

It is not yet known whether rats were eradicated on either island. Although rats are present now on Nu'utele, but it is not clear whether these are survivors of the operation or re-invaders. It is unlikely that Pacific Rats would swim the distance from Upolu to Nu'utele, but the tsunami in September 2009, just after the eradication operation, washed up large quantities of debris on the island, on which rats could have floated. Samples were collected for DNA analysis to try to determine whether the rats now on the island are survivors or re-invaders, but these were lost by the courier company contracted to send them to the lab in Auckland. Further sampling is planned for May 2012.

It has not been possible to survey Nu'ulua specifically for rats since just after the rat operation. A further survey is needed to confirm whether or not they are present, and is planned for May 2012.

Component 2: Protection of Friendly Ground Doves

An EIA identified that the main threat from the rat operation was that Friendly Ground Doves might eat and be killed by the baits. The project thus included catching and removing birds from Nu'utele into temporary captivity near Apia on Upolu. The birds were re-released on the island on completion of the eradication.

Friendly Ground Doves are considered close to extinction on the two main islands of Upolu and Savai'i (though their status in the uplands of the latter has yet to be confirmed), so Nu'ulua and Nu'utele are considered to be the last stronghold of the Samoan subspecies. As a bird that feeds on the ground on fruit and seeds they were considered at risk from the grain-based pellets containing brodifacoum. Discussion among experts on the best approach resulted in a decision to move a group of birds from Nu'utele, the more accessible of the two islands, to temporary captivity on Upolu rather than try to protect them on the islands. Glen Holland, then Director of Auckland Zoo, was asked to assist with this work and David Butler

carried out trial captures as part of planning for the operation. Dieter Rinke, who had previously kept the species in Tonga, Peter Luscombe of Honolulu Zoo, and Peva Levy who had kept the related Tuamotu Ground Dove in captivity, were involved in discussions on capture techniques, aviary design and captive management.

The project built aviaries at the Vailima Botanical Garden. Holland, Butler and Richard Parrish managed the capture of 26 doves on Nu'utele. The doves were managed in captivity for 49–56 days by Rose Collen and Bronwyn McCulloch. Three birds died during the course of the operation and the others were released on Nu'utele after a suitable period to allow baits to disappear completely.

Birds left on both islands survived the operation: none was found dead on either island, and several live birds were seen on both islands a few days after it.

This operation was considered highly successful and much was learned about capturing and holding the species. This is valuable experience if similar work should be needed in the future, with this or related species.

Three unpublished reports (Parrish 2009, Collen et al. 2010, McCulloch & Collen 2010) and one published article (Collen et al. 2011) provide further detail on this operation.

Component 3: Management of Yellow Crazy Ants

The project contributed to this research by examining the biology and impacts of Yellow Crazy Ant in accessible areas of the populations on Nu'utele. This will contribute to formulating a management plan.

Two studies carried out in 2006 by Abbott (2006) and Vanderwoude (2006) contributed to the design of this project. Yellow Crazy Ants were found to have spread throughout Nu'ulua and a small infestation was detected on Nu'utele in 2007. Night video recording on both islands had suggested that the ants' presence was associated with significant changes in invertebrate populations, as seen elsewhere in the world. The ants also threaten birds and reptiles including turtle hatchlings, and could lead to irreversible vegetation changes.

Work in Australia and elsewhere has shown that it is possible to reduce the numbers of Yellow Crazy Ants by ground or aerial distribution of baits containing toxin or insect growth regulators. Baiting trials and invertebrate sampling were carried out on Nu'utele before the project, and a draft EIA and operational plan developed for a proposed toxic baiting programme. However work continues to identify the ideal bait with minimal non-target impacts and, on the basis of expert advice from Dr Ben Hoffmann, it was considered premature to carry out ant management on Nu'utele and Nu'ulua before further information could be obtained on the ant populations and their impacts there, and on bait developments elsewhere.

Ant populations on the islands were monitored before and during the project, particularly on Nu'utele. Up to 2009, the species was found to have spread on Nu'utele, from its 2006 level of *c*. 8 ha, and with several new infestation sites found. However, surveys after 2009 showed that the main infestation at Nu'utele Bay had severely declined in extent, to *c*. 1 ha, perhaps partly as a result of the September 2009 tsunami, although ants had also disappeared from higher parts of the former infestation. Also, new infestation sites were discovered while others disappeared. In 2010 and 2011, the largest infestation appeared to be at the north side of Vini Beach (Fig. 6). The infestations in the western half of the island may represent separate introductions by boats from Upolu.

