NIUE
STATE OF ENVIRONMENT REPORT
2019

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NIUE
STATE OF ENVIRONMENT REPORT

2019

DEPARTMENT OF ENVIRONMENT

SPREP Library Cataloguing-in-Publication Data

Niue: State of the Environment Report 2019.
Apia, Samoa : SPREP, 2021.

184 p. 29cm.

ISSN: 978-982-04-0971-2 (print)
978-982-04-0972-9 (ecopy)

1. Environmental impact analysis – Niue.
2. Environmental policy – Niue.
3. Conservation of natural resources – Niue..
I. Pacific Regional Environment Programme (SPREP).
II. Title.

333.7209626

Cover photo by Huggard Tongatule.

Other photos: Unless otherwise acknowledged, all photos were taken by Huggard Tongatule.

Designed by: The Little Design Company, Nelson, New Zealand.

An initiative of the African, Caribbean and Pacific Group of States funded by the European Union.

This document has been produced with the financial assistance of the European Union and the United Nations Environment Programme. The views expressed herein can in no way be taken to reflect the official opinion of the European Union or the United Nations Environment Programme.

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Our vision: A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.

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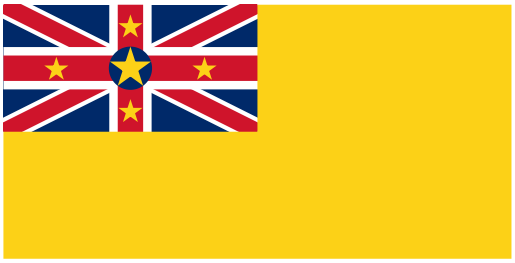

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ACKNOWLEDGEMENTS

The Niue State of Environment report was developed by Niue's Department of Environment and the Secretariat of the Pacific Regional Environment Programme (SPREP). Content contributions were made by numerous representatives from government, universities and NGOs listed below. There are many others not listed who also helped in the data gathering, analysis and design, without whom it would not have been possible to develop a report of this complexity and scope. Their contribution is greatly appreciated, and we apologise for any unintentional omissions.

Atmosphere and Climate

Climate Change, Meteorology Service, Department of Environment

Water

Utilities, Department of Health, Department of Environment

Land

Department of Agriculture, Forestry and Fisheries, Department of Environment, Tāoga Niue, Justice Department

Marine

Department of Agriculture, Forestry and Fisheries, Department of Environment. Olive Andrews – (SPWRC, Whaleology, Conservation International). Fiafia Rex (Oma Tafua).

Biodiversity

Department of Agriculture, Forestry and Fisheries, Department of Environment

Culture and Heritage

Tāoga Niue, Tourism Niue, Department of Environment

Built Environment

Department of Environment, Niue Power, and the Justice Department

The section on marine mammals was contributed by Olive Andrews, South Pacific Whale Research Consortium/ Whaleology/ Conservation International and Fiafia Rex, Oma Tafua.

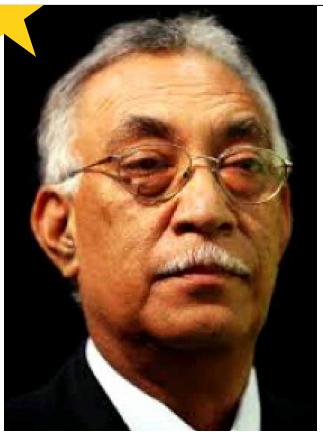
A special mention of the following individuals for their help: Josie Tamate (Director General, Ministry of Natural Resources), Sauni Tongatule (Former Director, DoE), Haden Talagi (Director, DoE), Charlotte Pihigia (Climate Change, DoE), Huggard Tongatule (Biodiversity, DoE), Poi Okesene (Director, DAFF), Rossy Mitiepo (Director, Met Service), Andre Siohane (Director General, Ministry of Infrastructure), Speedo Hetutu (MoI), Moira Enetama (Director, Taoga Niue), Zarn Kavisi (Taoga Niue), Birtha Tongahai (Director, Education), Grizelda Mokoia (DoH), Andy Manu (DoH), Brendon Pasisi (Director, NOW), Olive Andrews (SPRWC).

Also many thanks to Stuart Young (provision of maps), Melanie Bradley, Whitney Isenhower, Sela Soakai-Simamao, Robin South and SPREP staff for their input and revisions of the report.

ACRONYMS

ABS	Access and Benefit Sharing
ADB	Asian Development Bank
ADO	Automotive Diesel Oil
CBD	Convention on Biological Diversity
CFC	Chlorofluorocarbon
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
DAFF	Department of Agriculture, Forestry and Fisheries
DoE	Department of Environment
DoH	Department of Health
DoU	Department of Utilities
DPSIR	Drivers, Pressures, State, Impact, Response
DWSP	Drinking Water Safety Plan
EIA	Environmental Impact Assessment
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FPAM	Forest and Protected Area Management
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Product
GHG	Greenhouse gas
GoN	Government of Niue
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HFCA	Huvalu Forest and Conservation Area
ICRI	International Coral Reef Initiative
IFAW	International Fund for Animal Welfare
IUCN	International Union for the Conservation of Nature
LPG	Liquid Petroleum Gas
MEA	Multilateral Environmental Agreements
INDC	Intended Nationally Determined Contributions
NEMS	National Environmental Management Strategy
NEP	Niue Energy Policy
NGGI	Niue Greenhouse Gas Inventory
NGO	Non-Governmental Organisation
NISSAP	National Invasive Species Strategy and Action Plan
NiSERM	Niue Strategic Energy Road Map
NIWMS	National Integrated Waste Management Strategy
NNSP	Niue National Strategic Plan
NOW	Niue Ocean Wide
NPC	Niue Power Corporation
NZD	New Zealand Dollar
ODS	Ozone Depleting Substances
PACCSAP	Pacific-Australia Climate Change Science and Adaptation Planning Program
PICs	Pacific Island Countries
POPs	Persistent Organic Pollutants
SAIDI	System Average Interruption Duration Index
SOE	State Of Environment
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat for the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SPWRC	South Pacific Whale Research Consortium
UNFCCC	United Nations Framework Convention on Climate Change
WMP	Waste Management Plan

MESSAGE FROM THE PREMIER



Life in Niue exists because of the way our *tupuna* understood and used the land, the sea, the earth and the underground water lens for their survival. This traditional knowledge is passed from generation to generation, and it is part of our *Tāoga*, and our way of life.

The natural resources in Niue have helped shape our living standards, and our local and national economies. It is incumbent on all Niueans, to be the custodians of our cultural and natural heritage, and it is our responsibility to preserve and share it with our children, grandchildren and generations to come.

The environment is an important pillar under Niue's National Strategic Plan 2016–2026. The protection of the environment requires the contributions of all Niueans, as well as our global and regional partners.

I am pleased to present the 2019 Niue State of the Environment (SOE) Report, which comes 25 years after the previous one. This SOE captures the state of our resources, the impacts caused by our actions and recommendations on how we can do things better.

I would like to express my sincere appreciation to all the stakeholders who contributed to this report, through national consultations and personal communications, with the key drafting group. This report was developed under the leadership of the Department of Environment and in close partnership with SPREP.

It is my hope that all agencies from the government to civil society, and our partners and donors, use this SOE and the NEMS 2019–2023, to inform their actions and thinking for a bright future for all Niueans.

I invite all Niueans and friends of Niue, to help us address the challenges and forge a new alliance for a sustainable future.

Hon. Sir Toke Talagi
Premier of Niue

FOREWORD FROM THE MINISTER OF ENVIRONMENT

The changes to our environment are occurring at a rapid pace. Some are due to global drivers such as globalisation, economic and technical developments and climate change. Other changes are driven by our actions, such as mass migration leading to declining population on the island. Our people are embracing contemporary lifestyles and outside cultures, often at the expense of our traditional knowledge and cultural values. Some of these drivers are putting pressure on our natural resources and cultural heritage.

The specific areas highlighted in this SOE are a reflection of priority areas, which the government and the Niuean community are dealing with. Seven priority areas are identified in the report: Atmosphere and Climate Change, Water, Land, Marine, Biodiversity, Culture and Heritage, and Built Environment.

Our landmass and our population, provide both the challenge and the opportunity, to address these priority areas. But this requires the agreement and the engagement of all our people, as well as our national, regional and global partners. Climate change is impacting our way of life in Niue. Category five cyclones are no longer a once in a lifetime event, but are the norms, if climate modelling and predictions are to be expected. We can, and we will, continue to do all that we are capable of, to lessen the impacts on our people and infrastructure.

Waste and sanitation are localised threats to our environment. These issues are well within our means to address them, but again, it requires the cooperation of every resident in Niue. We must learn from the past, so we can have a brighter future. Our environment deserves better, and we must do better.

For us to be a proud nation, we must take pride in the work that we do. Everything starts at home. Our language, our traditions and our ceremonies are our *Tāoga* that must be passed to the future generations.

If we fail to take into account lessons from the past and the recommendations in this SOE, we risk the opportunity to develop and grow into a strong nation. The 2019 SOE recommendations are reiterated in the National Environmental Management Strategy (NEMS) 2018–2022, which is Niue's blueprint on strategic environmental planning and actions, over the next five years.

Hon. Dalton Tagelagi
Minister for Ministry of Natural Resources

MESSAGE FROM THE DIRECTOR GENERAL OF SPREP

The natural environment has always been part of Pacific island cultures. It has shaped and influenced our way of life over the centuries and as the primary source providing for our Pacific communities, it has fed, clothed and kept us safe over the years.

Despite its immense value, our environment is under growing pressure due to economic development, tourism expansion, invasive species, and the threat of global climate change. Therefore, it is important that we continue monitoring and maintaining the quality of our environment for future generations.

The 2019 Niue State of Environment (SOE) report updates the last report completed in 1993. The report assesses seven themes as well as the baseline information for new and emerging environmental challenges. Four new themes are introduced in this report: Atmosphere and Climate, Biodiversity, Culture and Heritage, and Water. Other themes include Land, Built Environment, and the Marine Environment. Improving on the 1993 Niue SOE, this report is based on the collation of new data for all indicators.

The 2019 SOE will provide a baseline for future reports and can help Niue with national, regional and international reporting obligations, including those required under multilateral environmental agreements. This report has already informed environmental planning and decision making, and has guided the development of the National Environmental Management Strategy.

SPREP is pleased to have partnered with the Niue Government in developing this document, as well as the many other agencies and Civil Society Organisations that contributed to the consultative process.

I would like to sincerely thank the individuals and all the government ministries and departments for their contributions. It is important that regular updates to this SOE are conducted to assess Niue's environmental conditions. I encourage this report to be widely used to help track, manage, plan and report on Niue's natural resources and environment.

Kosi Latu
Director General
Secretariat of the Pacific Regional Environment Programme

EXECUTIVE SUMMARY

In terms of both population and land area, Niue is one of the smallest self-governing nations in the world. It is unique by its formation, as an uplifted coral atoll. It has a circumference of 64 km by road and extends 19 km from north to south. Niue is situated 480 km east of Tonga, 560 km southeast of Samoa and 2,400 km north-east of New Zealand. Niueans are New Zealand citizens.

The population of Niue has been declining since the 1970s and migration to New Zealand has been the leading cause. In 2013, 23,883 people identified themselves as Niuean according to the New Zealand census, and 79% of these Niueans were born in New Zealand (up from 66% since 1996).

DRIVERS AND PRESSURES IN NIUE

The low population and the small size of the island make any changes to Niue obvious. Social, economic, technological and cultural factors are the key drivers facilitating these changes. Short-term population increases from tourism and returning residents, and the export and import of goods, are some of the issues that influence Niue's society and environment. Of the many drivers influencing Niue, climate change stands out as one that will dictate present and future living on the island. The reliance of the people on resources that are vulnerable to climate change (e.g. fresh water, agricultural crops) creates a situation in urgent need of addressing.

THE STATE OF ENVIRONMENT IN NIUE

The themes of the SOE were selected by local stakeholders and experts to provide a checklist on the state of the environment for Niue. A number of sub-topics and indicators were identified under the themes to help focus the discussion and this SOE report. The following provides a summary of the themes in the 2019 SOE.

Atmosphere and Climate

The greenhouse effect and the ozone layer protect life on earth by regulating the amount of heat and ultraviolet radiation entering the atmosphere. Certain gases are trapped in the greenhouse forming a thick layer that prevents heat from escaping. As the earth's temperature rises due to the trapped heat, events such as melting of the icecaps, coral bleaching from elevated sea surface temperatures, and category five cyclones and hurricanes become prominent. Other gases contain compounds or substances that interact with the ozone layer causing it to break down, therefore allowing harmful ultraviolet radiation to get through. The UV radiation causes skin cancer, eye damage and death to cellular DNA. International protocols have been established in a global effort to control the use of many of these gases and substances. Niue is a contributor to the use of these gases and substances as they are found in common domestic and industrial equipment. Niue can, however, be proud to highlight that on the global scale its overall contribution towards reducing CO_2 in the atmosphere far outweighs its emissions. Two indicators are assessed under Atmosphere, specifically greenhouse gas (GHG) emissions and ozone depleting substances (ODS).

This theme assesses the state of Niue's climate and its contribution to the state of the atmosphere, focusing on the physical climate, GHG and ODS. For the physical climate: Temperatures will continue to rise with more very hot days predicted in the future. It is expected that sea surface temperatures will continue to rise. Rainfall patterns show no clear trends, but more days with extreme rainfall are predicted. The frequency of droughts is expected to remain more or less the same. Predictions are for fewer tropical cyclones but with increasing intensity. It is anticipated that sea levels will continue to rise, within a range of between 17 cm and 60 cm by the end of the 21st Century, and ocean acidification will continue to increase, threatening coral reef ecosystems. Most GHG emissions in Niue originate from the use of fossil fuels for the generation of electricity and the powering of motor vehicles. Efforts to manage GHG emissions have started including the installation of solar hot water heating, public education campaigns, increased grid penetration by renewable energy, use of renewable technologies, and the promotion of low emission fuel sources.

Freshwater

Access to water is a fundamental right for every person and it is expressed in Goal 6 of the global Sustainable Development Goals, and listed as a priority area under the SAMOA Pathway. Niue has nearly 100% penetration in public water access and supply. The infrastructure remains in fair condition, although a concerted effort to upgrade and replace some of the older equipment is needed. Cyclones and power failures have disrupted the distribution of water. The government is assisting by supplying rainwater tanks and bases. The government is also installing solar panels to generate electricity for the bore pumps, to ease the demand on the main grid. The current rate of water extraction is low but there is an expectation that the demand for water will rise, as government policies take effect in terms of increasing economic development, including tourism. Water quality remains a priority issue

and regular monitoring takes place. The water supply contains essential trace elements. Seawater mixing does occur in the deeper sections of the groundwater lens, which makes the water very hard but it is still safe for drinking. The levels of nitrates and pesticides in the water are very low and well within the safety limits imposed by WHO and the US standards. Bacterial contamination is detected in many of the sites and further attention is urgently needed. Water management is a government priority and legislation, policies, plans and guidelines have been developed to ensure water remains potable and accessible to all Niuean residents.

Land

This theme covers land use primarily through the forest and agricultural sectors. Niue's rainforest has declined to half of what it once was. Human settlement, agricultural conversion, extreme climate events (cyclones and droughts) and invasive species are contributing factors. The population decline due to migration has led to reduced agricultural activities and forest conversion in some areas. Abandoned agricultural lands have matured into secondary forests. A few pockets of primary forests remain intact in the heart of the island, with a big proportion found at the Huvalu Forest Conservation Area. Agriculture is important to most Niuean people, and most households have a plot used for planting of crops. About three per cent of the total land area is used for agriculture. Taro is the main crop planted, followed by copra, yams, lime, passionfruit, vanilla, kava, and noni. The livestock kept is mostly pigs and poultry, as previous efforts to farm cattle, goats and sheep were unsuccessful. Land degradation has been exacerbated through a number of practices, including shifting nature of agriculture combined with significantly reduced fallow periods, previous large scale land clearance for export cropping of taro, and increased reliance on synthetic fertilisers and herbicides. Niue's soil condition is variable but generally well drained and porous.

Marine

Niue's coastline is comprised of cliffs with terraces and a narrow, subtidal fringing reef that descends to over 1000 m within 5 km from the shore. There is no barrier reef or lagoon and beaches are limited. The windward side (the east coast) is exposed especially to prevailing south winds, whereas the leeward side has a bit of a reef flat, with sheltered areas and is the side where most of the fishing takes place. The reefs are still recovering from cyclones and coral bleaching events that have occurred in the past few years. Marine plants, especially macro-algae and crustose coralline algae, dominate the benthic community. Live coral cover varies considerably depending on habitats and sites. Sheltered areas, such as Tamakautonga and Tuapa, support high coral cover, whereas the exposed windward sites have low coral cover. Giant clams and sea urchins are the most common marine invertebrates, but biomass varies depending on the site. Sites that are accessible to fishers have a low biomass of giant clams and sea urchins. The abundance of the Grey-reef sharks at Beveridge Reef is greater than at any other site in the world. A protected area designation around Beveridge Reef and other submerged reefs, would help Niue achieve its commitment to conserving ten per cent of its coastal and marine areas by 2020. Niuean waters are an important wintering area for humpback whales. The number of whales sighted is increasing every year, supporting a growing whale-watching tourism industry. Commercial fishing in the EEZ has been low and the number of fishing licences being issued remains within the Government's plans. Better catch records are needed in this sector to allow for improved management of offshore and inshore fisheries stocks.

Biodiversity

With most of the tropical species originating in the volcanic island hotspots to the west of Niue, the central position of the island in the Pacific Ocean means species have been haphazardly introduced through ocean currents, swimming, migration or strong winds. Over many years, some of these species have adapted and evolved into unique species. Since the arrival of Niueans on the island, they have utilised the available biodiversity and interwoven it into their culture and traditions, their diet and daily living, and their folklore and legends. Some of the species have died out, whereas others are on the verge of extinction. This biodiversity loss is primarily due to human activities, and has been exacerbated by introduced invasive species and climatic events. The good news is that the size of the country and its population provide opportunities to put sustainable conservation practices and measures in place. Ultimately, it is important for all Niueans to understand that conservation is an important management tool towards responsible land tenure and ownership.

Culture and Heritage

Culture and the environment are inseparable forces that make Niue and Niueans the place and the people of today. The environment reinforces and strengthens culture, as every aspect of living is dependent on available resources. A strong culture is a good reflection of a healthy and intact environment. Indicators such as language, customs and ceremonies, social governance and respect provide a measure of how strong the culture is. Niueans have always had strong cultural ties to the land and at times apply a number of traditional conservation practices, such as closing off areas or restricting activities through the imposition of *fono* (a temporary control) or *tapu* (a longer-term taboo) involving sacred beliefs with a strong spiritual overtone. Niueans have a remarkable ability to read biological indicators, such as the flowering of a certain plant, which would indicate that a certain type of fish was readily available and use the cycles of the moon to time the planting of crops.

The origin of Niueans remains obscure but language and cultural ties link it to Samoa and Tonga. Conflicts with neighbouring islands were not recorded. Two main groups occupied the island with Motu residing to the northern

part of the island and Tafiti to the south. Captain James Cook called Niue the Savage Island after he failed to land there due to hostility shown by the locals. Whalers and ships passed through Niue often bringing diseases and other untold horrors to the people. In the early 1800's, a young Niuean named Nukai Peniamina travelled to Samoa where he learned Christianity. He returned to Niue in 1846 and introduced Christianity to the people. There was much resistance to Peniamina's effort and about 60 warriors of his family were required to protect him on his mission. Today, Niue celebrates Peniamina's legacy through a public holiday in October.

The impacts and changes to Niuean society have been significant. The close association with New Zealand is viewed by most as positive for the development and the wellbeing of the people. Many Niueans are proud of who they are, their culture and their island. Embracing these values while living in a culturally diverse New Zealand present challenges and opportunities. The fact that most Niueans grow up in New Zealand during the most active and productive time of their lives (from early teens to under 40 years) prepares them for a first world society. Skills gained through this period can be adapted to benefit Niue in the long run. However, incentives to bring these skills back to the island remain challenging. The bond between the individual and the family is strong and this is the incentive that is encouraging some of the Niueans to return back home.

Built Environment

The population density for Niue is the lowest in the Pacific Islands – 6.2 persons per/km^2. The capital Alofi, subdivided in to Alofi south and Alofi north, has the highest resident population with 33% (572 persons – 2017 Census). The low population base and the geographic distribution means that services (water, sanitation, energy, food, etc.,) are currently able to cope with the demand. As the nation continues to push for economic development especially in the tourism industry, these infrastructure services will need to keep pace with the demand. Energy, waste and sanitation are three key challenges under the Built Environment theme that need to be addressed as the nation continues towards its economic development. With very limited landmass, waste and sanitation are key priorities from an environmental perspective. The high importation of goods and the demand by locals for overseas products means that the waste problem will continue to mount. With many imported white goods and vehicles, the demand for energy will also increase. Efforts to import low energy demand goods, energy efficient vehicles and installations of renewable energy sources such as solar, will help in managing the energy needs and use for the country. Sanitation is improving with septic tanks but many of these tanks need to be replaced or upgraded to reduce any leachate to the environment.

Figure 1: The intricate patterns of a cave draws tourists to the area.

BACKGROUND

ENVIRONMENTAL REPORTING IN NIUE

Niue's last SOE was completed in 1993 as part of a regional effort coordinated by the Secretariat of the Pacific Regional Environment Programme (SPREP). At the time, environment was often subsumed under the major government departments, either as a unit or a division under the agriculture, fisheries or forestry sectors. The establishment of a stand-alone regional organisation in the Pacific to focus on the environment (i.e. SPREP in 1993) provided the catalyst for many governments to elevate the environment as a significant part of their governing structure. Since then, Niue has been able to provide regular reports to the CBD Secretariat to fulfil its party obligations. The last report submitted in 2014 was its fifth iteration, where the most up-to-date information on Niue's state of environment can be found.

Niue's environment legislation includes the Environment Act of 2003 mandating the establishment of the Environment Department and its core functions. The Environment Act 2015 provides for Niue's obligations to international agreements to which it is party. While Niue's environment legislation does not specifically mandate the completion of a national state of environment report on a timely basis, one of the Environment Department's functions is environmental planning and natural resource management. This necessitates the need to regularly review the state and health of the environment and to develop informed management strategies to safeguard the environment and resources for all Niueans.

There is a special case to be made for Niue with regards to its environmental and sociological settings. Besides its geographic isolation, the declining population is perhaps the biggest challenge that it faces when it comes to the development and importantly the implementation of any policy, as well as meeting its obligations to international and regional agreements. As succinctly captured in its 5th National Reporting to the CBD:

"The key issue experienced by Niue in implementing the Convention on Biological Diversity is a shortage of human capacity. There are limited numbers of technically trained staff and significant time requirements involved in reporting on all the different Conventions and Agreements to which Niue is a party. It is difficult to maintain consistent efforts to address the threats to biodiversity and improve the status of species when available funding typically comes in large 2–3 year blocks with nothing in between." – Niue's fifth National Report to the CBD.

PURPOSE OF THE SOE

The government of Niue commissioned this State of Environment report with the purpose of:

- Providing all Niueans with the most up-to-date information on the state of the environment that is the backbone of the economy and community wellbeing; and
- Providing the government, community leaders and other decision makers responsible for the management of Niue's environment with an assessment of how effective management actions have been, so as to identify any deficiencies that need to be addressed for the future of all Niueans.

The State of Environment report looks at the major drivers of change in the environment that are facilitated and influenced by global, regional or national factors. By understanding these drivers, measures can be formulated that will help mitigate their impacts and preserve the integrity of the environment for Niueans today and in the future.

AUDIENCE

The audience for the State of Environment report includes:

- Government of Niue ministries and personnel, particularly those working in the environment sector, but also those working in the planning and infrastructure, health and education, natural resource management (especially in the fisheries, forestry and agriculture), and the tourism sector;
- Community/civil society groups, businesses, as well as all residents of Niue;
- Development partners and donor organisations;
- Non-governmental organisations;
- Private sector;
- Research institutions and their staff; and
- Those responsible for international instruments, including multilateral environmental agreements.

THE 1993 AND THE 2019 SOE REPORTS

The 1993 State of Environment report provided basic background information on Niue's environmental sectors, and was also a source of general and educational information on the environment and issues of concerns. One of the key challenges for the first SOE was the lack of baseline data to support environmental planning and policy. A review of the 1993 State of Environment report was not formally carried out. However, many of the issues noted in the 1993 report are included in this SOE. Issues relating to climate change, such as coastal erosion and storm damage, or the threat to the country's water lens were raised in the 1993 SOE. While these issues remain a concern today, some progress has been achieved through the implementation of various government policies, such as water security with rain-water tanks. Access to information has been improved through regional and bilateral partnership arrangements.

Water was a key issue in the 1993 SOE where an upgrade to the network was flagged, and management of activities around the bore water system was recommended. The septic system was considered inadequate and a number of bores had high faecal contamination. Progress since then includes the water safety plan, having a national water committee and the necessary legislation to safeguard Niue's water resources.

Land management was another important issue in the 1993 SOE. The four vegetation types of open areas, coastal forest, light forest and merchantable forest were noted and changes were largely attributed to agricultural activities. The declining population strongly influenced the changes seen in forest cover. Biodiversity, especially relating to the bird population, noted how abundant or uncommon some of the species were. The *peka* was the only native mammal reported, with the population noted as small. Introduced invasives including cats and rats were having a significant impact on the populations of birds, reptiles and crabs. Reptiles were commonly seen but population counts were a gap in the 1993 SOE. The coconut crab population was estimated at less than 200,000 individuals, mostly small specimens. Concerns about the state of the coconut crab led to a number of recommendations in the report including no harvesting of breeding females, minimum harvest size, banning exports and establishing crab sanctuaries.

The rugged coastline of the island makes access to the sea very difficult in many places. Despite this challenge, fishing continues to be an important part of the people's activities and diet. In 1993 it was reported that sustained fishing pressure with motorised boats may have contributed to overfishing in some areas and an overall decline in fish catch. The cheap cost of imported canned fish and the presence of foreign fishing vessels were other concerns. Imposing fono or a chiefly ban was noted as a positive measure for protecting fish stocks. Fishing within the EEZ was undertaken through a licensing agreement and fish catch data provided by the fishing vessels showed 5–8 mt of albacore and 1–2 mt of other pelagic species being harvested on a monthly basis. A precautionary approach was seen as the best way to manage fishing activities within the EEZ.

APPROACH TO THE 2019 SOE

Niue's SOE follows an internationally accepted approach for reporting on the environment – the drivers, pressures, state, impact and response model (Figure 2). Drivers are the factors that indirectly affect the environment. These drivers exert pressures that directly affect the environment, which may result in observable changes in trends or condition. The impacts of these changes will affect communities, economies and ecosystems. By understanding this system, informed responses can be applied to manage the various factors in this process. The links between the processes in the DPSIR model are not simple cause-and-effect relationships, but involve complex interactions, including cumulative and historical effects.

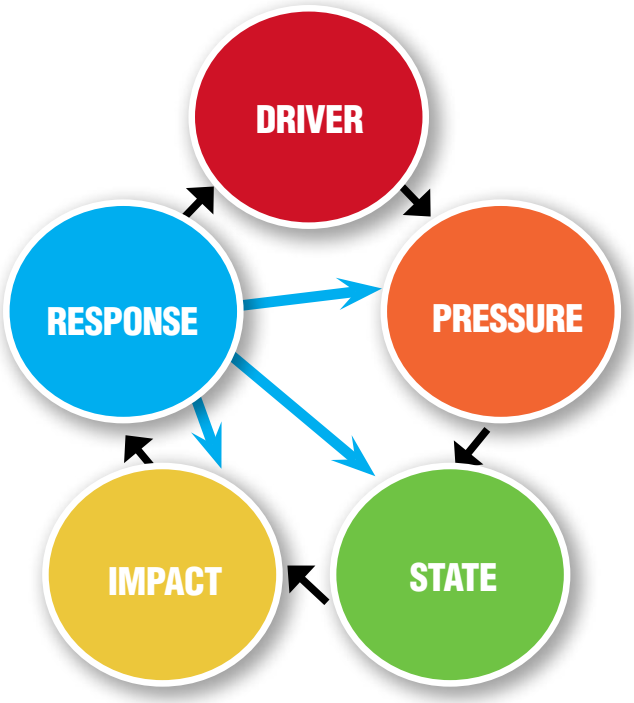


FIGURE 2. Drivers, Pressures, State, Impact and Response (DPSIR). model used for assessing the state of environment.

THEMES FOR THE 2019 SOE

Since the 1993 SOE, a number of policies, strategies and management programmes have been implemented to assist with improving the state and trends of the environment in Niue. The specific aspects of the environment that are assessed under this 2019 SOE are given in Table 1.

TABLE 1. Themes, sub-topics and indicators for Niue's State of Environment report

Theme	Sub-topic	Indicators	MEAs and Regional Framework
Atmosphere and Climate	Greenhouse Gases	Emission status and management efforts	SDG – Goal 13 (Climate Action) – Affordable and Clean energy; Goal 14: Life Below Water. SAMOA Pathway [Climate change; Sustainable Energy; Disaster Risk Reduction]. UNFCCC [Article 2, Article 4.1, Article 4.2] Kyoto Protocol NBSAP – Theme 7
	Ozone Depleting Substances	Emission status and management efforts	Montreal Protocol SAMOA Pathway – Climate Change (45)
	Physical Climate	Rainfall patterns	SDG – Goal 13 (Climate Action); Goal 14 (Life Below Water) SAMOA Pathway – Climate Change (44a-d)
		Temperature trends	
		Cyclone events and frequency	
		Ocean acidification	
Water	Water Infrastructure	Access to water network and water security Infrastructure management	CBD – Aichi Biodiversity Target: Goal C [Target 14] SDG – Goal 6 (Clean water and sanitation) NBSAP – Theme 6
	Water Quality	Testing programme on chemical and biological parameters	CBD – Aichi Biodiversity Target: Goal B [Target 8] SDG – Goal 6 (Clean water and sanitation) NBSAP – Theme 6
Land	Forests	Forest cover and change	CBD – Aichi Biodiversity Target: Goal B [Target 5; Target 7]; Goal C [Target 15] SDG – Goal 15 (Life on Land) NBSAP – Theme 1
	Agriculture	Land under cultivation	CBD – Aichi Biodiversity Target: Goal A [Target 4], Goal B [Target 7]; Goal C [Target 13] NBSAP – Theme 1
	Soils	Fertility	SDG – Goal 15: Life on Land NBSAP – Theme 1
Marine	Benthic Community	Benthos population	CBD – Aichi Biodiversity Target: Goal B [Target 6, Target 10] NBSAP – Theme 3
	Reef Biodiversity	Live coral cover	CBD – Aichi Biodiversity Target: Goal B [Target 6; Target 10] SDG – Goal 14 (Life below water) NBSAP – Theme 3
		Algal diversity	
		Echinoderm abundance	
	Reef Fish	Species richness, biomass and abundance	CBD – Aichi Biodiversity Target: Goal B [Target 6] NBSAP – Theme 3
	Marine Mammals	Population	CBD – Aichi Biodiversity Target: Goal C [Target 12] Convention on the Conservation of Migratory Species of wild animals NBSAP – Theme 3
	Subsistence Coastal Fisheries	Fish catch	CBD – Aichi Biodiversity Target: Goal B [Target 6] SDG – Goal 14 (Life Below Water) NBSAP – Theme 3
	Artisanal and Commercial Fisheries	Fish catch and state of fisheries stock	CBD – Aichi Biodiversity Target: Goal B [Target 6] SDG – Goal 14 (Life Below Water) NBSAP – Theme 3
	Marine Conservation Areas	Areas protected and biodiversity abundance	CBD – Aichi Biodiversity Target: Goal C [Target 11] NBSAP – Theme 3 SDG – Goal 14 (Life below water)

Theme	Sub-topic	Indicators	MEAs and Regional Framework
Biodiversity	Endemic, Threatened and Native Species	Population of keystone species and groups (reptiles, flying fox, birds, flora)	CBD – Aichi Biodiversity Target: Goal C [Target 12] SDG – Goal 15 (Life on land) NBSAP – Themes 2 and 4
	Environmental invasive species	State and abundance	CBD – Aichi Biodiversity Target: Goal B [Target 9] SDG – Goal 15 (Life on land) NBSAP – Themes 2 and 4
	Protected areas	Area protected and biodiversity	CBD – Aichi Biodiversity Target: Goal C [Target 11, Target 15] NBSAP – Themes 2 and 4 SDG – Goal 15 (Life on Land)
Culture and Heritage	Sites of National Significance	State of management	CBD – Aichi Biodiversity Target: Goal D [Target 18] Convention on the protection of the World Cultural and Heritage (WHC 1972) NBSAP – Theme 8 SDG – Goal 11
	Language	Number of people fluent in Vagahau Niue	UNESCO NBSAP – Theme 8
	Food Production and Consumption	Production and consumption	CBD – Aichi Biodiversity Target: Goal D [Target 18] NBSAP – Theme 8 Pacific Framework
	Ceremonies, Culture and Traditions		UNESCO
	Arts and Crafts		UNESCO NBSAP – Theme 8
Built Environment	Energy	State of energy accessibility, efficiency and sustainability	SAMOA Pathway – Sustainable Energy [47, 48, 50]; Oceans and Seas [53]; Sustainable Transportation [67] SDG – Goal 7 (Affordable and Clean Energy) NBSAP – Theme 5
	Waste Management	Management	SDG – Goal 12 (Responsible Consumption and Production) NBSAP – Theme 5
	Sanitation	Management	CBD – Aichi Biodiversity Target: Goal B [Target 8] SDG – Goal 6 (Clean water and sanitation); Goal 14 (Life below water: …by 2025, prevent and significantly reduce Stockholm Convention (POPs) UNCLOS Noumea Convention (Dumping Protocol, Emergencies Protocol) SDG 14 [Life below water – by 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution NBSAP – Theme 5

A READER'S GUIDE TO THE 2019 SOE

How to read the report

This SOE report condenses a large amount of information on various aspects of the environment. The report can be read as a whole or according to different themes, noting that most of the themes are connected to each other and to the pressures and drivers behind them. In addition, to allow for a summary of the state, trend and confidence in the assessment, symbols have been designed for each individual indicator.

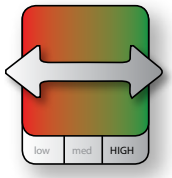
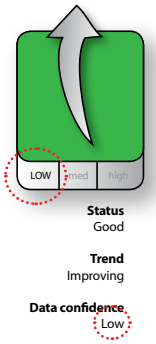
A guide to the symbols used

Many sources have been reviewed to collect useful information and data for this SOE report, and expert opinions have been sought to validate the authenticity of the information. While more data and knowledge has been generated since the 1993 SOE, much of the data was not collected in a consistent and timely manner. Therefore, it has been challenging to extrapolate trends.

The use of symbols should help the reader to understand the state of each indicator (Table 2 and Figure 4). It is hoped that using these symbols will provide an easy-to-understand synopsis and establish a baseline for comparing the state of each indicator/topic area in future assessments. The symbols include a state rating, trend rating and confidence rating. A Guide to Interpreting the Symbols table explains how to interpret the symbols and how they were typically derived during the assessment process.

FIGURE 3. Coconut crab

TABLE 2. A guide to interpreting the symbols

	CATEGORY	DESCRIPTION	HOW IS IT DERIVED?	EXAMPLE
State (can be a range)	**GOOD** **FAIR** **POOR**	The level to which the indicator meets or exceeds (good), is close to meeting (fair) or is well below (poor) a given standard for healthy ecosystems, habitats, species, watersheds or an urban environment.	Assessment is based on: Recent trends; • Comparison with similar jurisdictions; and • Comparison with "healthy" habitats and systems. Where little data exists to make an assessment based on these criteria, expert opinion is used.	
Trend	**IMPROVING**	The state of the environment related to the indicator is getting better.	Trends show a significant increase, or based on weight of evidence, indicators are improving.	
	DETERIORATING	The state of the environment related to the indicator is getting worse.	Trends show a significant deterioration, or based on weight of evidence the indicator is worsening.	
	STABLE	The state of the environment related to the indicator shows no detectable change.	Trends show no significant increase or decrease or, based on weight of evidence, the indicator is stable.	
	MIXED	The state of the environment related to the indicator shows a mixed trend; some worse, some better, some better and some stable	Used primarily for sub-topics with multiple indicators, or in cases where data shows two distinct trends.	
	UNDETERMINED	The state of the environment related to the indicator is unclear.	Not enough data exists to determine a trend.	
Confidence	**HIGH**	Confidence in the data and assessment process is high.	Data is of high quality and provides good spatial and temporal representation.	
	MEDIUM	Confidence in the data and assessment process is medium.	Data is either lower quality, geographically sparse or limited temporally.	
	LOW	Confidence in the data and assessment process is low.	Data quality is poor and does not meet any of the above criteria.	

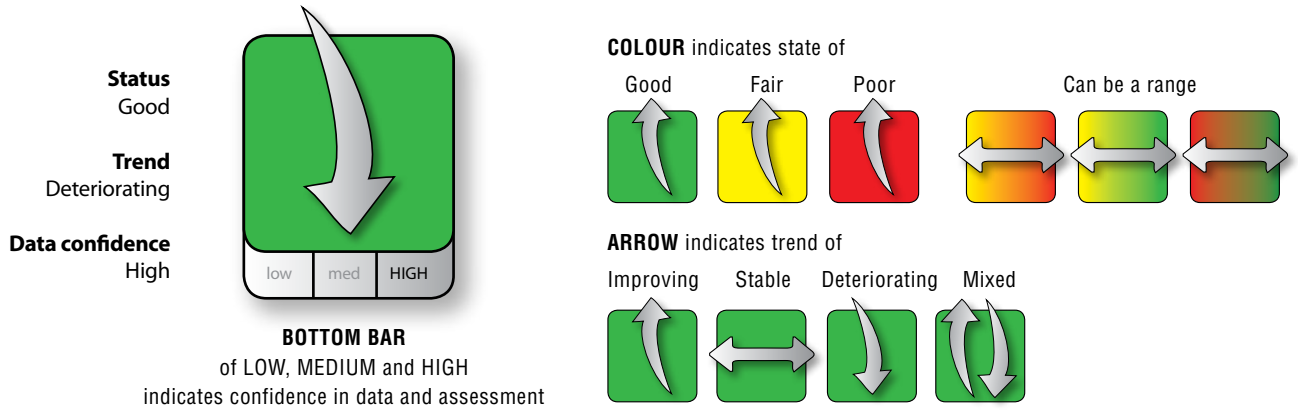


FIGURE 4. Explanation of the indicator symbol

SDG – Sustainable Development Goals

The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The SDGs provide clear guidelines and targets for all countries to adopt in accordance with their own priorities and the environmental challenges of the world at large. The goals are interconnected – often the key to success on one will involve tackling issues more commonly associated with another.

Throughout this report, the Sustainable Development Goals will be linked to the different indicators, by using the symbols shown in Figure 5.

FIGURE 5. Overview Sustainable Development Goals

Aichi Biodiversity Targets

The Strategic Plan for Biodiversity 2011–2020, under the Convention on Biological Diversity (CBD), consists of five strategic goals, including twenty Aichi Biodiversity Targets. An overview of these goals and targets is given in Table 3. The Aichi targets will be linked to the indicators in this report, using the different symbols.

TABLE 3: Overview of Aichi Biodiversity Targets

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
 **TARGET 1** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	**OBJECTIVE 1** People are aware of the value of biodiversity and the steps they can take to conserve and use it sustainably
 **TARGET 2** By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations
 **TARGET 3** By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations
 **TARGET 4** By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
 **TARGET 5** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 6** By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 7** By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 8** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	**OBJECTIVE 2** Both economic development and biodiversity conservation recognise and support sustainable livelihoods, cultural heritage, knowledge and expressions, and community resilience and development aspirations **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 9** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 10** By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	**OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	
 **TARGET 11** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites
 **TARGET 12** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance
 **TARGET 13** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	
 **TARGET 14** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites **OBJECTIVE 5** Manage threats to biodiversity, especially climate change, invasive species, over-exploitation, and habitat loss and degradation
 **TARGET 15** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	**OBJECTIVE 3** Identify, conserve, sustainably manage and restore priority sites, habitats and ecosystems, including cultural sites
 **TARGET 16** By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
 **TARGET 17** By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 18** By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	**OBJECTIVE 4** Protect and recover threatened species and preserve biodiversity, focusing on species and genetic diversity of ecological, cultural and economic significance **OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 19** By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5
 **TARGET 20** By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011–2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	**OBJECTIVE 6** Build capacity and partnerships that strengthen synergies between science, policy, local knowledge systems and indigenous sciences and enhance local and international agreements, to effectively mobilise resources to achieve Objectives 1–5

The State of the Environment report supports multiple reporting requirements. To make this reporting process more streamlined, icons are used to help readers identify which reporting requirements relate to which indicators.

Throughout this SOE report, a coconut symbol is used to indicate the mapping of the state of the environment indicators to the Niue National Strategic Plan.

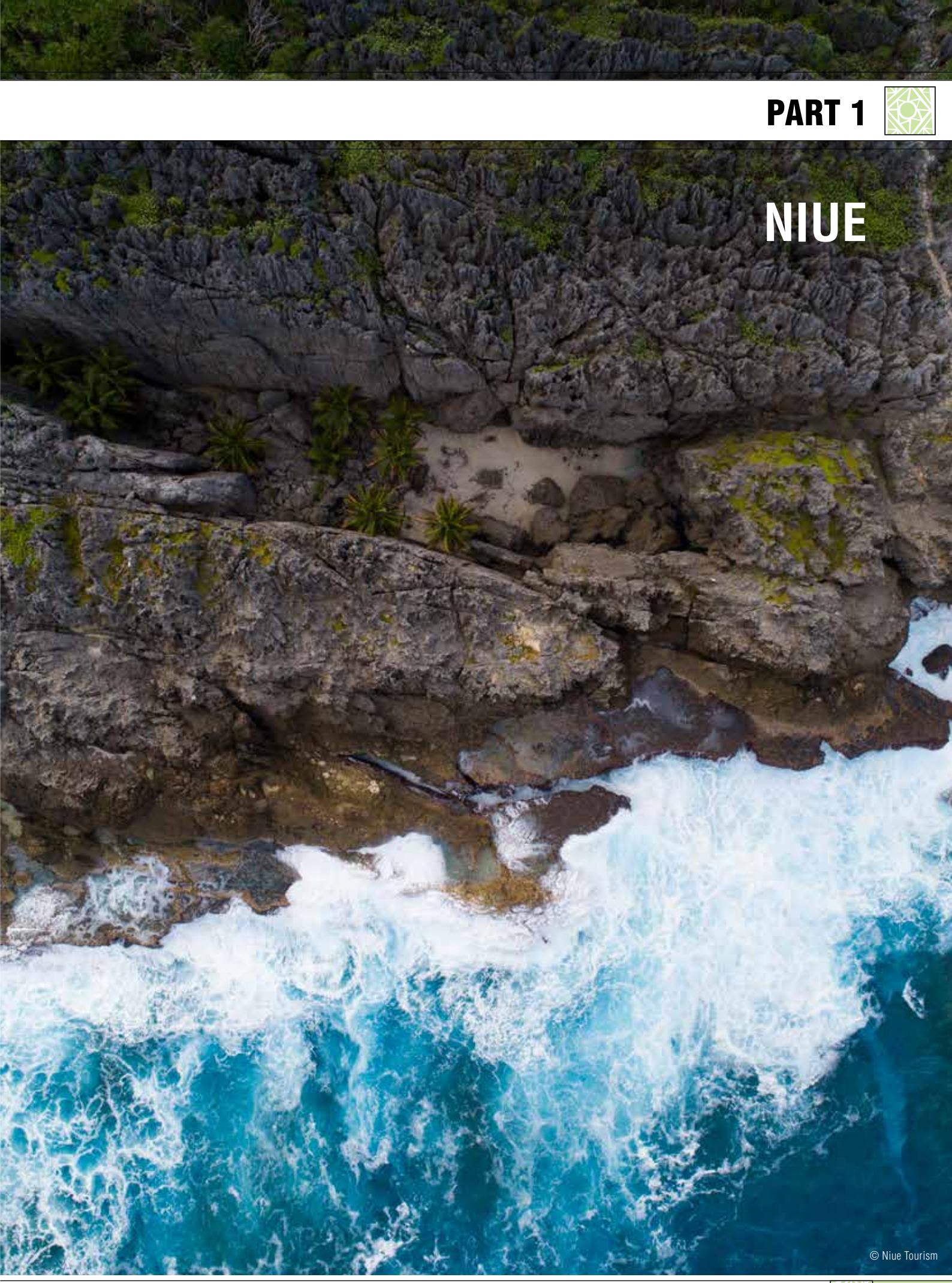
Table 4 gives an overview of all the SOE indicators used in this report, linked to the components of the Niue National Strategic Plan (NNSP).

TABLE 4: Alignment of the SOE Indicators to the components of the Niue National Strategic Plan (NNSP)

NISP Pillar			NNSP Component	SOE Indicators
1	Environment and Climate Change	A	Climate Change and Natural Hazards: A safe and resilient Niue to impacts and challenges of climate change	Greenhouse Gases Emissions (GHG), Ozone Depleting Substances (ODS)
		B	Natural Resources: Protection and conservation of Niue's natural resources through responsible, sustainable use and management for food and nutrition security that is sufficient, safe, affordable and accessible	Forest cover and changes, Agriculture (land under cultivation), Subsistence coastal fisheries
		C	Pollution: Reducing risks and protecting natural resources on land, marine and coastal resources from the impacts of pollution	Waste Management, Sanitation Access Management
		D	Sustaining Climate and Weather Services: Providing credible and timely weather and climate services	Physical Climate Trends: Rainfall patterns, Temperature trends, Cyclone events and frequency, Sea level rise, Ocean acidification
		E	Waste Management: Residents and visitors manage waste to protect the environment with minimum impact to public health	Waste Management, Sanitation Access Management
		F	Biodiversity: Protecting biodiversity, maintaining sufficient remaining habitats and ecosystems to support the population of all species and their genetic diversity	Endemic, threatened and native species, Environmental invasive species, Terrestrial protected areas, Marine Conservation Areas
2	Infrastructure	A	Energy: Continuous and reliable power supply transitioning to efficient renewable energy sources	Energy (Access, Efficiency, Sustainability)
		B	Water: Access to 24 hour water supply and safe potable drinking water, Water quality monitoring results	Access to water, infrastructure and water security, Water quality monitoring results, Sanitation Access Management
3	Finance and Economic Development	A	Fisheries and Marine Resources	Benthic Community, Reef Health, Reef Fish, Marine Mammals, Subsistence coastal fisheries, Artisanal and Commercial fisheries, Marine Conservation Areas
		B	Agriculture	Agriculture (land under cultivation), Soil Fertility, Food production and consumption
		C	External Relationship: Strong working partnerships. Simplified bureaucratic processes for faster access to funding, reporting and implementation	
		D	Tourism	Sites of National Significance

NISP Pillar			NNSP Component	SOE Indicators
4	Governance	A	National security: Residents and visitors live in a safe and secure environment	
		B	National emergency response and resilience: a strengthened emergency management sector with a well informed public who are prepared for adverse effects of disasters from natural hazards and emergencies	
		C	Government Services: Working for the people by being professional, and responsive, with fair and smarter work practices within a safe and healthy working environment	
		D	Human Resource Development: Well skilled workforce and ongoing training opportunities for lifelong learners	
5	Social Services	A	National, Sector and Village Development: Working together for national, sectoral and village development.	
		B	Public Information and Communication: A well informed public and information available	
		C	Health: Healthy lifestyle choices with well supported health services, and food and nutrition security that is sufficient, safe affordable and accessible	Food production and consumption, Sanitation Access Management
		D	Education: Quality, nurturing education services for happy, healthy and vibrant children	
		E	Land: Land availability for all	
6	Taoga Niue	A	All residents and visitors embrace and respect Taoga Niue	Language, Ceremonies, culture and tradition, Arts and Crafts
		B	Taoga Niue actively integrated from the home to the national level	
		C	The Cultural Bridge with Niueans abroad is strengthened	
7	Private Sector	A	Create and Capitalise on Market Opportunities: Assist businesses to benefit from tourism growth	Sites of National Significance

NIUE



© Niue Tourism

INTRODUCTION

Niue lies in the heart of the Polynesian triangle with the Samoan archipelago to the north, the Cook Islands to the east and the Kingdom of Tonga to the west, at coordinates of 19o South and 169o West (Figure 6). Niue is an independent, self-governing nation in free association with New Zealand. The total land area is 261 km² (26,146 ha) surrounded by 390,000 km² of exclusive economic zone (EEZ). Average land height above sea level is 23 metres and the highest point is just under 70 metres.

