Monuriki Island Goat Removal

(a project of The National Trust of the Fiji Islands supported by the Pacific Invasives Initiative)

Report of a Feasibility Study Visit; 7-11 June, 2010

(with updates to December, 2010)

Prepared for: The National Trust of the Fiji Islands

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The National Trust of Fiji (NTF) is a statutory body funded jointly by the Fiji Government, independent donors and multi-lateral projects and was established in 1970 to provide for the protection of Fiji's natural, cultural and national heritage. It is the only National Trust of the South Pacific region and specialises in both the natural and cultural aspects of heritage conservation.
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The Pacific Invasives Initiative (PII) works to strengthen the capacity of Pacific Island Countries and Territories to effectively manage invasive species threats.
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Yanuya community involvement
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Jope Samila – Village Headman (government official connected to Provincial Office)
Timoci Cava – Village Committee Chairman
Apisai Susu (No. 1) – Mataqali Vunaivi - Goat owner
Sitiveni Drigi (No. 2) - Village Committee. Mataqali Vunaivi - son of the Goat owner
Mitieli Bale: Mataqali Vunaivi – leader of muster
Josevata Lewavari - Chef
Yanuya Rugby Team

Reviewers: Island Eradication Advisory Group, NZ Department of Conservation

Version History:

VERSION	DATE	AUTHOR	REASON FOR CHANGE
Original draft	*30 June 2010*	*Glen Coulston*	*Created*
2nd draft	*07 December 2010*	*National Trust of Fiji*	*Additional information*
3rd draft	*17 December 2010*	*M. Ratu*	*Additions & alterations*
4th draft	*24 December 2010*	*Bill Nagle*	*December update*
5th draft	*01 February 2011*	*National Trust of Fiji*	*Final draft*

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EXECUTIVE SUMMARY

This feasibility study has been undertaken by the National Trust of the Fiji Islands (NTF) with support and advice from the Pacific Invasives Initiative. The investigation was conducted to determine the best way to eradicate goats from Monuriki Island and how to proceed with such an operation.

Goat eradication on Monuriki is technically and socially feasible. It is clearly evident from numerous past Pacific island goat eradications (for example Lord Howe, Kermadec, Galapagos) that removal of goats from a small 40ha island such as Monuriki is highly achievable. The issue however is how best to go about doing so.

The community on Yanuya including the Matagali Vunaivi and the family that owns the goats have agreed to the total removal of the goats in perpetuity. Prior to the arrival of the Feasibility Study team, they had decided to proceed with a mustering technique followed by use of local dogs. After discussion, there was agreement that where any goats remain following this approach they should be removed by hunters contracted to NTF in 2011. The initial stages of this approach have already started with three musters conducted during the visit in June and several since then. Many goats still remain.

The eradication attempt is being undertaken in several stages. Firstly by the community of Yanuya in conjunction with NTF in order to procure a boat and outboard for the goat owners and set of rugby jerseys for the local rugby team, with the expectations that, secondly, NTF will remove any remaining goats once the community has obtained the aforementioned assets. Changes in the commitment of the community are described below in Section 6.3 Updates.

There are a numbers of risks and challenges that largely revolve around resource availability (skilled contract labour, skilled dogs, staff time, finances), and timeframe planning for completion, particularly surrounding the duration of mustering approaches and when to change to contract hunting. These however can and will be managed as explained further in the document.

Goats are not the only invasive species on Monuriki. Pacific rat densities may increase as a result of increased flowering and fruiting following goat removal and this may well exacerbate levels of rat predation on eggs and young iguana. Ants were also observed at the campsite.

Between the Feasibility Study visit in June and the last NTF visit in November there were changes in the commitment and activities of the community. These are described below in Section 6.3 Updates.

The final recommendation is that NTF discuss with the Yanuya community the possibility of bringing in professional hunters who will use Judas goats, trained dogs and firearms to complete the eradication in a timely manner. This should be treated as a separate project by NTF so that it is not compromised by other commitments.

1. INTRODUCTION

This report is prepared for the local authority, community and sponsors that have commissioned the work and will be undertaking the removal of the goats from the island.

The National Trust of the Fiji Islands (NTF) is the local authority responsible for this feasibility report and for implementing this eradication attempt. It is part of the Fijian Crested Iguana *(Brachylophus vitiensis)* recovery project that NTF is undertaking with funding from the Critical Ecosystem Partnership Fund (CEPF).

The project has three main components: 1) captive breeding of iguanas captured on Monuriki; 2) translocation of iguanas from the Yadua Taba Sanctuary and Kula Environmental Centre to chosen sites (Namenalala and Monuriki Islands); 3) weed management at the translocation sites.

The opportunity to eradicate goats as part of the restoration of Monuriki Island arose unexpectedly after years of consultation with the land-owning community and the involvement of the Nadroga/Navosa Provincial Office. The Pacific Invasives Initiative (PII) is supporting NTF with the invasive species management component of the project. During the feasibility study visit, it became apparent that the priority for NTF was to collect iguanas for captive breeding.

The purpose of this document is to provide an account of the work undertaken in determining whether feral goat removal from Monuriki Island is feasible and, to report on the findings of that work in terms of what technique is most suited for the eradication and how to proceed.

Thanks to Taukei Yanuya Ratu Sitiveni Drigi, Turaga ni Koro Jope Samila, Mataqali Vunaivi, the family of Apisai Susu that owns the goats, Assistant Roko Ratu Ilaitia Kurisaru of Nadroga/Navosa Provincial Office, Elizabeth Erasito, Jone Niukula and Kasaqa Tora of NTF, Steve Cranwell and Sialesi Rasalato of Birdlife Pacific and Bill Nagle and Natasha Doherty of PII.

NTF, Mataqali Vunaivi/Yanuya Community and Kula Environmental Centre have a memorandum of understanding regarding Monuriki Island and its population of iguana. The key attributes of which revolve around the capture of iguana for captive breeding and release back onto Monuriki once the pests are removed from the island.

This report will be used to guide the eradication through to completion and as one example for future goat eradication investigations in Fiji.

2. GOAL, OBJECTIVES and OUTCOMES

2.1. GOAL

Confirm the most feasible way of eradicating goats from Monuriki island and describe how to proceed with such an operation.

2.2. OBJECTIVES

2.2.1. Objective 1

Collate and investigate site and community specific information necessary to complete a plan for Monuriki goat removal

2.2.2. Objective 2

Complete a review of the information and provide recommendations on the best way of removing goats from Monuriki

2.3. OUTCOMES

2.3.1. Outcome 1

Provide a comprehensive report detailing how to remove goats from Monuriki in the most effective and efficient manner.

2.3.2. Outcome 2

Eradication of goats from Monuriki Island by December 2011

3. ECOLOGICAL PROBLEM

Monuriki Island is home to a unique, genetically distinct species of Fijian Crested Iguana *(Brachylophus vitiensis)*. Iguanas on Monuriki are at risk of extirpation unless goats and other introduced pests are removed. 10 pairs are being relocated to a captive breeding unit at Kula Environmental Centre for safe-keeping and captive breeding until the island is cleared of pests. Kula Environmental Centre is the only Centre in Fiji that runs captive breeding programmes for animals.

The iguana is an herbivorous species and goats are directly competing for food sources such as Vau or Tahitian Hibiscus *(Hibiscus tiliaceus)* with extremely adverse effects. Goats are also destroying the iguana habitat and possibly nests or burrows through the processes of erosion, forest denuding and trampling.

The population of Fijian crested iguana on Monuriki in 2003 was estimated to be less than 50 individuals. Vegetation surveys suggested that the abundance of the herbivorous crested iguana reflects the abundance of food trees present with only 2% of remaining forest trees on Monuriki being edible. Monuriki has been subjected to at least three decades of intensive goat grazing and regular dry season burning. The combination of goats and fire may have reduced the survivorship and recruitment of iguana food tree species. Selective browsing by goats on the seedlings of palatable tree species on Monuriki has resulted in the competitive release of unpalatable species inedible to both goats and crested iguanas (Harlow and Biciloa, 2001).

In 1998, 13 iguana per km of transect were recorded, but in 2003 the same areas were resurveyed and only 3.4 iguana per km of transect were recorded highlighting a marked decline (Harlow et al, 2007).