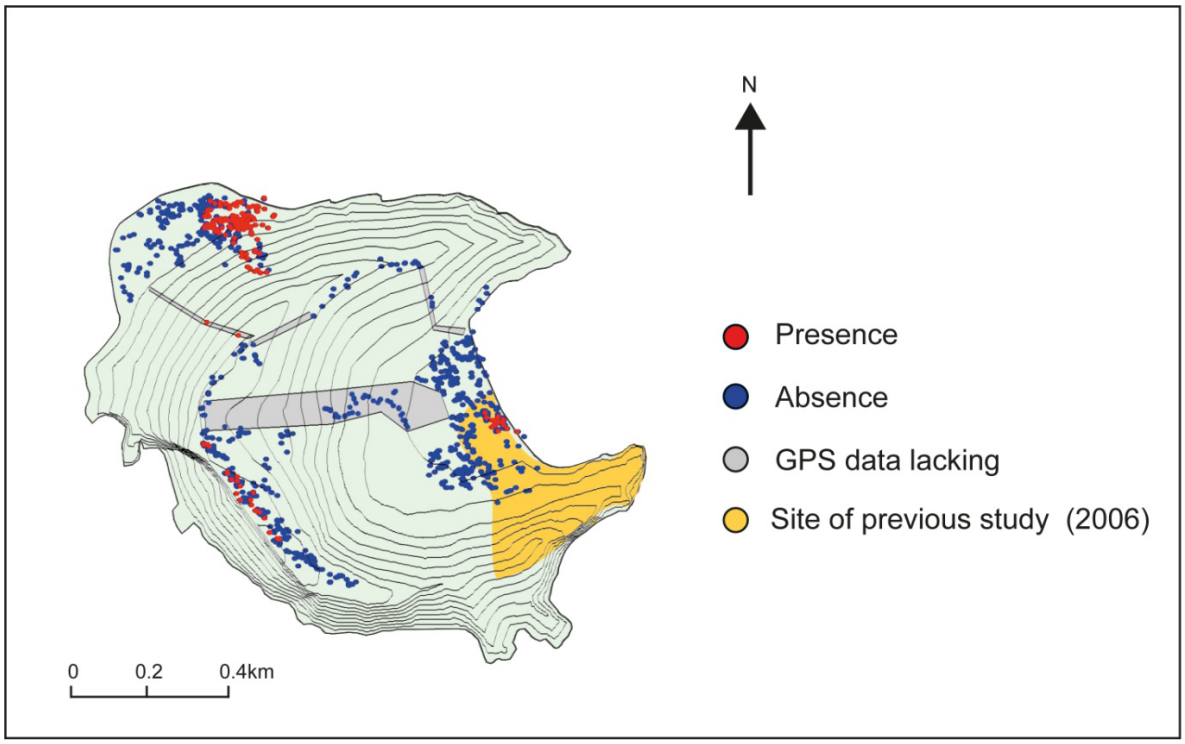

Figure 6. Infestations of Yellow Crazy Ant on Nu'utele Island in 2010, with 2006 infestion at Nu'utele Beach shaded yellow. Map from Auina (2011).

Details of the ant's reproductive cycle were obtained during visits to the island by Hoffmann and Saronna Auina in October 2010 and May 2011. This information is essential for determining the best timing for management actions, particularly when using growth regulators. However, further information on this is still required, based on monthly monitoring over at least a 12-month period. Monthly monitoring of Yellow Crazy Ant and invertebrates was to have been carried out during this project by MNRE staff, but this was unfortunately not done.

This study also gathered further information on impacts of the Yellow Crazy Ant, which was shown to affect the ant community composition. Native ant abundance was lower in areas with Yellow Crazy Ant although native ant species richness was higher in infested areas. Abundance and diversity of most invertebrate groups were not significantly affected by the presence of Yellow Crazy Ant. However, at least at one of the two visits, woodlice and Diptera were more common in infested sites, while spiders, Lepidoptera and hermit crabs were less common in infested areas. Some relationships between the ant, certain plant species with extra-floral nectaries, scale insects and mealy bugs were discovered, but their significance (if any) for management is not yet clear.

Further details of this work can be found in Auina (2011) and Hoffmann (2011).

Component 4: Monitoring ecosystem response

Since the main objective of the project was to contribute to the restoration of the native ecosystem of the islands, monitoring was established to attempt to assess to what extent this objective was achieved following each intervention. This is envisaged as the establishment of a long-term monitoring programme on the islands, with a baseline set by monitoring various ecosystem components before the rat eradication operation, immediately

after the operation, and at intervals thereafter (Fig. 7). So far, up to three monitoring phases have been completed, for different ecosystem components, as described below.

