



**Kaveinga Paruru a te Kuki Airani
no te au tu
Katiri Kikino
2019 - 2025**

**Cook Islands
National Invasive Species Strategy
And Action Plan 2019 - 2025**

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FOREWORD

EXECUTIVE SUMMARY

This National Invasive Species Strategy and Action Plan (NISSAP) was developed during a collaborative process involving the many stakeholders who have roles to play in managing invasive species. It was prepared as one of the outputs of the GEF PAS project “Prevention, eradication and control of invasive alien species in the Pacific islands” which is funded by the Global Environment Facility (GEF), implemented by the United Nations Environment Programme (UNEP) and executed by Secretariat of the Pacific Regional Environment Programme (SPREP) in partnership with the National Environment Service.

Introductory sections identify the vital importance of invasive species to the Cook Islands as potential threats to its economy, biodiversity and the health of her people, and describe the species of most impact. For example, mosquitoes that originated in Africa carry infectious diseases like dengue fever and Zika virus; climbing vines threaten native forests; and it cost over \$250,000 to eradicate a fruit fly from Asia that threatened agricultural crops. There are also many very damaging invasive species within the region that have not yet reached the Cook Islands, and details of the vital role played by border control in intercepting some of these to prevent their establishment is outlined.

While the threat posed by invasive species is great, and it is best to stop them reaching the country, there are many examples of successful ways to manage them. The NISSAP identifies programmes to eradicate rats and mynah birds, and to reduce the threats posed by pest plants and pest insects through biological control, bringing in their natural enemies from overseas in carefully researched programmes.

The Strategy also identifies that many people play a role in invasive species management, from individual members of island communities, through to Government departments and NGO’s. It sets out the legislation and policies in place to underpin the effort.

The key part of the NISSAP is the Action Plan. This identifies priority actions for the next few years, together with indicators to measure their successful achievement and specification of who will be responsible for carrying them out and how they might be resourced. These actions can be fed into planning at national and organisational levels.

Actions are grouped according to regional guidelines developed by SPREP. They begin with those that establish the necessary foundation, which includes raising awareness and education so that

everyone is aware of the importance of the issue and can help tackling it, and having the necessary capacity, policies and legislation in place. Secondly there are actions to identify the scope of the problem and the priorities, such as baseline surveys and research. Thirdly there are management actions including biosecurity and border control, surveillance, and a significant number of priority eradication and control programmes.

The Strategy concludes with a section on how the progress of implementation will be monitored and evaluated.

Addressing the actions in the Strategy in a coordinated effort will allow the Cook Islands to minimise the threat of invasive species to its natural environment, people and economy.

KEY CONCEPTS AND ACRONYMS

Biocontrol or biological control: Controlling an invasive species by introducing a natural enemy, such as an insect or fungus, that specifically attacks the target species and does not attack other native or economically important species.

Biodiversity: The variety of living organisms on the earth, including the variability within and between species and within and between ecosystems.

Biosafety: describes the range of efforts to address the safe transfer, handling and use of living modified organisms resulting from modern biotechnology.

Biosecurity: Preventing the spread of pests and diseases across international or internal borders.

Control: Reducing the population of an invasive species.

Eradication: removal of the entire population of an invasive species.

Genetically modified organism: An organism whose genetic composition has been altered by the application of modern biotechnology techniques

Introduced species: Plants, animals and other organisms taken beyond their natural range by people, deliberately or unintentionally.

Invasive species: *Introduced species* that become destructive to the environment or human interests; can also include some *native species* that increase in number and become destructive following environmental changes.

Native species: Plants, animals and other organisms that occur naturally on an island or in a specified area, having either evolved there or arrived without human intervention.

Risk assessment: Evaluation of the risk that a new introduced species will become invasive with damaging consequences, prior to its introduction

Surveillance: Monitoring to detect the arrival of new invasive species.

Acronyms

ACIAR	Australian Centre for International Agricultural Research
BIO	Biosecurity Service, Cook Islands
CABI	Commonwealth Agricultural Bureaux International
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CIPA	Cook Islands Ports Authority
EDRR	Early Detection and Rapid Response
ERP	Emergency Response Plan
FAO	UN Food & Agricultural Organisation
GCF	Green Climate Fund
GEF-PAS IAS	Global Environment Facility Pacific Alliance for Sustainability, United Nations Environment Programme: Prevention, Control and Management of Invasive Alien Species in the Pacific Islands
GISD	Global Invasive Species Database (maintained by ISSG)
GISIN	Global Invasive Species Information Network
HPWRA	Hawai'i-Pacific Ecosystems at Risk
IBPoW	Island Biodiversity Programme of Work
IAS	Invasive Alien Species
IMO	International Maritime Organisation
IS	Invasive Species
ISSG	Invasive Species Specialist Group of the Species Survival Commission of the IUCN
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
MMR	Ministry of Marine Resources
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOT	Ministry of Transport
NBSAP	National Biodiversity Strategy and Action Plan
NES	National Environment Service
NHT	Cook Islands Natural Heritage Trust
NISSAP	National Invasive Species Strategy and Action Plan
OMIA	Office of the Minister for Island Administrations, Cook Islands
OPM	Office of the Prime Minister, Cook Islands
PEARL	Pa Enea Actions for Resilience and livelihood (Climate Change Adaptation Program)
PestList (PLD)	Pacific Islands PestList Database
PIER	Pacific Island Ecosystems at Risk – for plant risk assessment information
PII	Pacific Invasives Initiative
PILN	Pacific Invasives Learning Network
PIP	Pacific Invasives Partnership
PIRNC	Pacific Islands Roundtable for Nature Conservation
Plant Pono	Hawai'i-Pacific Ecosystems at Risk website for plant risk assessment information
PoWPA	Programme of Work on Protected Areas
SPC	Secretariat of the Pacific Commission
SPREP	Secretariat of the Pacific Regional Environmental Programme
SRIC	Southwest Research and Information Center
SSC	Species Survival Commission of IUCN
TIS	Te Ipukarea Society
UNEP	United Nations Environment Programme

1. INTRODUCTION

Introduction to Cook Islands

The Cook Islands consists of 15 small islands scattered over 2 million square kilometres of the Pacific Ocean. They lie in the centre of the Polynesian Triangle, flanked by Fiji 2,300 km to the west, Tahiti 1,140 km to the east, Hawaii 4,730 km to the north and New Zealand 3,010 km to the southwest. The climate of the Cook Islands is sub-tropical and tropical oceanic moderated by trade winds. The islands form two groups: the Northern Cooks and the Southern Cooks. The Northern Group consists of five atolls (Pukapuka, Rakahanga, Manihiki, Suvarrow and Penrhyn), and a sand cay (Nassau). The Southern Group consists of four makatea islands (Mangaia, Atiu, Mauke and Mitiaro), two atolls (Palmerston and Manuae), one almost-atoll (Aitutaki), one sand cay (Takutea) and one high island (Rarotonga). Twelve of the islands are permanently settled, while the other three islands are wildlife reserves (Suvarrow, Takutea, and Manuae) (Figure 1) (Annex 3). About 70% of the population of approximately 20,000 live on the largest of the southern islands, Rarotonga.

Rarotonga is the home of the Government and the National Administration. The other inhabited islands are administered together as the Pa Enuu, allocated resources from the national budget based on formulas depending on their populations and the infrastructure and resources that they have to manage. Their communities are typically dominated by the very young, old or women.



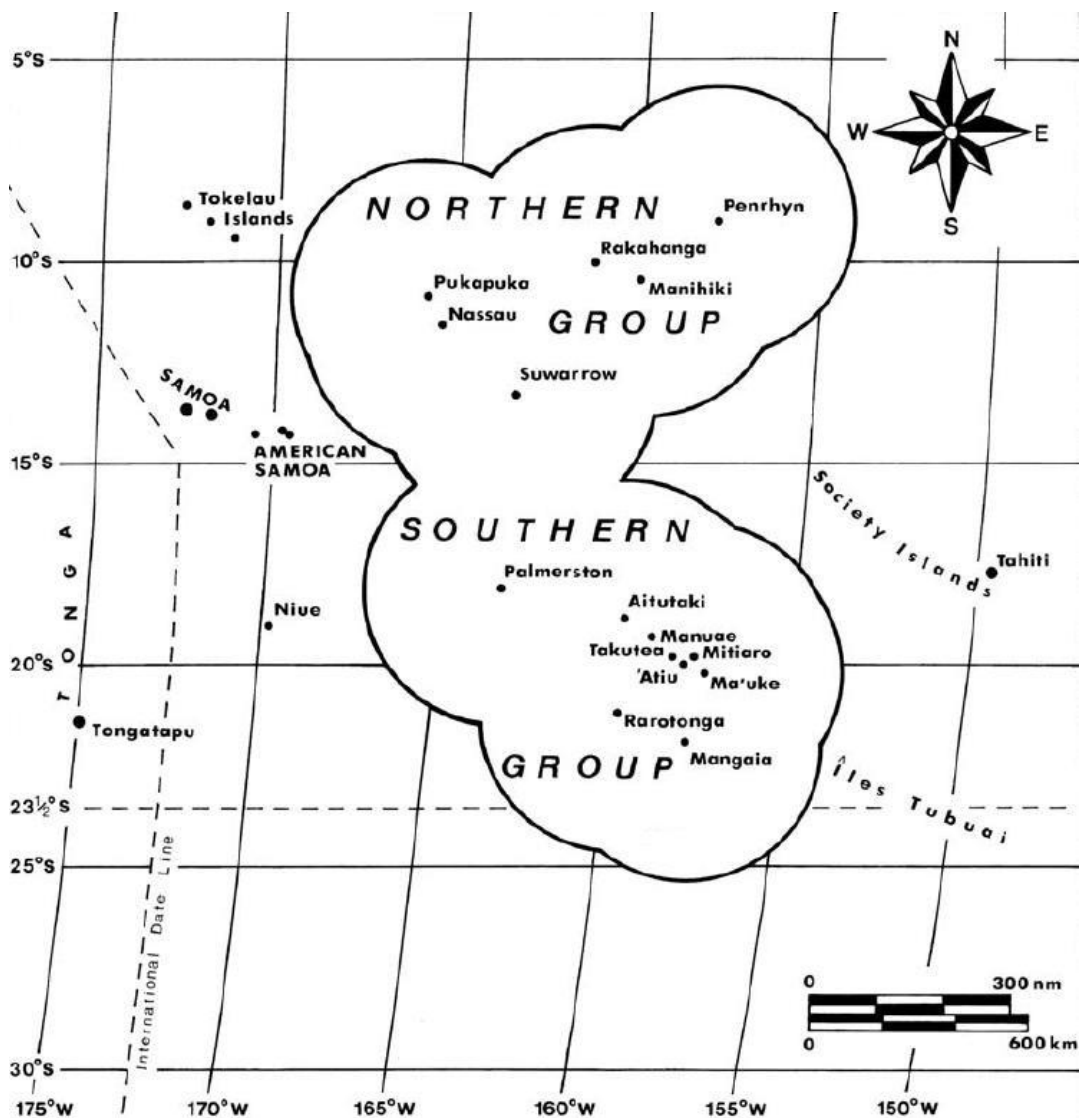
Photo: Rarotonga from the air. (The airport and main town of Avarua at top of picture). Source: Ministry of Agriculture PowerPoint Presentation.

The country's biodiversity is vital to its future. The primary sector (Agriculture, Fishing and Pearl Industries) made up 5.7% of Gross Domestic Product (GDP) in 2012 (Ministry of Finance and Economic Management, National Accounts). That year there was a 9.3% increasing in the Fishing and Pearl Industry and a continuing declining trend in the contribution from agriculture. The single biggest contribution to GDP is tourism, which significantly depends on the beauty of the country's land and sea environments and the native species within this.

The native biodiversity of the different islands has been used by generations of Cook Islanders to sustain their culture. Its forests protect the land and store water, its coral reefs protect the coasts, and native species provide food, medicines, building materials, and firewood, and provide the country with its unique identity.

The terrestrial native biodiversity of the Cook Islands has a relatively small number of species and lacks many of the common taxa found in larger islands and continental landmasses. For example there are no amphibians and only one land mammal (Pacific flying fox *Pteropus tonganus*). This means the species that are present assume greater significance and there are a number that are endemic – i.e. only found in the Cook Islands and nowhere else in the world: 20 flowering plants, six landbirds, 26 landsnails (14 of which are extinct), and a largely unknown number of invertebrates.

Figure 1: Map showing Cook Islands and its Exclusive Economic Zone (Source: 4th National Report to the CBD).



In the marine area, though there is some ecosystem diversity between the high islands in the south, with their shallow lagoons and fringing reefs, and atolls in the northern group with their large, deep lagoons encircled by coral reef, there is a limited number of ecosystems present overall.

What is an invasive species (IS)?

The clearest examples are species that have ‘invaded’ the country from overseas, arriving by air or sea, then found their own way across the border, increasing in numbers because they have no natural enemies and causing significant damage to native biodiversity, the economy or human health.

There are also many examples of IS that people have brought in deliberately from overseas. Many such species have proved beneficial and provide the basis for agriculture, or provide flowers for gardens. However others have caused damages, like some climbing vines brought into the country because of their attractive flowers that have then spread to smother native forests.

Some species brought in from overseas are considered invasive only in some situations. For example, pigs are very beneficial when farmed in controlled conditions, but they are damaging when they run wild, destroying plantations, changing the structure of native forests and acting as predators of native species such as coconut crabs. Wild or 'feral' pigs and feral goats will thus appear in this strategy as invasive species on certain islands.

Finally, some native species can become invasive and cause damage when something upsets the natural balance. Examples include the crown of thorns starfish (*Acanthaster planci*) which occasional builds up in number to the point that it damages coral reefs, and the native fruit fly (*Bactrocera melanotus*) which damages fruit and vegetable species brought into the country from overseas such as dragon fruit and orange varieties.

The vital importance of invasive species to Cook Islands

Invasive species (IS) currently have impacts on Cook Islands' economy, biodiversity, and human health and culture. They have been recognised as a high risk of creating a major emergency or national disaster in the country (Government of Cook Islands 2009).

In biodiversity terms, IS have been identified as the biggest threat to the country's flora, and invasive plants are destroying habitat for native birds such as the Kakerori or Rarotonga Flycatcher (*Pomarea dimidiata*), the I'oi or Rarotonga starling (*Aplonis cinerascens*) and the Kuramoo or Blue Lorikeet (*Vini peruviana*), and endemic landsnails (National Environment Service 2011). Rats (*Rattus rattus*) continue to threaten the Kakerori through predation and Indian myna (*Acridotheres tristis*) are a threat to other native birds through disturbance and competition.

In economic terms, the Cook Islands has fortunately not suffered the dramatic impacts from IS that other countries in the region have. There are a range of introduced pest insects and diseases that affect food crops grown in the country, but the impacts of these are largely felt by individual farmers and families as reduced productivity or increased costs of production, as there are currently no significant export programmes.

There are suggestions that the temporary collapse of the pearl industry on Manihiki may have involved invasive species that arrived on technical equipment from overseas. However analysis identified increases of naturally occurring bacteria (*Vibrio* sp.) following a long period of calm weather and some overstocking of the lagoon as the main causes (Diggles et al. 2007). In 2007 the pearl and pearl shell industry contributed US \$2.2 million to the Cook Islands economy (FAO 2010), so it is important to prevent invasive species impacting on it in the future..

The most obvious invasive species impacting on human health are the mosquitoes (*Aedes* spp.) that carry infectious diseases such as dengue fever, Zika fever and chikungunya. The most harmful species *Aedes aegypti* which lives near human habitation and feeds exclusively on human blood (McCormack 2007) originated in Africa. The virus causing chikungunya is an invasive species itself which was also first detected in Africa, in Tanzania in 1952 (Pan American Health Organisation <http://www.paho.org/>). A recent outbreak with 15 cases in 2014 and 770 in 2015 ran over a 38-week period, largely on Rarotonga with cases on 6 other islands (Health Department Update report 11/11/15). Information on the disease (for which there is no vaccine) was made available to tourists and it is not known if this has caused some to change their plans to visit. There was a Zika fever outbreak in 2014 that ran for about 16 weeks with over 850 cases on Rarotonga and a few on four other islands (Health Department 2014 Zika Outbreak Summary Report).

The arrival of a pest insect, the Cuban laurel thrip (*Gynaikothrips ficicorum*) in 2009, provides an example of an invasive species that had wide impacts on many aspects of peoples' lives on Rarotonga. They took the island 'by storm', swarming over brightly-coloured t-shirts, covering arms and faces, and most people who regularly drove motorbikes experienced the pain of a thrip in the eye (Poeschko 2010). This insect was attracted to bright colours, covering the newly-painted fire-truck at the airport, coating tennis balls, and may even have affected the results of sports games by swarming more over the shirts of one team and not the other! The thrip attacked tomato plants and Benjamin fig trees, popular shade trees. Another species, the red-banded thrip (*Selenothrips rubrocinctus*) landed on Rarotonga around the same time as its Cuban cousin causing severe damage to avocado, guava and *Terminalia* trees. The Cuban laurel thrip is currently largely under control following the introduction of a predatory bug as a biocontrol agent.

The Coconut flat moth (*Agonoxena argaula*) arrived in Rarotonga in October 2000, apparently through an illegal importation of palms. An awareness campaign was established urging the public not to take any coconut and ornamental palms, including parts of palms such as leaves, nuts, and

trunks, from the infested area, and but the moth spread rapidly to Aitutaki, Atiu, Mauke, Mangaia, Palmerston, Mitiaro by November 2003. A parasitic wasp (*Bracon* sp.) was introduced from Fiji and has successfully reduced the impact of the moth.



Photos: Coconut flat moth & parasitic wasp introduced as biocontrol (Maja Poeschko photos).

There are many examples from other island countries of invasive species that have had devastating and very costly consequences. The brown tree snake is thought to have caused the extinction of 10 native landbird species on Guam leaving only two (Rodda & Savige 2007). The taro leaf blight reduced annual export returns for this crop in Samoa from around WS\$10 million to c.WS\$150,000 (US\$60,000) over a couple of years (Hunter et al. 1998). The yellow-crazy ant (*Anoplolepis gracilipes*) has killed an estimated 10-15 million of the famous red crabs on Christmas Island in the Indian Ocean in recent years (O’Dowd et al. 2003). The little fire ant (*Wassmania auropunctata*) has been described as ‘perhaps the greatest ant species threat in the Pacific region’ (GISD 2014) and is found on three island groups in Vanuatu, for example, where it occupies gardens and homes in large numbers frequently stinging the residents and making crop growing very difficult.

