



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

Report on Beach Burr Control Program on Pukapuka 2015



By

Elizabeth Munro - Biodiversity Officer
Moana Tetauru – Media Officer
Olaf Rasmussen – GIS Officer
Basilio Kaokao – Mauke Officer
National Environment Service



TABLE OF CONTENTS

INTRODUCTION	3
GOAL, OBJECTIVES AND OUTCOMES	3
GOAL	3
OBJECTIVES AND OUTCOMES	3
ISLAND OF PUKAPUKA GENERAL INFORMATION	4
WALE	5
MOTU KO	5
MOTU KOTAWA	5
BEACH BURR (CENCHRUS ECHINATUS) PROFILE	6
INVASIVE SPECIES COMMUNITY WORKSHOP	8
INVASIVE SPECIES	8
CONTROL AND ERADICATION PROGRAMS ON MAUKE AND RAROTONGA	9
INVASIVE SPECIES NOT YET PRESENT IN THE COOK ISLANDS	10
PUKAPUKA INVASIVE SPECIES PRIORITIZATION EXERCISE	11
FIELD SURVEYS	11
WALE FIELD VISIT	12
MOTU KOTAWA FIELD VISIT	13
MOTU KO FIELD VISIT	14
BEFORE AND AFTER PHOTO OF SITE REMOVED OF BEACH BURR	15
BIODIVERSITY OF PUKAPUKA	16
EDUCATION AND AWARENESS	17
CONCLUSION AND RECOMMENDATIONS	18
ACKNOWLEDGEMENT	19

LIST OF ANNEX

ANNEX I – PUKAPUKA INVASIVE SPECIES PRIORITY LISTING	20
ANNEXII - DAILY PROGRAM SUMMARY	22
ANNEX III – PROGRAM ON PUKAPUKA	24
ANNEX IV – LIST OF PARTICIPANTS TO COMMUNITY WORKSHOP	26
ANNEX V – INVASIVE SPECIES TEAM TO PUKAPUKA	27
ANNEX VI – NEWS ARTICLE IN THE PAPER	28
ANNEX VII – MAPS OF BEACH BURR ON PUKAPUKA	29
ANEX VIII – MAP OF NATIVE TREES ON PUKAPUKA	32
ANNEX IX – MAP OF AGRICULTURAL AND LOWLAND AREAS	33

LIST OF ABBREVIATIONS

IAS	Invasive Alien Species
MOA	Ministry of Agriculture
NES	National Environment Service



Photo1: Aerial view of the island of Pukapuka

INTRODUCTION

This document is to report on the work carried out to assess the status and the possibility of controlling beach burr (*Cenchrus Echinatus*) on the island of Pukapuka. This work was conducted by the National Environment Service and funded under the Regional Invasive species program.

A team from the National Environment Service, the Ministry of Agriculture and the Arorangi Boys Brigade travelled to Pukapuka to carry out some work on beach burr. The visit to the island of Pukapuka was conducted from 25th to 29th May 2015.

GOAL, OBJECTIVES AND OUTCOMES

Goal

The goal of the program is to control and/or eradicate beach burr on the island of Pukapuka.

The Pukapuka trip aims to carry out the status and distribution of beach burr on the island and determine best management method to control the spread of beach burr on Pukapuka. The trip to the island also aims to identify a person or a community group to continue with the work and provide them with management examples of beach burr on the island of Pukapuka.

Objective & Outcomes

Project Objectives	Outcomes
1. Survey beach burr on the island of Pukapuka	1.1 All island of Pukapuka surveyed for beach burr 1.2 Data collected for analysis
2. Map area where beach burr is present	2.1 Maps developed for each motu on the presence of beach burr 2.2 Maps presented to island council and community indicating beach burr sighting
3. Identify and training of person/s on management of beach burr	3.1 Person/s identified to carryout beach

<p>4. Community consultation and awareness on invasive species on Pukapuka</p> <p>5.</p> <p>6. Education and awareness in the community & school on invasive species.</p>	<p>burr program on the island</p> <p>3.2 Person/s trained on identifying beach burr</p> <p>3.2 Person/s trained on data collection of beach burr</p> <p>4.1 Meet with community on invasive species in particular beach burr Community made aware about invasive alien species, the threat it can cause to an environment and biodiversity</p> <p>5.1 community and school made aware of the invasive species threats.</p> <p>5.2 students able to identify and locate beach burr around the island.</p> <p>5.3 ID cards and posters developed for the Island of Pukapuka on Beach burr</p>
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THE ISLAND OF PUKAPUKA GENERAL INFORMATION

Pukapuka is a coral atoll consisting of three islets (motus) situated at the corners of a roughly triangular lagoon. These three motu are, Wale (House) the main island, Motu Ko is approximately 10 kilometres south of Wale and approximately 7 kilometres to the west is Motu Kotawa, the smallest of the three motu. There is an 8km submerged reef to the west of the island from which the island derives its name “Danger Island”.



The islands of Pukapuka are thickly covered with vegetation, consisting of coconut palms among which are scattered trees of Tamanu, Pukatea, Tou etc. The centre of the larger 2 islands has a depression of large swampy areas, predominately used for taro and other species.

Wale

Wale the main island of Pukapuka is at the north end of the triangular atoll and has three permanent villages Yato, Roto and Ngake however during our visit, the island due to depopulation has been divided into two villages, Tawangake (East) and Tawalalo (West).

Wale is the main island of Pukapuka where the Island Administration and other medical, communication, utilities, government and goods services are located.

Motu Ko

Motu Ko is approximately 1.65km² and is south of Wale the biggest or longest island in Pukapuka where the airport located. The village is situated on the lagoon side of the island and has a church and community hall. The motu is a food crop reserve for the Ngake village and is inhabited a short time when food crops are ready to harvest during the cyclone season.

Motu Ko is covered largely with scrub forest, clumps of coconut trees and a swampy area planted with taro and bananas. An area on the motu has been allocated for agricultural fruit trees such as citrus, guava and vikavakava (*spondias dulcis*).