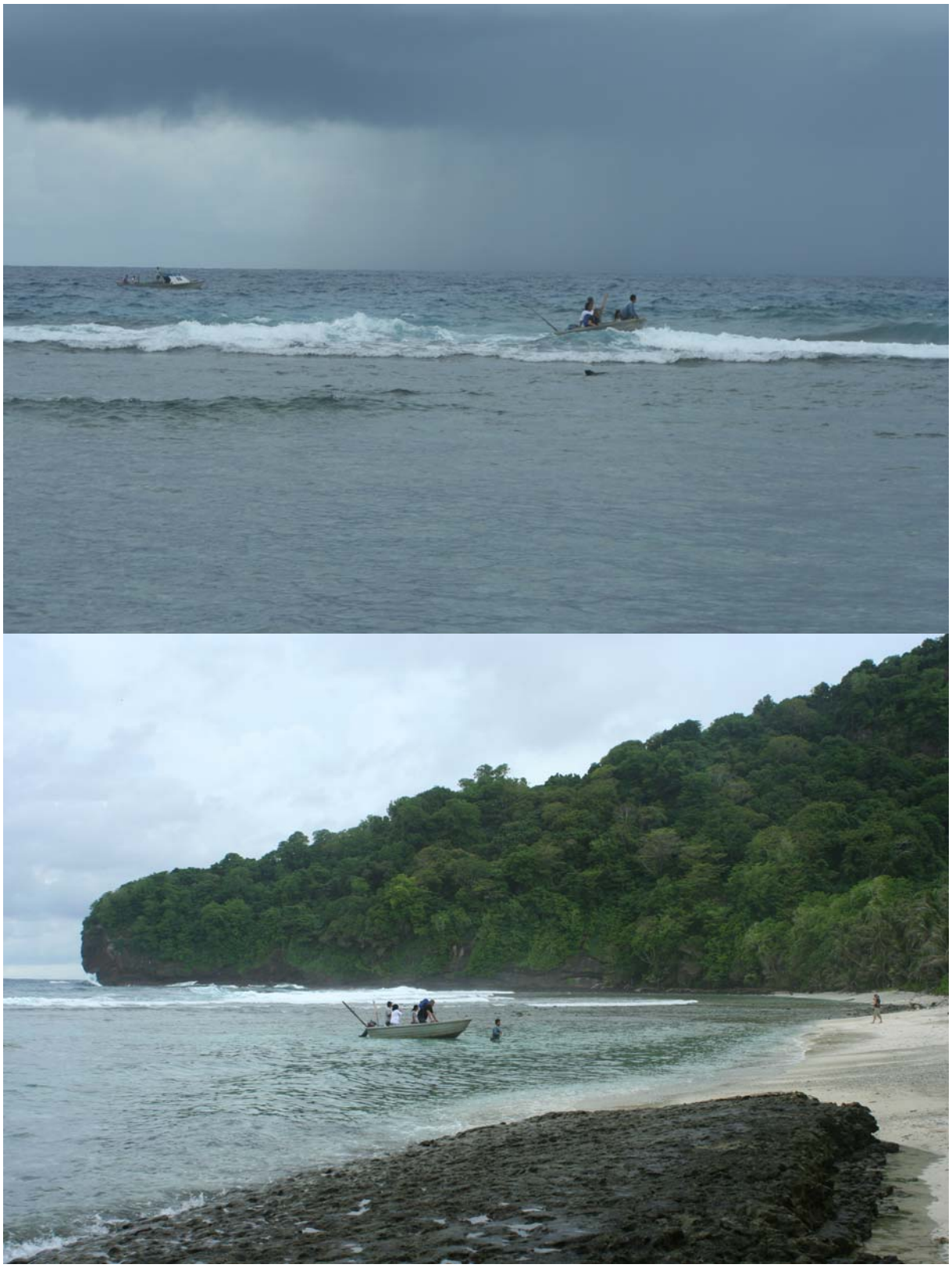

Figure 7. Landing for a monitoring visit, on Nu'utele Beach, east side of Nu'utele Island.

Reptiles. Robert Fisher was contracted from the US Geological Survey to carry out three surveys of reptiles on Nu'utele, Nu'ulua and the two other Aleipata Islands of Namu'a and Fanuatapu. The first survey was prior to the rat operation, the second soon afterwards (December 2009) to determine if the rat poison had any impact, and the third a year after it (August 2010) to determine any response from the planned removal of rats. Dr Fisher has not supplied any reports on his work.

Birds. Cedric Schuster was contracted to carry out bird surveys on Nu'utele before and a year after the rat operation, using 5-minute point counts. The results are of questionable value because at the post-operational survey only two days of surveying were possible, timing between the surveys was apparently inconsistent, and the sampling regime was sensitive enough to detect only very large population changes with any reliability. The results are presented in Schuster (2010).

Vegetation. Photo-points were established on Nu'utele and Nu'ulua before the operation but it has only been possible to repeat these on Nu'utele to date. Two locations have been lost due to a tree fall and the tsunami. The results of these and other observations suggest that a cohort of tree seedlings survived to reach sapling stage as a result of the rat population reduction. These saplings are now no longer vulnerable to rat damage and so should provide a pulse of forest regeneration. Before this project began, MNRE staff also established nine vegetation plots on Nu'utele, in 2007 (Foliga *et al.* 2007). As part of the present project, MNRE established similar plots on Nu'ulua in 2009. However, the Nu'utele plots have not been resurveyed, and the coordinates and results of the Nu'ulua recording were lost, so they cannot be repeated.

Invertebrates. The studies by Abbott (2006) and Vanderwoude *et al.* (2006) provided a partial baseline for invertebrate monitoring, although both of these studies were focused on ants. However, coordinates for their pre-operation sampling sites were lost, so these sites could not be re-sampled. The sticky traps used by Robert Fisher for reptile sampling provided information on invertebrates too, but Dr Fisher has not supplied any reports on his work. Ben Hoffmann and Saronna Auina carried out invertebrate sampling as part of their work on Yellow Crazy Ant. These results are presented in Auina (2011) and Hoffmann (2011).

Component 5: Community Relations

MNRE led the liaison with the MPA Committee who represented the communities, supported by project staff. MNRE passed to the communities the information needed to obtain their support for the aerial drop. Three of the MPA Committee observed the first drop, and members of the community were contracted as assistants (bait loaders etc.) during the drops.

Other initiatives planned with the community and local schools were put on hold when the tsunami devastated Aleipata District in September 2009. Life has slowly returned to normal, though many families have moved away from the coast. Some of the planned work could now be contemplated, although this will require new resources.

Community liaison and awareness benefited from activities associated with the detection and eventual eradication of a mongoose in the District. The response to this incursion was part-financed by another CEPF grant, and the two projects worked in parallel during 2010. Full details of this work are given in Fisher *et al*. (2011) and Tye *et al.* (2011).

Component 6: Biosecurity

An essential part of any island eradication is an assessment of the probability of reinvasion by the pest which it is proposed to eradicate, and the introduction of means to reduce that probability, if considered advisable. The project planning phase evaluated the probabilities of rats reaching the islands by various means, and considered that they were low enough to recommend eradication, but that improving biosecurity was advised. As part of the restoration of the islands, it is essential also to prevent other invasive species from reaching them. The project therefore included a set of activities to improve biosecurity for the islands.

MNRE staff and the local communities of Aleipata District were to be trained in biosecurity and given the means to implement improved measures. This included training, the development, production and use of biosecurity protocols and guides, and the implementation of a long-term monitoring and rapid response system.

The biosecurity training was scheduled to be run by PII in September 2009 in Auckland, and community and MNRE members were attending the course when the tsunami struck Samoa. The Samoan participants had to abandon the course and return to their families, and this workshop was eventually completed in Samoa in March 2010.