Wedgetailed shearwaters *(Puffinus pacificus)* are also found on the island and the erosion and trampling by goats is reducing the habitat for shearwaters to occupy. (Sialesi Rasalato, *pers.comm.* 2009)

3.1. Site description

Monuriki Island is listed under Fiji's National Biodiversity Statregic Action Plan as a site of national significance because of its threatened vegetation, iguana population and seabird colony. Based on the comprehensive national soil survey conducted in the 1950s

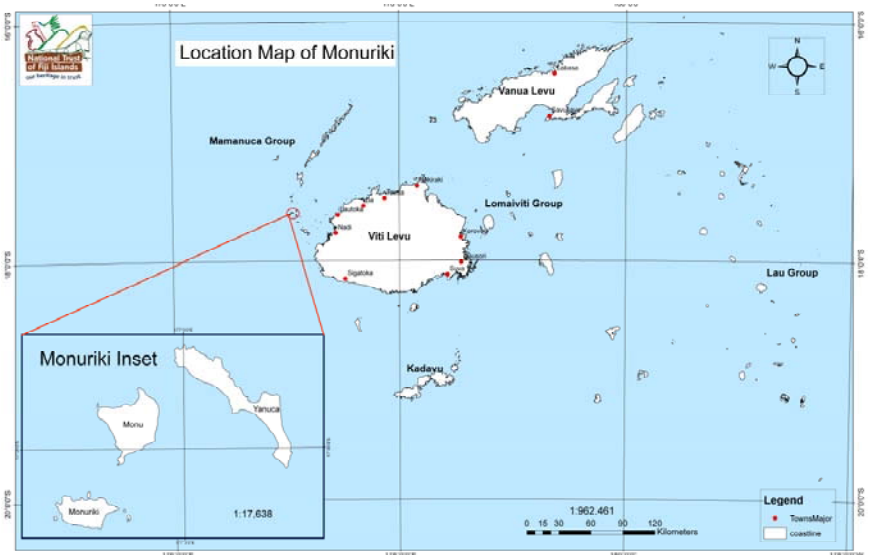
by Twyford and Wright (1965), the island has only 1 soil series. Tau boulder and stony clay loam defined by Twyford and Wright (1965) is shallow steepland soils developed on hard limestone and supporting heavy broadleaf forest, under a climate with a strong to moderate dry season.

The island is surrounded by a marine park the status of which is reviewed every 5 years. It has been in existence for one 5-year term and was renewed 1-2 years ago for a second term.

Monuriki is approximately 40ha in size and circular in shape. It has steep and broken terrain with two narrow strips of flat land with coconut beach forest on the south coast and the eastern tip. Located in the Mamanuca island group, it is two hours by ferry from the mainland port of Denarau.

The nearest village (population 500) is located on Yanuya Island a 15 minute boat ride east of Monuriki. The Mataqali Vunaivi clan own Monuriki Island and live at Yanuya. Members of the goat owning family visit the island occasionally to catch goats. The most recent reported visit was the week before our arrival with four goats caught.

The island has international interest as the site of the movie *Castaway* (Tom Hanks). Mataqali Vunaivi have given South Pacific Cruises a concession to land tourists on the island twice a day.



This is the first conservation project to occur on Monuriki Island and follows the trip made by representatives of the Yanuya community to Yadua Taba, a sanctuary with the largest population of Fijian Crested Iguanas in Fiji. The community owning Yadua Taba are very aware of conservation efforts and the status of native species in their area and Monuriki landowners decided to follow in their footsteps in order to save Fiji's unique native species.

So far, no one has done a comprehensive island biodiversity survey and the National Trust of Fiji will work with other organisations that have conducted surveys for their special interest on Monuriki and incorporate all findings into one report. A table of all species found on the island will be produced. The table will also list the conservation status of native species and include all invasives species on Monuriki.

Birdlife International conducted a Bird survey in November 2009 and created a list of all birds observed. Birds observed are listed below:

Monuriki birds observed: 9 November 2009

Common name	Scientific name
Vanikoro Broadbill	*Myiagra vanikorensis*
Fiji White Eye	*Zosterops explorator*
Wattled Honeyeater	*Foulehaio carunculata*
White Collared Kingfisher	*Todiramphus chloris*
Orange Breasted Myzomela	*Myzomela jugularis*
Fiji Goshawk	*Accipiter rufitorques*
Pacific Pigeon	*Ducula pacifica*
Red Vented Bulbul	*Pycnonotus cafer*
Seabirds:	
Noddy	*Anous* spp.
Booby	*Sula* spp.
Tern	*Sterna* spp.
Wedge-tailed shearwater	*Puffinus pacificus*

NTF will also be working with the Herbarium Department at the University of the South Pacific to conduct a vegetation survey and map weeds using GPS/GIS technology. A weed management plan will be prepared from the results shown to address any issues arising.

3.2. Target species and their impacts

Feral goat (*Capra hircus*) occupy the entire island. Community members estimated the goat population to be about 30-40 goats. However, the population during our visit was estimated at 120-140 goats - equivalent of 3-4 goats per hectare. Colouration was either pure black, white or fawn. There were no patchwork mixed-colour goats observed other than fawn/white-striped.

It appears from anecdotal reports and discussion with individual elders on Yanuya that the headmaster at Yanuya School released the goats onto Monuriki Island *circa* 1969. Official Department of Agriculture records are not available, but goats were reported to be available for sale and to be eaten on occasions from then until today.

Eighty animals were removed over the three days we were present in June, leaving an estimated 40-60 goats. This figure was arrived at based on the observations of goats caught and escaped during the mustering attempts and a single transect search the length of the island following the second day of mustering.

The goats are highly inbred, symptomatic of a low establishment population and confinement on a small island. Nannies as small as 10-15kg live weight were found pregnant upon first gestation. The largest billy observed was approximately 35kg live weight. Triplets were observed with one nanny.

Condition of the goats was very poor. Many were emaciated and pot-bellied and during the mustering some animals died from stress and exhaustion which displays the fine balance for survival these animals are living under. It is suspected there is little seasonal variation in population due to the benign tropical climate, however, it was evident that population growth saturation verses food availability and the resultant starvation cycles are likely to be holding the population at a static level.

Unlike temperate climate goats (for example New Zealand) these goats are breeding at different times. Our visit found new-born kids in June with many nannies heavily pregnant, whereas temperate climate goats are usually breeding March/April and giving birth in August/September.

The infrequent harvest by the Yanuya residents would be providing a respite to the goats in terms of population thinning, but it is not enough to prevent the damage the goats are causing to the ecosystem or to encourage a healthier and stronger population with adequate iguana food supply.

Browsing damage on germinating coconut. Photo: Glen Coulston

Severe erosion and goat tracks are evident across most of the island. Photo: Bill Nagle

The goats are having a major and negative effect on the island. Much of the threatened natural dry forest vegetation has been removed by the proliferation of goats and, in part, by occasional dry season burning. The goats are preventing any ability for full species composition revegetation to occur and, in the areas where natural vegetation has persisted, there is only a canopy tier with the sapling recruitment, groundcover and understory limited to the most unpalatable species. Iguana-palatable species are vanishing from the island or remain in very low populations.

In places, erosion is so severe that only bare rock is visible and trampling by goats may also have affected iguana nest sites. Casuarina has taken over in places where the forest has been browsed out and goats may have transported weed seeds around the island in their bellies. The weed burden will not be evident until goats are removed.

Severe browsing has stopped regeneration and damaged mature plants. Photo: Bill Nagle

The rugged terrain of Monuriki Island is ideal goat habitat. Photo: Chiemi Nagle

4. WHAT WILL IT TAKE?

4.1. Technical approach

Goats are a highly adaptive animal. They are very quick to learn and adjust to different pressures placed on them. Any individual control technique utilised on its own invariably becomes ineffective unless the element of surprise from the first encounter manages to catch all individuals exposed in the one opportunity.

Where animals manage to escape the first few attempts they become extremely wary and it is only by good luck the same technique will work at catching that individual. A different technique is required for the remaining goats in a population.

Eradication has 5 main criteria (Bomford, M and O'Brien P, 1995):
1. Kill rate must exceed birth rate
2. All target species must be put at risk by the method.
3. Immigration must be manageable
4. The method(s) used must be socially acceptable
5. The benefits must outweigh the costs.

On a small island such as Monuriki, with the community supporting the eradication and numerous proven techniques available for such geographic settings, these criteria can be met. The question is how best to proceed and minimise risk of a particular technique not meeting criteria 1, 2 or 5, so as to ensure it is successful and cost effective.

The answer to this is in the use of multiple techniques and not a reliance on one or two. Options include mustering/capture, dogging, Judas goats, toxin use, ground shooting and aerial shooting.