FIGURE 6. Map of Niue

There has been a steady decline in the population since the 1970s (Figure 7). Niue's population at its highest was recorded at 4,990 in the 1971 Census. By 1989 the population had declined by 37%, it then steadied at -1 to -3% annual decline up to 2009, when the population reached its lowest number of 1536 people, before increasing in 2011 (to 1611) and most recently in the 2017 Census (to 1716). Migration has been the leading cause of the decline. In 2013, 23,883 people identified themselves as Niuean according to the New Zealand census, and 79% of these Niueans were born in New Zealand (up from 66% since 1996) (SPC 1999; Statistics New Zealand 2014).

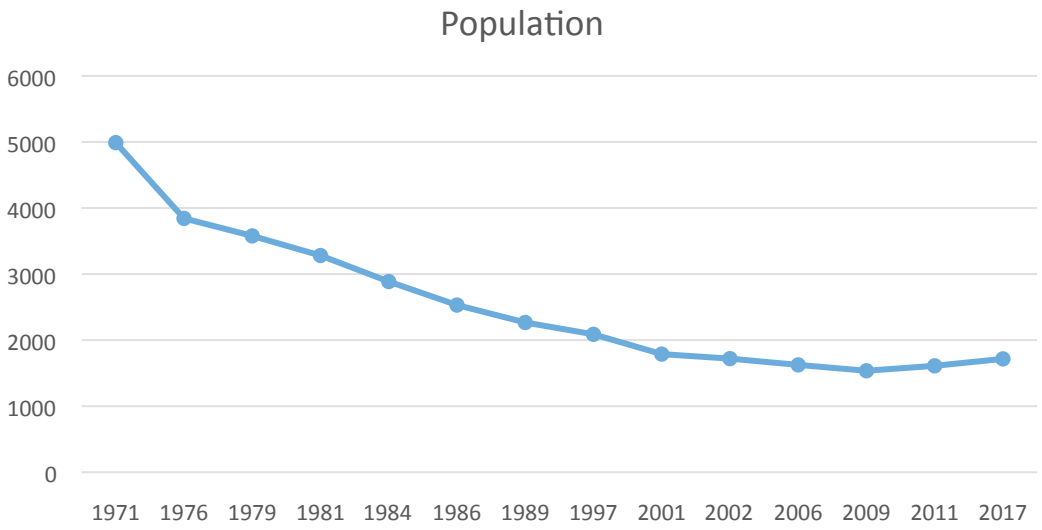


FIGURE 7. Population decline in Niue since the 1970s. Source: Statistics Department – Census.

Niue is in a challenging position as the population on the island steadily declines, with a corresponding increase in those living overseas, particularly New Zealand (23,883 in 2013 NZ Census). Migration to New Zealand and other Pacific islands is the main factor influencing the population of the country. A number of measures to counteract this high migration and to attract Niueans back to the island have been initiated with limited success (NBSAP 2015: 10).

Niue's economy remains highly fragile due to its small population, limited labour force, expensive and limited transport options, poor land quality and vulnerability to natural disasters (cyclones and droughts). The economy has traditionally been based on agriculture. The recent focus on tourism has seen a 56% rise in tourism sector earnings from 2010 to 2013 (Smith 2015). New Zealand remains Niue's biggest trading partner with 100% of exports and 90% of imports (GoN 2015a). Imported goods continue to dominate the national economy, with a steady rise since 2009 from NZD 11 million to NZD 18 million in 2015. The export of goods remains low, from NZD 1.5 million in 2009 to NZD 1.6 million in 2015 (Figure 8). A large bulk of the exports is the re-exporting of jet fuel, which accounted for 91.6% of overall export goods in 2015 (GoN 2015a). The trade deficit as of 2015 was –NZD $16,623,061, with an annual growth of 10.2% (GoN 2015a).

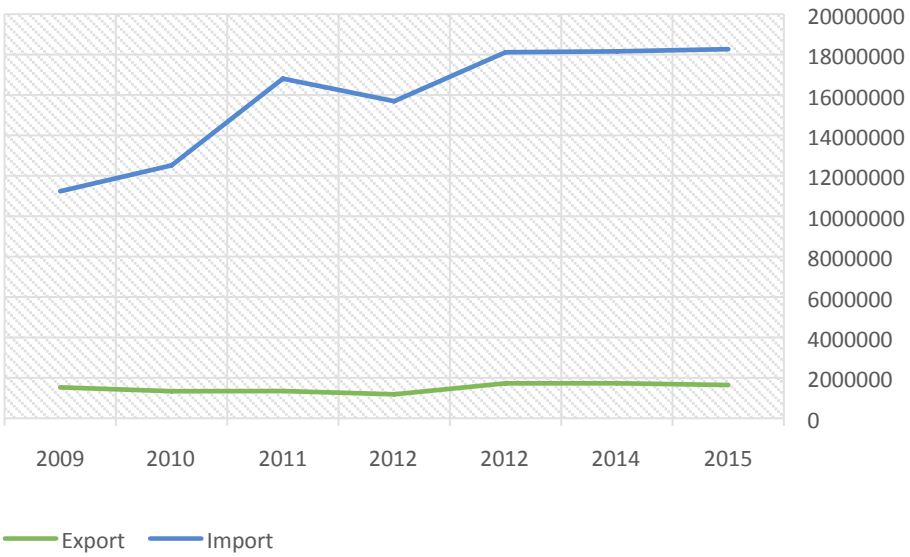


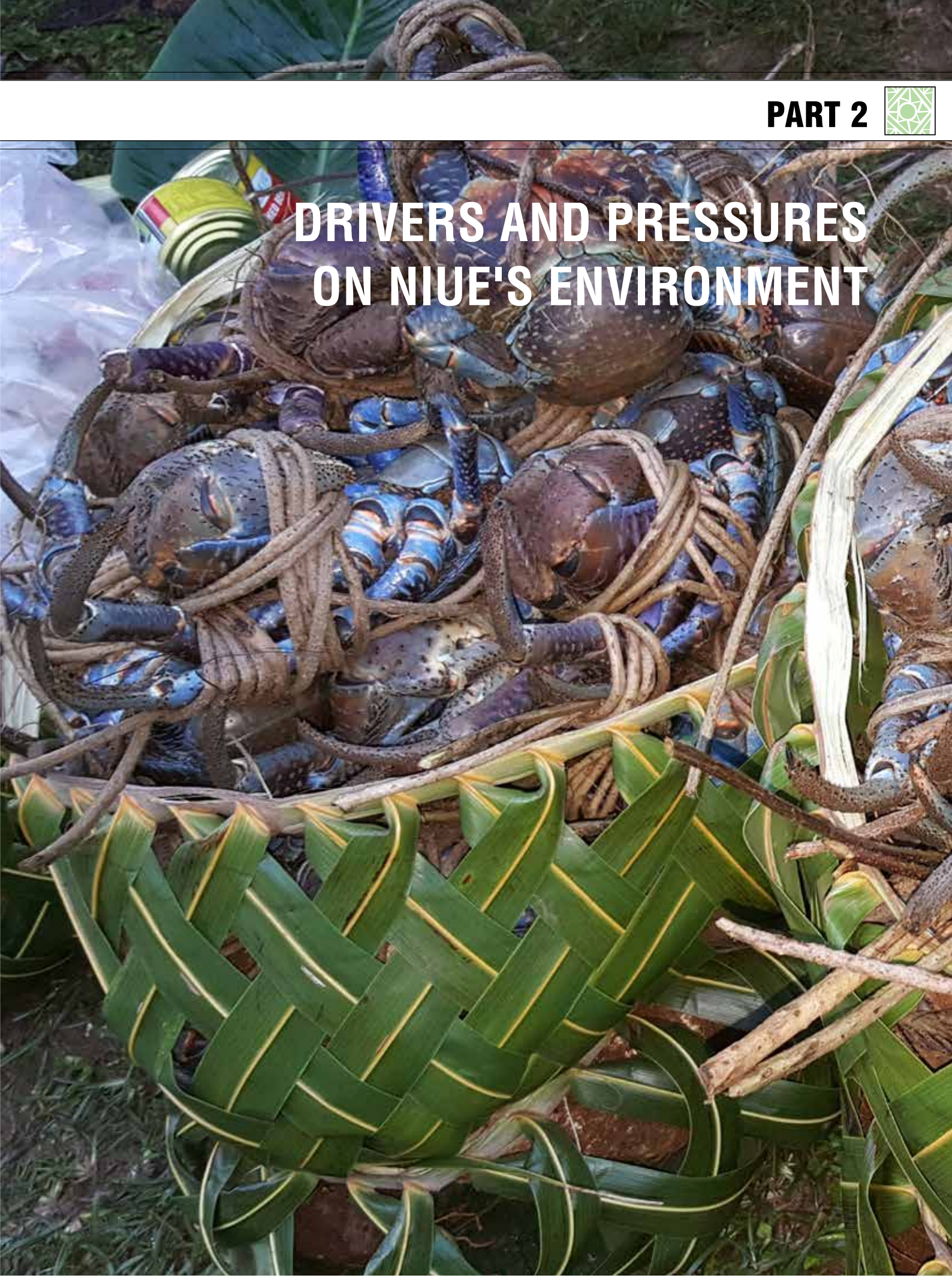
FIGURE 8. Value of Exports and Imports (2009–2015). in NZD. Source: GoN 2015a..

Niue's GDP remains one of the highest per capita in the Pacific, estimated at USD 16,675 in 2014, and this is largely due to assistance from New Zealand. Aid assistance to Niue for the 2015/16 period was NZD 22.5 million, of which New Zealand contributed 57%.

The environment remains an important priority for the government, and all Niueans and most of the ecological systems remain in relatively good condition. The environment is one of the seven pillars under the Niue ke Monuina (Niue's National Strategic Plan 2016–2026) of the government, which it advocates for sustainable use and management of natural resources and the environment for present and future generations. The key threats to Niue's biological diversity are invasive species, cyclones and droughts, although other pressures, including waste and sanitation are contributing to environmental degradation. There are very few endemic species found in Niue, and many are susceptible to human activities and natural disasters. The *peka (*flying fox), lupe (Pacific pigeon) and the *uga* (coconut crab) are hunted for food, and as such their numbers are on the decline.

"I look forward to a change in development attitudes, a change that will bring about a greater awareness of the Moui Faka-Niue and its relationship to our natural resources and the beautiful environment of Niue."

The Honourable Frank Fakaotimanava Lui – 1993 SOE



PART 2

DRIVERS AND PRESSURES ON NIUE'S ENVIRONMENT

DRIVERS AND PRESSURES

There are a number of global forces which drive changes with regards to our interaction with the environment. Many of these forces are beyond our control; however, we are contributing and often fuelling the speed of change.

For Niue's 2019 SOE report a number of broad drivers were identified including:

- Population decline and demographic change
- Globalisation and geography
- Climate change impacts and variability
- Economic and technological development
- Traditional and contemporary values, attitudes, lifestyles and governance

Driver 1. Population decline and demographic change

While excessive population growth is a major challenge for many countries, Niue's population decline has resulted in some environmentally positive impacts (e.g. increasing forest cover), but also some social challenges (e.g. decline in cultural knowledge). The high migration by indigenous Niueans to New Zealand and Australia, is contributing to a slight ethnic demographic shift in the country (Figure 9).

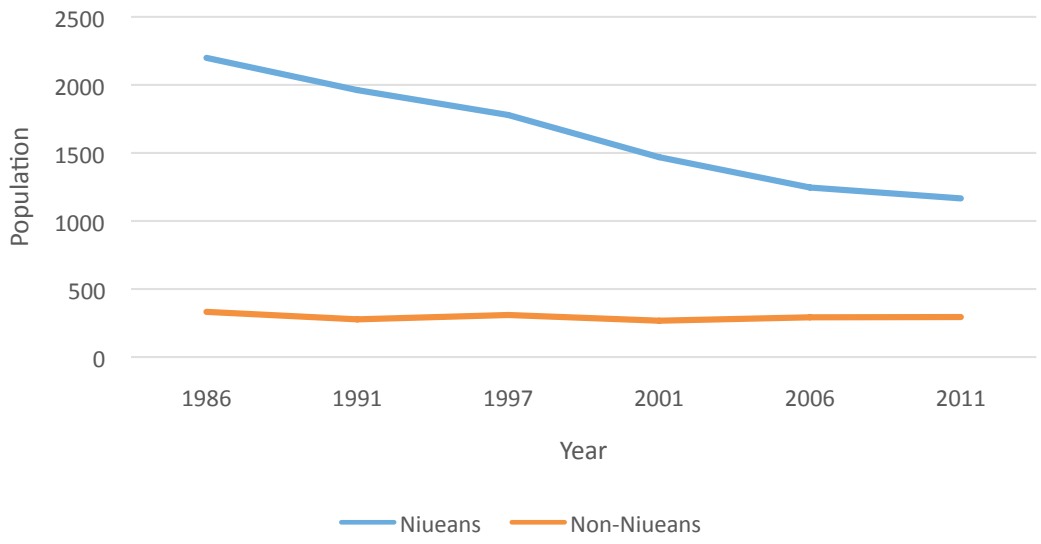


FIGURE 9. Population trend between Niueans and non-Niueans. Source: Statistics Department 2011.

Driver 2. Globalisation and geography

The geographic isolation of Niue from major trading markets, provides a distinctive disadvantage for the country to trade and participate in the global market. Materialism, associated with globalisation on the other hand, has infiltrated Niue.

Driver 3. Climate change impacts and variability

Climate change adaptation measures can strengthen the resilience to negative impacts from climate change, and build the capacity to better adapt to changing climates. The costs of adaptation can be expensive. Soft measures such as the protection and sustainable management of at risk coral reef habitats, replanting of native trees, and investing in rainwater catchment tanks for households or local communities, are cheaper options. Climate change adaptation measures are designed to allow communities to handle a changing climate, and reduce the negative impacts of doing nothing, or very little.

Driver 4. Economic and technological development

With growth in Niue's tourism sector and greater access to global markets, the economic drivers have changed.

Globally, from 1970 to 2010, there has been a rise in the contribution of the service industry sector to GDP, and a fall in the contribution of the agricultural and fisheries sectors to GDP. This is also the case for Niue.

Economic growth and a declining private sector have mixed impacts on the environment and society. As economic drivers have shifted from resource-based to services and trade, this has increased the urban economy, where most services are based. The decline in the resource-based economy, has led to an underperforming rural economy. Technological development can have positive and negative impacts on the environment. For example, improved technology can lead to larger fishing grounds with the adoption of power boats over canoes. It can bring about more environmentally sensitive and efficient extraction, shipping and processing methods. Technology also influences society, bringing access to a global culture. Electronic waste or e-waste can increase the burden of an already challenging waste management situation.

Driver 5. Traditional and contemporary values

Lifestyle, behaviour and values are important drivers of environmental change, and are often strongly linked to other drivers, such as income and globalisation. Increases in Niuean incomes, coupled with a globalised transport sector, has allowed for better access to imported items. Cheaper goods can increase the reliance on imports, which can change traditional cultural values and behaviours.

Education is another important indicator of the cultural change driver. Access to education, particularly secondary and post-secondary, can have profound impacts on the environment through a change from subsistence to a service-based economy, greater environmental awareness, and increased adoption of contemporary values and lifestyles over traditional ones. Most Niueans aged 15 and over are educated in New Zealand or elsewhere.

PRESSURES

This section highlights the key pressures on Niue's environment and society created by the overarching drivers identified above. Pressure indicators present data about the main human activities that could adversely affect the environment, and each indicator is linked to at least one of the drivers. Pressure indicators are organised using three classifications: land development, resource extraction and consumption and waste.

Pressure 1. Land development

AGRICULTURE

With the increased demand for foreign earnings, there has been a considerable push to clear land for agricultural purposes. However, agriculture has declined partly due to out-migration, and also to global market competition.

The recent decline in agriculture is of concern, with far reaching social and environmental impacts, for several reasons. Firstly, a serious agricultural decline can create food insecurity, especially in vulnerable small island nations. Secondly, a reliance on imported foods and goods introduces more waste packaging to an overburdened waste management system. Thirdly, the agricultural decline contributes to the already few agricultural opportunities within the country.

URBAN DEVELOPMENT

Urban development is not a serious issue in Niue because of the small (and declining) population, although the pressure to increase tourism infrastructure may have some similar long-term impacts. Urban development puts pressures on the environment by increasing the removal and fragmentation of sensitive habitats. Also, more development increases waste discharge, in particular sewage and solid waste. A complicating factor is that the impacts of the new building codes are not yet evident on the historically poorly designed waste and sanitation infrastructure. Over time, expanding the urban area and tourism infrastructure, without expanding sanitation systems, will lead to overload.

INVASIVE SPECIES

The spread of invasive species is a serious problem for many Pacific islands countries and territories. The impact, from species that were deliberately or accidentally introduced to the country, can be serious. These species predate on or displace native species, carry diseases or alter ecosystem functions, either by overwhelming the system with their population, or producing toxins that can harm the local fauna and flora, or the community. Besides the environmental impact caused by these species, there is also an economic cost to the community. Agricultural pests, such as fruit flies, can lead to economic collapse if they are not treated.

Increased globalisation and connectivity to the world bring more invasive species to Niue. However, the main pathway for spread is infrastructure related to development such as roads, urban expansion and agriculture. Natural disasters such as cyclones give invasive plants more resources, such as space and sunlight, and can result in a long-term domination of biomass.

Pressure 2. Resource extraction

FORESTRY LOSS

Remains of original forest are rare but some large trees survive in the Huvalu protected area. As the population has declined through out-migration, pressures on forests have been reduced, allowing for regeneration. However, the 2004 category five cyclone Heta did enormous damage to the whole island, with some 60% of trees suffering some damage.

Land clearing for agriculture, and for use of forest products, has had a major impact on forest cover since colonisation around 1,500 years ago. Between 1990 and 2000, Niue lost an average of 200 hectares of forest per year. This amounts to an average annual deforestation rate of 1.18%. Between 2000 and 2005, the rate of forest change increased by 13.3% to 1.33% per annum. In total, between 1990 and 2005, Niue lost 17.7% of its forest cover, or around 3,000 hectares.

The expansion of agriculture is generally one of the chief causes of deforestation, where the key agricultural activity is the growing of taro for export. Prior to the 1950s evidence suggests that Niue was well forested, with up to 90% forest cover. Recent comparative studies using forest cover maps revealed the primary and regenerating forests have been reduced by 30% from 1966 to 1994, with the greatest percentage reduction occurring from 1981 to 1994. This intensified period of deforestation occurred at a time where Niue was undergoing its most rapid depopulation.

Actual logging of the high rainforest for timber contributed only a small percentage in the forest loss between 1966 up to the present day. The local timber industry had an annual harvest of 230m^3 in the late 1990s, and currently is well below that. All of which lie within the sustainable logging level of the indigenous forest of Niue, determined as being 3,500m^3. The small timber industry provides import substitution for local construction needs and is supportive of the sustainable concepts and methods of harvesting being advocated.

FISHING

Niue's fisheries consist of motorised boat fishermen and canoe fishermen within the territorial seas, and the annual catch by these artisanal fishermen is up to 30 metric tonnes. There are at least 100 canoe fishermen, and 53 motorised boats fishing for the local market. The catch from bottom fishing by dinghies is mostly snappers, from pelagic fishing by dinghies mostly wahoo then yellow-fin tuna, and from pelagic fishing by canoes largely yellow-fin. Within the inshore fisheries, the development of a sports fishery, where charter vessels have been serving tourists, has steadily grown to at least 11 registered vessels. Sports fishing ranges from trolling to open water spearing of prize fish such as wahoo, mahimahi and tuna.

The Fisheries Unit has prepared a management plan for the offshore fishery including four tuna species, wahoo, billfish (marlin, sailfish, swordfish), and by-catch species such as shark and matimati (snake mackerel). All species of shark and ray are protected in the EEZ under a 1996 Act.

Most fishing and collecting of invertebrates occur on the side of the island protected from the prevailing south-easterlies. The natural inaccessibility of the eastern coast means that this area plays an important role in marine conservation.

Niue has provided offshore fishing licences on a sporadic basis and these have resulted in variable catches. The documentation of the catches isn't maintained in a centralised area, thus most of what has been reported is based on estimates.

Pressure 3. Consumption and waste

With the growth in household incomes and a globalised transport sector, demand for imported goods has increased, particularly for consumer and electronic goods. The dramatic increase in household ownership of white goods and televisions is an example of this higher demand for imported consumer goods and electronics.

SOLID AND LIQUID WASTE

In general, the waste management regimes within many Pacific island countries struggle to keep up with the rising consumption and associated waste patterns of their citizens, and their tourism sectors. This is largely due to limited physical space for disposal of the waste products, and a lack of financial and human resources to meet the growing waste management challenges. Waste is likewise a serious and growing problem in Niue, which is seeing the entry of more non-organic waste products. Solid waste items including plastics and glass are a particular problem, as there is limited room for land-filling and storage of the waste items. The tourism industry is one source of introduced waste products. Hazardous wastes, such as electronic wastes (e-waste) and bulky goods, have also increased. The rising demand for imported goods, as a result of more disposable income, is worsening the waste problem as more goods are introduced without adequate waste management infrastructure to support their waste streams.

Management of sewage is a significant challenge. All sewage is managed through septic systems, most of which are very old and at, or over, capacity. Poor sewage management creates numerous pressures on environmental and human health. Human and animal wastes introduce high levels of bacteria and nutrients, and have the potential to impact the safety of the water supply system.

WATER USE

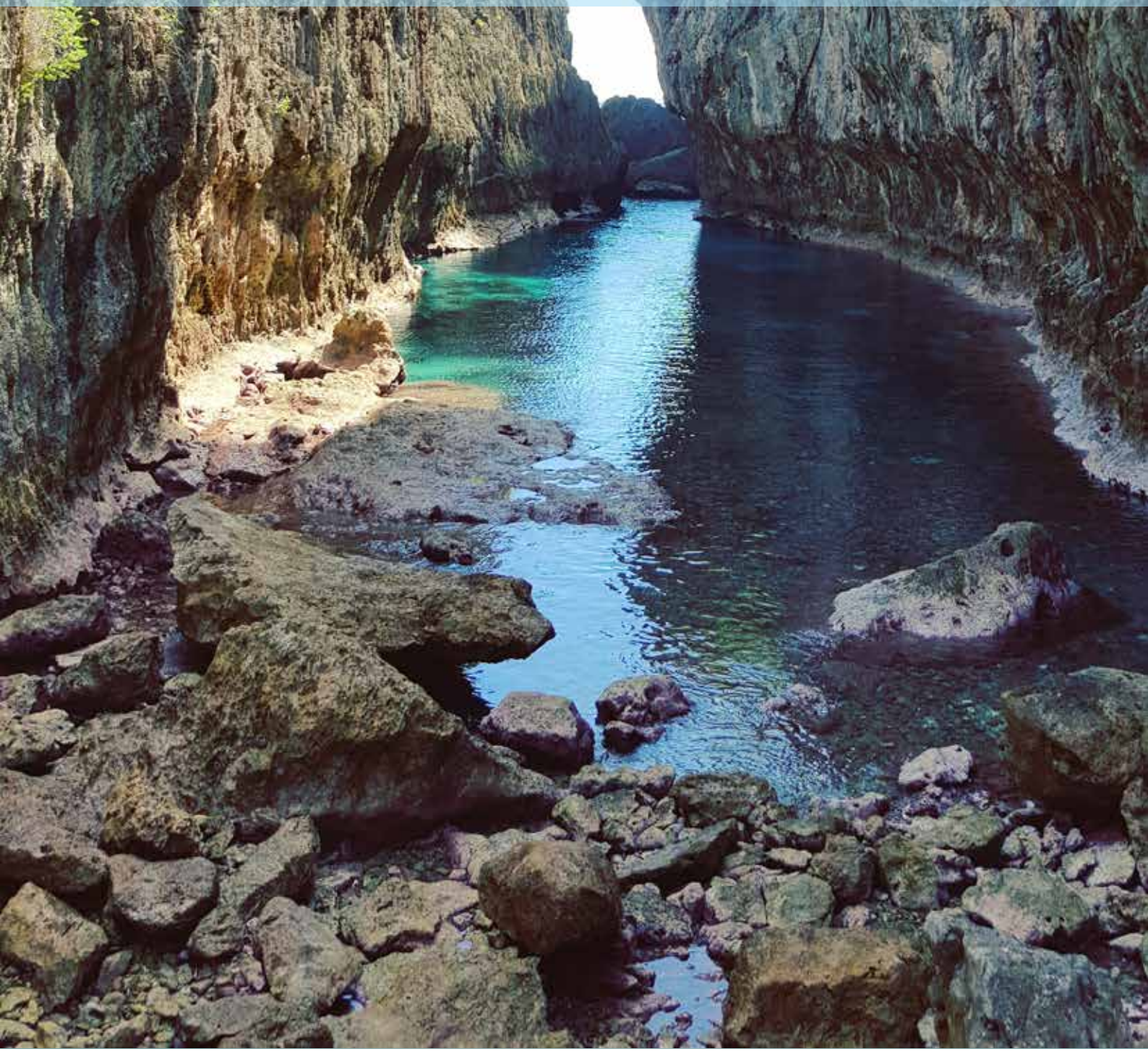
Water consumption for drinking, agricultural and domestic uses is another environmental pressure in Niue. Out-migration reduces domestic water use, but changes in tourism infrastructure will place new demands on the water supply. Preservation and sustainable use of water from the lens is of utmost importance, as well as the protection of supplies from contamination. The upkeep of the water distribution system, including repairs to leaking pipes, is an on-going issue. Installation of domestic rain collection tanks is one measure being undertaken to conserve supplies from the lens.

ENERGY CONSUMPTION

Niue's energy source is mainly from fossil fuel. About 1.27 million litres of diesel was imported in 2014 to generate electricity. The remainder of the imported energy source goes to the transport sector. Currently, there is no up-to-date figure to show the energy use trend at the national level, but there is evidence that the demand for energy is rising.

PART 3

STATE OF NIUE'S ENVIRONMENT, THE IMPACTS AND RECOMMENDED RESPONSES



OVERVIEW

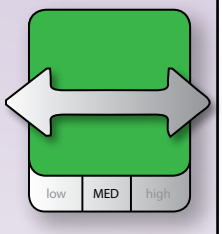
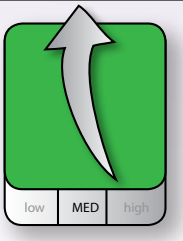
The greenhouse effect and the ozone layer protect life on earth by regulating the amount of heat and ultraviolet radiation entering the atmosphere. Certain gases are trapped in the greenhouse forming a thick layer that prevents heat from escaping. As the earth's temperature rises due to this trapped heat, events such as melting of the icecaps, coral bleaching from elevated sea surface temperatures and category five cyclones and hurricanes become prominent. Other gases contain compounds or substances that interact with the ozone layer causing it to break down, therefore allowing harmful ultraviolet radiation to get through. The UV radiation causes skin cancer, eye damage and death to cellular DNA.

International protocols have been established in a global effort to control the use of many of these gases and substances. Niue is a contributor to the use of these gases and substances as they are found in common domestic and industrial equipment. Niue can, however, be proud to highlight that on the global scale its overall contribution towards reducing CO_2 in the atmosphere far outweighs its emissions.

This theme assesses the state of Niue's climate and its contribution to the state of the atmosphere, focusing on the physical climate, greenhouse gases (GHG) and ozone depleting substances (ODS).

For the physical climate: Temperatures will continue to rise with more very hot days predicted in the future. It is expected that sea surface temperatures will continue to rise. Rainfall patterns show no clear trends, but more days with extreme rainfall are predicted, bringing the risk of flooding. The frequency of droughts is expected to remain more or less the same. Decreasing numbers of tropical cyclones but increasing intensity are predicted and the impacts of such extreme events will be magnified in the future by rising sea levels. Sea levels will continue to rise to within a range of between 17 cm and 60 cm by the end of the 21st Century. Recent studies that account for ice sheet dynamics suggest that sea level increases may be above this range. Ocean acidification will become an increasing threat to coral reef ecosystems, presenting a threat to biodiversity as well as to key sectors such as fishing and tourism. Niue's contribution to global greenhouse gas emissions is negligible (less than 0.0001%), and Niue is a net sink due to its forests, nevertheless steps are being taken to reduce emissions, in particular in the energy sector. Most GHG emissions in Niue originate from the use of fossil fuels for the generation of electricity and for vehicles. Efforts to manage GHG emissions have started including the installation of solar hot water heating, public education campaigns, renewable energy, use of renewable technologies, and the promotion of low emission fuel sources.

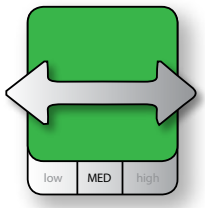
ATMOSPHERE AND CLIMATE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
ATMOSPHERE	**GHG**  **Status** Good **Trend** Stable **Data confidence** Medium	Niue's contribution to global GHG emissions is negligible (<0.0001%); and overall, Niue is a net sink. The country is working to reduce its emissions further, in particular in the energy sector. Fossil fuel remains the key source for Niue's GHG emissions.	A range of measures are being proposed to help further reduce GHG emissions including those outlined in the NiSERM 2015–2025. Recommendations captured in the NiSERM 2015–2025 remain valid and are reiterated below: • Efforts to reduce dependence on fossil fuel. • Energy efficiency should be improved. • Explore sustainable and clean energy to replace or supplement the existing system. • Improve cost-effectiveness of energy services. • Attract funding for energy sector development.
OZONE DEPLETING SUBSTANCES	**ODS**  **Status** Good **Trend** Improving **Data confidence** Medium	Niue was one of the first countries to phase out HCFCs. The next substance to be phased out is HFC, by 2020. An ODS alternative survey was completed in 2017. Some capacity building on halon – another important ODS, was held in country. One of the key challenges is safe disposal of ODS.	Ozone Layer Protection Regulations 2007 developed to ban the importation of ODS. Work with partners to fulfil its obligations under international agreements. Undertake an ODS alternative survey identifying the current rate of consumption and provide future projects of growth and trends by substance and sector.
PHYSICAL CLIMATE	 **Status** Fair **Trend** Deteriorating **Data confidence** Medium	Niue and many other small island countries remain vulnerable to climate change. Temperatures are rising with predictions of more hot days, leading to coral bleaching. More intense cyclones, causing destruction, are predicted and sea level will continue to rise. Ocean acidification is predicted to continue and will threaten reefs and all marine organisms with carbonate structure.	A Climate Change policy was developed in 2009, defining the government's position and other stakeholders' roles in raising awareness, collecting and sharing of data, and adaptation and mitigation measures. In 2012, a 3-year joint national action plan for climate change and disaster risk management (JNAP) was developed. Town and country planning needs to consider the threat posed by cyclones, storm surges and sea level rise along coastal areas, and ensure critical services are located in secure areas. Vital sectors, such as agriculture, health and fisheries need to climate proof and ready their operations to cater for climatic events and changes. Review the JNAP and continue with its implementation.

GREENHOUSE GAS (GHG) EMISSIONS

INDICATOR DEFINITION

The greenhouse effect is the effect of atmospheric gases, including carbon dioxide, trapping a proportion of the energy received from the sun nearer the Earth's surface rather than being reflected back into space. Without this natural greenhouse effect, the average temperature at Earth's surface would be below the freezing point of water, therefore it plays a critical role in enabling life on earth, as we know it. As more carbon dioxide, methane and other gases are emitted and trapped in the atmosphere, through actions such as the burning of fossil fuels, it intensifies the greenhouse effect leading to the phenomenon of Global Warming. The impacts of this increased warming are various and complex, but include rising sea levels from thermal expansion of sea water and melting of icecaps and glaciers; increased land and sea surface temperatures; and changes in local and regional patterns of weather and climate, including droughts and more intense rainfall. In turn, these changes have the potential to affect all aspects of society; the places we live and work, agricultural production, our natural environment and our health. Increased CO_2 in the atmosphere can also cause ocean acidification. Since the industrial revolution, CO_2 emissions have risen extensively and now contribute approximately 76% of GHG s (IEA 2012). This indicator assesses the emission and management of greenhouse gases in Niue.



Status
Good

Trend
Stable

Data confidence
Medium

SDG	SAMOA Pathway	NBSAP
13 CLIMATE ACTION	44	Theme 7 Climate change

Environment and Climate Change Pillar [NNSP 2016–2026]
Climate Change and Natural Hazards: A safe and resilient Niue to impacts and challenges of climate change

Status and Findings

The first GHG inventory for Niue used 1994 as the base year. GHG emissions are primarily from combustion of secondary fuels, gasoline and diesel. CO_2 generated from fossil fuel use accounts for 99.1% of total GHG emissions for Niue: 51% of CO_2 emissions was from burning diesel for power generation and 48% was from vehicles, with the remainder from residential use at less than one per cent (Figure 10; Table 5).

In the energy sector, CO_2 (63.8%) and SO_2 (32.0%) were the highest GHGs emitted. The high SO_2 emission may be an anomaly given that the year 1994 saw the importation of heavy machines for upgrading and fixing of the Hanan International Airport.

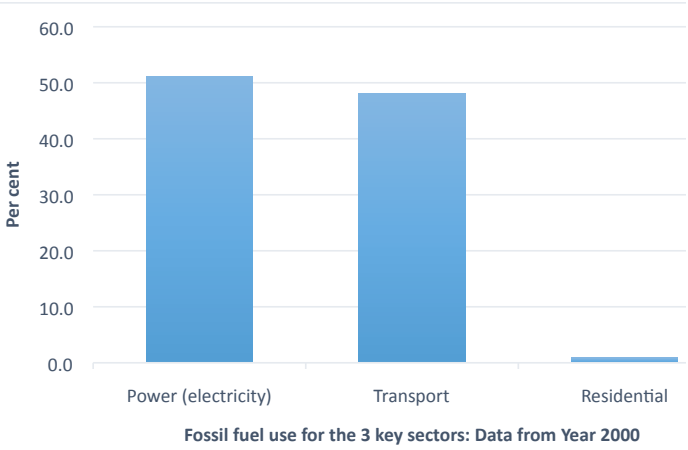


FIGURE 10. CO_2 emissions result from use of fossil fuels for power generation (electricity)., transport (vehicles). and residential activities. Source: First National Communication to the United Nations Framework Convention on Climate Change.

TABLE 5. SO_2 and CO_2 emissions from different sectors. (Source: First National Communication to the United Nations Framework Convention on Climate Change 2000.

Sector	SO_2 emissions (Gg)	CO_2 emissions (Gg)
Public electricity	0.014	2.25459 (51%)
Transport	2.1971	2.1178224 (48%)
Residential	0.00001	0.03970917 (0.9%)
Total	2.2111	4.41213

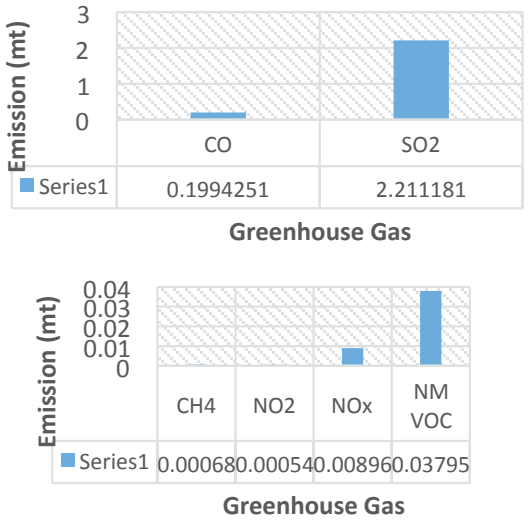


FIGURE 11. Greenhouse gas emissions.
Source: First National Communication to the United Nations Framework Convention on Climate Change 2000.

Aside from CO_2 and SO_2, other GHG including methane (CH4), nitrous oxide (N_2O), oxides of nitrogen (NOx), carbon monoxide and non-methane volatile organic compound (NMVOC) are produced from fossil fuel combustion (Figure 11).

The residential and commercial sectors rely heavily on electricity for lighting and running appliances. Cooking is conducted using gas, which has replaced kerosene and charcoal stoves. Water is mainly heated by solar power and, to a lesser degree, by electricity. Other sources of GHG emissions are provided in Table 6.

TABLE 6. Sources of GHG emissions Source: First National Communication to the United Nations Framework Convention on Climate Change 2000. Values corrected based on the 2nd National Communication under the United Nations Framework Convention on Climate Change 2014a.

Source	CO_2 emission (Gg)
International bunkers	0.84083
Industrial processes	0.0000064
Solvents and other products	NA
Agriculture	0.0000427
Forestry	NA
Managed land	0.11933
Grassland conversion	0.20432

In the waste sector, solid and liquid waste are the key sources of methane and nitrous oxide. The volume of solid and liquid waste generates insignificant amounts of GHGs. The 2009 estimation for methane generated from solid waste is less than 1 Gg, and it is negligible for wastewater (2nd National Communication to the United Nations Framework Convention on Climate Change 2014a). On the other hand, the forests of Niue removed an estimated 1000 Gg of CO_2 in the 2000 to 2009 period (2nd National Communication to the United Nations Framework Convention on Climate Change 2014a).

Diesel fuel is used mostly for electricity generation, whereas 90% of petrol is used for land transport (Figure 12). The expected growth in fuel use for petrol and jet fuel is two per cent per year, two per cent for automotive diesel oil (ADO) use for electricity, and three per cent for ADO use for transport. LPG use is expected to grow rapidly at six per cent per year.

FIGURE 12. The main petrol station in Niue. Photo: P. Skelton.

The 2002 estimation of petroleum based GHG emissions is 6.9 Gg, and the 2012 forecast is 8.7 Gg. If renewable energy and energy efficiency measures are aggressively applied, a saving of 11% (0.96 Gg) of the total CO_2 emissions can be made. The Niue Greenhouse Gas Inventory (NGGI) carried out in 2009 estimated 2.1 Gg of CO_2 emissions from the generation of electricity. Some 144 Gg of CO_2 was absorbed through the conversion of cropland to secondary forest, thus making Niue a net sink of GHG in 2009 (2nd National Communication to the United Nations Framework Convention on Climate Change 2014a).

Impact

The impacts of climate change are becoming increasingly evident to communities in Niue and include the inundation of low-lying areas by seawater, frequency and the length of time of droughts, and the loss of infrastructure and resources due to high intensity cyclones. This will necessitate the relocation of key services and assets to less vulnerable places. Niue's dependence on agriculture and fishing for food security will be challenged by changes in precipitation and atmospheric temperature. This could lead to socio-economic challenges and an increase in outward migration.

Response and Recommendations

Niue has had a national conversation and developed a national response for identifying and implementing climate change adaptation and risk reduction measures. Some of these measures include the need to relocate vulnerable infrastructure to areas of lower vulnerability, as well as increasing knowledge through research and collaboration with key partners and experts in climate science. By continuing to collect and monitor weather in Niue, the information and data can help the global community to improve the accuracy and predictions of climate models.

Niue acknowledges while its contributions towards GHG emissions are negligible (less than one per cent) and its absorption of carbon dioxide is considerable, the country needs to take the right steps to reduce its emissions, particularly in the energy sector.

The Niue Strategic Energy Road Map (NiSERM) 2015–2025 (Figure 13) outlines Niue's aspiration to meet 80% of its electricity needs from renewable energy sources by 2025, which would in turn reduce the country's high reliance on imported fossil fuel. Part of this goal can be achieved through national resources and identified assistance, but achieving such high levels of electricity from renewables (from around two per cent today) is very ambitious and will require considerable contributions of financial and capacity support from Niue's partners.

Niue has also included the same energy targets in its Nationally Determined Contribution as part of Niue's obligations to the Paris Agreement under the thematic area of Climate Change Mitigation.

FIGURE 13. The Energy Road Map.

The focus of GHG mitigation efforts for Niue is firmly on electricity generation and transport. In 2015, Niue had a 100% electricity penetration rate and total electricity demand was stable, having recorded only three per cent growth from 2008 to 2012. However, Niue is 96% dependent on imported fuel for power generation and 100% dependent on imported fuel for land, sea and air transportation. In light of Niue's vulnerability on imported oil, the Niue Strategic Energy Roadmap (NiSERM) 2015 – 2025 was developed, with the goal of "a sustainable energy sector for a Prosperous Niue". The NiSERM builds on the 2005 Niue Energy Policy (NEP) and Niue's National Strategic Plan (NNSP) 2016–2026, to pursue five key motivations:

- Reduced dependence on fossil fuels
- Improved energy efficiency
- More sustainable, cleaner energy
- Improved cost-effectiveness of energy services
- Attract funding for energy sector development

OZONE DEPLETING SUBSTANCES

INDICATOR DEFINITION

The ozone layer protects life on earth by absorbing UV radiation from the sun. The ozone layer is made up of three atoms of oxygen, forming a gaseous layer in the upper atmosphere or the stratosphere, approximately 12–50 km above the surface of the earth. Since the 1970s, this protective layer has diminished, especially around the north and south poles – a phenomenon known as the ozone hole. The main cause of ozone depletion has been the synthetic chemicals used in refrigerators, air-conditioners, fire extinguishers, aerosols, fumigants, foam and solvents for cleaning electronic equipment. These ozone-depleting substances include chlorofluorocarbons (CFCs), halon, methyl chloroform, carbon tetrachloride, hydrochlorofluorocarbons (HCFCs) and methyl bromide. Hydrofluorocarbons (HFCs) were introduced in the 1990s as alternatives to CFCs and HCFCs. The rapid adoption of HFCs led to the rapid phase-out of ODS and has helped protect the earth's ozone layer.

Global concerns about the ozone layer led to the adoption of the Montreal Protocol in 1987, banning the production of CFC, halons and other ozone depleting substances (ODS). Niue became a party to the Montreal Protocol on 22 December 2003.

This indicator reviews Niue's response towards the management of ODS nationally.

Status
Good

Trend
Improving

Data confidence
Medium

SAMOA Pathway

45

Environment and Climate Change Pillar [NNSP 2016–2026]

Climate Change and Natural Hazards: A safe and resilient Niue to impacts and challenges of climate change

Status and Findings

Whilst a full audit to identify all ODS has not been carried out, a persistent organic pollutants (POPs) audit was carried out in 2003, where 30 kg of methyl bromide was found in storage at the Government's Works Depot Store.

Methyl bromide is a highly effective agent used by quarantine and biosecurity for fumigation of goods. Its use elsewhere (i.e. in non-quarantine situations) is prohibited in many countries that are party to the Montreal Protocol.

Since becoming a Party to the Montreal Protocol, Niue has commemorated World Ozone Day every year.

One of the challenges for Niue is disposing of hazardous wastes from the island. Strict international rules regarding transportation of hazardous wastes, and the lack of willing receptors, mean that ODS wastes remain on the island where they continue to be a threat.

Impact

The use of equipment that contain ozone depleting substances, or particular chemicals such as methyl bromide, will continue to contribute towards the depletion of the ozone layer. This will allow UV radiation to reach ground level, causing serious problems such as skin cancer and eye diseases for humans or stunted growth for plants. Marine organisms will also suffer, as UV will affect the development stages of fish and other marine life.

FIGURE 14. Children's artwork during the World Ozone Day.

Response and Recommendations

Internationally, Niue's role in managing ODS has been outstanding and it continues to work with partners and other Pacific Island Countries (PICs) to reduce ODS from the Pacific. Niue was one of the first countries to sign onto the international agreement to protect the ozone layer. It is a party to the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that deplete the Ozone Layer. It has enacted national legislation (Ozone Layer Protection Regulations 2007) as an important part of its commitment to these international instruments. The Regulations prohibit the importation of ozone depleting substances (CFC, halon, carbon tetrachloride, methyl chloroform, other CFC, or HCFC, and methyl bromide).

Global efforts have reduced the use of CFCs in refrigerators, air conditioners and aerosol cans, which have benefited the management of ODS in Niue, as well as many other PICs.

Niue is currently in the process of undertaking a survey of ODS alternatives in partnership with the United Nations Environment Programme (UNEP). The overall objective is to survey the current consumption of ODS alternatives and provide future projections of growth patterns by substance and sector. There is a move towards eliminating the use of Hydrofluorocarbon (HFC), which was an alternative to the HCFC. While HFC is not an ODS, it is a greenhouse gas, contributing to global warming.

There is currently an update of the Ozone Regulations 2007, as well as the establishment of the licensing system for importers/exporters of ODS as part of the obligations to the Montreal Protocol. Niue has also ratified the Kigali Amendment.

PHYSICAL CLIMATE TRENDS

This section sets out the current climatic trends in Niue and also highlights the current and projected impacts of climate change.

INDICATOR DEFINITION

The island is dominated by two distinct seasons; the wet (warm) season, which lasts from November until April, and the dry (cool) season, lasting from May to October. Factors affecting Niue's climate include the South Pacific Convergence Zone (SPCZ, which is close to the island in the wet season, contributing to high rainfall totals), the sub-tropical high pressure zone and south-easterly trade winds (PACCSAP, 2011). There are two phases of El Niño Southern Oscillation (ENSO): The El Niño and the La Niña. The El Niño brings drier than normal conditions to Niue, as well as cooler temperatures in the dry season. La Niña usually brings wetter conditions (see Figure 15).

This indicator reviews the state of five climate-related parameters: rainfall, temperature, cyclones, sea level rise, and ocean acidification.