Motu Kotawa

Motu Kotawa (Frigate Bird Island) is situated west is the smallest motu of Pukapuka at approximately 0.57km². The island is also a food crop reserve island for the village of Yato and is inhabited only periodically during harvest season. The village is situated along the north eastern shore on the lagoon side.

Motu Kotawa has taller and more luxuriant vegetation, up to a total height of 80 to 100 feet, its west end with especially dense undergrowth. The island is dense and rich with native and introduced crops including some taro in a central wet depression, coconuts, bananas, pawpaw etc. Bird nests are on the western end of the island found roosting on *Pisonia* trees (pukatea).



Photo 2: Typical vegetation on the Motu

BEACH BURR (*CENCHRUS ECHINATUS*) PROFILE

Local name	Piripiri or Parango
Common name	Beach burr, bur grass
Family	Asteraceae
Genus	Cenchrus
species	echinatus
Scientific name	Cenchrus echinatus
PIER WRA	11
Invasiveness	3
Organism type	Grass Cenchrus echinatus is an annual grass that is a native of tropical America, but has now widely colonised tropical and temperate zones worldwide. Though it is typically associated with dry, sandy habitats it can also grow in moist areas, where it may be long-lived and reach a much larger size. It is recognisable by the burrs it produces, which readily attach themselves to animals and clothing, making C. echinatus easily dispersed. It is fairly easily managed by physical and chemical means, though the soil seed reservoir means followup treatments are necessary.
Description	Cenchrus echinatus is an annual, branched and somewhat tufted grass that grows up to 60 c m tall. It is erect at the base, with fibrous roots and has the ability to form mats. The blades are either smooth or slightly hairy on the upper surface, smooth on the lower surface and are up to 9 mm wide. The inflorescence are spike-like, up to 10 cm long and has up to 50 or more spiny burrs (5 - 7 mm long), which are well-spaced, sessile with 2 - 4 spikelets. These burrs are easily detached. (PIER 2010).
Occurs in:	agricultural areas, coastland, riparian zones, disturbed areas, urban areas, wetlands
Habitat description	Cenchrus echinatus can grow in a variety of conditions, and grows readily in tropical and temperate zones. Though it is often associated with dry, sandy soils, C. echinatus thrives in moist conditions where it is generally longer lived and can grow much larger. It readily colonises open ground and is known to invade

	agricultural areas, riparian zones, disturbed areas, sand dunes and other coastal areas, pasture, road sides, gardens and swamp margins. (PIER 2010).
Introduction pathways to new locations	The <i>Cenchrus echinatus</i> panicle when ripe consists of up to 50 spiny burrs that can stick to clothing, wool, and fur, and machinery; the burrs can float on water and is dispersed through flowing water. Dispersal methods <ul style="list-style-type: none"> ➤ On animals (local) ➤ On clothing/footwear ➤ Translocation of machinery/equipment (local) ➤ Water currents
General impacts	<i>Cenchrus echinatus</i> infests dry areas especially along leeward coastlines. Burs are a nuisance for people. They are reported as dangerous for hatchlings of seabirds. (Motooka et al. 2003). A prolific seeder, it forms mats and can displace native grasses (Flint & Rehkemper 2002).

Beach Burr (*Cenchrus echinatus*) known locally as piripiri or parango is present on the island of Pukapuka. The distribution or spread of beach burr on Pukapuka was unknown however according to Gerald McCormack of Natural Heritage Trust, Beach Burr was common but localized on Motu Kotawa and Motu Ko and don't recall seeing beach burr on Wale.

To determine the status and distribution of Beach Burr on Pukapuka a team from the National Environment Service, a representative from the Ministry of Agriculture and Arorangi Boys Brigade travelled to the island of Pukapuka to formulate a plan to control and manage beach burr on the island.

While on Pukapuka the team met with the island council, carried out a community workshop and a promotional program within the school. The teams also visited all of the islands of Pukapuka to survey and map the distribution of beach burr.



Photo 3: Beach Burr (*Cenchrus echinatus*)

INVASIVE SPECIES COMMUNITY WORKSHOP

A community workshop was carried out on Tuesday 26th May on invasive species, what invasive species are, its threats and control methods. Examples of invasive species control and eradication programs were highlighted at the workshop.



Photo4: Participants at the Invasive Species community workshop in Pukapuka

INVASIVE SPECIES

The workshop commenced with Elizabeth presenting on the definition of invasive species, the threats it can cause to an environment and a community and the various ways of controlling invasive species.

She also highlighted on the purpose of the trip that is to;

- Look at Beach Burr on Pukapuka
- The status of Beach Burr on Pukapuka
- Identify management method for beach burr
- Survey the distribution of Beach Burr on Pukapuka
- Identify implementing agency/group
- Carryout invasive species listing and prioritization
- Look at the biodiversity of the island

Beach burr was highlighted as the invasive species of concern because of its recent introduction to Motu Kotawa and Motu Ko and the likelihood of affecting the whole island. Elizabeth also highlighted how beach burr seeds can easily be spread by sticking to clothing, vehicles and machineries and stressed that the best way of controlling beach burr,



Photo5: Elizabeth presenting on Invasive species on Pukapuka

is to remove the plant material especially those bearing seeds and to ensure plants do not produce any seeds. She said that once a plant produces seeds the whole plant growth cycle starts again. She also pointed out that the best method is to manually remove the plant, regularly monitoring to ensure mature plants do produce seed and young shoots are removed.

Elizabeth also emphasized on the impact beach burr can cause to a community and to ground nesting birds.

During the presentation the community stressed its concern on beach burr where it has impacted some of their community activities. They also stated the worst area on Wale (main islet) is at the community sports ground and they have seen school students who use the field for sporting activity being affected by the burr seeds. They pointed out that beach burr is also found on both motu.

CONTROL AND ERADICATION PROGRAMS ON MAUKE AND RAROTONGA

Red passion-fruit on Mauke



Photo 6: Red passion-fruit *passiflora rubra* trying to exhaust the seed bank in the soil.