A biosecurity manual and visitors' guide (MNRE & Aleipata Islands MPA Committee 2012, MNRE et al. 2012) were developed by SPREP and PII, and submitted to MNRE for eventual publication and distribution.

A system to inspect boats, equipment and supplies taken by people visiting the islands was established by the MPA Committee and they undertook inspections through most of 2010. However, the system lapsed in 2011.

The tsunami was a possible cause of the rats now found on Nu'utele, as much debris was washed up on Vini Beach (see Figs 8 and 9). Lines of bait stations with wax baits and traps were set up on Vini Beach in January 2010 and on Nu'utele Beach in March 2010. Such devices have not yet been set up on Nu'ulua owing to problems of access. Nu'ulua can only be reached if seas are relatively calm and the consequent low rate of visitation by boats is one of its key defences against re-invasion by rats. It has not been possible for MNRE to establish regular monitoring or a rapid-response system for the islands. This should be a major concern for any future eradication plans, whether of rats or any other pest on the islands.

Figure 8. Ulutogia Women's Committee Centre, 22 November 2005 and 2 October 2009. Nu'utele and Nu'ulua are off the frame to the right. Photos courtesy of Petaia I'amafana.

Figure 9. Lalomanu looking east, 10 December 2005 and 2 October 2009. Namu'a Island is visible on the right, with Nu'utele and Nu'ulua further off the frame to the right. Photos courtesy of Petaia I'amafana.

Component 7: Dissemination of results

The three publications and 12 unpublished reports produced by this project to date are marked with asterisks in the References, below. Further publications are expected to be produced in the coming months, to place more of the results on the scientific record.

Periodic press releases were issued by SPREP to mark significant stages of the project, and articles stemming from them appeared in the Samoan media, including newspapers, radio and television.

The project was featured in the SPREP Annual Report for 2009 (Anon. 2010), and on the SPREP web site. Periodic information briefings and reports were disseminated throughout Pacific invasives and conservation networks, in the *PILN Soundbites* and PII e-newsletters.

MNRE staff met periodically with the MPA Committee and local communities, to keep them informed of progress with the project.

The rat operation was the subject of a presentation at the international conference on *Island Invasives: Eradication and Management*, held in Auckland, February 2010.

It was planned to produce a short video on the project, but this proved impossible owing to capacity loss due to staff turnover at MNRE. Extensive footage of project activities was taken and remains available.

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*Schuster, C.T. 2010. *Bird Counts Report: Restoration of Nuutele and Nuulua Islands (Aleipata Group)*. Unpubl. report to SPREP.

Tye, A., Barun, A., Bonin, M., Evaimalo, N., Fisher, R., Gleeson, D., Iese, C., Tipama'a, T., Uili, M. 2011. *CEPF Small Grant Final Project Completion Report: Emergency Management of an Incursion of Mongoose on Upolu Island, Samoa*. Unpubl. report to CEPF.

Vanderwoude, C., Siolo, S., Sio, F. & Samani 2006. *Assessment of Yellow Crazy Ants (*Anoplolepis gracilipes*) on Nuulua Island, Aleipata, Samoa with recommendations for population control.* Unpubl. report to SPREP.

*Wylie, M. 2009. *Report on the Nuutele & Nuulua Island (Aleipata) Pacific Rat Eradication Project*. Unpubl. report to SPREP.

Please summarize the overall results/impact of your project.

Planned Long-term Impacts - 3+ years (as stated in the approved proposal):

Nu'utele and Nu'ulua Islands, Aleipata Group, are restored as key sites for the conservation of Samoa's indigenous biodiversity. The native fauna and flora have shown dramatic improvements in populations after being released from the impact of introduced pests, and further species have been introduced to the islands to ensure their conservation. Nu'utele Island is used for small-scale ecotourism under the MPA umbrella and benefiting its traditional owners and the people of the District. Nu'ulua Island is a largely unvisited wildlife sanctuary.

Actual Progress Toward Long-term Impacts at Completion:

It is too soon to assess the long-term impacts of this project fully, but these may be summarised as follows:
1. Rat eradication. Rats have been detected on Nu'utele Island, following the eradication attempt. We do not know whether these are survivors of the eradication or reinvaders. Survival might have been favoured by high densities of crabs burying bait quickly, while reinvaders might have been assisted by the September 2009 tsunami. We hope that this question may be resolved by future DNA analysis of rat populations, and a future plan (another eradication attempt or not) will depend to some extent on the results of these analyses.
2. Island restoration. Even though rats are on Nu'utele, the temporary reduction in their population permitted an escape of seedling regeneration which will have a lasting effect on future forest structure. Regeneration had been impeded by predation on seeds and seedlings, and there is now a cohort of saplings ready to serve as replacement and reinforcement of the populations of native forest trees. This would not have occurred without the eradication attempt, and its effects will last for decades.
3. Nu'ulua. It has been impossible to resurvey Nu'ulua fully since a few days after the eradication attempt, so we do not know whether rats still occur on the island. It is hoped to resolve this question by helicopter-assisted survey in May 2012.
4. Yellow Crazy Ant. The work carried out by this project provides the basis for an eventual realistic management plan. It is hoped that Dr Ben Hoffmann will continue work on the islands and contribute to such a plan.

Planned Short-term Impacts - 1 to 3 years (as stated in the approved proposal):

Following the removal of rats and control of yellow crazy ants, a recovery of native plants and animals has been documented by monitoring. Friendly ground doves have been returned to the Nu'utele and are increasing in number. A biosecurity programme is active to minimise the risks of these and other pests invading.