Removal of goats from Monuriki is comparatively simple in comparison to successful goat eradications such as Lord Howe, Galapagos, Santa Cruz, etc., which involved large and complex landscapes, terrain and habitats. However it is also going to be more complex than other eradications such as Yadua Taba with its gentle terrain, less impacted and higher density/more resilient populations of threatened species.

The goats on Monuriki are very naïve to hunting having had very little human pressure placed on them. However we can never underestimate their adaptability to pressure when it is applied. Just prior to this feasibility study commencing, the community decided to muster by people and then by dogs. Given that the local community has started mustering and, in essence educating the more cunning goats, it is critical now that the eradication is followed through to completion in a very short timeframe.

It is important for NTF to work with the community to ensure proper recording of data during goat mustering and it is recommended that NTF set a timeframe for the Mataqali Vunaivi to complete the mustering and dogging and move on with the eradication.

The use of local dogs could see an eradication achieved, as it brings in a second technique to deal with those goats wise to the mustering but, without knowing the effectiveness of the local dogs and the amount of pressure being applied, it is difficult to determine whether this may actually achieve the eradication, or whether further follow up effort will be required with contracted hunters and professional hunting dogs.

The nature of the terrain means goats have numerous escape routes into bluff areas where dogs may not be able to track. It is therefore likely that dogging and mustering will only be successful with a strong dose of good luck. The next phase, should the mustering and local dogs not have achieved the eradication, will be to engage professional hunters.

A number of scenarios are potentially going to play out:
- It is highly likely that the effort required to catch the last few goats will become unattractive to the local people investing such time and energy necessary to get the remainders. The mustering work will leave a low residual population that are wary and educated to humans from being chased.
- The local dogs could be highly effective and remove the last goats if they are used consistently and regularly enough and are capable. However, given the many hiding locations and bluffs for goats to escape from dogs and hole up in, it is a very remote outside chance that dogs alone will catch the last goat as the cunning goats will smell the dogs presence coming and head to its safe haven until the threat passes.

A decision needs to be made when to commence with the Judas goats or the preferred technique. It is imperative contingency plans are in place and ready to go for when the Mataqali Vunaivi decide they have finished. It will be necessary to confirm the goats are gone and to react immediately if there are still a few present.

It is recommended that locally-caught Judas goats (with tracking collars) be deployed as soon as the local dog effort has ceased and these goats monitored to see if any other goats do come out of hiding. These Judas goats should be easily caught animals kept on Yanuya until it is considered all goats are gone from Monuriki and then re-released and monitored. They should consist of 2 nannies and one billy. The last animals caught should not be used as these animals are likely to be more elusive and clever.

A key concern to address is the envisaged timescale for the eradication. There has not been a time-frame stipulated. The risk is in the fact that the island vegetation will start to respond the moment the browsing pressure is reduced by the thinning of the goat population.

This factor will enable more hiding places for the goats and make hunting them more difficult with the higher noise and lower visibility working in the goats favour. The longer the timeframe the worse this factor becomes. With an estimated 90% of the goats gone through the mustering and dogging strategy, one rainy season will see a dramatic increase in understory and vine regeneration, enough to hamper the final eradication attempt.

It is further recommended this eradication needs to be completed by December 2011 for a number of reasons:
1. The commitment to the community that eradication will occur.
2. The vegetation regeneration will significantly hamper eradication attempts if left any longer with a low residual population of educated goats.
3. Population buildup by the goats will be rapid given low density and high food availability and evidence already that the breed present can produce triplets.
4. Birdlife Pacific have expressed an interest in the goat eradication as part of the wedge-tailed shearwater restoration work outlined in their Draft feasibility report for Monuriki and Monu islands. They have indicated they have sponsor funds that may be available but that require expenditure by this timeframe (S Cranwell, *pers. comm.*, 2010). Further discussion between NTF, Birdlife and donors regarding availability and purpose is warranted.

4.2. Indicative costs

Item	Details	Cost
Operational Planning Stage:		
Contributions to community for economic loss of goat removal	Boat Water tanks as per quote ($400 x 6) and transportation cost	**FJD 4000** **FJD 4000**
Transport	FJD130 per person discounted cruise boat transport 1 way x 25 Fibreglass boat to Monuriki FJD60 per boat trip x 12 Take into account increased prices due to 15% VAT	**FJD 3,250** **FJD 720**
Contractor's Accommodation	FJD50 per night in Yanuya 2pp 4 nights Motel in Nadi FJD120 per person.2pp 4 nights Take into account increased prices due to 15% VAT	**FJD 400** **FJD 960**
General Field equipment	Field food Ammunition	**NZD 5,700**
Community Consultations	$1,000/visit x 2 visits	**FJD 2,000**
NTF Staff/Provincial Office Staff Costs	3 Pax @ FJD 150/day x 10 days	**FJD 4,500**
Firearms permits	Freights, permit application	**FJD 2,500**
2 x Professional dogs	Quarantine costs per dog Quarantine costs $5000 per dog	**FJD** **NZD 10,000**
Freight costs for dogs AKL-NAD-AKL (does NOT include internal travel in Fiji)		
Airfares for 2 hunters	$1500 each 2pp return NZ - Fiji x2 trips	**NZD 6,000**
Contract hunters	2 at $500/day with all their equipment provided - rifles, camping kit, GPS, 10 days each - 2 x 10-day trips.	**NZD 20,000**
Overheads		
Operational Planning Stage, Sub-total		
Operational Planning Stage, Contingency (10%)		
Operational Planning Stage, Expected cost		
Implementation Stage:		
Pre-operational monitoring		
Post-Operation Report		
Implementation Stage, Sub-total		
Implementation Stage, Contingency (20%)		
Implementation Stage, Expected cost		
Sustaining the Project Stage:		

Biosecurity – Set up		
Biosecurity – annual running costs		
Post-operational monitoring – annual costs		
Sustaining the Project Stage running costs for 5 years (A)		
Sustaining the Project Stage Set up costs (B)		
Sustaining the Project Stage sub-total(C=A+B)		
Sustaining the Project Stage Contingency (D=20% of C)		
Sustaining the Project Stage, Expected 5-year cost		
PROJECT TOTAL, Expected cost		

These total costs are for the worst-case scenario where firstly the community effort mustering and dogging does not eradicate the goats and secondly, the professional hunters and Judas goats fail to get all residual goats and then thirdly, professional trained dogs are brought in. The plan needs to be developed and alternatives in position to step into each stage when it becomes evident the effectiveness of the preliminary techniques have become exhausted.

4.3. Socially acceptable

The NTF has had several consultations with the community of Yanuya to discuss plans for the captive breeding program and later, the goat eradication program. Support for the captive breeding program was formalised by a MOU between NTF, Mataqali Vunaivi and Kula Environmental Centre. This document forms the basis for mutual cooperation between the NTF and the community of Yanuya and is an important point of reference for any future work with the community.

A socio-economic survey of the village was also conducted by the Provincial Office with assistance from NTF and Birdlife International staff with seventy-two of the one hundred and ten households interviewed. As there are a large number of hotels situated along the Mamanuca and Malolo group most men and women from the village are employed in this tourism industry. The second most common source of income for the village is through fishing.

More than half of the population surveyed are aware of the conservation of the Monuriki iguanas and the goat removal projects. This may be due to the recent activities that the community have been involved with in working with the NTF and Provincial officers. It was also observed that women are not actively participating in these initiatives.

The community of Yanuya, the family that own the goats, and the Mataqali Vunaivi clan who own Monuriki are all supportive of the goat eradication in the interest of protecting a national treasure and repairing the integrity of the island.

It was agreed by the goat owners that income generated through goat sales would be used to purchase a boat and outboard motor. There needs to be a follow up on the amount generated through sales to date and the remaining amount required to purchase the goods.

KEY STAKEHOLDERS

Name	Organization	Contact details	Stakeholder Group (interests/Motive)	Notes/comments
Assistant Roko Ratu Ilaitia Kurisaru	Nadroga Provincial office	6500 004	Endorsement and support from the Provincial Office	Strongly involved since the beginning of the Project – Protocol is to go through the Provincial level before travel to any Fijian community to carry out work
Taukei Yanuya Ratu Sitiveni Drigi	Yanuya Village Chief/ Mataqali Vunaivi	9338 139	Approval/village regulation knowledge	Good relationship with the community to assist NTF to continue working on the island, support of the "Vanua". Will be representing all community interests.
Steve Cranwell Sia Rasalato Elenoa Seniloli	Birdlife Pacific	3313 492	Environmental awareness programs, research/surveys/ eradication process	Provision of training to locals at Yanuya village
Betani Salusalu	Mamanuca Environmental Society		Environmental programs	
TBA	Donor			
Bill Nagle	PII	w.nagleAT auckland.ac.nz	Technical advice and support to Pacific agencies.	Capacity development

4.4. Politically & legally acceptable

The Fiji Arms and Ammunition Act (2003 regulates the possession, manufacture, sale, repair, storage, import and export of arms and ammunition. Additional provisions are defined in Fiji's Penal Code (1978), the Firearms, Explosives and Ammunition (Amnesty) Act (1998) and the Arms, Explosives and Ammunition (Amnesty) Decree (2000).