Basilio Kaokao the Environment officer for Mauke highlighted the eradication program he is implementing on Mauke in particular the red passion-fruit *passiflora rubra*. He emphasized that he has been working continuously in removing red passion-fruit on Mauke for the last 8 years and that he has gotten the plant to a stage where the plant does not produce any seeds and there are fewer plants around and is

He also highlighted that he was able to eradicate wedelia daisy (*sphagneticola trilobata*) and starburst flower (*Clerodendrum quadriloculare*) on Mauke. He stressed that regular monitoring and removing plants before they bear any seeds is very important in controlling an invasive species.

Tiaea on Rarotonga



Photo 7: Tiaea (*Cuscuta campestris*)
bottom and tainoka top

Daniel Apii of the Arorangi Boys Brigade presented on their experience with the Tiaea dodder (*Cuscuta campestris*) an invasive species on Rarotonga. He highlighted the Boys Brigade researched extensively about the plant, its life cycle, the impact it can cause to an environment and how this plant arrived on Rarotonga. He emphasized that the group also carried out a community awareness program on Tiaea to make the community understand the impact it can cause to an environment. The group also mapped out the sites where Tiaea is found to determine how widespread the problem is.

He said that he has inspected Wale island to see if Tiaea is present but have only seen Tainoka a similar plant to Tiaea that causes minimal damage to the environment.

The community responded that they don't see any threat caused by the tainoko because the mama's use this plant as compost for their taro patches.

INVASIVE SPECIES NOT YET IN THE COOK ISLANDS

Moe Tutira from the Ministry of Agriculture presented on invasive species that are in neighboring countries that are not yet found in the Cook Islands. He stressed that these invasive species we have to be on alert because once they arrive in the Cook Islands it will cause social and economic impact on the country. He highlighted on the recent fruitfly eradication program which cost the Ministry of Agriculture and the Cook Islands government millions of dollars to eradicate.

Moe emphasized the need to protect our islands and country from invasive species because for food security. A number of invasive species will impact our food resources such as Taro leaf blight in Samoa, fire ants in Tahiti and many more species not yet in the Cook Islands.

He also highlighted successful eradication programs in the country such as Queensland and Oriental fruitfly, African snail etc. Some invasive species have natural predators and these have been introduced to the Cook Islands such as wasps for flat moths and Cuban thrips and the recent fungus for mile-a-minute.



Photo 8: Giant African Snail
not found in the Cook
Islands but present in Samoa

He stressed that we need to protect our islands from invasive species and encouraged the community to be proactive in detecting and removing invasive species from our islands and to report any subspecies species to the Ministry of Agriculture or environment.

Moe encouraged the community to support the Beach Burr eradication program as this will be of benefit for their island. He also encouraged the community to continually monitor and remove beach burr and they can initiate a community beach burr removal program especially at the sports field.

PUKAPUKA INVASIVE SPECIES PRIORITIZATION

The second part of the workshop was on invasive species listing and prioritization. Those present at the workshop was put into groups and was asked to list down plants and animal invasive species present in three areas, around the community, on the motu and agricultural areas. After listing these invasive species they were asked to number each species, five for the most serious and one for the least invasive. The listing was then analyzed for most serious to least serious invasive species. See Annex 1 for table.



Photo 9: Mama’s at the Invasive Alien Species community workshop on Pukapuka

FIELD SURVEYS

The three islands of Pukapuka was surveyed and mapped for beach burr. Other species and areas were also mapped on Pukapuka such as taro planting and wetland areas, bird nesting sites and trees such as Pukatea (*Pisonia grandis*), Tou (*Calophyllum inophyllum*) and Tamanu (Pacific mahogany). The two motu are declared ra'ui sites and the team was able to request permission to access these two motu.

Field visit on Wale

Participants from the workshop visited the community sports ground next to the islands only school where most of the beach burr are located. Participants were taken through training on how to recognize the difference between beach burr and other non-invasive grasses. Beach Burr identification cards were given out to assist with recognizing the plant.

Maps were produced for beach burr sighting on Wale see annex VI. The area with the most beach burr was the community sports field and center. Small patches are also located along the sides of the road and access ways.



Photo 10: Participants observing the beach burr identification card and assessing surrounding location.



Photo 11: Participants removing beach burr at the community sports ground

Field visit on Motu Kotawa

The team visited and surveyed Motu Kotawa on Wednesday. All walk ways and access ways were surveyed and mapped for Beach Burr and other important species. Beach Burr were located at certain areas along the access ways. Areas with direct sunlight to the ground have about 5 to 10 plants in an area. The areas of high beach burr density are around the community huts.



Photo 12: Olaf taking GPS points while Moe take down some notes of the area

While on Motu Kotawa the team was able to remove 145 by 10 meters of beach burr.



Photo 13: Olaf and Iotama removing beach burr on Motu Kotawa

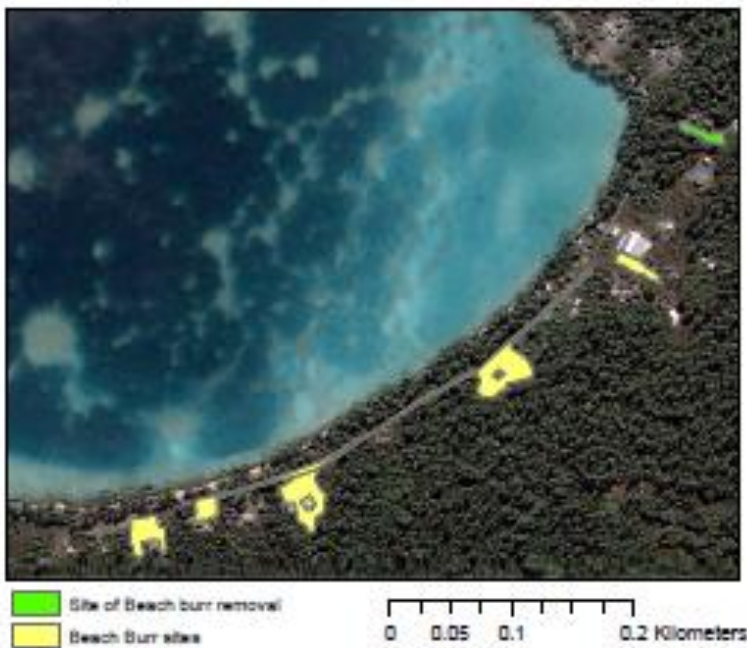
Field visit on Motu Ko

On Thursday Motu Ko was visited by the team. They had two groups to check all roads and access ways. They found that beach burr were mostly around the community huts. They were able to remove beach burr from one end of the island, Matai Tu to the Catholic Church as well as the road from the airport to the beginning of the village.