Actual Progress Toward Short-term Impacts at Completion:

1. Biosecurity. The local communities and MNRE staff were trained in suitable biosecurity measures for the islands, and these were temporarily implemented. However, procedures are no longer being followed.
2. Bird populations. Bird populations seem to have benefited from the reduced rat population, although if rat populations reach their pre-eradication levels, the bird populations are expected to return also to their pre-eradication levels.
3. For other aspects of recovery, see Long-term impacts above.

Please provide the following information where relevant:

Hectares Protected: 108 (Nu'utele) and 25 (Nu'ulua).

Species Conserved: This was an ecosystem-focused project. However, the following IUCN threatened species benefited: Friendly Ground Dove *Gallicolumba stairi* (VU); Tooth-billed Pigeon *Didunculus strigirostris* (EN); Hawksbill Turtle *Eretmochelys imbricata* (CR); Coconut Crab *Birgus latro* (DD).

Corridors Created: n/a

Describe the success or challenges of the project toward achieving its short-term and long-term impact objectives.

Successes and shortcomings are described above and are summarised under individual components, below. Challenges and steps taken to overcome them are described under Lessons Learnt, below.

Were there any unexpected impacts (positive or negative)?

None noted that were directly attributable to the project.

Project Components

Project Components*: Please report on results by project component. Reporting should reference specific products/deliverables from the approved project design and other relevant information.*

Component 1 Planned: Pacific rats (Rattus exulans) are eradicated from Nu'utele and Nu'ulua Islands by aerial delivery of toxic baits.

Component 1 Actual at Completion:

It is not yet known whether rats were eradicated on either island. Rats are present now on Nu'utele, but it is not clear whether these are survivors of the operation or re-invaders. It is unlikely that Pacific Rats would swim the distance from Upolu to Nu'utele, but the tsunami in September 2009, just after the eradication operation, washed up large quantities of debris on the island, on which rats could have floated. Samples were collected for DNA analysis to try to determine whether the rats now on the island are survivors or re-invaders, but these were lost by the courier company contracted to send them to the lab in Auckland. Further sampling is planned for May 2012.

It has not been possible to survey Nu'ulua since August 2009, just after the rat operation. No rats were detected then, but a further survey is needed to confirm this. The survey is planned for May 2012.

Component 2 Planned: Friendly ground doves (Gallicolumba stairii) protected by capture and transfer from Nu'utele to a temporary facility and return to the island after the poisoning operation.

Component 2 Actual at Completion:

Successfully completed.

Component 3 Planned: Consultancy to CSIRO for ant work.
Yellow crazy ants are either managed or researched, according to information acquired during first year of project. Research focuses on biology and impacts and the results are used to prepare a management plan.

Component 3 Actual at Completion:

Research on biology and impacts was carried out, although more needs to be done before a detailed management plan can be prepared. Management recommendations include not to attempt eradication, although on Nu'utele, suppression of the Vini Beach population and local eradication of the Nu'utele Beach and western ridge populations are feasible.

Component 4 Planned: Changes in native flora and fauna following removal of pests are monitored.

Component 4 Actual at Completion:

This component was only partially successful, largely due to inconsistency of sampling techniques and lack of reports from some contributors. Best results were obtained for vegetation photo-points.

Component 5 Planned: Increase awareness of project and its benefits within Aleipata communities and ensure their involvement.

Component 5 Actual at Completion:

Community support was in general good, and liaison with the communities worked well, despite the effects of the 2009 tsunami on Aleipata District. However, the latter caused delays or inability to complete some of the formal community relations exercises planned.

Component 6 Planned: A biosecurity programme is established with the aim of preventing the reintroduction of rats (all Rattus spp.), ants and other invasive species to the islands following the project.

Component 6 Actual at Completion:

Training was completed and a biosecurity manual and visitors guide written. A community-led biosecurity inspection system was put in place, but was has since been abandoned by MNRE and the communities. A monitoring and response system was partly established, but it has not been possible for MNRE to maintain it.

Component 7 Planned: Project results are written up and shared widely in region.

Component 7 Actual at Completion:

Mostly completed, except for the planned project video. Further publications are expected.

Were any components unrealized? If so, how has this affected the overall impact of the project?

No Component was entirely unrealized, however, some did not fully achieve the results expected of them, as follows:

Component 1: Eradication of Pacific Rats. The detection of rats on Nu'utele after completion of the eradication attempt was a disappointment, and the reason for the presence of rats is not yet known, as discussed above. However, the project resulted in a release of forest regeneration and of populations of some animals, and the long-term effects of this will be positive for the island ecosystem.

Component 3: Management of Yellow Crazy Ants. The ant studies provided valuable information needed to produce a rational management plan, but part of the study, intended to have been carried out by MNRE staff, was not done. Before a management plan is written, further information is required on suitable bait-toxin mixes and on ant biology on the islands.

Component 4: Monitoring ecosystem response. No reports on the reptile monitoring were provided by the consultant recruited to do this work, Dr Robert Fisher. The bird monitoring programme was insufficiently sensitive to determine modest population changes, although if continued and refined it could provide valuable data. Vegetation plots established by MNRE were not maintained and data were lost, but photopoints provide some record of vegetational changes.

Component 6: Biosecurity. The community-managed biosecurity system for the islands was not maintained. Biosecurity is no better than before the project, and further pest incursions to the islands may be expected. A monitoring and rapid-response system, to be operated by MNRE, has not been established.

Component 7: Dissemination of results. The planned project video was not produced, although extensive footage of project activities was taken and remains available.

MNRE has included follow-up on some components of this project in its activities financed by the GEF-funded Pacific Alliance for Sustainability project "Prevention, control and management of invasive alien species in the Pacific Islands". This includes further monitoring for rats, other invasives and ecosystem response on the islands.

Please describe and submit (electronically if possible) any tools, products, or methodologies that resulted from this project or contributed to the results.