Other significant invasive species in the Cook Islands

Climbing vines particularly *Merremia peltata* (morning glory), *M. tuberosa* (wood rose) and *Mikania micrantha* (mile-a-minute) create major problems for farmers trying to keep land open for plantations, and together with balloon vine (*Cardiospermum grandiflorum*) smother native forests, particularly on Rarotonga. A rust fungus (*Puccinia spegazzinii*) has recently been introduced as a biological control for *Mikania micrantha* in a programme involving the Cook Islands Ministry of Agriculture, New Zealand’s Ministry of Foreign Affairs and Trade, and Landcare Research.

Invasive ants have been implicated in the declines and extinctions of landsnails on Rarotonga (Brook 2006). The big-headed ant (*Pheidole megacephala*), first collected in Rarotonga in 1914, is a major threat to biodiversity through its impacts on native invertebrates, and to agriculture through harvesting seeds and increasing the numbers of crop-damaging sap-sucking insects. The yellow crazy ant (*Anoplolepis gracilipes*), first collected in Rarotonga in 1937, will also impact on native invertebrates including land crabs as in the Christmas Island example, though it does not appear widespread.

The glassy-winged sharpshooter (GWSS) (*Homalodisca vitripennis*) was discovered in Rarotonga in March 2007 by the country's entomologist Dr Maja Poeschko. Following its discovery, about 1.5 km from the International Airport, the insect spread relatively quickly to adjacent areas. It was suspected that the pest entered the Cook Islands via ornamental plants from Tahiti, where it was first detected in 1999. The significance of the GWSS is that it can carry the plant bacterium *Xylella fastidiosa* which causes a disease of economic significance to grapes, citrus and peaches. Biosecurity New Zealand undertook tests to determine if this bacterium was present in the Cook Islands for fear of its possible impact on the wine industry in New Zealand. An introduced biocontrol agent, a parasitic wasp is keeping the GWSS population under control.

There are two fruit flies in the Cook Islands that are threats to fruit and vegetable production: *Bactrocera melanotus* an endemic native species and *B. xanthodes* which is found in several other Pacific countries. Control involves removing ripe fruit and unwanted fruit trees and the use of traps and poison baits (NES 2004). A monitoring programme using traps is maintained to detect the arrival of other potentially more damaging species, in a regional programme coordinated by Secretariat of the Pacific Commission (SPC). This resulted in the detection and subsequent eradication of nine Queensland fruit flies *B. tryoni* between 2001 and 2003 (NESAF). A further species the Oriental fruit fly, the most destructive species of fruit and vegetable infesting flies in the world, was found in Rarotonga and Aitutaki in May 2013 and it too was successfully eradicated in a major programme by the Ministry of Agriculture by September 2014. As an example of the economic impact of an invasive species, this eradication programme cost over \$246,000 (Cook Islands Government \$110,000, SPC \$80,000, New Zealand Government \$35,000 and Aitutaki Island Council \$21,000) together with the services of three technical experts from SPC and three entomologists from New Zealand.

There is very limited information on marine invasives. One example is the native crown-of-thorns starfish (*Acanthaster planci*) that feeds on corals which undergoes periodic outbreaks.

The Indian mynah (*Acridotheres tristis*) is found on five islands where it feeds on some food crops and interferes with the nesting of some native birds. A major eradication programme is close to completion on Atiu to protect the Rimatara lorikeet (*Vini kuhlii*) re-introduced there in 2007 and kakerori introduced in 2001/02.

Two mammals brought into the country for farming, goats and pigs, are causing problems on several islands where animals are roaming widely outside farm situations, destroying native biodiversity and plantations.

In 2004 the IUCN produced an updated publication of a selection of ‘100 of the World’s Worst Invasive Species’ (Lowe et al. 2004). Cook Islands has 19¹ of the species on this list, but there are a vast number more out there ready to invade if Cook Islands does not maintain strong border control.

Priority invasive species on different islands

Communities have identified the pests that they consider priorities on the different islands on two occasions. The first was during the development of the country’s first National Biodiversity Strategy and Action Plan in 2001 and the results are included in section 5.2 (Government of Cook Islands 2002). The second was during the process of formulating this NBSAP during workshops in Rarotonga attended by representatives of the southern group and through a questionnaire circulated to all islands. The results are summarised in Annex 3.

Invasive species intercepted at the Border

The ever-present threat that invasive species pose is demonstrated by the significant number that have been intercepted by biosecurity staff at the airport, seaport or in the post, or by other individuals who reported them before they had a chance to disperse widely (Table 1). Additionally, a cane toad, a very damaging pest, was recorded in 1986 prior to the period covered by the table.

¹ African tulip tree, black wattle, giant reed, lantana, leucaena, mile-a-minute, shoebutton ardisia, strawberry guava, wedelia, big-headed ant, yellow crazy ant, Mozambique tilapia, western mosquitofish, Indian myna, feral cat, feral goat, mouse, feral pig, ship rat.

Table 1: Interceptions of invasive species at ports of entry in the Cook Islands since 2000 (Source: Maja Poeschko, MOA).

No.	Date found Month/Year	Common name <i>Scientific name</i>	Host(s)- Damage	Action taken & Current status
1	March 2006	Currant lettuce aphid <i>Nasonavia ribis-nigri</i>	On imported iceberg lettuce from New Zealand still in boxes	Lettuce confiscated and destroyed by incineration. Areas where boxes had been stored sprayed with insecticide. No further find.
2	May 2006	Grass <i>Not further identified</i>	Seeds on traditional grass- brooms from China imported with building material in a sea freight container	Conducted viability test, seeds germinated, brooms confiscated and destroyed by incinerating, thorough cleaning of container, monitoring programme for germinating seeds in the area. No further find.
3	Oct. 2005	Giant African Snail <i>Achatina fulica</i>	Serious pest in food crop and flower gardens. Seven live snails found inside a luggage container of an Air New Zealand air craft. Container was from Samoa which was sitting on grass area of airport for a week before used for freight. In 1992 there were three interceptions of Giant African Snail on sea freight containers. One detected specimen was crushed upon arrival.	Snail baiting programme, public awareness and monitoring programme, night searches. No further find.
4	June 2006	Snails <i>Not further identified</i>	Four live snails found inside a sea freight container with natural roof thatching from Fiji	Snail baiting programme, public awareness and monitoring programme. No further find.
5	June 2007	Red-back spider <i>Latrodectus hasseltii</i>	Adult female spider guarding two egg sacs found on the outside of a sea freight container from New Zealand. Bite can cause serious poisoning	Application of surface pesticide Icon, public awareness and monitoring programme. No further find.
6	Jan. 2005	Rhinoceros beetle <i>Oryctes rhinoceros</i>	Weak but alive adult female found in an overhead locker of an Air New Zealand air craft. Serious pest of coconut trees	Public awareness. Note: Coconut trees showing suspicious rhinoceros beetle-like damage in Aug. 2002 (Takitumu) in May 2006 (Muri) and Feb. 2007 (Penrhyn) triggered a pheromone trapping programme. No beetles were found.
7	Feb. 2007 x 2 Nov.2007	Brown garden snail <i>Cornu aspersum ?</i>	Up to 28 snails were found on three occasions on the outside of sea freight containers ex New Zealand.	Snail baiting programme, public awareness and monitoring programme. No further find.
8	May 2006	Cogon Grass	Serious invasive weed. Grass imported from	Import of cogon grass was found to be outlawed in bio-

		<i>Imperata cylindrica</i>	Bali as roof thatching in sea freight containers. Risk of contamination with viable seeds	security regulations. The recommendation of reshipping or destruction was overruled by the Ministry's Secretary. The consignment was released.
9	Jan 2011	Flies Not further identified	A large population of flies developed inside a sea freight container feeding on exposed canned fish	The contaminated cans were destroyed. The container was fumigated with an insecticide.
10	2014	Brown widow spider	One found at freight warehouse at Rarotonga airport – reported by freight staff	Spraying program initiated around warehouse and neighbouring buildings. Spraying continued towards the Are Pa Metua building, a distance of 200m. All importers' facilities in the Avarua district e.g. Pickering Motors & CITC Warehouse were sprayed including their vehicles. Spraying was also carried out in Atiu, Aitutaki and Mitiaro. The programme was not continued as the spider was found to be widespread and not very harmful.

Recent occurrences of new invasive species in the Cook Islands

Table 2 identifies invasive species that have recently crossed the border, some of which are now established in the country to varying extents. Again they emphasise the scale of the threat posed by such species.

Table 2: New pest occurrences for the Cook Islands since October 2000 (Source: Maja Poeschko, MOA).

No.	Date discovered Month/Year	Common name <i>Scientific name</i> Origin	Host(s)- Damage	Action taken & Current status
1	Oct. 2000	Coconut flat moth <i>Agonoxena argaula</i> Ex Fiji?	Coconut palms & ornamental palms- Caterpillars feed on leaves causing severe damage	Introduction and breeding of the parasitic wasp (<i>Bracon sp.</i>) from Fiji successful
2	Oct. 2000	Orchid weevil <i>Orchidophilus aterrimus</i> Ex Fiji?	Orchids- Weevil larvae and adults feed on orchid flowers, stems, leaves and exposed roots	Attempted of eradication failed. Pest reported to be present at different locations a few years later
3	Nov. 2001	Queensland fruit fly	Larvae feed on over 100 species of edible and	Detection in surveillance trap: Attempted eradication:

		<i>Bactrocera tryoni</i> Ex Tahiti?	wild fruits and fleshy vegetables	Intensive trapping, destruction of fallen fruits, distribution of Bactromat pheromone baits, protein bait spraying. Traps sent to Pa Enuu, not present on these islands. Eradication on Rarotonga successful due to early detection.
4	Dec. 2003	Hibiscus flower beetle <i>Aethina concolor</i>	Adult beetles lay eggs into flower buds which causes them to drop	Pest widespread. Eradication not feasible. Remains a major pest. Control with systemic insecticides.
5	April 2004	Papaya ring spot virus <i>PRSV-P</i> Mutation of PRSV-W of intercropped cucurbits	Yellowing and distortion of leaves, dark green target like ring spots and C-shaped markings on fruits	Attempted eradication: Plant destroyed by incineration, systemic herbicide poured into remaining plant stump, area sprayed with insecticide to kill possible insect vectors, monitoring programme and two island wide virus surveys. No further find. Eradication successful.
6	April 2005	Wax moth Not further identified	Caterpillars feed on bee hives	Pest not considered to be serious by beekeeper. No further action taken
7	July 2006	False armoured scale <i>Conchaspis angraeci</i>	On stems of papaya- mainly found on abundant plots with mature trees all over the island	Beneficial ladybird beetles (<i>Chilocorus circumdatus</i>) were found feeding and breeding amongst the pest. No further action taken.
8	Nov. 2006	False oleander scale <i>Pseudaulacapsis cockerelli</i> Ex Australia	On leaves and stems of imported crafted mangos from Australia planted in Matavera and Titikaveka	Attempted eradication: Trees pulled and destroyed by incineration, area sprayed with insecticide, monitoring programme. No further find. Eradication successful.
9	March 2007	Glassy-winged sharpshooter <i>Homalodisca vitripennis</i> Ex Tahiti?	Many plants, with preference for citrus and gardenias Severe sap feeder;	Trapping monitoring programme, attempted eradication with insecticides not successful, bio-agent from Tahiti was successful
10	Dec. 2007	Red-banded mango caterpillar <i>Dennolis sublinbalis</i> (new) <i>Noorda albizonidalis</i> (old)	Caterpillars bore into mango fruit and seeds	Pheromone trapping not very effective, Population fluctuates from season to season
11	July 2008	Greenhouse thrips <i>Heliothrips haemorrhoidalis</i>	Avocado	Tree and surrounding area sprayed with Imidacloprid, no further find, eradicated?
12	Aug. 2009	Black twig borer <i>Xylosandrus compactus</i>	Avocado Beetle burrows in fresh stems of crafted plants	On imported grafted seedlings from NZ, plants re-dipped in insecticides and monitored. Beetle reported to be present and a nursery pest in 2012

		Ex New Zealand		
13	Nov. 2009	Banana-shaped scale Slender soft scale <i>Prococcus acutissimus</i>	Severe infestation on lychee leaves causing sooty mould. On sago palm (Aug. 2010)	Widespread. Natural enemies present
14	Nov. 2009	Cuban laurel thrips <i>Gynaicothrips ficorum</i>	Severe damage on young leaves, particularly <i>Ficus benjamina</i> ; swarming, nuisance for people, attracted to bright colours, bites, painful when caught in eye	Bio-agent introduced from Hawaii in Dec 2010
15	Nov. 2009	Red-banded thrips <i>Selenothrips rubrocinctus</i>	Guava, Avocado, Terminalia, Copperleaf Severe damage, causing browning-silvering of leaves and fruits	Natural enemies present. Still severe damage observed in 2012
16	Nov. 2009	Trilobite scale <i>Pseudaonidia trilobitiformis</i>	Desert rose Severe damage on leaves, Stunted growth without flowers	Widespread. Remains major pest despite natural enemies present
17	Aug. 2011	Caterpillar <i>Not further identified</i>	Caterpillar bores into star apple fruit	Rearing of caterpillars to adult stage for easier ID failed, Setting up of yellow sticky traps, monitoring
18	Nov. 2012	Caterpillar <i>Not further identified</i>	Caterpillar bores into strawberry fruit	Rearing of caterpillars to adult stage for easier ID failed, Setting up of yellow sticky traps, monitoring
19	May 2013	Oriental Fruitfly <i>Bactrocera Dorsalis</i>	Host on 170 fruits and vegetables.	Detected in surveillance traps. Eradication initiated with intensive trapping, destruction of fallen fruits, distribution of Bactromat pheromone baits, protein bait spraying. Traps sent to Pa Enea and were present on Aitutaki. Eradication successful on Rarotonga and Aitutaki.

There are major threats present in neighbouring countries with which the Cook Islands trades. Several recent arrivals of invasive species appear to have come from French Polynesia including the glassy-winged sharpshooter and Queensland and Oriental fruit flies. This country also holds giant African snails, little fire ant and a variety of plant pests. Other species of particular concern are:

- Banana bunchy top virus – Samoa, Fiji, Tonga
- Taro leaf blight - Samoa, American Samoa, Fiji, Papua New Guinea, Solomon Islands, Hawaii
- Taro beetle - Papua New Guinea, Fiji, Kiribati, New Caledonia, Solomon Islands and Vanuatu
- Banana scab moth – Australia, Solomon Islands, American Samoa, Samoa, others.

Space & Flynn (2002) identified 28 weed species that they considered priorities to keep out of the country. Indications are that they have been successfully excluded to date. They put a particular emphasis on *Miconia calvescens* found in French Polynesia and Hawaii because of its potential devastating impact. They also provided separate lists for Rarotonga, Aitutaki, Atiu, Mangaia, Mauke, Mitiaro and the Northern Group of invasive and potentially invasive plants found on other islands but not on these.

Invasive species are everyone's responsibility

The movements of people, and their goods and supplies, are the key pathways that invasive species take to reach a country, or move from island to island within it. So the behaviour of individuals is the key to their management. There is a need to avoid bringing 'at risk' goods into the country (fruit, plant material including seeds, soil (even on boots), etc.). If you see a plant overseas that you would like to grow in Cook Islands, identify it, and then request an import permit through Biosecurity Service first. They will do a 'risk assessment' to decide if it is safe to import into the Cook Islands.

If you are importing a container of goods, or deck cargo such as a vehicle or timber, check it very carefully when you get it home and alert Biosecurity Service if you find any live animals/insects, or their eggs. There are several examples of damaging species being found in this way in Table 1. Don't try to take specimens to Biosecurity staff which may risk their spread, but close the container and ask the staff to come to you. Keep an eye out in your village, plantations and forest for any unusual animals or plants, for trees with leaves being eaten or dying over large areas – you may be the first to spot the arrival of a new plant disease or insect pest. Detecting it early is the key to eradicating it and potentially saving Cook Islands millions of dollars.

Inter-island biosecurity

A key part of this strategy will be to try to prevent invasive species moving between different islands within the country. It is too late to eradicate many from Cook Islands altogether but we can maybe keep some islands free of them. Invasive species found on some islands but not others include ship rats, Indian myna, no-see-'em biting-midge, *Mimosa invisa* and many other weeds.

International responsibilities

Invasive species are clearly also an international issue with an emphasis on preventing them moving from one country to another. Agencies and exporters in the countries of origin have some defined responsibilities to check consignments before they are sent and to provide paperwork identifying what is in containers, other cargo and mail items. This system can go wrong, as in the lettuce aphid example (Table 1) when the three boxes found to contain the pest were identified as having missed inspection as the exporter had sourced them from another supplier to make up the order. There are a number of international and regional organisations undertaking coordinating roles, a number of international regulations in force, and countries that trade with each should work in close cooperation.

Cook Island's native biodiversity at risk

The Cook Islands has 63 native species assessed for their conservation status using the IUCN Red List of Endangered Species that are ranked as 'endangered' (8 species) or 'vulnerable' (55 species) (ISSG 2014). There are ten endemic species, i.e. found only in the Cook Islands, on the list, six birds (five 'vulnerable' and one 'near-threatened'), one reptile ('vulnerable') and three fish ('least concern').

These species and the key factors that threaten them with extinction are identified in Table 3. (Note: the three endemic marine fish are not included as invasive species are not considered among their threats).

The country's landsnail fauna includes species endemic to the country and endemic to Rarotonga itself. There is a pattern of extinctions spreading from coastal areas to the interior on Rarotonga, particularly of ground dwelling species, and invasive species are implicated in this and pose a threat to some remaining species (Brook 2010). Rooting and scratching by pigs and chickens can disturb

ground-layer micro-habitats making them uninhabitable by snails, and ship rats, mice, introduced ants and other invertebrates are likely predators.

Table 3: Cook Islands threatened endemic birds and lizards and the key threats to them. (Source: modified from ISSG 2015 and Gerald McCormack pers. comm.).