Photo 14: Typical road on the Motu

Motu Ko: Beach burr areas of removal



Total Beach burr removed from area - 224.6 (m2)

The map shows the areas where beach burr is found. Beach burr is mainly found around the dwellings and access roads on motu Ko. The map also shows the area where beach burr has been removed of 224.6 m².

Before and after photo of beach burr



Photo 15: An area with beach burr



Photo 16: Same area above after beach burr was removed

Biodiversity of Pukapuka

Biodiversity species on Pukapuka were also looked at and mapped during the field visit. These were taro planting areas, agriculture sites and sites with huge puraka and Tamanu trees.



Photo 17: Typical taro patches on Pukapuka



Photo 18: coconut tree infested with mite



Photo 19: Daniel, Moe & Tipereta in-front of a Pukatea tree



Photo 20: Daniel holding on to a puraka plant

EDUCATION AND AWARENESS

The team visited the secondary school to carry-out some education and awareness program. They presented on Biodiversity and invasive species, its importance and endemic species of the Cook Islands. What is GIS mapping, its benefits was highlighted to the students. Tips on writing news articles were also presented to the students and were encouraged to send any article they write on our environment to NES to publish. The last presentation was on waste management highlighting the impact plastic can cause to our environment and marine animals.

A competition on the best time to putting a biodiversity jig-saw puzzle together was the highlight for students.



Photo 21: Olaf presenting on the benefits of GIS mapping



Photo 22: Niua students during the education and awareness presentation

CONCLUSION AND RECOMMENDATIONS

The program to determine the status and distribution of beach burr on the island of Pukapuka was successful. The three islands were visited and mapped for the presence of beach burr and other significant trees such as bird nesting trees and huge tamanu and pukatea trees. Maps can be viewed in Annex VI.

The team presented their finding to the island council and the community and concluded that the control of beach burr on the island of Pukapuka can be managed by pulling and burning. Attempt to remove beach burr in some areas were carried out by the group and this was highlighted in the meeting.

The recommended that the beach burr program

- Be part of the Agriculture officers work plan
- Agriculture officer to take the lead with the program and to monitor progress
- Island council to oversee the program
- Island council to encourage community to remove beach burr around public area and village
- Areas under Ra'ui, for tiaki ra'ui with the Agriculture officer to remove beach burr during visits to the motu

And that to control the removal of beach burr is;

- By pulling the whole plant and place in a bag
- Ensure seeds are in the bag so they are not dispersed
- Burn or bury beach burr close to site
- Cover area where plants have been removed with kikau to reduce germination

The Agriculture officer was part of the team to visit the islands and was trained on how to go about with controlling beach burr on the islands. He stressed his support of the program and that this can be incorporated into his work plan for the island.

The island council also gave their support of the program as they see this as a hindrance with the community's daily life.



Photo 23: Papas' during the community workshop

ACKNOWLEDGEMENT

Ata wai wolo to the Island Council members, Government Representative, Ui Ariki for approving our visit to the island of Pukapuka and giving us permission to access the ra'ui sites to map the biodiversity in these areas.

The people of Pukapuka for looking after us through-out our stay on the island, Ata wai.

Ata wai to Iotama Ravarua, Tipereta Vave and Nei Tineiao for assisting us through-out program on Pukapuka.



Photo 24: Participants at the Community workshop. Mayor and Ariki of Pukapuka in the foreground

ANNEX I PUKAPUKA INVASIVE SPECIES PRIORITY LISTING

The tables below lists invasive plant and animal species present, around the community, on the motu and agricultural areas from most invasive (5) to least invasive (1).

Area: Motu Spp. : Plants

Pukapuka name	English name	Priority #(ttl/5=)
Pilipili Rau Talatala		4.2
Vayavaya Kau Makeke		3.8
Vayavaya Makeke		3.8
Pilipili Liliki		3.2
Poue Lau Lapalapa		2.6
Purumu (I loto I te pai taro)		2.4
Vavai		2.2
Pilipili Wua Loloa		2.2
Kavekave, Tipani		2

Area: Motu Spp. : Animals

White Fly	White fly	4.6
Reo	Ants	4.4
Rango	Tiny fly QQ Pukapuka 12	4.4
Potipoti	Caterpillar (spp. Unknown)	4.4
Tunga	Termite	4.2
Namu	mosquito	4
Poporongoi		3.4
Puaka	Pig	3.2
Rango Pete/Rango Patia		2.6
Moa	Chicken	2.6
Kaipea		2.4
Tupa	Mud crab	2.4
<u>Kaipea</u>		0.4
Unga	Coconut crab	0.4

Area: Agri Areas Spp. : Animals

Tunga	Termites	4.8
White Fly	White fly	4.6
Rat	Rat	4.2
Namu	mosquito	4
Puaka	Pig	4
Moa	Chicken	3.8
Potipoti	Caterpillar	3.6
Ymoli	Moth	2.6
Naonao	Drosophila/ vinegar fly	1.4
Mangamanga		1.4
Lady Birds	Ladybirds	1

Area: Agri Area **Spp. : Plants**

Poue Wenua		4.4
Piripiri		4.2
Mauku		3.6
Vayavaya (Pai Taro)		3.4
Kave		2.2
Venevene		2.2
Coconut Roots		1.4
Kavekave		1.4
Vavai		1.4

Area: Village **Spp. : Animals**

Tunga	Termite	4.8
White Fly		4.8
Potipoti	Caterpillar	4
Kiole	Rat	3.6
Namu	Namu Kukula Wuluwulua	3.6
Pig	Pig	3
Moa	Chicken	2.8
Popolonga		2.6
Red Ants	Red ants	2.4
Man (human thieves)	Human	1.2
Molokau		1.2
Sandflies	Sandflies	1