Status
Fair

Trend
Deteriorating

Data confidence
Medium

Status and Findings

SDG	SAMOA Pathway
13 CLIMATE ACTION 14 LIFE BELOW WATER	44

Environment and Climate Change Pillar [NNSP 2016–2026]

Sustaining Climate and Weather Services:
Providing credible and timely weather and climate services

Rainfall patterns

Rainfall is highly variable in nature and ranges between 839 mm to 3,226 mm per year (average 2,180 mm per year), with trends strongly associated with ENSO patterns (SPREP 2009; PACCSAP 2011). Torrential downpours during the wet season are common and account for approximately 68% of Niue's total annual rainfall. Severe droughts occurred in Niue in 1983, 1986, 1991 and 1996 where less than 400 mm of rainfall was received (PACCSAP 2011).

Data collected from the Hanan Airport over the last 60 years shows no clear trends in annual or seasonal rainfall – see Figure 15 (PACCSAP, 2011). The climate model predictions projected a moderate confidence for the wet season rainfall to increase over the course of the 21st Century due to the likely increase in intensity of the South Pacific Convergence Zone (SPCZ), which lies over Niue during the wet season. The projection for the dry season rainfall indicated little change, although the level of confidence in this projection is low. There is a moderate level of confidence in the total annual rainfall to increase towards the year 2090.

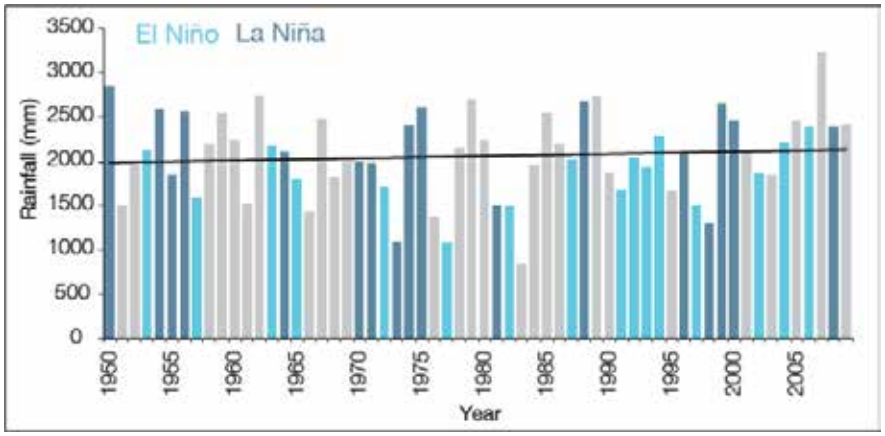


FIGURE 15. Annual rainfall measured at Hanan Airport. The grey bars represent neutral years. Source: PACCSAP 2011.

Temperature trends

Niue's annual average temperature is 24oC with a small season-to-season range of 4oC. The temperature trends for Niue indicate an increasing trend since the early 1900s (PACCSAP 2011). Maximum wet season temperatures have increased at a rate of 0.06oC per decade and minimum wet season temperatures have increased at 0.12oC per decade (PACCSAP, 2011). Niue recorded its highest temperature on record on 2 February 2016 of 33.9oC, breaking the previous record of 32.6oC recorded in January 2010. Climate change is likely to bring a continued increase in average temperature conditions, with an increase of up to 0.9 – 1.7oC by 2055 in a high emissions scenario (see Table 7 – PACCSAP, 2011). An increase in the number of hot days and warm nights is also likely, with a decline in cool weather.

TABLE 7. Project changes in the annual average surface air temperature for Niue. Values represent 90% of the range of the models and are relative to the period 1986–2005. Source: PACCSAP 2011.

	2030 °C	2050 °C	2070 °C	2090 °C
Very low emissions scenario	0.3–0.9	0.3–1.0	0.3–1.0	0.2–1.1
Low emissions scenario	0.3–0.9	0.6–1.5	0.7–1.8	0.7–2.1
Medium emissions scenario	0.3–0.9	0.5–1.4	0.8–1.9	1.1–2.5
Very high emissions scenario	0.4–1.1	0.8–2.0	1.3–3.0	1.7–4.2

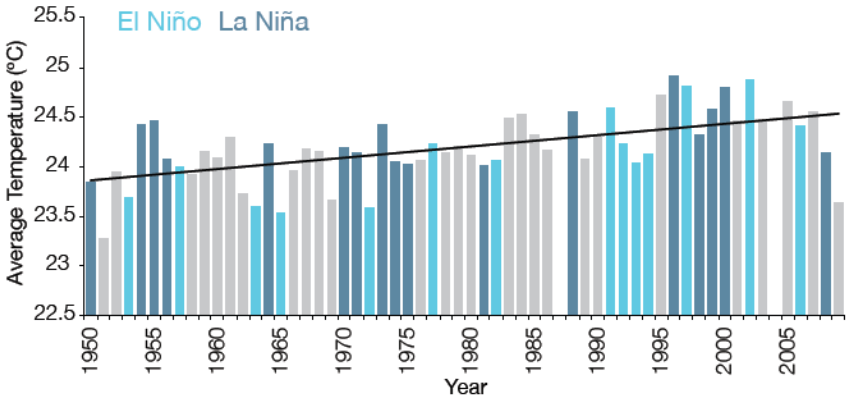


FIGURE 16. Annual average temperature measured at Hanan Airport. The grey bars indicate neutral years. Source: PACCSAP 2011.

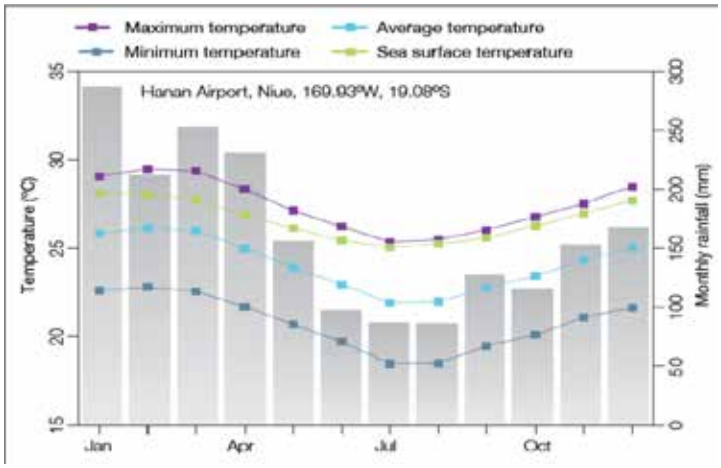


FIGURE 17. Typical mean annual cycle of rainfall (grey bars). and daily maximum, minimum and mean air temperatures at Hanan Airport, and local sea surface temperatures. Source: PACCSAP 2011.

Cyclone events and frequency

Life on the island is influenced by the weather. Fishing or planting crops are timed to ensure that weather conditions are right to assist with harvesting or catching these resources. This is evident during the wet season, where there is expectation of cyclones. Communities prepare for cyclones by harvesting and preserving certain crops to sustain them during tough times. Recent tropical cyclones, including Cyclone Ofa in 1990, transformed Niue from a food exporting country to one dependent on imports (JNAP 2012).

FIGURE 18. Damage caused by Cyclone Heta.

Niue's tropical cyclone season runs from November to April and during the past 40 years a total of 69 cyclones have passed within 400 km of Alofi (Figure 19, Figure 20 and Table 8). The impact from Cyclone Heta in 2004, is still evident throughout the villages (Figure 18). Heta was a category five cyclone causing serious damage to infrastructure, costing an estimated NZD 37.7 million, or three times Niue's GDP. It was a combination of a high spring tide, the directional travel of the cyclone, the wind velocity and the geographic position of the island, that facilitated a 50 metre sea surge penetrating 100 metres inland causing most of the damage.

The global predictions are that the anthropogenic warming by the end of the 21st Century will cause tropical cyclones globally to be more intense on average. This change would imply an even larger percentage increase in the destructive potential per cyclone, assuming no reduction in cyclone size. This increase in intense cyclone occurrence is projected despite a likely decrease in the global numbers of tropical cyclones (www.gfdl.noaa.gov). The rainfall intensity within the cyclone system will increase by about 15% due to an increase in atmospheric moisture content. The predictions for Niue follow the global trend, with the intensity of cyclones being of considerable concern (PACCSAP, 2011). Most government sectors operate under a cyclone preparedness plan especially during the cyclone season (Niue Asset Management Plan 2015–2030 – Section K).

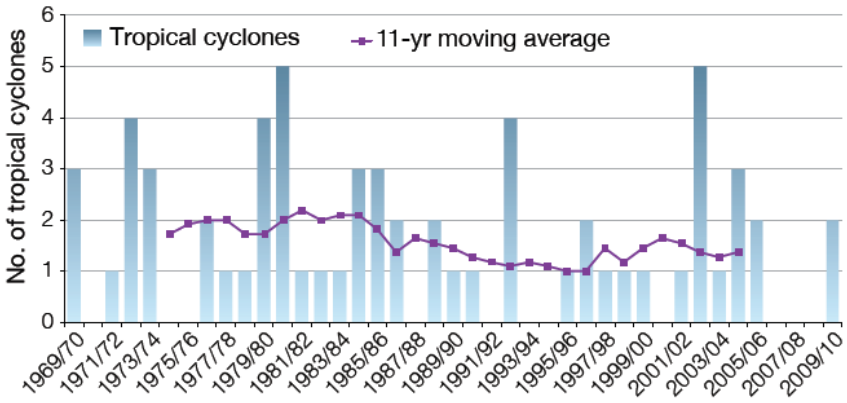


FIGURE 19. Number of cyclones passing near Alofi. 11 year moving average in purple. Source: PACCSAP 2011.

TABLE 8. Tropical cyclones that affected Niue from 1915–2010. Source: Niue 2nd National Communication to the United Nations Framework on the Convention of Climate Change.

Year	Month	Severity
1915	March	Severe
1920	January	Minor
1929	January	Moderate
1944	January	Moderate
1946	January	Minor
	December	Minor
1948	December	Moderate
1955	January	Minor
1956	January	Minor
	February	Minor
1957	February	Severe
1959	February	Severe
1960	January	Severe
1968	February	Severe
1970	February	Unknown

Year	Month	Severity
1972	January	Unknown
	February	Unknown
1973	November	Unknown
1974	April	Unknown
1979	December	Severe
1983	March	Minor
1987	April	Minor
1988	April	Minor
1989	January	Minor
	January	Moderate
	February	Severe
1990	January	Severe
2004	January	Severe
2006	January	Minor

FIGURE 20. Map showing (in red). the main areas affected by cyclones in Niue. Source: www.seafriends.co.nz.

Sea level rise

The Intergovernmental Panel on Climate Change (IPCC) has indicated that over the last hundred years, the global average rise in sea level has been 1–2 mm per year. In the Pacific region where Niue is included, the rate of sea level rise has been higher (+2.1mm/year) than the global average (PACCSAP 2011). The projection for the mean sea level is to continue to rise over the course of the 21st Century due to increasing ocean and atmospheric temperatures due to thermal water expansion and the melting of glaciers and ice caps (PACCSAP 2011). See Figures 22 and 23 for more details. The expected sea level rise is between 5–15 cm by 2030 with an increase of 20–60 cm under the higher emission scenarios (see Table 6 for the different emission scenarios). Niue installed a tidal gauge at the Alofi Wharf (Figure 21) in September 2015 to measure wind, water temperature and tidal range and other variables.

FIGURE 21. Tidal gauge located at Alofi Wharf.

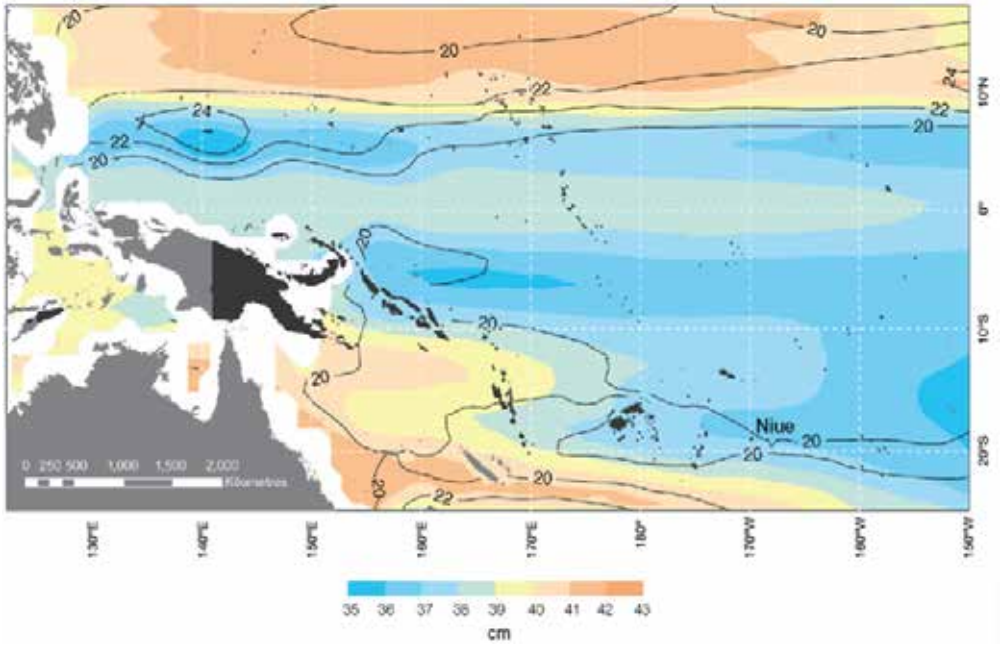


FIGURE 22. The sea level rise projections (in cm). for the medium emissions scenario in the Niue region for the average over 2081–2100 relative to 1981–2000 are indicated by the shading, with the estimated uncertainty in the projections indicated by the contours (in cm).

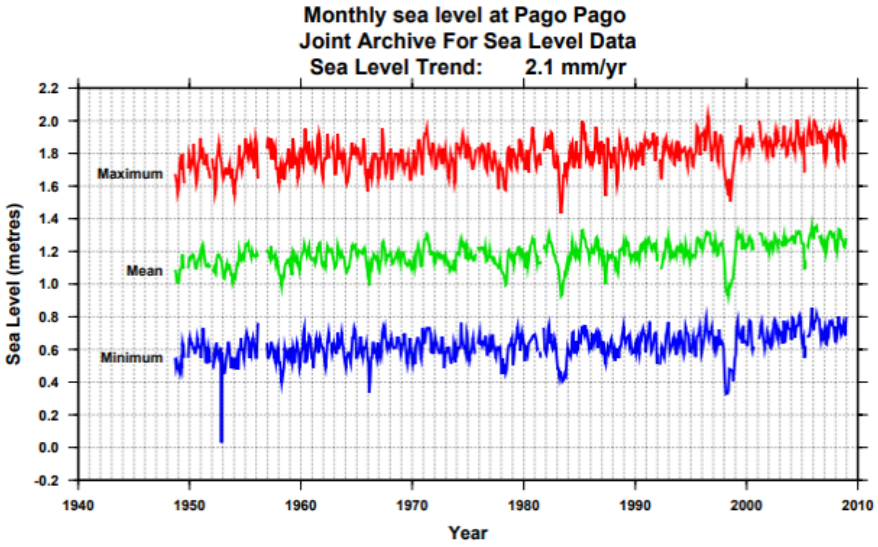


FIGURE 23. Sea level trend recorded at Pago Pago, America Samoa (close proximity to Niue). showing the fluctuation and the impact of El Nino weather events to the sea level trend. Source: SEAFRAME 2008.

Ocean acidification

A quarter of CO_2 generated annually by human activities is absorbed by the ocean. Carbon dioxide reacts with the water making the water more acidic. Many of the marine animals and plants require calcium carbonate for their structure. Under an acidic ocean, the calcium carbonate will dissolve leading to the death of the animal. Many marine animals found in Niue such as snails, sea urchins, oysters, clams, scallops and conchs will be affected (Figure 24). Coral reefs are formed by the deposit of calcium carbonate by the coral polyps. An acidic ocean will dissolve the foundation of reefs, leading to the inundation of coastal areas by storm surges and loss of fish habitats. This will impact community along the coastal area of Niue, as well as the fishing and tourism sector. Families and communities that rely on seafood for their protein will also be affected.

Data have shown that since the 18th Century the level of ocean acidification has been increasing in Niue's waters (PACCSAP 2011). The ocean acidification prediction for the future is that it will continue to worsen and together with other stressors such as coral bleaching, storm damage, fishing pressure and invasive species, will see the destruction of reefs and loss of biodiversity, as well as impacts to the community as mentioned above.

FIGURE 24. Many of the marine species and the carbonate reef structure that they rely on for habitat, will be affected by the acidification of the ocean. Photo: Huggard Tongatule.

Response and Recommendations

As the earth continues in its warming path, Niue is expected to be affected by elevated sea surface temperatures that will lead to coral bleaching, and sea level rise, which may contaminate the groundwater lens. Services and settlements along the coastal areas will need to be relocated to lessen losses from extreme weather events.

With an intensifying focus on production of key commodities such as vanilla, honey, noni and fish for export, and an increase in facilities for tourists, the expected damage bill from extreme climate events for Niue in the future will be very high. As demonstrated when Cyclone Heta struck Niue in 2004, the vanilla industry was set back by two years. Similarly, tourist accommodations such as the Niue Hotel and the Namukulu motel were out of operation following Heta, reducing the ability of the island to cater for tourists.

Climate change-related health issues are a concern for most countries. Loss of a clean water supply due to water contamination poses significant medical concerns. An increase in atmosphere and sea temperatures could intensify the risks of water and vector-borne diseases (e.g. dengue fever); disaster-related fatalities, injuries and illnesses; heat stress and conjunctivitis (pink-eye). Sea level rise may potentially lead to seawater incursion into the freshwater lens. Another key concern for the health sector is infrastructure loss. Following Cyclone Heta, much of the hospital was demolished and many medical records were lost. The hospital has now been relocated inland and patients' records are backed up on a cloud system.

Niue developed its joint national action plan for climate change and disaster risk management (JNAP) in 2012, as part of its commitment to build community, infrastructure and economic resilience. The plan, although set out as a three year plan, remains a relevant and important document for the government and other stakeholders. Some of the key achievements from the JNAP include incorporating disaster risk reduction and climate change considerations into the national building code and into the school curriculum, establishing an effective early warning system for extreme weather events, and supporting energy efficiency and renewable energy options. There are still activities to be implemented to reduce the vulnerability of Niue to disaster and climate change. It is anticipated that many of the government sectors will be affected (Table 9).

TABLE 9. Climate change impacts in selected sectors in Niue (adapted from Kirono *et al.* 2008).

Sector	Changes	Impacts
General	Increase in the number of extreme rainfall events Increase in tropical cyclone intensity Increase in mean sea level rise	Increased erosion Storm surges and large waves causing coastal inundation and erosion, coastal retreat
Water resources	Decrease in dry season rainfall	Groundwater recharge may be lessened Depletion in quality and quantity of groundwater
Agriculture	Decrease in rainfall Increase in evapotranspiration Increase in wind speed during extreme events	Decrease in taro and other crop production Potential increase in soil erosion (from water and wind), reducing area of land suitable for agriculture
Fisheries	Increase in sea water temperature Changes in ENSO could contribute to changes to ocean current patterns	Artisanal and subsistence fisheries may decline due to an increase in the number of coral bleaching episodes and increased risks of ciguatera poisoning caused by disturbance to the reefs Availability and seasonality of deep water fish may change
Tourism	Tropical cyclone frequency may not decrease or remain unchanged, but the intensity may increase Increase in air and sea surface temperatures	Safety concerns for tourists, especially during cyclone season Proliferation of certain organisms (e.g. mosquitoes and medusas) posing a health threat

Food security is one of the key activities under Goal 3 of the JNAP (Strengthened livelihoods, community resilience, natural resources and assets). For Niue to secure its food security, it needs to increase the percentage of food produced within the country. This is currently constrained by the declining and aging population and a limited workforce. Climate variability adds to this challenge for Niue, where drought or flood conditions can cause food production to fail and increase the outbreak of crop diseases (PACCSAP, 2011)

The decision making process is being improved nationally, through the introduction of new technologies that can predict climate patterns. By strengthening existing conservation practices, this will allow communities to maximise opportunities to adapt to future changes.

Niue has completed its Niue Food and Nutritional Security Policy 2015–2019, which included promoting local food and encouraging planting of food trees. One activity was the planting of fruit and nut trees at the Vaipapahi Agricultural Research farm, at the Niue High School, the Niue Primary School and at Hakupu, Tuapa and Tamakautonga. Promotional material

through dietary guidelines is being developed to help individuals make informed choices. Various government ministries and sectors play an important role in addressing food security and nutritional needs for the country (Table 10).

TABLE 10. Contribution of the various sectors to food and nutritional security. Source: Fukofuka 2015.

Agency/Ministry/ Sector	Food availability measures	Food accessibility measures	Utilisation	Stability
Central Agencies	Regulatory and policy frameworks.	Income. Price control measures.	Food safety regulations.	Prudent fiscal policies. Disaster risk management.
Commercial and Trading Agencies	Food imports. Entrepreneurial private sector.	Markets. Value adding.		Price Control.
Ministry of Social Services	Traditional food cultivation practices.	Nutrition information. Education.	Food safety. Health checks. Healthy dietary advice and counselling. Food preparation skills.	Sustainable consumption patterns. Health care services.
Ministry of Natural Resources	Domestic food production (food crops, livestock, fisheries). Biosecurity and Quarantine. Sustainable land management. Meteorology and Climate information. Environmental management.	Land management.	Food Processing Facility – food testing.	Management of natural resources. Promoting use of climate resilient food crops. Meteorology and Climate Change.
Ministry of Infrastructure	Farming machinery and equipment	Transportation. Renewable energy sources for storing and cooking food.	Water and sanitation.	Renewable energy and transport infrastructure. Water and sanitation. Waste management.
Civil Society	Farmers (NOFA, NOEA) and Fishermen (NIFA)			Livelihoods and subsistence farming/fishing.
Private Sector	Food imports. Retailers.	Price.	Food processing. Marketing and promotions.	Employment opportunities.

To assist Niue in tracking change and providing the information for informed decision making, there is a need to review and re-develop Niue's Joint National Action Plan for Disaster Risk Management and Climate Change to ensure that climate change and vulnerability indicators are clearly specified and implemented.

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Kirono, DGC., Jones, RN., Bathols, JM. (2008). Climate change in Niue. CSIRO, Aspendale, Australia.

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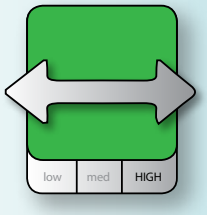
OVERVIEW

Access to water is a fundamental right for every person. It is Goal 6 of the global Sustainable Development Goals, and a priority area under the SAMOA Pathway. Niue has nearly 100% penetration in public water access and supply. The infrastructure remains in fair condition, although a concerted effort to upgrade and replace some of the older equipment is needed. Cyclones and power failures have disrupted the distribution of water. The government is assisting by supplying rainwater tanks and bases. The government is also installing solar panels to generate electricity for the bore pumps, to ease the demand on the main grid. The current rate of water extraction is low but there is an expectation that the demand for water will rise, as government policies take effect in terms of increasing economic development, including tourism. Water quality remains a priority issue and regular monitoring takes place. The water supply contains essential trace elements. Seawater mixing does occur in the deeper sections of the groundwater lens, which makes the water very hard but is still safe for drinking. The levels of nitrates and pesticides in the water are very low and well within the safety limits imposed by WHO and US standards. Bacterial contamination is detected in many of the sites and further attention is urgently needed. Water management is a government priority and legislation, policies, plans and guidelines have been developed to ensure water remains potable and accessible to all Niuean residents.

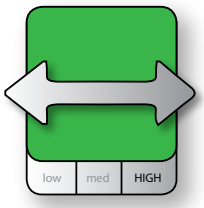
WATER HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
ACCESS TO WATER, INFRASTRUCTURE AND WATER SECURITY	 **Status** Good **Trend** Stable **Data confidence** High	98% of Niueans have access to the public water system; 2% access water wells. The current rate of extraction is low compared to the rate of replenishment. Demand for water will rise due to increased development and population, especially from tourist arrivals. Households with fully functional water tanks represent 60% of the population, thus efforts are being made to increase this to ensure water security for all.	The Integrated Water Resource Management Plan provides the overarching policy on water. Roles and responsibilities of agencies are stated in the Plan. A Committee exists to oversee the implementation of the Plan. Regular village inspections are helping to detect leaks in the system. Secure resources (financial and human capacity) to implement the various water frameworks. Complete installation of household water tanks and provide guidance on their proper use. Continue with village inspections to allow for early detection of leakages and other water problems. Fix and replace water assets to improve efficiency and performance.
WATER QUALITY MONITORING RESULTS – BACTERIAL AND NITRATE LEVELS AND WATER HARDNESS	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Water is being tested on a quarterly basis through a joint effort between Department of Utilities and Department of Health. The lack of staff and funding are the challenges in carrying out the testing. Results showed normal levels of trace elements. Bacterial contamination present in most of the samples tested.	Regular surveys of vulnerable points in the water system need to be carried out to detect any contamination. A remedial plan must be developed to ensure that responsible officers and agencies understand their role and what needs to be done to rectify the problem. Water points, where faecal contamination is detected, must be rectified and sources identified and removed. Secure funding resources to allow the water authority to undertake surveys and implement the Drinking Water Safety Plan. Ongoing capacity building for key stakeholders in water monitoring. Provision of rainwater tanks to vulnerable households including components and monitoring programmes for water quality.

WATER ACCESS AND QUALITY

INDICATOR DEFINITION

Having amenities readily available in the household demonstrates the level of sanitation and hygiene. Hence, amenities such as toilets, bathrooms, taps and kitchens are good indicators of a well-functioning system. The information highlights the level of healthy living amongst the population and the ability to sustain this level. This is important information for water and health authorities, as it can assist in identifying risk areas and remedial actions when and where appropriate. The local authority, including the Health Department, the Department of Environment, and the Water Division of Department of Utilities, can use this information to improve services to the public. The two indicators are access to water, including infrastructure and security, and the quality of the water from contamination.



Status
Good

Trend
Stable

Data confidence
High

Status and Key Findings

SDG	CBD
6 CLEAN WATER AND SANITATION	14

Infrastructure Pillar [NNSP 2016–2026]

Water: Access to 24 hour water supply and safe potable drinking water, Water quality monitoring results

Since 1997 to 2011, 98–99% of Niuean households had access to public piped water. Five key parameters were regularly assessed:

1. Number of households with taps inside homes;
2. Taps outside homes;
3. Public piped water to household water tanks;
4. Water tanks fed by rainwater; and
5. Water from other sources (e.g. well).

The trend suggests a high and stable access to public water by most households (Figure 25). The number of households with outside and inside taps was high and stable at around 80–90% between 2006 and 2011, whereas there was a decline in the number of households with rainwater fed water tanks, from 53% in 1997 to 14% in 2011. Access to alternative water sources, such as wells, remained stable at two to three per cent.

The main public water supply for Niuean households is the groundwater lens that is pumped into 22 reservoirs, before being reticulated into 18 systems and distributed to households via a 113 km pipe network. The groundwater is recharged via rainfall infiltration and the rate of recharge exceeds the rate of extraction. Domestic use accounts for 80% of the water consumption with agriculture (15%) and commercial (5%) the remaining water users. The water usage as of 2015 is 200 litres per person per day, a reduction from 350 litres per person per

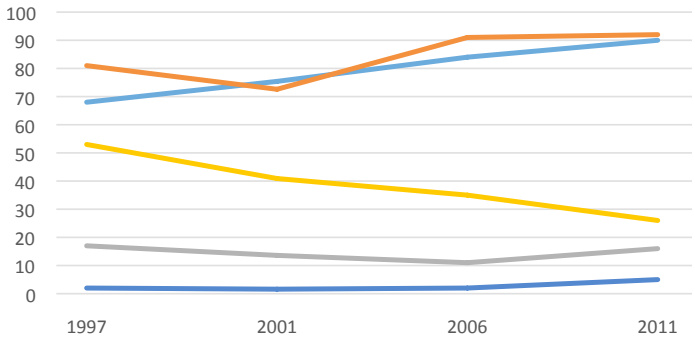


FIGURE 25. Water access trend from 1997 to 2011: percentage of households with access to water over the years. Source: GON 1997, 2001a, 2006 and 2011 Census reports.

day as recorded in 2006. The target is 150 litres per person per day (Niue Asset Management Plan 2015–30 – Section F – Water and Wastewater). There is additional demand on the system during the tourist season around June to September each year. As government continues to develop and promote the tourism sector, it is likely that water demand will increase.

Climate variability and climate change present a number of risks to water security for Niue, as was evident following Cyclone Heta in 2004. Cyclones and extreme rainfall events damage infrastructure and disrupt water supply, as well as increase the risk of water borne diseases and illnesses (Barnett and Ellemor 2007). Drought, another climate induced threat, has an immediate impact on vegetation and crops, with crop failure if drought persists over a two-month period.

FIGURE 26. The underground water lens supplies the water to all Niuean homes

The potential for increased water demand through economic stimulation and development means that supplementary water sources need to be investigated and secured. Recognition of the need for an alternative water source accelerated in the late 1990s, with a good percentage of households having personal water tanks. The number has since declined due to the convenience of and access to the public water system. A renewed focus and interest in an alternative source of water became apparent following Cyclone Heta, when power outage prevented water being pumped and reticulated. The government and partners assisted households to install water tanks, as a response to threats posed by climate change (Figure 27). The government provided rainwater tanks including installation, and households were encouraged to connect the water tanks to their roof for the collection of rainwater. While a good percentage (126 households in 2011 Census) of households have connected their water tanks in order to collect rainwater, many have yet to make the connection.

FIGURE 27. More households are installing water tanks, as a mean to secure this resource in times of drought or cyclones. Photo: P. Skelton.

Impact

Maintenance of the water infrastructure and water pipe network is vital to ensure secure and efficient delivery of water to all households (Figure 28). Much of the equipment needs to be replaced, and needs to be climate-ready to ensure minimal disruption during extreme weather events. Unused bore water pumps can be a reservoir for disease-causing organisms, especially if they are to become operational. Cracks or leaks in pipe work or fittings/connections pose a risk of microbiological and chemical contamination. Pipes damaged by plant roots could affect the distribution network and expose drinking water to contamination. The majority of water loss through leakage in the reticulation system is from private households. The capacity of the current system to meet the water needs of the population is adequate if key components are upgraded. As Niue continues to develop and attract investment there will be some foreseeable need to enhance and expand the existing system in order to cope with increased demand for water. An important consideration is the additional demand on the network during the tourist season, around June to September.

FIGURE 28. The location of water bores and reservoirs (tanks).
Source: Niue AMP 2016.

Response and Recommendations

The state of the water infrastructure, including the reservoir tanks (Figure 29 and Figure 30), is satisfactory; however, some equipment is in need of repair or replacement. Not all rainwater tanks are connected to roofs to harvest rainwater; this must be rectified to enhance water security for households. Projects to assist the government and communities to address this issue, include the European Union working with SPC under the Global Climate Change Alliance in Pacific Small Island States (GCCA-PSIS) to supply 5000 litre tanks in coordination with the Pacific Adaptation to Climate Change (PACC) and PACC+. The latter project constructed a manufacturing facility and trained local staff to supply the water tanks and the ability to mould more rainwater-tanks including septic tanks for Niue.

FIGURE 29. One of the main reservoir tanks supplying water to many of the households.

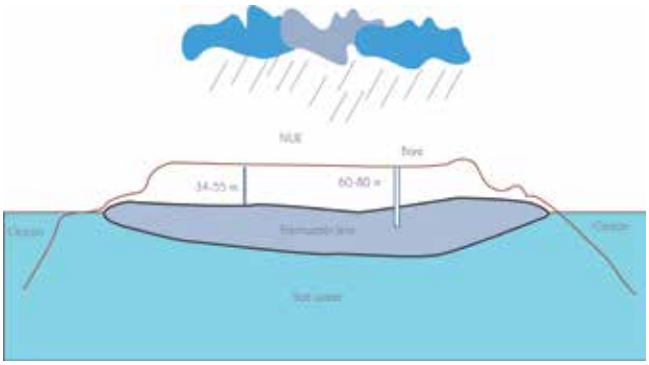


FIGURE 30. Water catchment for Niue.
Source: Adapted from Niue AMP 2016.

The Water Act 2012 outlines the roles and responsibilities of three government departments in managing water resources:

- Department of Utilities is responsible for the construction, management, regulation and protection of the water supply;
- Department of Environment is responsible for water quality and its protection;
- Department of Health is responsible for monitoring water quality in any supply system.

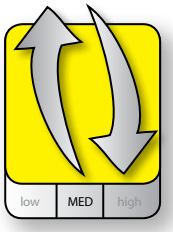
The Water Safety Plan is an important strategy outlining the details and responsibilities of households, water supply details, risk assessment, safety plan, monitoring schedule, and improvement plan (Siohane and Chapman 2008). The Water Regulations 2017 provide the framework to manage the extraction of water, including the construction of bores, levy for water extraction and water pollution. The Niue Water Steering Committee Regulations 2017 provide an additional management framework where a committee is established to advise and make recommendations on water matters and to act as the overarching national body for water-related matters. These national frameworks underpin a very positive move forward by Niue in managing a vulnerable resource for the future of its people. Securing the necessary resources (both financial and human capacity) should be prioritised to enable the implementation of these frameworks. Continuing with village inspections to allow for early detection of leaks and other water problems will require working closely with communities and encouraging early reporting of any problem.

Water meters are being installed in households in Alofi and Tamakautonga, with the plan of rolling this out nationwide. This will provide a means to monitor water use for management purposes. The water system relies heavily on electricity and any power outage will result in a system shutdown. The government is exploring solar as an alternative energy source for the bore-water pumps.

CHEMICAL COMPOSITION, COLIFORM AND *E. COLI* COUNTS

INDICATOR DEFINITION

The quality of Niue's water supply is assessed through monitoring of trace elements within the water, including water hardness (chloride) and nitrate, and the presence of coliforms and *E. coli.*



Status
Fair

Trend
Mixed

Data confidence
Medium

SDG	CBD
6 CLEAN WATER AND SANITATION	8

Infrastructure Pillar [NNSP 2016–2026]

Water: Access to 24 hour water supply and safe potable drinking water, Water quality monitoring results

Water hardness and chloride levels

Niue's water contains essential trace elements, including chloride, sulfate, calcium, iron, magnesium and sodium (Hasan and Hetutu 2010). The concentration of these trace elements varies depending on the location of the bore and extraction depths (Figure 31). For example, extractions at depths of 70 m (which includes bores in the southern and central part of the island) yield high levels of chloride (529 ppm) making the water hard, compared to shallow bores where the chloride ranges from 10 to 32 ppm. Chloride plays an important role in the hardness of Niue's water. This water hardness ranges from 149 to 396 ppm (Table 11). Soft to moderately hard water is 0–120 ppm. Other trace elements, including barium, iron, manganese, strontium, and zinc, contribute to the hardness of the water. The hardness can lead to scale deposits in pipes, hot water cylinders, and jugs, and can cause excessive soap consumption and the formation of "scum". The hardness of the water does not have any harmful impact to public health but the World Health Organisation is considering some guidelines for drinking-water quality.

FIGURE 31. There are numerous naturally formed limestone water catchments found across the island that were used by the ancestors as a water source.

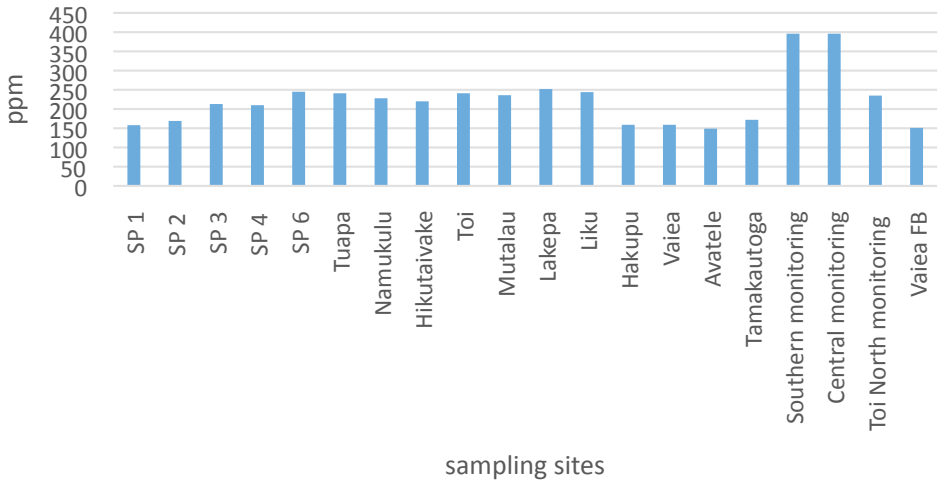


FIGURE 32. Water hardness (ppm). per bore site. Source: Hasan and Hetutu 2010.

TABLE 11. Hardness of bore waters in Niue. Water hardness: 0–60 ppm = soft; 61–120 ppm = moderately hard; >181 ppm = very hard. Source: Hasan and Hetutu 2010.

Sample Bore Name	Total Hardness ppm $CaCo_3$	Nitrate – Nitrogen (ppm)
SP 1	158	0.46
SP 2	169	0.53
SP 3	213	0.20
SP 4	210	0.22
SP 6	245	0.15
Tuapa	241	0.19
Namukulu	228	0.10
Hikutaivake	220	0.39
Toi	241	0.32
Mutalau	236	0.20
Lakepa	252	0.36
Liku	244	0.27
Hakupu	159	0.007
Vaiea	159	0.25
Avatele	149	0.41
Tamakautoga	172	0.09
Southern monitoring	396	0.20
Central monitoring	396	0.21
Toi North monitoring	235	0.36
Vaiea FB	151	0.44

Nitrate levels

High levels of nitrate have adverse impacts on human health. Infants of less than six months of age are most vulnerable and if exposed to high nitrate levels may develop a condition called methemoglobinemia (blue baby syndrome). The infant will show a bluish colour around the lips that spreads to the fingers, toes and face, and eventually covers the entire body. If the problem is not dealt with immediately, the baby can die. Nitrate pollution may occur from fertiliser runoff or seepage into groundwater and from discharge of human and animal waste. High nitrate levels from agricultural sources can also indicate that there may be a problem with other agricultural pollutants. Groundwater analysis for nitrates found a range of 0.09 ppm to 0.53 ppm (Hasan and Hetutu 2010). from a number of bores. The World Health Organisation guidelines for nitrates in drinking water is 10.0 ppm. Testing for the presence of pesticides in the water system in 2004 and in 2010 yielded a very low level (<0.001 mg/l). See Table 12.

TABLE 12. Analysis of three pesticide active ingredients. Source: Hasan and Hetutu 2010.

Active ingredient	US Drinking Water Standard (mg/L)	Result (mg/L)
Paraquat	0.2	<0.001
Glyphosate	4	<0.001
Chlorothalonil	0.5	<0.001

Bacterial contamination

Total coliforms and *E. coli* are used as indicators of the degree of pollution and sanitary quality of water, because testing for all known pathogens is a complicated and expensive process. The main source of pathogens in drinking water is through:

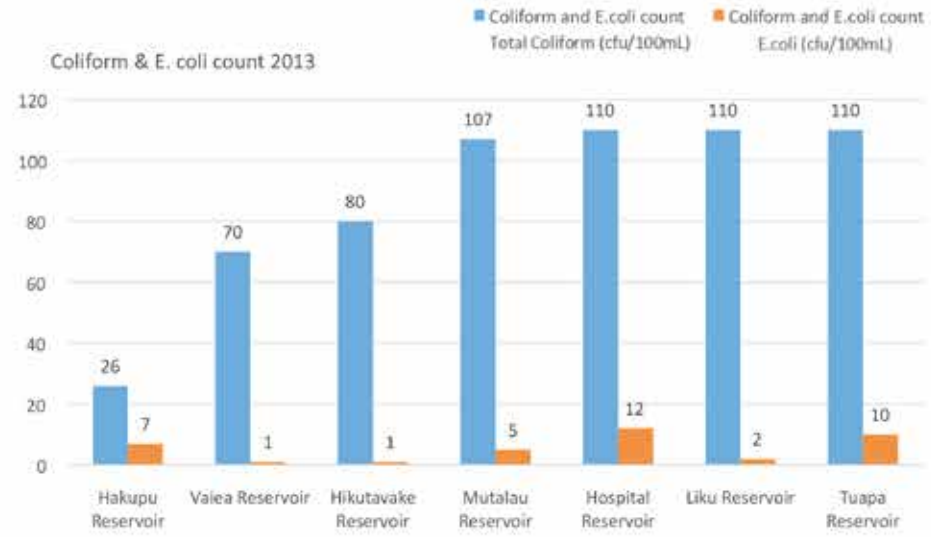
- Contamination from human or animal waste
- Improperly treated septic and sewage discharges
- Leaching of animal manure
- Storm water runoff
- Domestic animals or wildlife

During and after heavy rain, bacteria and other harmful microorganisms from any of the sources listed above may contaminate the groundwater lens. Poor reservoir construction and maintenance can increase the risk of contamination. Data from 2011 to 2016 on total coliform and *E. coli s*howed various levels of contamination in some of the bores, reservoirs and taps. Figure 33 a-c show the total coliform count and E. coli count for the years 2013, 2014 and 2016. There was a downward trend in the total number of contaminated sites between 2011 and 2016 (Figure 34). Contaminated sites were investigated and tanks were cleaned before the water was allowed to be used for human consumption (Mokoia pers. comm.). The source of the contamination needs to be investigated to ensure that remedial actions are taken to address the problem.

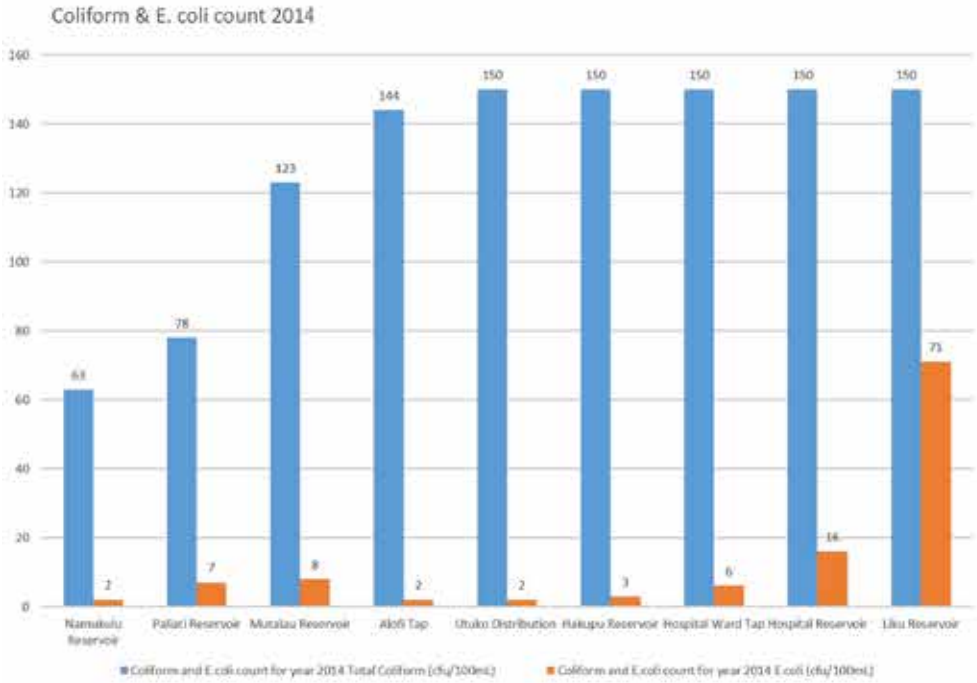
Impact

Water is essential for all life on the island. The quality of the water is affected by many factors, especially human activities and climate impacts. Inundation of the groundwater by sea due to sea level rise can alter the trace elements and the taste of water. Contamination by faecal matters of the water system, such as not sterilising machinery, can lead to health impacts. The key factor is to ensure that a monitoring system is in place to detect these events before they harm community health.

2013



2014



2016

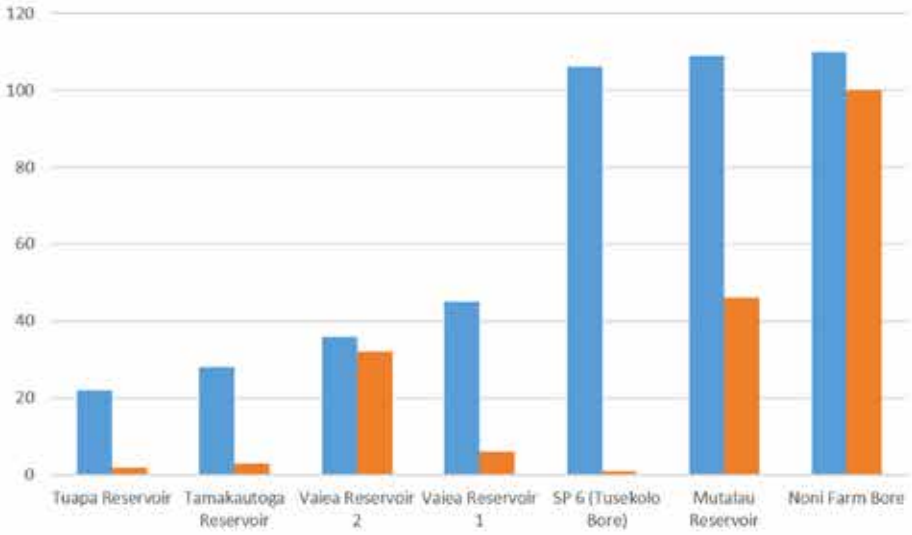


FIGURE 33 (A-C). Total coliform and E. coli counts from infected sites for the year 2013, 2014 and 2016. Source: Department of Health Statistics.

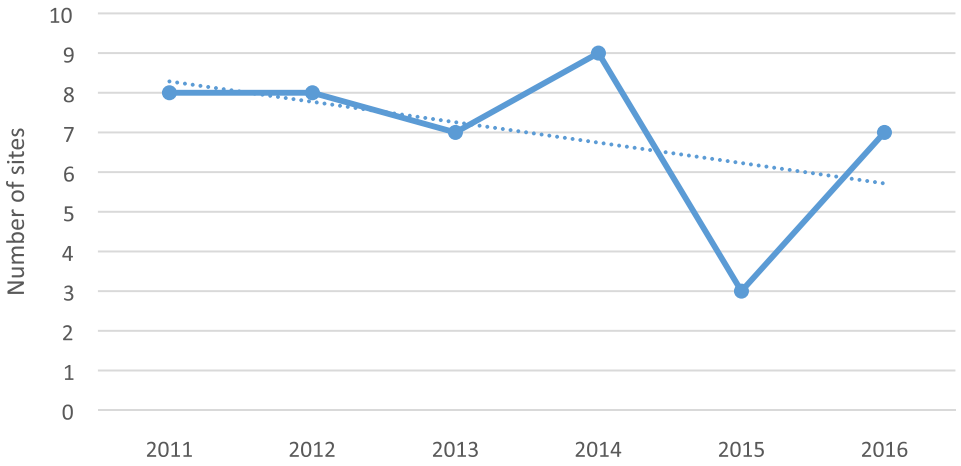


FIGURE 34. Total number of sites contaminated with total coliforms and E. coli from 2011 to 2016. Source: Department of Health.