Species	IUCN Red List Category	Location	Invasive Species Threats
Cook Islands Reed-warbler (<i>Acrocephalus kerearako</i>)	Near threatened	Mangaia, Miti'aro	Cats, Pacific and ship rats (predation); goats (habitat modification)
Rarotonga starling (<i>Aplonis cinerascens</i>)	Vulnerable	Rarotonga	Common myna (competition, disturbance); ship rats (predation); introduced diseases
Atiu Swiftlet (<i>Collocalia sawtelli</i>)	Vulnerable	Atiu	Land crabs (predation)
Rarotonga Flycatcher (<i>Pomarea dimidiata</i>)	Vulnerable	Rarotonga, Atiu	Cats, and ship rats (predation); weeds (habitat modification)
Cook Islands Fruit-dove (<i>Ptilinopus rarotongensis</i>)	Vulnerable	Rarotonga, Atiu	Common myna (competition, disturbance?); ship rats (predation?); introduced diseases
Mangaia Kingfisher (<i>Todiramphus ruficollaris</i>)	Vulnerable	Mangaia	Common myna (competition, disturbance); cats, (predation); goats (habitat modification)
Cook Islands skink (<i>Emoia tuitarere</i>)	Vulnerable	Rarotonga	Cats, and potentially Pacific, Norway and ship rats (predation)

Note: The arrival of ship rats on islands where they are currently absent, e.g. Atiu, is identified as a very significant invasive species threat.

The National Biodiversity Strategy & Action Plan (2002) identified 30 nationally endangered plant species. Competition from introduced vines and shrubs is one of the factors that threaten their continued survival.

Cook Island's productive sectors at risk

The importance of tourism to the country was identified earlier. Invasive species can impact on tourism in several ways, such as mosquito-borne diseases that discourage people from visiting; invading climbing vines and foreign trees that can turn Polynesian tropical forests into replicas of ones found overseas; or predators that remove native fauna leaving only foreign species.

An example of an invasive species that affects tourists, is the no-see-'em biting-midge (*Culicoides belkini*), a small biting insect that can pass through mosquito screens which is found on Aitutaki, Manuae and Mitiaro. A taxonomic review identified this species as present in French Polynesia in the 1960's and indicated that it had probably arrived there from overseas via the airfield (Wirth & Arnaud 1969) and it was first detected in Aitutaki about the same time (McCormack 2015). It reached Mitiaro in around 1980.

The agricultural sector does not make a large contribution to the country's exports but is vital for people's livelihoods providing much of the food they eat, particularly on islands other than Rarotonga. It also provides the tropical fruits that tourists expect to enjoy. Most food crops have been brought in from overseas so are very vulnerable to the arrival of pest insects, fungi and diseases from their native lands, because Cook Islands has none of the other organisms that keep these in balance overseas. Traditional cropping systems that involved leaving land fallow for several seasons have come under pressure from population growth and reducing fertile land available. Over-cropping of land, with limited crop rotation or fallow periods, has resulted in the depletion of soil organic matter and nutrients in many areas. Incidences of soil pests and diseases, such as nematodes and *phytophthora* root rot, have risen rapidly and conditions have favoured the spread of weeds (Cook Islands Government 2013).

Commercial forestry is no longer pursued in the Cook Islands, other than through small plantations by private individuals. So any insect pests and diseases that can affect overseas species introduced for forestry may have some but limited impact nationally.

Collecting seafood in lagoons and reefs provides an important source of protein for people which could be impacted by marine invasives. Aquaculture poses a particular risk by concentrating non-native organisms in situations where there would be no natural controls for any alien invasive species that can arrive. There are clear pathways for such invasive species to arrive either with marine farming equipment or stock – an importation of freshwater prawns from Fiji was banned when testing revealed the presence of two viruses that can cause a significant disease (Ministry of Marine Resources file). When an outbreak of disease occurred in pearl farms in Manihiki, technicians were required to bring their seeding equipment to Ministry of Marine Resources for sterilisation when they arrived and left the country. While invasive species can threaten the success of an aquaculture project, the more significant, irreversible impacts can be on native fauna – i.e. on Cook Islands' freshwater prawn species in the case of the proposed importation from Fiji.

Why a NISSAP is needed

Invasive species are an ever-present and growing threat and their management involves many different organisations from Government Departments, NGO's, farmers, fishermen and women, and island communities. This management effort has in the past been fragmented and under-resourced and the NISSAP seeks to address this by bringing all stakeholders together around an agreed plan of priority actions.

While border control procedures to minimise the introduction of new invasive species are in place, the necessary resources and personnel to be fully effective at the international and national levels are lacking. It is widely perceived that the system is not backed up by adequate action (fines, prosecutions, etc.) being taken when an interception is made. Border control covers the movement of passengers and cargo via air and sea transports and in addition to this the shipping companies must manage wastes and ballasts from their vessels.

Several initiatives have been implemented to educate and make the public aware of the risks involved in smuggling in plants from overseas un-declared, however the problem continues, highlighting the need to expand or alter the current education and awareness program (National Environment Service 2011).

The sphere of invasive species management is vast and severely under resourced (especially human and financial) and as a result some invasive species populations have grown to levels where eradication or even management is either impossible or well beyond the Country's means. Therefore a concentrated effort will be needed at the national, regional and international arenas to manage where we can (ibid).

Invasive species management has concentrated on plant and animal pests of the productive sector in the past, but there has been a growing recognition of their impacts on native biodiversity and the environment as a whole. This recognition has led to increasing efforts from environmental agencies, taking more of a coordination role addressing all invasive species, and to the development of a regional programme. Production of the NISSAP is an activity within that programme: the GEF-PAS regional invasives project '*Prevention, control and management of invasive alien species in the Pacific Islands*' being implemented by UNEP with SPREP as the executing agency.

The NISSAP takes account of the regional guidelines produced by SPREP and SPC whose goal is: 'To assist Pacific Island countries and territories in planning the effective management of invasive species, thereby reducing the negative impacts of invasives on their rich and fragile native heritage, communities and livelihoods' (SPREP 2009). The Action Plan is organised according to the three thematic areas of the Guidelines: Foundations, Problem Definition, Prioritisation, and Management Action.

Implementation of the NISSAP should ensure that Cook Islands meets the Aichi target 9, established under the Convention of Biological Diversity: that *by 2020, invasive alien species and*

pathways are identified and prioritized, priority species are controlled, and measures are in place to manage pathways to prevent their introduction and establishment.

Process of NISSAP development

An overseas consultant was recruited to assist in the development of the strategy. He made a first visit in May 2015 to collect information and meet with the key agencies. A second visit in June 2015 centred on the development of the draft Action plan and included agency meetings and two workshops, one focussed on the national picture and one on Pa Enea (including representatives of the islands of Aitutaki, Atiu, Mangaia, Mauke and Mitiaro). All the outer islands were circulated with a questionnaire to identify the priority pests of most concern to their communities.

Draft plans were circulated in June and August 2015 and questionnaires received over this period. There was then a process of following up on individual issues with different agencies. A number of stakeholder meetings were held since May 2016 to go through the document until the text was finalised and submitted to [Cabinet on what date?].

Linkages of the NISSAP to other strategies

This section reviews other Government strategies and policies that address invasive species and the sectoral plans of the key agencies involved. The actions identified in this NISSAP should be fed into these strategies and plans when they are next revised.

National Strategies

Cook Islands has a strong framework of national strategies and policies in place and many show that environmental issues are mainstreamed across different sectors and invasive species are widely mentioned.

The Cook Islands National Sustainable Development Plan 2016 - 2020

The country's key national strategy is working towards a national vision "*To enjoy the highest quality of life consistent with the aspirations of our people in harmony with our culture and environment*". The plan is based on the identification of 'National Development Goals' and relevant indicators. Three of 16 suggested goals relevant to invasive species are to: '*Achieve food security and improved nutrition, and increase sustainable agriculture*' which covers biosecurity and to '*Conserve and sustainably use our ocean, lagoon and marine resources*' and '*Protect, promote,*

sustainable land use, management of terrestrial ecosystems, and halt biodiversity loss' Key objectives in the plan that link to addressing invasive species are 'Improve Biosecurity', 'Protect Biodiversity' and Support healthy coral reefs. However there are no measurable targets established for invasive species management.

Sectorial Strategies

National Environment Strategic Action Framework 2005-2009 (NESAF)

The NESAF was developed as a mandate under the Environment Act 2003, to replace the 1992 NEMS, and became the leading environment policy framework for the period from 2005-2009. It provided guidance and direction to the Cook Islands to protect, conserve and manage its environment and natural resource. It contained a key performance indicator in relation to invasives: '*Estimated Areas (size) of contamination by spreading invasive species reduced as a result of effective control*'.

Four immediate invasive species priorities were identified:

- A survey of all islands for invasive species
- A community-based programme to eradicate invasive weeds and animal pests that are not yet widespread on particular islands
- A national programme to assist with the control of more serious invasive weeds and animal pests
- A multi-sectoral review of control of trans-boundary and inter-island movements of terrestrial and marine IS.

An implementation review in 2008 identified the following progress against each:

- Report completed of IAS on Rarotonga, Aitutaki, Atiu, Mitiaro and Mauke.
- Paper on grazing impacts of goats.
- Rat control initiatives at Takitimu (Rarotonga) and monitoring on Aitutaki and Atiu. Myna bird eradication on Atiu.
- Status survey of agricultural invasives.
- Initiative on Mauke to eradicate Red-Passion Vine.
- Initiatives to eradicate *Mimosa* from Mitiaro, Mauke and Mangaia ceased due to funding constraints.
- Monitoring exercises through Ministry of Agriculture e.g. Cuban thrip and fruit-flies.
- Biosecurity Act 2008 enforced.

- Draft Biosafety Framework and National Status Report on Biosafety prepared.

An updated NESAF 2016-2020 is under development. It contains as a strategic target: ‘Effective prevention, control and management of Invasive Species’ and identifies a series of actions that will be included in the Action Plan (Section 8.0).

‘Healthy soils, healthy foods - sustaining our common livelihoods.’ Agriculture & Food Sector Strategy, 2015 draft.

This strategy identifies the overuse of pesticides as one way that agriculture impacts negatively on the environment and recommends an agro-ecology approach whereby more attention is paid to diversified cropping systems and/or integrated crops-livestock systems. Integrated pest management helps to protect crops against pests by relying on the natural environment such as beneficial trees, plants, animals and insects.

Land Use Policy (2008 Draft)

This policy identifies pests and weeds among the predominant adverse environmental effects of land use. It proposes a policy element of ‘*Coordination and processes to protect agricultural systems and forests from weeds, pests and pathogens.*’

National Biodiversity Strategy & Action Plan (NBSAP)

The Cook Islands produced its first NBSAP in 2002 and is currently preparing a second one, allowing the priority actions identified in the NISSAP to be fed directly into this. Invasive species management was one of eight themes in the initial NBSAP, with goals to reduce the adverse impacts of invasive species on indigenous species and ecosystems and on agricultural species and ecosystems, including preventing new invasions. It is expected to have equal importance in the second NBSAP.

The Fourth National Report to the CBD includes a collation of the country’s most serious alien invasive species and reviewed progress towards the invasive species goals of the NBSAP.

National Biosafety Framework

A draft National Biosafety Framework was completed in 2008. It identified that the Framework should be used to strengthen the legislation and management of biosecurity as a whole to reduce the risks posed by invasive species and Genetically Modified Organisms (GMO’s). Its steering committee recommended the development of an Independent Biosecurity Agency. Other

recommendations on importing procedures and risk analysis are equally applicable to invasive species as they are to GMO's.

A legislative review was carried out as part of the process to develop the Framework. This was used to guide the compilation of section 7.0 on legislation.

National Capacity Self-Assessment

The Biodiversity Thematic Assessment carried out within this project summarised the capacity gap in relation to invasive species (National Environment Service 2007) and identified the root causes as follows:

- Insufficient capacity for effective implementation of quarantine legislation and activities such as monitoring and management of ports for early detection and action against invasive and potentially species
- Current border control staff are limited and some are unskilled or have no scientific background
- Limited capacity to identify and carry out thorough risk assessments on potentially invasive species
- Limited capacity to respond to the threats posed by invasive species, particularly to identify, control, eradicate and monitor invasive species to minimize their impacts on biodiversity resources
- Lack of policies and legislation prohibiting and preventing the movement of invasive species between islands of the Cook Islands
- Ports lack capacity to control or prevent movements of biomaterial between islands and internationally
- Limited coordination of efforts to eradicate invasive species
- Assessment of feasibility of eradication and control options for invasive species in the Cook Islands is limited as well as identified successful methods
- Communications between relevant stakeholders related to invasive species is limited
- Limited awareness of how invasive species are introduced and spread within the Cook Islands
- Lack of awareness of the potential consequences of clearing vegetation in terms of the spread of invasive species further inland where the majority of our endemic and native species reside
- Border Control and Ministry of Health has yet to initiate plans to minimise to risk of health impacts from events such as Avian Influenza or SARS - no plan of action has been prepared.

Many of these are still relevant eight years later.

National Disaster Risk Management Policy 2005

This policy requires formal processes of risk management to be applied in all aspects of national development planning, and emphasises the need to strengthen the resilience of the Cook Islands and its communities through the development of effective preparedness, response and recovery arrangements. The Central Policy and Planning Office are responsible for coordination and implementation of the national disaster risk reduction policies.

Cook Islands National Disaster Risk Management Arrangements 2009

This plan, formulated under the National Disaster Risk Management Act 2007, is to provide the framework to support national disaster risk reduction and disaster management. Invasive species (IS) are listed as 'high' risk based on their potential to create major emergencies or national disasters in the Cook Islands. While they contain no specifics in relation to IS, the Arrangements set out the system relevant to all identified risks including communication, planning and responding. Clearly key activities in relation to invasives are the development of an Early Detection and Rapid Response (EDRR) Plan and the running of simulation exercises to maximise preparedness for a new invasion of a potentially damaging IS.

Joint National Adaptation Plan for Disaster Risk Management and Climate Change Adaptation 2016-2020

It is anticipated that climate change will have increased negative impact on sectors sensitive to it such as marine resources, health, agriculture and biodiversity, in particular the increased prevalence of invasive species. In recognition of this, the Joint National Adaptation Plan for Disaster Risk Management and Climate Change Adaptation 2016-2020 identifies actions to improve the conservation and management of marine and terrestrial biodiversity, to increase resilience to the impacts of climate change. Specifically, these include developing programmes to eradicate and control alien invasive species. Furthermore, Kaveinga Tapapa (Climate & Disaster Compatible Development Policy 2013-2016) recognises that to strengthen climate resilience requires bolstering the conservation and management of biodiversity and ecosystems through integrated holistic approaches.

Cook Islands National Action Programme (NAP) for Sustainable Land Management (SLM) (Government of Cook Islands 2013)

The NAP was prepared in accordance with the United Nations Convention to Combat Desertification and recognised invasive species as an important part of the context for SLM. Improving information on invasive species was included within a goal of ‘*Science Technology and Knowledge is enhanced to address desertification/land degradation pressures and mitigate the effects.*’

Invasive species in corporate plans

For invasive species management to be appropriately organised and resourced it should appear in the Corporate Plans of the key agencies and this section reviews these.

Ministry of Agriculture

The Ministry of Agriculture Business plan 2015-16 identifies several biosecurity-related challenges that the NISSAP can address:

- The risks posed by neighbouring countries with serious pests
- The lack of trained biosecurity staff in the outer islands to carry out border control activities e.g. non-scheduled vessels, yachts, etc.

It has the following invasive species-related goals and targets:

1. Maintain an effective and efficient pest surveillance and monitoring programme throughout the Cook Islands including the regular monitoring of the “Fruit Fly” traps (Research & Development)
2. Rear and release biological agents for the management of selected invasive species (Research & Development)
3. Effectively implement the Bio-Security Act 2008 throughout the Cook Islands (Biosecurity)
4. Review the Draft Biosecurity Regulations (Biosecurity)
5. Monitor the status of animal health and other diseases that may impact on both local livestock sector as well as the human population (Livestock)

These are incorporated in the Action Plan (Section 8.0).

National Environment Service

The NES 2015-16 Business Plan identifies the current project that funded this NISSAP as one of its Aid projects: 3.2.2 Project Two– Prevention, control and management of Invasive Alien Species in

the Pacific Islands. It identifies ‘Promoting and implementing the National Invasive Species Strategy and Action Plan’ as a target/indicator for 2016/17. The Island Futures Division within the Biodiversity Conservation Unit is the division responsible for invasive species management.

Ministry of Marine Resources

There is no specific mention of invasive species in the Ministry’s business plans, but the following three outputs would cover their management particularly through preventative measures and advocacy and education:

Output 1 Offshore Fisheries

- To expand income earning opportunities from sustainable offshore fisheries, through effective management, capacity building, and infrastructure and market development
- Establish monitoring and controls to prevent illegal practices.
- Promote sanitary standards through appropriate legislation and practical implementation to apply to all Cook Islands fish products wherever they may be sold or exported to.
- Implement all conservation and management measures agreed by any regional fisheries management organization of which the Cook Islands is a member.

Output 2 – Pearl industry support and environmental management

- Develop capacity in cross-cutting areas within the marine sector concerning environmental management, public health safety and food safety programs.

Output 3 – Inshore fisheries and aquaculture

- Ensure safe, sustainable fishing and conservation practises, the protection of culture and tradition and long term food security.

2. GUIDING PRINCIPLES

The ‘precautionary principle’ should be applied – where there is not enough information to predict whether a species will become invasive or not, it should be assumed that it will have a damaging impact and action should be taken to stop it establishing or spreading. It should also be assumed, based on international experience that any species imported to only be kept in ponds, pens or cages will eventually escape into the wild.

Preventing the arrival of introduced species is more effective and cheaper than trying to manage them after they arrive, so an emphasis should be placed on effective border control.

Eradication is more effective and cheaper in the long run than permanent control of an invasive species, so it should be attempted in situations in which it is likely to succeed. Eradication is most effective if a new arrival is detected early while in small numbers, so surveillance is important.

Species that cannot feasibly be eradicated should be considered for on-going control, particularly biological control. This control may be aimed at keeping them out of important sites for native flora and fauna, e.g. protected areas, or restricting them to very low numbers there.



Photo: Biosecurity Officers checking a passenger's luggage at the airport (source, MOA website)

3. GOAL, MISSION & THEMES

Goal:

Akamatutu'anga i te Kuki Airani no te parūrū, akaiti e te takore'anga i te au tū katiri kikino kia vai meitaki ua to tatou Ao Ora Natura e te au tu Mariko Ao Ora e te oraanga tangata.

To facilitate and guide the protection of the country's biodiversity, ecosystems and the livelihoods of its people, from the impacts of invasive species.

Mission:

Kia 'anga'anga taokotai te iti tangata i te parūrū, akaiti e te takore'anga i te au tū katiri kikino kia meitaki te tupu'anga o te Ao Ora Natura, te au tu Mariko Ao Ora, te au tu kai tanutanu e te oraanga tangata.