Area: Village **Spp. : Plants**

Pilipili		4.2
Vayavaya Tolo (Uwi)		4
Vayavaya Puela Tiale		3.2
Mauku totolo		2.6
Mauku totolo - poue		2
Mauku totolo - kave		1.2
Mauku totolo – vavai - too		1.2
Nono	Morinda	.8
Tiare maori	Gardenia	.8
Akari	Coconut	.8
Purou		.8

ANNEX II SUMMARY OF DAILY PROGRAM BY MOANA TETAURU

Day 1: Monday 25th May 2015

The Pukapuka Beach Burr Project Team tasked with the mapping and removal of the invasive Beach Burr on the island, departed for Pukapuka on Monday 25th May 2015. The team consisted of Project Coordinator Elizabeth Munro (NES), GIS Officer Olaf Rasmussen (NES) Media Officer Moana Tetauru (NES), Mauke Environment Officer Basilio Kaokao (NES), Moe Tatira (MoA) and Daniel Apii (Arorangi Community Leader).

The team arrived in Pukapuka around 230pm Monday 25th May, and was transported by boat to the main island where they were met by the Pukapuka Island Council and the Pukapuka Community. The team was then transported to their accommodation where they will spend the next 5-days.

After an official welcome with the Island Council and the elders, the team then returned to their accommodation to finalize and prepare for the IAS workshop the following day. The team was also able to map various beach burr sites on the main island – which will be relevant to the IAS workshop the next day.

Day2: Tuesday 26th May

Tuesday was an early start for the Project Team as preparations for the workshop began at 6.30am. Once set-ups were completed, the teams were then hosted to breakfast by one of five groups charged with catering. The workshop began at 9am with the opening address by Team Leader Elizabeth Munro, followed by her informative presentation to explain the importance of Bio-security for each of our islands, and the effects beach burr has on Pukapuka.

This was followed by a presentation by NES Mauke Officer, Basilio Kaokao who spoke about the Red Passion-fruit Eradication Program he conducted on Mauke. Kaokao explained the processes he's made and learnt over the 3-year period and how important it is to continue the monitoring process in which he will continue to do so for the next 6-years.



Photo 26: Moana presenting on media and the environment

The third presentation for the day was conducted by Arorangi Community Leader Daniel Apii. Mr. Daniel explained his involvement with the Arorangi Boys Brigade in the eradication of the Tiaea-Cuscutta program. The last speaker of the day was MoA Officer Moe Tatira who spoke about the recent Fruit-fly program which is currently being monitored. He too spoke about the importance of bio-security and the costs involved in controlling this program.

Once presentations were completed, an activity was created to identify invasive species of concern in three areas, community, motu and agricultural sites and to prioritize this from most problematic to least concern. This was followed by lunch then a visit to Niua School's community field where both Olaf and Basilio identified as being the most problematic area. The team was able to take on a hands on approach in educating those present in the removing of the invasive to prevent it from spreading. Those present thanked the Project Team and looked forward to more productive 3-days ahead.

The team then returned to their home to discuss and evaluate the day's events – highlighting the field visit and the invasive species priority exercise. Preparations began for the school and Motu Kotawa visits.

Day 3: Wednesday 27th May

Another early morning start for the team as preparations began for the all day program. First stop was Niua School where Team NES (Elizabeth, Mona and Olaf) were to hold presentations with the senior students of Niua School.

After the official formalities, Team Leader Elizabeth Munro conducted a presentation on Biodiversity, this was followed by a presentation by Olaf explaining GIS and lastly by Mona who based her presentation on Media and the Environment. An activity by the Project Team and the handing over of educational material to the school followed.

The team was then transported by boat to Motu Kotawa where they spent the remainder of the day. The team was split into 2 groups who went in opposite directions. Each group consisted of a Biodiversity and GIS Officers.

The team walked the length of the motu – through this, the teams were able to map all beach burr sites, all agricultural areas, various tree species and bird nesting sites. Once this ended, the team then regrouped and all agreed that the invasive beach burr was only found in populated areas. After brief discussions, the removal of beach burr began. This took at least 2-hours to complete and the team was able to remove 145metres by 10m of beach burr.

Day 4: Thursday 28th May

Another early start for the IAS team, as preparations begins for Motu Ko, the biggest of the motu's. The team was able to adopt an identical approach from Motu Kotowa to Motu Ko. Again, the team mapped out various sites. These maps were important as the data collected can be used by the team, Island Council, NES and MoA.



Photo 27: The team marking the puraka site on their maps

Once regrouped, again it was discovered that the invasive is found only in populated areas of the motu.

Day 5: Friday 29th May

The team worked tirelessly to prepare for the morning's findings with the Island Council and the Pukapuka Community. All data collected were compiled by both Olaf and Basilio ready for presenting. Formalities were conducted by Team Leader Elizabeth Munro, who then presented its findings to the Island Council and Mayor.

The findings were also supported by Basilio Kaokao, Moe Tatira and Daniel Apii. In ending, the findings were accepted and the Island Council has agreed to continue the project which will be lead by the Pukapuka MoA Officer.