Response and Recommendations

The risk of contaminating the water system is highest during water extraction, storage and distribution. Of particular concern are the storage tanks and distribution pipes supplying water to households. Activities near bore water extraction areas, such as agriculture, or the use of herbicides and other chemicals, can be a threat to the underground water table (Table 13). In addition, poorly constructed and maintained septic tanks and open disposal of sewage can also contaminate groundwater. Managing groundwater relies on the input of three government departments: Department of Utilities, Department of Health and the Department of Environment (Table 14 and Table 15).

TABLE 13. Threats to Niue's groundwater lens and responsible agencies. Source: Siohane and Chapman 2008.

Hazard	Hazard Event	Responsible Agency
Microbiological contamination	Seepage from septic tanks	DoE
	Seepage from piggery waste	DoH
Asbestos	Seepage of asbestos from waste sites	DoU/PMCU
Nitrates	Seepage from septic tanks	DoU/DoE
	Seepage from piggery waste	DoU/DoH
Heavy metals	Industrial discharge	DoU and DoE
	Used batteries disposed in roadside dumps	DoU and DoE
Pesticides	Agricultural runoff	DoU, DoE and DAFF
Saltwater	Saltwater intrusion	DoU

TABLE 14. Key agencies and their responsibilities, as mandated by the Government. Source: Niue AMP 2016.

Responsible agency	Monitor	Site	Frequency
Dept. of Utilities	Temperature, salinity, pH (profiling and trending)	Bores	Monthly
Dept. of Health	Total coliforms, *E. coli*	Bores, Reservoirs, Reticulation	Quarterly
Dept. of Utilities	Rainfall	4 x rain water sites	Monthly

In order to maintain good-quality water, key issues need to be prioritised and implemented, such as the implementation of national legislation and policies (e.g. Water Regulations 2017, Niue Water Steering Committee Regulations 2017, Water Resources Standards, Policies and Guidelines, and the Niue Water Safety Plan). The drinking water safety planning approach should be implemented within the larger framework of the Integrated Water Resources Management (IWRM) to ensure everyone from the community to cabinet understands their responsibilities and contribution to protecting Niue's water resource.

Microbial analysis of bore water should remain the priority parameter for testing as stated in the Niue drinking water quality monitoring programme, with chemicals and pesticides tested periodically or when a contamination risk is suspected. The results from the 2011 to 2016 data show there is bacterial contamination of some sites and this needs to be urgently addressed. The Niue Water Steering Committee should ensure regular dialogue and collaboration on water quality monitoring and water resource assessment to enable useful data on water quality and quantity to be produced for informed decision-making.

While the priority should be in safeguarding the groundwater lens, all residents should be mindful of the impact of runoff to coastal areas. Removal of domestic and chemical wastes from coastal areas is one of the steps that the community can take. A coastal water quality survey in 2003 found high nitrate and phosphate levels in the water column, which contributed to fish deaths (Mosley 2004).

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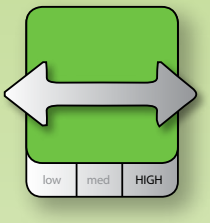
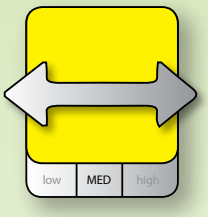
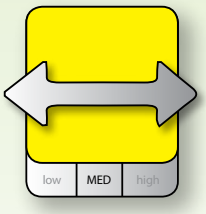
OVERVIEW

This theme covers land use, primarily through the forest and agricultural sectors. Niue's rainforest has declined to half of what it once was. Human settlement, agricultural conversion, extreme climate events (cyclones and droughts) and invasive species are contributing factors. The population decline due to migration has led to reduced agricultural activities and forest conversion in some areas. Abandoned agricultural lands have matured into secondary forests. A few pockets of primary forests remain intact in the heart of the island, with a big proportion found at the Huvalu Forest Conservation Area. Agriculture is important to most Niuean people, and most households have a plot used for planting crops. About three per cent of the total land area is used for agriculture. Taro is the main crop planted, followed by bananas, cassava, yams, lime, passionfruit, vanilla, kava, and noni. The livestock kept is mostly pigs and poultry, as previous efforts to farm cattle, goats and sheep were unsuccessful. Land degradation has been exacerbated through a number of practices, including disc ploughing, the shifting nature of agriculture combined with significantly reduced fallow periods, large-scale land clearance for export cropping of taro, and increased reliance on synthetic fertilisers and herbicides. Niue's soil condition is variable but generally well drained and porous.

LAND HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
FORESTS FOREST COVER AND CHANGES	 **Status** Good **Trend** Stable **Data confidence** High	Forest cover declined since the 1950s due to land clearing for agriculture and logging. Forest cover recovered slightly in the mid 2000s, attributed to a declining population and therefore falling agricultural activities and low demand for timber. The push for coastal development to cater for a resurgence in the tourism industry threatens littoral forests. Abandoned agricultural lands are reverting to secondary forests. Threats to forests come from slash and burn, bull-dozing and cyclones.	The government has developed its forest management plan and built its capacity in assessing forests, seedlings, planting and tending to forest trees. Implement the management plan for the Huvalu Forest Conservation Area and ensure that buffer zones provide the necessary protection for the core of the primary forests. Monitoring of forest and vegetation cover should be done regularly to keep track of areas that need management. Ensure a sustainable harvesting regime is put in place to conserve and protect trees and associated biodiversity.
AGRICULTURE LAND UNDER CULTIVATION	 **Status** Fair **Trend** Stable **Data confidence** Medium	Based on the last comprehensive agriculture data collected in 2009, the majority of households (91%) continue to depend on agriculture, with about 299 households engaged in subsistence agricultural activities, and 109 engaged in subsistence and cash crop activities. Major crop is taro; however, new crop varieties are being introduced.	Agriculture Sector Plan 2015–2019, Food Security Policy developed – all in line with the National Strategic Plan 2016–2026. Capacity remains a challenge for the sector, as people migrate abroad, farmers are getting older and youth are not interested in becoming farmers.
SOIL FERTILITY	 **Status** Fair **Trend** Stable **Data confidence** Medium	Niue soil is formed from volcanic ash overlaying limestone. Soil is high in clay that is strongly aggregated, with high pore space and permeability. Nutrients are sufficient to support plant life. Human activities have impacted soil fertility and influenced plant diversity and abundance. Disc ploughing and burning are impacting soil.	Government completed the development of a soil manual and guidelines to conserve and protect soil resources. Conservation of soil is important for the health of plant life on the island, as well as for agricultural production. Initiatives to discourage disc ploughing of land for clearing and burning of vegetation should be implemented. Encourage more composting to improve soil conditions. Regular monitoring of soil nutrients should be undertaken, especially in areas where intensive farming takes place.

FOREST COVER AND CHANGES

INDICATOR DEFINITION

Niue was once covered with an extensive forest of tall trees that formed a relatively dense canopy with the understorey composed of limited shrubs and an herbaceous layer (Sykes 1970). Figure 35 provides a schematic profile of Niue's typical habitat zones. Over generations, human activities and natural events (cyclones, droughts) have contributed to the decline in forest cover. There are many ecological services provided by forests, including soil preservation; maintenance of watershed quality; and nurturing and supporting unique and diverse species through providing habitat, nesting and food resources. Forests also provide medicine, firewood, ornamentals and spiritual uses for Niuean communities (Thaman *et al.* 2004). Forest loss has serious implications for these ecological services and human survival on the island. The change of forest cover indicator aligns with the CBD Aichi Target 5 – whereby by the year 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible, brought close to zero, and degradation and fragmentation is significantly reduced.

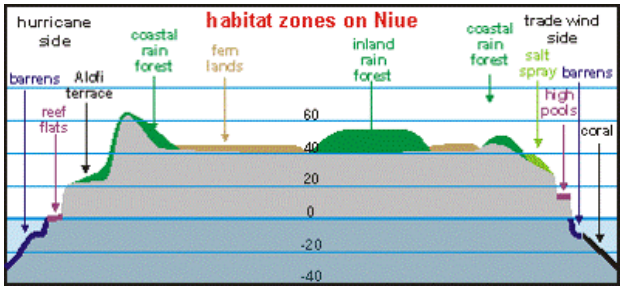
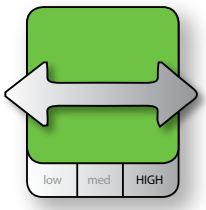


FIGURE 35. Profile of the country showing distribution of habitats. Source: www.seafriends.org.nz.



Status
Good

Trend
Stable

Data confidence
High

Status and Findings

SDG	CBD	NBSAP
15 LIFE ON LAND	5, 7, 15	**Theme 1** Conservation and sustainable management of terrestrial habitats

Environment and Climate Change Pillar [NNSP 2016–2026]

Natural Resources: Protection and conservation of Niue's natural resources through responsible, sustainable use and management for food and nutrition security that is sufficient, safe, affordable and accessible

Niue's vegetation has been mapped and classified by a number of researchers (Table 15, Figure 36 and Figure 37). Frost and Berryman (1966) delineated forest areas, among other classes, in a survey of timber resources, a theme repeated in a survey of merchantable forests by the Niue Forestry sector in 1990. Whistler and Atherton mapped the Huvalu Forest Conservation Area as part of a botanical survey in 1997, and in 2002 Krausse and team produced a classification (using the Satellite Pour l'Observation de la Terre, or SPOT, multispectral imagery) of the whole island as part of a forestry aid project.

FIGURE 36. Coastal shrub land.

TABLE 15. Land cover classifications (earlier and current systems).

Niue LCDB Class Name	Earlier Classifications
Built-up area	Bare land
Transport infrastructure	
Quarry or dump	
Bare soil	
Urban open space	
Improved grassland	Managed Land
Unimproved grassland	
Short rotation cropping	
Perennial cropland	
Exotic forest	
Fernland	
Managed shrubland	
Broadleaved scrub	Secondary forest
Secondary forest	
Mature forest	Mature forest
Littoral forest	Littoral forest
Littoral shrubland	Littoral shrubland

According to Whistler and Atherton's assessment of the forest, the mature forest has a high, closed canopy dominated by native trees (*kolivao, kafika, tuali, le* and *tava*) and several other species. Coastal forest is comprised of littoral and coastal tree species, with a lower scrubby forest on the seaward margin typically dominated by the native futu tree, and in open exposed areas, by littoral shrubs. Secondary forest lacks the closed, even canopy layer of the mature forest and is dominated by a wide range of secondary forest species such as fou, tavahi, toi and moota. Abandoned managed land left fallow (4 to 10 years) is dominated by secondary scrub species such as fou, nonu, tete and le hau. If over-cropping occurs, then ferns, particularly mohuku (Nephrolepis hirsutula), dominate over the ground cover. Niue's native forests (primary and secondary) now cover an estimated 70% of the land (see Figure 38 and Figure 39) (DAFF, 2008).

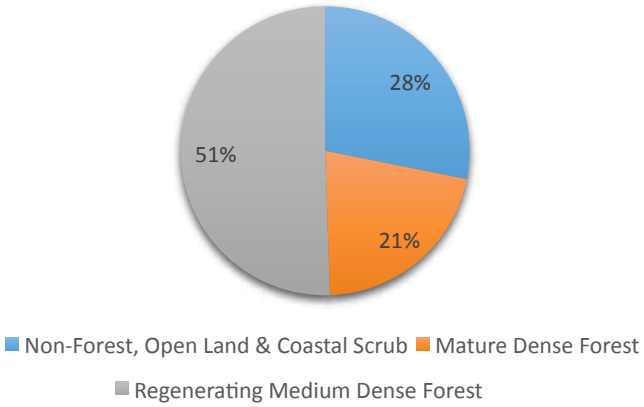


FIGURE 37. The vegetation types in Niue dominated by regenerating forests. Source: GON 2014b.

Recent mapping of the island (Figure 38) illustrates the change in land cover over the years 1994, 2001 and 2008, noting numerous but often very small differences in area covered by different types of land use (Table 16). According to Newsome (2017), "… *the changes could be described as a volatile cyclic pattern of land cover change in managed cropland and shrub land, overlying a general expansion and thickening of woody vegetation, as a declining population allows progressive reversion of many former croplands".*

TABLE 16. Comparative analysis of land area cover between 1994 and 2001 with the seven vegetation types. Source: Nemaia 2004.

	1994		2001	
	Land area (ha)	**% Area cover**	**Land area (ha)**	**% Area cover**
Mature forest	6805.0	26	9273.8	35.5
Secondary forest	11232.6	43	9190.5	35.2
Littoral forest	1313.0	5	1471.0	5.6
Littoral shrub land	5449.9	1.7	487.6	1.9
Managed land	5449.9	20.9	5329.1	20.4
Bare land	886.1	3.4	390.1	1.5
Total land area	26142.1		26142.1	

In 1994, 5450 ha of land was classified as managed land, and in 2009, only 744 ha was documented as managed land. Most of the land captured in this decline has been converted to secondary forest. The current estimation of mature forest cover (including littoral and shrubland), or land not available for agricultural purposes, is 35%. The most intact of this mature forest area is preserved within the Huvalu Forest Conservation Area.

Forest decline has plateaued and evidence is pointing towards a positive recovery of around 36%, largely due to managed land reverting to secondary forest. This gain, together with the 35% of mature forests make up the overall forest covers. Forest decline was heavy from the 1950s to late 2000s, as a result of population settlement, agricultural demand and the use of overly efficient technology to clear large areas (DAFF 1998; DAFF 2008; De Vletter 2008; Nemaia 2004). Cyclones also contributed to changes in forest cover and forest species, and invasive species (e.g. wild pigs, feral cats and rats) have had serious impacts.

FIGURE 38. The distribution of vegetation types in Niue. Source: Newsome 2017.

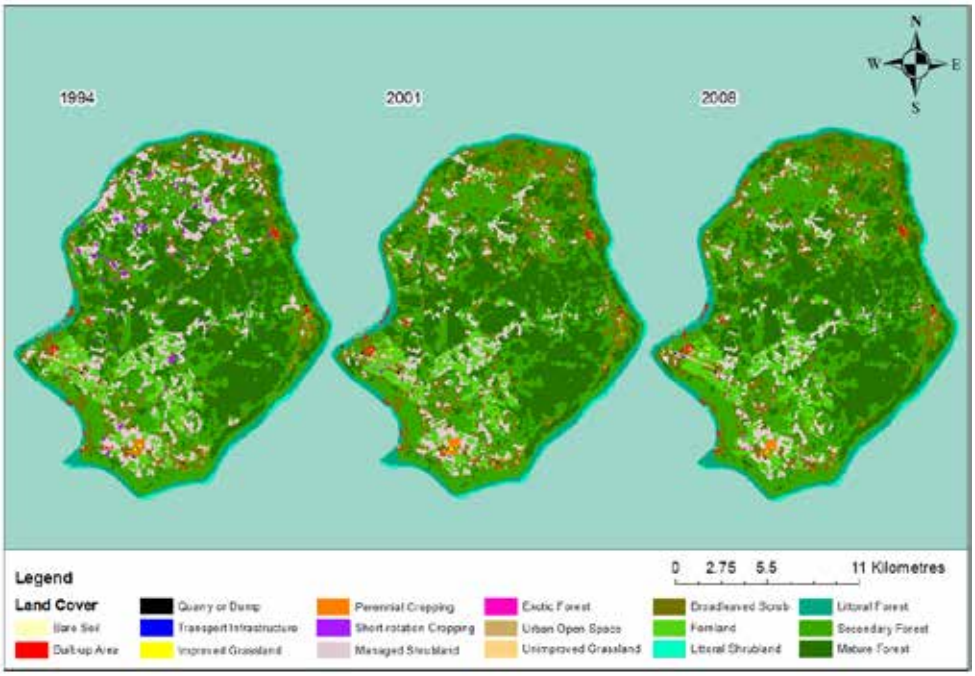


FIGURE 39. Land cover mapped at three time steps: 1994, 2001 and 2008. Source: Newsome 2017.

Impact

Agriculture is a leading cause of forest loss, where tracts of land are cleared using bulldozers for planting taro and other crops. The clearance of forests and land have on occasion led to the destruction of heritage sites. Previous government incentives, such as the Moui Faka Niue scheme, increased the affordability of land clearing for agriculture, which may have led to loss of some forest and heritage areas. With the use of larger bulldozers, access to forest areas has increased. Bulldozer tracks have also provided access for feral pigs to move around and access more areas as observed by agriculture farmers during village consultations.

Cyclones also affect forests, leading to vegetation loss. For example, Cyclone Heta defoliated or uprooted an estimated 5–30% of trees (Butler 2004). Invasive plants are another threat undermining the quality of forest areas, through outcompeting native plants, disturbing forest regrowth, and encroaching on native and endemic species, territory. Invasive weeds are usually faster growing, outcompeting native species especially in abandoned croplands. Landowners often resort to burning or bulldozing weed infested areas, ultimately affecting soil condition and health. With the opening up of the forest, vulnerable species, such as *lupe*, *peka* and *hega*, become easy targets for hunters, as well as invasive predators, including pigs, feral cats and rats. The decline in native species numbers has implications for the pollination and distribution of seeds of native trees and vegetation.

Logging of high rainforest timber has contributed only a small percentage to forest loss between 1966 up to the present day. The sustainable logging level of the indigenous forest is 3500 m^3/annum. The 1990s rate was 230 m^3 and the current rate is well below the 1990s level. The focus on developing the tourism industry may have some implications for littoral forests due to the construction of facilities in coastal areas.

Response and Recommendations

The pressure from logging and agricultural land conversion is absent at this time, hence it is anticipated that mature forests will continue to remain intact unless other pressures such as cyclones or human settlement, are presented. Secondary forests will likely increase in cover, largely due to the conversion of agricultural plots to forests. Threats to secondary forests are primarily from invasive plants and burning. It is important that the clearing of forests by bulldozing or burning is effectively managed to minimise any adverse impacts on native biodiversity, soil health, the groundwater system and coastal waters. Littoral or coastal forests are likely to be impacted due to the current push to develop tourism and construct more facilities along the coast. Efforts to monitor this development need to be put in place to ensure there is a balance between economic development and the integrity of the littoral forest system. Invasive species are one of the key threats to forests and the Government has developed its National Invasive Species Strategy and Action Plan (NISSAP) to target priority invasives, which will benefit the health of Niue's forests. A Forest Management Plan has been developed containing provisions for commercial forestry, should the industry be revived. This includes having a sustainable harvesting rate to ensure careful management of Niue's forest resources (Figure 40).

FIGURE 40. Mahogany plantation at Vaipapahi forms an important forestry management plan. Photo: P. Skelton.

The Huvalu Forest Conservation Area (HFCA) remains one of the highlights for Niue since its establishment in the mid-1990s (Figure 41). The area is relatively pristine, with little impact from human activities within its core, where a *tapu* is placed. The HFCA provides a safe haven from humans, for bird and *peka* populations, and a source for native plant seeds. However predatory invasive species, such as rats, cats and pigs, impact tremendously on both the fauna and flora of this area. Human use is permissible in certain areas, especially around the buffer zone. Arthur Whistler and James Atherton (1997) studied the vegetation of the HFCA, where the vegetation was categorised as either Managed Land Vegetation (vegetation that is in a continual state of disturbance) or Natural Vegetation (vegetation that has not been disturbed for some time).

The level of understanding of land use and land cover has increased due to recent projects and developments. The Niue Land Cover Database is a recent effort to monitor land use and land cover change through 17 land cover classes using GIS mapping (Newsome 2017). This database needs to be utilised and therefore adequate capacity and resources need to be secured to ensure that it is able to fulfil its purpose.

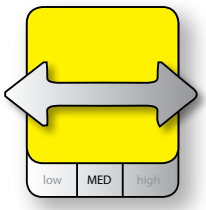
The use of emerging technologies such as LiDAR, drones and monitoring the land-use cover for whole of Niue.

FIGURE 41. Entrance to the Huvalu Forest Conservation Area, Niue's location for the best intact primary forests. Photo: P. Skelton.

AGRICULTURE: LAND UNDER CULTIVATION

INDICATOR DEFINITION

Agriculture is still practiced primarily for domestic food consumption, and if there is a surplus to provide a source of income to supplement primary income. It is also an important response to securing food and nutritional security for the country as it faces uncertain global changes. As agricultural practices can have adverse impacts on the environment; it is prudent that all agricultural activities are encouraged but managed appropriately. This indicator tracks agricultural production, in particular land under cultivation, crops and level of household participation.



Status
Fair

Trend
Stable

Data confidence
Medium

CBD

SDG

Environment and Climate Change Pillar [NNSP 2016–2026]

Natural Resources: Protection and conservation of Niue's natural resources through responsible, sustainable use and management for food and nutrition security that is sufficient, safe, affordable and accessible

Finance and Economic Development Pillar [NNSP 2016–2026]

Agriculture

FIGURE 42. Planting taro is a key household activity.
Photo: H. Tongatule.

Status and Key Findings

Agriculture farming is constrained due to the limited availability of arable land (Figure 42). Despite this limitation, a significant subsistence-farming sector exists. In the 2009 Agriculture Census, 91% of households (422 households) were engaged in some form of agricultural farming (Figure 43 and Figure 44). The majority (299 households) were subsistence farmers, with 109 households undertaking subsistence/cash farming, and 14 households farming primarily as a commercial venture (2009 Agriculture Census). Taro plantations were the most abundant taking up 1317 acres of land (2009 Agriculture Census), with exports of 3,300 mt in 2007 (Manner and Taylor, 2009). Other crops being planted include coconut,

vanilla, yam and banana. The total area farmed declined significantly from 26% (6,819.5 acres) in the 1989 Agriculture Census, to 7.2% (1,882 acres) in the 2009 Census.

Unreliable services and the unavailability of large equipment like bulldozers has discouraged many farmers. This has led to a decline in farming plantations with implications on food security.

Uncontrolled burning has lead to social tension on land boundaries and slow regeneration of vegetation.

Of the 467 households surveyed in the 2009 Agriculture Census, 333 households kept livestock, primarily chickens and pigs. Cattle, goats and sheep were introduced in the 1960s to early 2000s (Table 17 and Table 18), but by the mid-2000s local interest in maintaining livestock declined. Most households only have pigs and chickens.

During the past five years the agricultural focus has been on vanilla (*Vanilla tahitiensis*) (Figure 45), kava (*Piper methysticum*), and Nonu (*Morinda citrifolia)*. Farmers of these crops are being certified as organic producers. The Niue Vanilla International sells its certified vanilla to the United States and Europe, but the company is in need of more growers in order to meet the demand.

There is a need for the encouragement of youth to maintain farming practices, traditional knowledge and links to the land.

TABLE 17. Statistics on livestock from 1997–2007. Source: Numbers in . are taken from FAOSTAT. ** figure from 2006 Census.

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cattle	80	50	30	30	n.r	n.r	n.r	n.r	n.r	n.r	n.r
Goats	5	5	5	5	n.r	n.r	n.r	n.r	n.r	n.r	n.r
Sheep	6	6	6	6	n.r	n.r	n.r	n.r	n.r	n.r	n.r
Pigs	(1800)	(1800)	(1800)	(1800)	(1900)	(1900)	(1900)	(1900)	(2000)	(2000)1164**	(2100)

TABLE 18. Agricultural activity and land use by villages. Source: 2009 Agriculture Census.

Village	Households	Agricultural Activity		No. Holdings	No. Parcels	Area (acres)	Area (ha)	Est. total area (ha)
		Yes	No					
Makefu	17	15	2	21	57	52.8	21.3	1713
Tuapa	33	32	1	50	105	168.3	68.1	1254
Namukulu	4	3	1	6	6	9.0	3.6	148
Hikutavake	18	18	0	26	47	59.8	24.2	1017
Toi	9	9	0	13	24	28.0	11.3	477
Mutalau	34	34	0	57	151	165.5	67.0	2631
Lakepa	19	18	1	24	55	70.8	28.6	2158
Liku	26	25	1	30	91	197.3	79.8	4164
Hakupu	43	41	2	55	140	306.9	124.2	4804
Vaiea	15	15	0	16	32	42.5	17.2	540
Avatele	42	42	0	56	123	170.8	69.1	1399
Tamakautoga	35	34	1	40	128	135.5	54.8	1193
Alofi South	118	87	31	143	200	294.8	119.3	
Alofi North	54	44	10	56	104	135.6	54.9	4648
TOTAL	**467**	**404**	**63**	**593**	**1263**	**1837.3**	**743.5**	**26146**

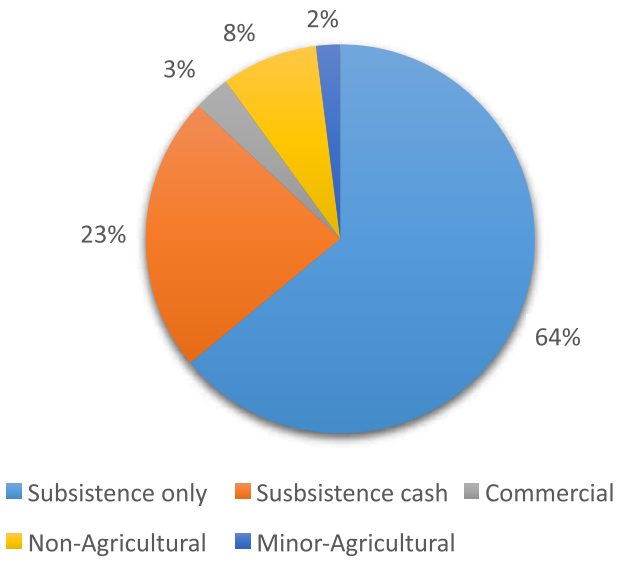


FIGURE 43. Percentage of households by level of agricultural activity. Source: 2009 Agriculture Census.

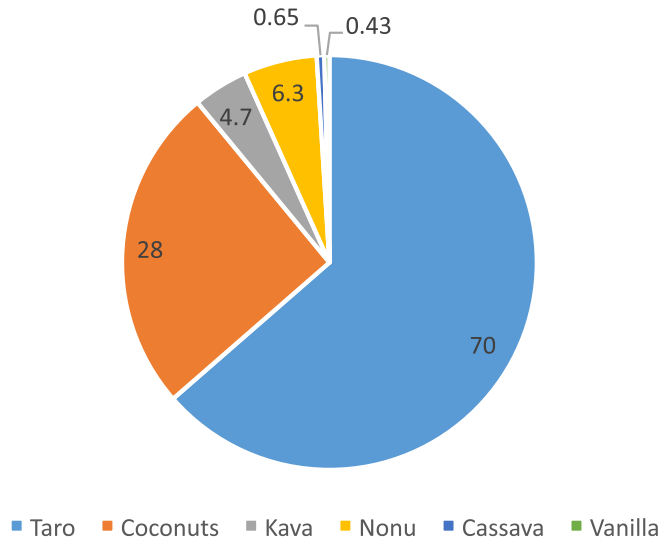


FIGURE 44. Percentage of agricultural land being used to farm the six key crops. Source: 2009 Agriculture Census.

FIGURE 45. Niue vanilla is exported to the United States and European markets.

Impacts

Agriculture has always been a part of Niuean living, and people were able to grow their taro, yams and other edible crops by understanding good farming areas and practices. The economic focus on promoting exports led to large scale farming that involved the use of disc ploughing to clear land. The 2009 Agricultural Census reported over 600 acres of land was cleared using a bulldozer. Alongside the use of these overly efficient land clearing methods, the practice of fallowing land for a certain time period was also disregarded. The decline in population, with most of the active farmers and future farmers opting to move overseas, left the agricultural sector in crisis. Most of the agricultural lands are now abandoned croplands that are reverting to secondary forests. Some of these lands are teeming with invasive shrubs providing a constant threat to native forests. Another important impact with the decline in agriculture production is the high reliance on imported food, which may undermine efforts for food security. Imported foods are often highly processed, which has been linked to lifestyle diseases such as obesity and diabetes.

Response and Recommendations

Agriculture is integral to the economy of Niue and has been identified in the National Strategic Plan as one of the priority areas for economic growth.

There is no doubt that the agricultural sector faces a number of important challenges. These include high production costs, limited arable land, the declining interest in the primary sector from the youth, managing invasive species and climate variability. The Government remains committed to the sector promoting initiatives and programmes to engage community, youth and the private sector. One of the areas that government needs to be wary of is avoiding perverse incentives, such as the Moui Faka Niue that led to widespread land clearing and the spread of invasive species.

The Vaipapahi Farm continues to play a central role as a farming demonstration site for the promotion of new crop varieties, for propagating plants and as a nursery providing seedlings to farmers. Efforts to support the Vaipapahi Farm to ensure it continues to provide planting materials to farmers and the general public are worth pursuing.

The implementation of the Niue Agriculture Sector Plan 2015–2019 with its five key objectives should be pursued:

1. Improving food and nutritional security,
2. Sustainable food production,
3. Sustainable economic growth,
4. Natural resource management, and
5. Improve capacity.

The Niue Food and Nutrition Security Policy 2015–2019 is another government endorsed document that needs implementation and support by all sectors.

Finance and Economic Development Pillar [NNSP 2016–2026]

Agriculture: Economically viable and sustainable industry development.

FIGURE 46. Vaipapahi Farm remains an important farming demonstration site. Photo: P. Skelton.

SOIL FERTILITY

INDICATOR DEFINITION

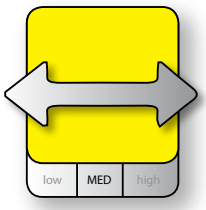
Soil fertility is the capacity of soil to provide a supply of nutrients in the right proportions for crop growth. Plants need about 15 chemical elements (nutrients) which are absorbed from the soil through their roots in addition to carbon, hydrogen and oxygen that are obtained from the atmosphere. A deficiency of a nutrient may result in stunted plant growth with visible symptoms such as yellowing of leaves. For plants in Niue, besides the nutrient content and availability (Table 19), the depth of the soil and its ability to hold water (moisture storage) and its acidity/alkalinity are other key factors. There are four main soil types in Niue (see Figure 47): i) Hikutavake – outer fringe of the island; ii) Hakupu – coconut/pasture soil; iii) Fonuakula – pasture soil, and iv) Palai – forestry soil, root crops.

This indicator measures the soil fertility from the perspective of plant and crop health and cultivation.

TABLE 19. Essential nutrients for crop growth.
Source: Widdowson 2016.

Major Nutrients	Micro-Nutrients
Nitrogen	Iron
Potassium	Manganese
Phosphorus	Copper
Calcium	Zinc
Magnesium	Boron
Sulphur	Molybdenum
Silicon	Cobalt
	Chlorine

FIGURE 47. Soils of Niue. Source: NBSAP 2015.



Status
Fair

Trend
Stable

Data confidence
Medium

SDG

Finance and Economic Development Pillar [NNSP 2016–2026]
Agriculture

Status and Key Findings

The Niuean soils have been formed from volcanic ash overlaying coral limestone or *makatea (*Wright and van Westernport 1965; Leslie 1986a, b; Widdowson 2016), and productivity is limited by both physical and chemical limitations (Leslie 2015). The soils are high in clay that is strongly aggregated; therefore, they do not behave like high clay soils found in other places. The soils have high pore space and high permeability to air and water, and therefore, good aeration and drainage. Where forest trees stand, the soil is deepest and in the coastal salt spray zone, the shallowest. While the coastal forests are unsuitable for agriculture, they are a haven for coconut crabs. The supply of calcium, magnesium and many of the trace elements seems adequate for plant growth in most areas. The fernland that occupies large areas of the central basin is thought to be the result of prolonged over-cropping and subsequent soil impoverishment, and it is suspected that this is probably an old settlement site.

Impacts

Soil condition is critical to all living things in Niue, and the soil plays an important role in filtering water and other liquids before they enter the groundwater lens. Soil condition also determines agricultural productivity. A 7–10 year fallow period was a practice by Niue farmers for a long time, but this is being replaced by shorter fallow periods in order to fast track crop yields. The implications are

that the soil is not given the time to naturally enhance its nutrient contents. Farmers are then resorting to the use of synthetic fertilisers in an effort to reap the same yields. In addition, the use of bulldozers to clear the land, can affect the soil. Historically, disc ploughing was the biggest factor affecting soil structure and fertility in the 1950–1960s. The purpose of using bulldozers was to open up larger areas to extensive agriculture by removing rock outcrops and deep ripping soils. Burning of some areas before planting is common and this may be a reason why some areas are deprived of nitrogen.

Response and Recommendations

The Government's 2016–2026 National Strategic Plan advocates for the sustainable use and management of Niue's soil, forests and biodiversity. Agricultural production and conservation of forests rely on understanding and protecting the soil. The emphasis on soil has led to the production of a manual on Niue's soil and fertility in relation to crop growth (Leslie 2015; Widdowson 2016). The decline in soil fertility and value is a good indicator to demonstrate the unsustainability of certain land clearing and management practices.

FIGURE 48. Arable soil in Niue is limited. Photo: H. Tongatule.

To maintain quality soil that will allow good crop yields, a concerted and united effort by the government, farmers and landowners is needed. The knowledge in soil types and distribution throughout Niue is much better now, which means more informed interventions can be implemented. These include employing better management practices for clearing of fallow lands or the new areas earmarked for farming. Discourage the use of uncontrolled and frequent burning but investigate other alternatives, to help retain nutrients in soil. Composting and the use of organic matter will also enhance soil condition. A programme to encourage communities including church groups, youth and schools to plant native trees will also contribute to the conservation of soil. The need for ongoing monitoring of soil condition is recommended, especially in view of changing weather patterns. Early detection can help with early interventions to prevent impacts to communities. Building the capacity of government staff, as well as raising the awareness of the communities, should remain a core goal for Niue.

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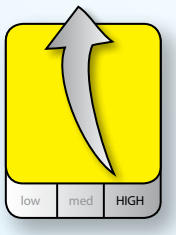
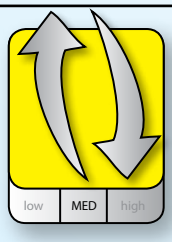
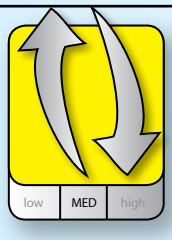
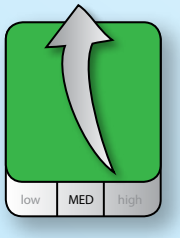
THEME 4 MARINE

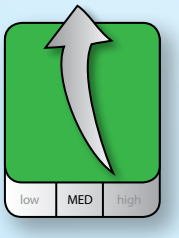
OVERVIEW

Niue's coastline is comprised of cliffs with terraces and a narrow, subtidal fringing reef that descends to over 2,000 m within five kilometres from the shore. There is no barrier reef or lagoon and beaches are limited. The windward side (the east coast) is exposed, especially to prevailing southerly winds, whereas the leeward side has a bit of a reef flat, with sheltered areas and is the side where most of the fishing takes place. The reefs are still recovering from cyclones and coral bleaching events that have occurred in the past few years. Marine plants, especially macro-algae and crustose coralline algae, dominate the benthic community. Live coral cover varies considerably depending on habitats and sites. Sheltered areas, such as Tamakautonga and Tuapa, support high coral cover, whereas the exposed windward sites have low coral cover. Giant clams and sea urchins are the most common marine invertebrates, but biomass varies depending on the site. Sites that are accessible to fishers have a low biomass of giant clams and sea urchins. The abundance of the Grey-reef shark at Beveridge Reef is greater than at any other site in the world, supporting the need for this area to be protected. A protected area designation and formal legal recognition would help Niue achieve its commitment to conserving ten per cent of its coastal and marine areas by 2020. Niuean waters are an important wintering area for humpback whales. The number of whales sighted is increasing every year, supporting a growing whale-watching tourism industry. Commercial fishing in the EEZ has been low and the number of fishing licences being issued are within the acceptable level. Better catch records are needed in this sector to allow for improved management of offshore and inshore fisheries stocks.

MARINE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
BENTHIC COMMUNITY	 **Status** Fair **Trend** Improving **Data confidence** High	The benthic community continues to recover from cyclones and coral bleaching events. The exposure to tides and trade winds determines the benthic composition, with the leeward side showing high diversity. Giant clams and sea urchins are in healthy numbers, except in areas where fishing takes place. Algae dominate most habitats with live coral and bare substrate as the other major benthos.	Fisheries legislation helps with managing giant clam harvest. Marine protected areas and other forms of management, including *tapu* and *fono*, should assist benthic communities to recover from exploitation and natural disasters. While only a small subset of marine invertebrates and echinoderms have been assessed, the populations of other targeted species need to be surveyed. The rarity of the fluted giant clam (*Tridacna squamosa*) may indicate that it is overfished. Enforcing the legislation should help in protecting giant clams and other regulated marine species. Increased communication and awareness noting high tourist numbers, more Niueans returning to settle on the island.
REEF HEALTH	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Live corals continue to recover from cyclones and coral bleaching. Coral cover and diversity is high on the leeward side of the island and reef. Live coral reached a high of 45% cover in 2003, but recent surveys found 15–19% cover. Algal cover is high and the overall reef health is in good condition but limited due to the origin of the island and its geographic isolation.	Legislation is in place prohibiting the harvesting of live corals. Elevated sea surface temperatures are an increasing threat to Niue's coral reefs. Forecasting these bleaching events is improving and the Meteorology office has the capacity to oversee and share such information. It is critical that relevant authorities work with the Meteorology office to implement measures for the protection of coral reefs. Such measures may include limiting human activities and threats to reefs during the recovery stage. Increased communication and awareness noting high tourist numbers, more Niueans returning to settle on the island.
REEF FISH	 **Status** Fair **Trend** Mixed **Data confidence** Medium	The overall fish diversity is limited by the habitats and island's isolated geographic position. Reef fish biomass varies depending on the sites, with high biomass recorded at the Beveridge Reef. The population of the Grey-reef shark is the highest anywhere in the world, but is confined to Beveridge Reef only. Biomass was lowest at 20 m depth at sites around Niue. Three dominant fish groups were surgeonfish, parrotfish and triggerfish.	Fisheries legislation contains provisions for the management of the size, quantity and certain life-stages of several species, including moray eels, giant wrasse, rays and crustaceans. Enforcement of the legislation should contribute to the protection of these vulnerable species. Working with communities to put in place *fono* or *tapu* (traditional bans), will also help in the implementation of the legislation and the protection of marine resources. Increased communication and awareness noting high tourist numbers, more Niueans returning to settle on the island.
MARINE MAMMALS	 **Status** Good **Trend** Improving **Data confidence** Medium	Niue represents an important wintering site for humpback whales. The presence of whales during the migratory season continues to increase. Whales have been critically impacted by commercial whaling, resulting in grave concerns for their survival.	A number of policy and legislative frameworks have been developed to help protect whales and govern the whale tourism industry. These frameworks need to be enacted and implemented as soon as possible. Increased communication and awareness noting high tourist numbers, more Niueans returning to settle on the island.

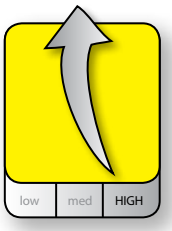
MARINE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
SUBSISTENCE COASTAL FISHERIES	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Subsistence fishing is limited to certain areas due to reef structure and exposure to the elements. Fishing takes place on the leeward side of the island with women gleaning on the narrow fringing reef, and men usually on canoes fishing just off the coast. Documentation of fish catch is sporadic and needs to be improved so that this sector can be better managed. In some areas where fishing takes place, the biomass of target fish is very low indicating over-fishing. In many other places, fish biomass is in good condition.	Subsistence fishing is an important part of Niuean family and community life. Fishing and cultural pride are interchangeable. For this to continue prudent actions must be taken by communities with assistance from the Government. Surveying of fish stocks must also be carried out and documented properly for future management planning.
ARTISANAL AND COMMERCIAL FISHERIES	 **Status** Fair **Trend** Mixed **Data confidence** Medium	The commercial fishing sector is still being developed. Issuing of fishing licenses has been sporadic. The Niue EEZ is relatively small, therefore fishing activities are not as prevalent as seen in other parts of the Pacific. Fish catch varies depending on the source and many are just estimates. The 2013–2014 period saw the largest fish catch on island with 543 and 493 mt of fish, respectively. Fish catch reduced to 296.3 mt by 2016, and just 79 mt in 2015.	Catch limits are imposed on fishing vessels as part of Niue's contributions to the management of tuna stocks in the Pacific. Fisheries legislation has been developed but the capacity to enforce it remains a challenge. Proper documentation of this sector must be a priority. Marine spatial planning framework needs to be developed.
MARINE CONSERVATION AREAS	 **Status** Good **Trend** Improving **Data confidence** Medium	Niue has used traditional bans (*fono* and *tapu*) in certain marine areas as a mark of respect to the passing of a chief. Effectively, these bans can last several years and can assist with the protection of marine resources. Niue has a number of nationally and locally recognised marine conservation areas with the primary focus on protecting marine resources. A recent announcement by the Government calls for 40% of its EEZ to be protected. Details are being finalised but the Beveridge Reef will benefit in this new announcement.	Marine protected areas are an effective management tool that can protect fish diversity, abundance and biomass, while contributing to the replenishment of fished areas. These protected areas must be established in the right place and accorded respect and recognition to make them effective. Details for the 40% of the EEZ designated for protection need to be demarcated and communicated to all stakeholders. There is still confusion about some of the protected areas around the coast and villages, therefore a national consultation between the government and communities needs to take place so that formal recognition and support can be provided.

BENTHIC COMMUNITY

INDICATOR DEFINITION

This indicator assesses the major benthic groups and benthos that live in and on the seabed. The benthic community is critical to the overall health of marine ecosystems, as many of the animals filter water for food and remove sediments and organic matter from the water column. The benthos are the key species that form reefs, provide food for communities and other ecological services. Unfortunately, they are the first to be affected by land-based runoff and poorly managed coastal developments.



Status
Fair

Trend
Improving

Data confidence
High

Status and Key Findings

CBD	NBSAP
6 10	**Theme 3:** Conservation and sustainable management of marine ecosystems and species

Finance and Economic Development Pillar [NNSP 2016–2026]
Fisheries and Marine Resources

The exposure of the fore-reefs to swell and strong winds dictates the distribution and replenishment of benthic species around both Beveridge Reef and Niue reef (Figure 49 and Figure 50). The most recent survey of Niue reefs by Friedlander *et al.* (2017) have found invertebrate numbers were low with the exception of sea urchins and giant clams. The population of giant clams (Tridacna maxima and T. squamosa), was variable, with the density at Beveridge Reef close to the regional reference of healthy stocks (750 individuals/ha) (see Figure 49). The leeward side of Beveridge Reef and inside the lagoon suggest a healthy giant clam population with low fishing pressures, whereas Niue had low densities even on the windward part of the reef, which receives less fishing pressure than the leeward coast (Friedlander *et al.* 2017). Giant clam surveys by Kronen *et al.* (2008) found the average size was 148 mm reaching 300 mm in length. The 2017 survey found clams ranging from 20–400 mm, with a modal length of 111–120 mm in Niue and Beveridge Reef (Friedlander *et al.* 2017). An earlier survey by Dalzell *et al.* (1993) noted the low giant clam densities in Niue. Aside from fishing in some sites, cyclones were a likely factor influencing giant clam population and density (Friedlander *et al.* 2017).

Surveys that included the presence of crown-of-thorns starfish (COTS) found none or very low numbers, however, observation has seen an increase in COTS and Drupella Snails around yacht moorings at Alofi Harbour (Dalzell *et al.* 1993; Kronen *et al.* 2008; Butler, 2004; Fisk 2007; Friedlander *et al.* 2017).

FIGURE 49. Niue is surrounded by a narrow fringing reef, with most accessible reefs on the westward side of the island.

Algae (including macrophytes and crustose coralline algae) were the dominant benthic group at Beveridge Reef (44%) and Niue reef (57%); live coral cover was 15% (Beveridge Reef) and 19% (Niue) and coral rock cover was 13% (Niue) to 35% (Beveridge Reef) depending on the site. Leeward and windward exposure is a determining factor for benthic cover and composition. Macro-algae and hard corals were dominant on the leeward side, whereas coral rock and crustose coralline algae (CCA) dominated the windward side.

Impacts

The benthic community is important for the health of the marine ecosystem and helps to build a strong coral reef. Disruptions to the benthos can undermine the overall ecological services provided by the reef. The exposure and adaptation of many of these animals and plants to their habitat have taken place over millennia. The increasing severity in storm and cyclone activities continues to threaten this balance and lessens the protection provided by the reef for shoreline and human settlement. Cyclone Heta devastated areas of the Beveridge and Niue reefs, and the scars from that event are still evident today. The prognosis looks bleak if the predictions of more category five cyclones are realised. In addition, global warming is raising sea surface temperatures, as well as increasing the acidity of the ocean. Fishing pressure on some of the resources will eventually weaken the quality of the reefs with serious consequences for Niue.

Response and Recommendations

While our knowledge continues to improve, the overall lack of good quality data on the state of the resources and the environment over a sustained period makes projections and management a challenge. Regardless of this challenge, efforts to protect coral reefs should be a conservation priority.

This needs to be a multi-stakeholder approach between government, non-government organisations and private sector including Niue Tourism.

The various surveys over the past 30 years have demonstrated that the overall marine benthic community remains vulnerable from fishing pressure and from destructive cyclones. Beveridge Reef provides a refuge for some of the vulnerable species, such as giant clams, which have seen low populations in reefs surrounding Niue. Fishing activities can be regulated and it requires the agreement and engagement of all villagers, fishers and also the government. Encouraging the establishment of community conservation areas where fishing is prohibited either in the short or long-term will contribute to the protection of the benthic community. Identifying and establishing key areas for long-term monitoring will provide the much needed data to make informed management decisions.

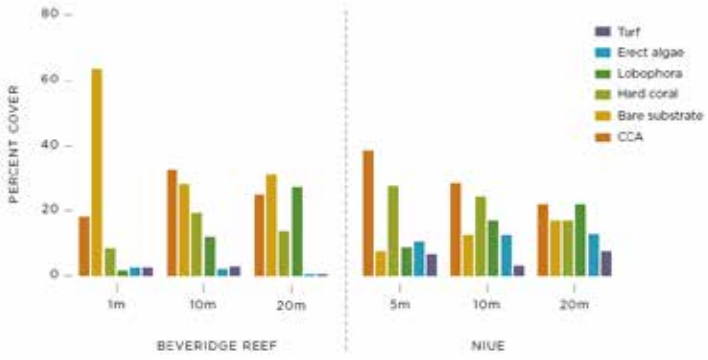


FIGURE 50. Benthic community at Beveridge Reef and reef around Niue. Source: Friedlander *et al.* 2017.