To conserve biodiversity, wildlife habitat, recreation resources, and crop production, while protecting and enhancing human health and wellbeing, by cooperation and coordination by all to carry out effective prevention, control and management of invasive species.

Themes:

The strategy follows the Regional Guidelines (SPREP 2009) with three themes as follows:

Theme A: Foundations

Managing invasive species is a huge task that will only be effective if based on strong foundations.

This requires:

- Generating Support - from Government, village communities, and funders
- Building Capacity – including strong institutions, individuals with sound management and technical skills, and regional networks
- Legislation, Policy and Protocols – appropriate laws, regulations, policies, protocols and procedures.

Theme B: Problem definition, prioritisation and decision-making

There are a large number of invasive species present in Cook Islands and many more outside its borders, and resources to tackle them will always be limited. There need to be systems in place to

decide how to allocate resources based on the best possible information on the distribution, numbers and likely impacts of these species.

This requires to:

- Establish baseline information on invasive species and monitor change;
- Establish systems for risk management and prioritisation;
- Update knowledge and develop new management techniques.

Theme C: Management Action

Management action has three elements:

- Biosecurity - preventing the arrival of new invasive species through effective border control;
- Eradication or control of those invasive species already present;
- Restoration work if needed on sites where invasive species (e.g. weeds) have been removed.

4. PATHWAY ANALYSIS

A spreadsheet has been compiled that identifies the detailed means that the different IS present in Cook Islands, move around (ISSG 2014). As an example, soil is a medium that can transport weed seeds, the nests of ants, the eggs of land snails and the larvae of pest insects. This section reviews the major pathways through which invasive species can enter the country or move between islands within it.

There are several peaks in activity at the border from Customs and Biosecurity points of view:

- Yachts - May to September;
- Peak tourism by air – April to September and December;
- Cruise ships – January to March.

4.1 International

By Air

Four international airlines currently fly into Rarotonga:

- Air New Zealand: Up to nine flights a week via Auckland departing from Adelaide, Melbourne, Sydney and Brisbane.
- Virgin Australia: Four flights a week via Auckland departing from Brisbane, Sydney and Melbourne.
- Tahiti Nui: One flight a week from Papeete.

- Jetstar Airways Pty Ltd: Three flights a week via Auckland departing from Melbourne, Gold Coast, Sydney, Wellington and Christchurch.
- Air Rarotonga Jet: occasionally visit, Tonga, Niue, Samoa, Fiji and Tahiti.

By Sea

Commercial shipping

There are three international shipping schedules currently operating through the Cook Islands, operated by three companies Matson Ltd (MV Liloa) Excil Shipping Ltd (MV Imua II) and Transam Cook Islands (MV Tiare Moana – currently out of service looking for a replacement vessel) and they run on an approximately three weekly cycle with ships originating from Auckland (New Zealand). There are two container ports in the Cook Islands one on Rarotonga and one on Aitutaki. Matson's and Excil's vessels travel to Cook Islands via Suva (Fiji), Apia (Samoa) and Pago Pago (American Samoa).

The other internationally shipping SV Kwai operated by Hawaii Pacific Maritime Ltd occasionally visits the Cook Islands bringing cargos from the United States and entering the country via Penrhyn directly from Hawaii via Kiribati.

The keys to blocking the commercial shipping pathway are good procedures when filling containers and preparing manifests (lists of contents) at the country of origin; inspecting and fumigating as many as possible on arrival in Cook Islands; then careful emptying them at their destination. Paperwork providing a clean bill of health should be received by border control from the forwarding countries. Some goods and machinery are shipped as deck cargo rather than in containers and these can pose a particular risk.

Visiting Yachts

There are 3 designated Biosecurity Ports of Entry for yachts visiting the Cook Islands: Rarotonga (Avatiu Harbour), Aitutaki (Arutanga), Atiu (Taunganui). No one can come ashore until a vessel has been cleared by Customs, a biosecurity clearance has been issued by Quarantine, and a 'certificate of pratique' issued by Health Department. Suvarrow Atoll is not a recognized port of entry however the Government has allowed vessels to enter the island but only when the national park rangers are present.

A registry of 100 yachts visiting Suvarrow between May and November 2018 identified that the last port visited by 91 (91%) of these was in French Polynesia, of 1 in Fiji, 1 in Finland and 7 elsewhere in the Cook Islands. This confirms a strong potential pathway for invasives to move by yacht from French Polynesia and other countries.

Voyaging Canoes

A Te Manava Vaka Festival in 2015 illustrated the high risk posed by traditional vaka voyaging to the Cook Islands. Despite prior discussions between the Biosecurity Service and the festival organisers, Biosecurity staff found and destroyed over 30kg of fresh fruit on a vaka from French Polynesia. The Biodiversity Director identified in the media that this quantity of fruit could have concealed over 100 fruit flies.



Photo: Agriculture officers (Ngai Aratangi and Piri Maa) take the confiscated fruit away to be burned. (Source: Biosecurity).

Cruise or Passenger ships

Passenger ships are becoming frequent to the Cook Islands. There were twelve visits in 2017 and eleven in 2016. These ships sail directly from French Polynesia, New Zealand, Tokelau, Samoa, Fiji and Tonga to the Cook Islands. The visits are usually for one day, arriving in the morning and departing in the afternoon.

Other External Pathways

Natural disasters

Natural disasters such as cyclones may directly carry new invasive species to the Cook Islands however their major threat is likely to be an indirect one through the consequent relief operation. Large quantities of supplies and relief materials are likely to enter the country over a short period

from a variety of different countries, putting a strain on border control facilities and procedures at a time when these may have been damaged or staff and their families directly impacted.

While humanitarian needs are obviously the priority, disaster management planning needs to emphasise biosecurity to avoid the recovering population being also faced with a long-term threat to their economy or environment. There may be a need to bring in overseas biodiversity personal to assist local staff to manage the increased traffic which is likely to include more high risk items.

The Cook Islands National Disaster Risk Management Arrangements provide a framework for border control procedures to be strongly maintained during disaster responses (Government of Cook Islands 2009).

‘Natural’ pathways

New organisms can also arrive in the ways that they have done forever unaided by people: by flying to the islands, being carried here on the wind, swimming here, or ‘rafting’ here on floating vegetation. All people need to keep an eye out for any unusual species and assess any found for the risk they pose.

4.2 Internal Pathways

By Air

There are airports on nine islands: Rarotonga, Aitutaki, Atiu, Mangaia, Mitiaro, Mauke, Manihiki, Pukapuka, and Penrhyn. Air Rarotonga is the only domestic airline and all flights depart from Rarotonga. Between April and Mid December Air Rarotonga flies non-stop between Aitutaki and Atiu (www.airraro.com). Flights also fly from Rarotonga to Mitiaro and onwards to Mauke and Rarotonga to Aitutaki on to Mitiaro.

By Sea

Taio Shipping runs a shipping service approximately once every two months from Rarotonga to Penrhyn, Rakahanga and Manihiki, once every two and a half months to Palmerston and Pukapuka, and once or twice a month to Atiu, Mitiaro, Mauke and Mangaia.

Cook Islands Towage Ltd run a regular service to the Pa Enea, particularly to transport heavy machineries under donors and Governments projects. The frequency of the service normally depends on the timing of such projects. The Cook Islands Towage Ltd is currently seeking a replacement for a barge that sank off Mauke in November 2015.

As a possible example of transmission by the internal sea pathway, an individual in Penrhyn commented that he saw an insect that he had never seen on the island before, only a couple of months after the shipment of aggregates for the solar power project there (Dorothy Solomona *pers. comm.*).

5. ROLES & RESPONSIBILITIES

This section identifies the roles of the main agencies and organisations who are stakeholders in IAS management.

5.1 National

Ministry of Agriculture (MOA)

The Ministry of Agriculture plays a major role in invasive species control through administering the Biosecurity Act, 2008. It has two key divisions involved:

Research Division

- Undertakes research on and maintains database of agricultural pests
- Undertakes bio-control programmes

Biosecurity Service

- Administers Biosecurity Act 2008 through:
 - Managing border control & quarantine
 - Import and export requirement including risk assessment for importation of new species

National Environment Service (NES)

The mandate of the NES is provided by the Environment Act 2003. Three key functions are to:

- Protect, conserve, and manage the environment to ensure the sustainable use of natural resources
- Protect, conserve, and manage wildlife, in particular protected species
- Protect, conserve and manage the environment in relation to Cook Islands waters.

It is largely to achieve these functions that the NES has an important role in managing invasive species, primarily those impacting on native biodiversity. The NES manages the Cook Islands

activities within the Regional GEF-PAS project: ‘Prevention, control and management of invasive alien species in the Pacific Islands’.

Ministry of Marine Resources

Ministry of Marine Resources is responsible for both inshore and offshore fisheries management. The Marine Resources Act 2005 defines the fishery waters of Cook Islands as the internal waters, territorial sea and exclusive economic zone. The Ministry is mandated to provide for the conservation, management and development of marine resources.

Natural Heritage Trust

This Trust was established by the Natural Heritage Trust Act 1999 and its goal is to encourage the protection of the natural environment and associated traditional knowledge by an increased awareness of Cook Islands plants and animals, and related traditional and scientific knowledge.

The Cook Islands Biodiversity Database developed and maintained by the Trust is the principal source of information on terrestrial and marine plants and animals including their invasiveness.

Ministry of Transport (MOT)

The MOT is responsible for regulating the maritime and civil aviation transport systems under the mandate of the Maritime Transport Act 2008 and the Civil Aviation Act 2002 respectively. The MOT is also responsible for the enforcement of the Prevention of the Marine Pollution Act 1998. Among others, MOT ensures the Ballast water and Hull fouling meets the requirements of the IMO relevant Conventions and domestic legislations.

Te Ipukarea Society (TIS)

The mission of Te Ipukarea Society is to promote the balance and harmony, which should characterise the relationship of the Cook Islands people with other components of their environment. It has three core objectives:

- To disseminate information and create public awareness amongst members and the community regarding environmental matters.
- To demonstrate sound ideas and practices for the purpose of promoting conservative and sustainable development through carefully selected field projects; such demonstrations to draw on the traditional knowledge and practices where they are considered beneficial.
- To co-operate with similar organizations within the Cook Islands and throughout the world for the purpose of advancing the course of conservation and sustainable development.

TIS is managed by a voluntary committee and paid staff and volunteers attend to the day-to-day running of the Society and it is a member of IUCN and Birdlife International. It is involved in several invasive species projects including the eradication of rats from Suvarrow and support for rat control to protect kakerori in Rarotonga.

Growers Associations

There are 10 registered growers associations in the Cook Islands. About one third of the farmers in the Cook Islands are full-time farmers and two thirds are part-time farmers.

Table 4: Growers Associations on Rarotonga and Aitutaki

Island	Association
Rarotonga	The Titikaveka Growers Association Inc. (see below)
	Te Mou Enuu Famers Federation Cook Islands Inc.
	The Nikao Growers Ass. Inc.
	Rarotonga Organic Growers Ass. Inc.
	Te Tango Enuu O Tupapa - A Cook Islands Food Security & Self Reliance Ass. Inc.
	Matavera Cash Crop Growers Ass. Inc.
	Matavera Growers Ass Inc.
	Ngatangiaa Growers Association Inc.
Mangaia	Tamarua Growers & Association Inc.
Aitutaki	Aitutaki Growers association Inc.

Titikaveka Grower’s Association

This association has the aim: *‘to promote, facilitate and manage Biological and Organic practises in all forms of Agriculture, Livestock Management programs and other self- dependency ventures in those fields’.*

Department of Customs

The Department of Customs is the Government agency with the role of ensuring security of the border and protecting the country from the entry, or exit, of people, craft, or goods and other treasured items, where the entry or exit may pose a risk to national interests. This includes assisting in preventing the entry of invasive species. The Department works to ensure that lawful travellers and goods can move across the border as smoothly and effectively as possible.

Customs areas of operations include airports, vessels, marine ports, airfreight and sea freight facilities, the postal centre, and express mail. Staffs have the power to search any goods or persons

arriving at the border or to check the documentation and contents of goods either imported to or exported from the Cook Islands.

The Cook Islands has nine designated Customs Ports of Entry: Rarotonga International Airport Avarua, Avatiu Wharf Rarotonga, Arutanga Wharf Aitutaki, Akaiami Sea Landing Aitutaki, Taunganui Wharf Atiu, Omoka Wharf Penrhyn, Yato Wharf Pukapuka, Tauhunu Wharf Manihiki and Tukao Wharf Manihiki. There are also two non-designated Customs Ports of Entry, Suvarrow and Palmerston Island.

Customs has offices in Avarua and Aitutaki; authorised officers who are also police officers in Atiu, Penrhyn, Manihiki and Pukapuka; authorised officers who are the Park Rangers under the National Environment Service in Suvarrow; and an Authorised Officer in Palmerston who is the Island Administrator for the Island.

Department of Public Health

The Vector Control Unit of the Ministry of Health under the Community Health Service Directorate is responsible for the prevention and control of mosquito-borne diseases, namely lymphatic filariasis, dengue fever, zika virus and chikungunya.

This activity is mandated under the Public Health Act 2004 Part 5 Mosquitoes and other Regulated Vectors, the International Health regulation 2005, and the Ministry of Health (International Health Regulation Compliance) Regulation 2014. The object of this activity is to protect and safeguard the health and wellbeing of the people of the Cook Islands.

The Cook Islands Vector-Borne Work Plan contains activities relating to public awareness and health promotion, mass cleaning campaigns, border control, monitoring and surveillance, risk assessment, and localised spraying. A commercial service is also included to address household pests such as flies, ants, cockroaches and centipedes.

Cook Islands Ports Authority

The Ports Authority is a Crown-owned statutory corporation established by Act of Parliament in 1995 and, in line with the provisions of the Cook Islands Investment Corporation Act 1998, it is a subsidiary of the Cook Islands Investment Corporation.

The Authority is responsible for the ports of Avatiu on Rarotonga, and Arutanga on Aitutaki. Its assets include buildings, wharves, port facilities, tugboats, plant and equipment, storage/transit

sheds, open storage areas, and stacking areas for commercial purposes. It also maintains the channel, approach, berth depths, navigational aids, and wharves (piers, jetties).

The Authority provides marshalling services for the movement of containerised, breakbulk and homogeneous cargoes through the ports. It also provides cargo handling equipment for containers and general cargo, and a cleaning service for containers leaving the country.

As part of its weekly work plan, which has short-term and long-term scheduled maintenance items, the Port Authority ensures that the port area is free of rats by setting up rat baits and monitoring around the port area every month. To reduce rat infestation, garbage is removed three to four times a week.

Biodiversity Steering Committee

Steering committee members from key stakeholders with involvement in biodiversity issues were initially appointed by the Cook Islands Government for the NBSAP project in 2001. The composition of steering committee has changed over time.

The committee now consists of representatives of the following agencies:

- National Environment Service,
- Ministry of Agriculture,
- Ministry of Marine Resources
- Ministry of Education
- Ministry of Culture,
- Ministry of Finance & Economic management – Development Coordination Division
- Cook Islands Natural Heritage Trust
- Office of the Prime Minister
- Cook Islands Tourism Authority
- House Of Ariki
- Koutu Nui
- Marae Moana
- Te Ipukarea Society

Each Steering Committee member has a role to play in regards to the progress of biodiversity projects and activities in the Cook Islands. The committee provides a useful forum for discussion of issues affecting the environment and biodiversity gives overall policy guidance, support and advice on biodiversity-related issues and meets when required.

5.2 Regional

SPREP and SPC are the two key agencies to provide regional coordination and support for the management of invasive species with impacts on native biodiversity, and agricultural and fisheries sectors, respectively. SPC also supports border control programmes. Annex 1 provides further details of their roles and identifies other agencies and initiatives that support invasive species work in the region.

6.0 PAST & CURRENT PROGRAMMES

GEF-PAS Regional Invasive Project – Prevention, control and management of invasive alien species in the Pacific Islands

The National Environment Service is managing the Cook Islands component of this regional nine-country project, coordinated by SPREP. It contains the following main activities:

- development of this NISSAP
- revised risk analysis and early detection and rapid response systems to include invasive species that threaten biodiversity
- ship rat early detection surveillance (Atiu and Suvarrow)
- formulation of an Emergency Response Plan
- develop of community training and awareness programme
- management activities including determining practices for control of Cuscuta or Dodder (Rarotonga), beach burr (Pukapuka), and sand flies (Aitutaki and Mitiaro); eradication of red passionfruit (Mauke); rearing and re-distribution of biocontrol agents for priority species including *Mimosa invisa*.

Border Control & Quarantine

The ongoing work of the Biosecurity Service is guided by a Biosecurity Manual revised in 2014 that covers:

- Aircraft and Passenger Clearance
- Vessel and Yacht Clearance
- Import clearance - ensuring that all inward cargo meets biosecurity requirements
- Export certification - ensuring that all exports of both private and commercial agricultural products are as pest-free as possible and in compliance with the protocol of the country of destination
- Internal quarantine - certification of the movement of plants within the Cook Islands.

Ten staffs are employed on biosecurity work on Rarotonga and a small number of the Agriculture Department staff on the outer islands has training in this field.

Internal (inter-island) Border Control

Prevention of arrival, or early detection and eradication of rats

The return of any rat species to Suvarrow or the arrival of ship rats on Atiu would be disastrous for birdlife. Measures put in place to prevent this include a biosecurity plan for Suvarrow and an awareness programme on Atiu including the poster below.

Protect the Kura and Kākerōri



The Pacific Rat (*Rattus exulans*) on Ātiu does not harm these birds.

If the Ship Rat (*Rattus rattus*) lands and survives on Ātiu the Kura and Kākerōri will be destroyed.

You can protect these birds

- by preventing rats arriving in cargo, and
- by the early detection of Ship Rat

Prevent rats arriving

by checking your cargo for rats and rat damage at the wharf, on the truck, at your destination, and when you unpack. If you see a rat, make every effort to kill it.

Please report any arriving rats to the Quarantine Officer or Executive Officer.

Detection of Ship Rat

If Ship Rat arrives on Ātiu, the earlier it is detected the easier it will be to eradicate. You can detect the presence of Ship Rat by the way it destroys coconuts – see 1 and 2 below.