Firearm licenses may be granted for hunting, sport shooting and building a gun collection.

As a condition of licensing, firearms and ammunition must at all times be kept securely, in safe custody and in serviceable and safe condition. Owners must take all reasonable precautions to ensure they are not lost, stolen or at any time available to a person not lawfully entitled to use or possess them. No specification for safe civilian storage or description of minimum security standards is provided. Reportedly, an accepted option for Fiji gun owners is to leave their firearms and ammunition at a local police station for safekeeping.

A person arriving for a temporary stay with arms and ammunition for personal use, for example on a visiting vessel, must either deposit these with Customs or Police for safekeeping, ***or apply for an interim arms import license***.

The Minister and Commissioner of Police jointly hold authority to prohibit arms imports and exports.

Fiji's Quarantine regulations allow for the import of small animals such as cats and dogs, directly into Fiji by air only from Australia, Hawaii, and New Zealand. There are no exceptions to this list.

In order to import animals from a country that is not listed, they have to be first exported to one of the above countries, satisfy ALL their quarantine requirements and then applied to re-export the animals to Fiji from that country. All of Fiji's quarantine requirements will then have to be fulfilled for importing from this country.

The conditions of importation including the period of quarantine for Australia and New Zealand, is a minimum of seven days. All imported dogs and cats will be quarantined at the government Post-entry station located in Koronivia, near Nausori (Fiji). HOME QUARANTINE IS NOT PERMITTED.

The first step of this process is to obtain, fill and return an "APPLICATION TO IMPORT LIVE ANIMALS INTO FIJI" form from the office of the Director of Animal Health and Production in Fiji and or the Embassy of Fiji in New Zealand. If the application is approved, an Import Permit will be issued together with the conditions of importation and other relevant information. Veterinary staff at the Animal Health and Production Division will only be available for consultation at this stage of the process.

The activities assigned in this eradication are politically and legally acceptable. There should be no reason for such applications to be declined as long as appropriate, comprehensive and fully informative applications are submitted where they are necessary.

4.5. Environmentally acceptable

Removal of goats will have very positive benefits to the Monuriki Island environment. The extent of erosion and deforestation occurring due to goat presence is rapidly depleting the soils on the island. In places there is little or no topsoil available for plant growth. As mature trees collapse there is nothing to replace them other than non-palatable species as all palatable seedling recruitment has been browsed out in the presence of goats.

The eradication methods will have minimal impact on non-target species. There is a low impact possible from trampling of burrows and wildlife by the people involved if they are not made aware. Burrows and threatened wildlife are not in large numbers however, so they are easy to avoid. Use of suppressed firearms and well trained dogs is target selective so risk to other wildlife is non-existent.

In terms of disturbance factors during the eradication, the intensity of the activity is too low to create any significant disturbance such as species vacating the island to escape from people presence and noise. Untrained dogs could pose the greatest threat if they choose to attack the few threatened wildlife present. For this reason the dogs used must be well trained and target specific to avoid such risk. Professional hunters and dogs are well versed in all these aspects.

A small amount of mongoose grass (sp.???) was evident on the bluffs at the western end of the island. A single small infestation of Mikania (*Mikania micrantha*) was found on the eastern end of the island. These species will aggressively colonise the many bare, open sites once the goats are removed.

This eradication should include total control of the mongoose grass and Mikania as soon as possible and before the majority of goats are removed. Reasons being, firstly while in low numbers it is cost effective and secondly whilst in low numbers it is feasible to keep on top of the weeds. It is possible that the island could be littered with seed from these and other seeds that will survive germination with the goats gone.

Casuarina (*Casuarina equisetifolia)* is prevalent on the island and may require a long term management plan as it is more than likely a native plant. No seedlings or lower epicormic growth was observed on the Casuarina within browse line of the goats suggesting it may regenerate in thickets with the goats removed and may prevent plants palatable to iguana from germinating.

A long term weed control strategy should be designed for managing the three plants and responding to any other weeds species that may appear once the goats are gone. The mongoose grass and Mikania will require foliar spray and hand digging. Casuarina will require chainsaw and frill, drill and poisoning and foliar spray operations.

Whilst weed invasion is detrimental to the habitat it is not as catastrophically detrimental as the presence of mammalian pests. Weeds will slowly change the forest structure but still retain vegetation, prevent erosion and provide habitat for wildlife. The effect of weeds is over a longer term and can therefore be managed over the longer term. The fact weeds will increase if left unmanaged should not detract from the greater benefits of removing the mammalian pests.

A further benefit for the iguana stemming from goat eradication will be the increase in vegetation cover to protect iguana from avian predation from Pacific harrier and goshawk. Currently the denuded and grazed out forest makes for easy hunting for these raptors, and their current impacts on iguana and juvenile wedgetails first leaving the burrow on Monuriki could be underestimated.

4.6. Sustainablility

The NTF has recently signed an MOU between the Monuriki landowners and the Kula Environmental Centre for the protection of the Fijian crested iguanas on Monuriki Island through a captive breeding program. This is a huge milestone for community partnering in conservation in Fiji.

The community has witnessed firsthand the decrease in numbers of the Iguana populations over the years. This was reiterated during the first ever presentation conducted by the NTF on the island on threats and competition faced by the Monuriki Iguanas. An important factor here is how to identify the importance of non-target species and include them in the conservation planning process with all stakeholders.

For this year, it was the community's initiative to remove the goats and other pests from the island before releasing the new captive-bred iguana population back on Monuriki. The community of Yanuya have also highlighted that they will keep an open door policy, now that they have seen the clear picture of what conservation really means to them particularly not putting enough attention on native species. Now the idea is clear, to get

rid of the introduced and invasives species that can do a lot of damage to the Monuriki environment.

The NTF is also looking at conducting school outreach particularly for the Mamanuca Primary School based on Yanuya Island. This is part of its long-term strategy based on the number of years it will take to remove all pests from Monuriki Island particularly goats, rats and ants. Because there is a need to do an island restoration, this is a good time to begin a nursery at the site, to use seedlings that are native to Monuriki and Yanuya and schools can use the site to conduct its school project and that is to do planting activity at the site. The NTF should be providing data sheets just to keep the record of seeds planted and the methodology used.

There is a need to conduct community and hotel outreach as well. In this capacity, the NTF can link with the Mamanuca Environment Society that is currently running an awareness programs on the island and other NGO's creating various activities working towards the same goal. Media articles and awareness publications and materials should also go out to resorts and schools and the communities nearby.

INVASIVE PATHWAYS and BIOSECURITY

Communities

The greatest risk is that of local residents and tourists bringing pests onto the island when they visit. Bio-security risk is manageable as long as the people involved are willing to accommodate a change of behaviour from past practices.

Every party that visits the island should only use sealed containers for their equipment and supplies and these should have been checked and cleared for pests before sealing.

Transport such as fibreglass boats, cruise boats, helicopters, etc should be kept clean and tidy and checked before gear is loaded into them. Larger vessels with many hiding areas for pests should carry and maintain rodent and insect poison stations and traps.

Clothing, equipment and footwear should be checked and cleaned of soil, insects and plant matter.

Reverse biosecurity should occur when coming back from the island as well

Education and training of local residents and tourism operators is fundamental. Tourism operators' diligence can be controlled by concession rules and compliance.

Environmental factors

Many pests are spread by birds, ocean currents and wind. The primary pests being windborn insects and weed species. It is inevitable this risk is beyond our control to stop with border security procedures, however, active surveillance on the island and prompt response to incursions discovered can manage these invasions before they have a significant impact.

This table summarises invasive pathways and biosecurity issues.

Species	Source	Pathway	Risk	Prevention Strategy
Goats	Human	Deliberate reintroduction	Moderate	Education. Raised awareness of the risk of goats to islands of high ecological importance
Ants, insects, weeds, rodents	Visitors	Failure of biosecurity procedures	High	Education. Raised awareness of the risk of invasive species to islands of high ecological importance. Raised awareness of best practice for visiting special islands. Agencies leading by example. Surveillance and response to incursions.
Weeds	Neighbouring islands	Wind/birds	High	Surveillance and response to incursions.
Weeds	Visitors	Failure of biosecurity procedures	High	Education. Raised awareness of the risk of weeds to islands of high ecological importance. Raised awareness of best practice for visiting special islands. Agencies leading by example. Surveillance and response to incursions.