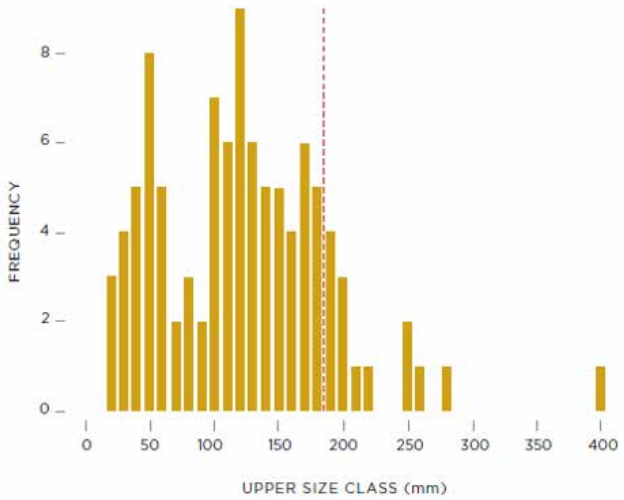


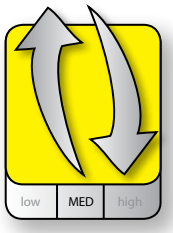
FIGURE 51. Size frequency distribution of T. maxima at Beveridge Reef. The red dotted line represents the minimum legal limit size for harvest in Niue. Source: Friedlander *et al.* 2017.

REEF HEALTH

INDICATOR DEFINITION

Reef Biodiversity Health: Live coral cover, algal diversity and echinoderms abundance

Corals are integral in the formation of reefs that provide habitats for thousands of species, as well as coastline protection. Any change to the environment will affect corals and the reefs. Corals are thus ideal indicator species due to their susceptibility to environmental conditions. This assessment looks at indicator species including corals, algae, and echinoderms. It is important to note that survey methods can have an influence on the data and their interpretation.



Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Findings

SDG | CBD

14 LIFE BELOW WATER

Finance and Economic Development Pillar [NNSP 2016–2026]
Fisheries and Marine Resources

Live coral cover

A total of 121 coral taxa from 12 families is recorded for Niue. The four dominant coral families are Acroporidae (Figure 52), followed by Faviidae, Poritidae and Agariciidae (Friedlander *et al.* 2017). About 18 coral species were considered rare at both Niue and Beveridge Reefs. Coral composition varies between the island and Beveridge Reef, indicating that some of the species on Beveridge Reef may have come from a different source. The dominant Acropora species on Niue were typical of those that thrive in mostly sheltered places, whereas those on Beveridge Reef were generally adapted to strong currents and water movement.

Coral cover varies considerably depending on location, depth and exposure to currents and wind. Recorded percentage of live coral cover can vary depending on the methodology used, therefore the results should be viewed with caution. Around Niue, Dalzell *et al.* (1993) recorded between 5–35% of live coral cover in the west and north coast (between Tepa Point and Liha Point). Coral cover from Liha Point to Vaigata was between 40–70% (mean cover 57.5%). Yeeting (2003) recorded 30% live coral cover in the Alofi area, whilst conducting ciguatera surveys. Fisk (2007) recorded 20–50% live coral cover around the Omahi Sea Track in 2003, and three months after the 2004 Cyclone Heta, another survey recorded 1–9% live coral cover around the Namoui Marine reserve (Fisk 2007)

FIGURE 52. An Acropora coral is one of the dominant group of corals in Niue. Photo: P. Skelton.

(see Figure 53). A year after Cyclone Heta, live coral cover was seven per cent in Avatele (compared to two per cent recorded four months after Cyclone Heta hit) but along the north and west coasts it was less than two per cent, reflecting the destructive path of the cyclone (Kronen *et al.* 2008). The east side of the island fared better from the cyclone recording 29% live coral cover, dominated by Tamakautoga (40% of recorded cover) and Tuapa (10% of recorded cover) (Kronnen *et al.*2008). Three years after Cyclone Heta, average live coral cover was 19% around the island, and 15% at Beveridge Reef (Bruno and Selig 2007). Nearly a decade after the last coral reef assessment was carried out in Niue, live coral cover was found to be the same (19% around the island and 15% at Beveridge Reef) (Friedlander *et al.* 2017). Some areas on the eastern side of the island recorded 26% coral cover, compared to eight per cent on the windward side.

As mentioned earlier, the live coral cover shown in Figure 53, should be interpreted with some caution, due to differing methodologies used for the surveys. A typical healthy live coral cover in the Pacific islands is usually around 20–40%, with crustose coralline algae and live rock dominating the substratum. A decade after Cyclone Heta, live coral cover had rebounded to around 20%, which should be viewed as a strong positive.

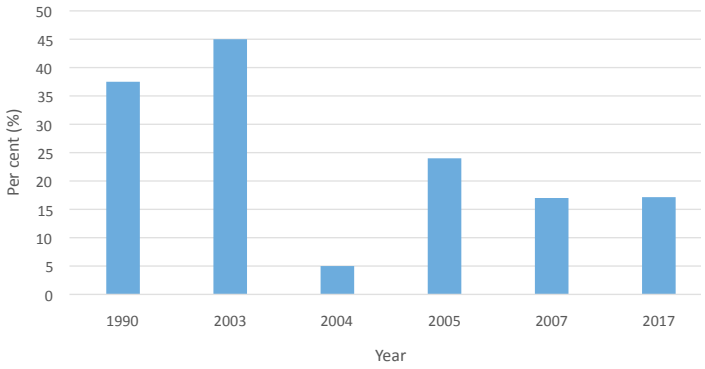


FIGURE 53. Live coral cover taken as an average of survey results for the given years (including Beveridge Reef). Source: Dalzell *et al.* 1993; Fisk 2007; Kronen *et al.* 2008; Friedlander *et al.* 2017.

Algae

A total of 59 algal taxa is recorded for Niue. The green and blue-green algae are the other major floral groups for Niue (see Figure 54 and Figure 55). The affinity of the algal flora is typically tropical and is dominated by the red algal group – Rhodophyta. Temperate to cold-water marine flora are dominated by brown algae (Ochrophyta or Phaeophyta), which in Niue represents 8% of the total flora (Figure 54). The diverse and favourable habitats around Niue reef support a higher number of algal species than Beveridge Reef. In comparison to neighbouring islands and places, the number of species found in Niue is as expected given its geographic location and isolation and the limited diverse habitats (Figure 56, Table 20). Based on the three algal groups, the algal flora of Niue aligns closely with other atoll islands such as the Phoenix Islands, Kiribati and the Mariana Islands (Skelton and South 2007).

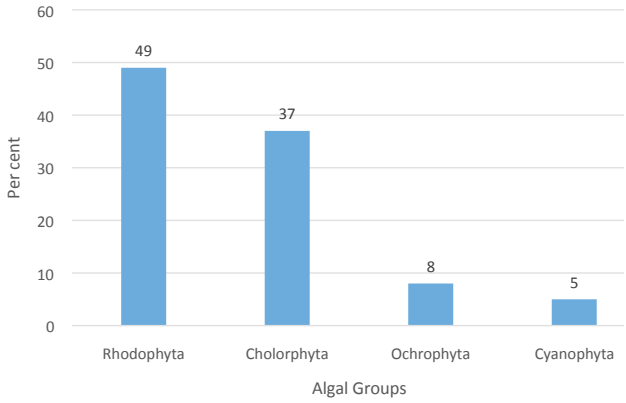


FIGURE 54. The marine flora of Niue is dominated by the four algal groups. Source: Friedland *et al.* 2017.

Lobophora variegata was the most abundant alga recorded for Beveridge and Niue reefs, and from shallow reef flat areas down to below 30 m depth. This alga has two forms – the encrusting form that favours shallow depths and the upright form from 30 m and below (Friedlander *et al.* 2017). Most of the algal species found in Niue have been reported from neighbouring countries. There are a few anomalies including *Palmogloea protuberans* – usually a freshwater green alga and some taxa yet to be determined to specific level (Friedlander *et al.* 2017).

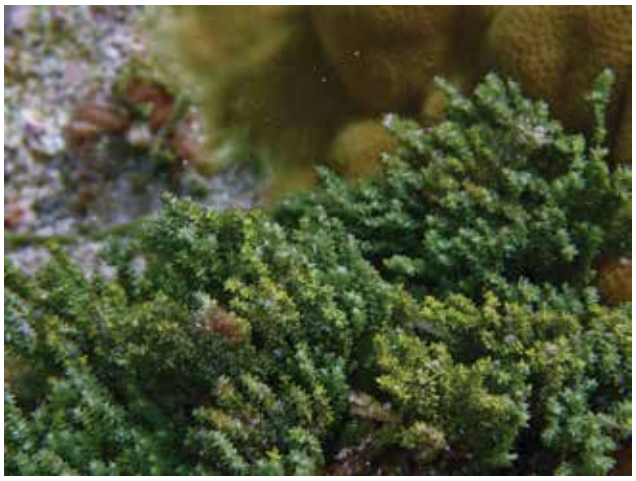


FIGURE 55. Caulerpa cuppresoides one of the few green algae found on Niue reef. Photo: P. Skelton.

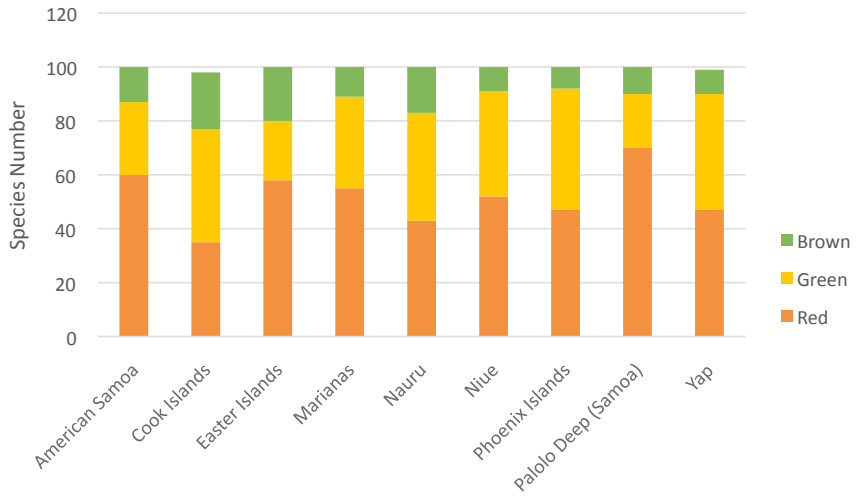


FIGURE 56. Comparison of the Niue flora to neighbouring islands and places showing the distribution of the three major algal groups. Source: Skelton and South 2007.

TABLE 20. Comparison of Niue's three dominant algal groups with selected flora from countries and places in the Pacific. Source: Skelton and South 2007.

Country	Red Algae (no. species)	Green Algae (no. species)	Brown Algae (no. species)	Total (no. species)
American Samoa	133 (60%)	60 (27%)	29 (13%)	222
Cook Islands	20 (35%)	24 (42%)	12 (21%)	56
Easter Islands	79 (58%)	30 (22%)	28 (20%)	137
Marianas	162 (55%)	100 (34%)	32 (11%)	294
Nauru	17 (43%)	16 (40%)	7 (17%)	40
Niue*	29 (52%)	22 (39%)	5 (9%)	56
Phoenix Islands	29 (47%)	28 (45%)	5 (8%)	62
Palolo Deep (Samoa)	88 (70%)	24 (20%)	12 (10%)	124
Yap	101 (47%)	92 (43%)	20 (9%)	213

Echinoderms

Sea urchins, *Echinometra mathaei, Echinostrephus aciculatus* and *Echinothrix diadem*a, are the three most common echinoderms (Figure 57) (Friedlander eta al. 2017). The abundance of sea urchins was higher at Beveridge Reef compared to Niue reef. *Echinostrephus aciculatus* was found to be abundant at 10 m depth, whereas *E. mathaei* was common in the shallow and back reef at Beveridge Reef. Echinothrix was more abundant at five metre depth than in 10 m or below at both Beveridge and Niue reefs.

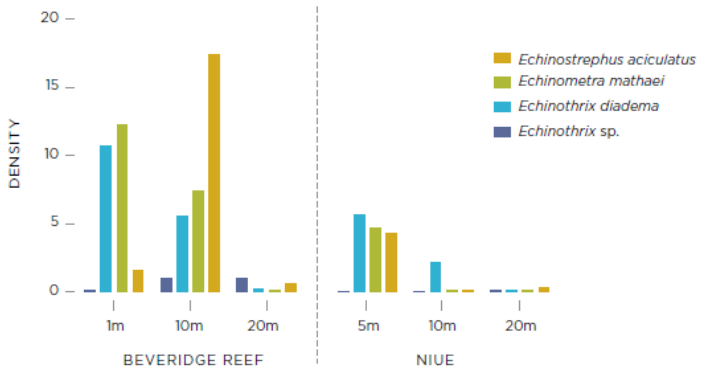


FIGURE 57. Echinoderm densities at Beveridge Reef and Niue island. Source: Friedlander *et al.* 2017.

Impacts

Corals form reefs and are themselves food for many commercially important species. Coral colonies provide shelter for fish and other species. Tourists that visit Niue identified the clear pristine waters and exceptional [sea] visibility as one of the highlights of their experience (Niue Tourism 2015). Any adverse impact on corals will affect the natural beauty that is part of Niue Tourism Office's promotional efforts. Global warming, acidification of the ocean and elevated sea surface temperatures are real threats to coral reefs. The 1997–1998 warming event resulted in a high mortality of corals and coral reefs. Land-based activities can affect coral reefs, especially excessive use of herbicides and pesticides, as well as raw sewage run-off into the ocean. The ecological services provided by corals will be lost if corals die out, including protection of shorelines. Fish stocks and other shellfish are likely to diminish or move elsewhere threatening the livelihoods of communities.

Response and Recommendations

The role of coral reefs in all tropical seas and oceans is critical. Niue contributed to the global state of knowledge on coral reefs through regular reporting under the Global Coral Reef Monitoring Network. Efforts to re-initiate engagement with countries like Niue to monitor and report on the state of reefs should be encouraged.

The government recognises coral reefs as a national *Tāoga* (treasure) for all Niueans. The Niue Sustainable Coastal Development Policy provides a list of action strategies for the protection of coral reefs. The policy acknowledges the inter-relationship between the land and the sea. The management of pollution and waste from land will contribute to safeguarding Niue's coral reefs. Legislation and village rules also play an important role in the management and protection of marine resources. Village participation through national awareness programmes will help foster community ownership of their reefs and marine resources.

New initiatives for government to consider include marine spatial planning framework.

Regular monitoring of key reef habitats should be encouraged and undertaken on a regular basis, either annually or twice a year if resources are available. This may necessitate the establishment of long-term monitoring sites, and the development of monitoring protocols that can be used consistently over time. The role of citizen science should be encouraged, through partnerships with the private sector, especially the dive sector, where there is potential to collect useful data for the management of resources. The Niue Tourism Office should be involved in promoting such a partnership by encouraging citizen science and including it in their marketing promotions.

Ongoing biodiversity and ecological research should be promoted, especially to young Niuean students and researchers, to help them understand ecosystem dynamics and processes that are driving and supporting marine life in Niue.

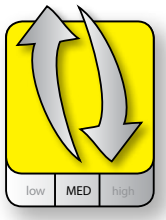
It is critical that during the recovery phase of coral reefs, especially after cyclones and bleaching events, human pressures should be reduced. This may mean having a fishing moratorium in certain areas, especially sites that are considered of high biodiversity value so that there is stock available to help replenish the reef. Enforcement of fishing regulations and encouraging village management will also assist with the fast recovery of reefs.

REEF FISH

INDICATOR DEFINITION

Reef Fish Species Richness, Biomass and Abundance

The role of fish and other species in the marine environment is critical in maintaining reef health and ecosystem services. Fish diversity and abundance is a good indication of the state of the marine environment. The presence of corals, algae and other marine groups influences fish richness and biomass. Herbivorous fish, such as parrotfish and surgeonfish, favour reefs that have good algal cover. Fish that prefer this environment are vital in controlling algal growth and clearing sections of the reef structure to allow new corals to establish. Carnivorous fish favour coral dominated reefs for shelter and food. High abundance and diversity of fish supports coastal communities, but there is often a fine line between harvesting and replenishment of fish stocks. This indicator assesses fish diversity and biomass in Niue.



Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

CBD

Finance and Economic Development Pillar [NNSP 2016–2026]
Fisheries and Marine Resources

FIGURE 58. Fish diversity in Niue. Photo: H. Tongatule.

Fish diversity in Niue includes 295 species in 41 families (Friedlander *et al.* 2017). Limited habitat diversity and geographic isolation are key factors influencing Niue's fish diversity. Endemics in the marine environment are usually rare. Niue has a few fish species that have only been reported from the island (or with limited distribution to neighbouring islands). The Niue blenny (*Ecsenius niue*), the Niue triplefin blenny (*Enneapterygius niue*) and the Avaiki goby, *Kelloggella avaiki*, are three recently recorded fish species for the island (Springer, 2002; Fricke and Erdmann 2017; Tornabene *et al.* 2017).

Fish assemblage varies significantly between Beveridge Reef and the reef systems around Niue, and at three depth levels of 5, 10 and 20 metres. Species richness was lowest at 10 m sites at Beveridge Reef but similar among all other reef/depth combinations. Abundance was highest at the 10 m depth at sites around Niue, and similar among all others. Biomass showed large differences:

- 2.3 times higher at Beveridge Reef than Niue reef;
- Highest at the 20m depth at Beveridge Reef sites;
- Biomass lowest at 20m at Niue sites;
- No significant difference between 5 and 10 m depths for fish biomass across Niue sites;

- Grey-reef shark accounts for 28% of biomass at 10 m depth and 44% at 20 m depth at Beveridge Reef. If sharks were excluded, then biomass was not significantly different between reefs or depth levels.

Friedlander *et al.* (2017) found the fish species richness was highest in deeper areas outside of the fringing reefs, usually below 10 m; the shallow back reef at around 1–2 m depth had low species richness. There is a strong association between species richness and habitat complexity, with the bay off Tamakautoga and Tuapa having high species richness associated with a high complex coral cover. Areas with low reef complexity (e.g. comprised mostly of encrusting corals) had limited species richness, which includes most of the reefs around the island (Kronen *et al.* 2008).

The three dominant fish groups are surgeonfish, parrotfish and triggerfish (Kronen *et al.* 2008; Friedlander *et al.* 2017). Species of particular interest in terms of their abundance and biomass include *Ctenochaetus striatus, Acanthurus blochii, A. nigricans, A. achilles, A. lineatus, Scarus forsteni,* and *Chlorurus frontalis.* The dissimilarity between Niue and Beveridge Reef fish fauna is attributed to the Grey-reef shark, bluelined surgeonfish, bristletooth tang and peacock grouper (see Table 21 – Friedlander *et al.* 2017).

TABLE 21. Fish species that are responsible for the dissimilarity between Niue and Beveridge Reef. Source: Friedlander *et al.* 2017.

Species	Common Name	Beveridge Reef Biomass (g/m²)	Niue Reef Biomass (g/m²)	Average dissimilarity
Carcharhinus amblyrhynchos	Grey-reef shark	40.82	0	10.80
Acanthurus nigroris	Blue-lined surgeonfish	6.83	2.39	5.52
Ctenochaetus striatus	Bristletooth tang	5.36	3.7	4.63
Cephalopholis argus	Peacock Grouper	2.88	3.15	3.01
Chlorurus sordidus	Bullethead Parrotfish	4.15	0.4	2.88
Scarus forsteni	Forsten's parrotfish	1.23	3.23	2.65
Lutjanus bohar	Red Snapper	2.63	2.82	2.64
Parupeneus crassilabris	Double-bar Goatfish	2.87	2.13	2.20
Melichthys vidua	Pinktail Triggerfish	2.22	2.1	2.15
Acanthurus nigrofuscus	Brown Surgeonfish	1.22	2.76	2.12

Sharks

The shark population around the Pacific is threatened with extinction (Jupiter *et al.* 2014), with fishing as a leading cause. Niue supports one of the largest Grey-reef shark populations in the world, but only at Beveridge Reef. The unique population of Grey-reef sharks at Beveridge Reef is a catalyst for designating this area for conservation purposes. Sightings of sharks around other parts of the island are rare. Besides the Grey-reef shark, the Whitetip-reef shark (Triaenodon obesus), the Spotted eagleray (Aetobatus narinari), and the Marbled stingray (Himantura oxyrhyncha), are also found. These elasmobranchs were present in 66% of the total sites surveyed, with a 34% occurrence around Niue and a 98% occurrence at Beveridge Reef.

TABLE 22. Mean MaxN for the Grey-reef and Caribbean reef sharks from various studies around the world. Source: Friedlander *et al.* 2017.

Location	Reef Shark Species	Mean MaxN	Reference
Beveridge Reef	*Carcharhinus amblyrhynchos*	5.10	This study
Palmyra Atoll	*Carcharhinus amblyrhynchos*	1.08	Bradley *et al.* In press
Raja Ampat	*Carcharhinus amblyrhynchos*	0.50	Jaiteh *et al.* 2016
Niue	*Carcharhinus amblyrhynchos*	0.44	This study
GBR = Great Barrier Reef	*Carcharhinus amblyrhynchos*	0.26	Espinoza *et al.* 2014
Belize	*Carcharhinus perezi*	0.23	Bond *et al.* 2012
Fiji	*Carcharhinus amblyrhynchos*	0.20	Goetze and Fullwood 2013

Impact

Niue's dependence on fish for income or food is not as high as other Pacific islands (Kronen *et al.* 2008). Fishing is primarily done for traditional values or for exchange during cultural activities. Fishing pressure is having impacts on some of the fisheries stocks in Niue, but the scale is small compared to similar settings in the Pacific and around the globe. The fish population within the Beveridge Reef lagoon was high, suggesting low fishing pressure (Friedlander *et al.* 2017). The low fish density in Niue, even on the windward part of the reef with low fishing pressure, suggests that other factors may be involved, including cyclones. Kronen *et al.* (2008) estimated the fishing pressure as high, however, the impact as moderate.

Response and Recommendations

Niue has developed its fisheries legislation in an effort to manage the resources and provide safety to all fishers. The legislation includes the Domestic Fishing Act 1995, Domestic Fishing Regulations 1996, Domestic Fishing (Annual Fees) Regulations 2007 and the Domestic Fishing Amendment Regulations 2015. The complexity and availability of suitable habitats are significant factors influencing the fish biomass and population in Niue waters. Fishing pressure of any level is likely to have added impacts on the already low fish biomass and diversity. The fish biomass and diversity between the no-take MPAs and open areas were the same. This may indicate that the level of protection is absent. The Government and the community need to revise the boundaries of some of the MPAs, so that fishers are aware of the protected sites. Proper management plans should also be developed and implemented for these revised MPAs. The significant population of the Grey-reef shark at Beveridge Reef highlights the importance of this area. Conservation and management measures should be considered to safeguard their population.

MARINE MAMMALS

INDICATOR DEFINITION

Niue represents an important habitat for wintering humpback whales, resident spinner dolphins and other cetaceans including pilot, sperm and minke whales. Whales were critically impacted by commercial whaling during the 19th and 20th Centuries and fears for their survival resulted in most species being listed as endangered under the IUCN Red List. In other parts of the ocean, for example the Antarctic, whales play an important role in the health of the marine environment by regulating the flow of food as well as stimulating the growth of phytoplankton that absorbs carbon from the atmosphere. Today, Oceania humpback whales number less than 5,000, and are the least abundant humpback whale breeding population in the southern hemisphere with no significant trend in abundance. This contradicts the recovery seen in most other populations throughout the world (Constantine et al, 2012). Thus whales in Niue warrant continued study and management attention, particularly in lieu of growing tourism pressures.

This indicator assesses the population of whales passing by the island.

Status
Good

Trend
Improving

Data confidence
Medium

Status and Findings

CBD

Finance and Economic Development Pillar [NNSP 2016–2026]
Fisheries and Marine Resources

Recovery in the abundance of humpback whales in Oceania has been slow and variable. Surveys of the endangered Oceania Humpback whales in Niue began in 2008 through the Niue Whale Research Project and local partner, Oma Tafuā. Whale sightings recorded by researchers indicate much variability in the numbers of whales visiting the island between June to October each year (Figure 59). There is concern that Oceania Humpback whales are travelling longer distances to feeding grounds, which potentially may affect their recovery (Constantine *et al.* 2014; Riekkola et al, in 2018).

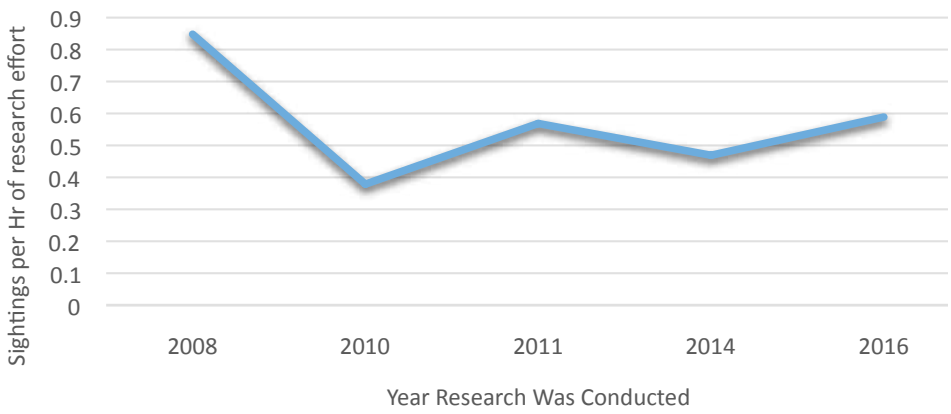


FIGURE 59. Number of whale sightings per year. Source: Olive Andrews, SPWRC – unpublished data.

The Niue Whale Research Project (a long-term research partner of the South Pacific Whale Research Consortium – SPWRC), has identified the interchange between humpback whales of the eastern and western South Pacific Ocean. Several whales in Niue have been matched to other SPWRC catalogues confirming that several humpback whales recorded in Niue waters were sighted in the Cook Islands, Tonga and the Kermadec Islands, New Zealand. Another individual seen in 2011 re-visited the island in 2015.

Niue's very deep bathymetry provides the ideal environment for deep diving species such as sperm whales and beaked whales. The Cuvier's beaked whales have been encountered close to Niue's coast in areas of up-welling. Juvenile Sei whales have been documented associated with Niue's eastern seamounts, 16 km from shore. A pod of Blainville's beaked whales, consisting of at least four individuals, was observed to the west of Beveridge Reef in 2016, and one individual was observed to the east of Beveridge Reef four days later (Friedlander *et al.* 2017). This observation represents the first confirmed record of the Blainville's beaked whale in Niue waters. The global information on Blainville's beaked whales is limited but some studies on movement patterns suggest strong site fidelity (Schorr *et al.* 2009), hence these individuals may represent a resident population. Species that have been recorded in Niue, or from historical records are likely to be present in Niue, are listed in Table 23**.**

TABLE 23. List of cetacean species reported, or likely to be present in the waters of Niue. "R" Indicates the species has been recorded. "L" Indicates the species has not been recorded but is likely to be present. R* (Andrews 2005). a pod of at least four individuals was filmed to the west of Beveridge Reef on Oct. 1, 2016 by Friedlander *et al.* (2017).

Common Name	Species	Niue
Blue whale	*Balaenoptera musculus*	L
Humpback whale	*Megaptera novaeangliae*	R
Bryde's whale	*Balaenoptera edeni*	L
Sei whale	*Balaenoptera borealis*	R
Fin whale	*Balaenoptera physalus*	L
Antarctic Minke Whale	*Balenoptera acutorostrata*	L
Dwarf Minke whale	*Balaenoptera bonaerensis*	R
Sperm whale	*Physeter macrocephalus*	R
Dwarf Sperm Whale	*Kogia simus*	L
Pygmy Sperm Whale	*Kogia breviceps*	L
Killer whale	*Orcinus orca*	L
False killer whale	*Pseudorca crassidens*	L
Blainville's beaked whale	*Mesoplodon densirostris*	R*

Common Name	Species	Niue
Pygmy killer whale	*Feresa attenuata*	L
Short-finned pilot whale	*Globicephala macrorhynchus*	R
Bottlenose dolphin	*Tursiops truncatus*	L
Common dolphin	*Delphinus delphis*	L
Spinner dolphin	*Stenella longirostris*	R
Pantropical spotted dolphin	*Stenella attenuata*	L
Striped dolphin	*Stenella coeruleoalba*	L
Melon-headed whale	*Peponocephala electra*	L
Risso's dolphin	*Grampus griseus*	L
Fraser's dolphin	*Lagenodelphis hosei*	L
Rough-toothed dolphin	*Steno bredanensis*	L
Cuvier's beaked whale	*Ziphius cavirostris*	R

The only resident cetaceans in Niue are the dwarf spinner dolphins (*Stenella longirostris roseiventris)*, but genetic studies are needed to confirm this. Further scientific research such as habitat modelling in Niue waters is needed for the development of management strategies such as zoning and seasonal closures, in addition to tourism and fishing regulations, which are needed for better protection and management of cetaceans within the Niue Whale Sanctuary, particularly species of global conservation concern such as the endangered Oceania humpback whales.

Impacts

Cetaceans are considered '*tapu*', or sacred, to Niueans due to legends attached to their contribution to Niuean society including traditional stories associating them with pregnancy, good luck in birthing, and Mataginifale, a Niuean woman who travelled in the mouth of a whale, having arrived in Tonga where she was said to have taught midwifery to the Tongans. Niuean people do not have a history of eating cetaceans like their Pacific neighbours in Tonga. Cetaceans have high socio-economic value to Niue having become one of the main tourism drawcards for the country, which relies heavily on tourism for over 70% of its GDP. Thus, conservation management of this key resource on which the country depends is critical.

Response and Recommendations

The protection and conservation of whales in Niue waters is captured under the Niue Domestic Fishing Regulations 1996, where cetaceans (whales, dolphins and porpoises) are classified as protected fish species. “No person shall interfere, take, kill or bring ashore whales, porpoises or dolphins”. The Niue Whale Sanctuary Regulations 2003, enhanced the protection of whales by declaring Niue’s EEZ and Territorial Seas as a whale sanctuary in 2002.

A management plan for the Niue Whale Sanctuary was also developed to complement the Whale Sanctuary Regulations, with four main objectives:

- Manage the sanctuary with respect to the cultural values and aspirations of Niuean people,
- Conserve and protect the sanctuary’s cetaceans, particularly those of vulnerable status and/or of regional significance,
- Promote understanding of cetaceans and the sanctuary’s cultural and environmental significance, and
- Minimise the effects of human use on the conservation values of the sanctuary, while providing for recreational and commercial uses.

Collaboration amongst the government, the Niue Tourism Office, SPWRC and the local NGO – Oma Tafuā to implement the whale management plan remains challenging due to limited capacity and resources. This has implications for the implementation of other conservation initiatives including the Convention on Migratory Species (CMS). Regional partners including the International Fund for Animal Welfare (IFAW), Whales Alive, Whaleology and Tofia Niue have provided support to Oma Tafuā to conduct national workshops, community consultations, public education, annual whale watch operator training and the whale research project, between 2003 to 2018. This support has contributed to the development of the Whale Watching Regulations 2016. The main recommendations for whale conservation include:

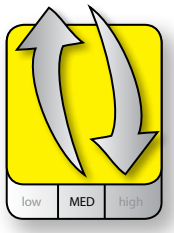
- Update and implement the recommended actions of the Plan of Management for Niue Whale Sanctuary.
- Build enforcement capacity for the implementation of Niue Whale Watching Regulations.
- Combine visual and acoustic surveys with habitat modelling to define the distribution and areas of critical habitat for cetaceans in Niue waters.
- Use habitat modelling outcomes to create zoning for the nearshore area of Niue whale sanctuary to allow for cetacean resting areas/no-go zones for boats.
- Continue photo identification and genetic research of endangered Oceania humpback whales in Niue for inclusion in regional population estimates with SPWRC .
- Conduct population dynamics assessment of resident and commercially important Niuean Spinner dolphins to inform management.
- Implement and enforce national legislation including the Niue Domestic Fishing Regulations 1996, Niue Whale Sanctuary Regulations 2003 and the Niue Whale Watching Regulations 2016.

Whale watching from land is also an important part of the tourism promotion of the island. One of the key recommended actions is to investigate and install high quality wildlife marine viewing infrastructure by assessing existing whale watching sites and identifying required improvements and any additional sites, and by installing interpretive materials, seating platforms and shaded areas for whale viewing from land.

SUBSISTENCE COASTAL FISHERIES

INDICATOR DEFINITION

There are three main fishing categories – subsistence, artisanal and commercial (Figure 60). The primary purpose of subsistence fishing is to provide food for the family and not for selling. Artisanal fishing is for home consumption with surplus sold to local networks and local businesses at the Resort. The commercial fishery is a business operation with the sole purpose of harvesting fish or seafood for selling. This indicator focuses on subsistence fishing, primarily through the number of canoes available for fishing and the amount of seafood consumed at home.



Status
Fair

Trend
Mixed

Data confidence
Medium

SDG	CBD
14 LIFE BELOW WATER	

Environment and Climate Change Pillar [NNSP 2016–2026]

Natural Resources: Protection and conservation of Niue's natural resources through responsible, sustainable use and management for food and nutrition security that is sufficient, safe, affordable and accessible

Finance and Economic Development Pillar [NNSP 2016–2026]

Fisheries and Marine Resources

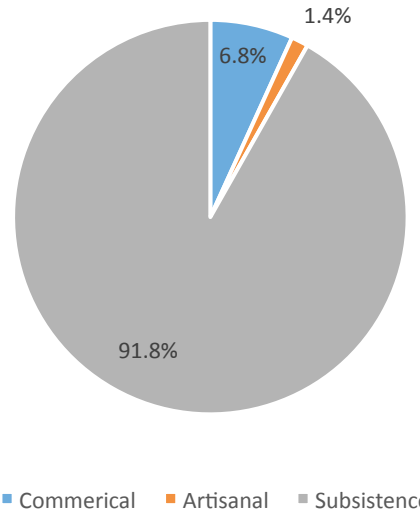


FIGURE 60. The breakdown of the total catch in the three main fisheries sectors for the period of 1950–2010. Source: Zylich *et al.* 2012.

Status and Key Findings

Subsistence fishing remains the dominant fishing category in Niue, where fish and seafood are harvested for home consumption. Artisanal and commercial fishing have increased providing revenues for family, and for the government through fishing licenses.

TABLE 24. Fisheries contributions towards Niue's GDP.
Source: Gillett 2016.

	2008 (NZD 000)	2009 (NZD 000)	2010 (NZD 000)	2011 (NZD 000)	2012 (NZD 000)	2013 (NZD 000)	2014 (NZD 000)
Private (fisheries)*	86	106	115	118	121	122	125
Private and subsistence	839	1,032	1,117	1,152	1,180	1,188	1,212
Total fisheries	925	1,138	1,232	1,271	1,301	1,310	1,337
Niue GDP	21,417	22,858	25,073	26,970	28,125	30,381	31,273
Total fisheries as % of GDP	4.3%	5.0%	4.9%	4.7%	4.6%	4.3%	4.%

*Private (fisheries) = commercial fisheries; **Private and Subsistence = People fishing for subsistence and occasional sales.

Subsistence fishing activities are limited to certain areas due to reef structure and exposure to the elements. The windward side (east to the northern parts) has strong currents and waves therefore fishing in this area is limited (H. Tongatule 2017 pers. communication). The leeward side of the island (western parts) is where most of the fishing activities take place, with about 62–64% of the fishing in the inshore areas. About 31% of fishing takes place exclusively in the offshore area, whereas some fishers utilise both areas (inshore and offshore) for fishing (2009 Agriculture Census). Slightly more males fish (363) than females (201), out of 564 fishers surveyed in 2009. The women usually glean and collect invertebrates, fish, echinoderms and other seafood on the narrow reef flats and shallow tidal pools. Men usually use small motorised crafts or wooden outrigger canoes to spear, line and troll for pelagic fish and bottom fish. The number of households owning a canoe declined from 163 in 1989 to 98 in 2011 (40% decline) (1989 Agricultural Census; 2011 Census). The number of canoes recorded in 1989 was 241, before it declined to 130 canoes in 2009 (Figure 61). A slight resurgence in 2011 saw the number of canoes increase to 142 (Figure 61). The number of motorised boats (dinghies) nearly doubled between 1989 and 2011, from 60 to 115 (1989 Agricultural Census; 2011 Census).

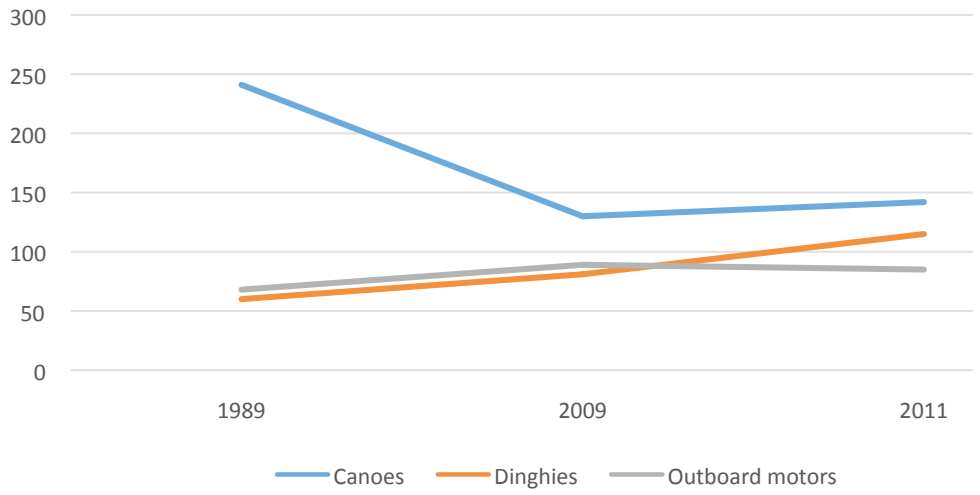


FIGURE 61. Number of households and the number of canoes and dinghies from 1989 to 2011. Source: Censuses 1989, 2009 and 2011.

The documentation of the subsistence fisheries is scarce and it makes it challenging to determine the intensity of fishing and the sustainability of the stock. Anecdotal evidence from local fishers indicates a decline in fish catch and longer hours spent fishing, than in previous times. Reconstruction of fisheries catch is fraught with challenges as demonstrated below. In assessing the catch rate and trend for Niue, the population and consumption per capita was used by various authors. Gillett and Lightfoot (2001) estimated a consumption rate of 118.9 kg/person/year for 1950, which Zylich *et al. (2012) revised to 87.9 kg/person/year for 2007 (Table* 25). Kronen *et al. (2008) estimated the household fish consumption rate to be 31.1 kg/person/year for 2005, however, this did not take into account consumption at restaurants, snacks and functions (Figure* 62). Gillett (2016) recalculated the figures and suggested the fish consumption rate was 112 kg/person/year.

TABLE 25. Fish consumption rate from the 1950s to 2010.

Years	Consumption rate kg/person/year	Reference
1950	118.9	Gillett and Lightfoot (2001)
1987	49	Dalzell *et al.* (1993)
2000	118.9	Gilett and Lightfood (2001)
2002–2006	79.3	Bell *et al.* (2009)
2005	33.56* 94.8	Kronen *et al.* (2008) Gillett (2016)
2007	89.7	Zylich *et al.* (2008)
2014	110	Gillett (2016)

**The consumption rate provided by Kronen et al. (2008) was re-calculated by Gillett (2016) based on the total fish harvest for the year 2005.*

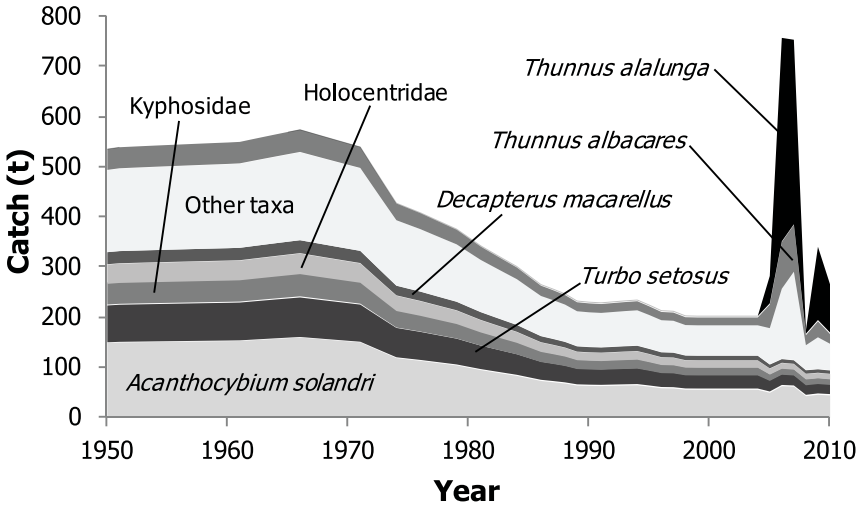


FIGURE 62. Coastal fish catch composition from 1950–2010. Source: Zylich *et al.* 2010.

Impacts

Overfishing is a serious challenge for all fisheries. The demand for seafood and fisheries resources by households, businesses or for export can lead to overfishing and a collapse in fisheries stocks. The fishery stocks are also affected by the condition of the environment and by the fishing methods used. The use of destructive fishing methods including poisons is detrimental to fish and other marine life. Cyclones impact on marine life and have also caused problems for coastal fisheries. After Cyclone Ofa in the 1990s, a survey found that many highly prized species such as giant clams, lobsters and some shellfish, were hard to obtain (Figure 63). Ornamental shells used for community crafts were also rare. Communities noted a reduced level of catch and perceived that the reef resources were declining.

FIGURE 63. Seafood harvest. Photo: H. Tongatule.

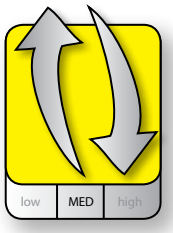
Response and Recommendations

The subsistence fishery continues to play an important role to family and community on the island. There is a link between fishing and cultural pride, which has resulted in a resurgence in the use of traditional outrigger canoes for fishing. A healthy coastal fishery will ensure that this level of interest and cultural pride continues forward. Prudent management actions are needed to safeguard subsistence fishery resources. The government has developed a management plan for coastal and pelagic fisheries, which includes guidelines for certain species and by-catch. Fisheries legislation has been enacted but needs to be supported by enforcement. The participation and leadership of village elders and communities will go a long way to safeguarding these resources. Continuing with surveying of fisheries stock and documenting creel surveys is important, and is an area that needs strong assistance and encouragement by partners. Establishing protected areas along the coast and throughout the EEZ will also assist in safeguarding coastal subsistence fisheries in Niue.

ARTISANAL AND COMMERCIAL OFFSHORE FISHERIES

INDICATOR DEFINITION

This category includes all fishing for the purpose of selling and making a profit. It includes the local fleets that fish from the coastal areas, as well as large licensed vessels that fish in Niue's exclusive economic zone. The indicator reviews the fishing effort (based on licenses issued to foreign vessels) and the catch as reported, and it also includes data from the artisanal sector. By assessing these, it will provide a snap-shot of the current state of fisheries stock in Niue waters.



Status
Fair

Trend
Mixed

Data confidence
Medium

SDG	CBD
14 LIFE BELOW WATER	

Finance and Economic Development Pillar [NNSP 2016–2026]

Fisheries and Marine Resources

Status/Key Findings

Niue has one of the smallest exclusive economic zones (EEZs) in the region, as it is surrounded by Tonga to the west, Cook Islands to the east, American Samoa to the north and to the south are international waters (Figure 64). Commercial fishing activities in the EEZ are relatively recent and have been low and sporadic, with periods of high activities followed by low to no activities (Table 26, Figure 65). Catches were only reported when caught by foreign fishing vessels, and catches through local joint-fishing ventures are not well documented. All vessels fishing in Niue's EEZ are required to be licensed by the Fisheries Department.

The number of vessels licensed to fish in Niue's EEZ varies from year to year. Between 1998–2002, twenty-one vessels were licensed to fish, catching 50–100 mt of tuna. Between 2002 to 2005 no record of licenses were issued, although a record exists of a total fisheries catch of 200 mt (Pasisi 2005). In 2005, Niue entered into a joint fishing agreement with a New Zealand company (Reef Group) to fish Niue's waters (Tafatu 2006a), with the catch to be processed at Niue's Fish Processors. Tafatu (2007) reported a catch of 320.3 mt of tuna in 2006, with 12 vessels licensed. Gillett (2009) pointed out that the 320.3 mt were caught by six vessels, therefore he doubled the catch reported by Tafatu (2007) to 640 mt. Gillet (2009) argued that the 640 mt aligned closely with the 2007 figure of 602.2 mt. The fishing venture between the government and a private company ended in 2007, impacting the fish catch to 212 mt from seven vessels. In 2008, 18 mt were recorded by three vessels. A joint agreement was again initiated in 2009, resulting in an increased fish catch. Offshore fishing was re-established in 2013 when licenses were issued for seven longline vessels. Five licenses were issued in 2014 catching 547 mt of tuna. The 2015 to 2016 period saw 11 licenses issued to a fleet comprising of nine longliners and two purse-seiners (DAFF 2017).

Longline fishing in Niue increased for 2016 from the previous year, and this increase can be attributed to the addition of more vessels and more trips taken per vessel. However, total catch showed a significant reduction that year.

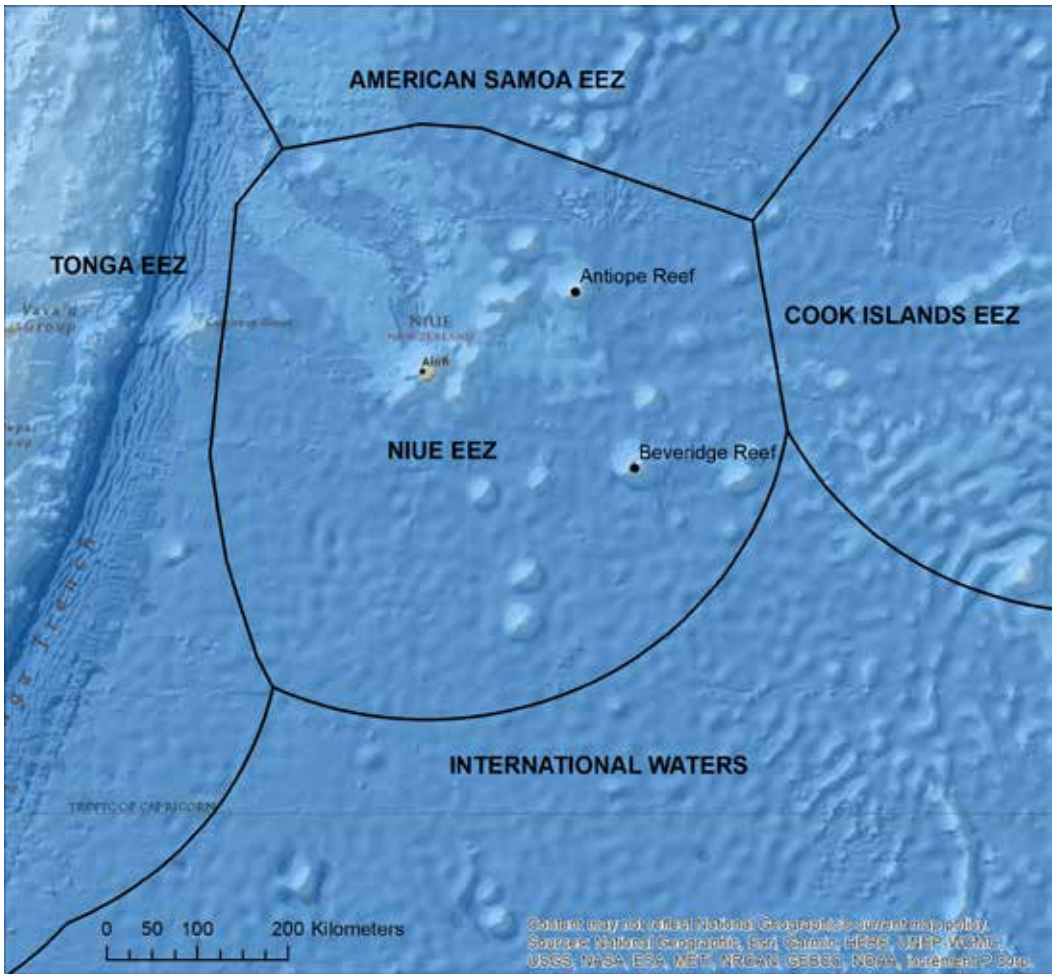


FIGURE 64. Niue is surrounded by other Pacific nations, with international waters to the south. Submerged reefs and their approximate location shown. Source: www.seafriends.org.nz.