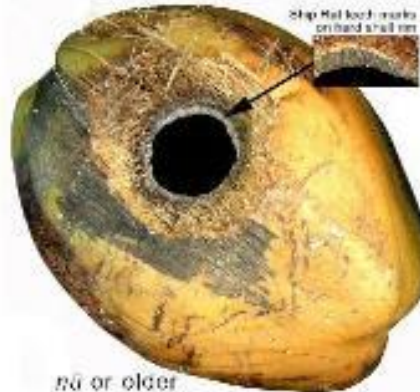
1. a BASAL hole in 2 or more immature coconuts under one palm



kopio or kōpio

Please report either of the following signs of Ship Rat as soon as possible to the Quarantine Officer or Executive Officer. They will decide what to do. Poison and traps are available on Ātiu or Rarotonga.

2. a SIDE hole through the hard shell of a coconut



nā or older

If you kill an unusually large rat please show it to Bird-man George for identification.

Emergency Response

There has been some work on emergency response plans to sit under the National Disaster Risk Management Arrangements. A Cook Islands Animal Health Emergency Response Plan was endorsed by Cabinet in June 2011. The plan identifies the steps to be taken following the detection of an outbreak as:

- investigate and determine the extent of an outbreak
- establish quarantine measures at affected sites to contain the pest or disease
- identify the likely source of the outbreak
- assess the feasibility of successful eradication being achieved.

It identifies the high risks posed by the possible arrival of diseases such as avian influenza and Newcastle disease affecting poultry or other birds, and foot and mouth disease affecting cattle, pigs and goats.

The GEF-PAS Invasive Species project funded the development and testing of a more general Emergency Response Plan for all invasive species in 2016.

Eradication of Pest Vertebrates

Suvarrow Island Rat Eradication

Suvarrow Island is a National Park with globally significant seabird populations, consisting of 30 motu around a lagoon with a landmass of c.1.68sq km. Pacific rats were detected on one motu in 2008 during a seabird survey and four motu were later found to be infested. In May 2013 the National Environment Service, Te Ipukarea Society and Birdlife International carried out a ground poisoning operation using the toxin brodifacoum (Munro 2015). A draft Biosecurity Plan has been developed to minimise the risks of rats becoming re-established in the future. Subsequent monitoring has determined that this operation was successful and Suvarrow officers had not detected any rats until 2016, when they reported sighting rats on Motu Tou. Frequent monitoring on Anchorage Island resulted in no rats being found, thus determining that rats are only present on Motu Tou and these could be survivors of the eradication program or new arrivals. In 2018, a rat eradication program was carried out and it is anticipated this program has successfully eradicate rats on the Island.

Programmes to eradicate Indian Myna

A major programme was initiated on Atiu (2693ha) in 2009 aiming to eradicate myna to increase the productivity of native birds, including the chattering kingfisher, and the kakerori and Rimatara

lorikeet recently introduced to the island. A programme developed and coordinated by the Cook Island Natural Heritage Trust has carried out a combination of poisoning, trapping and shooting since June 2009 and is very close to achieving eradication. As of March 2016 no mynas had been reported since the beginning of November and it was considered that maybe up to five remained and a shooter was carrying out searches.

A feasibility study was prepared in 2006 on the eradication of myna from Mangaia (5180ha) to protect the kingfisher that is endemic to this island (Parkes 2006). This concluded that eradication was both justified and technical feasible. Experience from the programme on the smaller island of Atiu would be likely to significantly increase the chance of success. However it was decided that further proof of the detrimental effect of the myna on the kingfisher was needed to convince the community (and funding agencies) that the myna should be eradicated for the sake of this species. Surveys developed and coordinated by the Cook Islands Natural Heritage Trust over the 2006/07 and 2007/08 breeding seasons indicated that there were limited negative interactions between the kingfishers and mynas, so eradication was not justified.

Control of Pest Vertebrates

Control of rats to conserve kakerori on Rarotonga

A 26-year programme of periodic control of ship rats, through poisoning 155ha of forest at Takitumu Conservation Area using a grid of bait stations, has increased kakerori numbers from 29 in 1989 to over 300 birds today. A second population of birds has been established on Atiu and as a result of the recovery programme the status of the species has been down-listed by the IUCN from ‘critically endangered’ to ‘vulnerable’.

Control of Pest Invertebrates

Response to the arrival of Glassy-winged Sharpshooter (Rarotonga, March 2007).

After initial delimiting surveys, systemic insecticides were used to control the species at sites that contained high numbers of adult insects. In October 2007, a tiny (2 mm) parasitic wasp, *Gonatocerus ashmeadi* was imported from Tahiti and released as a possible biocontrol at three sites about 1 km apart. Since its release, the wasp has multiplied and spread quickly in areas where GWSS is present. Monitoring results indicate that the GWSS population has significantly decreased. Almost all eggs of GWSS collected from the field had been parasitised by the wasp. Although the wasp will not eradicate GWSS entirely from the island, it is keeping the population under control.

Response to the arrival of two thrips (Rarotonga, 2009).

The Cuban laurel thrips (*Gynaikothrips ficicorum*) and red-banded thrip (*Selenothrips rubrocinctus*) arrived in Rarotonga around November 2009 and reached high numbers in their first year attacking tomatoes, Benjamin fig trees, pawpaws and orchids, avocado, Terminalia trees and potentially mangoes. Insecticides cannot achieve complete control and a tiny predatory bug (*Macrotrachelia thripiformis*) was introduced from Hawaii in December 2010 which has reduced numbers of the Cuban laurel thrip to acceptable levels.

Biological control of coconut scale (*Aspidiotus constructor*)

This is a major pest on coconut trees and many other fruit trees on Atiu. A ladybird beetle *Chilocorus circumdatus*, originally introduced from Australia around 1990 was transferred from Rarotonga to Atiu in 2008.

Studies and control of no-see-'em biting-midge







The Cook Islands Natural Heritage Trust organised a team of international experts to visit Aitutaki and Mitiaro in 2015 to study this species and identify its breeding sites (McCormack 2015). The midges were observed breeding on the edge of a small swamp on Aitutaki, where follow-up control work is planned, and in the large central swampland on Mitiaro.

Control of Pest Plants

Biocontrol programme

A weed biocontrol scoping study was carried out in 2012 by Landcare Research (Paynter & Lloyd 2012). It identified 41 priority weed species of which a smaller number were suitable for biocontrol in the near term. Two species, the giant sensitive plant (*Mimosa diplotricha*) and lantana (*Lantana camara*), were not included because they are already well controlled by biocontrol agents that have been introduced to the Cook Islands. Eight species were identified for initial work and six bioagents were released on Rarotonga. The table below is a list of recent biocontrol agents released in the wild on Rarotonga.

Table 5: Biocontrol Agents recently released on Rarotonga (Source: MOA)

Biocontrol Agent	Host Plant	Biocontrol Agents on host plant
<p>Heliconius butterflies (<i>Heliconius errata</i>)</p>	<p>Red Passion Fruit vine (<i>Passiflora rubra</i>)</p>	
<p>Rust fungus (<i>Puccinia xanthii</i>)</p>	<p>Cockleburr (<i>Xanthium strumarium</i>)</p>	
<p>Tectococcus ovatus</p>	<p>Strawberry guava (<i>Psidium Cattleianum</i>)</p>	
<p>Mikania rust fungus (<i>Puccinia spegazzinii</i>)</p>	<p>Mile-a minute (<i>Mikania micrantha</i>)</p>	
<p>Rust fungus (<i>Puccinia arechavaletae</i>)</p>	<p>Balloon vine plants (<i>Cardiospermum grandiflorum</i>)</p>	
<p>Gall forming mite (<i>Colomerus spathodeae</i>)</p>	<p>African tulip trees (<i>Spathodea campanulata</i>)</p>	

Community-based programmes

Several community projects on Mauke, Mangaia, Aitutaki and Mitiaro have been focused on eliminating *Passiflora rubra* (Pōkutekute), *Mimosa invisa* (Pikika'a atupaka) and *Mimosa pudica* (Pikika'a).

Munro & Kaokao (2015) reported on a programme funded by the GEF-PAS Invasives Project to control red passion fruit which is confined to a single site on Mauke. There have been several previous attempts to eradicate this plant from 2001 onwards, and the latest effort was initiated in 2007 led by the Environment Officer based on the island. There have been no sightings of mature red passion fruit since 2013 and all juveniles have been killed. However there are increasing numbers of seedlings germinating from dormant seeds in the ground. Ongoing consistent efforts are needed to ensure that the seedlings are destroyed before they reach fruit-bearing age.

Management of Marine Invasives

There has not yet been any work conducted on the control of any marine alien invasive species. The native crown of thorns starfish (COT) is occasionally controlled when numbers rise to a point that reefs suffer significant damage, e.g. on Aitutaki in May 2003.

The Ministry of Marine Resources maintains a thorough biosecurity programme to manage the importation and exportation of new organisms for aquaculture. As an example, a rejection of prawn shipments was identified earlier. Paua spawning and rearing is governed by an export protocol that involves the shells being cleaned with chlorine before spawning, all water used for rearing being filtered, and this stock is isolated from the normal rearing of other clams.

Education and Awareness

National Environment Service, Ministry of Agriculture and Te Ipukarea Society have undertaken awareness programmes related to invasive species. As examples, the National Environment Service organised a ‘cross the island walk’ with Avarua school looking at threats to biodiversity, and developed an Invasive Species poster series (as below).

The Ministry of Agriculture ran a very comprehensive awareness campaign following the Oriental fruitfly outbreak including TV and radio programmes (poster below).

Example of Invasive Species posters in Maori and English produced by NES

Rakau Kikino
Tūtuarere i te Kōwhiri Aitani

Eaa ta ratou kino ka rave?

Kōwhiri

Wedelia Daisy

Tātārāmoa

Kōpūpū Taviri

Takore ia teia qu ngāngare hikino mei roto i to tatou Ao Ora Natura e no runga i to tatou enua

Invasive Species
in the Cook Islands

Why are they a problem?

Ship Rat

Mynah

Crown of Thorns

Polynesian mosquito

Remove these weeds from our islands and our Biodiversity





Photo: Elizabeth Munro, Senior Biodiversity Officer highlighting invasive species threats to endemic plants during a Web of Life school programme



Awareness material produced by Ministry of Agriculture during Fruit Fly outbreak

7.0 LEGISLATION & INTERNATIONAL CONVENTIONS

The following Acts and Regulations include provisions relating to invasive species management:

7.1 National Legislation

Biosecurity Act 2008

This Act is to prevent the entry of animal and plant pests and diseases into the Cook Islands, to control their establishment and spread in to the Cook Islands, to regulate the movement of animal and plant pests and diseases and of animals and plants and their products; to facilitate international cooperation in respect of animal and plant diseases; and to make ancillary and related provisions.

Its sections include coverage of border and internal controls, import and export procedures, and quarantine. It sets out the functions of the Cook Islands Biosecurity Service which are extensive.

The following legislation has been repealed with the passing of the Biosecurity Act:

Plants Act 1973, Plant Quarantine Regulations 1993, Domestic Quarantine Regulations 1993, Animals Act 1975, Animals Importation Redulations 1992, Animals Disease Prevention Regulations 1982, Copra Act 1970; Wandering Animals Act (24 of 1976); Cook Islands Fruit Regulations 1965.

Environment Act 2003

This is the principal legislation for biodiversity conservation. It provides national legislation for the conservation and management of biodiversity as follows:

- Protected Species – Designating animals and plant as protected species for the purpose of this Act.
- Providing for the protection, conservation and management of wildlife, protected species or both.
- Regulating or prohibiting trade and commerce in wildlife, protected species, or both.
- Protected Areas – Establishing Protected Areas

Environment (Biodiversity and Conservation) Regulations 2016

These regulations are currently being revised to fit a new Crown Law template. Part 2 ‘Trade in Endangered Species’ includes the following provisions:

1. Restrictions on Trade

(1) Unless a person holds a permit, issued by the Service before the trade takes place, that person must not trade in:

- invasive alien species to the Cook Islands
- invasive alien species between islands of the Cook Islands
- invasive native species between islands of the Cook Islands.

Pa Enuā Local Government Act 2012-13

One of the Objects of the Act is to enable Pa Enuā Local Governments and their island communities to decide on how best to promote the social, economic, cultural and environmental well-being of the respective islands.

It contains provisions for the Crown to transfer responsibilities to empower the Pa Enuā Local Government to perform any functions and exercise any powers, and to make bylaws which could be applied to aspects of invasive species management.

Disaster Risk Management Act

This Act provides for Disaster Risk Management in the Cook Islands. Its objects are to ensure Disaster Risk Management procedures are put in place, establish an efficient structure for the management of disasters, and enhance the capacity of the government, relevant agencies and the community to effectively manage the impacts of disasters.

Maritime Rules 2014

Several Rules were made in 2014 pursuant to the Maritime Transport Act 2008/4 including one to implement the country's obligations under the International Convention for the Control and Management of Ships' Ballast Water and Sediments. This places administration of the Rules which incorporate the Convention with the Ministry of Transport.

7.2 Island-specific Regulations:

Environment (Mitiaro) Regulations 2006 and Environment (Atiu & Takutea) Regulations 2008

These extracts from regulations for Mitiaro and Atiu & Takutea show the types of controls that island 'governments' can impose. The regulations state that it is:

‘Unlawful to import into or keep on the island any animal, or any coconut or plant not native to the island except with prior written approval of the Ui Ariki and the Island Council and provided that all Quarantine measures have been taken.

The Island Council may, from time to time, in consultation with the Island Environment Authority, establish measures necessary for the control or eradication of invasive animal or bird species that threaten or harm any birds present on Mitiaro or Atiu & Takutea which are native to these islands.

All pigs shall be kept outside any residential area or at least fifty metres from:-

- (a) any occupied dwelling; or
- (b) the boundary of any neighbouring land.

Every owner of a pig shall keep such a pig within a suitable enclosure, or tethered.

The Island Council shall be entitled to appoint and dismiss certain persons to act as Enforcement Officers to assist in enforcing these Regulations who may, when required, also be deemed to include any Officer of the Environment Service, Police Department, Quarantine, Public Health, Marine Resources and Public Works.’

7.3 International Conventions & Agreements

Convention on Biological Diversity (Ratified by Cook Islands 1993)

This is the key convention relating to the conservation of flora, fauna and ecosystems. It requires countries to develop a NBSAP and specifically to ‘prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species.’

An Aichi Target 9 adopted by a Conference of the Parties to the CBD covers invasive species as follows: *By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled, and measures are in place to manage pathways to prevent their introduction and establishment.*

International Plant Protection Convention (IPPC)

The IPPC is an international agreement on plant health developed in 1951 and overseen by the Food and Agriculture Organisation (FAO). Its objectives include:

- protecting sustainable agriculture and enhancing global food security through the prevention of pest spread
- protecting the environment, forests and biodiversity from plant pests

- facilitating economic and trade development through the promotion of harmonized scientifically based phytosanitary measures
- developing phytosanitary capacity for members to accomplish the preceding three objectives.

United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS includes (Part V) prescription of exclusive economic zones (EEZs) stretching to 200 nautical miles from its coast over which a country has special rights over the exploration and use of marine resources. Part XII contains provisions for protection and preservation of the marine environment including minimising pollution and preventing the introduction of invasive species.

Cartagena Protocol on Biosafety (July 2002)

This protocol to the Convention on Biological Diversity aims to ensure the safe handling, transport and use of living modified organisms (LMOs) resulting from modern biotechnology. The Parties undertake to ensure that the development, handling, transport, use, transfer and release of any LMOs are undertaken in a manner that prevents or reduces the risks to biological diversity, taking also into account risks to human health. While LMOs are different from invasive species, similar processes of risk management, border control and quarantine apply.

International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004)

The key obligation on Parties is '... to undertake comprehensive actions in order to prevent, reduce and if possible eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments.'

8.0 ACTION PLAN

The 5 year Action Plan is based on the nine outcomes in the regional guidelines.

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
GUIDELINES – THEMATIC AREA A: FOUNDATIONS						
<i>A1. Generating Support</i>						
OUTCOME 1.1: The impacts of priority invasive species on biodiversity, economies, livelihoods, food security and health, are widely understood and actions to manage and reduce them are supported.						
Raise awareness of the public on the impacts of Invasive Species present in the Cook Islands, and identify those that are a potential threat to the country's biodiversity, economy, livelihoods, food-security and health.	Develop and utilise awareness materials of the most damaging terrestrial invasive species not found in the Cook Islands but at high risk of arriving from overseas.	Poster of Invasive Species not found in the Cook Islands but likely to arrive developed in 2020 Poster of Invasive Species not found on 6 Pa Enea islands but likely to arrive produced in 2020	Poster produced and distributed to all islands	NES, MOA	NES, MOA, GEF-IAS Project, SRIC-CC, NHT, MOA-R2R	\$20,000
	Develop and utilise awareness materials on the potential threat of marine invasive species to the Cook Islands	Poster of marine invasive species that could theoretically reach Cook Islands produced by 2023	Poster produced and distributed to all islands	MMR, NES, TIS	NES, MOA, GEF-IAS Project, SRIC-CC	\$20,000
	Develop and utilise brochures for each island identifying priority Invasive Species not found there yet but at risk of arriving from neighbouring islands.	Pamphlets created in 2021 to identify each high risk species, with warnings aimed at preventing their arrival	Materials produced and distributed to all islands	SPC, MOA and NES, Outer Islands	NES, MOA, GEF-IAS Project, SRIC-CC, MOA-R2R	\$20,000
	Develop awareness programs on increased threats from invasive species associated with climate change	Radio and workshop programmes produced by 2020	Materials produced and distributed	MOA, NES, MOH, TIS, OPM	NES, MOA, GEF-IAS Project, SRIC-CC	\$80,000
	Raise awareness of Island Governments and other key stakeholders of the threat posed by invasive species	Organise a presentation and/or workshop on this issue 2020	Record of presentation and workshop	NES, Island Mayors	NES, MOA, MOA-R2R	\$10,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
	Develop awareness materials on the impact of invasive species on farmers operations	Information materials developed and distributed to farmers by 2022	Materials printed and disseminated to farmers	MOA, BTIB, TIS	MOA, BTIB, SPC, FAO, MOA-R2R	\$50,000
Carry out education programmes to raise awareness among school pupils	Work with primary schools to introduce invasive species through events during Environment Week or National Days (e.g. Biodiversity Day, Korero o te Orau, World Food Day)	Programmes established for primary school children to follow at school or during field visits, 2022. Children pass on what they learn to parents	Record of students' participation	NES, MOA, MOE, NHT, TIS	NES, MOA, MOE, MOA-R2R	\$50,000
	Awareness and understanding of Invasive Species raised in schools by incorporating invasive species into curriculum and by school visits by experts.	The issue of Invasive Species is taught via various subjects in schools: e.g. biology, science, social studies, Horticulture, agriculture by 2020. Visits made to each school biennially.	Record of number of schools and students involved with the subject annually.	MOA, NES, SPC, MOE, NHT, TIS	MOE	\$50,000

A2. Building Capacity

OUTCOME 1.2: The institutions, skills, infrastructure, technical support, information management, networks and exchanges required to manage invasive species effectively are developed.