ANNEX III PROGRAM ON PUKAPUKA

Day	Details	Notes
Mon 25th May Day 1	Morning <u>Depart Rarotonga - Pukapuka-Mon 25th May 2015</u> <ul style="list-style-type: none"> ➤ Reporting time - 6am ➤ Estimated departure time - 7am ➤ estimated travel hours - 4hrs ➤ estimated time of arrival – 11am Afternoon 1pm – courtesy call with island council & Govt Admin <ul style="list-style-type: none"> ➤ purpose of trip & intro program for the week 2pm – Tour, survey and mapping of Wale Island	 Discussion with Island Council & Admin <ul style="list-style-type: none"> ➤ Purpose of trip ➤ Program to be carried out
Tuesday 26th May Day 2	Morning <ul style="list-style-type: none"> ➤ Invasive Spp community workshop Afternoon Community site visit - Wale Island visit <ul style="list-style-type: none"> ➤ Field survey and mapping ➤ Removing of beach burr 	Key presentation <ul style="list-style-type: none"> ➤ Purpose of Trip ➤ What is IAS ➤ What & how to ID Beach Burr ➤ Why control Beach Burr ➤ Sample invasive program on Mauke and Rarotonga ➤ ID key invasive spp on island Discussion <ul style="list-style-type: none"> ➤ ID who will implement the program ➤ Requirements needed
Wednesday 27th May Day 3	Morning 9am School visit and presentations	School Presentations <ul style="list-style-type: none"> ➤ What is Biodiversity ➤ What are Invasive spp. ➤ What is GIS mapping ➤ Media presentation – Waste management
Thursday 28th May Day 4	Morning Motu Ko island visit <ul style="list-style-type: none"> ➤ Survey, mapping and data analysis ➤ Removing of beach burr 	Key presentation <ul style="list-style-type: none"> ➤ Outcome of control and survey work ➤ Presentation of survey and map results ➤ Method of control
Friday 29th May	Morning Meet with island council & community to report on	Discussion with Island Council & Admin

Day 5	work carried out on the island	<ul style="list-style-type: none"> ➤ report on activities carried out on the island ➤ outcome of trip ➤ where to from here
	Afternoon Depart Pukapuka for Rarotonga <ul style="list-style-type: none"> ➤ Estimated departure time – 1pm ➤ estimated travel hours - 4hrs ➤ estimated time of arrival – 5pm 	

Community workshop on Beach Burr Control Programme

Tuesday 26th May 2015

Time	Item	Note
8:30 am	Registration of participants Opening prayer Opening speech	
	Briefing of program <ul style="list-style-type: none"> - Purpose of trip - Target species - What is invasive species 	Elizabeth Munro – Biodiversity officer
	Invasive species control program on Rarotonga and Mauke <ul style="list-style-type: none"> - Red passionfruit eradication program on Mauke - Cuscutta control program on Rarotonga 	Basilioa Kaokao – Mauke environment officer Daniel Apii – Arorangi Boys Brigade
	Invasive species not present in the Cook Islands or on Pukapuka to be aware of and Food security	Moe Tutira – Agriculture officer
10:30am	Morning tea	
	Identifying and prioritising key invasive species on Pukapuka (community, motu and agricultural sites) – group work	Elizabeth Munro
	Discussions, comments and questions	
12pm	Closing prayer	
	Lunch	

ANNEX IV LIST OF PARTICIPANT TO THE COMMUNITY WORKSHOP

Pukapuka Invasive Workshop Attendance

NAME	AGENCY	CONTACT
Ki Mataora	Public Health	41664
Nei Tineiao	Agriculture Officer	57047
Iotama Ravarua	Senior Mechanic	77884
Uwitai Akima	Driver	41021
Tipereta Vave	Ass Mechanic/Driver	41074 or 70816
Puiki Pamani	Plumber	41137
James Auora	Public Health	41664 / 78863
Ioloko Williams	Disability Coordinator (NGO)	75998
Ruarau Iakoba	Supervisor energy	79988
Beni Wiiliams	Store mem	56289
Wale Teingoa	Retired school teacher	41016
Rima Paaru	Energy	78825
Brian Opo	Police	78327
Varia Marukore	Infrastructure	75521 / 41777
Tai Ravarua	Senior Marine Officer	41711
Moring Maia	MMR	41711
Puapii Neiao	House Wife	41135 / 50418
Yeutu Yeutu	Agriculture Officer	73926
Peretila Teinaki	Finance Officer	41037 / 41711
Ilingamunawitipayi	House Wife	41143
Tutau Punga	Fisherman	4111 / 78459
Pataku Manurere	Chairman of Tawa Ngake	41092
Temoana Kiiikii	Health	
Riata Maru	WDO	41119
Tumatini Rukuaro	Operator	41138
Lotoua Wuatai	Nurse Aid	

ANNEX V INVASIVE SPECIES TEAM TO PUKAPUKA

Six members from Rarotonga travelled to Pukapuka for the beach burr program coordinated by Senior Environment Officer, Elizabeth Munro. The team includes NES GIS Officer, Olaf Rasmussen, Media and Outreach Officer, Moana Vaevae-Tetauru, Mauke NES officer, Basilio Kaokao, Moe Tutira from the Ministry of Agriculture and Daniel Apii of the Arorangi Boys Brigade.

Roles and Responsibilities of members

Name	Role	Responsibilities
Elizabeth Munro	IAS Project Coordinator & Team leader	<ul style="list-style-type: none"> ➤ Coordinate IAS program ➤ Manage trip logistics ➤ Coordinate workshop on Pukapuka
Moana Tetauru	Media Officer	<ul style="list-style-type: none"> ➤ Video and document trip ➤ Document workshop discussions ➤ Assist team leader on logistics ➤ Introduce NES media program
Olaf Rasmussen	GIS officer	<ul style="list-style-type: none"> ➤ Mapping sites for beach burr ➤ Collect, manage and input information into database ➤ Map other related BD species ➤ Produce beach burr map for island council
Basilio Kaokao	NES officer	<ul style="list-style-type: none"> ➤ Field work organizer and trainer ➤ Collect, manage and input information into database
Moe Tutira	Agriculture officer	<ul style="list-style-type: none"> ➤ Share on invasive species eradication program ➤ Present on IAS threats from neighboring islands ➤ Assist on invasive species identification
Daniel Apii	Boys Brigade officer	<ul style="list-style-type: none"> ➤ Share experience on control project for Cuscutta on Rarotonga – ‘Not Knowing to Knowing’ ➤ Assist with invasive species identification and survey ➤ Assist with translation

COOK ISLANDS HERALD
NEWS

27 MAY 2015

Pukapuka Beach Burr control program

A team from the National Environment Service, the Ministry of Agriculture and the Arorangi Boys Brigade, will head to Pukapuka on Monday to formulate a plan to control and manage the invasive Beach Burr (Piri-piri) species.

The program is formulated under the National Environment Service's Invasive Alien Species (IAS) Project and is coordinated by Senior Environment Officer, Elizabeth Munro.