This was one of the first helicopter-delivered rat eradication attempts on islands of Oceania, and the first in Polynesia. The Ground Dove holding techniques were to some extent experimental. The ant work should contribute to the development of management techniques useful for Yellow Crazy Ant control, within and outside Samoa. The biosecurity documents would be useful if applied locally and serve as guides for the development of similar documents for other sites.

Lessons Learned

Describe any lessons learned during the design and implementation of the project, as well as any related to organizational development and capacity building. Consider lessons that would inform projects designed or implemented by your organization or others, as well as lessons that might be considered by the global conservation community.

Project Design Process: (aspects of the project design that contributed to its success/shortcomings)

A major factor contributing to success was the recruitment of key advisors for several of the components, including an overall operations supervisor for Components 1, 2 and 4 (David Butler), an aerial operations advisor (Malcolm Wylie) and an expert on Yellow Crazy Ant (Ben Hoffmann).

Some of the project's activities were not achieved owing to lack of completion of commitments by other project staff and advisors. This applied to parts of Component 3 (monthly ant monitoring), Component 4 (reptile, bird and vegetation monitoring) and Component 6 (implementation and maintenance of biosecurity inspections, long-term monitoring and rapid response). Capacity loss due to staff turnover at the main government partner agency contributed to this.

Further details on these points may be found in Butler *et al.* (2011).

Project Implementation: (aspects of the project execution that contributed to its success/shortcomings)

Based on our experience contracting a helicopter company, it is not sufficient to rely on one company that appears to be in a 'preferred supplier' position; a tender process should always be run to ensure back-ups in case situations change.

Based on experience with bait supply, if timing is tight, it would be worth drafting major supply contracts with suppliers at the point that funding looks assured rather than after it is approved. This would allow more time to address any conflicting issues.

A period of at least four months should be allowed between the confirmation of funding and an operation of the complexity of the rat eradication, to allow sufficient time for the process of tendering, testing equipment and assembling it on site.

Always build in at least one week's contingency for shipping delays and issues releasing and unloading cargo.

Butler et al. (2011) discussed the many changes in Government personnel involved in the project which meant that advisors and managers had to take a greater role than expected in project activities. Support from MNRE's Division of Environment and Conservation was not as strong as expected. In particular the Marine Section did not provide the boat support it was committed to, despite the project providing it with an outboard engine for its MPA work. MNRE Terrestrial Division was also unable to carry out other aspects of the project work, discussed above, owing to loss of capacity due to staff turnover during the period of the project.

For further lessons learnt regarding the rat operation, see Butler *et al*. (2011).

Other lessons learned relevant to conservation community:

Although the rat eradication on Nu'utele was followed by the detection of rats on the island, the temporary reduction of the rat population produced a valuable pulse of forest regeneration.

Additional Funding

Provide details of any additional funding that supported this project and any funding secured for the project, organization, or the region, as a result of the CEPF investment in this project.

Donor	Type of Funding*	Amount	Notes
SPREP	A, in kind	$50,000	Invasive Species Advisor and communications staff time, financial and administrative support, office supplies and communications costs.
New Zealand Department of Conservation	A, in kind	$15,000	Staff time contributions.
Pacific Invasives Initiative	A, in kind	$10,000	Staff time for training and biosecurity document input
Pacific Invasives Learning Network	A, in kind	$5,000	PILN Coordinator staff time
Ministry of Natural Resources and the Environment, Samoa	A, in kind	$85,000	Staff time
Local Community	A, in kind	$500	Logistical support
US Geological Survey	A, in kind	$8,500	R. Fisher staff time
University of Auckland	A, in kind	$5,000	Staff time and support for ant work.
GEF	B	$25,000	For ant research and management and for invasives monitoring on the Aleipatas.

Additional funding should be reported using the following categories:

- ***A*** *Project co-financing (Other donors or your organization contribute to the direct costs of this project)*
- ***B*** *Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF funded project.)*
- ***C*** *Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*

The total cost of the project

This may be calculated as the amount of the grant spent ($222,816) plus the major costed in-kind contributions mentioned above (excluding the new funding from GEF), making a total cost of US$401,816.

Sustainability/Replicability

Summarize the success or challenge in achieving planned sustainability or replicability of project components or results.

The main challenges to sustainability were the inconsistent support provided by government and local community partners to different aspects of the project, as discussed above and under "Recommendations" below. However, the project clearly fell within the priorities of Samoa's National Invasive Species Action Plan (NISAP), and follow-up activities have been included by MNRE in its plans under the GEF-PAS Invasive Species project which began in 2012, including further monitoring on the islands and revision of Samoa's Emergency Response Plan to cover incursions more effectively.

The project is replicable, and several Pacific countries and territories are planning similar projects. Part of the value of the present project was therefore its clear identification of some of the challenges to undertaking this kind of work in Oceania, as discussed in this report and in Butler *et al.* (2011) and Hoffmann (2011).

Summarize any unplanned sustainability or replicability achieved.

n/a

Safeguard Policy Assessment

Provide a summary of the implementation of any required action toward the environmental and social safeguard policies within the project.

The toxin used for the rat eradication, brodifacoum, is toxic to vertebrates. Negative impacts have been recorded on some bird species that eat bait fragments. The project recognised that a few bird species common in the country, such as the Banded Rail, might suffer a few individuals killed, but the national populations would be unaffected. Both islands were surveyed a few days after the bait drops, to determine non-target impacts. Two dead Banded Rails were found, but many other live ones were seen, and the population of this species on the islands remains healthy. No other dead animals were seen except rats.

As described above, Friendly Ground Doves were removed to a temporary aviary and returned to the island once the baits had disappeared, but doves left on the islands were unharmed.