4.7. Capacity

The capacity to conduct eradication of invasives species is slowly being developed at NTF and the staff is learning through workshops and overseas trainings and meetings on how our overseas partners are carrying out such activity.

The staff members are great at handling management and consultations, in particular in communicating with the community and the skills to complete the project. The involvement of scientists is important because there is a need to use best practice and also see how the eradication process is going and its monitoring processes as well.

5. SUMMARY

Eradication of goats from Monuriki Island is clearly feasible, and given adequate funding should be achievable in an 18-24 month timeframe at most. It is estimated from the field visit observations that approximately 120-140 goats were present on the island prior to the mustering. With 80 removed over the three days this leaves approximately 40-60goats on the island.

As the eradication process has already started it is with some urgency that effort must now be sustained to follow through to completion of the eradication. This urgency is derived from factors of technical success, survival of the residual iguana on the island and, for meeting community and social commitments.

The population trends for crested iguana from surveys conducted over the past 15yrs suggest the population on Monuriki is going through a final collapse. Unlike the population on Yadua Taba that was large and could sustain itself during a 10-15 yr goat eradication the Monuriki population is too small and favourable habitat too constricted for the iguana to hold on this long.

Translocation of 20 individuals for safe keeping in captivity and breeding, whilst securing the genetic stock and potentially re-releasing, will exacerbate this risk that local extirpation on Monuriki will occur in a short timeframe. As is prescribed in the Fijian Crested Iguana recovery plan *in-situ* restoration is the preferred approach in the first instance and is feasible if conducted with urgency.

With respect to goat eradication success, prolonged timeframes will see goats become educated making it harder to get the last animal. The habitat will rapidly start to change with vegetation density increasing dramatically when the goats are in low density and affect the ease of goat location and increase the opportunity for goat evasion. Eradication will become reliant on good luck rather than good management.

Weed issues will begin to increase the longer goats remain in low density and natural revegetation takes longer to heal allowing wind-borne weed species to establish. Existing established weeds need to be controlled quickly, in case the goats trampling and browsing are suppressing them. One small infestation of Mikania and a scattering of mongoose grass would be priorities to contain until the natural vegetation heals. Supplementary restoration planting of favourable iguana food species may be required to compete with the non-palatable predominance that currently exists.

The community have agreed to eradication as the definitive outcome and are eager and willing to see it happen, expectations are now present that this will happen and that NTF will make sure it does.

The recommended technical methodology is as follows:

First 6 months

Muster and live capture as many goats as is possible within a defined timeframe of no more than 6 months starting May 2010. During this timeframe, as goats become hard to catch by human mustering, utilise local community dogs that have had experience in previous goat capture efforts. This effort needs to be conducted regularly over the 6 months with at least one muster a month, allowing animals to regroup and settle in between. It is imperative that NTF collects data on all captures and observed escapees for each muster to plot the success trend and the population demography harvested at each attempt.

Should enough goats not have been caught to procure the boat and outboard for the Mataqali Vanuivi, then NTF broker a purchase of the residual goat numbers required as payment for the services the community have put into removing the goats and to honour the existing arrangement of procuring a boat and outboard.

It is also understood there is an arrangement over supply of rugby jerseys as well, so again, ensure this is completed within the 6 months.

During this 6 month phase, purchase 3 high visibility Judas goat radio collars and deploy them on 2 nannies and 1 billy caught and released.

Over the months 7-18 .
Ensure the residual goats are left alone for a period of 2 months to settle down and regroup. At month 9, deploy 3 contract professonal hunters on 2 x 10 day island camping trips, with a month between each of these trips. These hunters will actively stalk and remove residual goats and monitor the Judas animals for any companions, utilising supressed firearms.

At month 12, deploy 2 professional hunter/dog handler combinations for 10 days to confirm the eradication is completed and if so remove the Judas goats or, alternately to locate and remove any residual goats. If residuals are found, than at month 14 repeat a visit to check the Judas goats again and repeat until eradication can be declared successful.

Dogs need to be highly capable at the task required. Vetting of local dogs and dog owners may confirm the dog and handler skill-base is already available in the community and could be contracted to assist, otherwise, trained dogs and handlers may need to be purchased or imported with additional associated costs.

Should a helicopter be available at any stage during this eradication, its utilisation for 2 early morning and 2 late afternoon aerial shoots for 1.5 hour periods each (total 6 hours) will hasten the eradication success and be invaluable for targetting goats that are quick to escape onto inaccessible bluffs when pressured. This work should be conducted by experienced aerial shooters with shotguns. If any agencies have a need for helicopter use in the Mamanuca/Yasawa areas over the next 18 months and liaison and coordination of activities can happen to coincide with when the professional hunters are on the island, this would mean experienced aerial shooters are available.

Key issues
As the Mataqali Vunaivi have agreed to the eradication and it is technically feasible to remove the goats, the issues that remain revolve around four factors: 1) Anticipated and predicted timeframes for completion; 2) clarity of agreements made and information supplied; 3) lead agency having the staff capacity to deliver the project; 4) securing enough funding and resources required to complete the eradication.

Whilst the eradication has already been started by arrangements between the Mataqali Vunaivi and NTF staff, there has been no consideration of timeframes for completion. There has also been no mention of when various techniques will cease and new ones start in order to keep pressure on the entire goat population and on every individual goat. These need to be agreed and committed to and then communicated to all involved so as to ensure clear direction and understanding occurs.

It is further evident that a low-cost eradication by mustering alone, as is the current expectation of NTF, will only be successful with a strong dose of good luck. Mustering in such terrain as Monuriki does not meet the 5 criteria for an eradication and is highly unlikely to be successful, despite it having worked on Yadua Taba over a 15 year period.

It seems that NTF do not currently have the resources and funding required so there is work required to secure such. Birdlife Pacific are interested in this project and from preliminary discussion with them they may be able to assist and discussions with them may be fruitful.

There is much unknown or not communicated about the existing arrangements involving the boat purchase/goat sale and the rugby jersey deal. We could not confirm how many goats were actually required to obtain the boat and outboard and how long the Mataqali estimated it would take to procure them. These need clarification – exactly how many and by when. Is there an intention to let them breed up again to get the numbers required? Or, is it intended to get them all now

Discussion with Mitieli Bale provided us with information that pregnant nannies and kids were unsaleable. Small nannies fetched FJD60, large nannies FJD80, small billy FJD150-200, large billy FJD350-400. The cost of FJD13,000 for boat and outboard was mentioned which would mean a substantial number of goats (200 nannies or 40 premium billies). The data collected during the feasibility study showed primarily small nannies and billies with fewer large goats meaning the number of goats required has to be in the hundreds.

We were however, of the impression that when the boat was obtained, the left-over goats were for NTF to arrange removal.

Dedicated NTF staff capacity needs to be made available to manage the project, or external support may be needed. It was evident during the site visit there was minimal indepth knowledge of eradication techniques within the NTF staff involved. This is probably because of lack of experience in the area of invasion species management. Understanding of what constitutes good hunter skills or what makes an effective goat dog, what techniques are effective/efficient and what information needs to be captured to monitor the progress of the effort was lacking.

The site visit demonstrated that the NTF staff members who are involved need to be focussed on the particular task rather than have a multitude of tasks to undertake when on the island. Iguana catching, social surveys, prior arrangements with the community that had not been communicated, etc., all detracted from the effectiveness of the feasibility study team visit to gather information for eradication and build NTF capacity in undertaking further feasibility studies for eradication.

Whilst this was tolerable in the case of a capacity building exercise such as on this trip, an eradication attempt requires total focus and cannot be sidetracked by alternative trip purposes. It must remain entirely focused on the objective at hand. Individual capability needs may require expert support and assistance through advice. Should it be decided to use local dogs and handlers, an external person experienced in such matters should undertake a site visit with the dog handler to confirm what capabiliites do exist in the local dogs.

Funding

Total funding required, including contingencies and worst case scenario, will be in the vicinity of FJD120,000 over 2 years. It is recommended NTF actively seek dedicated funds via donors or grants.