The team includes NES GIS Officer Olaf Rasmussen, Media and Outreach Officer, Moana Vaevae- Tetauru, Mauke NES Officer Basilio Kaokao, Moe Tutira from the Ministry of Agriculture and Daniel Apii of the Arorangi Boys Brigade.

On Pukapuka, the team will hold discussions with the Pukapuka Island Council, as well as conduct an Invasive Species Workshop, map, control and manage all Beach Burr sites, visit all Motu's and Rai areas, and carry out education and awareness programs.

Moe Tutira from the Ministry of Agriculture will educate the people on invasive species eradication programs carried out on other islands, present his findings on IAS from neighboring Pacific Islands such as Pago-Pago.

Arorangi Boys Brigade Leader, Daniel Apii will share his experiences on the successful *Cuscutta* or Tiesa eradication program.

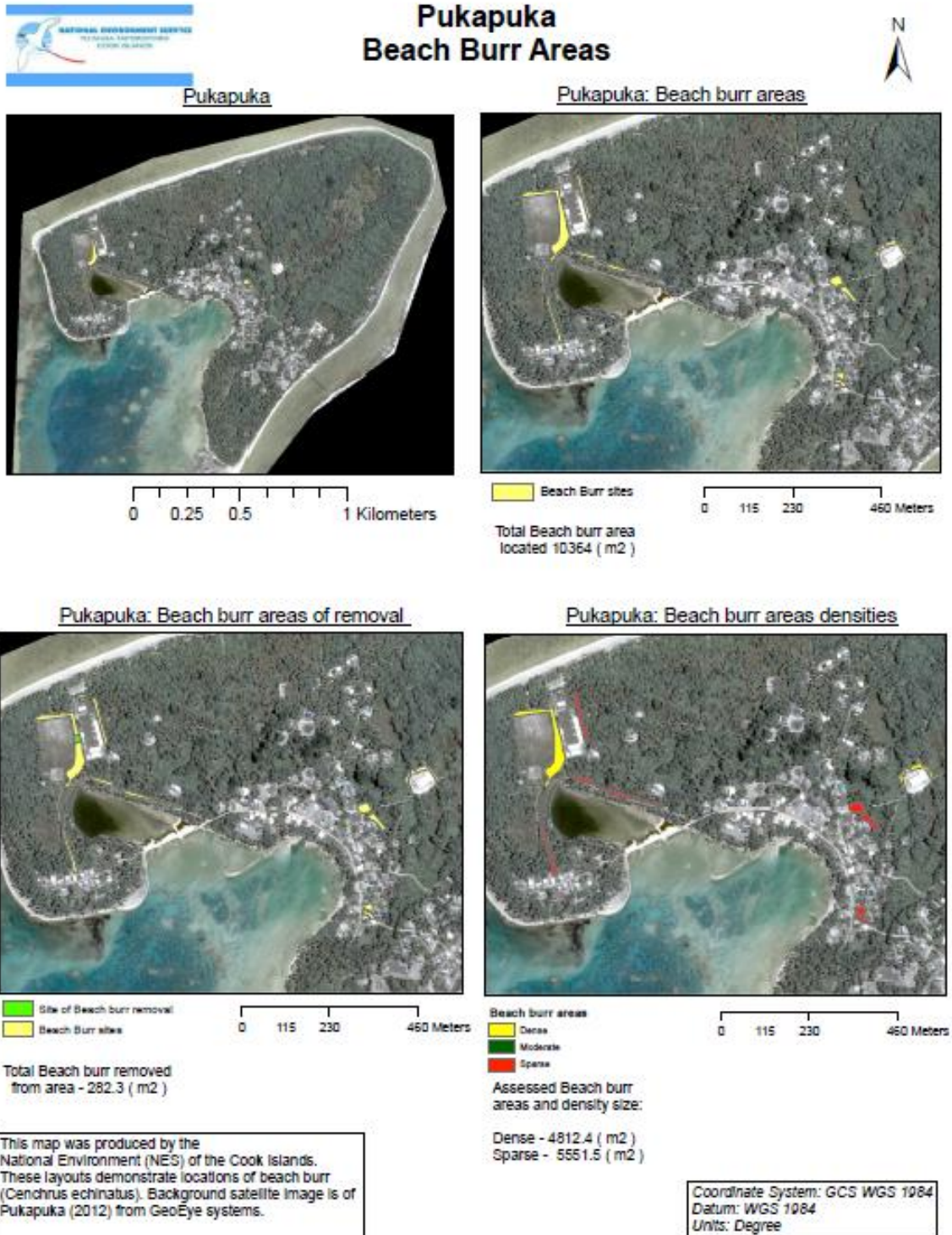
The team will also conduct school visits, and meet with the community before returning to Rarotonga on Friday.



Photo 28: Removing beach burr on the community field

ANNEX VII BEACH BURR MAPS

Map 1 – Wale Island



This map was produced by the National Environment (NES) of the Cook Islands. These layouts demonstrate locations of beach burr (*Cenchrus echinatus*). Background satellite image is of Pukapuka (2012) from GeoEye systems.

Map 2 – Motu Ko



**Pukapuka: Motu Ko
Beach Burr Areas**



Pukapuka: Motu Ko



0 0.275 0.55 1.1 Kilometers

Motu Ko: Beach burr areas



0 0.05 0.1 0.2 Kilometers
 Total Beach burr area located - 4991.7 (m2)

Motu Ko: Beach burr areas of removal



0 0.05 0.1 0.2 Kilometers

Total Beach burr removed from area - 224.6 (m2)

Motu Ko: Beach burr areas densities



0 0.05 0.1 0.2 Kilometers

Assessed Beach burr areas and density size:
 Dense - 3871.9 (m2)
 Moderate - 544.2 (m2)
 Sparse - 575.5 (m2)

This map was produced by the National Environment (NES) of the Cook Islands. These layouts demonstrate locations of beach burr (*Cenchrus echinatus*). Background satellite image is of Pukapuka (2012) from GeoEye systems.