Biodiversity Committee to take on the role of coordinating the implementation of the NISSAP.	Committee to include an annual review of progress on NISSAP implementation in its schedule.	Two committee meetings held on invasive species and NISSAP a year, one undertaking an annual review.	Meeting minutes twice a year.	NES, Biodiversity Committee members, MOA	NES, MOA	\$50,000
Ensure adequate staffing to manage invasive species	Ensure that a staff member at Environment Services has invasive species management as a key part of their role.	Staff position identified 2022.	Job description	NES	NES	\$100,000
	Ensure that MOA Biosecurity is staffed to fully cover the rest of the Cook Islands to manage border control and to also take on invasive species management activities.	Warrant of appointment for Pa Enea Biosecurity Officers by 2019(Southern Group Islands) 2022 (at least two Northern Group Island)	Pa Enea Biosecurity officers appointed	Biosecurity, MOA	MOA,SPC, SRIC-CC, MOA-R2R	
	Ensure that a staff member at Marine Resources has marine invasive species management as a key part of their role	Staff position identified 2022.	Job description	MMR	MMR	

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
Training/capacity needs addressed	Ensure that Biosecurity staffs receive training to bring them up to date with continued upgrading of biosecurity/border control manuals, inspection tactics, laws (Biosecurity Act) and legislation Train farmers on appropriate use of pesticide	Staff trained and carrying out duties according to procedural manual by June 2023 Farmers trained on use of pesticide	Training records and database.	Biosecurity, MOA, SPC, SPREP, FAO, OPM	MOA SPC, SPREP, MOA-R2R	\$200,000
Carry out a review of NISSAP and develop the next strategy	Commission an independent review of the NISSAP in 2024. Develop a revised NISSAP for 2026 and beyond	Review completed in 2024 Process to develop new NISSAP undertaken in 2025	Review report received. Recommendations acted on.	NES, MOA, Biosecurity NES, MOA	To be sourced	\$100,000
Strong links are maintained to regional support and expertise to achieve effective and timely information exchange	Continue partnerships with CROP Agencies and regional networks (PPPO, PIRAS, PAP-Net, Birdlife Pacific, etc.) Discuss with SPREP the creation of a Cook Islands Pacific Invasive Learning Network (PILN) team	Regular networking undertaken and updates on new technologies received Cook Island PILN team created in 2023 if agreement reached	Records of information exchanges Listing with PILN	NES, MOA, Biosecurity NES, SPREP, TIS	To be sourced NES	\$50,000

A3. Legislation, Policy and Protocols

OUTCOME 1.3: Appropriate legislation, policies, protocols and procedures are in place and operating, to underpin the effective management of invasive species.

Biosecurity Regulatory Framework completed.	Develop regulations identified under Biosecurity Act	Regulations completed by 2021	Legislative record	MOA, Biosecurity, SPC, FAO	To be sourced	\$50,000
Develop or revise policies.	Complete NBSAP and revised NESAF	NBSAP & NESAF completed	Strategy in place	NES	NES	\$80,000
Update biosecurity procedures manual	Biosecurity procedures manual reviewed for both shipping and aircraft-related activities	Biosecurity procedure manual reviewed as required	Revised manual	Biosecurity	MOA, SPC, FAO	\$20,000
Maintain updates of biosecurity import specifications	Review and update import specification requirements. Update border agencies and importers of any revised requirements	Regular update of specifications, and meetings held with border agencies and importers.	Importers updated and complies with import specification requirements Certification of imports covered under sanitary and phytosanitary	Biosecurity, Customs, Importers	MOA, MOA-R2R	\$15,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
			requirements updated Records of compliance and non-compliance with the requirements.			
Biosafety framework completed	Review and endorse biosafety framework and carry out capacity building on this.	2025 Biosafety framework a endorsed	Biosafety framework in place	NES, MOA	To be sourced	\$30,000

GUIDELINES - THEMATIC AREA B: PROBLEM DEFINITION, PRIORITISATION AND DECISION-MAKING

B1. Baseline and Monitoring

OUTCOME 2.1: Systems are in place to generate baseline information on the status and distribution of invasive species, detect changes, including range changes and emerging impacts.

Carry out necessary surveys to identify full range of priority invasive species present on all islands and monitor their spread.	Carry out invasive species stocktake of existing invasive species on most islands of the northern group GIS Mapping of distribution of invasive species on northern islands	Surveys completed by 2022	Survey reports; distribution maps and information entered in database	NES, MOA, TIS, NGO's	SPC	\$300,000
	Carry out surveys for marine invasive at Rarotonga and Aitutaki ports.	Surveys undertaken for Rarotonga and Aitutaki ports	Survey report	NES, MMR, TIS, SPREP, SPC	SPC, SPREP	\$50,000
	Identify and prioritise necessary surveys as new problems emerge or are detected through the use of GIS mapping as one of the tools	Surveys undertaken as required GIS maps produced	Survey reports and GIS maps	NES, MOA, MMR	To be sourced	\$50,000
Ensure appropriate data management and information systems are in place	Support further development of Cook Islands Biodiversity Database.	Database updated with invasive species information on an ongoing basis	Invasive species in database content	NHT, NES, MOA, TIS	To be sourced	\$60,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
<i>B2. Prioritisation</i>						
OUTCOME 2.2: Effective systems are established and implemented to assess risk and prioritise invasive species for management.						
Maintain & enhance current risk assessment system & data management	Biosecurity risk assessment profiling updated and inspection protocols are improved.	Regular inspection and reporting carried out	Report produced	Biosecurity, SPC	SPC, MOA	\$20,000
	Operational database systems in place to enhance biosecurity register and records.	Database up to date and reports developed.	Database records & reports	Biosecurity, SPC		
<i>B3. Research on priorities</i>						
OUTCOME 2.3: Knowledge is updated for priority invasive species, including species biology and impacts, and development of effective management techniques.						
Encourage research on priority species to assist in their management Promote local research	Carry out research on management of priority invasive species	Invasive species managed	Research reports produced	NHT, NES, MOH, MOA, TIS	NES – IAS project, NHT, MOA, SPC, FAO	\$100,000
Ensure that staffs are familiar with the use of online systems to identify and obtain information on invasive species.	Ensure key individuals utilise the Global Invasive Species Database http://www.issg.org/database/welcome/ and provide it with updates on invasive species in Cook Islands Provide key individuals with information on identification systems such as PestNet and PIER.	Local experts making full use of databases and these are updated regularly with Cook Islands' information	Databases updated	NES, MOA. Biosecurity, NHT	SPREP, SPC, FAO	\$10,000
Carry out research on taro to address risk of taro leaf blight	Carry out programme of breeding and selection to identify taro varieties resistant/tolerant to leaf blight	Research identifies resistant/tolerant varieties by 2025	Research reports	MOA	SPC, MOA	\$50,000
GUIDELINES - THEMATIC AREA C: MANAGEMENT ACTION						

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
C1. Biosecurity						
OUTCOME 3.1: Mechanisms are established to prevent the spread of invasive species across international borders and between the Pa Enea and main islands, quickly detect and respond to those that arrive.						
Strengthen international border control	Strengthen partnership with agencies to enhance border control	Partnerships and border control strengthened	Reports produced	MOA, Biosecurity	MOA, NZAID, FAO, SPC	\$200,000
Strengthen international border control – marine pathway	Review risks of incursion due to ships, yachts and vaka from international ports traveling directly to Pa Enea	Review conducted by 2023 and procedures amended as required	Review report and amended procedures	MOA, Biosecurity, OPM	MOA, SRIC - CC	\$50,000
Strengthen inter-island biosecurity procedures	<p>Advocate for revised financial allocation formula for outer islands biosecurity to reflect their front-line role in preventing invasive species reaching the country.</p> <p>Ensure that all containers and cargo from high-risk sources are inspected prior to leaving ports on Rarotonga and Aitutaki.</p> <p>Implement plan for rat management on inter-island shipping.</p> <p>Assess the opportunities for Island Councils to introduce by-laws to reduce risks posed by invasive species.</p> <p>Ensure the implementation of the Suwarrow Biosecurity Plan.</p>	<p>Revised allocation achieved by 2022</p> <p>Inspection of containers and cargo to Pa Enea</p> <p>Rat management plan in place by 2020</p> <p>Assessment carried out in 2021 and invasive species highlighted in island bylaws by 2023</p> <p>Full compliance with Suwarrow Biosecurity Plan</p>	<p>Financial reports</p> <p>Inspection report produced</p> <p>Plan documentation</p> <p>Assessment report and bylaws</p> <p>Reports of compliance and plan breaches</p>	<p>NES, MOA, Treasury, OPM</p> <p>MOA, OMIA</p> <p>Biosecurity, NES, TIS</p> <p>Biosecurity, OMIA</p> <p>Biosecurity, NES, OMIA, TIS</p>	<p>MOA, OMIA, SRIC-CC, PEARL, GCF</p> <p>MOA, OMIA PEARL, GCF,</p> <p>PEARL, GCF</p> <p>MOA, FAO, SPC, PEARL, GCF</p> <p>NES, MOA,</p>	\$500,000
Establish early detection and rapid response systems	<p>Endorse an Early Detection and Rapid Response Plan and carry out a simulation exercise.</p> <p>Ensure implementation of and compliance with Cook Islands Animal Health Emergency Response Plan.</p>	<p>Plan endorsed and exercise carried out for Pa Enea (at least two Islands)</p> <p>Officers aware of duties and carrying out implementation of plan</p> <p>Store of emergency response equipment</p>	<p>Plan and report of exercise</p> <p>Animal Health and Biosecurity reports</p> <p>Store established and</p>	<p>NES, BIO, MOA, SPC, SPREP, DRM</p> <p>Biosecurity, MOA</p> <p>MOA, MMR, NES</p>	<p>GEF-PAS IAS project</p> <p>To be sourced</p> <p>To be</p>	\$50,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
		established	inventory maintained		sourced	
Maintain or establish surveillance programmes.	Maintain fruit-fly surveillance on all islands	Fruit-fly surveillance traps sent to Pa Enea	Surveillance Report produced	Biosecurity, MOA-Research Division, Island council, SPC	MOA, SPC	\$50,000
	Carry out ant surveillance at ports	Surveillance carried out	Report of ant surveillance	Biosecurity, MOA – Research division, SPC, SPREP	SPC, Landcare	\$200,000
	Maintain current programme to manage disease-carrying mosquitoes on vessels travelling to Cook Islands Capacity Building carried out for Pa Enea Health officers on monitoring of vessels for mosquitoes and other regulated disease vectors	Vessels traveling to the Cook Islands are inspected and meet the Biosecurity and Health requirements for vector borne diseases. Pa Enea health officers trained on vessel inspection	Reports produced	MOH, Biosecurity, Island council	MOH, WHO, SRIC, NZAID	\$100,000
	Maintain programme to detect any arrival of ship rats on Atiu, Aitutaki and any rat on Suvarrow	Rat monitoring program continuously done on Atiu, Aitutaki and Suvarrow Awareness program carried out on ship rat prevention	Awareness program carried out No ship rat presence on all three islands	NHT, NES, Islands Council, TIS	Islands Council, NHT	\$30,000
Pest Control Certification developed for vessels to the Pa Enea	Introduction of Pest control certification to shipping to address pests such as rats, myna, ants etc. Mechanisms developed to ensure ships meet the biosecurity requirements and the Hazard Analysis Critical Control Point (HACCP) procedure	Shipping agent complies with certification requirement by 2022 Pest control certification by 2022	Record of ships in compliance HACCP log sheets	MOA, MOT, MOH, MMR, NES	MOA, MOT, MOH, MMR	\$30,000
Monitor and enforce ballast water and hull fouling rules	Strengthen surveillance and compliance with ballast water and hull fouling rules and carry out capacity building for staff involved Ensure ballast water and hull fouling meets the requirements of the IMO relevant Conventions and domestic legislation.	Ballast water and hull fouling strategies in place by 2020	Strategies endorsed	MOT, Cook Is Ports Authority	SPC, SPREP, MOT	\$100,000
The threats on the movement of Invasive species of major concern are captured	To revise the Compliance and Enforcement work programmes and manual on EIA processes to capture the movement of new species introduced to the Cook Islands;	Compliance work programmes and manual revised taking into consideration measures on new introduced specie and reducing the movements of invasive species	Compliance monitoring report; Project Completion report	NES, SPREP	NES, SPREP	\$200,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
under the EIA processes	Capacity building for all Rarotonga & Pa Enua compliance staff on invasive species identification, and threats; Strict monitoring of all approved projects.	Well-informed staff on invasive species identification and threats Project monitoring in place 2022	Training records Monitoring reports			
C2. Management of established invasive species						
OUTCOME 3.2: The impacts of priority established invasive species are eliminated or reduced by eradicating or controlling the target species.						
Continue bio-control programme for priority weeds	Monitor spread of bio-control agents already introduced.	Monitoring of Biocontrol agents Biocontrol agents maintain their control of IS	Programme and survey reports	MOA - Research, Landcare Research, NZ	MOA, SPC, Landcare Research, NZ	\$100,000
Carry out rat control and eradications	Investigate feasibility and cost-benefit of eradicating Pacific rats from Takutea, Mitiaro, Palmerston Rat guards and baiting stations established in port warehouses on Rarotonga Inspect and audit compliance with rat management at port	Feasibility assessment carried out in 2024 Shipping agents comply with rat management requirements by 2025 Report on inspection	Feasibility report Report produced	NES, TIS, Birdlife, Island Council, MOA MOA, CIPA, MOT, shipping companies and shipping agents	MOA, PEARL, GCF	\$100,00
Feral pigs	Develop options to reduce the impact of feral pigs on the Pa Enua including establishment of slaughtering units so animals can be processed and sold on Rarotonga	Options developed by 2021	Review documentation	MOA, Island Council(s)	NES-Ridge to Reef, MOA, FAO, SPC	\$50,000
Feral goats	Develop options to control goats on Pa Enua to protect habitats on the makatea including use of slaughtering units	Options developed by 2021	Review documentation	MOA, Island Council(s)	NES-Ridge to Reef, MOA, FAO, SPC	\$50,000
Management of myna	Carryout baseline survey and mapping of the two myna species on Rarotonga	Survey carried out on Rarotonga by 2022 Maps produced on myna distribution by 2022	Survey report and maps produced	NHT, TIS, NES,	NHT, TIS, SPREP	\$50,000
Manage stick insects on Atiu	Control and manage stick insects on the Island of Atiu Implement best practice to control stick	Acceptable control mechanism initiated by 2022	Reports produced	NHT, NES, MOA, island council	NHT, NES, MOA, island councils, Landcare	\$50,000

Outcomes & Actions	Activities	Target	Means of Verification and Monitoring Frequency	Responsibility	Financing	Costing estimate
	insects on Atiu				Research, SPC, SPREP	
Ant management	Provide communities with advice to manage problem ants Regular surveillance for new ants around the port area	Advice developed and widely circulated in 2020 New ants detected and eradicated	Awareness materials Ant report produced	NES, MOA, TIS	MOA, NES	\$30,000
Control mosquito populations to reduce spread of disease	Maintain current programme of Health Department including bi-annual community public health check (tutaka).	Public Health Check programme delivered annually	Programme reports	MOH, NES, MOA, Island council	MOH, NES, MOA,	\$500,000
Maintain community-based weed control programmes	Support control programme for cocklebur on Pukapuka Continue programme to eradicate red passionfruit on Mauke Establish/support programme to remove new plants of <i>Mimosa invisa</i> emerging on any other island	Programme delivery continues 2025 onwards Programme delivery continues 2025 onwards Establish and deliver programme from 2025 onwards	Programme reports Programme reports Programme reports	NES, MOA NES, MOA NES, MOA	To be sourced	\$145,000
Assess the Impacts of climate change on invasive species	Commission a review of the likely implications of climate change on the distributions and impacts of invasive species in Cook Islands.	Review commissioned in 2022	Review documents	NES, SRIC, OPM	OPM, SRIC-CC	\$15,000
Investigate options for managing Singapore daisy (<i>Wedelia triloba</i>), a species that thrives in dry conditions	Assess options for managing <i>Wedelia</i> on Rarotonga and Aitutaki to reduce its spread, including use of herbicide GIS mapping of <i>Wedelia</i> distribution Develop awareness to inform the public not to introduce <i>Wedelia</i> to other islands.	Study and trials undertaken in 2025 <i>Wedelia</i> GIS map produced Awareness materials developed by 2025	Study and trial reports Awareness Materials	MOA, NES	MOA, NES	\$30,000
C3. Restoration						
OUTCOME 3.3: Following invasive species management the best methods are determined and implemented to facilitate effective restoration of native biodiversity or recovery of other values.						
Biodiversity/plant restoration	Re-plant areas with native trees as appropriately where weeds have been removed such as java plum, acacia and guava	Areas where weeds have been removed or controlled are appropriately replanted.	Project reports	NES, SPREP,	To be sourced	\$100,000

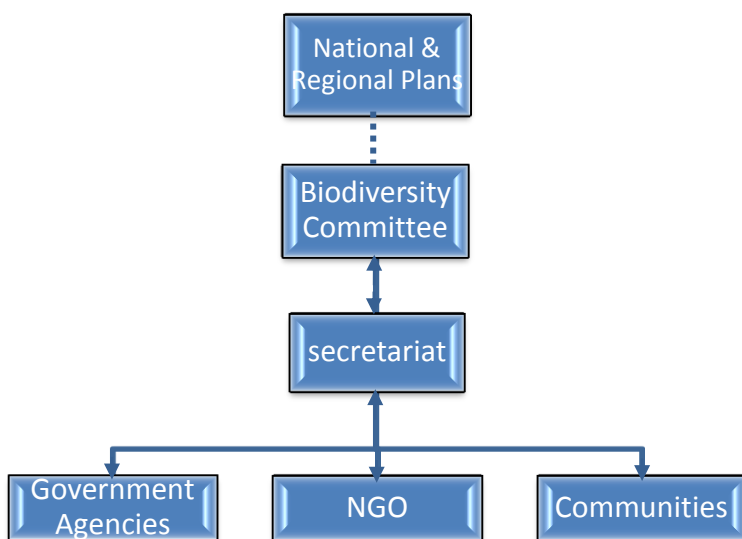
Key to abbreviations

BIO	Biosecurity Service, Cook Islands
CIPA	Cook Islands Ports Authority
FAO	UN Food & Agricultural Organisation
GEF-PAS IAS	Global Environment Facility Pacific Alliance for Sustainability. Prevention, Control and Management of Invasive Alien Species in the Pacific Islands
IMO	International Maritime Organisation
MMR	Ministry of Marine Resources
MOA	Ministry of Agriculture
MOA-R2R	Ministry of Agriculture – Ridge to Reef
MOE	Ministry of Education
MOH	Ministry of Health
MOT	Ministry of Transport
NES	National Environment Service
NISSAP	National Invasive Species Strategy and Action Plan
NHT	Natural Heritage Trust
PEARL	Pa Enea Actions for Resilience and Livelihood (Climate Change Adaptation Program)
R2R	Ridge to Reef
OMIA	Office of the Minister for Island Administrations, Cook Islands
OPM	Office of the Prime Minister, Cook Islands
SPC	Secretariat of the Pacific Commission
SPREP	Secretariat of the Pacific Regional Environmental Programme
SRIC-CC	Southwest Research and Information Centre – Climate Change
TIS	Te Ipukarea Society
WHO	World Health Organization

9.0 MONITORING & EVALUATION

The Biodiversity Steering Committee will act as a monitoring and evaluation mechanism to ensure that the NISSAP progresses to the common goal and actions, and that these are achieved in a timely manner. The roles and responsibilities of each stakeholder for the implementation of this strategy are clear.