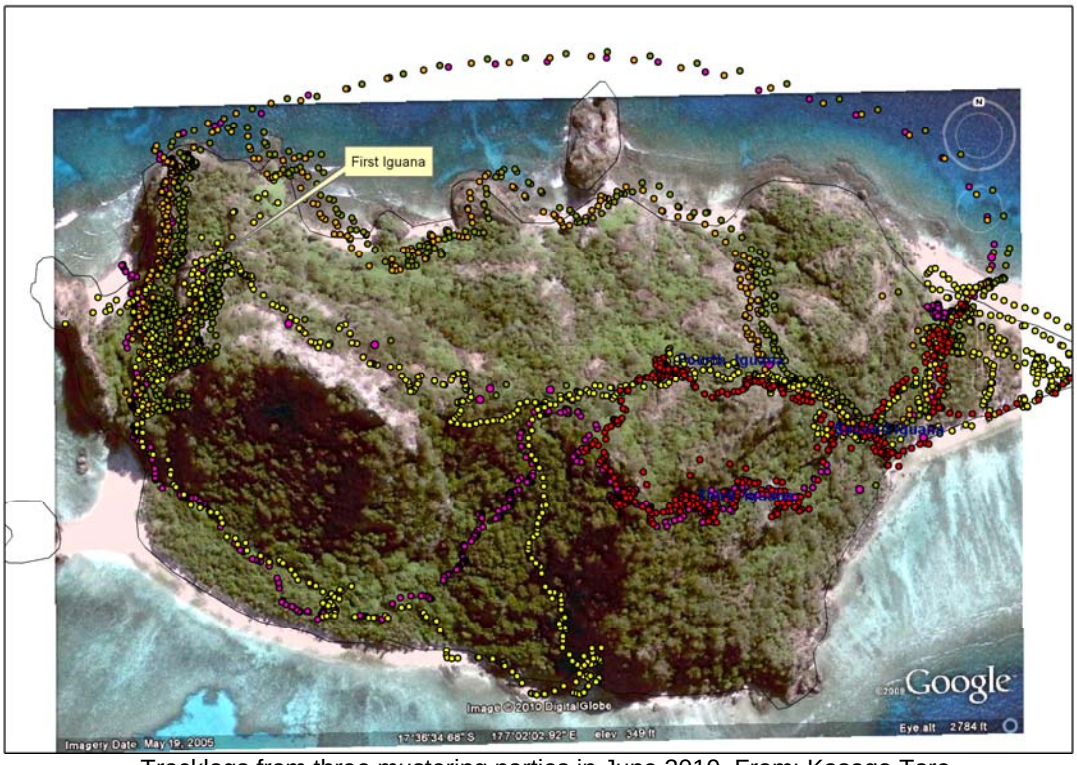
Birdlife Pacific have previously expressed a strong interest in restoration of Monuriki for wedgetail shearwater and have indicated they have some donor funding available until December 2011 for this purpose. There are direct and indirect synergies and benefits available between the wedgetail shearwater habitat restoration and the crested iguana habitat protection as both are affected by the same invasive species. For both endangered species goats and rats need to be removed and weeds managed.

6. APPENDICES

6.1. Site Visits

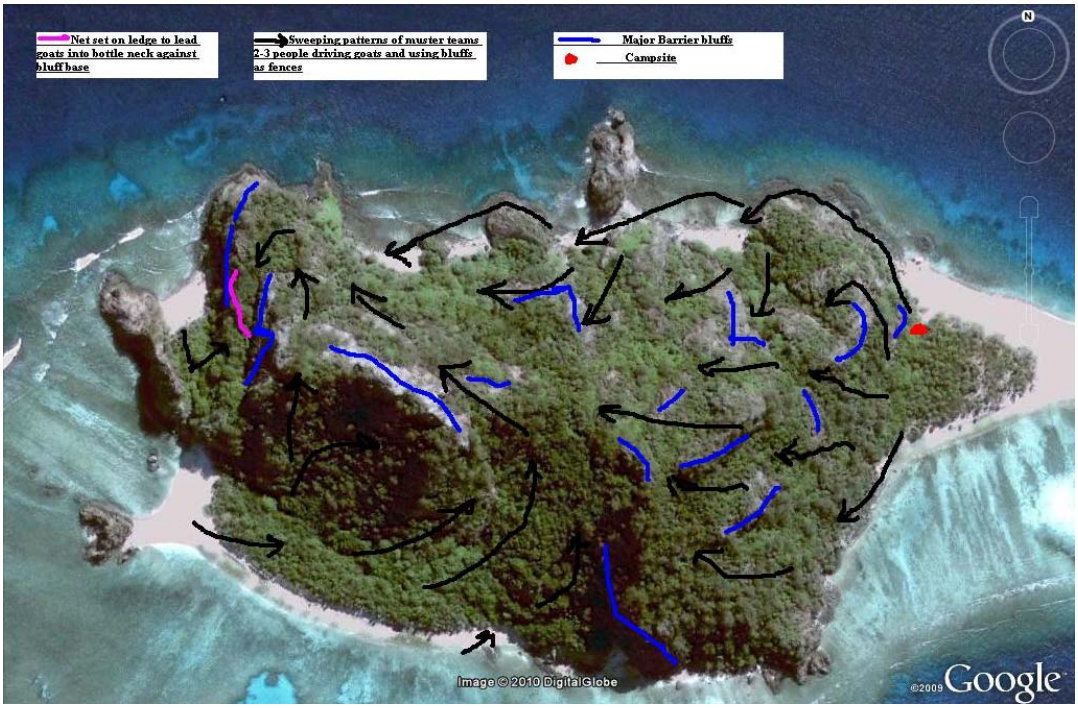
7th June 2010 Monday. During the Sevusevu we were informed there might be 30-40 goats on the island. There is an arrangement to sell the goats to an Indian farmer/merchant at Lautoka and the figure of around 100 goats was mentioned as required. This information did not add up as if this is the case, how and where was it intended to obtain the other 60 goats? As it so happened there were 80 goats caught over the 3 days with 5 dying during capture. We could not confirm how many of the 75 survivors were actually saleable verses those housed in the village or turned into goat curry.

8th June 2010 Tuesday
Persons staying on Monuriki overnight - Jone, Kasaga, Glen, Bill, Joe, Clea, Chiemi. Kasaga undertaking GPS work, Jone Iguana capture, Joe cooking and camp duties, everyone else involved in goat muster and collecting information for eradication and photopoints. (Mili and Sia stayed on Yanuya for socio-economic survey).
32 people for day - 57 goats caught. At least 22 escaped (that many seen to get away by random sample).
1 iguana captured.
Night spotlight transect conducted in eastern beach forest.
Very low hermit crab numbers (6 small crabs seen).
4 vegetation photopoints installed.
2 *Rattus exulans* seen near campsite.



Tracklogs from three mustering parties in June 2010. From: Kasaqa Tora

9th June 2010 Wednesday
36 people for day (Mili came from Yanuya) - 16 goats caught. At least 22 escaped capture (that number seen to get away by random sample). Those 22 could have been removed by a hunter.
Team doing iguana capture during day and evening.
2 further vegetation photopoints installed and recorded.
Returned to Yanuya Island.

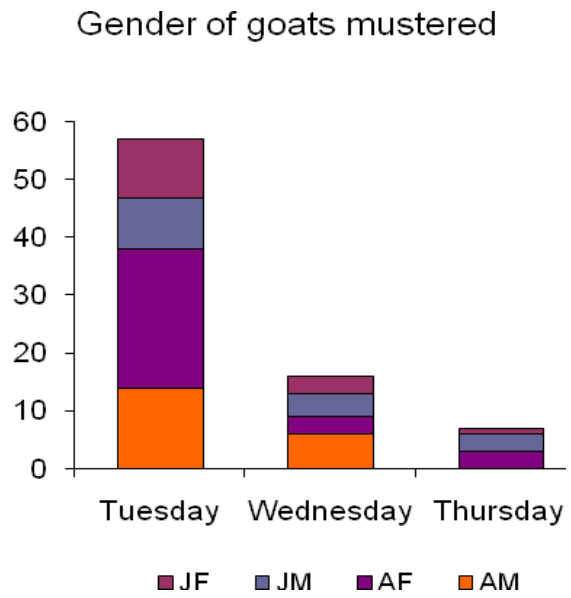


10th June 2010 Thursday.
Unconfirmed number of Yanuya Rugby team participants along with Jone, Kasaga - 7 goats caught, an undetermined number seen escaping as no one was focussed on observing such. However 7 escapees seen by iguana searchers during their course of duties.
3 iguana captured.
Mili and Bill involved in community discussions and development of PowerPoint presentation for evening ceremony.
Glen, Sia, Clea, Chiemi - day visit to Kadomo. Inspect goat issues there and 3 photopoints taken.