TABLE 26. Number of licensed vessels and their catch.

Year	Licenses Issued	Total Catch (mt)	Source
1997–1998	No record	331	Leolahi (2000); Pasisi (2003);
1998–2002	21	50–100	Pasisi (2005)
2002–2003	No record	200	Pasisi (2003);
2003–2004	0	0	Tafatu (2006a)* no catch due to local arrangements
2005	13	122.8	Pasisi (2005); Tafatu (2006b)
2007	7	212	Pasisi (2010)
2008	1	18	Pasisi (2010)
2009	10	202.5	Pasisi (2010)
2010	6	322	Gillett (2016)
2011	0	0	Anon (2013)
2012	0	0	Anon (2013)
2013	7	597	Gillett (2016)
2014	5	547	Gillett (2016)
2015	11		DAFF (2017)
2016	11		DAFF (2017)

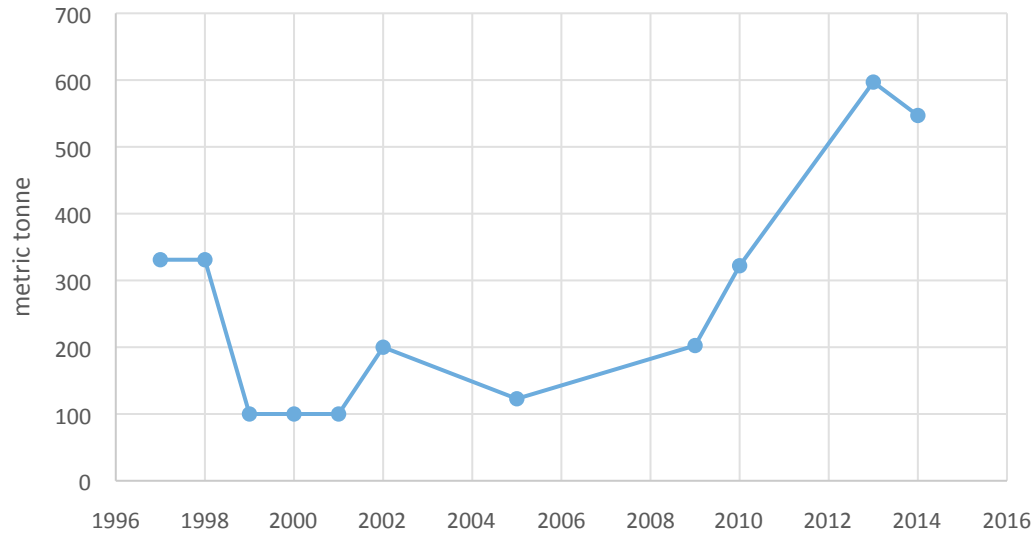


FIGURE 65. Offshore catch (mt). from 1997 to 2014.

TABLE 27. Annual catch estimates for Niue's EEZ, and the "catch for 2010 is for the first 4 months of the year before fishing operations by the fisheries partner ceased." Source: Country Fisheries Report – Niue. 2017.

Catch (metric tonnes)											
Year	Vessels	ALB	BET	SKJ	YFT	BLM	BUM	MLS	SWO	OTHER	TOTAL
2009	3	138	7	5	12	1	1	4	1	8	**177**
2010	6	97	4	1	8	0	1	0	0	5	**116**
2011	-	-	-	-	-	-	-	-	-	-	**0**
2012	-	-	-	-	-	-	-	-	-	-	**0**
2013	6	416	18	9	44	0	19	2	4	31	**543**
2014	5	325	26	13	84	0	19	1	3	22	**493**
2015	3	57	4	1	11	0	3	0	0	3	**79**
2016	7	233	12	3	31	0	9	1	0.3	7	**296.3**

Impact

Economic exploitation is contributing to large scale harvesting of tuna and other pelagic resources. Illegal and unsustainable fishing leads to a collapse in fish stocks, which ultimately impacts the wider ocean ecosystem. The removal of key species like sharks, that maintain the trophic balance, can impact the inshore and offshore ecosystems. Shark populations are extremely vulnerable to overfishing because sharks grow very slowly, and have a much lower capacity to reproduce than other bony fish species. Similar to sharks, the bigeye tuna is harvested well beyond its critical limits and it is listed as a vulnerable species in the IUCN Red list.

Response and Recommendations

Niue imposed catch limits on their offshore fisheries at the 10th annual meeting of the Western and Central Pacific Fisheries Commission, which have also been incorporated in the National Pelagic Management and Development Plan. Fisheries legislation has been enacted and it needs to be supported by strong enforcement. Documentation of fish catch and the cooperation of fishing vessels are needed to ensure that accurate data are maintained and shared, which will help in assessing the state of fisheries stocks.

MARINE CONSERVATION AREAS

INDICATOR DEFINITION

Niue has a long history of protecting different species of marine life from cetaceans, sharks, skates and turtles. Legislation has been in place for many years to protect these marine species. Niueans have on occasion imposed *tapu* and *fono* (traditional bans) in certain areas as a mark of respect, usually to mark the passing of an elder. These temporary bans vary from a few months to several years and can have a profound impact on the same resources. Depending on the length of the ban, it can provide opportunity for fish stocks and other marine life to replenish and flourish. These traditional protocols, together with legislation, provide a counter-measure against overharvesting and overfishing of resources. This indicator assesses the size of the marine areas under conservation or management in Niue and the state of biological resources, with specific focus on fish and live coral cover.

Ten per cent of coastal and marine areas to be conserved by 2020 is a global target that Niue has agreed to, under the Aichi Biodiversity Targets. While the existing marine conservation areas around the island are small, the recent announcement by the Government of a new Marine Protected Area (MPA) to protect 40% of its EEZ will surpass the global target.

Status
Good

Trend
Improving

Data confidence
Medium

SDG	CBD
14 LIFE BELOW WATER	11

Finance and Economic Development Pillar [NNSP 2016–2026]
Fisheries and Marine Resources
Environment and Climate Change Pillar [NNSP 2016–2026]
Biodiversity: Protecting biodiversity, maintaining sufficient remaining habitats and ecosystems to support the population of all species and their genetic diversity

Status and Key Findings

Niue has three marine conservation areas (Table 28; Figure 66): The Huvalu Forest Conservation Area is the largest terrestrial conservation area on the island, but has a small marine component (approximately 1.26 km^2 or 126 ha); the Anono Marine Reserve (formerly known as the Namoui Fisheries Reserve) (27.67 ha) and the Alofi North to Makefu covering 35 ha (Govan *et al. 2009). Recently, the Government announced the establishment of a new MPA to cover 40% of its waters, or approximately 127,000 km*^{2} of its 390,000 km^2 EEZ. The new MPA will include the Beveridge Reef with its high density of the Grey-reef shark, and fish population. This announcement demonstrates the willingness of the Niuean community to manage the resources within its space for the benefit of other communities and nations that share the Pacific Ocean. This is also an investment in the future of all Niuean children. The details of this new protected area are being finalised. The 40% announcement will also allow Niue to meet its obligations to the UN CBD Aichi Targets.

TABLE 28. The three marine managed areas in Niue. Source: Govan *et al.* 2009.

Conservation area	Management Arrangement	IUCN Category and Year of establishment	Size (ha)
Huvalu Forest Conservation Area	Community	VI 1992	126
Anono Marine Reserve	Government	VI 1998	27.67
Alofi North – Makefu	Community	2002	35
Total			**188.67**

HUVALU FOREST CONSERVATION AREA (MARINE COMPONENT)

The Huvalu Forest Conservation Area was established in 1992, within the communities of Liku and Hakupu. The total area of the Conservation Area is 5,400 ha, of which a small portion includes the adjacent reef (approximately 12 km), representing 18% of the 64 km coastline. While the terrestrial component of the Conservation Area has been assessed, the marine side remains largely unknown. The coastal area contains some of the unique features of the island including the Togo Chasm and the Vaikona Chasm, as well as many swimming pools. The rugged terrain and coastline of this area discourages it from development.

ANONO MARINE RESERVE (NAMOUI FISHERIES RESERVE)

The Anono Marine Reserve was established in 1998 as a fisheries reserve and is located south of Makapu Point (between Alofi and Makefu) covering an area of 27.67 ha (or 2% of the coastline). Its primary purpose is to protect and preserve marine biodiversity for the benefit of future generations. A survey was undertaken to document its biodiversity and to assist with formulating a management plan (Laborsse *et al.* 1999). The survey recorded 103 fish species, but importantly noted that fish biomass was low, compared to the second site surveyed (Avatele). The biomass of many species was lower compared to the 1990s (Labrosse *et al.* 1999; Kronen *et al.* 2008). Recent surveys found the fish diversity, biomass and assemblage to be limited, and after almost 20 years of existence, the Reserve appears to have had a low impact on the surrounding community (Kronen *et al.* 2008; Friedlander *et al.* 2017). The live coral cover for Anono Marine Reserve and Avatele was found to be high (40–50%) but declined rapidly following Cyclone Heta in 2004. The live coral cover dropped to less than five per cent but bounced back to seven per cent a year after the cyclone (Table 29). Giant clams were also assessed and found to be much lower in number at Anono Reserve compared to Avatele (15 clams per ha compared to 54 clams per ha).

FIGURE 66. Location of Niue's marine conservation areas.

TABLE 29. Comparison of live coral cover over three-time periods (1998, 2004 and 2005). for Anono Marine Reserve and Avatele. Source: Kronen *et al.* 2008.

Marine Conservation Areas	Live Coral Cover (%)		
	1998	2004	2005
Anono Marine Reserve	40	<5	7
Avatele	50	2	7

ALOFI NORTH TO MAKEFU

The Alofi North to Makefu conservation area was established in 2002 (GON 2014) under SPREP's International Waters Programme (Govan *et al.* 2009). This is a community-managed reserve under the villages of Alofi and Makefu; four temporary closed areas were set-up on a rotational basis to allow fish stocks to revive. The site was opened for harvesting in 2013, eight years after it was established.

Fish biomass surveys of the Alofi North to Makefu conservation area and other sites on the leeward side of

the island in 2016, revealed no significant difference among the sites (Friedland *et al.* 2017). In fact, fish biomass was higher, although not significantly so, in every depth surveyed outside compared with inside the no-take MPA (Table 30). The presence of fishing line throughout the MPA is evidence of low adherence to MPA rules.

TABLE 30. Fish biomass in the Alofi marine protected area (Alofi North MPA). and leeward locations at Niue by depth strata. Values are mean fish biomass (g m-2). with standard deviations in parentheses. Source: Friedlander *et al.* 2017.

Depth (m)	Alofi MPA	Open	% diff.
5	83.1 (49.1)	84.8 (57.7)	-2.0
10	55.1 (36.5)	72.6 (36.0)	-24.0
20	47.6 (34.9)	52.4 (35.2)	-9.0

Impacts

Conservation areas provide an important management tool for communities and the government in their efforts to ensure sustainability of resources. If these conservation areas are to achieve their intended outcomes, some level of management needs to be implemented to measure progress. The management should include effective enforcement of conservation area rules and ongoing monitoring of biological parameters to measure change. Critical to the success of these conservation areas is legislative support, especially to recognise community designated *fono and tapu areas.*

Response and Recommendations

Niue continues to work towards meeting its commitment to Target 11 of the Aichi Biodiversity Targets. The global target is 10% of marine area to be protected, and Niue's current effort is at 2.7%. One of the challenges that needs to be addressed is ensuring that existing conservation areas are protecting important biodiversity and ecosystem services, and that effective management programmes are used to achieve conservation outcomes.

It is clear from the biological data that more work needs to be done to protect and conserve Niue's marine resources. The fish biomass results indicates that fishing pressure continues unabated in marine conservation areas. There is a need to consider the appropriateness of the sites, which may include exploring whether there are sites that are more suitable for long-term conservation success.

There is a positive indication from at least five villages expressing interest in setting up conservation areas adjacent to their homes. These villages are working with Fisheries staff to identify sites for conservation. One such site worthy of consideration is the Tamakautoga (to possibly include parts of Avatele), which scientific surveys have found to be productive and diverse in marine life. This area is fairly protected and will be an important recruitment area of marine life for neighbouring areas after cyclones and other natural disasters.

Another important site that is of global significance is the Beveridge Reef. This is a reef of extraordinary natural and cultural values to the people of Niue. It is an important refuge for the Grey-reef shark, a globally threatened species, and potentially Blainville's beaked whale, whose life history and population status are virtually unknown. The fish biomass at Beveridge Reef was more than two times greater than at Niue, and the biomass of piscivores was 7.5 times greater (Friedlander *et al.* 2017). A no-take marine reserve at Beveridge Reef and its surrounding pelagic zone will protect species including sharks, tunas, cetaceans and sea turtles. The no-take Beveridge Reef marine reserve could include at least six seamounts, ecosystems known for their high level of endemism and importance as stepping stones for highly migratory species. Such efforts will help benefit Niue through ecotourism ventures, shark refuge, and pelagic fisheries recovery and meeting Niue's commitment in achieving the Aichi Targets.

The legislative framework (Niue Domestic Fishing Act 1995) provides the necessary support for the designation of marine reserves, fono or tapu in any sections of the reef. The support includes prohibiting fishing in the area or removal of sand, rubble or other inorganic matter.

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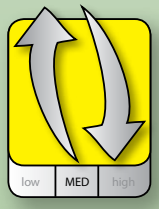
OVERVIEW

With most of the tropical species originating in the volcanic island hotspots to the west of Niue, the central position of the island in the Pacific Ocean means species have been haphazardly introduced through ocean currents, swimming, migration or strong winds. Over many years, some of these species have adapted and evolved into unique species. Since the arrival of Niueans on the island, they have utilised the available biodiversity and interwoven it into their culture and traditions, their diet and daily living, and in their folklores and legends. Some of the species have died out, whereas others are on the verge of extinction. This biodiversity loss is primarily due to human activities, and has been exacerbated by introduced invasive species and climatic events. The good news is that the size of the country and its population provide opportunities to put sustainable conservation practices and measures in place. Ultimately, it is important for all Niueans to understand that conservation is an important management tool towards responsible land tenure and ownership.

BIODIVERSITY HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
ENDEMIC, NATIVE AND THREATENED SPECIES	 **Status** Poor **Trend** Mixed **Data confidence** Medium	Niue has a few endemic but many native species, of which most are threatened due to limited habitats. Many species are endangered and their populations are critically vulnerable. Threats are from hunting (especially *lupe* and *peka*), fishing (giant clams and sea urchins), and from cyclones (all ecosystems and species). Logging and agriculture were once a serious threat, but the decline in population and low demand for crops and timber is having a positive result on native biodiversity. Invasive species are another threat, especially wild pigs, feral cats and rats.	A number of successful measures are being applied to protect and conserve Niue's native biodiversity, including banning the shooting of flying foxes and pigeons after Cyclone Heta, the ban in exporting coconut crabs overseas, and imposing *tapu* or *fono* in certain areas. Undertake regular monitoring and surveys of Niue's biodiversity, especially in protected areas, to ensure that populations of species are in healthy condition. Conservation plans for endemic and threatened species should be developed, such as for the *hega* and the Olive skink. Engage communities and the private sector to promote awareness and cooperation in the protection of species and habitats. All bird species should be monitored including all crab species monitored with a framework in place.
ENVIRONMENTAL INVASIVE SPECIES	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Niue is not immune from the scourge of invasive species. Many areas are infested with weeds, and some of the aggressive weeds are impacting native forests. Cyclones assist invasive species to invade intact forest areas. Feral pigs, rats and wild cats are also impacting the groundwater system, native vegetation and bird and lizard populations.	Great progress to address invasive species within the HFCA with support from the Global Environment Facility, UNEP and SPREP has been made. An invasive species team was established, capacity and awareness built, equipment purchased and the National Invasive Species Strategy and Action Plan (NISSAP) developed. Priority invasive species were identified, and the Government has prioritised invasive species to address in the immediate future. Invasive species will progressively get worse over time, and consistent actions are needed for eradication and control. Biosecurity measures must be implemented to prevent new introductions. The invasive species team should meet regularly to address national concerns. Funding and resources need to be secured to implement the NISSAP.
TERRESTRIAL PROTECTED AREAS	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Two terrestrial protected areas of Huvalu Forest Conservation Area and the Hakupu Heritage and Cultural Park make up just over 20% of the land under conservation status. None have management plans, however, there is an effort to develop one for Huvalu. The Hakupu Park was established by a local family to protect the biodiversity and cultural sites of the area.	Documenting ecological and cultural assets of many of the sites in Niue provides an opportunity to identify and prioritise areas for conservation. These sites rely on the participation and the sharing of knowledge by communities, including many of the elders currently residing abroad. The knowledge must be captured through the work of Taoga Niue and use for the management of the country's natural resources. Developing the management plan for the Huvalu Forest Conservation Area should be a high priority to ensure that the biggest protected area is properly managed.

ENDEMIC, NATIVE AND THREATENED SPECIES

INDICATOR DEFINITION

The endemic and native species of Niue have adapted and evolved to living on the island over millennia. Endemic species are genetically unique and are found nowhere else in the world, whereas some native species have remnant populations distributed across neighbouring islands. Many of these species and plants arrived on the islands by wind, or were attached to migratory species or debris floating on the ocean. The arrival of humans and subsequent introductions of new species have affected the population of these endemic and native species so that many are now threatened with extinction. For this indicator, the population of select keystone species and groups, including birds, reptiles, the coconut crab and flying fox is assessed to help give an overall picture of the health of Niue's endemic and native species.

Status
Poor

Trend
Mixed

Data confidence
Medium

Status and Key Findings

SDG	CBD
15 LIFE ON LAND	12

Environment and Climate Change Pillar [NNSP 2016–2026]

Biodiversity: Protecting biodiversity, maintaining sufficient remaining habitats and ecosystems to support the population of all species and their genetic diversity

Niue has a few endemic species and sub-species including the flat-tail sea snake, comb-tooth blenny, Polynesian starling, Polynesian triller, Niue Blue butterfly, Rattblebox moth, Niue leafhopper, Niue planthopper, Niue weevil, Niue scale insect, Niue land snail and the Vaikona slender-foot crab (http://Intreasures.com/niue.html). Table 31 summarises the biodiversity groups found in Niue, their status and red-list category.

TABLE 31. Major biodiversity groups including their status and IUCN Red List category.

Group	Number of Species	Number of Endemic/ Native Species	Number of Introduced Species	IUCN Red List NE – not evaluated; NT – near threatened; LC – least concern; EN – endangered; VU -vulnerable; CR-critically endangered
Skinks and Geckos	9	8	1	NE – 2; LC –6; EN – 1
Turtles	3	3	0	VU –1 EN – 1; CR – 1
Snakes	1	1	0	VU – 1
Birds	32	16	2	LC – 28; NT – 3 ; VU – 1
Flying Fox	1	1	1	LC – ; NT – ; VU – EN – CR -
Plants				LC – ; NT – ; VU – EN – CR -
Invertebrates				LC – ; NT – ; VU – EN – CR -

TABLE 32. List of terrestrial reptiles recorded from Niue. Source: Tongatule *et al.* 2015.

Scientific name	Common name	Status and IUCN Red List
Lepidodactylus lugubris	Mourning gecko	Native and Common – NE
Nactus pelagicus	Pacific slender-toed gecko	Native and Common – LC
Gehyra oceanica	Oceanic gecko	Native and Rare – LC
Hemidactylus frenatus	House gecko (an IAS of recent introduction)	Recent introduction and Common – LC
Emoia cyanura	White-bellied copper-striped skink	Native and Common – LC
Emoia impar	Dark-bellied copper-striped skink	Native and Common – LC
Emoia lawesi	Olive small-scaled skink	Native and Common – EN
Lipinia noctua	Pacific moth skink	Native – NE
Cryptoblepharus poecilopleurus	Snake-eyed skink	Native – LC

Reptiles – skinks, turtles and sea-snake

There are nine skink and gecko species recorded for Niue and most are common (Table 32) (NBSAP 2015). The Olive small-scaled skink is a conservation concern and is listed as endangered under the IUCN Red List. The distribution of this skink is in American Samoa and Niue, although genetic studies may reveal two separate and distinct populations (NBSAP 2015). The type specimen is purported to be from Tongatapu, but Zug (2013) expressed doubt over this record. Recent surveys have failed to locate any individuals in Niue (Butler *et al.* 2012). Habitat loss and invasive species (specifically cats and rats) are key threats to the survival of this and other reptiles in Niue. The House gecko is a recent introduction and is an aggressive species that has been blamed for the population decline of native geckos (Queensland Government 2016).

Three turtle species are recorded from Niue – the loggerhead (*Caretta caretta)* is recently confirmed from Niue waters, hawksbill (*Eretmochelys imbricata*) and the green-shell (*Chelonia mydas*) (Friedland *et al.* 2017). All three species are of conservation concern, with the hawksbill turtle listed as critically endangered (close to extinction), the green-shell turtle as endangered and the loggerhead turtle as Vulnerable. Although the loggerhead population in the South Pacific is distinct and has been assessed as critically endangered (a step toward extinction), none of the turtles breed on the island. No estimates of turtle numbers are available. Turtles were eaten in the past, but they are now a protected species (Domestic Fishing Regulations 1996). The main threats are from the fishing industry and predation of turtle eggs and hatchlings.

Niue Banded Sea snake or *katuali* (*Laticauda schistorhynchus)* is the only snake found on the island. This snake is common around Niue especially near the inter-tidal areas on the west side of the island. The loss of habitats, foraging and nesting areas due to sea level rise and coastal developments are the key threats to this species. It is listed as Vulnerable in the IUCN Red List and is a protected species under the Niue Domestic Fishing Regulations. The snake is an iconic species that is also important for the tourism sector.

Flying fox

The Tongan flying fox or *peka (Pteropus tonganus)* is the only native mammal found in Niue (Figure 67). Recent introductions of other mammals include the Pacific rat (*Rattus exulans*), Black rat (*Rattus rattus),* house mouse (*Mus musculus*), feral pigs, dogs and cats, which are having a serious impact on native biodiversity. The flying fox is a protected species, although this protection is only 11 months of the year. There is an open season in December where hunting of flying foxes is permitted. Unfortunately, hunting appears to go on throughout the year. A survey in 1998 found the number of flying foxes was low given the available habitat (Brooke 1998). The flying fox population crashed by at least 95%, with a mere 60 individuals left, following Cyclone Heta in 2004 (Brooke 2004). An immediate three-year ban following the cyclone helped with recovery. In 2012, surveys showed that the population had recovered to similar levels to 1998 (Butler *et al.* 2012). However, the current level of hunting is considered too great and likely to threaten the long-term survival of the species. In 1998, the take of peka was estimated at 1000 to 1500, whereas the maximum sustainable harvest for a population of 3,700 was only 748 per year. A population target of 8,000 animals was identified as desirable; both to allow the current take to be sustainable and to allow recovery of numbers after any future cyclones (Brooke 1998). The flying fox is listed as a Least Concern on the IUCN Red List; however, its vulnerability to cyclones and other threats rates it as more vulnerable than the score given on the IUCN Red List. Flying foxes are excluded from all international trade.

FIGURE 67. The flying fox remains vulnerable after a cyclone. Photo. Haden Talagi.

Birds

Thirty-two bird species are recorded for Niue (see Annex 1), not including the three bird extinctions based on fossil records found in the Anakuli Cave in Hakupu village: The Niue Night Heron (*Nycticorax kalavikai*), the Niuafo'ou Megapode (*Megapodius pritchardii*) and the Niue Rail (*Gallirallus huiatua*). Carbon dating suggested that these birds became extinct in the Holocene period (about 5300–3600 year BP), before human settlement (Steadman *et al.* 2000). Some birds are vagrant or migrant, and others are resident breeding birds. Niue's bird population fluctuates significantly due to weather events, as shown in surveys undertaken in 1994, 2004 and 2012 (Brooke 1998; Butler 2004; Butler *et al.* 2012) (Figure 68). The population of the Pacific Imperial Pigeon, or Lupe (*Ducula pacifica*), declined significantly in 2004 after Cyclone Heta by around 28–64% (Powleslands *et al.* 2004). A follow-up survey found the population increasing at Fue and Vinivini sites (Butler *et al.* 2012). A combination of a three-year hunting ban and the recovery of the Pigeon's food crops are contributing factors to the recovery. A combination of a three-year hunting ban and the recovery of the Pigeon's food sources are contributing factors to the recovery, however changes in weather patterns will also affect.

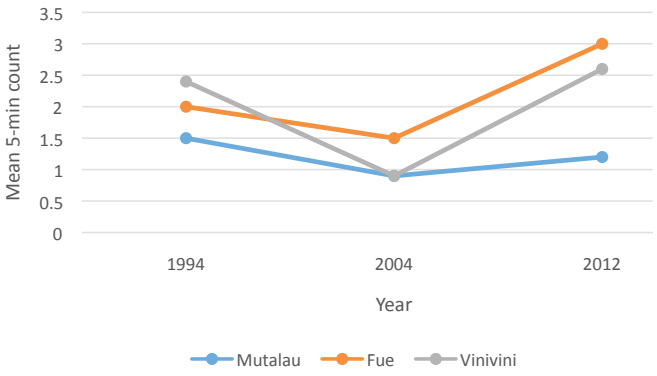


FIGURE 68. Mean 5-minute bird count results for Lupe along three transects in 1994, 2004 and 2012 period. Source: Butler *et al.* 2012.

FIGURE 69. The Polynesian Starling is a native species to Niue. Photo: P. Skelton.

Other bird populations are stable or on the decline, such as the Polynesian Starling (Figure 69), the White-rumped Swiftlet and the Blue-crowned Lorikeet, indicating that other factors and pressures are present. The jungle fowl (*Gallus gallus*) is the only confirmed introduced bird; a record of the red vented bulbul (*Pycnonotus cafer*) is probably erroneous. There are three endemic sub-species: Polynesian Triller – *Lalage maculosa whitmeei,* Polynesian Starling – *Aplonis tabuensis brumnescens*; and Purple-capped Fruit-dove – *Ptilinopus porphyraceus whitmeei.* Fourteen bird species breed on the islands, and fourteen are vagrant or migrant shore and seabirds. The hega or the Blue-crowned lorikeet, is becoming rare with concerns for its population (Butler et al, 2012). The many-coloured Fruit Dove (*Ptilinopus perousii*) is recently recorded (www.aviabase.bsc-eoc.org), but the record needs verification.

Flora

The Niue flora is defined as comprising all vascular plants (flowering plants, gymnosperms, and ferns). Plant species can be classified by their distribution; they are either native, i.e., they occur naturally in the area (arriving by non-human transport), or they are alien, i.e., they are introduced species (having arrived by direct or indirect human transport). The first flora of Niue was compiled by T. Yuncker (1943), and a more recent one was developed by W. Sykes (1970). A comprehensive checklist of the native and naturalised flora was included in Whistler and Atherton (1997). The flora comprises approximately 159 native flowering plant species (125 dicots and 34 monocots) (Figure 70), in addition to 25 ferns and two fern allies, for a total of 186 vascular plant species. Niue does not have endemic plants but a number of native plants are of conservation concern (*Bulbophyllum distichobulbum, Centrus caliculatus, Nicotinia fragrans, and Solanum amicorum).* Niue's flora is much smaller than that of adjacent Samoa, which has about 550 native species of flowering plants and an endemism rate of 30%, and Tonga, which has about 340 native species and an endemism rate of about three per cent.

A large number of about 260 alien species ('weeds') are also found on Niue. A recent survey identified 26 species as potential invasive weed pests and others as aggressive weeds that could become a problem in the future (Space and Flynn, 2000). Space and Flynn recommended control or eradication for eleven species, and programmes are already in place for some of these. Further information on the flora can be found in the 2015 NBSAP.

FIGURE 70. Flower of Barringtonia is common along the foreshore. Photo: P. Skelton.

Impact

The species that make up the biological diversity of Niue, are the capillaries that sustain life on the island. These are the foundation, which over many years have evolved and shaped every part of the country. People and communities rely on these species for food, housing material, clothing and medicine. These species indirectly helped shaped society's beliefs and also provided ecological services such as water and oxygen. Life on the island would be very different without many of these species. These species are under constant threat at the specific level or at a broad-scale ecosystem level. Forest loss due to deforestation, the introduction of invasive species that predate or displace native species, these threats are happening. The introduction of new technology has contributed to the isolation of people and their natural environment.

Response and Recommendations

Biodiversity remains an important focus for the government and is one of the six key thematic areas under the Environment and Climate Change national development pillar (Niue National Strategic Plan 2016–2026).

The Government has also endorsed its National Biodiversity Strategic Action Plan 2015 (NBSAP), amending the previous plan developed in 2001. Awareness on Niue's biodiversity and natural heritage continues to be promoted by government departments including the Department of Environment, as well as the Department of Education (Figure 71) and the Department of Agriculture, Forestry and Fisheries.

FIGURE 71. A student poster on saving Niue's biodiversity under the Ridge to Reef Project.

The NBSAP provides the blueprint for all government sectors, private sector and civil society on the vision, mission and goals in order to achieve the aspirations under the Niue National Strategic Plan 2016–2026. There are seven themes captured in the country's NBSAP.

- Theme 1: Conservation and sustainable management of terrestrial habitats
- Theme 2: Conservation of terrestrial species
- Theme 3: Conservation and sustainable management of marine ecosystems and species
- Theme 4: Management of invasive alien species
- Theme 5: Management of waste and pollution
- Theme 6: Management of water resources
- Theme 7: Climate change
- Theme 8: Traditional knowledge and access to benefit sharing

Another key recommendation is the need to undertake regular monitoring and surveys of Niue's biodiversity, especially in protected areas, to ensure that populations of species are in healthy condition. Any immediate decline should be investigated, and intervention measures put in place.

Conservation plans for endemic and threatened species should be developed, such as for the *hega* and the Olive skink. This ensures that stakeholders understand what they can do to be part of the solution.

Engage communities and the private sector to promote awareness and cooperation in the protection of species and habitats.

ENVIRONMENTAL INVASIVE SPECIES

INDICATOR DEFINITION

Invasive species are a huge threat to island biodiversity economic and resource sustainability, human health and the provision of ecosystem services (GoN SOE 1993; NISSAP 2015: 5). Invasive animals such as pigs, rodents, cats and yellow crazy ants predate on native birds, coconut and other land and marine crabs, reptiles, insects and other species including the seeds and seedlings of forest plants essential for forest regeneration and impact the health of ecosystems. (Powleslands 2004). Invasive weeds outcompete native plants and restrict the regeneration of forests, particularly following natural disasters. Food crops are impacted by fruit flies, pigs and rodents. Rodents, cats and other invasive mammalian species also support higher densities of *Aedes spp.* mosquitoes (Nigro e tal., 2017) raising the risk of diseases such as dengue fever, chikungunya and the zika virus. Under the Convention on Biological Diversity (CBD), Parties have agreed to meet the Aichi target 9: "By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated and measures are in place to manage pathways to prevent their introduction and establishment". The Guidelines for Invasive Species Management in the Pacific (SPREP, 2009) provides a comprehensive framework of thematic areas, on which to base a robust programme to meet the Aichi target 9. Pacific Island Countries and Territories use a National Invasive Species Strategy and Action Plan (NISSAP) to determine national priorities for invasive species management. This indicator assesses the number of introduced environmental species and their impact on the environment, especially on people's plantations.

Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

SDG	CBD
15 LIFE ON LAND	12

Environment and Climate Change Pillar [NNSP 2016–2026]

Biodiversity: Protecting biodiversity, maintaining sufficient remaining habitats and ecosystems to support the population of all species and their genetic diversity

The Global Register of Introduced and Invasive Species (GRIIS) lists 367 verified records of introduced species that have been recorded on Niue. In addition, nine species have been recorded on Niue of which their origin is uncertain.

Niue has identified eighteen priority invasive species with their NISSAP of which eleven have a current management programme.

Feral and semi-domesticated cats (Figure 72) and the two rat species have a significant impact on the population of birds, reptiles and crabs. Trapping studies by Powlesland (2004) found that the two rat species (Ship and Pacific rats) are distributed in plantations and modified habitats, but only the Ship rat is found in primary forest. These rats are implicated in the decline of the hega (blue-crowned lorikeet) and the olive small-scaled skink (Atkinson 1985; Powlesland *et al.* 2000; Powlesland *et al.* 2004). The rats are also known to predate on the seeds and seedlings of trees, and therefore can severely impact the structure of the forest and its ability to regenerate.

Feral pigs can devastate plantations by eating crops, or uprooting crops through their digging and foraging behaviour. The 2011 census found that feral pigs targeted established plantations (e.g. plantations at 9 months old

FIGURE 72. Abandoned domesticated cats quickly become invasive predators. Photo: P. Skelton.

– 40% were impacted), more than recently established plantations (3–6 months old, about 20% impacted). Plantations from all over the island were affected with Hikutavake, Lakepa, Liku and Alofi North and South being the most impacted.

Invasive plants are outcompeting native species as well as compromising the quality of forest and vegetated areas. Climate change impacts including those associated with droughts, wildfires and cyclones have been shown to help facilitate the explosion and expansion of many of the invasive plants (Space *et al.* 2004). Efforts to control them at about 40 sites have been successful but there is a need to eradicate them, as the risk of them spreading into new sites is very high (NISSAP 2015). The invasive plants of concern include the Taro vine (Epipremmnum pinnatum cv. aureum) (Figure 73), (Wedelia or the Singapore daisy (Sphagneticola trilobata), the giant sensitive weed (Mimosa diplotrica), the chain-of-love (Antigonon leptopus), the Honolulu rose (Clerodendrum chinense) and the firework tree (Clerodendrum quadiloculare). Lantana was a concern, but the introduction of a biological control agent from Fiji has managed to contain this invasive plant.

FIGURE 73. The taro vine is a serious invader, often smothers trees. Photo: P. Skelton.

The ornamental trade is an area of concern for Niue, given that many of the invasive plants are introduced through this sector (e.g. fireworks tree, chain-of-love, centipede vine and the Singapore daisy). Biosecurity measures and a stringent risk assessment processes must be mandatory to avoid current challenges being repeated in the future. This was a recommendation in Niue's State of Environment report in 1993, which stated that care must be taken when introducing exotic animal species to coastal waters, and that proper risk assessment should be undertaken prior to the introduction of any new species.

TABLE 33. Number of invasive and potentially invasive species in selected PICTs. Source: SOCO 2015.

Country	Invasive	Potentially Invasive	Total
American Samoa	40	156	196
Cook Islands	161	59	220
Federated States of Micronesia	22	385	407
Fiji	33	497	530
French Polynesia	201	253	454
Guam	40	447	487
Kiribati	42	158	200
Marshall Islands	66	238	304
Nauru	23	261	284
New Caledonia	9	462	471
Niue	46	287	333
Northern Mariana Islands	26	92	118
Palau	61	370	431
Papua New Guinea	17	385	402
Samoa	56	328	384
Solomon Islands	25	316	341
Tokelau	3	39	42
Tonga	39	378	417
Tuvalu	2	73	75
Vanuatu	23	172	195
Wallis and Futuna	31	225	256

Impacts

If left unattended, invasive species will continue to thrive and expand until a critical point is reached, due to habitat and food availability. Littered along this destructive path are species extinctions, loss of ecosystem services, impact to culture and traditional practices, and a highly compromised island environment.

The overall trend of invasive species and their impact on Niue's environment is mixed with some positive results in terms of containment and long-term control on some invasive plants (NISSAP 2015). Priority invasive species have been identified through Niue's Invasive Species Strategic Action Plan, and management actions have been proposed (see Annex 2).

Since the 1993 SOE, 13 new invasive plants have been documented (Whistler 1997; Space and Flynn 2000; Space *et al.* 2004; NISSAP 2015), representing about two

introductions per year. The fact that all of these are still present today may indicate the need to implement a rapid response plan to ensure that any invasive plant is not given the opportunity to establish and spread.

Some inroads to managing invasive plants are noted, and this is attributed to the introduction of biological control agents. Serious invasive plants, such as the giant sensitive weed and Lantana, are now considered controlled due to the introduction of these agents. Other invasive plants may need the introduction of biocontrols if eradication is not considered feasible.

Following Cyclone Heta in 2004, many of the invasive plants were noted as increasing in their population and areas being infested, especially Mikania micrantha (mile-a-minute), Passiflora foetida (wild passionfruit) and Leucaena leucocephala. (Space *et al.* 2004)

The harmful impacts caused by invasive species are well documented in many Pacific countries. For example, the extinction of many native bird species in Guam due to the introduction of the Brown Tree Snake during World War 2 (Amand, 2000). Another example is the economic hardship in Samoa due to a fungal disease, that wiped out all of Samoa's taros (Moorhead, 2011). The extinction of many native snails due to the introduction of the Papua New Guinea flatworm (Platydemus manokwari) (Cowie and Robinson 2003) is another reminder of how introduced invasive species can cause significant harm to island biodiversity. The impact caused by invasive species may be direct, such as predation of birds, or indirect, such as forest regeneration restricted due to lack of seed dispersers (no birds). Unfortunately, other threats can accelerate the impact of invasive species, such as a cyclone opening the rainforest canopy allowing fast growing invasive trees to colonise.

FIGURE 74. Feral pigs often invade plantations causing serious loss to the farmers. Photo: H. Tongatule.

Response and Recommendations

The high priority placed by the government to address invasive species is evident through the endorsement of Niue's National Invasive Species Strategy and Action Plan. This provides hope for the future of biodiversity and human wellbeing in the country. Invasive species are a priority issue for the Government. A number of response mechanisms have been put in place to help combat the adverse impacts of invasive species. This response is attributed in part to regional and global initiatives, highlighting the destructive impacts of invasive species, which will continue to grow in scale due to the increased movement of people and goods around the world, development and climate change. The best means of managing invasive species is to prevent the introduction in the first instance. Therefore, having biosecurity measures at ports is a start. Engaging communities, including the tourism industry, will also assist in minimising the bringing into the country of unwanted pests.

The current documented number of invasive species in Niue is 46 species, with another 287 that are potentially invasive. There are at least another 16 species that have been introduced, but have not shown any invasive traits.

Managing invasive species requires a risk assessment to identify vulnerable points where actions can be taken to minimise the introduction of any unwanted species. This means identifying pathways including air and sea ports, and visiting yachts, and putting in place strict quarantine or biosecurity measures.

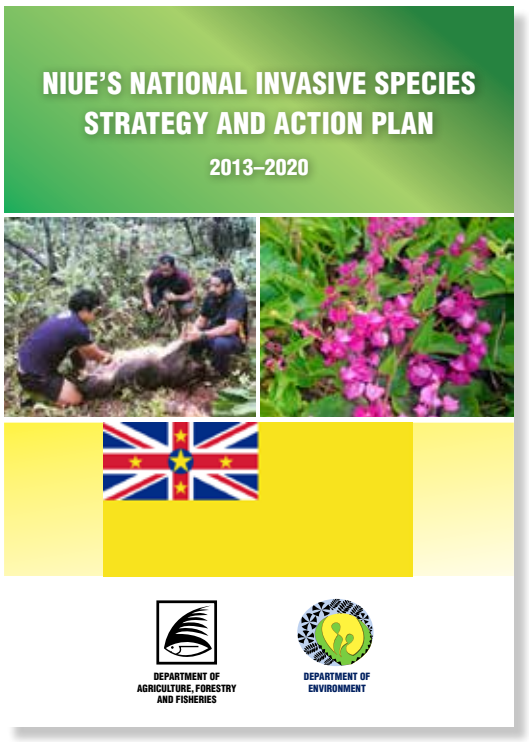


FIGURE 75. NISSAP

The key agency responsible for leading the coordination of managing invasive species is the Department of Environment. Other agencies including the Plant Protection and Quarantine Division of the Department of Agriculture, Forestry and Fisheries are also responsible for the protection of Niue from the introduction of invasive species. These agencies collaborate under a national invasive species committee, with their main focus on coordination and sharing of information to strengthen each agency's work. The development and endorsement of the National Invasive Species Strategic Action Plan (NISSAP) in 2015 provides an overall framework for this national committee. There are recently passed laws (Environmental Act 2015 and the Biosecurity Act 2016) that will enhance the protection of Niue's environment, economy and community wellbeing.

Additional actions include:

- Border control and quarantine
- Control of pest insects
- Control of pest plants
- Feral pig control
- Education and awareness
- Control of agriculture-related pests and insects

TERRESTRIAL PROTECTED AREAS

INDICATOR DEFINITION

Niue has two key protected areas (Hakupu Heritage and Cultural Park, and Huvalu Forest Conservation Area. The latter is the larger and most well-known of the two. Smaller village and community managed areas exist, but these are not found in government records. Currently, the Department of Environment is evaluating the best approach to promote and manage protected areas to achieve conservation outcomes and meet Niue's obligations to multi-lateral environment agreements. Some of the options, include expansion of existing conservation boundaries, and engaging villages and landholders to establish community-based protected areas. There is also an option to categorise the marine and terrestrial protected areas to make them easier to manage and to align them with the Aichi Biodiversity Targets. This indicator deals with terrestrial protected areas. Marine protected and conservation areas are included under the Marine Theme. This indicator looks at the size of the area included in the protected area.

Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

SDG	CBD
15 LIFE ON LAND	11, 15

Environment and Climate Change Pillar [NNSP 2016–2026]

Biodiversity: Protecting biodiversity, maintaining sufficient remaining habitats and ecosystems to support the population of all species and their genetic diversity

There are two existing protected areas established for the conservation and sustainable use of resources: the Huvalu Forest Conservation Area and the Hakupu Heritage and Cultural Site. On occasion villages and extended families have used traditional practices to manage land and prohibit activities in certain areas. A Fono is a temporary restriction imposed usually for a year, prohibiting access to an area, land or marine, and prohibiting harvesting in it as a mark of respect to a deceased family member. *Fono* may also be enforced for a few months to facilitate the harvesting of certain species of fish, for example the kaloama or yellow-striped goatfish *Mulloides flavolineatus.*

A tapu is a permanent restriction imposed by the whole village, protecting a certain area because it is sacred or vital to the breeding of certain species such as flying foxes. Many *tapu c*over primary forest and a key part of the Huvalu Conservation Area is protected by this means. There is some concern that such traditional measures are weakening, due to lack of awareness amongst the young, the poorly defined boundaries of such areas, and the pressures to clear more land or harvest more resources.

Huvalu Forest Conservation Area

Established in 1992, the Huvalu Forest Conservation Area (HFCA) lies in the south-eastern part of the island, within the villages of Hakupu and Liku. The Conservation Area covers 5,400 ha (54km^2), surrounding the largest area of primary forest in Niue. The site is divided into three areas according to local traditional practices. The core of the reserve, about 100 ha in size is *tapu*, a most sacred site, and hunting, logging or even research is prohibited. A surrounding area of about 2,500 ha of primary forest provides some protection to the core but is used for hunting and other activities and outside this is a buffer zone of 2,800 ha of agricultural land (see Figure 76) (First Country Report to the Convention on Biological Diversity, 2001). The Conservation Area also includes an area of reef platform, about 15–20 m from the high tide mark. A recent project to explore ways to sustain the protected areas and to develop a management plan has been completed. While the management plan is still work in progress, a number of recommendations were made to assist with sustaining the protected areas. This includes employing a forest ranger to monitor the protected areas, with funding generated through a visitor levy. Identifying ways to stop the illegal hunting of *lupe* and *peka* was also suggested, as well as finding ways for families to share the cost and benefits of managing the protected areas.

FIGURE 76. Huvalu Forest Conservation Area – showing the boundary and the tapu area.

Whistler and Atherton (1997) provided an extensive description of the HFCA vegetation. Two key vegetation types include managed land vegetation and natural vegetation. The managed land vegetation, which includes vegetation that is in a continual state of disturbance, was further categorised into crop-land and fern-land. The natural vegetation includes areas that have not been used by humans, or at least have not been disturbed for many years. The natural vegetation on the shore is herbaceous and shrubby, comprising littoral shrub-land. Four plant communities were recognised along the coastal area: littoral forests, coastal forests, mature forests (= primary forest) and secondary forests.

Hakupu Heritage and Cultural Park

The Hakupu Heritage and Cultural Park was designated as a national park in 1998. It extends south from the Tuhia access track in the village of Hakupu, hence it is in close proximity to the Huvalu Forest Conservation Area that is located to the north. This park was a private initiative by Misa Kulatea of the village of Hakupu with the support of family members. A committee comprising mainly of family members, who share ownership of the land, manages the park. The primary objective is to document and protect sites of historical and ecological significance. This includes some of the caves that were used for traditional burials, or for women to weave mats and other crafts. Some of the sites in the area were also used as a fortress and where the community lived. It was also an area with a flying fox sanctuary (*Tauga Peka).* Some of the natural components of the park include three fresh water caves at the Tuhia Sea Track and blowholes at Mata along the coastal area. The park is fairly small (0.05km^2) but it is an area with ecological and historic significance.

Impacts

The threats to Niue's biodiversity will remain constant with the increasing focus on development and with the impacts of climate change. Surveys of bird species following cyclones have demonstrated a serious population crash after such an event. Protected areas provide a large scale refuge for birds, crabs and reptiles. Without these protected areas, many of Niue's species will face extinction.

Response and Recommendations

Protected areas are important refuges for vulnerable species in Niue. Larger protected areas provide a better chance for species survival and offer resilience to the impacts of climate change. The diversity of protected areas, especially in terms of the vegetation types, offers a better opportunity for species to survive and to thrive. Hence, coastal forests are just as important as inland forests when it comes to protecting species population. Communities should be encouraged to protect primary forests under their stewardship and the government to work with communities to document the biodiversity, the ecology and the cultural knowledge of these areas. This will enhance Niue's commitment towards the conservation of its biodiversity and surpass the global target of 17% of terrestrial area for conservation under the Aichi Biodiversity Target. Currently, just over 20% of Niue's terrestrial area is protected. There is a need to develop the management plan for the Huvalu Forest Conservation Area and explore ways to ensure that families and communities are benefiting from protecting this national asset. Managing the threat posed by illegal hunters should also be considered and community participation in this area is encouraged.