This flow diagram illustrates the reporting process for the NISSAP.



The Biodiversity Steering Committee will appoint the agency/(s) to be secretariat for reporting on the progress in achieving the NISSAP goals and actions. In turn, the secretariat will organise an annual review of progress on implementing the Action Plan.

The monitoring and evaluation mechanism will provide an opportunity for feedback on progress on the implementation of the NISSAP. It will also help to build capacity whereby those utilising the system should benefit by increasing their competence and be able to identify and develop improvements to the monitoring and evaluation framework.

In addition, other target recipients of the NISSAP such as community groups and non-government organization should also benefit by increasing their understanding of the importance of monitoring and evaluation as a requirement of the development planning and implementation process.

Ministries and agencies are encouraged to use the targets and means of verification as the basis for internal monitoring and management.

Non-government and community groups are encouraged to implement some of the activities and to provide updates on the progress of their work to any of the relevant government agencies so these can be captured into the reporting system. They are also encouraged to provide and participate in the national reporting system of the NISSAP.

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We acknowledge the valuable contribution of the Biodiversity Steering Committee for their support and commitment in the development and formulation of this document.

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The development of the Kaveinga Paruru a te Kuki Airani no te au tu Katiri Kikino was made possible through financial assistance from the Global Environment Fund (GEF), the United Nations Environment Program (UNEP), (SPREP) and the Cook Islands Government.

We look forward to working closely with all of you in implementing the Kaveinga Paruru a te Kuki Airani no te au tu Katiri Kikino and continue to find ways to protect the Cook Islands from accidental and intentional introduction of invasive alien species and ways to minimise and eradicate invasive species that are now present in the Cook Islands.

Meitaki Maata e Kia Manuia

Annex 1: Regional and international organisations and databases related to invasive species management.

(Source: Prepared by ISSG for Kingdom of Tonga's draft NISSAP (2013)).

Secretariat of the Pacific Commission (SPC)

SPC helps Pacific Island people respond effectively to the challenges they face and make informed decisions about their future and the future they wish to leave for the generations that follow. Go to the website for a description of the core business of each of SPC's Divisions and more detailed information about how they can help. <<http://www.spc.int/>>

Secretariat of the Pacific Regional Environment Programme (SPREP)

SPREP works towards a Goal that, by 2015, all Members will have improved their sustainable management of island and ocean ecosystems and biodiversity, in support of communities, livelihoods, and national sustainable development objectives, through an improved understanding of ecosystem-based management and implementation of National Biodiversity Strategic Action Plans.

The SPREP Biodiversity and Ecosystem Management Strategic Priority will be delivered through four main priority thematic areas: Invasive Species, Island and Oceanic Ecosystems, Threatened and Migratory Species, and Regional and International Instruments

<<http://sprep.org/Biodiversity-and-Ecosystems-Management/bem-overview>>

Pacific Islands Roundtable for Nature Conservation (PIRNC)

Formed in 1997 at the request of Pacific Island Countries and Territories, PIRNC serves as a forum whereby organisations working on nature conservation in the Pacific can improve their collaboration and coordination to increase effective conservation action. In particular it is the coordination mechanism for the implementation of the Action Strategy for Nature Conservation in the Pacific Island Region 2008-2012. The Action Strategy was endorsed by SPREP members, and highlights the priority concerns for conservation in the Pacific region as well as outlining a roadmap for achieving the key goals. It is to be reviewed in December, 2013.

<<http://www.iucn.org/about/union/secretariat/offices/oceania/roundtable/>>

PIRNC has a number of Working Groups, one of which addresses invasive species; the **Pacific Invasives Partnership (PIP)**. PIP is the umbrella regional coordinating body for agencies working on invasive species in more than one country of the Pacific and promotes coordinated planning and assistance from regional and international agencies to meet the invasive species management needs of the countries and territories of the Pacific.

<<http://sprep.org/Pacific-Invasives-Partnership/invasive-partnerships>>

Two regional programmes operate with the guidance and support of PIP:

Pacific Invasives Initiative (PII)

PII builds the invasive species management capacity of Pacific island countries and territories by providing technical support, training, assistance with proposal and project design, and links to expertise. <<http://pacificinvasivesinitiative.org/pii/index.html>>

Pacific Invasives Learning Network (PILN)

PILN is a professional network for invasive species workers in the Pacific and organises skills and learning exchanges, workshops and meetings, and facilitates multi-sector invasives teams in countries. <<http://sprep.org/Pacific-Invasives-Learning-Network-PILN/piln-welcome>>

International Union for the Conservation of Nature (IUCN) - Oceania Regional Office

IUCN Oceania is working with like-minded organisations to contribute to the conservation of species and ecosystems in the Oceania region. Increasing awareness about the importance of species and the threats they are facing is crucial. The concept of “Investing in Nature” is central to this approach: too often, humans take other species and their day-to-day uses for granted. It is vital that investments in natural resources promote sustainable long-term use, management and conservation of the species we utilise in our everyday lives.

<<http://www.iucn.org/about/union/secretariat/offices/oceania/priorities/>>

Hawai`i-Pacific Weed Risk Assessment

Hawai`i-Pacific Weed Risk Assessment (HPWRA) provides a free service. Professional botanists use published information to predict whether plants have a low-risk or high-risk of becoming invasive in Hawai`i or similar Pacific islands. The information is available on the Plant Pono website <<http://plantpono.org/hpwra.php>>. (HPWRA receives funding from the Hawai`i Invasive Species Council <<http://www.hawaiiinvasivespecies.org/hisc/>> and Plant Pono received funding for website development from the Kaulunani Urban and Community Forestry Program <<http://www.kaulunani.org/>>)

International Union for the Conservation of Nature (IUCN), Species Survival Commission (SSC), Invasive Species Specialist Group (ISSG)

The Invasive Species Specialist Group (ISSG) aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. ISSG is a major source of information on invasive species either through the Global Invasive Species Database (GISD) or by direct contact. <<http://www.issg.org/about.htm>>

Global Invasive Species Database (GISD)

The GISD focuses on alien species known to have negative impacts on native biodiversity and ecosystems. It features over 850 species profiles of some of the most harmful species. While there are taxon and geographical biases on selection of species (due to funding sources and priority themes) that are featured on the GISD, the Oceania region is well represented with a large number of harmful species listed. Other information extracted from the GISD included information on taxonomy, species organism type, common names, habitat type, biome, biostatus information and information on pathways of introduction and spread of these species.

Pacific Island Ecosystems at Risk (PIER)

The PIER database is focused on plant species that are known to have been introduced to the Pacific region including the Pacific Rim. Information extracted from PIER included biostatus of alien species at island level, common names in Pacific languages, habitat information and most importantly links to risk assessments conducted for the Pacific region.

CABI Invasive Species Compendium (ISC)

CABI ISC is an encyclopaedic type of database on invasive alien species that impact biodiversity and livelihoods. CABI maintain compendia on Crop Protection, Forestry, Aquaculture and Animal Health and Production. The CABI ISC lists invasive species that impact biodiversity as well as pests of crops and pathogens. The focus for this project was on species that are known to impact biodiversity and ecosystems.

FishBase & SeaLifeBase

FishBase and SeaLifeBase are databases focused on all fish species known to science. Data and information included in FishBase includes ecological information, information on traits and distribution at country and ecosystem level including in the introduced range of fish species in the

aquatic system (both marine and freshwater). SeaLifeBase consists of similar information on marine species.

Annex 2: Priority invasive species of Cook Islands

Species	Comments	Source
Mammals		
Ship Rat <i>Rattus rattus</i>	Widespread threat to birds, invertebrates and food crops. Kakerori survival on Rarotonga dependent on rat control. Need to prevent rat reaching Atiu.	2
Pacific Rat <i>Rattus exulans</i>	A particular threat to ground-nesting seabirds on the northern atolls, hence its recent eradication from Suvarrow	
Feral pigs <i>Sus scrofa</i>	A threat to food crop plantations and gardens, particularly on Atiu, Ma'uke, Mitiaro and Takutea. Also a predator of coconut crabs and turtle eggs on some islands.	2
Feral cats	Likely to threaten survival or establishment of burrow-nesting seabird colonies on Rarotonga and Atiu.	
Feral goats	A particular problem on Atiu where they have removed most of forest understorey and reduced medicinal plants and grass diversity. (Mostly not feral as such, but owned and left to wander).	
Birds		
Indian myna	Subject to an eradication programme on Atiu. Not currently recommended for control/eradication on other islands where it is established. Detect early and eradicate if arrives on a new island.	
Jungle myna	Recently arrived on Rarotonga and not anticipated that it will cause problems but should be monitored. Detect early and eradicate if arrives on a new island.	
Plants		
Mile-a-minute <i>Mikania micrantha</i>	Identified as a pest interfering with agriculture and native forest areas on Rarotonga. Also found on Aitutaki, Mitiaro, Atiu, Mauke. Biocontrol programme in early stages.	1,2,3,4
Lantana – <i>Lantana camara</i>	Serious pest on Atiu due to its prickles and poisonous foliage. Subject to ongoing biological control.	1,2
<i>Mimosa invisa</i> Giant sensitive weed	Found only on Aitutaki where a psyllid was introduced for biological control with initial success. Subject to ongoing biological control, but needs programme to remove new plants emerging from seed bank.	1,2
Pikikaa - <i>Mimosa pudica</i> Sensitive weed	Identified as a problem by communities on Mitiaro where it occupies four small areas. Spraying with herbicide is recommended.	1
Grand balloon vine <i>Cardiospermum grandiflorum</i>	Overgrowing native plants on Rarotonga. Bring into current biocontrol programme as scheduled.	1,2,4
Java plum <i>Syzygium cumini</i>	Invasive on Atiu and Mauke where it was introduced as a wind-break	1,2
Cockleburr <i>Xanthium pungens</i>	Maintain community control programme. Bring into current biocontrol programme as scheduled.	3,4
<i>Merremia peltata</i>	Present on Rarotonga, Atiu, Mitiaro and Aitutaki. Bring into current biocontrol programme as scheduled.	2,3,4
<i>Merremia</i> spp (4 species including <i>M. tuberosa</i> Wood Rose)	Survey and monitor spread.	2
<i>Acacia mangium</i> & <i>A. auriculiformis</i>	Survey and map distribution. Assess threat to native ecosystems and farming and investigate options to use the timber and plant natives for land stability.	2
Red passionfruit <i>Passiflora rubra</i>	Subject to control programme on Mauke. Bring into current biocontrol project as scheduled.	3,4
African tulip tree - <i>Spathodea campanulata</i>	Bring into current biocontrol programme as scheduled.	3,4
Strawberry guava <i>Psidium cattleianum</i>	Bring into current biocontrol programme as scheduled.	3,4
Dodder <i>Cascuta</i> sp.	Present on Rarotonga and subject to research on control methods	
White ginger <i>Hedychium coronarium</i>	Infestation on top of Te Kou mountain. Review threat to other mountain areas.	3
Para grass <i>Urochloa mutica</i>	Agriculture pest on Rarotonga – arrived Tuapapa with tomato stock	

Invertebrates		
Fruit flies – <i>Bactrocera</i> spp.	Ongoing surveillance for new incursions – particularly Oriental and Queensland fruit flies. Ongoing control by growers of species present.	2
Glassy-winged sharpshooter <i>Homalodisca coagulata</i>	Subject to ongoing biocontrol on Rarotonga. Awareness to detect & eradicate if arrives on other islands.	
Cuban laurel thrip <i>Gynaikothrips ficorum</i>	Maintain monitoring of biocontrol programme.	
No-see-'em biting-midge (sand flies) – <i>Culicoides belkini</i>	Continue research on Aitutaki aimed at minimising impact, including testing repellents. Apply lessons learned on Mitiaro also.	2
White-fly spp.	Continue research and investigate biocontrol. Pesticide resistance developing.	
Leaf miner spp.	Investigate whether earlier biocontrol agent is still present.	
Tropical fire ant (<i>Solenopsis germinate</i>)	Survey to assess distribution and impact (on people and on crops through encouraging mealy bugs which increase sooty mould); investigate opportunities to control.	
Yellow crazy ant (<i>Anoplolepis gracilipes</i>)	Survey to assess distribution and impacts on Rarotonga. Assess need and options for control.	
Disease-carrying mosquitoes – e.g. <i>Aedes aegypti</i>	Ongoing programme of periodic inspections and control to reduce numbers.	
Pest and disease threats to honey bees	Investigate if problems of reduced pollination due to reduce honeybee numbers are confirmed by growers.	
Marine organisms		
Crown of thorns starfish - <i>Acanthaster planci</i>	Control in the event of periodic outbreaks when its numbers build up enough to damage coral reefs.	1

Code of source:

1. 4th National report to CBD - identified as 'most serious' invasive species by communities during NBSAP consultations. Comments from NES (2004)
2. 2004 5-island survey of Anau Matarangi (NES 2004)
3. Top 15 weeds as candidates for biocontrol (2009 biocontrol workshop by Landcare Research)
4. Top 8 weeds chosen for biocontrol (2009 biocontrol workshop by Landcare Research)

Annex 3: Pa Enea detailed information by island

The bulk of the Action Plan was developed during workshops and meetings with Government officials and NGO's based in Rarotonga. In order to capture the priorities of the other islands, a questionnaire was circulated to these with the assistance of Pa Enea Division, Office of the Prime Minister using a list developed from the Cook Islands Biodiversity Database in June 2015 using the search option 'INVASIVES – most serious'.

The island entries are coded as follows:

- No – not known from the island
- Blank - assumed that this species is not known from the island
- Yes/No – present on the island/not considered a problem
- Yes/Yes - present on the island/considered a problem

Table 5: List of priority invasive species on islands

Type	Scientific Name	English Name	Maori Name	Aitutaki	Atiu	Mangaia	Manihiki	Mauke	Mitiaro	Palmerston	Pukapuka	Rakahanga
Fern	<i>Nephrolepis saligna</i>	Samoaan Sword-fern	Maile Laulikiliki	Yes/No			No		No		Yes/No	Yes/No
Shrub	<i>Ardisia elliptica</i>	Inkberry	Venevene Tinitō	Yes/No	Yes/No Located in very small amount in Mapumai & Areora	Yes/No			Yes?/No		No	Yes/No Growing mostly around pig pens
Shrub	<i>Triumfetta rhomboidea</i>	Triumfetta Weed	Piripiri	Yes/No		Yes/No	Yes/Yes growing wild every where	Yes/No	Yes/No		No	Yes/Yes Covering all grassy areas on the main land
Shrub	<i>Sida rhombifolia</i>	Broom Weed	Purūmu	Yes/No	Yes/Yes Problem to agricultural lands	Yes/No	Yes/Yes very hard to get rid	Yes/No	Yes/Yes		Yes/Yes grows in swampy areas especially where taro is	Yes/Yes Growing in all taro & puraka swamps

											planted	
Shrub	<u><i>Leucaena leucocephala</i></u>	Leucaena	Nītō	Yes/Yes. Large problem as spread over farmland abandoned by growers	Yes/Yes Not a problem now but could become one. Found at airport, Mapumai & Taunga nui	Yes/No		Yes/Yes	Yes/No		No	No
Shrub	<u><i>Mimosa invisa</i></u>	Giant Sensitive-weed	Pikika‘a Papa‘ā	Yes/Yes	n/n				No		No	No
Shrub	<u><i>Mimosa pudica</i></u>	Sensitive Weed	Rākau Pikika‘a	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes very hard to get rid	Yes/Yes overgrows some small plants	Yes/Yes major problem in plantation areas		No	No
Shrub	<u><i>Senna obtusifolia</i></u>	Sicklepod	Pī‘ Aungakino	Yes/No			No	Yes/Yes spread by seeds	Yes/No		No	Yes/No
Shrub	<u><i>Eugenia uniflora</i></u>	Surinam Cherry	Venevene	Yes/No	Yes/No Grows where land not cultivate but could become problem	Yes/No	Yes/?	Yes/Yes	No		No	No
Shrub	<u><i>Tithonia diversifolia</i></u>	Tree Marigold	PuaRenga	Yes/Yes Spread very rapidly over island		Yes/No	No		Yes/No		No	No
Shrub	<u><i>Xanthium purgens</i></u>	Cockleburr		No					No		No	Unsure
Shrub	<u><i>Ludwigia octovalvis</i></u>	Willow Primrose	Tiēmu	Yes/No	No	Yes/No	No		Yes/No		No	No