11th June 2010 Friday
Farewells and return to Denarau.
Debrief Meeting held at the Nadi Hexagon Hotel. Present were Roko Ratu Ilaitia Kurisaru of Nadroga Provincial Office, Milika Ratu, Kasaqa Tora, Jone Niukula of NTF, Steve Cranwell, Sialisi Rasalato and Elenoa Seniloli of Birdlife Pacific, Glen Coulston and Bill Nagle of PII, Clea Gardiner and Chiemi Nagle, Volunteers.

The following table and graph were used to capture some basic data on the population structure from captures. In hindsight, kid numbers, pregnant nannies and the four saleable size classes should have been recorded as should the types seen to escape. Notably though, most escapees seen in June were adult nannies.

Date	Adult breeding male	Adult breeding female	Juvenile male	Juvenile female	Total caught	Escapees Seen
8/6/10	14	24	9	10	57	22
9/6/10	6	3	4	3	16	22
10/6/10	0	3	3	1	7	7
TOTALS	20	30	16	14	80	51



JF = Juvenile female, JM = Juvenile male, AF = Adult female, AM = Adult male

The attached goat record sheet in Appendix 6.4 would provide better detailed raw data storage for goat eradication operations.

6.2. Other Information

In the interest of the recovery of both endangered species (iguana and shearwater) present, habitat restoration and also the functioning and resilience of the Monuriki ecosystem, Pacific rat (*Rattus exulans*) eradication must be considered a priority as well as goat eradication. This species has been documented on the island during previous research trips and was observed during our site visit with moderate numbers around camp in the evenings.

A key question regarding the potential impacts of rats on Fijian Crested Iguana revolves around how long the two have been in co-habitation around the various Fiji isles. It is evident from observation during a human lifespan that they can co-habit for short-medium term but whether it is feasible in the long term is unknown and has not been researched or written up to date. A key indicator to this co-habitation compatibility question is the population age-class structure of the extant populations of Fijian Crested Iguana and researching how long the Pacific rat populations have been in existence on those islands.

There is conclusive and irrefutable evidence from New Zealand that the Tuatara (*Sphenodon punctatus*) an iguana-like punctid can co-exist with Pacific rat for a very long time due to their long life span compensating for low but adequate recruitment levels. However eventually the tuatara die out through aging population and recruitment levels not being sustainable over the longer periods.

Studies of age class structures on the Northern Offshore islands of New Zealand demonstrated that where Pacific rats occurred, there were no or minimal juvenile tuatara recorded in the populations, highlighting that the rats were supressing recruitment to near or below survey detectable limits. Upon eradication of Pacific rats the Tuatara population is recovering and age population structure returning to a healthy state with juvenile tuatara regularly encountered in survey and field work (D Towns et al, 2007).

Fijian crested iguana eggs have been observed to be predated by Pacific rat (J. Niukula, *pers. comm.*, 2010). The newly-hatched and juvenile iguanas are of a weight and size class within the range of Pacific rat predation. Pacific rat are arboreal, particularly at night when iguana are asleep in trees. Goat removal from Monuriki may well see an elevation in Pacific rat densities through increased flowering and fruiting which will exacerbate levels of predation on eggs and young iguana.

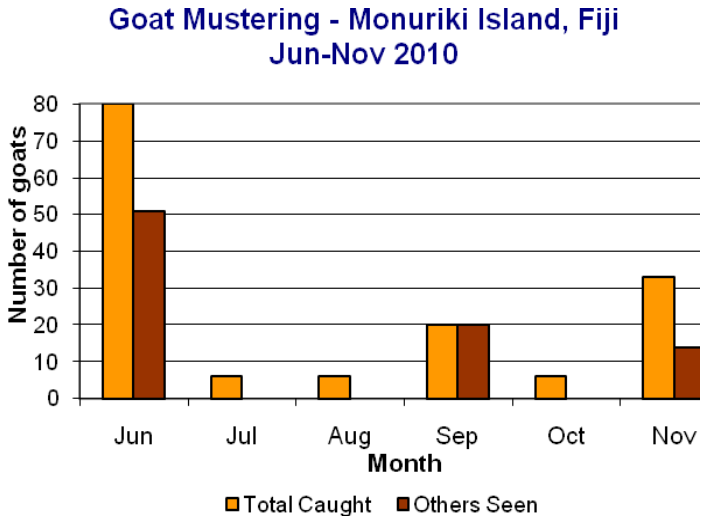
An ant that resembled yellow crazy ant (*Anoplolepis gracilipes*) in its size, shape, movement, behaviour and density, was evident on the island. This species needs collection for confirmation and if it is YCA, a management plan should be established for them firstly, delimiting the size of the infestation by survey and then a feasibility study made to either control, eradicate or do nothing with them.

Ants and human transported insects in general are key biosecurity risks to manage. This is achievable particularly through tourism concession requirements, community awareness and lead conservation agencies utilising biosecurity systems and protocols for island visitation.

6.3. UPDATE – December 2010

The Yanuya community are now (December, 2010) fully committed to remove all goats from Monuriki Island and it seems that the purchase of a boat (see 4.3 Socially Acceptable above) is no longer the incentive for removing the goats. They decided to muster goats on their own whether NTF is present or not as they recognise the need to conserve the Monuriki iguana.

Since June, goats have been mustered on 12 occasions and a total of 151 have been removed by live capture as at December 2010 (see graph below). About 80 goats were sold at the Lautoka market with an estimated price between $120 and $150 per goat.



In November, NTF estimated less than 20 goats were still present. However, on the last day of November mustering, only four goats were seen when the team left Monuriki Island. Mustering with village dogs was not as successful as hoped because the dogs are not trained and this made it more difficult for the mustering team to catch the goats. NTF will provide the team with a data sheet to ensure detailed recording (see table below) as there was no information on age and gender of goats caught between July and November.

Date	Adult breeding male	Adult breeding female	Juvenile male	Juvenile female	Seen to escape	Total caught	Musterers (see below)
Jun (x3)	20	30	16	14	51	80	1
Jul						6	2
Aug						6	2
Sep (x3)					20	20	2, 3
Oct						6	2
Nov (x3)					14	33	2, 3
TOTALS	20	30	16	14	85	151	

Musterers: 1 = Feasibility Study Team and Yanuya Rugby Club, 2 = Yanuya Community, 3 = National Trust of Fiji

The team jerseys for the Yanuya Rugby Club are now produced and will be delivered to Yanuya before the new game season of 2011. This will provide the opportunity for further discussions with the community on the need to bring in professional hunters and trained dogs early in 2011 to complete the eradication in a timely manner.

The cost of this will be high and it is recommended that NTF treat the operation as a separate project rather than use existing project funds. The budget will have to include payment for any goats lost to sale and the costs of erecting a goat-proof fence on Tokoriki Island for the remaining goats on Yanuya.

The Pacific Invasives Initiative arranged for Milika Ratu to visit New Zealand and discuss this project with the Island Eradication Advisory Group (IEAG) of the New Zealand Department of Conservation (NZDOC) in December, 2010. The IEAG congratulated NTF on this important initiative and their recommendations are in Appendix 6.5. Milika also visited the NZDOC Whangarei Conservancy where Glen Coulston had arranged discussions with a GIS specialist and three professional hunters contracted to NZDOC for goat management operations. Milika accompanied two hunters on field operations, one shooting and one using an indicator dog to detect goat presence.

6.4. Habitat Photopoints

The data below records the photopoint (PP) information for future reference and monitoring. NTF have these photos on electronic file.

All PP data for Date, Time, Grid ref, metres ASL are exactly as per the GPS waypoint data NTF have saved in GIS files.