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THEME 6 CULTURE AND HERITAGE

OVERVIEW

Culture and the environment are inseparable forces that make Niue and Niueans the place and the people of today. The environment reinforces and strengthens culture, as every aspect of living is dependent on available resources. A strong culture is a good reflection of a healthy and intact environment. Language, customs and ceremonies, social governance, respect, and other elements provide a measure of how strong the culture is. Niueans have always had strong cultural ties to the land and at times apply a number of traditional conservation practices, such as closing off areas or restricting activities through the imposition of *fono* (a temporary control) or *tapu* (a longer-term taboo) involving sacred beliefs with a strong spiritual overtone. Niueans also have a remarkable ability to read biological indicators, such as the flowering of a certain plant that would indicate a certain type of fish was readily available, and use the cycles of the moon to time the planting of crops.

The origin of Niueans remain obscure but language and cultural ties link it to Samoa and Tonga. Conflicts with neighbouring islands were not recorded. Two main groups occupied the island, with Motu residing to the northern part of the island and Tafiti to the south. Captain James Cook called Niue the Savage Island after he failed to land there due to hostility shown by the locals. Whalers and ships passing through Niue often brought diseases and other untold horrors to the people. In the early 1800s, a young Niuean named Nukai Peniamina travelled to Samoa where he learned Christianity. He returned to Niue in 1846 and introduced Christianity to the people. There was much resistance to Peniamina's efforts, and an estimated 60 warriors from his family were required to protect him on his mission. However, today Niue celebrates Peniamina's legacy through a public holiday in October.

The impacts and changes to Niuean society have been significant. The close association with New Zealand is viewed by most as positive for the development and wellbeing of the people. Many Niueans are proud of who they are, their culture and their island. For Niueans who live in culturally diverse New Zealand, embracing these values presents challenges and opportunities. The fact that most Niueans grow up in New Zealand during the most active and productive time of their lives (from early teens to under 40 years) prepares them for a developed country. Skills gained through this period can be adapted to benefit Niue in the long run. However, incentives to bring these skills back to the island remain challenging. The bond between the individual and the family is strong and this encourages some Niueans to return home.

There were challenges in finding and assessing hard data related to Culture and Heritage, so it is recommended that more data is gathered or publicly shared for this theme to better assess the relation to Niue's current environmental state. However, Tāoga Niue does outline suggestions and ideas for using oral history and other documentation methods for preserving Culture and Heritage.

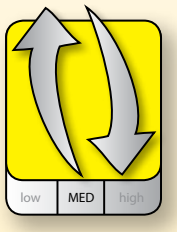
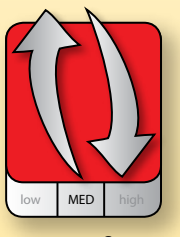
Kua tū au he matamaka tu viliviliō, ko e fonua tavana, takatakai ai he tahi lanu moana uhi kikila kua leveki e tufugatia he Atua. Nākai fai foki ne tatai – Niue Nukututaha, Nukutuluea, Fakahoamotu – ko e atefua he ha tautolu a tau tupuna, ko e kaina tokiofa, ko e fakaalofa ne mua ma e tau tagata Niue oti.

Tokologa haaku a tau tagata kua momole atu tokologa foki kua toka hifo e matagahua leveki, puipui mo e fakatūmau e fakaalofa he moui ke he tokogahoa ha mautolu. Liliu mai ma haaku tau tagata hā kua tata mai tuai e magaaho ti kua lata nī a tautolu ke fafagu auloa e tū hokohoko ma Niue, Nukututaha, Nukutuluea, Fakahoamotu.

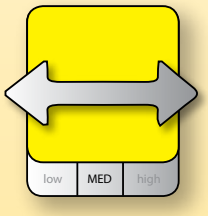
I stand on this an isolated, pristine landform, surrounded by the jewel blueness of the ocean that protects the unique creation of God. There's nowhere like it – Niue, Nukututaha, Nukutuluea, Fakahoamotu – the inner soul of our ancestors, our treasured home, a precious gift for every Niue person.

Many of my people have passed on and many have left the responsibility to the few of us to guide, protect and sustain the gift of life. Please return soon my people for the time is near as we must breathe together sustainability for Niue, Nukututaha, Nukutuluea, Fakahoamotu.

CULTURE AND HERITAGE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
SITES OF NATIONAL SIGNIFICANCE	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Niue has many sites that are important for tourism, as well as the history of the people and island. Many of the sites are well maintained, but a lot more are in need of maintenance. Cultural sites are overgrown with weeds and many of the knowledge holders to these sites are living outside of Niue or have passed on. Tourists' feedback has been positive when visiting and exploring many of the sites that are on the tourism brochure. Only a few cultural sites are being mapped and documented by Tāoga Niue.	Sites are maintained by the government and the villages. Sites that are well known (highlighted in Niue Tourism Office brochures) are accessible to all visitors. Many cultural sites can be found in villages, but these are not well known. There is an urgent need to document many of the cultural sites and use this as part of the eco-tourism experience for visitors, as well as a connection to the past. Establishing a national sites registry is important. The work by Tāoga Niue should be supported in mapping and documenting historical and cultural sites. Need to address encroaching invasive species as well as stop dumping waste at these sites. This also includes defacing of signs.
LANGUAGE	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Language is important in maintaining the cultural connection with the land. There is a concern that the Niuean language is declining due to the influence of other languages and the increased number of non-Niueans living in the country. While most Niueans are bilingual (Niuean and English), the number of Niueans who speak Vagahau Niue (or formal Niuean) is declining. The recent census found other languages spoken in Niue include Tuvaluan, Samoan, Tongan, Fijian, Hindi and Mandarin. The number of fluent Niuean speakers living in NZ has declined over the years.	Government enacted the Vagahau Niue Act 2012 to protect and promote the Niue language. The efforts to document the language and knowledge are being spearheaded by Tāoga Niue and various government ministries. The NZ government is also assisting with promoting of the Niuean language and culture at schools. The use of Vagahau Niue must be encouraged at all government departments, especially with the media due to their influence in the community. All project-related documents should be translated into the local language including communication and awareness tools.
FOOD PRODUCTION AND CONSUMPTION	 **Status** Poor **Trend** Mixed **Data confidence** Medium	Food is an important part of the Niue custom and is exchanged as gifts during ceremonies, such as the boys' first hair cutting and girls' ear piercing. Traditionally wild yams (*ufilei*) were planted by the tupuna in preparation for the cyclone season. Unfortunately, this tradition is no longer practiced. In some communities a certain small land crab was a delicacy and there was a prestige attached to its preparation. With societal changes, this is no longer practiced and the skill is seen as backward.	The continuation of customs and related food gift exchanges should be encouraged in the home and in expatriate Niuean ceremonies. Eating a local, varied diet should also be encouraged, while keeping in mind sustainable practices when sourcing fish and other meats and foods. Need to address food security in relation to climate change. Need for sustainable food security to supply to tourism markets, including innovative methods and emergence of new technologies, eg) hydroponics. Also, strengthening of local NGOs to provide and for government to provide adequate support and networks, eg) Niue Fisherment Association, NIOFA, Niue Growers Association.

CULTURE AND HERITAGE HIGHLIGHTS

TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
CEREMONIES, CULTURE AND TRADITION, TRADITIONAL KNOWLEDGE	 **Status** Poor **Trend** Mixed **Data confidence** Medium	A number of ceremonies still hold strong values and recognition for Niueans, such as haircutting for boys and ear-piercing for girls. Many of these ceremonies continue to evolve and have incorporated modern elements, such as blessings done in English instead of Vagahau Niue, and the exchange of money instead of crops. Traditional knowledge often relates to close interactions amongst communities and their environment. Societal norms dictate certain activities, and as such, knowledge becomes exclusive to certain people and groups. In Niue this was true of fishing with outrigger canoes, which was and continues to be seen as a male-only activity. Weaving mats and other crafts was seen as something only women do. Farming was also seen as an activity mostly for men, but increasingly, women are taking an active role due to necessity rather than societal expectations.	There is a need for a conversation to discuss how best to preserve Niuean ceremonies. Many of the changes to what is perceived as 'traditional ceremonies' are taking place outside of Niue and these are slowly being filtered back into Niue, causing much anxiety to local residents. The government and community leaders have recognised the erosion of traditional knowledge as a serious challenge. Efforts to address this are being promoted through sector-led programmes, such as the work of Tāoga Niue and the Meteorological Service. The work of some individuals in documenting their stories, or the stories of their tupuna (parents and grandparents), help to capture some of the traditional knowledge. Village plans also provide a means to capture some traditional knowledge, and as such should be promoted.
ARTS AND CRAFTS	 **Status** Fair **Trend** Stable **Data confidence** Medium	A few residents continue to practice arts and crafts. The government does some promotion through festivals and villages, which host events to display culture and traditions. There's a shift in using imported products for craft making, due to their accessibility. This is a risk to the skills and knowledge associated with preparing crafts using traditional materials.	The government put legislation in place to protect and safeguard all Niuean arts and crafts. Strengthening a national arts council will help in the coordination and promotion of Niuean arts and crafts. Developing a national arts agenda will help foster the role of arts and make them mainstream in Niuean society.

SITES OF NATIONAL SIGNIFICANCE

INDICATOR DEFINITION

Niue has many sites that are of geographic, cultural, religious and historical significance. The preservation of these sites will mean the protection of the environment and will help foster a closer connection to the land. Some of the sites are classified as protected or conservation areas, whereas others are being promoted and utilised for eco-tourism. This indicator looks at the status of sites of national significance.

Status
Fair

Trend
Mixed

Data confidence
Medium

FIGURE 77. The magnificent Matapa Chasm, is not only a tourist attraction but also of cultural significance. Photo: P. Skelton.

Status and Key Findings

SDG	CBD
11 SUSTAINABLE CITIES AND COMMUNITIES	18

Finance and Economic Development Pillar [NNSP 2016–2026]
Tourism
Private Sector Pillar [NNSP 2016–2026]
Create and Capitalise on Market Opportunities: Assist businesses to benefit from tourism growth

Niue has many fascinating sites that capture the attention of visitors to the island. Caverns, caves, chasms and rock pools are abundant throughout, and communities have traditionally used many of these sites. Some of the sites are used as part of the eco-tourism promotion due to their interesting geological formation, or provide a safe place for swimming. Religious and historical sites are also highlighted, which include the place where James Cook tried to land and where Christianity was first introduced. What is lacking is documentation of the cultural sites that are located closer to villages. These sites have significant meanings and are sometimes associated with legends and spiritual events governing the community's interaction. Tāoga Niue is currently mapping some of these sites in partnership with communities (see Table 34).

TABLE 34. Various sites of significance in Niue.

Site name	Significance
Opaahi	Noted as the site where James Cook first attempted to land. Managed by Niue Tourism Office.
Tomb Point	Cultural and Tourism Two Kings buried at this site. Good site for whale watching.
Avaiki Cave, Makefu	Cultural and Tourism Niue Tourism Office
The Huanaki Cultural Centre	Cultural Cultural meeting place. Site destroyed by Cyclone Heta in 2004.
Peniamnia's Cave	Religious, Cultural and Tourism First Niuean to bring Christianity to the island. Pilgrimage site for some.
Huvalu Forest Conservation Area	Natural Heritage Community Largest primary forest on the island. Has *tapu* areas. Managed by village.
Reef at Tamakautoga and Tuapa	Natural Heritage Biodiversity-rich sites and sites for Wandering Tattlers and gold plovers.
Tuhia Sea Track	Natural Heritage. Site has been mapped and village has more information. It is well maintained and a good site for harvesting seafood and swimming. There are three freshwater caves.
Mata Blowhole	Natural Heritage
Matapa Chasm and Hikutavake Sea Track	Tourism. The Matapa Chasm is located in Hikutavake and is a popular swimming and snorkelling area as it is sheltered from the open sea. The pool is surrounded by high cliffs with an opening to the open ocean blocked by a large boulder.
Talava Arches	Natural Heritage. A stunning sight caused by the weathering of the island forming a large arch. Located at Hikutavake.
Tauei Fupiu (fort)	Religious and Cultural
Ulupaka Cave	Natural Heritage
Hikulagi Sculptural Park	Tourism
Vaikona Chasm	Tourism
Togo Chasm	A national heritage site comprising a freshwater chasm that is used for tourism promotion.
Anapala Chasm	This is a cultural site of a fresh water cave that was used for drinking and bathing during times of drought before the village of Hakupu had access to running water. It was also used for the traditional practice of making arrowroot starch (*nu pia).* The water of the cave was used to treat an eye infection that affected the majority of the people of Niue in the early 1990s. Family owners still use the Anapala track to gather *'luku,'* or bird nest fern, (*Asplenium nidus*) for eating and to hunt coconut crabs. The site is located on the main sea track of the village of Hakupu, Tuhia.
Foa (On the main road from Hakupu to Alofi)	A sheltered cave that contains the remains of early settlers. A giant right-side footprint over a metre wide is located near the cave but is covered by shrub land. According to elders, this footprint matches a left-side footprint found at Avatele, and a left handprint in Tuapa. The legend was these prints are Maui as he separated the earth from the sky. There has been no research or record of these sites or photos taken of the hand and footprints. This warrants further investigation. The site is fairly accessible from the road, but shrubs and ferns have covered the footprint. The last sighting of the footprint was in the 1960s. There is also the uncertainty of it being damaged by crop ploughing in the area.
Havaka (Hakupu to Alofi)	There is a clearing with a prayer mound, or rock and cement base in this area. The area was used for ancient rituals before Christianity arrived. When Muifonu Mose and Hafonua Tavita brought Christianity to the area, the place was converted to a Christian place of worship. As the word of God spread, more people gathered in the area. It is unknown why, but the place of worship was relocated to Tamani, before eventually settling in its third and final place of Fineone Hakupu Atua, where the village of Hakupu was formed. The area is maintained by the landowners.
Kakaoka (left side of the village towards Vaiea)	The story goes that a warrior named Lefutogia discovered some taro shoots in the forest and took them back to his home at Kakaoka. He planted the taro shoots in his home and used freshwater from the cave to water his garden. His taro grew big and plentiful and it was a remarkable sight. One day, he went up North to give food to the King, and he used the taro leaves to wrap the food. When the King saw how big these leaves were, he ordered his men to follow Lefutogia back to his home to find out what plant the leaves came from. When the King's men discovered Lefutogia's garden, they slew him and took his entire taro for themselves. This story has links to the history of the taro and the art of ancient cultivation. This site holds great significance in terms of history and cultural practices.
Lalofetau (right of the village of Hakupu)	This place has a cave that was used as the first prison of the Hakupu village. When Christianity was introduced to Hakupu, the law and punishment for breaking it was also introduced. Caves were used as a prison as a way of using the fear of the dead as punishment and deterrence from crime. Caves were also used for shelter during storms or cyclones. There are other caves in the area used for weaving during the day when it is cool, and there is a fresh water cave.

Impacts

Niue is blessed with many important sites, including sea tracks, caves, karsts and chasms. These sites hold interesting information on the formation of the island and the various climate history over thousands of years. The cultural sites have a close connection with the people and the environment. Much of the oral history is tied to these sites; therefore, their preservation will help in maintaining the close relationship and connection between the people and the land. Unfortunately, much of the oral history and connection to sites is being lost, due to the passing of the knowledge holders.

Response and Recommendation

By preserving sites of national significance, Niue is able to hold on to part of its history and cherish what makes the country and people special. Establishing a registry or a national sites database is an excellent step towards achieving this preservation. This will provide an opportunity for many of the Niueans based abroad to learn more about places and sites that have shāped their story. Such a registry ensures that developments will need to be cognisant of activities and their impacts to sites. The role of Tāoga Niue in capturing and mapping some of the historical village sites should be strongly supported and expanded to include all the villages.

There is an opportunity to develop cultural sites and use this as part of the eco-tourism experience for visitors. Guided tours through the cultural settings can help generate income for the villages, and enrich the experience of the visitor. Maintenance of these sites is vital to protect the value that they hold. It should be mentioned that from the 1993 NEMS report, there were money making schemes initiated in the Huvalu Conservation Area. This included coconut oil making, vanilla planting and forest tours which have all ceased to exist in the present.

To preserve the oral history of cultural knowledge, interviews could be conducted with the knowledge holders to document their understandings, perspectives and experience, perhaps supported by and housed in a university or museum.

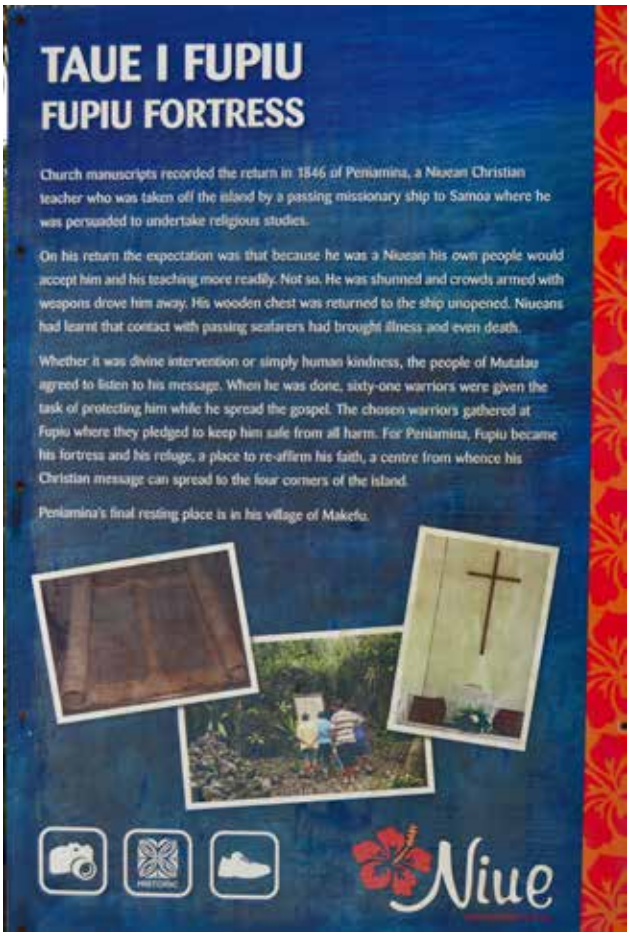


FIGURE 78. The Fuipu Fortress is an important religious site.
Photo: P. Skelton.

Fono
Tamakautoga
Fakaalofa lahi atu
Taoga
Peniamina
TAPU
Nukututaha
Mouia faka-Niue
Fakahoamotu
Kulukulu
LEVEKI MAGAFAOA
Matapa
Opaahi
Nukutuluea
Hikulagi
Leveki
Kia monuina
Limu

LANGUAGE

INDICATOR DEFINITION

Language and culture play an important part in defining one's identity and origins. The knowledge and skills of the *vagahau (Niuean language*) culture and its usage ensure its continued survival. There is concern that the vagahau and certain cultural skills are disappearing, and there is a general consensus that adults and children are using English more than Niuean in everyday conversations. The loss of these language skills relates to knowledge surrounding other cultural practices, such as how to weave a basket and traditional cooking and food preparation. This indicator looks at the state of the language in terms of the number of people that identify Niuean as their mother tongue, as well as children's proficiency in speaking, reading, writing and understanding vagahau Niue.

Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

CBD

Taoga Niue Pillar [NNSP 2016–2026]

- All residents and visitors embrace and respect Taoga Niue
- Taoga Niue actively integrated from the home to the national level
- The Cultural Bridge with Niueans abroad is strengthened

The Niuean language is related to other western Polynesian languages, including Samoan and Tongan. The language was formalised in the western alphabet by the missionaries up until 1890. Presently, the majority of Niueans are bilingual with *vagahau* being spoken mostly during family and communal gatherings, whereas English is the language used at schools and businesses. The Niuean language is listed as one of the world's endangered languages (Moseley 2010). The 2011 census identified approximately 46% of households speaking solely vagahau and 32% speaking both English and vagahau. This figure is encouraging since the 2006 census had the number of vagahau-speaking households at 37% (Table 35).

TABLE 35. Change of language spoken in each household from 2006–2011 Census data.

Language spoken in Niue households	Niuean	Niuean and English	Niuean and Others	English	Others	Total
2006	37%	43%	4%	7%	9%	**100**
2011	46%	32%	5%	11%	6%	**100**
Number of change	44	-54	5	19	-11	**3**
Change in %	9%	-12%	1%	4%	-2.4%	

Although the number of people who identified Niuean as their first language increased by 10%, proficiency in speaking, reading, writing and understanding shows a decline from 2006 to 2011 (Table 36).

TABLE 36. Proficiency in vagahau Niuean showing a decline in speaking, reading, writing and understanding. Source: 2006–2011 Censuses.

	2006	2011
Niuean as first language learned	**Total (%)**	**Total (%)**
Niuean	65	75
Speak Niuean		
Yes	86	80
Just a little	7	13
No	7	8
Read and Write		
Yes	88	75–76
Just a little	6	13
No	5	10–12
Understand		
Yes	88	81
Just a little	6	13
No	5	6

This declining trend in language proficiency is also observed in those identified as Niueans living in New Zealand. In the 1996 NZ census, 32% of Kiwi Niueans identified themselves as being fluent. This number declined to 28% in the 2001 NZ census, which may correlate to a five per cent drop in the Niuean population in NZ from 2001 to 2013.

Impacts

Language is an important part of one's cultural identity. Culture integrates communities and the environment. The loss of a language is a strong indication that culture (including traditional knowledge) is threatened, and people are becoming disconnected to their environment. A strong culture indicates that the language is well used and valued. The environment will also be strong, as customs and ceremonies that incorporate the surroundings, continue to be encouraged and practiced. The threat to the Niuean language comes primarily from Niueans migrating to New Zealand to take advantage of opportunities that may not be found on the island. These Niueans accept the New Zealand lifestyle and embrace the English language in order to be part of New Zealand society. The Niuean language is relegated to being spoken only at home or within a narrow group of Niueans. The richness of Niuean culture, painted by the beauty of the language, is thus watered down.

Response and Recommendations

There is a fear that language is becoming diluted. This is illustrated by anecdotal evidence from adults and children alike who use English more than Niuean in everyday conversations, and students who, in years past, were only allowed to converse in English at school. While there is some good news with the number of households speaking *vagahau* Niuean, the proficiency is sadly declining. The data from New Zealand, where the population base is for those speaking Niuean, is also of concern. The role of the family, especially the parents and the extended family, in ensuring that vagahau continues to strengthen and proliferate is vital. The government can put in place policies and plans to assist through childhood schooling, improving the education curriculum, holding cultural festivals and offering vagahau classes for adults. A national pride campaign could help solicit a holistic approach in improving language proficiency, as well as improving many aspects of what it means to be a Niuean living in Niue. It cannot be emphasised enough that language is a key factor in retaining one's cultural identity. There is a strong onus for Niueans living abroad to learn, practice and pass on their language skills and knowledge to future generations.

There is a need for documents to be translated, especially scientific and technical terms, as some English words do not have any corresponding Niuean words. This can result in loss in translation or the context being missed.

FOOD PRODUCTION AND CONSUMPTION

INDICATOR DEFINITION

Food is a form of currency in Niue, as in many island cultures. No communal activity is complete without the preparation and sharing of food (Figure 79). While imported food is well accepted and adopted by Niueans, there is still a preference for traditionally grown, harvested and prepared food. There is a perception that those who grow and harvest their own food are more connected to the land than those who buy food from stores. This indicator looks at the state of knowledge in food preparation activities (husking coconuts, food processor), food production (tools and equipment and plantations), and food security (storage).

Status
Poor

Trend
Mixed

Data confidence
Medium

Status and Key Findings

CBD

Finance and Economic Development Pillar [NNSP 2016–2026]
Agriculture
Social Services Pillar [NNSP 2016–2026]
Health: Healthy lifestyle choices with well supported health services, and food and nutrition security that is sufficient, safe affordable and accessible

There are certain specialised skills needed for food preparation, including coconut husking and basket weaving. In the 2009 Agricultural Census, 62% of people in the population indicated they knew how to weave a basket, whereas 82% indicated they could husk a coconut (Table 37). For food consumption, 67% of households consume green bananas six times per week on average (Figure 80). About 78% of Niueans consume, on average, 19 dry or mature coconuts per week (2009 Census). The majority of the coconuts are used to feed the pigs. Taro is readily consumed by about 96% of households. Cassava is consumed by 64% of households. *Uga* (coconut crab) is a delicacy and around 60% of households actively participate in hunting them. In 1989, only 30% of households were recorded as actively participating in the hunting of *uga*. The average number of *uga* harvested is 27 per household, a slight increase from 24/household in the 1989 Census. Hakupu, Avatele, Makefu, Hikutavake and Liku households harvested the most number of *uga* (well over 40 per household). 93% of households set hunting trails to catch the *uga* (Table 38).

FIGURE 79. Takihi, a traditional dish made with papaya, taro and coconut cream. Photo: Huggard Tongatule.

Fishing remains an important activity for up to 64% of households, although the number that actively participate has declined by about 20% from 320 in 1989 to 248 in 2011. This drop may correlate to the 35% decline in population over the same period. The number of canoes declined from 241 in 1989 to as low as 130 in 2009. The number of motorised boats has increased by 40% from 1989 to 2011. Most of the fishing takes place in the inshore waters (62%), with 31% taking advantage of fishing inshore and offshore. Only a small number (7%) fish offshore. Hook and line is the most popular (85% of fishers) form of fishing method, followed by reef gleaning (71%). Bottom fishing, trolling, spearing and fish nettings are also used. Most of the fish caught are consumed at home (about 80%), and only a small proportion sell their catch.

TABLE 37. Number of respondents that are able to perform traditional food preparation tasks. Source: 2009 Census.

Activity	Consumption and Use Rate (%)
Coconut husking	82
Basket weaving	62
Green banana consumption	67
Dry coconut consumption	78
Taro consumption	96
Cassava consumption	64
Engaged in fishing	64

TABLE 38. Households hunting uga and the numbers collected

Uga	Hunt	Total uga caught	Average per HH
Alofi South	52	1221	10
Alofi North	26	646	12
Makefu	15	715	42
Tuapa	19	654	20
Namukulu	1	15	4
Hikutavake	11	710	39
Toi	8	305	34
Mutalau	19	1043	31
Lakepa	10	278	15
Liku	18	1078	41
Hakupu	30	2365	55
Vaiea	10	363	24
Avatele	35	2027	48
Tamakautoga	25	964	28
TOTAL	**279**	**12,384**	**27**

Owning tools for the plantation provides an indication of some level of preparation for planting food crops. The majority (90%) of households identify owning a bush-knife, followed by brush cutters (71%) (Table 39).

TABLE 39. Households with agricultural tools and equipment. Source: 2011 Census.

Tool / Equipment	Knapsack sprayer	Metal husker	Firearm	Bush knife	Axe	Chainsaw	Brush cutter	Motor mower
Households with	61%	64%	50%	90%	66%	43%	71%	56%
Households without	39%	36%	50%	10%	34%	57%	29%	44%

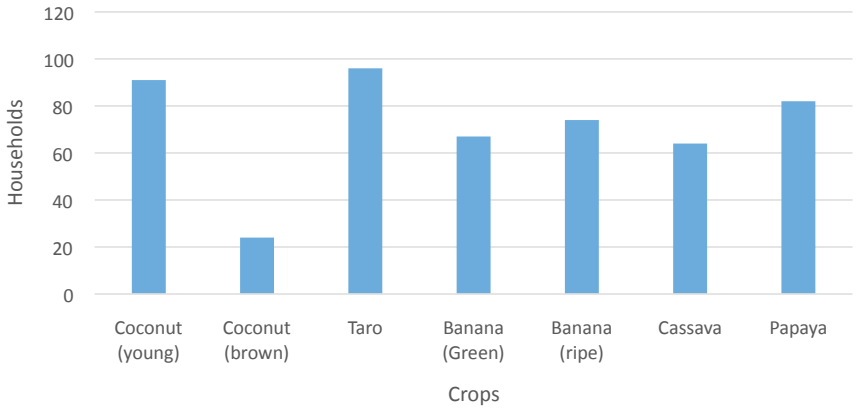


FIGURE 80. Household consumptions of various crops. Source: GoN, 2009 Census.

Impacts

The cultural practices of sharing food and preferring locally grown and harvested foods, such as taro and green bananas, signify that Niueans value a connection to the land through their plates. These practices maintain a tie to the culture and values of family and community. Consumption of some imported foods that contain unnatural ingredients and excessive sugars and salts can lead to health problems, such as diabetes and hypertension. Additionally, imported foods must be shipped or flown to the island and affect the environment in coming over on vessels that require fuels that can negatively affect air and water.

The 64% rate of engagement in fishing is another indicator Niueans use their surrounding resource of the sea for food. However, overfishing of certain species can deplete reefs and their health.

Response and Recommendations

Maintaining the practice of connecting to the community, family and land by growing and sharing local foods is encouraged. It is important to ensure local foods that have a variety of vitamins and minerals can be grown and consumed, such as edible local greens that can be nutrient-dense. The slight increase in consumption of imported foods should be monitored so it does not overtake eating local, healthy foods. Many imported foods also come in plastic packaging that can be littered easily into the land and sea, and does not biodegrade.

When sourcing fish, an assessment of which fish can be sustainably sourced to ensure reef and marine health should be conducted and implemented with fishermen.

Consistency and availability of bulldozer to clear agricultural lands for food security and maintenance of planting materials and food crop varieties.

Uncontrolled burning poses a risk to land, land boundaries, social issues and loss of crops.

Need for food variety crops to be distributed to different farmers to maintain food security as many crops will perform under different conditions, eg) different varieties of taro and yams - need to be grown and planting materials spread.

CEREMONIES, CULTURE AND TRADITIONS

INDICATOR DEFINITION

The strength of traditions and cultural ceremonies, such as the raising of pigs and chickens for feasts, or the cutting of boys hair, or piercing of young girls ears, are what make Niue unique from other Polynesian cultures (Figure 81). These ceremonies are accompanied by a feast made with local produce, such as taro, yams, chickens, pigs and a range of seafood. The production of this food is the pride and joy of all Niuean farmers, and an indication of wealth and standing, plus an opportunity to demonstrate ability and knowledge in farming the land. Ceremonies allow fishers to demonstrate their skills to catch fish and other seafood for their community. The produce is also an indication of family wealth and standing in the community. The migrating population to New Zealand has adversely influenced many of the traditions associated with the ceremonies. Speeches, which were revered, as they demonstrate the ability of the family to speak eloquent vahagau Niue, are now conducted in English, or in pidgin (Niuean/English mixed). This indicator assesses the production of crops and livestock by households for the purpose of traditional cultural ceremonies.

FIGURE 81. Women sharing their culture through participating in craft making. Photo: Huggard Tongatule.

Status
Poor

Trend
Mixed

Data confidence
Medium

Status and Findings

CBD

Taoga Niue Pillar [NNSP 2016–2026]

- All residents and visitors embrace and respect Taoga Niue
- Taoga Niue actively integrated from the home to the national level
- The Cultural Bridge with Niueans abroad is strengthened

The country census provides the key source of information used in assessing the production of household crops. One of Tāoga Niue's important functions is documenting and recording the customs and traditions of Niue. The number of chickens and pigs raised can have an impact on the environment, depending on whether they are kept in clean, hygienic conditions and fed a proper diet. Of the 477 households recorded in the 2011 Census, a large proportion (379 households) had pigs in enclosed sties, with another 21 households having pigs roaming freely. Of these 477 households, 413 had free-range chickens, whereas only 23 households kept chickens within an enclosure. Overall, there is little hard data on customs and ceremonies, and the information found is more general or local knowledge.

Impacts

A serious impact to Niue's ceremonies, culture and traditions is the loss due to the lack of practice or use by the people. The outside influence on ceremonies is already affecting many aspects of traditional living. The ready acceptance of money as a replacement of produce from the land, has an unintended consequence where people will no longer see the value of toiling the land. As people refrain from farming, part of their knowledge will also be lost if this is a continuing trend.

Response and Recommendations

The Niuean culture, ceremonies and traditions are important *Tāoga* (treasures), worthy of preserving for the future identity of all Niueans. Traditions and ceremonies, which together make up the spirit and the material being of *tagata Niue* (Niuean people), are what the Government promoted in a 2004 initiative (GON 2008). A clear message from the initiative was the strong cultural ties to the land, where the natural resources were used in traditional arts and crafts. Traditional practices of farming, hunting and fishing, as are the practices of fono and tapu (closure of certain areas from use), were part of the make-up of tagata Niue. The establishment of the Tāoga Niue in 2004, as part of the Government initiative, continues the commitment to enhance the Niuean culture and identity. Under the Tāoga Niue's umbrella, a number of core focused areas were identified:

- History
- Heritage
- Arts and Crafts
- Customs and Traditions
- Vagahau Niue
- Environment
- Cultural Bridging

Within these focused areas are some key actions that should be prioritised and implemented. These actions are listed below.

The documentation of the history of Niue needs to be continued, by encouraging families in Niue and overseas to record their stories, and to archive a copy with Tāoga Niue. Time is of the essence, as many of the knowledge holders are passing on, and others have moved overseas.

Establishing the Huanaki (museum and the cultural centre) to exhibit traditional crafts, customs, performing arts and other cultural history was recognised earlier on as a means to encourage and strengthen Niuean heritage. The destruction Cyclone Heta caused to the Huanaki Centre included the terrible loss of many traditional materials and artefacts. A Heritage workplan has been developed that focuses on recording stories from the elderly, exhibiting traditional handicrafts and knowledge, learning traditional dances and songs, registering all cultural artefacts, and educating the public. Registering the copyright of all artefacts is also a key action taken to safeguard Niue's rights to its cultural history.

Arts and crafts are a symbolic representation of Niue, and all Niueans should be encouraged to be custodians of these Tāoga. Talents and skills taught and handed down from the *tupuna* (elders) must be cherished and protected and not given away easily. Such skills, for example, canoe carving or medicine making, are often passed down from the parents to the children. Other important arts, such as music composition, are the Tāoga of communities or villages, and as such need to be respected.

Establishing a central database to record the customs and traditions of Niue is a key action under the Tāoga Niue's Custom and Traditions focus. Having such a database will help in ensuring that many of the Tāoga of Niue can be accessed and used appropriately, as well as awaken and maintain pride in Niuean identity and sovereignty.

Vagahau Niue encapsulates in part the Niuean language, and holistically, the mana that makes a person a Niuean. The action is to ensure that a standard of Vagahau Niue is recognised and appropriate training and teaching are provided to ensure that this will continue in the future.

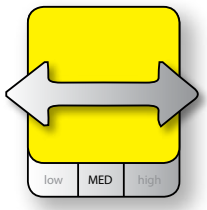
In the environment provided for the Niuean people since their arrival, traditional knowledge was quickly learned and applied. Biodiversity was used to enhance ceremonies and also for the making of crafts. These natural resources are also Tāoga of Niue, and through the biodiversity action plan (NBSAP), themes have been identified for which to take action. These include the conservation of forests, sustainable use of land, and the protection of the peka and the uga. Many other environment actions are listed in the NBSAP.

The Cultural Bridging focuses on bringing Niueans living abroad, and those living in Niue, to pursue a path that protects Niuean culture. It is recommended to develop a plan that allows for the effective participation of Niueans living abroad.

ARTS AND CRAFTS

INDICATOR DEFINITION

Arts and crafts are an important Tāoga (treasure) of Niue. They represent the history of the people crafted since the first arrival and moulded over the years with totems and legends inspired from their environment. Many of the traditional arts and crafts used local materials such as the leaves and bark of plants, wood and timber, tusks and teeth of animals, feathers of birds, or shells from the sea or coastal areas. Many of these arts and crafts are intimately linked to legends and lores of the land. Understanding these stories and the knowledge through the making of these arts and crafts are indicative of the people's relationship with the environment. The more the arts and crafts are practiced and showcased, the stronger this relationship between Niueans and their environment. This indicator identifies the number of groups and individuals who practice the arts and crafts of Niue, and while there is no empirical data to support this indicator, it provides the baseline for future assessments.



Status
Fair

Trend
Stable

Data confidence
Medium

Status and Key Findings

CBD

Taoga Niue Pillar [NNSP 2016–2026]

- All residents and visitors embrace and respect Taoga Niue
- Taoga Niue actively integrated from the home to the national level
- The Cultural Bridge with Niueans abroad is strengthened

Niue continues to develop and promote a range of arts-related activities, including the Niue Arts and Cultural Festival, the Kai Niue Festival and the Niuekulele Festival. Most of these events include various cultural and traditional aspects, with food preparation and consumption, songs, stories, paintings and carvings. These events promote the fusing of old and new ideas, and they encourage traditional arts and crafts to continue to be practiced. Groups, such as Niue Women's Weaving, are set up to encourage elders to remain active and to pursue generating alternative income through the making of local crafts and artworks that can be sold to tourists. Only a few men do crafts, which are sometimes available for sale (Figure 82).

Most of the materials used for crafts are pandanus and local woods, but increasing other readily accessible and imported items, such as raphia are being used. Making traditional arts and crafts is taught at school, and after that there are no other avenues to pursue traditional art/craft making. The demand for local arts and crafts is very high through requests from the Museum, but the lack of supply means that very few items can be purchased.

Village shows are another avenue for traditions and culture to be showcased, especially with regards to traditional dance and story-telling, as well as sharing food and preparing customary delicacy and cuisines.

The Hikulagi Sculpture Park was established in 1996 by members of the Tahiono Arts Collective as a free-form art space, where visitors are encouraged to leave their small mark on Niue by adding to the large, found object assemblage entitled “Protean Habitat”.

FIGURE 82. A range of cultural items on display during a village show day. Photo: Huggard Tongatule.

Impacts

There are a number of challenges relating to arts and crafts in Niue, including the loss of resources used for arts and crafts as a result of overharvesting or displacement caused by invasive species. There is also the lack of conservation efforts to protect or increase plants and animals that are used in arts and crafts. The easy access and convenience of synthetic materials have also displaced the skills and knowledge for the harvesting and preparation of natural resources used for Niuean arts and crafts. The importation of synthetic materials can often mean more waste and non-biodegradable goods entering the country and adding more problems to the environment. On the other hand, the loss in the practice of art and craft making will exacerbate the disconnection between the people and nature. Some of the legends that are enhanced through the practice of arts and crafts will be lost.

Arts and crafts must continue to evolve to tell stories of the past and present. The value and meaning of some traditional arts and crafts will also change as society dictates and evolves. The *kahoa hihi* (shell necklace) that was once a household adornment has evolved into a political accessory used to garland visiting dignitaries and visitors, and it is commonly used to assert national pride.

Response and Recommendations

The promotion of arts and crafts can help foster a strong relationship between communities and their environment. Valuing and promoting the skills required to make arts and crafts and encouraging the use of traditional materials will enhance the value and integrity of local artworks. This in turn will help promote the planting and conservation of local trees and shrubs, as well as the sustainable harvesting of shells. The government’s role is integral in this area by promoting the work of Tāoga Niue, encouraging traditional arts and crafts as an important part of the Niue Tourism Office, and incorporating arts and crafts in the education system. Establishing an effective partnership with the private sector and NGOs through an Arts Council – whose role is to support the efforts of individuals, organisations, villages and businesses in promoting Niue’s arts and crafts -would help in their promotion and preservation.

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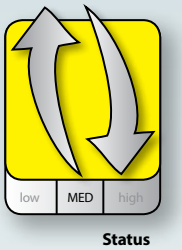
OVERVIEW

The population density for Niue is the lowest in the Pacific Islands – 6.2 persons/km^2. The capital Alofi, subdivided in to Alofi south and Alofi north, has the highest resident population with 33% (572 persons – 2017 Census). The low population base and the geographic distribution means that services (water, sanitation, energy, food, etc.,) are currently able to cope with demand. As the nation continues to push for economic development, especially in the tourism industry, these infrastructure services will need to keep pace with the demand. Energy, waste and sanitation are three key challenges under the Built Environment theme that need to be addressed as the nation continues towards its economic development. With very limited landmass, waste and sanitation are key priorities from an environmental perspective. The high importation of goods and the demand by locals for overseas products means that the waste problem will continue to mount. With many imported white goods and vehicles, the demand for energy will also increase. Efforts to import low energy demand goods and energy-efficient vehicles, and installations of renewable energy sources, such as solar, will help in managing the energy needs and use for Niue. Sanitation is improving with septic tanks, but many of these tanks need to be replaced or upgraded to reduce any leachate to the environment.

BUILT ENVIRONMENT HIGHLIGHTS

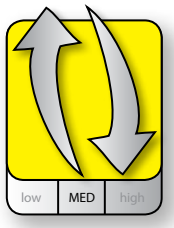
TOPIC	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
ENERGY ACCESS EFFICIENCY SUSTAINABILITY	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Nearly 100% of households have access to reliable energy. Niue's energy is primarily from fossil fuel, with solar energy currently in the exploratory phase. Most of the fuel is used to generate electricity and for the transport sector. LPG was promoted as the energy source for cooking in order to ease pressure off the grid. Unfortunately, challenges with the equipment meant that most households reverted to an electric stove.	A national Energy Roadmap has been developed (Energy Roadmap 2015–2025), complementing the energy plan under the NBSAP 2015. The focus of the plan includes a 10% savings through efficient use and a 90% uptake of LPG by households. A renewable energy target of 80% by 2025 has also been included. Technical capacity remains an impediment to Niue's efforts to achieve its energy targets. Energy efficiency requires the participation of all households in the country to reduce energy wastage.
WASTE MANAGEMENT INCLUDES ALL FORM OF WASTE (SOLID, MEDICAL, QUARANTINE AND HAZARDOUS)	 **Status** Fair **Trend** Mixed **Data confidence** Medium	Domestic and commercial waste are collected weekly and taken to the government run tip. The volume of waste is increasing. Bulky waste remained uncollected in private lands. Only aluminium cans are recycled. Hazardous waste (including asbestos) remain a threat to communities, as these are found on lands of absent owners.	The government continues to prioritise waste, but they are limited by resources and the lack of capacity. The policies are being drafted but resources are needed to implement them. A review of the Integrated Waste Management Strategy and Action Plan is needed. The private sector needs to be at the forefront in managing waste, especially from the tourism sector. Explore increasing recycling capability by investing in proper infrastructure and support existing efforts. Campaigns are needed to promote the reducing, reusing and recycling of waste. Resources and capacity to manage waste should be provided.
SANITATION ACCESS MANAGEMENT	 **Status** Fair **Trend** Mixed **Data confidence** Medium	The majority of the population use septic tanks. There are still incidents of sewage being disposed off directly to caves and to the sea. Many septic tanks need servicing including fixing leaks. Sewage collected in dump truck is disposed in an open area near the airport. Dump truck trips are increasing per annum.	The government is producing locally made septic tanks, which are designed to comply with the Building Code. Furthermore, the government has secured a new sanitation truck with a capacity of 5,000 l. There is an urgent need for safe disposal of sewage collected from homes as the current system poses a risk to the environment and communities. There is a need to develop a solid sanitation strategy and plan to address sewage and other waste issues. The government should continue to work with communities to upgrade the existing sanitation system. It should be an urgent priority to work with those who currently do not have access to septic tanks.

BUILT ENVIRONMMENT ENERGY

INDICATOR DEFINITION

State of energy consumption, accessibility and sustainability

Energy affordability, accessibility and stability remain a serious challenge for many Pacific nations including Niue, primarily because of the reliance on fossil fuel sourced and controlled by international markets. How best to balance energy use by the country and contribute to the global efforts to reduce carbon emissions and mitigate against climate change impacts is a challenging dilemma for small countries like Niue. By addressing accessibility, reliability, efficiency and sustainability challenges, Niue can make inroads towards these global aspirations. Securing alternative energy sources to reduce the reliance on fossil fuel is a major consideration in addressing carbon emissions and climate change for Niue.



Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

SDG

7 AFFORDABLE AND CLEAN ENERGY

Infrastructure Pillar [NNSP 2016–2026]

Energy: Continuous and reliable power supply transitioning to efficient renewable energy sources

The main source of energy comes from fossil fuel. About 75% of the 1.27 million litres of diesel imported in 2014 was used to generate power with the remainder used for transportation. The government distributes the electricity to all registered homes. Most of the households are connected to the main grid, but a few of the households use stand-alone generators and solar (either independent of the grid or in parallel). The electricity is generated from two generators (capacity of 1026 kW), and two more generators are on standby – bringing the total national capacity to 2084 kW. The fuel used for the electricity is subsidised by the Government at NZD 0.63 per KWh. Energy use has been stable since the 1980s, apart from an increase of around 30% from 2004–2007, due to the clean-up and the rebuilding of infrastructure following Cyclone Heta in 2004 (Figure 83). There are no recent figures to show energy use trends at the national level, but there is evidence that the demand for energy is rising, including a four per cent annual growth for the transport sector. On the other hand, the efficiency of fuel to generate power has decreased from 4.29 kWh/litre in 2009 to 3.77 kWh/litre in 2014.

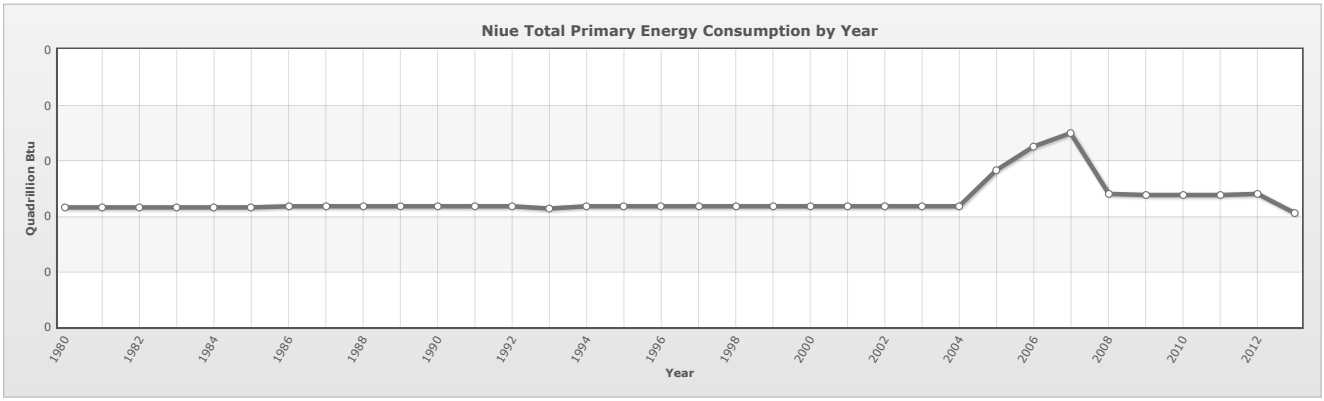


FIGURE 83. Total energy consumption in Niue from 1980–2012. Source: Index Mundi.

TABLE 40. Total consumption (GJ). of LPG per sector: 2010–2014. (GON 2015c).

2010		2011		2012		2013		2014	
	GJ	%	GJ	%	GJ	%	GJ	%	GJ	%
Residential, community and social services	818.2	69	898.1	69	978.1	69	924.1	60	891.3	55
Commercial	365.2	31	400.9	31	436.6	31	626.8	40	737.1	45
Total consumption	1183.4	100	1298.9	100	1414.6	100	1550.8	100	1628.4	100

Part of the government's effort to ease pressure on the national grid was promoting the use of liquefied petroleum gas (LPG). A government initiative saw the introduction of LPG stoves to households and businesses (Table 40) in 2010. Four years after the LPG stoves were introduced, the number of households using the stoves dropped, whereas business use increased from 31% to 45%. The drop in household numbers using LPG stoves was attributed to the high cost of LPG, and faulty stoves with no available parts on the island.

The use of solar as an alternative source to support the national energy need was explored in 2009 under the EU's REP 5 programme, which included the installation of solar panels at the high school, the hospital and the NPC office. At its peak in 2014, the solar panels generated 343 kWp with a battery storage of 150 kWh. Only 80 kWp was connected to the grid due to stability issues. This meant that less than two per cent of the energy came from solar, with the bulk still sourced from fossil fuel.

Figures are not available to show the forced outage rate for Niue, however, those from neighbouring countries reported eight per cent in 2011 and five per cent in 2012. For the system average interruption duration index (SAIDI), the average was 794 minutes in 2011 rising to 5,664 minutes in 2012. Fuel supply security days in 2014 was 28 days based on monthly shipping schedules.

Impacts

Energy remains an important challenge for the government as it looks towards promoting and developing infrastructure and services for the country. The global dilemma and pressure is for all countries to put in place domestic policies and incentives that will contribute to the reduction in carbon emissions, as well as meeting national and global climate change targets. The economic base for Niue is still in the development phase. The challenge, as well as an opportunity, is to find the balance where economic and environmental goals can be achieved. It is inevitable that the demand for energy needs will rise, driven by the increasing investment and possibly a population increase. Government incentives and policies are influencing factors towards meeting the energy needs of the country.

Response and Recommendations

Niue has developed its Energy Roadmap (2015–2025), with the objectives of improving energy security and developing low carbon emission through three goals:

- Renewable energy integration to the national grid;
- Energy efficiency within the electricity and transport sectors;
- Reliable energy supply (GoN 2015).

A number of energy targets have been identified through the Roadmap as well as other government strategies (*viz National Biodiversity Strategic Action Plan 2015*). Targets include:

- 436 (90%) households to use LPG by 2025;
- 50% energy from renewables by 2020, and 80% by 2025;
- Increase fuel supply security days to 60 days (baseline is 28 days in 2014);
- Keep the average forced outage to below the regional average of 5.4% (2012 baseline);
- Keep the SAIDI to less than the regional average goal of 200 minutes per customer;
- Minimising losses at the NPC station at an acceptable level of four per cent by 2020 (baseline loss of 5.19% in 2011 as a benchmark);
- Maintain power generation efficiency above 4 kWh/litre by end of 2017;
- Savings of 10% on residential, commercial and government energy use by 2020;
- One per cent of fuel-efficient vehicles by 2020.

Niue has considered a number of renewable options, including biomass, biogas, wind power, wind turbines, tidal hydro or geothermal sources, and solar (IRENA 2013). Only solar appears to be feasible of the major initiatives. A number of larger projects are in the planning stage or completed. Solar water heating has been used for more than two decades in Niue. Domestic solar water heaters were installed from 2004–2005 under EDF9, resulting in about 290 households benefitting. Plans are in place to install solar water heaters in all Niue houses. There are some challenges identified for renewable energy in Niue, including technical capacity and integrating renewables into the grid without causing instability, but these are being considered under the Energy Roadmap.

Need to consider electric vehicles including appropriate infrastructure for this emerging technology.

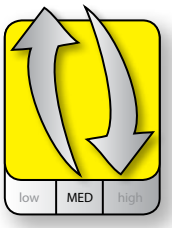
WASTE MANAGEMENT

INDICATOR DEFINITION

Waste has a serious impact on the environment and for many small landmass islands, like Niue, the problem is huge. The porous nature of Niue's soils means that any waste dumped on land will breakdown or leak into the underground water lens. All waste disposed in the open tip can become hazardous to the marine environment, especially during cyclones. Asbestos waste is dangerous to human health, and large bulky waste is an ideal refuge for vermin and other invasive species. This indicator assesses the state of the different types of waste and their management.

A number of regional and international conventions are considered in the management of waste in Niue. These include:

- Waigani Convention
- Pacific Regional Solid Waste Management Strategy
- Pacific Islands Framework for Action on Climate Change 2006–2015
- Stockholm Convention
- Framework for Resilient Development in the Pacific (FRDP)



Status
Fair

Trend
Mixed

Data confidence
Medium

SDG

Environment and Climate Change Pillar [NNSP 2016–2026]

Pollution: Reducing risks and protecting natural resources on land, marine and coastal resources from the impacts of pollution

Waste Management: Residents and visitors manage waste to protect the environment with minimum impact to public health

Status and Key Findings

The disposal of solid waste includes an uncontrolled dumping site near Makato dumpsite. The site is open to the public, and it is also used as a 'tip and burn' operation. There is only one recycling option that has operated on an ongoing basis. There is lack of engineering control in the disposal site, and the leachate can increase the risk of pollution of Niue's underground water.

Niue has three waste sites: Makato is the main site, Mutalau is a site used mainly by nearby residents, and Vaiea is a site that has been used since 2005. The management of Makato dumpsite has improved, however challenges still remain and it is still a breeding ground for flies, rats and other pests. The lack of proper engineering planning to manage issues, such as leachate, threatens the water lens and coastal water. The waste sites are managed by the Department of Environment, and contractors are hired to compact the site in order to make room for more waste.

SOLID WASTE

Waste from domestic and commercial premises are collected on a regular basis. Waste is collected twice a week across the island, in all villages. In a comparative survey done in 2000 and 2010, more waste per capita per day was generated in 2000 compared to 2010 (Table 41). An estimated 244,890 kg/year of household waste was generated in 2000 or an equivalent of 0.36 kg/person/day (Niue AMP Section N 2016). The waste was reduced to 153,100 kg/year or 0.27 kg/person/day according to the Niue AMP Section N 2016 (GoN 2010). Of the household waste categories, organic material and paper were the most common in 2000 (59%), and 37% in 2010. Inorganic waste (metal, diapers, plastic bottles and bags, and glass bottles) made up 28% of wastes in 2000, but increased to 49% in 2010. Williams and Haynes (2014) reported the waste generation rate for Niue at 0.31 kg/person/day for 2010, finding organic waste represented 37%, and inorganic at 54% of the categories.

TABLE 41. Household waste composition in Niue from studies in 2000 and 2010. Waste generation rate in 2000 = 0.36 kg/person/day. Waste generation for 2010 = 0.31 kg/person/day. Population 2000 =1,865. Population in 2010 = 1,549. Source: Niue AMP Section – N, 2016.

Category	2000		2010	
	%	kg/year	%	kg/year
Organics	54.3	133070	27.7	48620
Metals	8.1	19850	13.2	23070
Paper	14.7	36020	9.4	16510
Diapers	6.5	15920	16.3	28490
Plastic – bags	6.9	16910	8	14020
Plastic bottles	4.9	0	8.59	
Textiles	-	0	0.4	680
Others	8	19600	9.3	16280
Glass	1.6	3920	3.1	5430
Total	**105**	**245,290**	**95.99**	**153,100**

RECYCLING

Only aluminium cans are recycled, which is operated by the Catholic Church Mission located in Alofi North. The government collects a deposit of 8.3 cents on each imported can, and 5 cents is refunded when the can is returned to the Catholic Church depot, where the operator is paid a handling fee of 2.5 cents per can, and is allowed to keep the proceeds from the sale of the cans in NZ. The volume of cans being recycled varies, but since 2004, there is a slight increasing trend in the number of cans being recycled (Figure 84 and Figure 85). One of the challenges of the recycling programme is the breakdown of the can crusher with parts having to be sourced from NZ. This can take weeks or months, meaning that cans often end up at the waste disposal site.

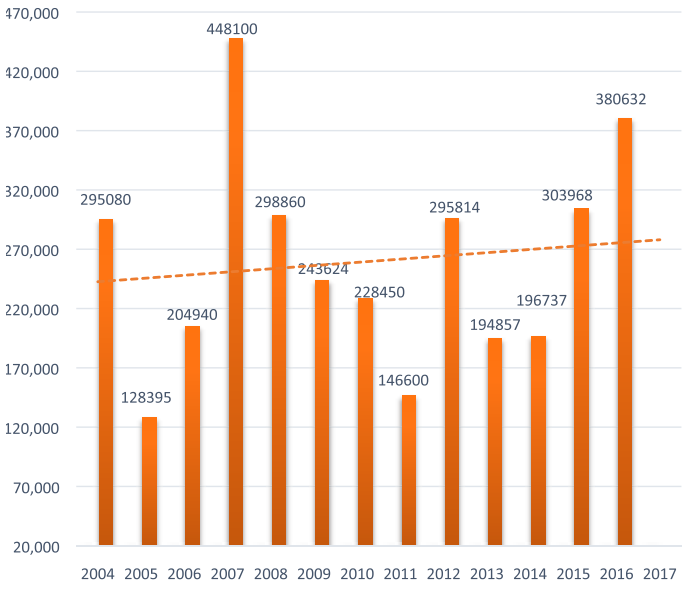


FIGURE 84. Number of cans being recycled from year 2004 to 2016. Source: Catholic Mission – pers. comm. 2017.

FIGURE 85. Aluminium cans are the only item being recycled on the island. Problems with the crusher often results in cans ending up at the Makato waste site

BULKY SOLID WASTE

Bulky solid waste includes derelict vehicles (Figure 86), gas stoves, construction and demolition waste, and others that are large and non-hazardous. There are a number of derelict vehicles throughout the island, particularly at a site in Tuaki-Hakupu. Efforts to remove abandoned vehicles were carried out in a clean-up Niue campaign in 2010. Cyclone Heta also contributed to a high quantity of bulky waste, which resulted in about 50 containers being shipped out of the country with scrap metal.

FIGURE 86. Derelict and abandoned cars are an eyesore and an environmental problem. Photo: P. Anderson.

MEDICAL WASTE

The Niue Foou Hospital was rebuilt in 2006 after the previous hospital was destroyed by Cyclone Heta. The hospital has nine beds and generates waste that includes sharps, chemical waste, pathological waste, dressings and other waste contaminated with bodily fluids. The chemical waste, which includes a developer and fixers for x-rays, are disposed down the drain at the rate of 20 litres per month. The hospital generates approximately 1,560 kg/year of healthcare waste, which is treated in a wood-fired incinerator (ENVIRON 2014). The incinerator can burn up to three bags of medical waste in two hours, using 10 buckets of wood as fuel. The capacity of the incinerator is 150 kg per week, but the actual use is much lower at 30 kg/week. After incineration, the ash is removed to the Makato waste site. Prior to incineration, the waste is stored in wheelie bins and bags in a 20-foot container. An imprest ordering system has been implemented at the hospital. This system specifies a maximum stock level for each item, which significantly reduces the amount of expired and obsolete chemicals generated.

In 2009, the hospital adopted a clinical waste management policy, which contains several recommendations for waste segregation, storage, and training and public awareness.

QUARANTINE WASTE

Quarantine waste from incoming vessels are incinerated. On occasions when the incinerator is not working, the waste is burnt in a hole, using diesel (or kerosene) as an accelerant, and the ash is disposed at the Makato waste site. The incinerator is a basic kettle style burner, with a loading lid at the top and emptying chute at the bottom, with no stack. Much of the ash residue is unburnt and has been left to spill out of the bottom chute and accumulate on the ground. The area where the incinerator is located is open to the public and there is no weather protection for it. According to a review by ENVIRON Australia, the incinerator is not optimal for its purpose (ENVIRON 2014). The volume of waste being treated is small due to limited flights into the country, as well as the number of visiting vessels. There is no documentation of the volume of waste being treated.

HAZARDOUS WASTE

Hazardous waste found in Niue includes asbestos, electrical and electronic waste (e-waste), waste oil, and lead acid batteries.

Asbestos in the form of cement roof sheets was introduced to Niue following cyclones in 1959 and 1960, when many of the homes were destroyed and had to be rebuilt. Over the years, many of these houses were abandoned as owners emigrated. The weather and lack of maintenance meant that most of the houses were not in good condition. The onslaught from Cyclone Heta caused significant damage to many homes, which resulted in a lot of asbestos material being exposed. A project to clean up asbestos in 2004–2005 resulted in asbestos stockpiled in Huihui. An estimated 3,650 m^2 of asbestos from Niue High School was removed and buried. The current estimate is 347 houses still have asbestos roofing materials, and 45–73 container loads of asbestos need to be disposed of (GoN 2010). The 2011 Census recorded only 27 households (out of 477) have asbestos roofing (Table 42). According to Department of Environment staff, more than 20 containers of asbestos have been sent abroad for safe disposal with more being planned (Talagi, pers comm. 2017). The Clean-up Niue Campaign is also trying to address the collection of asbestos waste from communities. Bitumen tanks lined with asbestos still remain on the island following the extension of the airport runway previously.

TABLE 42. Type of roofing material by villages. Source: 2011 Census.

Village	Type of Roofing Material			
	Steel	Asbestos	Both	Total
Alofi South	120	5	3	128
Alofi North	53	1	2	56
Makefu	21	0	1	22
Tuapa	27	2	1	30
Namukulu	5	1	0	6
Hikutavake	14	1	0	15
Toi	8	1	0	9
Mutalau	3	0	1	31
Lakepa	19	1	1	21
Liku	21	0	1	22
Hakupu	36	3	0	39
Vaiea	15	0		15
Avatele	42	1	0	43
Tamakautoga	39	1	0	40
Total	**450**	**17**	**10**	**477**

E-WASTE

E-waste is defined simply as any unwanted device that has an electrical plug or runs on some form of energy. E-waste contain both non-hazardous such as glass, wood, non-ferrous and ferrous metals, and hazardous components, such as lead, mercury, arsenic, cadmium, and flame-retardants. The e-waste problem will increase with an increasingly affluent population, as more people gain access to technology. This is true for Niue as shown in the 2006 and 2011 Census. In the 2006 census, computer, laptops, i-Pods, smart phones, and printers weren't considered, but by 2011, these products made up a significant portion of household items (Table 43).

TABLE 43. Household appliances. Source: 2006 and 2011 Censuses.

Equipment	2006	2011
Electrical jugs/kettles	489	468
Refrigerators	415	448
Toasters	388	373
Microwaves	290	347
Washing Machine	308	438
Air Condition	17	22
Stereos	373	310
Still Camera	76	308
Digital Camera	175	75
PlayStation /Xbox	134	151
BSP/MP3/MP4/Ipod	No data	327
Smart phone	No data	249
Desktop Computer	No data	155
Laptop Computer	No data	337
Printer	No data	153
Radio	No data	371
Television set	519	573
Sky TV	No data	54

Many of these personal and household appliances will eventually become e-waste. Whether the trend per annum is an increase or decrease of these appliances, it is very concerning how they are being disposed of. Some e-waste, such as computers, televisions and office equipment, are currently stockpiled at Huihui. However, others, such as refrigerators and stoves, are usually taken to the Makato waste site or dumped illegally, despite the fact that residents can contact the Department of Environment to have the waste collected. There is a small reuse sector in Niue, which includes Vili Franchise Limited that dismantles and reuses some e-waste parts from refrigerators, stoves and washing machines. The company also stores the waste oil generated from these activities.

Waste oil is produced mainly from the Niue Power Corporation (NPC), the Public Works Department, and to a lesser extent from private garages and the community. A central site for waste collection was established at Amanau, but this was destroyed by Cyclone Heta in 2004. In March 2010, the waste oil stockpile at NPC was estimated at 12,000 litres. This oil was stored in metal drums, which had deteriorated and leaked into the ground. In recent times, 10 industrial bulk containers (IBC) with 1000 litre capacity each were purchased to provide more secure storage of the waste oil at Amanau. The Public Works Department also plans to purchase IBCs to be placed at the Public Works compound for waste oil. Other tanks are also expected to be placed at suitable locations for waste oil from the private sector and communities. The location of the Niue Power Corporation on the upper terrace of Niue, and any direct disposal of waste oil to the ground, increases the risk of pollution of the water lens.

The main source of waste lead acid batteries is from motor vehicles registered in Niue. These batteries are collected by the Department of Environment on an as-needed basis and stockpiled at Huihui, with the intention of shipping them off the island for disposal. As of March 2010, there are about 300 batteries at Huihui. Dry cell batteries are also generated and are thrown out with the household waste.

PERSISTENT ORGANIC POLLUTANTS (POPS)

POPs are toxic chemicals that can accumulate in the fatty tissues of humans and animals causing cancer and birth defects and compromising the immune system. Many people do not realise that the open burning of household rubbish, including green waste, causes the release of POPs into the atmosphere (GoN. 2005; SPREP 2015). A POP inventory was completed in 2003 where contaminated sites were identified, including six locations of buried pesticides. The inventory found 12.5 mt of PCB liquid and 60 mt of pesticides. No PCB contaminated oil was found. A list of pesticides and their quantity was documented for safe disposal abroad (SPREP 2003). A POPs National Implementation Plan was developed in 2005, where public awareness was one of the key components (Figure 87). A total of 3,971 kilograms of chemicals and chemical containers were removed from Niue and transported overseas for proper disposal. There are still some chemicals in Niue, which could not be collected, including acids, copper fungicide, lime sulphur spray, laboratory chemicals, and methyl bromide (Anon. 2011). Testing of local food sources for POPs found no definite levels in any of the samples (GoN 2005). A comprehensive strategy for preventing the generation of POPs is already detailed in the Niue NIP, and it addresses cross-cutting issues, such as waste incineration (quarantine, medical and solid waste), and public awareness on better solid waste disposal. As of 2019, steps have been made to update the NIP to reflect certain circumstances.

FIGURE 87. A billboard poster on persistent organic pollutants, as part of a public awareness campaign.

Impacts

The challenge posed by waste will continue and practical measures need to be put in place to ensure that the water sources and land are safe for use by communities. Niue generates a diverse array of waste, which pose a significant threat to the people and the environment. The business as usual approach of leaving rubbish to rot does not apply to much of the hazardous waste, such as asbestos, where every year claddings from dilapidated houses disintegrate, releasing asbestos particles and fibres into the environment.

Response and Recommendations

Waste is a growing problem for Niue as the population imports more goods into the country. Managing of the waste relies on two legislative frameworks: the Environment Act 2015; and the Public Health Ordinance Act 1982. The challenge with waste is the scope of waste categories, the perception about certain types of waste, the lack of available treatment options and the varying level of governance relating to the different wastes.

In 2000, the Cabinet endorsed the Niue Waste Management Plan (WMP). The plan contained over 80 recommendations for improving waste management. There has been limited implementation of the WMP due to a shortage of resources, particularly financial and human capacity, to coordinate and implement activities.

The National Integrated Waste Management Strategy 2010–2015 superseded the 2000 plan, with a broad scope of managing solid, liquid, hazardous, medical and quarantine waste. Nine thematic areas were developed, including coordination, legislation, data collection and analysis, education and awareness, waste reduction, reuse and recycle, waste collection, waste disposal, and environmental monitoring. A review of the 2010–2015 strategy has not been conducted. The strategic thematic areas, including the targets and actions, remain current and valid. National coordination is very important with waste management and while this is clear, as captured in Table 44, the lack of a lead and dedicated coordinator within each of the departments mean that waste is prioritised according to the pressing issue of the day. The Department of Environment needs to take the lead in the coordination and delivery of waste management outputs in partnership with other agencies, private sector and NGOs including Village Councils. Establishing a national waste management committee or taskforce will help elevate the issue on par with the water steering committee.

Niue is a party to the Waigani Convention, which bans the importation of hazardous and radioactive wastes, as well as controlling the trans-boundary movement and management of hazardous wastes within the South Pacific region. The Convention enables countries, such as New Zealand and Australia, to receive hazardous wastes exported from Pacific Countries, like Niue. The Waigani Convention is implemented under the Department of Environment and is the instrument that enables the safe removal and disposal of Persistent Organic Pollutants (POPs) and other hazardous wastes from Niue.

The Pacific Regional Solid Waste Management Strategy 2010–2015 (RS2010), is the region's guiding document for solid waste management. The implementation of this regional strategy is coordinated by SPREP, and it prescribes actions for SPREP as well as SPREP member countries and territories. In particular it addresses nine priority areas: Sustainable financing; Integrated solid waste management; Legislation; Awareness, Communication and education; Capacity building; Environmental monitoring; Policy, planning and performance; Solid waste industry; and Medical waste.

Niue needs to consider becoming a Party to other MEAs in regards to Waste Management.

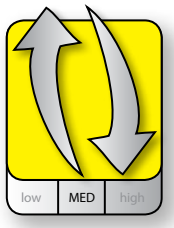
TABLE 44. Institutional arrangement for waste management in Niue.

Area of responsibility	Responsible Department				
	Solid	**Liquid (incl. sludge)**	**Quarantine**	**Hazardous**	**Medical**
Regulation and policy development	Environment	Environment	Dept. Agriculture, Forestry and Fisheries	Environment/DAFF	Health
Monitoring and enforcement	Environment	Environment	DAFF	Environment	Environment
Operation (collection and disposal)	Environment (collection contracted to Private)	Environment	DAFF	Environment	Niue Foou Hospital
Recycling	Environment (in partnership with Niue Catholic Mission)				

SANITATION

INDICATOR DEFINITION

Sewage is a major challenge from a human health perspective. Proper disposal of sewage to avoid environmental incidents is a high priority for the government. The lack of proper sewage disposal allows contamination of Niue's water sources, as well as coastal waters, where seafood is harvested. The cost to rectify contamination can be expensive, especially for the health and wellbeing of the community. This indicator focuses on assessing household sanitation, specifically looking at toilet types and septic tanks.



Status
Fair

Trend
Mixed

Data confidence
Medium

Status and Key Findings

SDG	CBD
6 CLEAN WATER AND SANITATION	8

Infrastructure Pillar [NNSP 2016–2026]

Water: Access to 24 hour water supply and safe potable drinking water, Water quality monitoring results

Environment and Climate Change Pillar [NNSP 2016–2026]

Pollution: Reducing risks and protecting natural resources on land, marine and coastal resources from the impacts of pollution

Environment and Climate Change Pillar [NNSP 2016–2026]

Waste Management: Residents and visitors manage waste to protect the environment with minimum impact to public health

Social Services Pillar [NNSP 2016–2026]

Health: Healthy lifestyle choices with well supported health services, and food and nutrition security that is sufficient, safe affordable and accessible

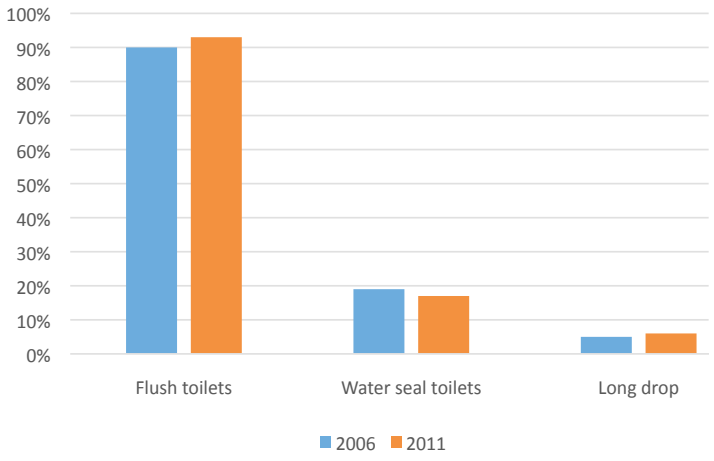


FIGURE 88. Percentage of toilet types from 2006 to 2011.
Source: 2006 and 2011 Censuses.

The sewerage system in Niue is not reticulated. There are several types of systems used; septic tank systems (sealed and unsealed tanks) and water seal latrines. Sealed septic tanks are those that are fully concreted and these are considered the best options. Water seal latrines and unsealed septic tanks are those that have concrete on the sides only and release raw sewage directly into the ground. There are also anecdotes of raw sewage being piped directly from flush toilets into caverns and crevices (Talagi, as per comm). The toilet situation continues to improve, especially with regards to flushed toilets (see Figure 88; Table 45).

TABLE 45. Sewage disposal system available in country. Source: 2011 Census.

Toilets and Sewage	Long-drop	Water-seal	Flush	Natural-hole	Bottomless	Complete
Number	26	82	443	50	77	372
Distribution	5.5%	17.2%	92.9%	10.5%	16.1%	78.0%

The occurrence of long-drop toilets is a concern, but these toilets are kept for use in emergencies when there is no power or water. Another concern is the state of many of the septic tanks, with only 78% fully enclosed concrete tanks, 15% non-concrete tanks and seven per cent in long drops. There is a general lack of awareness on the maintenance of septic tank systems. The septic tank is only emptied when it becomes a problem. The Department of Environment has a 5,000 litre sludge pump truck that can be hired to empty household septic tanks at a charge of $75 per load for households with different rates for businesses, government departments and emergencies.

Infiltration of wastewater into the groundwater lens has yet to occur, as the water supply wells are located in the interior of the island, while most of the population is concentrated along the coast. In 2013, Niue manufactured 5,000 litre high density polyethylene (HDPE) rainwater tanks using a local tank moulding facility. This facility will also manufacture septic tanks to help prevent untreated wastewater flowing into the environment through inadequate septic tank systems. This pilot project for septic tanks funded by GIZ under the ACSE Project is an attempt by the Government of Niue to reduce risks to the underground water lens and coastal marine ecosystems.

Impacts

The catastrophic results from drinking water contaminated by the lack of a good sanitation programme in the country can be fatal. This is the reason why the government recognises seepage from sewage and wastewater as a high priority in its draft Water Safety Plan.

Response and Recommendations

Any sewage leak from household septic tanks is of concern to public health, as it has the potential to contaminate the ground water lens. The increase in the population will also increase the risk of the groundwater being affected by sewage, especially given that many septic tanks need to be upgraded or replaced. The responsibility of monitoring the quality of water, as well as the septic tanks, lies with the Department of Health, and resources can be a challenge. Septic tanks are currently being manufactured in Niue and the government is encouraging households to replace existing sewage tanks with this new model (Figure 89).

Another serious risk from unmanaged sanitation is the threat to marine coastal ecosystems, including potential outbreaks of ciguatera fish poisoning. The last outbreak was in the early 2000s, where the research found increased nitrates and phosphates at the sites where the ciguatoxin was abundant. The nitrates and phosphates were caused by inadequate wastewater treatment, primarily from septic tanks draining into the groundwater regime. The research highlighted the vulnerability of Niue's water resources to any land surface activities and the close link between land and catchments activities and coastal zone impacts.

Niue needs to urgently facilitate and implement a sewage treatment facility and to phase out open dumping of sewage which is a high risk to health and Niue's water lens.

Niue also needs to finalize and implement the updated Niue Building Code which has the standards for new septic systems.

FIGURE 89. The new septic tank models being built locally to replace aging and tired septic systems. Photo: P. Skelton.

PART 4

SUMMARY AND RECOMMENDATIONS

© Niue Tourism

Niue is not immune from many global and regional drivers that affect its environment. Climate change impacts and cultural and societal shifts towards embracing a global community are some of the drivers. The pace of many of these drivers and issues is frighteningly fast, and their impacts are much deeper than first imagined. Subsistence harvesting is no longer a motivating factor, giving way to economic ventures. Pelagic species are targeted for factories and wholesale supply on the international markets. The purpose of agriculture and farming is primarily to ensure export quotas are met. These forces put pressure on the environment, including using more land for farming, and importation of goods and fuel to satisfy the local demands. As a result, biodiversity is threatened due to the loss of habitats, the degradation of land areas due to accumulated waste, the disruption to ecosystems, and the overharvesting of key species. An even bigger challenge is the loss of the connection between people and their environment.

This report attempts to capture the impacts of many of these pressures and drivers and evaluate the state and trends as Niue looks forward to moving in a progressive but sustainable manner. Figure 90 shows the percentage of indicators with a good, fair and poor status, as evaluated in this report.

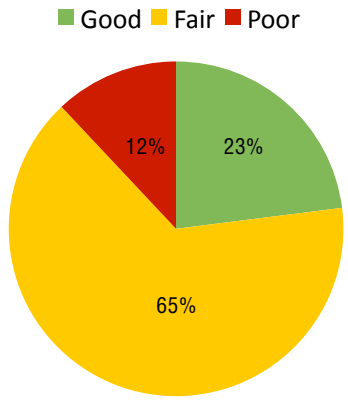


FIGURE 90. Percentage of indicators that are Good, Fair and Poor

There are some serious gaps in the report primarily due to a lack of data and proper documentation in most of the areas that were assessed. There are also many positives to be found in how Niue is addressing environmental concerns, such as the recovery of bird and bat populations following Cyclone Heta in 2004. Some of these positives are unplanned, for example, increasing forest cover primarily due to the conversion of many agricultural lands back to secondary forests, due to outmigration, whereas others are due to government interventions and support from the village council and communities.

The atmosphere and climate change theme shows a strong national commitment to addressing ODS and GHG issues. Phasing out ODS has been an ongoing success for the government, which included putting in place legislation and working with the private sector to prevent further importation of banned substances. Climate change is a global challenge and Niue continues to forge alliance and partnerships with many countries and organisations in order to understand and contribute to addressing this global issue. Mainstreaming climate change into the government sectors has resulted in sector-specific climate change plans. These sector plans need synergising to provide a holistic national approach and reporting on climate change adaptation and mitigation actions. On par with developing these strategic plans is the need to keep abreast of global knowledge through building sufficient technical capacity and strengthening partnerships with global and regional organisations.

Water is life, and in Niue no truer statement can be said. The underground water lens provides the main source of water for all Niuean residents. The water lens is vulnerable due to the porous nature of the soil, which allows any liquid to filter through. The use of chemicals, or poorly constructed and maintained septic tanks, is a serious threat to the water. Faecal contamination has been detected at some of the sites being monitored, thus it is of concern to the wellbeing of the country. A drinking water safety planning framework has been developed to address problems, including contamination, which needs to be adopted and implemented. A national framework exists that allows for the inspection of households by the Department of Utilities and the Department of Health, but this is often under resourced. The household inspections allow for early detection of infrastructure vulnerabilities and failures, which is cost-effective in the end. Securing an alternative water source is a priority for the government in view of possible interruptions to the water network from the impacts of climate change and other events. Harvesting rain water using concrete tanks was introduced a few decades ago, and many of these tanks are now out of commission. New improved HDPE water tanks are now manufactured on the island, and incentives to encourage households to install these tanks are continuing as an adaptation intervention, therefore increasing water security resilience to climate change.

The population decline over the past several decades means many of the abandoned agricultural lands are being converted into thriving forests. Fast growing trees, including many invasive species, remain a threat to these forests. Primary forests are protected in discreet conservation areas or on private properties. These forests are in good condition, supporting native wildlife. There is a need to plant native trees in secondary forest areas to discourage invasive trees from thriving. Niue has put in place a Niue Land Cover Database that monitors the temporal sequence of land cover state and change. This resource becomes valuable in detecting changes, especially given the increasing interest by overseas Niueans returning home to run small businesses. This may also see more agricultural farming plots being restarted and land areas being cleared for settlement. It is critical that proper planning and the application of government policies, including building codes, environmental legislation and environmental impact assessments, be a key part of these developments.

The state of the marine environment is constantly changing as it adapts to global and local impacts. Climate change and warming of the ocean will lead to bleaching of corals, and adverse effects on many other marine species, with negative consequences to human life and infrastructure. Catastrophic cyclones can cause severe damage to marine life, either due to debris from land washing into the sea, or the force of the wind and waves to uplift coral reefs and move them inshore. Monitoring the benthic community, live coral cover and other biological parameters allow the assessment of the change that is taking place in the marine environment. Niue's benthic community is still recovering after Cyclone Heta in 2004. Marine plants that provide food and habitat for many marine animals dominate the recovery of the coral reefs. Live coral cover varies from sites with the leeward side having a much higher cover than the windward side. Fish biomass is greater at Beveridge Reef, primarily due to the large numbers of Grey-reef sharks, which has the highest density in the world. The presence of whales during the migratory season continues to increase, which is also supporting a whale tourism industry for the island. The fisheries sector remains in good condition, and there is low commercial exploitation of tuna and pelagic species within the country's EEZ. However, serious challenges with accurate monitoring of fishing activities need to be rectified. Marine conservation areas exist but are not well documented or demarcated. In order for Niue to meet its commitment to the Aichi Biodiversity Target 11 – it will need to declare more areas under protection and develop good management plans for these areas. The positive move by the government to designate around 40% of its EEZ for conservation purposes, will help meet its commitment to the CBD.

Terrestrial biodiversity is vulnerable from human activities, cyclones and drought. The impact from cyclones is severe and usually short-term, but the consequences can be ongoing. The loss of habitat, nesting areas and food following a cyclone can mean species will starve or become easy targets for hunters. However, if measures such as banning the hunting of vulnerable species are enforced immediately after cyclones, the recovery of affected species can be fast. This was demonstrated for bats and birds when a moratorium was put in place after Cyclone Heta in 2004 and saw a rapid recovery within a couple of years at some of the sites. Flowering of fruit trees have been observed to have changed over the past few years and will affect food sources for birds. The state and trends for many reptiles are stable, with the key threats coming from cats and loss of habitats. Invasive species are a serious challenge for Niue. The invasive Tonga Vine (*Epipremnum pinnatum*) is a serious killer of native trees where it overtops the trees and prevents them from getting the sunlight. Feral cats, pigs and rats are other serious invasive species that have been prioritised for control. Niue has established a national invasive species team and has started the management of invasive weeds from the Huvalu Forest Conservation Area. An eight-year National Invasive Species Strategic Action Plan has been adopted to help guide the activities and priorities of the country.

It is worth remembering that the largest driver of cultural change in Niue is population mobility, which exposes a significant majority of Niueans to modern lifestyles, where English is the main language, and diets, customs, and natural and built environments differ. This mobility is creating serious concerns about the retention of the culture and traditions that Niueans value. The strengthening of local institutions and government agencies and prioritising what is important to Niueans can help to address this challenge. Documenting traditional knowledge, including sites of community and national significance will help retain the connection of the people to the land. By encouraging village show days, and by including cultural songs, stories and language in the school curriculum, Niue will be on the right track to retain what is important to them.

The low population base and the geographic distribution of households, means that services (water, sanitation, energy) are able to cope with demand expected in a built environment. As the nation continues to push for economic development, especially in the tourism industry, these infrastructure services will need to keep pace with the demand. Energy is expensive in Niue, as fuel is imported for the electricity grid, for the transport sector, and for domestic use. A blueprint for the energy sector has been developed to help address the issues of efficiency, accessibility and sustainability. Generating energy through solar panels continue to be a target for the government, as a way to reduce its reliance on imported fuel. Another initiative by the government is to encourage the public to purchase energy efficient appliances. This includes high star-rating white goods, energy efficient light bulbs and fuel efficient vehicles.

Waste is a growing problem for Niue due to high importation of goods and the limited landmass for managing the waste. The diversity of waste makes it hard to manage in a single site, due to the toxic nature of some of the wastes. Any site that stores waste in an open environment is a risk to the underground water lens. The government recognises waste as a priority issue, but it needs the engagement of the public so that proper actions can be undertaken for the different waste streams. Sanitation in Niue needs to be urgently addressed due to its threat to public health and to the environment. The underground water lens is susceptible to human activities, and any leaks from septic tanks will affect the water.

The Inform project

Knowledge and understanding are important for driving and bringing about informed decision making. The project, *Building National and Regional Capacity to Implement Multilateral Environmental Agreements by Strengthening Planning and the State of Environmental Assessment and Reporting in the Pacific*, referred to as the Inform project, recognises the need for this data-driven decision making. The project will establish a Pacific island network of national and regional data repositories and reporting tools to support the monitoring, evaluation, and analysis of environmental information, which supports environmental planning, forecasting, and reporting requirements.

Over a four-year period from 2017–2021, Inform will work in the Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Republic of the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. The Global Environment Facility contributes 4.3 million USD to the Inform project, which is implemented by UN Environment and executed by the Secretariat of the Pacific Regional Environment Programme (SPREP).

The Inform project has created a Niue Environmental Data Portal to be tested and adapted for Niue. The portal can be accessed online via the following link: https://niue-data.sprep.org/

In the future, this portal could be a resource for uploading, storing and sharing data in a central place, thus facilitating the process for compiling and analysing data when writing future SOE Reports, NEMS and other policies.

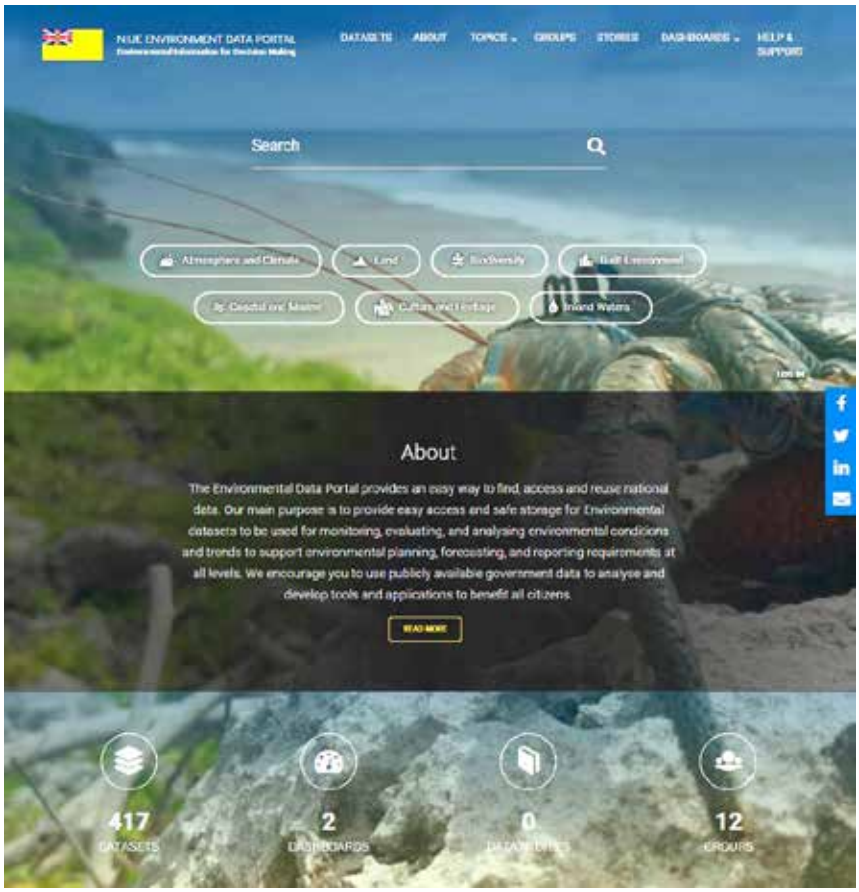


FIGURE 91. Visual of the online Niue Environmental Data Portal

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ANNEX 1 • BIRDS OF NIUE

Common Name	Scientific Name	Status (IUCN Red List category)
Pacific Black Duck	*Anas superciliosa*	Rare/Accidental – LC
Red Junglefowl	*Gallus gallus*	Introduced – LC
Southern Giant Petrel	*Macronectes giganteus*	Rare, Vagrant Seabird -LC
Wedge-tailed Shearwater	*Ardenna pacifica*	Rare/Resident Breeding Seabird – LC
Sooty Shearwater	*Ardenna grisea*	Rare/Accidental. Not recorded by Watling 2001 – NT
White-tailed Tropicbird	*Phaethon lepturus*	Resident Breeding Bird – LC
Great Frigatebird	*Fregata minor*	Rare, Vagrant Seabird – LC
White-faced Heron	*Egretta novaehollandiae*	Vagrant Landbird – LC
Pacific Reef Heron	*Egretta sacra*	Vagrant Landbird – LC
Buff-banded Rail	*Gallirallus philippensis*	Breeding Landbird – LC
Spotless Crake	*Zapornia tabuensis*	Breeding Landbird – LC
Black-backed Swamphen	*Porphyrio indicus*	Breeding Landbird. Recorded as *Porphyrio porphyrio* by Steadman, although correct identification is *Porphyrio melanotus* – LC
Pacific Golden Plover	*Pluvialis fulva*	Migrant Shorebird – LC
Bristle-thighed Curlew	*Numenius tahitiensis*	Vagrant Shorebird, – VU
Eurasian Curlew	*Numenius arquata*	Vagrant Shorebird – NT
Bar-tailed Godwit	*Limosa lapponica*	Vagrant Shorebird – NT
Ruddy Turnstone	*Arenaria interpres*	Migrant Shorebird – LC
Sanderling	*Calidris alba*	Migrant Shorebird – LC
Pectoral Sandpiper	*Calidris melanotos*	Vagrant Shorebird – LC
Wandering Tattler	*Tringa incana*	Migrant Shorebird – LC
Kelp Gull	*Larus dominicanus*	Vagrant Seabird – LC
Brown Noddy	*Anous stolidus*	Breeding Seabird – LC
White Tern	*Gygis alba*	Breeding Seabird – LC
Many-coloured Fruit Dove	*Ptilinopus perousii*	Not recorded by Watling and this may be an error. Recorded in Aviabase Bird Checklist of the World – Niue: 2018 – LC
Crimson-crowned Fruit Dove	*Ptilinopus porphyraceus*	Breeding Landbird – LC
Pacific Imperial Pigeon	*Ducula pacifica*	Breeding Landbird – LC
Long-tailed Koel	*Urodynamis taitensis*	Migrant Landbird – LC
Barn Owl	*Tyto alba*	Breeding Landbird – LC
White-rumped Swiftlet	*Aerodramus spodiopygius*	Breeding Landbird – LC
Blue-crowned Lorikeet	*Vini australis*	Breeding Landbird – LC (decreasing)
Polynesian Triller	*Lalage maculosa whitmeei*	Breeding Landbird – LC
Polynesian Starling	*Aplonis tabuensis brunnescens*	Breeding Landbird – LC
Niue Night Heron	*Nycticorax kalavikai*	EW
Niuafo'ou Megapode	*Megapodius pritchardii*	EN – but locally extinct from Niue
Niue Rail	*Galliralus huiatua*	EW

Sources: http://aviabase.bsc-eoc.org; Steadman *et al.* 2000; Watling, 2001

ANNEX 2 • ENDEMIC SPECIES OF NIUE

Common Name	Scientific Name	Status and Notes
Polynesia Triller	*Lalage maculosa whitmeei*	Endemic
Polynesia Starling	*Aplonis tabuensis brunnescens*	Endemic
Purple capped fruit dove	*Ptilinopus porphyraceus whitmeei*	Endemic
Combtooth Blenny	*Ecsenius niue*	Endemic. Found on Beveridge Reef, Alofi Wharf.
Niuean flat-tailed sea snake	*Laticauda schistorhynchus*	Endemic. Restricted range and is considered vulnerable under the IUCN Red List. Reproduce on land and therefore is vulnerable from habitat degradation, coastal development and extreme weather events such as cyclones and sea level rise.
Niuean Blue Butterfly	*Nacaduba niueensis*	Endemic
Niuean Rattlebox Moth	*Utetheisa maddisoni*	Endemic
Niuean Clodia Leaf hopper	*Empoasca clodia*	Endemic
Niuean Leaf Hopper	*Empoasca niuensis*	Endemic
	Macrovanua angusta	Endemic
	Rhinolaemus niueensis	Endemic
	Elytrurus niuei	Endemic
	Paracoccus niuensis	Endemic
	Vatusila niueana	Endemic
	Orcovita gracilipes	Endemic
	Pugiodactylus agartthus	Endemic
	Dantya ferox	Endemic
	Cenchritis (or Tectarius) niuensis	Endemic
Niuean Screwpine Pandanus	*Pandanus niueensis*	Endemic
	Psychotria insularum	Endemic

Sources: Eyles ***et al.*** *1974; Living National Treasures* (http://www.intreasures.com)

ANNEX 3 • PRIORITY INVASIVE SPECIES

Species	Status	Management
Mammals		
Feral pig *Sus scrofa*	Widespread and a threat to native forests and agricultural plantations	At planning stage
Ship rat *Rattus rattus*	Widespread – all habitats – higher numbers in forest than Polynesian rats	Control if areas of high priority for the conservation of rare fauna impacted by rats are identified
Polynesian rat *Rattus exulans*	Widespread – all habitats	Control if areas of high priority for the conservation of rare fauna impacted by rats are identified
Feral cat *Felis catus*	Widespread and numerous, including being commonly seen in forest habitats away from villages	Raise public awareness to reduce source of feral animals from family cats
Plants		
Singapore daisy *Sphagneticola (Wedelia) trilobata*	Located at a small number of sites and subject to periodic past eradication efforts	Review progress to date and survey to identify remaining populations. If eradication is considered achievable, establish a programme to complete this.
Chain of hearts *Antigonon leptopus*	Located at a small number of sites and subject to periodic past eradication efforts.	Review progress to date and if, as likely, eradication is considered achievable, establish a programme to complete this.
Honolulu rose *Clerodendrum chinense*	Located at a significant number of sites (most villages) and subject to periodic past control efforts.	Review past control programmes and current distribution. Then consider further control efforts to prevent spread to key habitats.
Giant sensitive plant *Mimosa diplotricha* =invisa	Located at a small number of sites and subject to periodic past eradication efforts.	Review progress to date and if, as likely, eradication is considered achievable, establish a programme to complete this.
Epipremnum pinnatum (=Scindapsus aureus)	Increased in distribution since Cyclone Heta (2004) and now potentially a more significant threat to forest areas.	Survey current distribution and trial new control methods. Determine whether eradication or control to keep important habitats free of the plant is the appropriate action.
Bronzed-leaved Clerodendrum *Clerodendrum quadriloculare*	Recently arrived ornamental found at two sites.	Complete current eradication programme.
Mile-a-Minute (fue saina) *Mikania micrantha*	A widespread weed of agricultural plantations that requires significant management by farmers	Liaise with regional programmes developing biological control for this species.
Merremia (fue vao) *Merremia peltata*	A widespread vine, considered to be a native species, which can smother large areas of forest.	Liaise with regional programmes developing biological control for this species.
Hawaiian wood rose *Merremia tuberosa*	An introduced vine recorded at a few sites and considered particularly aggressive on Niue.	Survey to identify its distribution before determining and carrying out appropriate management.
Invertebrates		
Yellow crazy ant *Anoplolepis gracilipes*	An African/Asian species that is currently spreading in Niue and a threat to invertebrates including crabs.	Survey to identify current distribution and investigate control options to prevent spread to key forest areas.
Fruit flies *Bactocera passiflorae, B. kiriki, B. xanthodes*	There are fruit fly species present here in Niue.	Continue to monitor population and distribution here in Niue and investigate control methods for future management.
Yellow fever mosquito *Aedes aegypti*	An African species that is widespread in the Pacific and carrier of dengue fever.	Continue with and enhance current programme to restrict numbers under Mosquito Control Act.

States funded by the European Union
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