Shrub	<u>Clerodendrum chinense</u>	Honolulu Rose	Pītate-māma‘o	Yes/No		Yes/No	No	Yes/Yes over grows any small plants	Yes/No		No	Yes/No
Shrub	<u>Lantana camara</u>	Lantana	Tātarāmoa	No/No	Yes/Yes Invades arable land & habitat for feral pigs	Yes/Yes difficult to eradicate on farm lands	No		Yes?/Yes problematic in crop areas		No	No
Shrub	<u>Cestrum nocturnum</u>	Night-blooming Cestrum	Tiare Ariki-va‘ine	Yes/No	Yes		No		Yes/No		No	No
Shrub	<u>Indigofera suffruticosa</u>	Indigo	‘Initiko	Yes/No	Yes	Yes/No	No	Yes/Yes	No		No	No
Vine	<u>Calopogonium mucunoides</u>	Calopo		Yes/No			No		No		No	Unsure
Vine	<u>Passiflora maliformis</u>	Hard Passionfruit	Pārapōtini ‘Enua	Yes/No	Yes/No	Yes/No	No	Yes/No	Yes/No		No	No
Vine	<u>Passiflora rubra</u>	Red Passionfruit	Pōkutekute	No/No	Yes/No		No	Yes/No	Yes/No		No	No
Vine	<u>Puerariapha seoloides</u>	Tropical Kudzu	Kūtū	Yes/No	Yes/Yes-no. Will become problem if allowed to invade	Yes/No		Yes/No	Yes/No		No	No
Vine	<u>Centrosema pubescens</u>	Centro Butterfly-Pea	Piriarero	Yes/No			No		No		No	No
Tree	<u>Pimenta racemosa</u>	Bay-rum Tree		Yes/No			Unsure		Yes/No		No	Unsure
Tree	<u>Psidium cattleianum</u>	Red Strawberry-Guava	Tūava Papa‘ā	Yes/No	Yes/Yes Will become problem	Yes/No	No	Yes/No	Yes/No		No	No

					if allowed to invade							
Tree	<u>Psidium guajava</u>	Common Guava	Tūava	Yes/No	Yes/Yes	Yes/No	Yes/No	Yes/Yes	Yes/No	Yes/Yes Becoming a problem	Yes/No only 4 trees growing on Motu Kotawa	Yes/No Less than 5 trees on main land
Tree	<u>Syzygium cumini</u>	Jambolan	Pistati	Yes/Yes Spreading rapidly over island. Difficult to bulldoze & clear land	Yes/Yes Huge problem on agricultural lands	Yes/No	No	Yes/Yes	Yes/Yes Overtaking crop areas		No	No
Tree	<u>Cecropia pachystachya</u>	Cecropia	Rau-Māniota	Yes/No			Unsure	No	Yes?/No		No	No
Tree	<u>Acacia crassiparpa</u>	Crassicarpa	Ākasia	No/No	Yes/yes Fast growing, seeds easily spread & hard to control	Yes/Yes	No	Yes/Yes	No		No	No
Tree	<u>Adenanthera pavonina</u>	Red-bead Tree	Mata Kōviriviri	Yes/No	Yes/No Could be problem if spreads to agricultural lands	Yes/No	No	Yes/Yes	Yes/No		No	No
Tree	<u>Spathodea campanulata</u>	African Tulip-tree	Kō'ī'ī	Yes/Yes. Very invasive & real concern if it establishes	Yes/Yes Hard to control but not many trees		No		No		No	No

				on hill terrain that cannot be bulldozed.								
Tree	<u>Falcataria moluccana</u>	Albizia	‘Ārapitia	Yes/No	Yes/Yes	Yes/No	No	Yes/Yes cover a large area of plantation	Yes/No		No	No
Tree	<u>Syzygium jambos</u>	Rose Apple	Ka‘ika Papa‘ā	Yes/No	Yes/No	Yes/No	No	Yes/Yes	Yes/No		No	No
Vine	<u>Cardiospermum grandiflorum</u>	Grand Balloon-Vine		No			No		Yes/No		Yes/No	No
Vine	<u>Merremia peltata</u>	Peltate Morning-glory	Kūrima	Yes/Yes	Yes/Yes Fast growing & killing trees		No		Yes/Yes getting serious		Yes/No	No
Vine	<u>Cuscuta campestris</u>	Dodder	Tīaea	Unsure			No		Yes/No		No	No
Herb subshrub	<u>Stachytarpheta cayennensis</u>	Blue Rat's-tail	Tiāki	Yes/No		Yes/No		Yes/No	Yes/No		No	No
Herb	<u>Hyptis pectinata</u>	Comb Hyptis	Miri Tita		Yes/Yes Weed of agricultural lands, hard to control	Yes/No		Yes/No	Yes/No		No	No
Herb Shrub	<u>Ocimum gratissimum</u>	Wild Basil	Miri Taratoni	Yes/No		Yes/No	No	Yes/No	Yes/No		Yes/No	Yes/No
Herb	<u>Desmodiumincanum</u>	Spanish Clover	Ngātoro	Unsure			No		Yes/Yes problematic in cultivated areas		No	No
Herb	<u>Bidens pilosa</u>	Beggar's-tick	Piripiri Kerekere	Yes/No		Yes/No	Yes/Yes sticks to clothes	Yes/No	Yes/Yes nuisance in planting areas	Yes/Yes Constant weeding & burning keeps	Yes/Yes A noxious weed	No

										it at bay		
Herb	<u>Elephantopus spicatus</u>	False Elephant's-foot	Tapuae 'Erepani	Yes/No	Yes/Yes	Yes/Yes		Yes/No	Yes/Yes	Nuisance in vegetable gardens & crop areas	No	No
Vine	<u>Mikania micrantha</u>	Mile-a-minute Weed	Pōkutekute Teatea	Yes/Yes	Yes/Yes-No	Yes/No	No	Yes/No	Yes/No		No	No
Grass	<u>Arundo donax</u>	Giant Reed		Unsure					No		No	No
Grass	<u>Brachiaria mutica</u>	Para Grass	Mauku Puakatoro	Yes/Yes	Yes/Yes hard to control on Agriculture land	Yes/No		No	Yes/No		No	No
Grass	<u>Cenchrus echinatus</u>	Burr Grass	Piripiri	Yes/Yes	Yes/Yes grows fast & seeds easily spread	Yes/No	Yes/Yes	Yes/No	Yes/Yes	Yes/Yes Spreading and very difficult to control	Yes/Yes spread easily, problematic & unmanageable	Yes/Yes found mostly in the village area & the road side
Bamboo	<u>Phyllostachys bisetii</u>	Bisset's Bamboo	Ko'e Tiāpāni	Unsure	Yes/Yes fast growing & hard to control	Yes/Yes Overtaking arable land	Unsure	Yes/Yes slowly spreading & covering a huge area	Yes/No		No	No
Grass	<u>Sorghum bicolor drummondii</u>	Sudan Grass	Tarapī	Yes/Yes	Yes/Yes	Yes/No	No	Yes/Yes seeds carried by tractor from plot to plot	Yes/Yes		No	No
Herb	<u>Hedychium coronarium</u>	White Ginger	Kōpuī Teatea	Yes/No	Yes/No	Yes/No	No		Yes/No		No	No
Mite	<u>Phyllocoptruta oleivora</u>	Citrus Rust Mite		Yes/Yes	Yes/Yes	Yes/Yes			Unsure	Yes/Yes large no. of shrubs & trees affected	No	Unsure

Centipede	<i>Scolopendra subspinipes</i>	Brown Centipede	Veri Tara	Yes/	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes	Yes/No	Yes/No Kept in check by chickens	Yes/No	Yes/Yes usually enters the house during rainy nites
Mosquito	<i>Aedes aegypti</i>	Dengue Mosquito		Yes/	Yes/Yes	Yes/Yes	Yes?/Yes	No	Yes/Yes serious only at time of dengue fever	Yes/Yes Occasional outbreaks after heavy rain	No	Yes/Yes Worst disease outbreak since 1980
Mosquito	<i>Aedes polynesiensis</i>	Polynesian Mosquito	Namu-Tore	Yes/	Yes/Yes	Yes/Yes	Yes?/Yes		Yes/Yes	Yes/Yes Occasional outbreaks after heavy rain	Yes/Yes	Yes/Yes-No usually found at nite after 2/3 days rain
House Fly	<i>Musca domestica</i>	Housefly	Rango	Yes/	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes When food is plenty	Yes/Yes
House Fly	<i>Musca sorbens</i>	Skin Fly		Yes/		Yes/Yes			Yes/Yes		Yes/Yes	
Fruit Fly	<i>Bactrocera melanotus</i>	Cook Islands Fruitfly	Ongaonga	Yes/Yes	Yes/Yes	Yes/Yes		Yes/Yes	Yes/Yes	Yes/No Minimal planting of food crops & vegetables	Yes/Yes	No
Fruit Fly	<i>Bactrocera xanthodes</i>	Pacific Fruitfly	Ongaonga	Yes/Yes	Yes/Yes	Yes/Yes		Yes/Yes	Yes/Yes		No	No
Blow Fly	<i>Chrysomya megacephala</i>	Latrine Blowfly	RangoAui ko	Yes/	Yes/Yes	Yes/Yes	Yes/Yes		Yes/Yes	Yes/No	Yes/Yes	Yes/Yes-No
Biting Midge	<i>Culicoides belkini</i>	No-see-'em Biting-Midge		Yes/Yes					Yes/Yes	Unsure Reports of a bug biting but unable to see	No	
Bug	<i>Homalodiscac oagulata</i>	Glassy-winged Sharpshooter		Unsure	No				Unsure	Unsure	No	
Thrip	<i>Gynaikothrips ficorum</i>	Cuban laurel thrip		Yes/					Yes?	Unsure	Yes/No	
Thrip	<i>Selenothripsru brocinctus</i>	red-banded thrip		Yes/					Yes?	Yes/Yes sever effect on vegetables	No	
Moth	<i>Agonoxena</i>	Coconut		Yes/	Yes/Yes	Yes/No		Yes/No	Unsure	Yes/Yes	Yes/No	Yes/No

	<i>argaula</i>	Flat-Moth			Becomes huge problem when numbers exceed that of its parasite			Under control		Appearing other motu, Serious threat that needs eliminating		
Wasp	<i>Polistesolivaceus</i>	Yellow Paper-Wasp	Rango Patia	Yes/Yes	Yes/Yes	Yes/Yes	Yes	Yes/Yes	Yes/No		No	No
Sea-star	<i>Acanthasterplanci</i>	Crown-of-Thorns	Taramea	Yes/Yes	Yes/Yes	Yes/Yes	Unsure	Yes/No	No	Yes/No Present but scattered & isolated	Yes/Yes Decimate corals	Yes/Yes Found once every 5-10 years
Land Mammal	<i>Mus musculus</i>	House Mouse	Kiore	Yes/Yes		Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes Large nos. on motus (Cooks)	Yes/Yes Destroys coconuts, taro & other fruits	Yes/No Very few on main land
Land Mammal	<i>Rattus exulans</i>	Pacific Rat	Kiore Toka	Yes/Yes	Yes/Yes A pest that attacks human food & fruits	Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes Large nos. on motus (Cooks)	No	No
Land Mammal	<i>Rattus norvegicus</i>	Brown Rat	Kiore Toka	Yes/Yes			Yes/Yes	Yes/Yes	Yes/Yes	Unsure	No	No
Land Mammal	<i>Rattus rattus</i>	Ship Rat	Kiore Toka	Unsure	No			Yes/Yes	Yes/Yes	Unsure	No	No
Land Mammal	<i>Sus scrofa</i>	Feral pig	Puaka	Yes/Yes	Yes/Yes pest to agriculture crops & damage roads	Yes/Yes	Yes/Yes wanderig pigs is the number one problem on Tukao	Yes/Yes destroyin g root crops & plantations	Yes/Yes damages crops & vegetable gardens		Yes/Yes destroys taro plantation & uproot Banana trees if not kept in pens	Yes/Yes Destroy taro plantations
Land Mammal	<i>Capra hircus</i>	Feral goat	Puakani'o	Yes/Yes	Yes/Yes pest to agriculture crops	Yes/No	No	Yes/Yes	Yes/Yes damages crops & vegetable		No	Yes/No Only 4 present

					& damages to land prone erosion				gardens			
Land Mammal	Felis catus	Feral cat	Kiore Ngiao	Yes/Yes	Yes/Yes	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes killing new born chicks	Yes/Yes
Bird	<u>Acridotheres tristis</u>	Common Myna	Manu Kavamani	Yes/Yes	Yes/No Close to eradication	Yes/Yes	No	Yes/Yes	No		No	No

Table 6: Summary of priority species identified during Pa Enea questionnaire survey

Island	Priority species - community areas	Priority species - Agricultural areas	Priority species – Motu (islets)
Aitutaki	Mile a minute Tree marigold Johnson grass	Mile a minute Tree marigold Morning glory Jambolan Johnson grass Lucaena	
Atiu	Fly (Rango tari one – Sceliphron spp. mud carrying wasp) Yellow paper wasp Coconut termite (<i>Neotermes rainbowi</i>) Housefly Mosquitoes	Fruit piercing moth Aphids Jambolan Feral pigs Acacia	Feral cat Pacific rat Feral pigs Coconut flat moth Ship rats
Mangaia	Dengue mosquito Wasp Centipede Sensitive weeds False elephant foot	Bissets bamboo Feral pigs Feral goats Rats Fruit fly	
Mitiaro	No-see-em biting midge Housefly Polynesian mosquito Latrine blowfly Feral pigs Rodents	Sensitive weed (<i>Mimosa pudica</i>) Jambolan (<i>pistati</i>) Burr grass Morning Glory Dodder Sudan grass False elephant foot Bissets bamboo	
Manihiki	Feral pigs Flies Rats Piripiri (<i>Triumfetta</i> weed) Purumu (Broom) Centipede	Feral pigs Piripiri Purumu	
Mauke	Rats Feral pigs	Java plum Acacia Feral goats	
Pukapuka	Feral Pigs Piripiri	Pigs	Piripiri
Rakahanga	Flies Mosquitoes White-fly Feral pigs Piripiri	Feral pigs Purumu White-fly	
Palmerston	(Areas not distinguished) Common guava Coconut moth Piripiri Beggar's tick Red-banded thrip Citrus rust mite Rats Feral cats Polynesian mosquito Housefly Fruit fly		

Table 7: Information relevant to inter-island biosecurity.

Island	Popn (2011)²	NES	Agriculture (Biosecurity trained)	Marine	Customs	Area (ha)
Aitutaki	1771	2	3 (2 with some training)	3	1	1805
Mangaia	562		8 (1 trained and done some training for others)	1	N	5180
Mauke	300	1	4 (none with recent training)	1	N	1842
Atiu	468	1	6 (1 trained who has trained others)	1	Police	2693
Mitiaro	189	1	2 plus fieldworkers? (One trained)	1	N	2228
Palmerston	60			1	N	405
Pukapuka	451			3	Police	506
Penrhyn	213			3	Police	984
Manihiki	238	1		5	Police	544
Rakahanga	77			1	N	405
Nassau	73			2	N	121
Manuae	0					617
Suvarrow	0	Seasonal rangers – how many, when?				40
Takutea (22km from Atiu)	0					122

² Note: populations on these islands are generally decreasing over time, with the population on Rarotonga showing a corresponding increase.

Annex 4: Attendees at NISSAP development workshops

Date : Wednesday 1st July 2015

Time : 8am – 3pm

Venue : New Hope Church Hall

Name	Organization	Contact
Hon Kiriau Turepu	Minister of Environment	
Vaitoti Tupa	Director - NES	Vaitoti.tupa@cookislands.gov.ck
Pavai Taramai	MoA	ptaramai@agriculture.gov.ck
Avaiki Aperau	Retired Agriculture officer	72587
Teuanuku Koroa	Mangaia Agriculture officer	20031
Nooroa Tokari	MoA	28711
Joseph Brider	NES	Joseph.brider@cookislands.gov.ck
Emily Onufer	Te Ipukarea Society	Emily.onufer@richmond.edu
Ngatoko Ngatoko	Director – Biosecurity	nngatoko@agriculture.gov.ck
Fred Charlie	Aitutaki – Agriculture officer	31267/55248
Tereinga Maoate	MoA	28710
Lydia Marsh	BTIB	lydia.marsh@cookislands.gov.ck
Liam Kokaua	TIS	liamkokaua@hotmail.co.nz
David Brundell	-	david@gardenzainparadise.com
Dr Mat Purea	HOM – MoA	Mat.purea@hotmail.com
Gerald McCormack	CINHT	gerald@nature.gov.ck
Maara Tairi	Atiu Agriculture officer	agri07@atiu.gov.ck
Tokai Ngaoire	Mitiaro Agriculture officer	76767
Maja Poeschko	MoA	28711
Kelvin Passfield	TIS	k.passfield@tiscookislands.org
Tiria Rere	MoA	28711
Dorothy Solomona	MMR	d.solomona@mmr.gov.ck
Otheniel Tangianau	Pa Enuua – OPM	Otheniel.tangianau@cookislands.gov.ck
Basilio Kaokao	NES	58025
Dan-Olaf Rasmussen	NES	Olaf.rasmussn@cookislands.gov.ck
Reboama Samuel	RR682	682downsouth@gmail.com
Hilary Ayton	MMR	77365
Brian Taire	MoA	briantairea@agriculture.gov.ck
Matthew Rima	NES	matthew.rima@cookislands.gov.ck
Moana Tetauru	MoA	moana.tetauru@cookislands.gov.ck
Maru	MoA	
Elizabeth Munro	NES	Elizabeth.munro@cookislands.gov.ck
Dr Dave Butler	Consultant	d.butler@xtra.co.nz
James Heather	Planter	
Tetupu Apera	MoA	
Louisa Karika	NES	louisa.karika@cookislands.gov.ck



Photo: NISSAP Workshop Participants, 2015. Source: NES

NISSAP Workshop with Pa Enea Participants

Date: Thursday 2nd July 2015

Time: 9 – 2pm

Venue: Ministry of Agriculture conference room

Name	Organization	Contact
Dr Dave Butler	Consultant	d.butler@xtra.co.nz
Maara Tairi	Atiu Agriculture officer	agri07@atiu.gov.ck
Tokai Ngaoire	Mitiaro Agriculture officer	76767
Fred Charlie	Aitutaki – Agriculture officer	31267/55248
Teuanuku Koroa	Mangaia Agriculture officer	20031
Basilio Kaokao	Mauke NES officer	58025
Elizabeth Munro	NES	Elizabeth.munro@cookislands.gov.ck



Photo: L - Maara Tairi, Agriculture officer of Atiu and R- Basilio Kaokao, Environment officer of Mauke presenting their group work during the NISSAP workshop on Rarotonga, 2015. Source: NES



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