Coordinate System: GCS WGS 1984
 Datum: WGS 1984
 Units: Degree

Map 3 – Motu Kotawa



**Pukapuka: Motu Kotawa
Beach Burr Areas**



Pukapuka: Motu Kotawa



0 0.275 0.55 1.1 Kilometers

Motu Kotawa: Beach burr areas



0 37.5 75 150 Meters

Beach Burr sites
Total Beach burr area located - 4867.9 (m²)

Motu Kotawa: Beach burr areas of removal



0 37.5 75 150 Meters

Site of Beach burr removal
Beach Burr sites
Total Beach burr removed from area - 1406.3 (m²)

Motu Kotawa: Beach burr areas densities



0 37.5 75 150 Meters

Beach burr areas
Dense
Moderate
Sparse
Assessed Beach burr areas and density size:
Moderate - 1400.7 (m²)
Sparse - 3467.2 (m²)

This map was produced by the National Environment (NES) of the Cook Islands. These layouts demonstrate locations of beach burr (*Cenchrus echinatus*). Background satellite image is of Pukapuka (2012) from GeoEye systems.

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

ANNEX VIII NATIVE TREES ON PUKAPUKA

Below is a map of native trees on three islands of Pukapuka. The trees mapped are Pukatea and Tamanu trees with a diameter greater than 100cm and Tou trees with a diameter greater than 50cm.



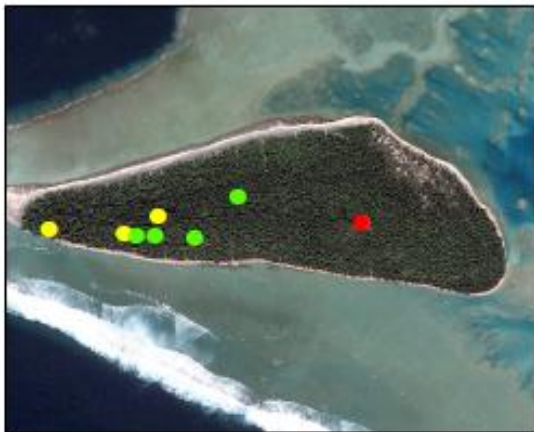
Pukapuka: Species Tree Features



Pukapuka

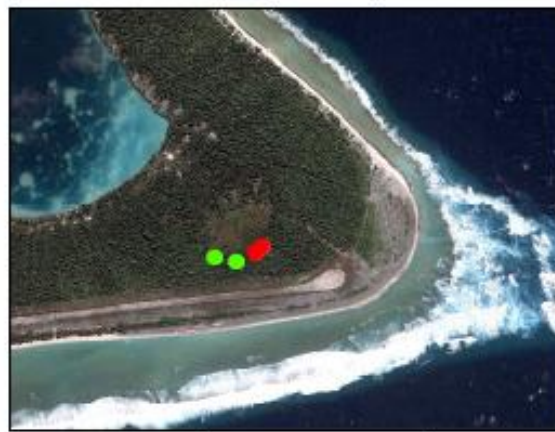


Motu Kotawa



0 0.175 0.35 0.7 Kilometers

Motu Ko



0 0.175 0.35 0.7 Kilometers

Classification:

- Pukatea, *Pisonia grandis*
- Tamanu, *Calophyllum inophyllum*
- Tou, *Cordia subcordata*

The following layout was produced by the National Environment Service (NES) of the Cook Islands which demonstrates tree species of special interest on the Islands of Pukapuka.

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

ANNEX IX AGRICULTURAL AND LOWLAND AREAS

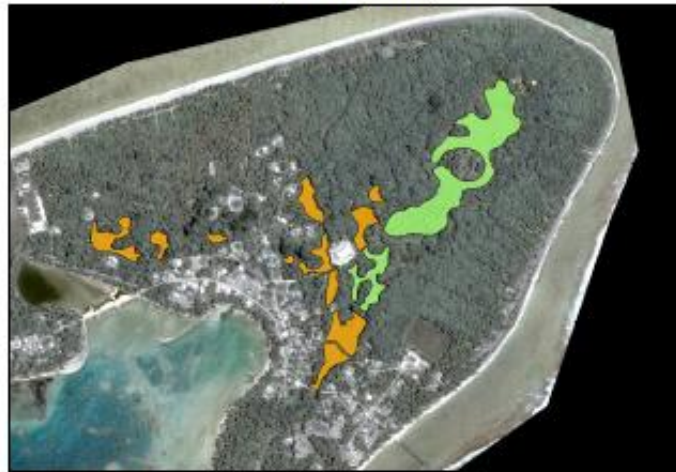
Below is a map of areas used for agriculture. The green and brown colours are wetland areas and purple area is a site planted with fruit trees such as citrus, guava etc.



**Pukapuka:
Agricultural and
Lowland/ Wetland Areas**



Pukapuka



Total Area used for
Agricultural purposes = 0.03 (km²)
Wetland/ Lowlying = 0.04 (km²)

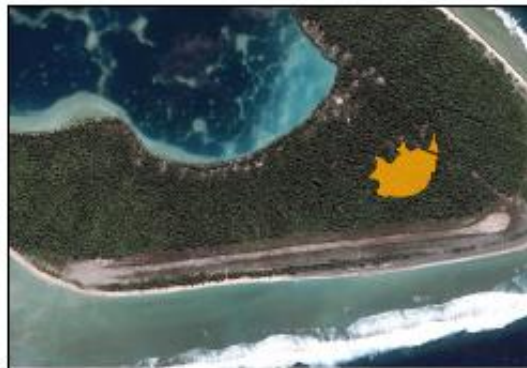
0 0.15 0.3 0.6 Kilometers

Motu Kotawa



0 0.2 0.4 0.8 Kilometers

Motu Ko



0 0.175 0.35 0.7 Kilometers

Classification:

	Agriculture
	Agriculture (Fruit Trees)
	Wetland/ Lowlying areas

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

The following layout was produced by the National Environment Service (NES) of the Cook Islands which demonstrates areas used for Agricultural purposes and lowlying areas on the Island of Pukapuka. The background satellite images is provided by Geosystems (2012).



Ata wai wolo Pukapuka