PP 1 - East face beach - Coconut forest habitat - 2 photos taken
018 - facing 180 deg magnetic, 019 - facing 90 deg


PP 2 - Casuarina weed habitat East facing slope - 3 photos taken
020 - facing 320 deg 021 - facing 120 deg 022 - facing 040 deg



PP 3 - Seral scrub habitat/ Dry ridge saddle habitat - 3 photos taken
023 - facing 320 deg 024 - facing 240 deg 025 - facing 130 deg



PP 4 - Tall native broadleaf forest/west facing slope habitat - 1 photo taken
026 - facing 360 deg

PP 5 - Seral scrub habitat/Dry Ridge plateau - 4 photos taken

065 - Facing 360 deg

066 - Facing 090 deg

067 - Facing 180 deg

068 - Facing 270 deg

PP 6 - South face beach Coconut/Tall native broadleaf forest margin habitat - 4 photos taken

078 - Facing 090 deg

079 - Facing 360 deg

080 - Facing 270 deg

081 - Facing 180 deg

6.4 HUNTER'S DAILY REPORTING FORM

ISLAND_____
DATE____/____/____

CREW LEADER (and name of dogs if applicable)_____
CREW MEMBERS_____

GOATS OBSERVED/REMOVED

LOCATION 1 E_____ N _____
NUMBER OF GOATS OBSERVED AT THIS LOCATION_____
NUMBER OF ADULT MALES _____
NUMBER OF ADULT FEMALES_____
NUMBER OF JUVENILE MALES_____
NUMBER OF JUVENILE FEMALES_____

Colours of goats observed _____
Photo **Y/N** Ref _____

WAYPOINT 1 NAME _____
NUMBER OF GOATS REMOVED AT THIS LOCATION:_____
NUMBER OF ADULT MALES _____
NUMBER OF ADULT FEMALES _____
NUMBER OF JUVENILE MALES_____
NUMBER OF JUVENILE FEMALES _____
AUTOPSY INFO (WHERE PRACTICAL), NO OF EMBRYOS PER FEMALE_____

Colours of goats killed _____
Photo **Y/N** Ref _____

GOATS OBSERVED/REMOVED

LOCATION 2 E_____ N _____
NUMBER OF GOATS OBSERVED AT THIS LOCATION_____
NUMBER OF ADULT MALES _____
NUMBER OF ADULT FEMALES _____
NUMBER OF JUVENILE MALES_____
NUMBER OF JUVENILE FEMALES _____

Colours of goats observed _____
Photo **Y/N** Ref _____

WAYPOINT 2 NAME _____
NUMBER OF GOATS REMOVED AT THIS LOCATION:_____
NUMBER OF ADULT MALES _____
NUMBER OF ADULT FEMALES _____
NUMBER OF JUVENILE MALES_____
NUMBER OF JUVENILE FEMALES _____
AUTOPSY INFO (WHERE PRACTICAL), NO OF EMBRYOS PER FEMALE_____

Colours of goats killed _____
Photo **Y/N** Ref _____

GOAT SIGN OBSERVED AND TYPE

LOCATION E_____N_____
WAYPOINT NAME _____
TRAILS (L/M/H)_____
BED SITES (sqm) _____
BROWSE (L/M/H)_____
Photo **Y/N** Ref _____

LOCATION E_____N_____
WAYPOINT NAME _____
TRAILS (L/M/H)_____
BED SITES (sqm) _____
BROWSE (L/M/H) _____
Photo **Y/N** Ref _____

LOCATION E_____N_____
WAYPOINT NAME _____
TRAILS (L/M/H)_____
BED SITES (sqm)_____
BROWSE (L/M/H)_____
Photo **Y/N** Ref _____

(ADDITIONAL SPACE FOR COMMENT ON GOATS REMOVED AND GOAT SIGN OBSERVED IS PROVIDED ON THE REAR OF THIS FORM)

OTHER COMMENTS REGARDING GOAT SIGN/POPULATION INFORMATION/ETC (please record if accompanied by photo and ref)

OTHER COMMENTS *(E.G. WEATHER AND SEA CONDITIONS, ACCESS, VISITORS, POTENTIAL GOAT REINVASION, OTHER PESTS, Etc.)*

6.5 Comments from the Island Eradication Advisory Group, Department of Conservation, New Zealand.

To: Milika Ratu, National Trust of Fiji,
Bill Nagle, Pacific Invasives Initiative
From: Island Eradication Advisory Group

Date: 11th January 2011

Subject: IEAG Comments on Monuriki Goat Eradication project

1. Background
A draft feasibility study report was prepared by National Trust of Fiji and PII and was made available to IEAG members prior to a meeting held on 16th December 2010. Milika Ratu presented the issues facing the endangered Fijian Crested Iguana on Monuriki and provided details of the work done to remove goats from the island in 2010 as part of a wider programme to save the iguana.

2. IEAG Comments
The IEAG congratulates NTF for this important initiative to save the Fijian crested iguana and recommends that the goat work be seen always as part of a wider package of island restoration measures necessary to achieve the conservation of this species. Other aspects of this package include:

- Removal of rats from the island
- Control or removal of invasive ants from the island
- Captive management and breeding of iguana with a view to their eventual return to Monuriki
- Identification and management of invasive plants on the island which pose a threat to iguana habitat or could become a problem following the removal of goats and/or rats.
- Enhanced biosecurity measures for visitor to the island to prevent the reinvasion of invasive species which have been eradicated or the introduction of new species to the island which could become invasive.

The work done so far in mustering and removing goats from the island is to be applauded, the project is well advanced. However the remaining few goats will be the most difficult to remove because:

- They will be very wary of humans and will have learnt how to escape efforts to capture them
- The forest will be responding to a sudden reduction in levels of goat browsing and will grow quickly to become difficult for people to move through.
- The goats will be better fed by the re-growing vegetation and will breed more because of this better nutrition (eg twins will be more common).

Because of these factors the future success of mustering is predicted to be less and less compared with the results so far. IEAG recommends that these final animals be removed by different methods than those deployed so far. The most efficient and therefore cheapest way of

concluding the goat eradication is to employ a couple of professional goat hunters with suitable firearms and highly trained dogs to kill the last goats.

A key to understanding the benefits of this approach is to view the removal of the last few animals as quite a different task compared with the removal of the bulk of the population already achieved. Just as ordinary people can lay electrical cables in a new house but a professional and qualified electrician should be employed to connect the wires to the electricity (to avoid the danger of electric shock and possible fire), the final part of a goat eradication must be done by professional hunters. This avoids the situation where the last few animals continue to escape attempts to get them and are able to breed as many replacements as those removed in each attempt. If this situation arises eradication will never be achieved. This has happened in other eradication projects and many thousands of dollars have been wasted before organisations involved either gave up or did what they should have done all along and employed professionals.

The optimum sequence of techniques in goat eradication projects is to use:

- aerial hunting with a helicopter, then
- hunting without dogs, then
- hunting with indicator dogs, then
- hunting with bailer or holding dogs

Each technique is a step up in aggressiveness and disturbance targeting a diminishing population of increasingly wary animals. Unfortunately on Monuriki high disturbance techniques have already been applied right from the outset so that the element of surprise and effectiveness in this equation has been reduced/diluted. This does not make it impossible to complete the eradication but it does mean that the next techniques applied must be done so with the highest level of skill.

The use of highly trained dogs to indicate and bail the goats increases the efficiency of a hunter in forest by up to 90% so the expense of resourcing hunters with dogs will be worthwhile and cheaper in the long run. The choice of which type of dog to use (ie what hunting style they have been trained for- indicating or bailing*) depends on the current situation on Monuriki. Because we don't know this for certain our recommendation is to take both types if possible because each has advantages. The most important thing is that the hunters and dogs are highly trained professionals.

Our knowledge of what restrictions may be placed on the import and use of firearms for shooting goats on Monuriki is very limited and this is something NTF will have to investigate. We therefore give several options, starting with the best option we would recommend if Monuriki was an uninhabited island in NZ. Be aware that moving down the list may severely compromise the efficiency of the project.

1. A high powered small calibre rifle with sound moderator and telescopic sights. - This gives the most flexibility for different situations (long and short range shots) and creates the least disturbance to goats. It can be used in conjunction with any type of dog.
2. A small calibre rimfire rifle with sound moderator and telescopic sights- more limited in range and power but effective in skilled hands with correct ammunition and can be used with either dog type.
3. Shotgun using solid slug ammunition - this would be limited to short range only and cannot be fitted with sound moderator , best used with a bailing dog to allow closer shots.

4. If firearms were out of the question then hunting goats in the same way people hunt pigs in NZ might work ie a dog or dogs which grab hold of the animal until the hunter grabs it and kills it with a knife. The risk here is that some goats will end up in places the hunter cannot reach or the dogs can turn into killers themselves which is not acceptable for animal welfare.

*__Indicator dogs__ work close to the hunter and silently point or 'indicate' that a goat is nearby, allowing the hunter to sneak up to within shooting distance of them. The main advantage is that goats are not disturbed by the dog. The disadvantage is that the goat may run away before the hunter can shoot them.
*__Bailing dogs__ work farther from the hunter to find a goat and chase it to a point where the goat and dog have a 'stand-off facing each other. The barking of the dog calls the hunter down to within shooting range. The advantage is that the goat cannot hide from the dog once found. The disadvantage is the dog can only deal with a single animal at once and if there are groups of goats the others will escape and learn.

6.6 References

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