Additional Comments/Recommendations

This project was always envisaged as part of a longer-term programme for island restoration and maintenance. In this section some recommendations are given for the next steps towards this, organized according to the Components of the CEPF project.

1. Rats, pigs and fowl

From our present state of knowledge, three stages are envisaged for the next steps in rat management on the islands:

- Further research to discover whether rats are on Nu'ulua and whether those on Nu'utele are survivors or re-invaders.
- Based on research results, decide on the most advisable future management (new management plan).
- Securing funding and resources to implement the new plan.

Further research

Nu'ulua. The priority for Nu'ulua is to determine whether rats are present or absent. A thorough survey using a variety of detection methods should be carried out over several nights (minimum two nights). Leaving detection devices on the island and rechecking after four or five days would be an alternative acceptable means, or an additional step. This survey is planned to be carried out in May 2012, using a helicopter to drop and retrieve staff and equipment. In addition to traps and other detection devices, night searches should be undertaken, and other rat sign such as rat-chewed fruit should be looked for during the day. Any fruits found with chewed holes should be collected so that they can be examined by an expert to identify what was feeding on them. Walking slowly at night with powerful torches looking on the ground and up the lower parts of trees can detect rats through 'eye shine' or movement.

Detection devices to employ include Kamate aluminium and Victor wooden kill-traps, held by MNRE, with roasted coconut as bait. Tomahawk live traps can be set up to allow rats access and keep out crabs (fixed on platforms that crabs cannot reach, with a ramp placed with a gap between it and the trap that a rat can jump but a crab cannot reach across). Wax tags made from unscented candles melted in moulds and a lure added, such as coconut cream or grated coconut, are cheap and easy to produce in large quantities, and can be used to obtain good coverage over the whole island. Tags that have been chewed should be brought back for analysis. Traps and tags should generally be placed about chest height to be out of the reach of crabs. If lots of tags are available some could be placed lower as Nu'ulua appears to have few crabs. Sticky traps as used on reptile surveys by MNRE staff can be used to detect rat hair; staff experienced in using these would be able to detect rats and safely release any reptiles caught. Rodent Baiter stations (5-6 held at MNRE) can be nailed to small trees in a way that prevents crabs getting access to the entrances, and a variety of baits fixed inside. The presence of rats would be indicated by feeding on baits and by droppings found in the stations – they need to be opened carefully to catch any droppings.

If any detection devices show signs that rats are present, then traps should be moved to that area to try to catch them. Pieces of coconut can be placed on the ground around the trees with traps on to help attract rats.

If rats are detected on Nu'ulua, then the next steps would be as for Nu'utele, below. Rat tail samples should be obtained.

Nu'utele. The priority for Nu'utele is to obtain a new sample of rat tails for DNA analysis, to attempt to determine if they are survivors or re-invaders. Trapping should occur where rats have previously been caught, that is at Vini Beach and up the hill to the area where most rats were caught during the last survey. There is no need to go any further from Vini than the top of the ridge. Kamate and Victor traps should be used (technique as above) until a enough have been collected. The ideal number is 20–30, but at least 10 are needed.

A tail sampling protocol is available on the PII website. One tail only should be placed in each vial with scissors or a small sharp knife wiped clean with alcohol between rats, so blood etc containing DNA cannot be mixed from one to another. There are plenty of vials at MNRE and 96% alcohol can be bought from Samoa Pharmacy. Rubbing alcohol (50%?) could be used as a substitute.

Upolu. More Pacific Rat tails need also to be collected from Upolu in Aleipata District (ideally 20–30, but at least 10). Several trap nights may be required because the other two species of rat are common there. The single Pacific Rat caught during the last visit was on a coconut tree by the beach, not in the bush on the inland side of the road. Some habitats might be more favourable for catching Pacific Rats, perhaps a plantation or the forest at the base of the cliff at Lalomanu.

DNA analysis. Send the samples to Ecogene (Auckland University, Tamaki Campus) for analysis.

Considerations for a new rat management plan

Detailed recommendations must await the results of DNA analyses. These could provide evidence on whether the rats on Nu'utele are survivors or new arrivals, or they may give no clear guidance. If the rats on Nu'utele and Upolu have sufficiently different DNA (consistent with a long period of isolation), it can be concluded that the rats now on Nu'utele survived the operation. If the DNA of the two rat populations is not that dissimilar, then we cannot conclude whether the rats now on Nu'utele are survivors or re-invaders.

If rats are found on Nu'ulua, this would suggest that rats survived the operation, since new arrivals are unlikely because few boats visit there (though the tsunami a complication). Rat DNA from Nu'ulua would permit comparison with Nu'utele and Upolu, providing additional evidence on whether rats on both islands are survivors or re-invaders.

Before a follow-up poisoning operation is considered, concerns over biosecurity and Government support need to be addressed (see below).

Pigs and domestic fowl

Pigs should be eradicated from Nu'utele as soon as possible. A hunting operation with shooters and dogs or traps would be most effective. Pig eradication is desirable on its own, irrespective of rats, as pigs can do major damage to the island (including to breeding Ground Doves). Although domestic fowl (feral chickens) may be less damaging, they will have impacts on invertebrates and lizards and they should also be eradicated. Eradication of pigs and fowl would be achievable at low cost with experienced personnel. It would be advisable to make this community driven, via the Sagapolutele family, as it would only be through the community that pigs and chickens could get back to the island. This could also be an opportunity to do further community advocacy work.

2. Friendly Ground Dove

Feathers were collected for DNA analysis, to be sent to Mike Sorenson of Boston University msoren@bu.edu. This will be pursued by SPREP with Mike and with scientists in the Department of Marine and Wildlife Resources, American Samoa, who had proposed a study of genetic differentiation between the different populations of the species.

A system to monitor the populations of this species in the long term should be developed.

3. Yellow Crazy Ant

Monthly sampling of Yellow Crazy Ant nest contents and nest density should be continued to fill knowledge gaps on the biology of the ant, especially to determine the timing of queen production. Such information is critical for effective management, and should be known prior to any broad-scale management operation, because treatments should be timed around the queen reproductive phase. The distribution of the ant should be monitored annually to bi-annually, to ensure that management actions are achieving their goals or to re-assess the ant's status and risk on the island. Additional research should be instigated to address the apparent relationship found between Yellow Crazy Ant distribution and the supply of carbohydrate resources from both plants and phytophagous insects. The relationship found, between an invasive ant and vegetation composition, has never been demonstrated before, and might allow the distribution and impacts of Yellow Crazy Ant within any area to be predicted based on vegetation composition. This research would require comparative work on Nu'ulua, where the species is established island-wide.

Meanwhile, eradication from the island is not recommended as a management goal, in part because Yellow Crazy Ants are probably arriving relatively frequently on Nu'utele in boats and materials from Upolu. Suppression of the Vini Beach population and local eradication of the Nu'utele Beach and western ridge populations are feasible, although the suppression is likely to be temporary and the environmental impacts of repeated treatments by toxic baits need to be balanced against the impacts of the ants.

4. Ecosystem monitoring

Robert Fisher should be further encouraged to supply results and reports from his work on reptile monitoring.

An improved method of bird monitoring should be designed.

Periodic monitoring of reptiles, birds, vegetation and invertebrates should continue.

5: Community relations and Government support

MNRE should continue to work closely with the MPA Committee and Aleipata District communities, to ensure the maintenance and enhancement of the biodiversity values of the islands.

Currently MNRE's Terrestrial Division has minimal field capacity and is not functioning strongly. Changes are needed before MNRE can play its full role in any future operation.

6. Biosecurity

The community-managed biosecurity system needs continuous support from MNRE if it is to become and remain functional. The biosecurity manual and visitors' checklist should be printed and distributed to the MPA and local communities, and should also be adhered to and enforced by MNRE.

A long-term surveillance programme should be established on Nu'ulua and Nu'utele, to detect new pest incursions. A rapid-response system needs to be developed to deal with incursions detected. Outline plans for these are included in the biosecurity manual.

As part of the long-term pest surveillance system, rat detection devices should be left on Nu'ulua if no rats are detected there in May 2012. 'Storm' rodent baits (available from Farm Supplies) should be wrapped in aluminium foil and placed (ideally wired) in the Rodent Baiter bait stations. Kamate traps can be left nailed to trees with long-life baits. A line(s) of bait stations and traps should be set up in the forest on the flat behind the beach with devices 50 paces apart.

Information Sharing and CEPF Policy

CEPF is committed to transparent operations and to helping civil society groups share experiences, lessons learned, and results. Final project completion reports are made available on our Web site, www.cepf.net, and publicized in our newsletter and other communications.

Please include your full contact details below:

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*****If your grant has an end date other than JUNE 30, please complete the tables on the following pages*****

Performance Tracking Report Addendum

CEPF Global Targets

(1 May 2009 to 31 Dec 2011)

Provide a numerical amount and brief description of the results achieved by your grant.
Please respond to only those questions that are relevant to your project.

Project Results	Is this question relevant?	If yes, provide your numerical response for results achieved during the annual period.	Provide your numerical response for project from inception of CEPF support to date.	Describe the principal results achieved from 1 May 2009 to 31 Dec 2011. (Attach annexes if necessary)
1. Did your project strengthen management of a protected area guided by a sustainable management plan? Please indicate number of hectares improved.	Yes	133 ha	133 ha	Aleipata Islands Marine Protected Area.
2. How many hectares of new and/or expanded protected areas did your project help establish through a legal declaration or community agreement?	No			
3. Did your project strengthen biodiversity conservation and/or natural resources management inside a key biodiversity area identified in the CEPF ecosystem profile? If so, please indicate how many hectares.	No			
4. Did your project effectively introduce or strengthen biodiversity conservation in management practices outside protected areas? If so, please indicate how many hectares.	No			
5. If your project promotes the sustainable use of natural resources, how many local communities accrued tangible socioeconomic benefits? Please complete Table 1below.	No			

If you answered yes to question 5, please complete the following table

Table 1. Socioeconomic Benefits to Target Communities

Please complete this table if your project provided concrete socioeconomic benefits to local communities. List the name of each community in column one. In the subsequent columns under Community Characteristics and Nature of Socioeconomic Benefit, place an X in all relevant boxes. In the bottom row, provide the totals of the Xs for each column.

Name of Community	Community Characteristics								Nature of Socioeconomic Benefit												
									Increased Income due to:												
	Small landowners	Subsistence economy	Indigenous/ ethnic peoples	Pastoralists/nomadic peoples	Recent migrants	Urban communities	Communities falling below the poverty rate	Other	Adoption of sustainable natural resources management practices	Ecotourism revenues	Park management activities	Payment for environmental services	Increased food security due to the adoption of sustainable fishing, hunting, or agricultural practices	More secure access to water resources	Improved tenure in land or other natural resource due to titling, reduction of colonization, etc.	Reduced risk of natural disasters (fires, landslides, flooding, etc)	More secure sources of energy	Increased access to public services, such as education, health, or credit	Improved use of traditional knowledge for environmental management	More participatory decision-making due to strengthened civil society and governance.	Other
Total																					

If you marked "Other", please provide detail on the nature of the Community Characteristic and Socioeconomic Benefit: