

# Cook Islands Ridge to Reef Island Diagnostic Analysis Technical Report















#### Cook Islands Ridge to Reef Island Diagnostic Analysis Technical Report

Prepared by Pacific R2R Regional Programme Coordination Unit



Suva, Fiji, 2021

#### © Pacific Community (SPC) 2021

All rights for commercial/for profit reproduction or translation, in any form, reserved. SPC authorises the partial reproduction or translation of this material for scientific, educational or research purposes, provided that SPC and the source document are properly acknowledged. Permission to reproduce the document and/or translate in whole, in any form, whether for commercial/for profit or non-profit purposes, must be requested in writing. Original SPC artwork may not be altered or separately published without permission.

Original text: English

Prepared by Pacific R2R Regional Programme Coordination Unit

Edited by: Seema Deo (Footprints in the Sand Consulting)

Layout and Design by Navneet Lal/Pacific Community (SPC)

Prepared for publication at SPC's Suva Regional Office, Private Mail Bag, Suva, Fiji, 2021 www.spc.int | spc@spc.int

Printed by Quality Print, Suva, Fiji, 2021

# CONTENTS

Abbreviations	. vi
List of Tables	vii
List of Figures	viii
Executive Summary	1
1. Introduction	2
2. Methodology	3
2.1 Background	3
2.2 Cook Islands Methodology	3
2.2.1 Identifying and prioritising environmental problems:	3
2.2.2 Island Environmental Problem Prioritisation Criteria:	3
2.2.3 Determining environmental and socioeconomic impacts:	3
2.2.4 Developing causal chains:	4
2.2.5 Report back and discussion:	4
3. Description of Cook Islands	5
3.1 Physical and Geographical Characteristics	5
3.1.1 Geology	6
3.1.2 Soils and Topography	6
3.1.3 Vegetation	6
3.1.4 Climate	6
3.1.5 Natural disasters	8
3.1.6 Sources of Potable Water	8
3.2 Socioeconomic Situation	9
3.2.1 Demographic data	9
3.2.2 Migration processes	10
3.2.3 State of Economy	10
3.2.4 Agriculture	11
3.2.5 Livestock	12
3.2.6 Social development and living conditions	12
3.2.7 Health and Hygiene	12
3.3 Ecological Status	13
3.3.1 Assessment of legislation/policy that defines National Protected areas	13
3.3.2 Identification of hotspots – the characteristics that are used to assess a hotspot.	13
3.3.3 Species of note	14
3.3.4 Major threats and concerns	15
3.3.5 Review of Rapid Coastal Assessment	15

4. Ridge to Reef Management in Cook Islands	
4.1 Resources	16
4.1.1 Freshwater	
4.1.2 Coastal	
4.1.3 Solid Waste	
4.1.4 Liquid Waste	
4.1.5 Land rehabilitation	
4.1.6 Forest	
4.1.7 Minerals	
4.2 Nature Reserves and Protected Areas	21
4.2.1 The Cook Islands	21
4.2.1.1 Suwarrow Atoll National Park	22
4.2.1.2 Marae Moana	23
4.2.1.3 Manaue and Takutea Wildlife Sanctuary	24
4.2.1.4 Aitutaki Island Reserve	25
4.2.1.5 Manihiki Island Reserve	
4.2.1.6 Mitiaro Island Reserve	27
4.2.1.7 Nassau and Pukapuka Island Reserve	
4.3 Island Vulnerability	
4.3.1 Types of disasters	29
4.3.2 Issues and concerns	
4.3.3 Measures to manage impacts	
5. Institutional, Legal and Policy Factors	
5.1 Institutional Setting	
5.1.1 Sector-based Laws	
5.1.1.1 Environment	
5.1.1.2 Water	
5.1.1.3 Coast	
5.1.1.4 Land	
5.1.1.5 Forest	
5.1.1.6 Agriculture	
5.1.1.7 Minerals	
5.1.1.8 Disaster and Climate Change	
5.2 Linkages between policies	
5.3 Multilateral Environmental Agreements	
5.4 Constraints and Limitations	
5.5 Public and Stakeholder Participation	
7. Results: National Priority Issues	
7.1 Key Problems, Sectors, and Immediate Causes	
8. Options for Reform and Action	

9. Recommendations5	53
9.1 Key Sectors Contributing to the Problem	58
9.2 Linkage to other environmental problems	58
9.3 Geographical location of impacts	58
9.4 Ridge-to-reef continuum	58
9.5 Relevant institutional legal factors	59
References6	50
Annex6	53
Annex 1: Guiding material for the IDA workshop	63
Annex 2: Globally threatened species that occur in the Cook Islands	66
Annex 3 Summary of Data on Existing Protected Areas in the Cook Islands	68
Annex 4 Multilateral Environmental Agreements signed by the Cook Islands	69

## **ABBREVIATIONS**

ADB	Asian Development Bank
CEDAW	Convention on the Elimination of all forms of Discrimination Against Women
CIMP	Cook Islands Marine Park
CSO	Civil Society Organisation
DIN	Dissolved Inorganic Nitrogen
DRM	Disaster Risk Management
DSM	Deep sea minerals
EEZ	Exclusive Economic Zone
ENSO	El Niño Southern Oscillation
ETA	Electronic Travel Authority
FAO	Food and Agriculture Organization
FRA	Forest Resource Assessment
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIWA	Global International Waters Assessment
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
IDA	Island Diagnostic Analysis
IDP	Island Development Plan
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
MEA	Multilateral Environmental Agreement
MEC	Muri Environment Care
MMR	Ministry of Marine Resources
NBSAP	National Biodiversity Strategy and Action Plan
NCD	Non-communicable disease
NES	National Environment Service
NESAF	National Environment Strategic Action Framework
NGO	Non-governmental organisation
NIWA	National Institute of Water and Atmospheric Research
OPM	Office of the Prime Minister
R2R	Ridge to Reef
REE	Rare-earth elements
SAP	Strategic Action Plan
SBM	Seabed Minerals
SEAFRAME	Sea Level Fine Resolution Acoustic Measuring Equipment
SIDS	Small Island Developing States
SOPAC	South Pacific Applied Geoscience Commission
SPC	Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
UN	The United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
V&A	Vulnerability & Adaptation
WASH	Water Sanitation and Hygiene
WATSAN	Water, Waste & Sanitation
WHO	World Health Organisation

# LIST OF TABLES

Table 1:	Census information on Cook Islands (2019)9
Table 2:	Showing the various environmental legislations with formal status
Table 3:	Status of species in the IUCN Red List in the Cook Islands14
Table 4:	Highlights on the R2R related efforts in the forest sector
Table 5:	Protected areas in the Cook Islands21
Table 6:	Average damage cost per cyclone stands at about \$4.5 million which is about 2% of the countries GDP. (COP23 Fiji: UN Climate Change Conference 2017)
Table 7:	Summary of Cook Islands legislation relevant to the management of the catchment, coastal and marine environment, and resources
Table 8:	Coordinating mechanism, objectives, tasks and activity areas of the Environment Act
Table 9:	Coordinating mechanism, objectives, tasks and activity areas of the Marine Resources Act
Table 10:	Coordinating mechanism, objectives, tasks and activity areas of the Islands Government policy/legislation40
Table 11:	Coordinating mechanism, objectives, tasks and activity areas of the IWRM Policy 41
Table 12:	Coordinating mechanism, objectives, tasks and activity areas of the National Sanitation Policy
Table 13:	Major multilateral environmental agreements signed by Cook Islands
Table 14:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems and geographical location relating to the identified problem of deterioration of water quality
Table 15:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of stress on ground and surface water resources47
Table 16:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of deforestation, riparian, and vegetation clearance
Table 17:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of near shore, terrestrial and surface water, inland flora and fauna and wetlands ecosystem degradation
Table 18:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of eutrophication
Table 19:	Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of solid and liquid waste management
Table 20:	Identified options for reform of each environmental problem
Table 21:	Identified environmental problems and relevant aspects for decisions makers

## **LIST OF FIGURES**

Figure 1:	Location of Cook Islands in the Pacific Ocean (Parakoti and Davie 2007)5
Figure 2:	Map of Cook Islands (highlighting Avarua as the Capital) (Parakoti and Davie 2007) 5
Figure 3:	Monthly Temperature and Rainfall in Rarotonga, Cook Islands (2020)7
Figure 4:	The average positions of the major climate features in November to April. The arrows show near surface winds, the blue shading represents the bands of rainfall convergence zones, the dashed oval shows the West Pacific Warm Pool and H represents typical (Parakoti and Davie 2007)
Figure 5:	Water intakes in relation to the main upper catchment in Rarotonga (Data source: Ministry of Works)9
Figure 6:	Vulnerability & Adaptation (V&A) Assessments17
Figure 7:	The seafloor of the Cook Islands (McCormack 2002)20
Figure 8:	Map of the Cook Islands and locations of Suwarrow National Park and Takutea Wildlife Sanctuary21
Figure 9:	Map of Suwarrow Atoll National Park
Figure 10:	Marae Moana Marine Park23
Figure 11:	Map of Manaue and Takutea Wildlife Sanctuary24
Figure 12:	Map of Aitutaki Island Reserve25
Figure 13:	Map of Manihiki Island Reserve26
Figure 14:	Map of Mitiaro Island Reserve27
Figure 15:	Map of Nassau and Pukapuka Island Reserve28
Figure 20:	Mortality and combined economic losses caused by natural and other disasters 29
Figure 21:	View of Muri Beach in Rarotonga Island, Cook Islands, 2010
Figure 22:	The regional distribution of the rate of sea-level rise measured by satellite altimeters from January 1993 to December 2010, with the location of Cook Islands indicated
Figure 23:	Annual rainfall in Rarotonga for the past few decades (1950 – 2009)

## **EXECUTIVE SUMMARY**

Environmental problems that affect Pacific Island countries affect the livelihood, socioeconomic and general well-being of local communities. Many of these problems are cross-sectoral in nature, and influence the entire system, from ridge to reef. The rising onslaught of climate change and the issues relating to unsustainable and irresponsible management of natural resources, compounds the problem. This report is a diagnostic analysis of priority environmental problems that were identified during a stakeholder consultation held in Muri district in Rarotonga, Cook Islands in 2018. In the one-day workshop, representatives from government, civil society organisations and traditional community leaders gathered in Rarotonga to discuss, identify, and prioritise current issues of concern. The main discussions and cluster group work revolved around highlighting all existing environmental problems from ridge to reef, prioritising them, and coming up with the six most important issues, which were as follows:

- Deterioration of water quality
- Stress on ground and surface water resources
- Deforestation, riparian, and vegetation clearance
- Ecosystem degradation including fauna/flora in near shore, terrestrial and surface water, inland, lagoon and wetlands
- Eutrophication of coastal waters
- Solid and liquid waste management

The impact and socioeconomic consequences of these problems were also part of the discussions, and these were listed and recorded. Analyses were then conducted to identify the root causes of these problems, along with practices and sources from which these environmental threats have risen.

What transpired from the consultation was that the main causes of the environmental problems were related to poor water, waste, and land management practices. These would form the basis of potential leverage points where options for reform and intervention may be introduced. Reviewing current policies, stronger enforcement measures (i.e., harsher penalties and fines), building local capacity and technical expertise (workshops as well as awareness materials), and tighter stakeholder collaborations could be preliminary measures towards addressing and mitigating these problems. The thirteen (13) principles of ridge to reef provide guidance and a planning framework to address challenges and implement commitments to ensure ecosystem integrity, and to conserve and sustainably use goods and services in Rarotonga and the whole country.

"The key to making real change is to upskill the people and to build their knowledge and understanding. That's quite an iterative process, and one that takes time" Dr. Julie Hall, NIWA regional manager.

## **1. INTRODUCTION**

The 'Ridge to Reef' system in Small Island Developing States (SIDS) covers a significant part of the land, water and coastal ecological systems in each high island or atoll country in this region. The interconnectivity and inter-linkages are dominant considerations where the philosophy of cross-sectoral coordination and integration of freshwater watershed management with coastal area management is essential in the planning and management of these resources. These include planning and management of freshwater treatment and pollution control, sustainable land use and forestry practices, balancing coastal livelihoods and biodiversity conservation, hazard risk reduction, and climate variability and change.

The R2R island diagnostic analysis (IDA) is necessary to effectively mitigate and address issues and challenges that affect the 'ridge to reef' system. This IDA framework work in the Cook Islands was a focused exercise encouraging effective dialogue and consultations amongst relevant stakeholders. The exercise provided the opportunity for frank exchanges and discussion with the initial purpose of identifying and highlighting priority issues that affect the environmental and socioeconomic landscapes of SIDS.

Gender considerations and social inclusion is a necessary part of the IDA for R2R projects. The R2R IDA Guideline and Diagnostic Gender Guide aim to guide those preparing diagnostic analysis in project sites and at the country level on collection of sex-disaggregated data and the inclusion of women, youth, and other vulnerable members of community in all research areas and public consultations.

The IDA was designed as a tool and a collaborative stepwise process to identify, quantify, and set priorities for environmental problems that are cross-sectoral (or from ridge-to-reef) in nature. The IDA was also intended to help identify potential leverage points and options for reform and intervention.

Consistent with the R2R IDA Guide, the Cook Islands diagnostic analysis process involved:

- Identifying and prioritising the ridge to reef problems.
- Gathering and interpreting information on the environmental impacts and socioeconomic consequences of each problem.
- Analysing the immediate, underlying, and root causes for each problem, and in particular identifying specific practices, sources, locations, and human activity sectors from which environmental degradation arises or threatens to arise.
- Identifying and evaluating options for reform and action.



# 2. METHODOLOGY

## 2.1 Background

The approach taken for the Ridge to Reef Programme Island Diagnostic Analysis (IDA) was derived from the Global International Waters Assessment (GIWA), the GEF Transboundary Diagnostic Analysis, and Pacific IWRM Diagnostic Analysis methodologies. The substance of these methodologies has been adapted to suit the broader ecosystem approach of the Ridge to Reef Programme and include terrestrial and marine ecosystems as well as water (IW:LEARN, 2021).

Stakeholders from the various sectors and disciplines were present for the IDA and included representatives from government, the private sector, Civil Society Organisations (CSOs) and leaders of the local communities. Both genders were equally represented at the workshop.

## 2.2 Cook Islands Methodology

#### 2.2.1 Identifying and prioritising environmental problems:

- i. With the aid of a facilitator and the predefined list of common environmental problems (Annex 1), the IDA Development Team was encouraged to brainstorm a complete list of the environmental problems in country.
- ii. Once the list was refined, the participants focused on the 'real' environmental problems (as opposed to things that were governance causes or impacts).
- iii. Finally, the participants prioritised the problems based on the criteria provided in Annex 1 using printed score sheets. Each team member was requested to score the environmental problems individually.

#### 2.2.2 Island Environmental Problem Prioritisation Criteria:

Based on the set of defined criteria, a score was assigned to each transboundary problem<sup>1</sup> between 0 (no importance), 1 (low importance, 2 (moderate importance) and 3 (high importance) to determine the relevance of the problem.

#### 2.2.3 Determining environmental and socioeconomic impacts:

- i. Initially in plenary to describe the process followed by small breakout groups. After plenary, IDA Development Team members divided into groups of between 3 and 8. Groups were either by discipline, environmental problem or mixed. Groups were gender and socially inclusive, making sure there were women, youths and vulnerable represented.
- ii. The lead facilitator defined the groups prior to the workshop. At the end of the group work, each working group reported back in plenary.
- iii. Each group decided on a facilitator/chair, a rapporteur and ensured that all members knew each other.

<sup>1</sup> The Island Diagnostic Analysis (IDA) is based on the Transboundary Diagnostic Analysis (TDA) implemented for International Waters (GEF) projects. This methodology is to scale the relative importance of sources and causes, both immediate and root, of transboundary 'waters' problems, and to identify potential preventive and remedial actions. The TDA provides the technical basis for development of a Strategic Action Programme (SAP) in the area of international waters of the GEF.

- iv. One of the priority cross-sectoral problems was taken and the following were identified:
  - The environmental impacts
  - The direct and indirect socioeconomic impacts
  - Linkages between impacts and other island environmental problems
  - Geographical location(s) of impacts/consequences.
- v. A set time was allowed for each island environmental problem, e.g., 20 minutes.

#### 2.2.4 Developing causal chains:

- i. IDA Development Team members worked in facilitated groups to discuss a selected island environmental problem. Effort was made to have mixed discipline groups ensuring that a range of expertise areas was represented. This included natural scientists, social, legal, political, and economic experts.
- ii. The priority problems were reviewed, and their associated environmental and socioeconomic impacts identified.
- iii. For each problem, the following were identified and listed:
  - The key sectors (e.g., industry, agriculture, fisheries, etc)
  - The immediate causes
  - The underlying resource uses and practices that contribute to each immediate cause
  - The underlying social, economic, legal, and political causes of each immediate cause
  - Link the resource uses and practices, and social, economic, legal, and political causes
  - Determine the root causes.

The groups also needed to make linkages, which was done on butcher paper.

The causal chain was developed, and each group presented their results and discussion points.

#### 2.2.5 Report back and discussion:

In plenary, each group was asked for feedback. Critical discussions were then encouraged within the group; these comments and important points were captured by a rapporteur.



# **3. DESCRIPTION OF COOK ISLANDS**

#### 3.1 Physical and Geographical Characteristics

The Cook Islands are in the Pacific Ocean between latitudes 14° S and 22° S, and longitudes 159° W and 164° W (Figure 1).



Figure 1: Location of Cook Islands in the Pacific Ocean

The Cook Islands are a Pacific Polynesian Island group (Figure 1) comprising of 15 widely dispersed islands, surrounded by an Exclusive Economic Zone of 1.8 million km<sup>2</sup>. The country consists of two main island groups: the southern group of Rarotonga, Aituki, Atiu, Mangaia, Manuae, Mauke, Mitiaro, Palmerston and Takutea; and the northern group of Manihiki, Nassau, Penrhyn, Pukapuka, Rakahanga and Suwarrow (Figure 2).



Figure 2: Map of Cook Islands (highlighting Avarua as the Capital)

#### 3.1.1 Geology

The islands of the southern group differ widely in form, structure, and relief, which makes it difficult to deduce a generalised geological history that is consistent for the whole group (Wood and Hay 1970). The group includes the high mountainous island of Rarotonga, four raised coral islands with volcanic cores (Mangaia, Mauke, Mitiaro and Atiu), one atoll (Manuae), one near atoll with a volcanic core (Aitutaki), and a sand cay (small island of sand) on a coral foundation (Takutea). Several of the islands are isolated submarine mountains, but those between Aitutaki and Mauke form distinct chains that trend northwest in parallel, such as the Austral Group to the southeast (Wood and Hay 1970). The northern group consists of atolls, with one exception of a sand cay on a coral reef foundation known as Nassau. These islands are widely scattered, and their surrounding bathymetry shows that some are parts are submarine ranges of volcanic mountains, and others are summits of single volcanic cones rising some 4500 m to 6700 m above the ocean bed (Wood and Hay 1970).

#### 3.1.2 Soils and Topography

Soil fertility varies from island to island, and islands of the southern group are much richer in flora than the northern group. The thin layer of soil on the atolls of the islands of the northern group provide an environment which cannot support a wide range of flora, whereas the islands of the southern group, with richer volcanic soils, provide a good environment for plant growth.

Twelve different soil types have been identified based on the topography and parent materials available in Atiu (Campbell 1982). On the island of Mangaia in the southern Cook Islands there are makatea types of soil (the literal meaning in Polynesian is "white rock"). This is a coral limestone island which has been uplifted so that pure lime is at a considerable elevation above sea level. Thus, this area consists of soils that are derived from limestone and are usually of very high pH; very poor soils are weathered from the old limestone reef. On the inner lowlands, clay-rich soils are formed on alluvium, which is derived from the volcanic bedrock. The lowland soils are the most fertile and have been extensively used for agriculture and horticulture. Interior upland soils are dark red, clay-rich materials typically produced in tropical climates by weathering of basaltic volcano bedrock. These upland soils are generally less fertile due to nutrient deficiencies (Mataio and Syed 1993, McKean and Baisyet 1994).

#### 3.1.3 Vegetation

The vegetation for the Cook Islands is lush tropical on Rarotonga and the fertile southern group of islands. Vegetation on the coral atolls is sparse; mainly pandanus and coconuts. The inland area of Rarotonga (above 400 m) contains introduced species (Space and Flynn 2002) as well as 26 species of plants unique to the Cook Islands (Sykes 2016). These include the *ascarina* (kaiatea ko'u), the glossy tongue fern and the *Rarotongan freycinetia* (kiekie), a plant like pandanus (ara). The marine algal flora of the Cook Islands was most recently reported upon by Dr N'Yeurt (N'Yeurt 1999).

#### 3.1.4 Climate

The Cook Islands' climate is tropical and moderated by trade winds. The country experiences two distinct seasons: the dry months from April to November and the wetter humid months from December to March (Figure 3). The 1929–1992 average rainfall at Rarotonga airport was 2100 mm, with a maximum in 1967 of 3000 mm and a minimum in 1982 of 1100 mm (Clement and Bourget 1992). Rainfall in the northern group of islands is generally higher than that in Rarotonga (in the

southern group) where a similar distribution of rainfall occurs throughout the year. The temperature and rainfall in Rarotonga in 2020 showed that the least amount of rainfall occurred in June with an average of 75 mm of rainfall. The highest amount of rainfall recorded is 218 mm in January (Figure 3).



Figure 3: Monthly Temperature and Rainfall in Rarotonga, Cook Islands (2020)

Drought is linked to the El Niño Southern Oscillation (ENSO) with significant droughts on Rarotonga occurring in 1982, 1987 and 1997–1998 (El Niño years). Drought occurs through the lack of, or very low, rainfall during a rainy season (Dec – April). El Niño linked drought is not a nationwide phenomenon; the norm is that at the time of an El Niño event, the southern group of islands suffers drought while the northern group has enhanced rainfall. A La Niña event causes the reverse effect.

Rainfall in the Cook Islands is strongly affected by the South Pacific Convergence Zone. This band of heavy rainfall is caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. It extends across the South Pacific Ocean from the Solomon Islands to east of the Cook Islands (Figure 4). It is centred close to or over the southern group from November to May. This is when the South Pacific Convergence Zone is most active and furthest south. From November to March the South Pacific Convergence Zone is wide and strong enough for the northern group to also receive significant rainfall. The driest months of the year in the Cook Islands are from June to October (Hunnam 2013).

#### 3.1.5 Natural disasters

Natural hazards<sup>2</sup> threaten the Cook Islands in the form of cyclones, storm surge, drought, coastal flooding, river flooding, tsunamis, earthquakes, and landslides (Parakoti and Davie 2007). The biggest natural hazard are tropical cyclones (typhoons or hurricanes) such as Category 5 Cyclone Heta in January 2004, which caused widespread damage to infrastructure in the Cook Islands (other SIDS affected include Samoa, Tonga, and Niue). Cyclone Pat is the most recent severe cyclone that struck the Cook Islands in February 2010 and, despite no deaths or casualties, the entire population of the island of Aitutaki was either directly or indirectly affected. In 2005, a series of five cyclones, ranging from Category 3 to 5, passed over the islands in a period of just six weeks and in 1997, the Cook Island's worst disaster, Tropical Cyclone Martin, hit the atoll of Manihiki and left 19 people dead. In addition to the natural disasters, the Cook Islands experienced a serious dengue outbreak in May 2009 with nearly 1000 cases reported on the main island of Rarotonga.



Figure 4: The average positions of the major climate features in November to April. The arrows show near surface winds, the blue shading represents the bands of rainfall convergence zones, the dashed oval shows the West Pacific Warm Pool and H represents typical (Parakoti and Davie 2007).

#### 3.1.6 Sources of Potable Water

The Cook Islands sources its potable water supply from two main sources. In the southern group of islands, including the main island of Rarotonga, surface water is sourced from springs and streams within catchment valleys, while in the northern group, water is sourced from rainwater and groundwater. Figure 5 illustrates the location of main water supply intakes ( $\blacktriangle$ ) in Rarotonga. Note that the main villages and neighbourhoods on Rarotonga surround the main upper catchment. Avarua is the national capital, with the international airport.

<sup>2</sup> 

Emergency Management Cook Islands is the government's full-time disaster risk management coordination office to manage crisis prevention, response, and recovery.



Figure 5: Water intakes in relation to the main upper catchment in Rarotonga (Data source: Ministry of Works)

#### 3.2 Socioeconomic Situation

General migration of the younger population as seen in the past couple of decades leads to loss of skills and deterioration in the quality of services, especially in the education and health sector (Sharma 2007). Experts state that these losses of skills and lowering of quality of services have implications on the quality and availability of the state of environmental leadership and governance (SPREP, 2020).

#### 3.2.1 Demographic data

A large proportion of the population resides in the capital island of Rarotonga. This suggests potential developments and therefore possible elevated ecosystem goods and services exploitations occurring in Rarotonga. The spread of demographic information from the 2019 census such as age structure, urbanisation and other broad categories are important considerations for future R2R investments and ICM planning.

Population	17,548 (2019)
Age structure	<ul> <li>0-14 years: 21.61% (male 1,093/female 972)</li> <li>15-24 years: 17.2% (male 877/female 767)</li> <li>25-54 years: 38.08% (male 1,822/female 1,817)</li> <li>55-64 years: 11.34% (male 584/female 500)</li> <li>65 years and over: 11.76% (male 554/female 570) (2016 est.)</li> </ul>
Median age	total: 35.9 years male: 35.3 years female: 36.4 years (2016 est.)
Urbanisation	urban population: 74.5% of total population (2015) rate of urbanization: 0.88% annual rate of change (2010-15 est.)

Table 1: Census information on Cook Islands (2019)

Population	17,548 (2019)
Sex ratio	total population: 1.07 male(s)/female (2016 est.)
Ethnic groups	Cook Island Maori (Polynesian) 81.3%, part Cook Island Maori 6.7%, other 11.9% (2011 est.)
Religions	Protestant 62.8% (Cook Islands Christian Church 49.1%, Seventh Day Adventist 7.9%, Assemblies of God 3.7%, Apostolic Church 2.1%), Roman Catholic 17%, Mormon 4.4%, other 8%, none 5.6%, no response 2.2% (2011 est.)

## 3.2.2 Migration processes

New Zealand and the Cook Islands have been culturally and economically linked throughout the 20th century, and while this relationship has been unequal, it has nevertheless meant that Cook Islanders have been brought up with New Zealand as a key reference point. Furthermore, active recruitment by New Zealand employers in the 1950s and 1960s, the opening of the Rarotonga International Airport in 1973, combined with the ambitions of Cook Islanders to obtain better educational and employment options, signaled a significant increase in the numbers of migrating Cook Islanders in the mid-decades of the 20th century. The total Cook Islands population was at its peak in 1971 at 21,000 people, 17,700 as of 2011 (SPREP, 2020) and estimated at 18,000 in 2019 (Table 1). It is also worth noting that all Cook Island citizens carry New Zealand passports and can freely migrate between the two countries.

By the last decade, the Cook Islands were in some financial difficulty and New Zealand, as a key aid donor, was requiring structural adjustment to reflect new financial challenges. At a government level, relations have been strained at times, but the decline of the numbers employed in the Cook Islands public service, and the economic difficulties of the economy generally, have encouraged ongoing emigration to New Zealand. The size and relative affluence of the New Zealand-based population presents significant challenges for a Cook Islands government that wants to stem outward migration or attract Cook Islanders home.

#### 3.2.3 State of Economy

The leading source of revenue in the Cook Islands is tourism, accounting for around 60% of gross domestic product, ahead of offshore banking, pearl farming, marine industry, and fruit exports. The Cook Islands is highly vulnerable to external economic shocks, especially falls in tourism. This suggests that the country is reliant on a healthy state of environment as most tourists are coming to the Cook Islands to experience the pristine natural environment.

The Tourism and Migration statistics are released by the Cook Islands Ministry of Finance and Economic Management, which produces a monthly publication of the number of travellers crossing its border, both visitors and residents. Since 1999 tourist numbers doubled in number from 53,000 to 121,000 as of 2012. In January 2017, compared to January 2016 visitor arrivals (9976) were up by 1750. The biggest changes were in arrivals from:

- New Zealand (up 1058)
- USA (up 373)
- Europe (up 213).

The positive rise in visitor arrivals continues to be the trend with large increases from the Americas, Asia, and New Zealand.

In spite of this trend, the <u>economy</u> of the <u>Cook Islands</u>, as in many other <u>Pacific</u> island nations, is hindered by the isolation of the country from foreign markets, lack of natural resources, periodic devastation from natural disasters, and inadequate <u>infrastructure</u>.

Agriculture, employing more than one-quarter of the working population, provides an economic base with major exports of copra and citrus fruit. Manufacturing activities are limited to fruit processing, clothing, and handicrafts. Black pearls are notably the Cook Islands' leading export product. Trade deficits are offset by remittances from emigrants and by foreign aid overwhelmingly from New Zealand. In the 1980s and 1990s, the country lived beyond its means, maintaining a bloated public service, and accumulating a large foreign debt. Subsequent reforms, including the sale of state assets, the strengthening of economic management, the encouragement of tourism, and a debt restructuring agreement, have rekindled investment and growth. The Cook Islands has one of the highest female labour force participation rates in the Pacific islands region and women combine work for pay or profit with unpaid work in the home. A significant proportion of women work part time. Youth unemployment, while decreasing, is an issue given the use of contract migrant workers for technical, trade and tourism-related jobs (Pacific Community 2015).

## 3.2.4 Agriculture

The trend over the years has seen an increase in the service industry with a decrease in the agriculture industry. This has implications as urban areas would have higher income whereas rural areas that rely on agriculture and fisheries would have reduced income over the years.

Major determinants that directly impact the agricultural sector in the Cook Islands include land availability, limited water resources and inter-island communications, and related transport logistics. It is important to note that imports have consistently outstripped exports in the Cook Islands. Since the turn of the millennium, total imports increased from US\$27.9 million to US\$205 million in 2019. Exports, however, saw a growth in the same period from US\$9.01 million to US\$30.3 million. The share of food imports remained at around 20%–25% of total imports, whilst exports dropped significantly. According to the 2011 agricultural census, out of the 2334 households that took part in the census:

- 67.5% of households declared to be active in subsistence agriculture and 32.5% primarily for sales; and
- 68.6% of households declared to be keeping livestock for subsistence and 31.4% for sales.

Both males and females have equal rights to land and tenure, but men have a slight advantage over women in land holdings under various arrangements. Women and men in the Cook Islands have always participated in food production. In the case of traditional food crops such as the cultivation of taro and yams, men have been mainly responsible for land preparation and planting. The rest of the family, including women and children, participate in maintaining the plants and help in harvesting as well as cleaning the tubers (Fact Sheet Cook Islands 2007).

In 2012, crop farming in the Cook Islands produced an estimated total of 7971 metric tonnes (MT) of produce (excluding figures for noni production), which included 1329 MT of tropical fruits (of which 64% are grown in orchards); 1820 MT of coconuts; 1672 MT of various vegetables; and 3150 MT of root crops.

#### 3.2.5 Livestock

The 2011 agricultural census confirmed the predominance of the pork, poultry and goat production livestock sub-sectors as was also evidenced in the previous census. In 2011, a total of  $\pm$  14,000 pigs,  $\pm$  4400 goats and  $\pm$  34,000 chickens were reported. Indigenous species or low productive species seem to predominate.

Disposal of animals is low. According to the 2011 agricultural census, only 20% of total numbers are disposed of, of which 76% were slaughtered. Sales of slaughtered animals remain the exception ( $\pm$  10%). The informal market (household direct consumption and gifts) seems to absorb most of the slaughtered animals. In addition to the meat sales, one important sub-sector for poultry is the egg sub-sector. The latter is predominantly established in Rarotonga and streamlined around one major egg producer and a limited number of smaller operators. Imports of eggs have been increasing over the past years and since 2014, the imports tariff on eggs has been discontinued.

#### 3.2.6 Social development and living conditions

The Cook Islands is predominantly a lower-middle income nation but has far higher incomes than other Polynesian countries as a result of a stronger private sector, well-developed commercial agriculture, and extensively developed tourist industries. It also has one of the highest proportions of formal sector employees in the Pacific and compared with other Pacific Island countries, a larger number of employees in manufacturing and a smaller number in public and community services. In 2016, 77% of working-age men and 67% of women participated in the labour market in the Cook Islands; unemployment rate was higher among women (6.8%) than among men (5%). The female average annual income from all sources was eighty-five percent (85%) of that of men among the adult population (ages 15 and above) (Fact Sheet Cook Islands 2007).

Most Cook Islands government agencies can produce sex-disaggregated statistics on topics such as population, births and deaths, school enrolment, employment, hospital patients and parliamentary representation. Sex-disaggregated statistics are also available in areas such as statistics on violence against women (Pacific Community 2015).

#### 3.2.7 Health and Hygiene

There are no central sanitation treatment or disposal facilities in the Cook Islands and reliance is on septic tanks and individual systems. Individual assessments of households are undertaken by health officers on a regular basis.

The Cook Islands has various policies and strategies relating to Water Sanitation and Hygiene (WASH) with the review of the Water Policy currently underway (2017), which may include water treatment requirements, water quality guidelines and water safety planning. A UN-Water project known as the Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) based on water quality monitoring, sanitary surveys of rainwater tanks and chlorine treatment is currently planned (World Health Organization and UN-Water 2014).

The water supply in Rarotonga is untreated and the island suffers from a lack of water during drought conditions, which appear to be occurring more frequently. A large water project, Te Mato Vai, is being implemented with a focus on replacing the aging infrastructure, reducing water loss, and increasing water storage capacity. This will help reduce demand on water extraction from freshwater intake areas (SPREP, Cook Islands State of the Environment Report 2018, 2020).

Water quality monitoring is undertaken by the Ministry of Health and the samples are analysed at the hospital laboratory. There are often competing demands on laboratory services and the government has agreed to fund a central laboratory to increase the analytical capacity. The  $H_2S$  (hydrogen sulphide) test has also been used with good results in the outer islands to promote water safety. Workshops facilitated by WHO on rainwater and water safety planning were held in Rarotonga and Aitutaki, which raised awareness among the population and provided training to health officers, government staff and community leaders. An integral part of these workshops was the promotion of WASH activities, including hygiene.

## 3.3 Ecological Status

## 3.3.1 Assessment of legislation/policy that defines National Protected areas

The Cook Islands has installed legislations which protect areas of biological importance. The Acts are concerned with the maintenance of biodiversity and the control of invasive species. The most notable is the Environment Act in 2003. The legislations are put in place to conserve the nation's endangered species, develop systems of protected areas, reduce the effects of invasive species as well as preserve knowledge relating to biodiversity (Pulea 1992). Under the Environment Act 2003 a national protected area is defined as that "where an Island environment authority proposes to designate an area within its island having ecological, cultural, archaeological, historical or scenic importance for the purpose of environment and natural resource conservation and management".

1984	Ministry of Marine Resources Act		
1989	Marine Resources Act		
1992	Declaration on Environment and Development		
1994	Rarotonga Environment Act		
1975	Plants Act		
1998	Animals Act		
1999	Natural Heritage Trust Act		
2003	Environment Act		
2005	Marine Resources Act		

Table 2: Showing the various environmental legislations with formal status

# 3.3.2 Identification of hotspots – the characteristics that are used to assess a hotspot.

Though biodiversity hotspots are areas that support natural ecosystems that are intact and where native species associated with the ecosystems are represented, criteria for a biodiversity hotspot are that the area should have 1500 species of vascular plants as endemics, and loss of 70% of its original habitat (Myers et al. 2000). Biodiversity hotspots are also characterised by a high diversity of endemism. Hotspots help prioritise funding for management of areas of biological and ecological importance.

#### 3.3.3 Species of note

The Cook Islands is isolated and has a relatively compact land area, which supports high ecosystem diversity and endemism (Passfield and Rongo 2011). The Cook Islands has approximately 1600 described flora and fauna species of which 21 are considered endemic where the bulk of endemic species are gastropods and birds. Birdlife International in the Cook Islands has listed 9 endemic birds altogether. Mammals are seen to be ecologically under-represented in the country noting that bats and rats have a negative impact on the native flora and fauna. Though there is a relatively low number of endemism, Cook Islands has a large population of migratory terrestrial and marine species in which the migratory pathways are through the islands. Notable species are the hawksbill turtle (*Eretmochelys imbricata*) and the loggerhead turtle (*Caretta caretta*). Annex 2 has a table that highlights globally threatened species that occur in the Cook Islands.

Threatened Fish, Turtle & Whale Species				
Alopias pelagicus	Pelagic Thresher Shark	Cheilinus undulates	Humphead Wrasse	
Carcharhinus Iongimanus	Oceanic Whitetip Shark	Thunnus obesus	Big-eye Tuna	
Taeniura meyeni	Giant reef ray	Eretmochelys imbricate	Hawksbill Turtle	
Isurus oxyrinchus	Shortfin Mako	Chelonia mydas	Green Turtle	
Rhincodon typus	Whale shark	Caretta caretta	Loggerhead Turtle	
Epinephelus lanceolatus	Giant Grouper	Balaenoptera musculus	Blue Whale	
Plectropomus laevis	Black Saddled Coral	Balaenoptera borealis	Sei Whale	
	Grouper	Physeter macrocephalus	Sperm Whale	
Threatened Bird Specie	s			
Pomarea dimidiate	Rarotonga Flycatcher	Todiramphus ruficollaris	Mangaia Kingfisher	
Vini kuhlii	Rimatara Lorikeet	Vini peruviana	Blue Lorikeet	
Collocalia sawtelli	Atiu Swiftlet	Aplonis cinerascens	Rarotonga Starling	
Ptilinopus rarotongensis	Cook Islands Fruit Dove	Numenius tahitiensis	Bristle-thighed Curlew	
Pterodroma leucoptera	Gould's Petrel			
Other fauna				
Partula hyaline	Polynesian Tree Snail	Emoia adspersa	Micronesian Skink	
Threatened Plant Species				
Acrophorus raiatensis	Rarotonga Acrophorus	Cyrtandra rarotongensis	Rarotonga Cyrtandra	
Asplenium schizotrichum	Polynesian Asplenium	Garnotia cheesemanii	Rarotonga Garnotia grass	
Coprosma laevigata	Rarotonga Coprosma	Haloragis stokesii	Rarotonga Haloragis	
Cyrtandra lilianae	Te Manga Cyrtandra	Psychotria whistleri	Rarotonga Psychotria	
Radiogrammitis	Cloud grass fern	Sclerotheca viridifolia	Rarotonga Sclerotheca	
cheesemanii		Nesoluma polynesicum	Polynesian Nesoluma	

Table 3:Status of species in the IUCN Red List in the Cook Islands.

With the support of Birdlife International and the Critical Ecosystems Partnership Fund, an analysis of Cook Islands Key Biodiversity Areas and Important Bird Areas was performed in 2012. The islands in the south are the most studied and, therefore, have the most comprehensive and reliable information. The Cook Islands Marine Park is home to 61 globally threatened species as well as many endemic species that are locally threatened. There are 25 threatened coral species, 8 threatened fish species, 3 marine turtle species and 3 threatened whale species. There are also 8 threatened land bird species, 11 threatened plants, one tree snail, one skink and one threatened seabird (Annex 2).

#### 3.3.4 Major threats and concerns

Introduction of invasive species<sup>3</sup> threatens endemic and native plants and animals, which is a major concern. The threat is mainly from anthropological activity as the scattered nature of the islands has tended to abate spread of species. For example, the ship rat, which has decimated bird populations is seen in Rarotonga, Mangaia, Mauke and Mitiaro, but is absent from Aitutaki and Atiu islands. Other notable invasive species include the African tulip tree, elephant grass, giant sensitive weed, and the sand fly (*Culicoides belkini*).

Biosecurity works in conjunction with the Ministry of Agriculture to formulate ways to prevent new invasive species from establishing in the Cook Islands as well as controlling the effects of current invasive species. This is done through the strengthening of biosecurity protocols and continued implementation of public awareness strategies.

## 3.3.5 Review of Rapid Coastal Assessment

Protected areas form an important part of the Cook Islands culture, one of the benefits of this is the ability to set marine reserves. The Cook Islands Marine Park (CIMP) covers an area of 1.1 million km<sup>2</sup>. In addition to this, other protected areas include the bonefish reserve and other areas managed by private landowners. According to the CIMP survey in 2013 these areas were relatively healthy, showing good coverage of hard coral as well as coral associated reef fish (Teina et al. 2013).

Cook Islands is susceptible to predicted impacts of climate change, with nearly all the population living and working in the coastal area. Isolation within a vast expanse of ocean means heavy dependence on natural resources or unreliable and expensive imports. The value of the near-shore marine and coastal areas is seen in the main economic growth sectors of tourism, pearl farming and fisheries, together with subsistence and commercial agriculture, which is based in the coastal flood plains. Based on current sensitivity to climate variability, areas of concern in the coastal area are coastal erosion and land loss, reduced agricultural and mariculture viability, saltwater intrusion, damage to infrastructure, and health hazards associated with climate induced natural disasters (Carruthers 2009).

The Cook Islands Vulnerability and Adaptation Assessment for coastal areas found that while island profiles varied greatly, if there is community understanding and support, backed by consistent local government policy, adaptation responses are possible. Thus, it is important that there is community awareness, capacity building to ensure that support. Some of these would include awareness and capacity building relating to gender and social inclusivity considering women, youth, and all vulnerable members of communities.

<sup>3</sup> 

Invasive species are categorised as those damaging the natural or wild ecosystems and those damaging the agro-ecosystems.

## 4. RIDGE TO REEF MANAGEMENT IN COOK ISLANDS

#### 4.1 Resources

Resources relevant to ridge to reef management include the continuum from the mountainous ridge to the coastal areas and lagoons (reefs). The implications of the effects of solid and liquid waste along this continuum with the introduction of an excess amount of nutrients is concerning. Land rehabilitation, forestry and mining also contributes sedimentation and runoff that impact the waterways. Understanding the details regarding the affected resources will serve for more effective management and decision making.

#### 4.1.1 Freshwater

The Cook Islands sources its water from two main sources. In the southern group of islands, which includes the main island of Rarotonga, surface water is sourced from springs and streams within catchments valleys, while in the northern group, water is sourced from rainwater and groundwater as the islands are coral atolls. Freshwater lenses are present, however, the past practice of manually extracting water from wells has been abandoned.

Generally, in comparison to similar SIDS within the Pacific, environmental impacts are few, but the issue of sound water resources management is one of the main issues facing the Cook Islands. In terms of current water supply system, old steel and galvanised pipes have problems with corrosion and leakage.

During the wet season the water supply is often discoloured and turbid and contains silt, sediment, and debris. Thus, the water system at present is vulnerable to any form of disaster, such as contamination from agriculture chemicals, sanitation contamination and saltwater intrusion.

Septic tank systems are widely used throughout Rarotonga, comprising of a septic tank and a soak away. The septic sludge is currently dumped on vacant land, or on fields at the request of planters. There is only one reticulated sewerage system on Rarotonga. It collects sewage from the residents and is fed into septic tanks for treatment. The septic tanks were replaced in 1994 with an Enviroflow proprietary sewage treatment plant. However, the plant was neither maintained nor operated correctly, and fell into disuse. As of 2007, the raw sewage currently bypasses the plant and flows into the sea (SOPAC 2007). A 2011 audit of septic systems in Rarotonga found that almost 90% did not properly treat sewage waste properly and around 85% were installed before 1980. A concerning 50% of tanks were found to be leaking, with over 40% requiring replacement or urgent repair and almost 50% requiring de-sludging (SPREP, Cook Islands State of the Environment Report 2018, 2020).

#### 4.1.2 Coastal

The coastal zone is the base for sustaining livelihoods and economic development for Cook Islanders. Coastal degradation and erosion are a major concern for the Cook Islands primary industry, tourism, which relies heavily on the idyllic lagoon and white sand beach imagery. Pearl farming is the second most important economic sector, although only two atoll islands, Manihiki and Tongareva, participate to date. Shell and black pearl health is highly dependent on climate-influenced lagoon sedimentation, salinity, temperature, and currents. Coastal and pelagic fisheries are vital to subsistence and the hospitality industry. Ciguatera fish poisoning outbreaks, believed to stem from poor reef health, are a concern. Removal of shoreline vegetation, sand aggregate, construction of tourist accommodation and private dwellings, poorly designed seawalls and inappropriate land use practices are all contributing factors superimposed on the dynamic natural causes and patterns of erosion in the coastal zone. National Tidal Facility SEAFRAME data collected in a period of 92 months till November 2000, indicated a rising sea level trend of 5 mm/y. Although much longer data recording is needed, the sea level change may account for some observed coastal erosion over the past eight years.



Figure 6: Vulnerability & Adaptation (V&A) Assessments

The coral reefs provide a buffer from open ocean waves, contribute to 'island building' through sediment accretion, and provide breeding grounds and habitat for marine species that are important for subsistence and commercial Cook Islands fisheries. Coral bleaching events have been observed on several of the Cook Islands over the past few years, particularly during El Niño episodes when warmer and shallower waters affect reef health. The lack of any mangrove features is a notable contrast from other tropical countries where these serve as vital coastal ecosystem components. Although there are some mud flats and sea grass areas that are important fish breeding grounds, all sand is calcareous, stemming from the fringing coral reefs on each island. The ability of the coral reef growth to keep up or catch up with potential sea level rise as well as cope with coral bleaching events may depend on changing the trend of declining reef health as a result of over-fishing, destructive fishing methods, near shore construction and pollution.

Agriculture in the coastal floodplains produces pawpaws and mangoes for export. Formerly significant banana and pineapple industries have halted because of market competition and climate factors, particularly cyclone damage and erosion. Storm surges overtopping the reef and saltwater intrusion further threaten the viability of agriculture, as well as infrastructure and mariculture (Carruthers 2009).

#### 4.1.3 Solid Waste

Solid waste is defined or categorised as rubbish that goes into dumpsites or landfills including hazardous waste such as batteries, fertilisers and unwanted or expired hospital chemicals (Rongo 2002). Improper solid waste disposal primarily affects the wetlands which negatively affects river flow, contributes to flooding and is also a public health hazard. Solid waste sources include residential households, industrial and tourism sectors. With the increase in production and usage from the various sectors, it is essential to have a forward-thinking strategy regarding the management of these solid wastes.

#### 4.1.4 Liquid Waste

Liquid waste refers to washing wastewater and septic waste or sludge/sewage. In August 1999, a study conducted by the Onu Group Consultants (Friends 2004), showed that "basic understanding of the treatment process was not common knowledge to the local community except a few". The ignorance of the importance of the environment during the 1996 Cook Islands' Government and ADB funded economic reform resulted in the axing of the Environment Services' environmental monitoring programme. The reform also resulted in the axing of budget and staff for the Health and Agriculture department, which caused the Health Department to not have the capacity to cope with the increase in developmental activities, especially for Rarotonga (Friends 2004).

#### 4.1.5 Land rehabilitation

Land rehabilitation is considered a major problem in the Cook Islands (Friends 2004) due to the lack of commitment of those responsible for land development activities. Coral sand mining projects that left large excavation pits, had either been filled with solid waste or red soil (Friends 2004). No proper rehabilitation work was conducted on the relics of these projects. Future consideration was not given to them in case of safety hazards, legality of the practice, health consequences and so on.

#### 4.1.6 Forest

The Cook Islands has three types of forests, namely:

- Makatea atoll forests found in raised fossilised corals in Atiu, Mauke, Mangaia and Mitiaro;
- Littoral forests in coastal areas; and
- Montane and cloud forests.

In the Pacific region, Cook Islands has one of the highest proportions of natural forests that are intact. However, the pressures of invasive species such as *Merremia peltata* and *Cardiospermum grandiflorum* from now inactive agricultural activities, free range domesticated animals, and the development of the tourism and urban sectors threaten the forest ecosystems of the Cook Islands.

The natural forest cover provides essential ecosystem services such as the sheltering of biodiversity (flora and fauna), climate moderation, control of sedimentation (erosion) and sources of key products such as firewood and culturally significant items. Though the state of the native forests is relatively 'good', it is still crucial to pay great attention to potential impacts.

Table 4: Highlights on the R2R related efforts in the forest sector

Term	Definition		
Primary designated function	The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the landowner/manager, or evidence provided by documented studies of forest management practices and customary use.		
Protected areas	Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.		
Categories of prima	ry designated functions		
Production	Forest area designated primarily for production of wood, fibre, bioenergy and/or non-wood forest products.		
Protection of soil and water	Forest area designated primarily for protection of soil and water.		
Conservation of biodiversity	Forest area designated primarily for conservation of biological diversity. Includes, but is not limited to, areas designated for biodiversity conservation within the protected areas.		
Social services	Forest area designated primarily for social services.		
Multiple use	Forest area designated primarily for more than one purpose and where none of these alone is considered as the predominant designated function.		
Other	Forest areas designated primarily for a function other than production, protection, conservation, social services, or multiple use.		
No/unknown	No or unknown designation.		
Special designation	and management categories		
Area of permanent forest estate (PFE)	Forest area that is designated to be retained as forest and may not be converted to other land use.		
Forest area within protected areas	Forest area within formally established protected areas independently of the purpose for which the protected areas were established.		
Forest area under sustainable forest management	To be defined and documented by the country.		
Forest area with management plan	Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, which is periodically revised.		

#### 4.1.7 Minerals

Abundant manganese nodules with high cobalt-content have been found in the EEZ of the Cook Islands. These have significant resources of cobalt, nickel, and copper, which are of great global demand. According to an interview with the Cook Islands Seabed Minerals Authority Commissioner, Paul Lynch, the Cook Islands has taken a steady approach to the development of its national seabed minerals sector. In 2009, the Cook Islands became the first nation to pass legislation – *the Seabed Minerals Act* – which is dedicated to the sensible development of its national seabed minerals resources, known as polymetallic Manganese Nodules. The key objective is to "*establish a legal framework for the efficient management of the seabed minerals of the Cook Islands*". This Act commenced on March 1<sup>st</sup>, 2013, and currently, a world class, sustainable Regulatory Framework is being developed to regulate future seabed minerals (SBM) exploration activities in the Cook Islands (Lynch 2015).

Licences to commence the deep sea minerals (DSM) exploration phase in Cook Islands EEZ have yet to commence, however, the scientific, biological and benthic data obtained in the exploration phase over the next 3 to 5 years, will not only enable applicants to determine the economic viability of DSM exploitation activities in the Cook Islands, but the Cook Islands people will also be able to determine the overall risks and benefits that may be involved in DSM in their EEZ. If the benefits are available and the risks are mitigated, then an appropriate decision can be made to pursue DSM in the Cook Islands for the benefit of its people and development partners. Of great importance to the continued sustainable use and conservation of national marine resources in the Cook Islands Ocean context is the Government Declaration of a new national marine managed area, called Marae Moana, being seen by the Government as a multi-use, zoned marine managed area, of up to 1 million km<sup>2</sup>. (Lynch 2015).

Rising demand for hard-to-find rare earth elements (REEs) needed for high tech gadgets, green energy and batteries used by hybrid vehicles continues to push mining companies to scour the ocean floors (McCormack 2002).



Figure 7: The seafloor of the Cook Islands (McCormack 2002).

#### 4.2 Nature Reserves and Protected Areas

Refer to Annex 3 provides a detailed summary table on existing protected areas in the Cook Islands.

Table 5: Protected areas in the Cook Islands

Name of Protected Area	Size (km²)	Year of Establishment	National Focal Institu- tion
Suwarrow Atoll National Park	9.8	1978	National Environment Service
Marae Moana Marine Park	1,100,000	2017	National Environment Service
Manaue and Takutea Wildlife Sanctuary	1.22	1903	National Environment Service
Aitutaki Island Reserve	18.05	2000	National Environment Service
Manihiki Island Reserves	5.4	2009 (Seacology project)	National Environment Service
Mitiaro Island Reserve	22.3	2008 (Seacology project)	National Environment Service
Nassau and Pukapuka Island Reserves	1.3	2017 (Seacology project)	National Environment Service

The following section presents background on some of the protected areas and maps of their respective locations.

#### 4.2.1 The Cook Islands



Map of Cook Islands (Source: ortho.linz.govt.nz)

Figure 8: Map of the Cook Islands and locations of Suwarrow National Park and Takutea Wildlife Sanctuary

#### 4.2.1.1 Suwarrow Atoll National Park



Figure 9: Map of Suwarrow Atoll National Park

Suwarrow Atoll National Park is an important seabird breeding site for 11 species of birds, not only for the Cook Islands but for the region and the world. It supports regionally significant colonies of lesser frigatebirds (9% of world population), red-tailed tropic birds (3% of world population) and the Cook Islands' only large colony of sooty terns. The atoll also supports locally significant colonies of red-footed boobies, great frigate birds, masked boobies, and brown boobies. In addition, it is an important wintering site for the Alaskan migrant, the vulnerable bristle-thigh curlew (Cook Islands South Pacific 2021).

#### 4.2.1.2 Marae Moana



Figure 10: Marae Moana Marine Park

The Cook Islands Marae Moana Marine Park (Figure 10) covers 1.065 million km<sup>2</sup> (411,000 square miles) – an area more than twice the size of Papua New Guinea. It is the largest marine park ever declared by a single country for integrated ocean conservation and management. The area includes remote atolls, high volcanic islands surrounded by fringing reefs and unspoilt fauna associated with underwater mountains. It also hosts rich Pacific marine biodiversity, including rare seabirds, blue whales, manta rays and several shark species, several which are listed as threatened on The IUCN Red List of Threatened Species (IUCN 2012). The Marae Moana Act 2017 states that any economic activities within the EEZ must abide by the primary objective, which is "to protect and conserve the ecological, biodiversity and heritage values of the Cook Islands marine environment" (Marae Moana: Marine Park Map 2021)

#### 4.2.1.3 Manaue and Takutea Wildlife Sanctuary



Figure 11: Map of Manaue and Takutea Wildlife Sanctuary

Twenty kilometres (12.4 miles) northwest of <u>Atiu</u> is the tiny coral cay of Takutea (Figure 11). It is only 6 metres (20 feet) above sea level at the highest point and most of it is covered in coconut palms. The island has been designated a wildlife sanctuary and is administered by a Trust. Visits are only permitted by obtaining a special permission from the Trust Chairman, High Chief Rongomatane Ariki.

Thousands of red-tailed tropicbirds and red footed boobies' nest on the island, which is one of the most important seabird breeding grounds in the Pacific region. Feathers from the tropicbird are gathered for traditional costumes. Terns, noddies and frigatebirds are also found in large numbers. The kota or great frigatebird that nests there has become an unofficial emblem for the Cook Islands (Cook Islands South Pacific 2021).

#### 4.2.1.4 Aitutaki Island Reserve



Figure 12: Map of Aitutaki Island Reserve

Aitutaki has a population of approximately 2000 people and has several marine reserves that are restricted (Figure 12). Aitutaki is the second most visited island of the Cook Islands (National Environment Service: Tu'anga Taporoporo Cook Islands 2021). This leads to relatively higher levels of nutrients affecting inland waters. Though Aitutaki and Rarotonga have access to sanitary engineered landfills, there is a need for consideration of proper management of waste. Marine reserves help sustain the subsistence lifestyles on Aitutaki as numbers recover to sustainable levels. The tourist industry also benefits as fish become tamer for sightseeing visitors in Aitutaki.

#### 4.2.1.5 Manihiki Island Reserve



Figure 13: Map of Manihiki Island Reserve

Like its sister island of <u>Rakahanga</u> 44 km (18 miles) north, Manihiki sits on top of an underwater mountain which rises 4000 m (13,000 feet) from the ocean floor. But the island itself is flat and only 4 m (13 feet) above sea level at the highest point (Cook Islands South Pacific 2021). Forty tiny islets encircle a lagoon 4 km (2.5 miles) wide (Figure 13), which completely encloses a body of water where the black pearls are cultured. Given the significance of Manihiki for pearl aquaculture, a location to obtain pa'ua (giant clams) and as a green turtle nesting site, its status as an island reserve is essential.
## 4.2.1.6 Mitiaro Island Reserve



Figure 14: Map of Mitiaro Island Reserve

## **Description:**

Mitiaro (Figure 14) is just 6 km (4 miles) across at its widest point and is surrounded by a belt of razor sharp, fossilised coral or makatea 6 m to 9 m (20 ft to 40 ft) high. The island boasts the only sizeable freshwater lakes in the Cook Islands. Rotonui (Big Lake) and Rotoiti (Small Lake) are a little way inland on the eastern side of the island. The larger lake is about half the size of the whole island, and between them, the two lakes account for about two thirds of the island.

The lakes are home to prawns and eels called itiki, which are like caviar to the Cook Islanders. To protect the species and enable the supply of itiki to build up, a short-term ban was placed on catching them. It was a traditional conservation practice and remained in force until April 2016 (Cook Islands South Pacific 2021).

## 4.2.1.7 Nassau and Pukapuka Island Reserve



Figure 15: Map of Nassau and Pukapuka Island Reserve

The island is 9 m (28 ft) above sea level, and just 11 degrees below the equator which means days and nights are almost exactly 12 hours long. The daytime temperature also stays at about 27 degrees Celsius (83F) all year.

Nassau is surrounded by a reef flat which is 90 m to 130 m wide (98 yards to 142 yards) on all but the north side, where it is narrower (Figure 15).

Pukapuka island is said to derive its name from the puka tree (*Hernandia nymphaeifolia*), which is predominantly found on the island. Puka-Puka in the local dialect means 'land of little hills', and others say that the real origin of the name came from the first Polynesians who settled there thousands of years ago. Some know it as 'Danger Island' because of an 8 km submerged reef – Te Arai – and dangerous rip tides around it to the west (Cook Islands South Pacific 2021).

# 4.3 Island Vulnerability

# 4.3.1 Types of disasters

- As experienced in the rest of the Pacific, the Cook Islands has a high vulnerability to both natural and anthropogenically caused disasters, where the forefront of these disasters are cyclones.
- From 1969 to 2010, the country has seen over 70 cyclones. The year 2005 saw the worst devastation to the Cook Islands with 5 cyclones over a span of just two months (COP23 Fiji: UN Climate Change Conference 2017).
- There is also a growing concern over the introduction of pests and diseases.
- Anthropogenically caused disasters include soil erosion (induced), reduced access to clean water, reduced marine resources due to overfishing, deforestation, waste management and flora/fauna depletion.
- The coastal areas of the Cook Islands boast pristine white sandy beaches, which are the main attraction for the country's tourism industry, which makes up about 67% of its GDP. With the recent infrastructure developments and uncontrolled sand removal, the main island of Rarotonga has seen the degradation of its beaches. Reactive measures in the wake of these issues somewhat worsened the current state of the beaches in certain areas (National Environment Service: Tu'anga Taporoporo Cook Islands 2021).
- Inland waters streams, rivers, or lakes are also affected by modern farming chemicals and deforestation, which have contributed to increased algal growth, particularly in Muri lagoon and resulting in brown murky waters of Avarua Harbour.



Figure 20: Mortality and combined economic losses caused by natural and other disasters

Table 6: Average damage cost per cyclone stands at about \$4.5 million which is about 2% of the countries GDP. (COP23 Fiji: UN Climate Change Conference 2017)

8-year moving average 2005-2013		Extensive [%]	Intensive [%]
DataCards	0.88	85.71	14.29
Deaths	0.00	67.00	33.00
House destroyed	101.00	25.70	74.30
House damaged	72.25	100.00	0.00
Injured people	2.50	45.00	55.00
Displaced people	500.00	50.00	50.00
Combined economic loss (US\$)	11,143,718.03	17.36	82.64

Approximately 6% of the government's budget is toward four main initiatives of disaster risk management (DRM) including that of Emergency Management Cook Islands, Cook Islands Climate Change, Renewable Energy Division and Cook Islands Meteorological Service (HFA Monitor 2012).

### To what extent do disasters impact on water/coastal management?

Structural developments close to the foreshore have seen degradation of some beaches. Measures have been put in place to ratify these unforeseen circumstances, but this has exacerbated the current situation. For example, the building of sea walls in certain parts contributes to the redirection of the waves and deflecting the force in a downward direction which results in erosion of sand due to a high redirected force.

In 2005, a host of cyclones destroyed the Mangaia Harbour (Mangaia island is the second largest island after Rarotonga) and a new, more resilient harbour has since opened in 2014. However, outer islands suffer the most with severe water cuts lasting months.

## 4.3.2 Issues and concerns

#### Inundation of water resources

In the Cook Islands, coastal inundation tends to occur either during tropical cyclones, or when large swells, which has travelled across the ocean, reaches the Cook Islands. For inundation, this usually coincides with high seas due to tides and other sea fluctuations. To understand and assess inundation of coastal land in the Cook Islands, it is necessary to understand these wave conditions, how likely they are to occur with different sea levels, and how these two parameters influence wave set-up, wave runup, overtopping and overwashing at the shoreline. Climate change is an additional factor that needs to be considered, for example, sea level rise and other climate change effects, such as changes in intensity and frequency of cyclone conditions (SPREP 2014).

### Saltwater intrusion

 During the wet season the water supply is often discoloured and turbid and contains silt, sediment, and debris. Thus, the water system at present is vulnerable to any form of disaster, such as contamination from agriculture chemicals, sanitation contamination and saltwater intrusion (Pacific Community 2007).

#### Water quality impacts from pollution

• Scientific data is pointing to groundwater nutrient discharge being responsible for 81% of Dissolved Inorganic Nitrogen (DIN) in Muri Lagoon, Rarotonga. The main cause of the problem, according to surveys by the Pacific Community, has been attributed to ground water run-off (Lacanivalu 2016).



Photo: Gemma Longman Creative Commons Attribution 2.0 Generic license Figure 21: View of Muri Beach in Rarotonga Island, Cook Islands, 2010.

## Wetlands

• The National Environment Service highlighted the wetlands as one of the specific areas of concern, under the 2003 Environment Act. Many wetlands are being filled in despite environmental awareness, to make way for buildings. Communities have been advised that filling in a taro patch or other form of wetland, robs the value and purpose of the wetland. Wetlands are not only a cleaning and storage system, but they are also a food production site and a habitat for flora and fauna. If all the wetlands are filled in, there will be no more natural taro patches. Building on stilts over a wetland or partial fill were even being presented as a point of consideration. Reference to the Legislation [Section 58 of the Environment Act 2003]:

"No excavation, dredging, clearing, paving, grading, ploughing, dumping, reclamation, removal of trees or other activity of any kind which may alter the natural configuration of the wetlands shall be undertaken on any wetlands, nor shall any building or structure be erected or altered on any wetlands, without the written consent of the permitting authority."

## **Sloping land**

- Excavation, erecting and building of any structure on sloping land can only be carried out with the consent of the permitting authority. This is to prevent soil being washed away by rainwater or blown away by wind and to prevent any further damage to the property or neighbouring property. If building on a slope, building on stilts is recommended to limit the area needed to excavate. This can prevent causing erosion related problems and further expenditure on retaining walls. Other recommendations include keeping a number of large trees instead of cutting down all trees on a section noting that large trees take decades to grow and provide services such as shade, cooler air and also help in stabilising soils.
- The Environment Act 2003 clearly states that it is an offence to carry out any activity on any land having a natural gradient in excess of 1:10 without the prior consent of the Permitting Authority. Reference to the Legislation [Section 57 of the Environment Act 2003]:

"No person may –

- a. undertakes any excavation of any kind on any land having a natural gradient in excessof 1:10; or
- *b. erect or alter any building or structure on such land, except with the written consent of the permitting authority."*

#### Inland water

 Inland waters are stated as waters and banks of any stream, river, or lake, together with the bed (whether dry or not) of any stream, river, or lake. This area of concern needs to be carefully considered as it is connected to the marine environment and can also be a habitat for freshwater organisms. Any activity that may cause pollution or sedimentation of inland waters will cause problems downstream. Such problems become evident during periods of heavy rain when coastal waters are filled with mud as seen in the Avarua harbour, and in the periodic algae blooms seen especially in the Muri lagoon. These algae blooms are indicators for high levels of nutrients that come from nitrates and phosphates found in fertilisers.

#### Foreshore and Cook Island's waters

- Foreshore is the area between the mean high-water mark on the beach and 30 m inland from this mark. This area is of utmost importance for the Cook Islands, with its images of unspoilt, clean, white sandy beaches and spectacular coastal scenery. With approximately 67% of the national GDP dependent on tourism, Cook Islanders need to take care of this asset to prolong the life of tourism in the Cook Islands as well as their own properties.
- Over the years, the removal of sand and aggregate material, construction of buildings and other structures, and poor land use practices on the foreshore all take their toll on this fragile ecosystem. The removal of sand and aggregate has been a particular

environmental concern, with an enormous volume being removed on Rarotonga in the 1950s, which resulted in the degradation of the beach area, creating public pressure for control of this practice.

• Building near beaches has resulted in the construction of protection walls which only exacerbate the problem of coastal erosion. Those building walls to protect their beach properties increase beach scouring effects during high waves and cause erosion of neighbouring properties, leading to further construction of walls and other coastal protection structures, which is then reflected across consecutive neighbouring properties. During high wave periods, incoming waves contact the sudden vertical protection wall and that power of the wave is reflected or **deflected** off the wall, taking with it the sand in front of the wall. Therefore, if there is a plan to build at the coast, a more sustainable strategy would involve building as far away from the beach as possible to reduce expenditure in the long run..

#### Reference to the Legislation [Section 50 of the Environment Act 2003]:

*"Every person commits an offence who, without the prior consent in writing of the permitting authority or contrary to any provision of a management plan, –* 

- a. removes any silt, sand, cobble, gravel, boulder, coral or any tree from the foreshore or Cook Islands waters; or
- b. carries out any excavation, dredging, clearing, paving, grading, ploughing, removal of trees or vegetation, or other activity within the foreshore or Cook Islands waters which may result in the alteration of the natural configuration of the foreshore; or
- c. places any fill or material of any type within the foreshore or Cook Islands waters; or
- *d.* carries out the construction or erection of any wall or structure within the foreshore or Cook Islands waters."
- Customary laws and authorities are relevant in the Cook Islands, like other countries in the Pacific region, as they are the source of land allocation and sustainable use, and the source of management of marine Cook Islands. Therefore, the adequate management of natural resources goes through the recognition of traditional roles (SPREP 2018).

## **Climate Change and Sea level rise**

Monthly averages of the historical tide gauge, satellite (since 1993) and gridded sealevel (since 1950) data that are co-located have similar variability after 1993 and indicate year-to-year variability in sea levels of about 19 cm (estimated 5%–95% range) after removal of the seasonal cycle. The sea-level rise near the Cook Islands, measured by satellite altimeters (Figure 21) since 1993, is about 4 mm per year, like the global average of 3.2 ±0.4 mm per year (Australian Bureau of Meteorology and CSIRO 2011).



Figure 22: The regional distribution of the rate of sea-level rise measured by satellite altimeters from January 1993 to December 2010, with the location of Cook Islands indicated.

#### **Ocean acidification**

Based on the large-scale distribution of coral reefs across the Pacific and the seawater chemistry, seawater aragonite saturation states above 4 were optimal for coral growth and for the development of healthy reef ecosystems, with values from 3.5 to 4 adequate for coral growth, and values between 3 and 3.5 marginal (Guinotte et al. 2003). Coral reef ecosystems were not found at seawater aragonite saturation states below 3 and these conditions were classified as extremely marginal for supporting coral growth. In the Cook Islands region, the aragonite saturation state has declined from about 4.5 in the late 18<sup>th</sup> century to an observed value of about 4.1 ± 0.2 by the year 2000 (Australian Bureau of Meteorology and CSIRO 2011).

#### Smaller peripheral islands are at the greatest risk

Most of the Cook Islands are small, low-lying, and isolated, which makes them vulnerable to climatic influences such as storms, drought, and sea-level rise, which negatively impact agricultural livelihoods, the availability of food, and human health and survival. There are also concerns that climate change may deepen environment-related gender inequality. Women are considered among the most vulnerable groups, as they tend to be more dependent on the natural resources that are threatened by climate change and have fewer assets to cope with the change (Pacific Community, 2015). The Islands Government Act (2012–2013) has significantly increased the authority of Island Councils in the outer islands to manage their own affairs, including conservation and resource use decisions and policies. The Act states that it is the duty of the Island Government to promote sustainable and environmentally friendly management practices in the management of island resources.

 At the island level, most of the individual outer islands in the country have completed Island Development Plans (IDPs) in the past five years. These 5-year plans are generally focused on developing a community/island-based vision for the socioeconomic development and environmental conservation of each island. The Island Plans are important policy documents at the island level, as they cover such key issues as agriculture and land resources; fisheries and marine resources; biodiversity conservation and invasive species management; waste management; infrastructure development; eco-tourism and tourism development; as well as governance and numerous social sectors (health; education; economic development; etc.).

## Droughts

• Annual and seasonal rainfall trends for Rarotonga and Penrhyn for the period 1950–2009 are not statistically significant but have been quite consistent.



Annual Rainfall – Rarotonga

Figure 23: Annual rainfall in Rarotonga for the past few decades (1950 - 2009)

"The incidence of drought is projected to decrease over the course of the 21st century. There is moderate confidence in this direction of change because: A decrease in drought is consistent with projections of increased rainfall (Section 2.7.2). Most models agree on this direction of change for most drought categories. For the Northern and Southern Cook Islands, the majority of CMIP3 models project that mild drought will occur approximately seven to eight times every 20 years in 2030 under all emissions scenarios, decreasing to six to seven times by 2090" (Australian Bureau of Meteorology and CSIRO, 2011).

## 4.3.3 Measures to manage impacts

## What measures are in place with respect to disaster preparedness and climate change?

There have been partnerships with the Australian Agency for International Development (AusAID) and the New Zealand Aid Programme (NZAID) along with the Pacific Adaptation to Climate Change project, to foster discussions toward a Joint National Action Plan for disaster risk management and climate change adaptation. The Cook Islands has an extensive Disaster Risk Management network and associated activities for mitigating the impacts of climate change. However, gender roles are not specifically or systematically addressed in these programmes; village Disaster Risk Management committees focus on infrastructure and welfare, but do not yet provide facilities for women and with their young children, and people living with disability.

# **5. INSTITUTIONAL, LEGAL AND POLICY FACTORS**

# 5.1 Institutional Setting

This section discusses the institutional arrangements and legislative and policies in place to address the various environmental issues in the Cook Islands, using a sector-based approach. It is also noted that gender-mainstreaming is addressed through the Cook Islands National Policy on Gender Equality and Women's Empowerment 2011–2016, which includes a strategic action plan with clear policy direction, prioritisation, and commitment to allocate resources for gender equality (Pacific Community 2015). Cook Islands is party to the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), which commits Cook Islands to ensure that women and men have equal rights in participation in the formulation of government policies, participation in NGOs and representation of their governments at the international level. The Beijing Declaration and Platform for Action states that the empowerment and autonomy of women and the improvement of women's social, economic, and political status are essential for the achievement of transparent and accountable government that works for the benefit of both women and men.

# 5.1.1 Sector-based Laws

## 5.1.1.1 Environment

The Environment Act 2003 establishes the National Environment Service and Island Environment Authorities, appointment of National Environment Officers, environmental impact assessments, protected areas, and convening of the Cook Islands Environment Forum and the National Environment Council. The Environment Act works with the Marine Resources Act and Cook Islands National Heritage Trust Act to protect and report on the ecological status of the Cook Islands.

## 5.1.1.2 Water

The Ministry of Works oversees all public services including providing water to the general public The Environment Act also protects, conserves, and manages the environment in relation to Cook Islands waters.

The Cook Islands National Integrated Water Resources Management (IWRM) Policy is intended to guide planning, actions, and efforts in ensuring the sustainable integrated water resources management across the Cook Islands. The IWRM policy addresses the management of water resources from ridge to reef, including groundwater resources; lakes, streams, and rivers; estuaries and wetlands; captured rain from rooftops; catchments; and lagoon and coastal waters. The draft policy recognises that "land-based activity is a significant factor impacting on water quality" and proposes coordinated IWRM practices that include management of activities in the terrestrial environment that impact on aquatic and marine habitats.

## 5.1.1.3 Coast

Coastal areas are protected under government legislations (Land Act and Marine Resources Act) and local level authorities. Traditional leaders have been significant in establishing and enforcing 'raui' or conservation areas within their various coastal communities. Under the Marine Resources Act (2005) the Ministry of Marine Resources is to oversee the sustainable use of living and non-living marine resources for the benefit of the people of the Cook Islands.

## 5.1.1.4 Land

Due to the very limited land mass in the Cook Islands, land management is an important issue. About 90% of Cook Islanders do not live in the Cook Islands. Yet many of these people retain rights over land even though some of these absentee landowners were born overseas and have never set foot in the Cook Islands. This includes both men and women who are non-residents but hold user rights to land (Crocombe et al. 2008). The Land use Act (1969) sees to issues regarding land degradation, sustainable land management, and land resource use and management. Land resource use and management are principal issues at the national planning level mainly due to the high level of competition to use the limited land resources to support the growing national economy. The governing body overseeing the implementation of the Land Act is the Land Use Board. Given the current situation for land use, the Cook Islands National Action Programme for Sustainable Land Management has recently been drafted to address land degradation in the Cook Islands.

## 5.1.1.5 Forest

The reporting framework for Forest Resource Assessment 2010 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes variables related to the extent, condition, uses and values of forest resources, as well as the policy, legal and institutional framework related to forests. The Cook Islands Ministry of Agriculture National Forest Policy was developed as a set of orientations and principles of action adopted by public authorities in harmony with national socio-economic and environmental policies to guide future decisions in relation to the management, use and conservation of forest and tree resources for the benefit of society (Food and Agriculture Organization of the United Nations 2021).

## 5.1.1.6 Agriculture

Under the Ministry of Agriculture Act 1978 the principal aim was to maximise the potential in agriculture. Absence of a land use policy and planning, coupled with a complicated land ownership system and the inability of government to enforce existing land laws, has led to progressive encroachment into agricultural land and increasing soil infertility.

## 5.1.1.7 Minerals

The Cook Islands has developed its national <u>Seabed Minerals Policy</u>. The purpose of the policy is to establish the rationale and vision for high level policies that will guide the planning and implementation of the Government's sustainable management of the deep-sea resources under the control of the Cook Islands and to enable the wise regulation of SBM activities.

It is the expectation of the Government that this document will assist:

- the Cook Islands community to engage with Government to seek to ensure that SBM activities are managed for the greatest national benefit;
- the private sector to make informed decisions about investing or participating in SBM activities; and
- to continue to build stakeholder confidence in the Government's management of SBM activities.

## 5.1.1.8 Disaster and Climate Change

Disasters and climate change related issues in the Cook Islands are addressed under the Disaster Risk Management Act (2007). Implementation of this act is carried out by the Ministry of Finance and Economic Management in accordance with the 'disaster management arrangement 2009'. Since the Aitutaki cyclone, the Disaster Risk Management Act has been updated in accordance with lessons learnt from the catastrophic event. The Climate and Disaster Compatible Development Policy 2013 – 2016 articulates directions that are inclusive of all peoples of the Cook Islands building on their community spirit to strengthen resilience to climate change and disasters whilst embracing a holistic approach. The fundamental message is to 'prepare today for tomorrow'.

Policy/Legislation Title	Year enacted	National Focal Institution	Coordination Mechanism
Environment Act	2003	National Environment Service	National Environment Service (NES)
Marine Resources Act	2005	Ministry of Marine Resources	The Ministry of Marine Resources (MMR)
Islands Government Act	2012-2013	Island Governments	Office of the Prime Minister (OPM)
Integrated Water Resources Management (IWRM) Policy	2010	IWRM Project	GEF/SOPAC
National Sanitation Policy	2013	IWRM Project	WATSAN

Table 7 captures relevant policies/legislation titles and the respective focal institutions.

## 5.2 Linkages between policies

The aforementioned policies complement each other through existing frameworks and plans that relate to issues in the ridge to reef system, conservation, and sustainable management. The National Environment Strategic Action Framework (NESAF) and the National Biodiversity Strategy and Action Plan (NBSAP) provide linkages and support for the policies and thematic areas. It is noted that the Cook Islands National Gender Policy strategies and focus areas should be considered across all policies and frameworks to ensure that women, youth, customary leaders, and other vulnerable members of communities are part of discussions, decision making and participate meaningfully in resource management.

The NESAF 2014–2019 is intended to support the implementation of the high-level national goals and priorities related to the environment in the National Sustainable Development Plan 2011–2015 and the Kaveinga Nui 2016–2020. The NESAF is intended to provide sector level focus for stakeholders and to establish strategic links to guide the operational level plans and priorities of a range of agencies and stakeholders in addressing the sustainability and resilience of the environment of the Cook Islands. The NESAF has four thematic areas:

- 1. Natural Resource Conservation, Use and Management;
- 2. Increasing Resilience to Climate Change;
- 3. Waste Management and Pollution Control; and
- 4. Governance, Management, Planning and Finance.

The National Environment Service (NES) is mandated under the Environment Act 2003 as the responsible authority for overseeing the implementation of the NESAF and NBSAP. The NBSAP is intended to conserve important plants and animals by positive action and sustainable use; and to reduce negative effects of invasive species. The NBSAP provides guidance and priority setting for biodiversity conservation in the country and helps to enable the Government and Island Councils to initiate and coordinate conservation and usage programmes to ensure an equitable sharing of responsibility and benefits. The Cook Islands Marine Park Framework lays out the principles, vision and expected outcomes for the Cook Islands Marine Park, which encompasses the entire southern half of the country's EEZ. The five expected outcomes over the long-term are a healthy environment, sustainable multiple use, maintenance and enhancement of values, integrated community-based management, and informed, involved and committed communities.

Tables 8 to 12 outline the objectives and tasks of each of the key environment policies/legislations.

Policy/Legislation Title	Environment Act
Coordinating Mechanism	National Environment Service (NES)
Objectives	<ul> <li>The Advisory &amp; Compliance Division is concerned with the provision of regulatory, technical, advisory, and monitoring requirements for environmental sustainability.</li> <li>The Island Futures Division is concerned with promoting integrated approaches to environmental management through appropriate policy development, planning responses and education and awareness.</li> <li>The Administration Division manages the Service through effective and efficient administration of management systems.</li> </ul>

Table 8: Coordinating mechanism, objectives, tasks, and activity areas of the Environment Act.

Policy/Legislation Title	Environment Act
Tasks	Provides for the protection, conservation, and management of the environment in a sustainable manner, and explicitly supports the conservation and management of Biodiversity through provisions to establish Protected Areas and regulate or prohibit activities within these protected areas.
	protect and report on the ecological status of the Cook Islands
Activity Areas	General Environment from ridge to reef

Table 9: Coordinating mechanism, objectives, tasks, and activity areas of the Marine Resources Act.

Policy/Legislation Title	Marine Resources Act
Coordinating Mechanism	The Ministry of Marine Resources (MMR)
Objectives	To ensure the sustainable use of living and non-living marine resources for the benefit of the people of the Cook Islands.
Tasks	Provides for the conservation, management and development of marine resourc- es and related matters. Protection and conservation of the natural resources of the fishery waters and the prevention of damage to the flora and fauna of the aquatic environment.
Activity Areas	Marine, fisheries, and coastal environment The MMR continues to support Ra'ui established on other islands such as Ai- tutaki and Manihiki and provides enforcement for by-laws established by island council. MMR has also drafted regulations to provide enforcement to Ra'ui sites designated by traditional leaders on Rarotonga.

Table 10: Coordinating mechanism, objectives, tasks, and activity areas of the Islands Government policy/legislation.

Policy/Legislation Title	Islands Government
Coordinating Mechanism	Office of the Prime Minister (OPM)
Objectives	To provide good, efficient, and effective governance for the island To decide on how best to promote the social, economic, cultural, and environ- mental well-being of the respective islands.
Tasks	It is the duty of Island Government to promote sustainable and environmentally friendly management practices in the management of island resources - includ-ing conservation and resource use decisions and policies.
Activity Areas	Respective islands

Table 11: Coordinating mechanism, objectives, tasks, and activity areas of the IWRM Policy.

Policy/Legislation Title	IWRM Policy	
Coordinating Mech- anism	GEF/SPC	
Objectives	To improve groundwater, freshwater and lagoon water quality using an IWRM framework and to gain information on the availability of groundwater for drought relief	
Tasks	This IWRM Policy addresses the management of water resources from 'ridge to reef' – that is, from the point that rain falls on our land to the point where water is returned to the ocean.	
Activity Areas	<ul> <li>Groundwater resources</li> <li>Lakes, streams, and rivers</li> <li>Estuaries and wetlands</li> <li>Captured rain from rooftops</li> <li>Catchments</li> <li>Lagoon and coastal waters</li> <li>This policy also focuses on themes including:</li> <li>Building resilience to climate change and natural disasters • Conservation of natural ecology</li> <li>Water conservation and responsible usage</li> </ul>	

Table 12: Coordinating mechanism, objectives, tasks, and activity areas of the National Sanitation Policy

Policy/Legislation Title	National Sanitation Policy
Coordinating Mecha- nism	Water, Waste & Sanitation Project - WATSAN
Objectives	To improve water quality through better sanitation measures
	• To ensure that domestic wastewater is treated safely, effectively and in a sustainable manner
	• To ensure that commercial and residential properties that provide tourist accommodation to use 'best practice' for wastewater and sanitation management Cook Islands Sanitation Policy
	• To ensure that commercial and residential animal farmers, particularly piggeries, to manage their animals in ways that minimise potential impacts on the environment

Policy/Legislation Title	National Sanitation Policy	
Tasks	<ul> <li>To work in conjunction with the IWRM policy to improve integrated water resources management across the country.</li> <li>Safe collection, treatment, and disposal of wastewater to an approved standard for:         <ul> <li>Domestic residential homes</li> <li>Commercial facilities including tourist accommodation</li> <li>Community and public buildings</li> <li>The promotion of appropriate practices for wastewater management.</li> </ul> </li> </ul>	
Activity Areas	<ul> <li>Safe disposal of sewage and other wastewater; and</li> <li>The promotion of health and hygiene practices in the Cook Islands</li> </ul>	

# 5.3 Multilateral Environmental Agreements

# How do policies and legislation relate to multilateral environmental agreements and how do countries meet their commitments to such MEAs? – national, regional, international

The main legal response to many environmental problems is by way of Multilateral Environmental Agreements (MEAs). Several important MEAs were entered into at the 1992 United Nations Conference on Environment and Development (UNCED, or the "Earth Summit"), which was held in Rio de Janeiro, Brazil. The Earth Summit produced five key documents on sustainable development issues): two "hard law" – the <u>Convention on Biological Diversity</u>, and the <u>Framework Convention on Climate Change</u>, which many Pacific island countries and territories have signed and ratified (see below); and three "soft law" – <u>the Rio Declaration</u>, <u>Agenda 21</u>, and <u>the Forest Principles</u>, which were adopted by consensus at Rio.

Name of Convention	Focus Area	National Focal Institution
Noumea Convention	Protection of natural resources and environment of the South Pacific region. Prevent, reduce, and control pollution	Secretariat of the Pacific Regional Environment Programme (SPREP)
Rotterdam Convention	The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans	Jointly served by United Nations Environment Programme (UNEP) and the Food and Agriculture Organization (FAO)
Basel Convention	is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous wastes from developed to less developed countries.	The Secretariat of this Convention is administered by United Nations Environment Programme (UNEP)
Waigani Convention	The Waigani Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Trans- boundary Movement and Management of Hazardous Wastes within the South Pacific Region	Secretariat of the Pacific Regional Environment Programme (SPREP)

Table 13: Major multilateral environmental agreements signed by Cook Islands

Note: MEA's relating to Biodiversity are found in Annex 4.

Countries formulate policies and laws, which are entirely domestic in origin and scope, but as with MEAs, there is a tendency towards harmonisation amongst countries as a result of benchmarking against international standards and in adopting best environmental practices and sharing lessons learned.

SPREP (the Secretariat of the Pacific Regional Environment Programme) assists countries with implementing their MEA obligations through activities such as negotiations training and provision of technical support for major MEA meetings. SPREP also acts as the Secretariat for two regional MEAs, the Noumea (marine pollution) and Waigani (transboundary movement of hazardous waste) Conventions. At the domestic level, SPREP assists with environmental legislative reviews, formulation of policy and drafting of environmental laws. These multilateral and regional agreements are also closely tied to international gender agreements that Cook Islands has ratified and to Pacific regional mechanisms. Forum Leaders maintain ultimate oversight of the Agenda 2030 and the sustainable development goals (SDGs) as reflected in their national plans, the SAMOA Pathway, the Framework for Pacific Regionalism, and the Pacific Leaders' Gender Declaration, through their collective regional and national leadership (Pacific Islands Forum Secretariat 2018). Environmental Agreements are agreements between states which may take the form of "soft-law", setting out non-legally binding principles, which parties will respect when considering actions that affect a particular environmental issue, or "hard-law" which specify legally binding actions to be taken to work toward an environmental objective.

# 5.4 Constraints and Limitations

## What are the capacity shortfalls in the context of the absence of appropriate institutional arrangements/bodies, human resources, equipment, etc.

With the recent realities of climate change, sea level rise, the vulnerability to cyclones and other hosts of environmental impacts, the Cook Islands has put much effort into resilience. The formulation of disaster risk management plans and climate change adaptation strategies are now becoming synonymous agendas when it comes to national planning.

One shortfall, if not the main one identified, would be human capital. As stated in the national progress report (2011–2013), part of the reason behind the failure to implement strategies is because of the lack of human resources. In simple terms, there is a lot of work to be done, but there are not enough human resources to head/manage the projects linked with these donor agencies. The bulk of funding is secured via United Nations and agencies of the Council of Regional Organisations of the Pacific (CROP). Bilateral funding from Australia and New Zealand makes up a portion of funding, while other sources include the Asian Development Bank.

The government has also placed incentives for businesses in the private sector for employing renewable energy schemes. Albeit no incentive exists now for disaster risk management (HFA Monitor 2012).

Lastly, there has been no significant moves by on government to show commitment towards its own Disaster Emergency Trust fund. This fund has a goal of \$500,000 in 2010 and may have increased to date. In addition to this, there is a need for more accountability regarding government's expenditure toward Disaster Risk Reduction. This would ensure that donor agencies know how funds are being used and for the desired purpose.

# 5.5 Public and Stakeholder Participation

Public and stakeholder participation tends to be generally gender and socially inclusive, covering all sectors of the communities and inclusion of men, women, customary chiefs, youths, and other vulnerable group at all levels of governance. A detailed analysis of the existing environmental NGOs and their level of formal participation in coordinating mechanisms and committees were not conducted under this study. However, experience from the Integrated Water resources Management (IWRM) project (2011–2015) showed the value of local organisations such as the Muri Environment Care (MEC) Group, who play a significant role in spearheading environmental awareness and engagement. The Muri village traditional mayor, the local member of parliament and a senior tribal leader are members of the MEC.

# 7. RESULTS: NATIONAL PRIORITY ISSUES

## 7.1 Key Problems, Sectors, and Immediate Causes

The following six environmental problems were identified as priority issues of concern during the cluster group discussions:

- i. Deterioration of water quality
- ii. Stress on ground and surface water resources
- iii. Deforestation, Riparian and Vegetation Clearance
- iv. Ecosystem Degradation near shore, terrestrial and surface water, inland flora and fauna, lagoon flora and fauna and wetlands
- v. Eutrophication
- vi. Solid and Liquid Waste Management

Tables 14 to 19 provide an overview of the identified environmental problems, along with the environmental and socioeconomic impacts as well as the identified causes of the existing problems.

Table 14:Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems and geographical location relating to the identified problem of deterioration of water quality.

1.	PROBLEM: Deterioration of water quality		
	Environmental Impacts	Socioeconomic Impacts	
•	Impacts on ecosystem health	Impacts on human health	
•	Loss of biodiversity in streams	Prevalence of disease/infection	
•	Impacts on marine biodiversity (decline in biodiversity, coral deaths, fish deaths, etc) Contamination – groundwater, lagoon	<ul> <li>Loss in labour productivity</li> <li>Decline in safe drinking water</li> <li>Loss of commercial revenue</li> </ul>	
	water, surface water	Decline in tourism	
•	Algal blooms	Decline and loss in marine resources	

1. PROBLEM: Deterioration of water quality		
Immediate causes	Underlying causes	
Overpopulation	Limited investment in sewage treatment system	
	Lack of capacity to build and design sewage treatment system	
	Lack of capacity to maintain sewage treatment system	
	• Insufficient numbers of tourists to outer islands due to expensive flights, insufficient marketing. This needs to be developed carefully and slowly.	
	Bodies working independently for their own interests	
	Lack of integrated planning	
	Affects coastal development	
Too many nutrients in coastal	Soil Erosion	
waters and waterways – PO4, NO3, NH4	Domestic animals and strays	
	Livestock waste	
	Inadequate wastewater treatment standards	
	Lack of collection of stormwater	
Pesticides contaminants POPs	Soil erosion	
	Roading	
	Forest clearance for housing	
	<ul> <li>Various contaminants - Solid waste, pesticides, and POPs (persistent organic pollutants)</li> </ul>	
	Ineffective waste management	
	Lack of awareness	
	Lack of trust in recycling system	
Sewage	Ineffective sewage treatment systems	
	Inappropriate design of sewage treatment systems.	
	Lack of system maintenance	
	Regulation too stringent	
	Limited capacity	
	Limited enforcement in proper disposal and waste management	
	Limited public awareness	

PROBLEM: Deterioration of water quality				
Immediate causes	Underlying causes			
Stress on surface and groundwate resources	<ul> <li>Limited storage</li> <li>Climate</li> <li>Too many people</li> <li>Lack of the local appreciation of water. There would be more efficient usage of water supplies if there was more appreciation for it.</li> <li>Limited rooftop rainfall collection. Previously rooftop rainfall collection was too expensive for homeowners, so they weren't required to collect water. Also, there wasn't much water demand from hotels.</li> <li>Water is free</li> <li>Lack of awareness – ineffective education campaigns</li> </ul>			
ROOT CAUSES				
<ul> <li>Inadequate infrastructure</li> <li>No overarching policy to guide</li> <li>No national vision</li> <li>Irregular and inconsistent policy</li> <li>Poor farm management pract</li> <li>Low priority on environmenta</li> <li>Lack of community awareness</li> <li>Poor planning</li> <li>Poor enforcement</li> <li>Overuse and misuse of water</li> </ul>	y review as development progresses res, poor awareness impact of farming			
Linkage to other Environmental P	oblems Geographical Location			
<ul> <li>Health Issues – water borne d</li> <li>Affects schools, accommodati</li> <li>Low productivity for agricultu</li> <li>Harmful algal bloom</li> </ul>	seases/poor sanitation Nuri Parengaru Tikioki Totokoitua			
Key sectors contribution to proble	n			
<ul> <li>Agriculture</li> <li>Tourism accommodation</li> <li>Poor infrastructure – drainage</li> <li>Chemical (house hold data</li> </ul>				
Chemical/household deterger	S			

Table 15: Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of stress on ground and surface water resources.

2.	2. PROBLEM: Stress on ground and surface water resources						
	Environmental Impacts	Socioeconomic Impacts					
•	Decline in water quality Reduced availability of safe drinking water Decline in ecosystem health	<ul> <li>Decline in water supply – particularly for households</li> <li>Decline in availability of safe drinking water</li> <li>Increase in prevalence of disease and infection for human and aquatic life</li> </ul>					
	Immediate Causes	Underlying causes					
•	Affects farming/revenue loss	Livestock farming					
•	Affects tourism/surface water main source	Chemical storage leaks into groundwater					
•	Local people affected	• Leaking of old dump sites into the ground					
•	Insufficient rooftop collection of rainwater for domestic and commercial use	• Degradation of land and marine life					
	Key sectors contributing to problem	Geographical Location					
		Geographical Eocation					
•	Agriculture	Avana (VP in the hills)					
•	Agriculture Tourism – numbers	Avana (VP in the hills)					
•	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe	Avana (VP in the hills)					
• • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation	Avana (VP in the hills)					
• • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction	Avana (VP in the hills)					
• • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction Root Causes	Avana (VP in the hills)					
• • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction Root Causes Poor infrastructure and building designs	Avana (VP in the hills)					
• • • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction <b>Root Causes</b> Poor infrastructure and building designs Poor drainage systems	Avana (VP in the hills)					
• • • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction <b>Root Causes</b> Poor infrastructure and building designs Poor drainage systems Inadequate waste treatment facilities and reso	Avana (VP in the hills)					
• • • •	Agriculture Tourism – numbers Communities - Unreported leaking pipes deterioration of water pipe Tourism - accommodation Infrastructure/Construction <b>Root Causes</b> Poor infrastructure and building designs Poor drainage systems Inadequate waste treatment facilities and reso Lack of enforcement	Avana (VP in the hills)					

Table 16: Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of deforestation, riparian, and vegetation clearance.

<b>3.</b>	3. PROBLEM: Deforestation, Riparian and Vegetation Clearance					
Env	vironmental Impacts	Soci	ioeconomic Impacts			
•	Increase sedimentation	•	Sedimentation – food stocks lagoon			
•	Increase in erosion	•	Loss of good topsoil			
•	Change in terrain	•	Water loss			
•	Changes in flora and fauna	•	Loss of natural erosion protection – trees,			
•	Impact on groundwater		vegetation needs to be replaced with			
•	Catchment	•	Increased flooding massive costs to homes			
•	Increase in surface flooding		and infrastructure			
•	Loss of grass along streams and wetlands	•	Degraded lagoon/landscape – loss of native			
•	Erosion		trees and species			
•	Loss of nutrient sink					
•	Coastal tree removal – coastal erosion					
•	Reduction of trees – impact on hydrological cycle					
Im	nediate Causes	Und	lerlying Causes			
	Site clearance, invasive species, sedimentation					
•	Site clearance, invasive species, sedimentation	•	Housing development – slopes – increased			
•	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs (products	•	Housing development – slopes – increased roads, commercial properties			
•	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products	•	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry			
•	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land	•	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial			
•	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land	•	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain			
• •	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land	• • •	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land			
• • Lin	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land kage to other Environmental Problems	• • • Geo	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land graphic Locations			
• • Lin	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land kage to other Environmental Problems Loss of flora and fauna Impact on groundwater catchment	• • • Geo	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land <b>graphic Locations</b> Lagoons, streams, inland slopes, wetlands, water catchments, coastal strips, and flood			
• • Lin •	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land kage to other Environmental Problems Loss of flora and fauna Impact on groundwater catchment Sedimentation of lagoon – destroys coral and fish	• • • • •	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land <b>graphic Locations</b> Lagoons, streams, inland slopes, wetlands, water catchments, coastal strips, and flood plains			
• • Lin •	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land kage to other Environmental Problems Loss of flora and fauna Impact on groundwater catchment Sedimentation of lagoon – destroys coral and fish life	• • • • •	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land <b>graphic Locations</b> Lagoons, streams, inland slopes, wetlands, water catchments, coastal strips, and flood plains			
• • • • • •	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land Kage to other Environmental Problems Loss of flora and fauna Impact on groundwater catchment Sedimentation of lagoon – destroys coral and fish life Introduced invasive species (more dominant e.g., creepers, albizia, ornamental palms (spread by pigeons)	• • Geo	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land <b>ographic Locations</b> Lagoons, streams, inland slopes, wetlands, water catchments, coastal strips, and flood plains			
• • • • •	Site clearance, invasive species, sedimentation Increase use of native timber for tourism souvenirs /products Solar farms – clearing land kage to other Environmental Problems Loss of flora and fauna Impact on groundwater catchment Sedimentation of lagoon – destroys coral and fish life Introduced invasive species (more dominant e.g., creepers, albizia, ornamental palms (spread by pigeons) Coastal tree removal – coastal erosion	• • Geo	Housing development – slopes – increased roads, commercial properties Local entrepreneurship – opportunity to make money from tourism industry Solar energy – opportunity for commercial gain Competition for land <b>graphic Locations</b> Lagoons, streams, inland slopes, wetlands, water catchments, coastal strips, and flood plains			

3.	PROBLEM: Deforestation, Riparian and Vegetation Clearance
Key	y sectors contributing to problem
•	Unplanned expansion inland and coastal strips
•	Growth in population in urban areas for better opportunities
•	Tourism
•	Housing
Fo	restry

Table 17: Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of near shore, terrestrial and surface water, inland flora and fauna and wetlands ecosystem degradation.

# 4. PROBLEM: Ecosystem Degradation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flora and fauna and wetlands

Environmental Impacts	Socioeconomic Impacts
<ul> <li>Inland – water quality</li> <li>Loss of flora and fauna</li> <li>Algal blooms</li> <li>Decline in marine resources</li> </ul>	<ul> <li>Decrease in water quality</li> <li>Decrease in food sources/agriculture/kaura</li> <li>Health problems – increase in NCDs</li> <li>Loss of taro patches</li> <li>Decrease in food, health, exercise, and culture</li> <li>Lagoon – loss of species and decrease in food source</li> <li>Loss of tourism income, loss in labour productivity</li> <li>Prevalence of disease and infection</li> </ul>
Immediate Causes	Underlying Causes
	<ul> <li>Ignorance – neople cut down valuable trees because</li> </ul>
<ul> <li>Loss of Valuable trees – reduced coastal protection</li> <li>Agriculture – piggeries pollution</li> <li>Lagoon food basket – almost gone <ul> <li>reduced species</li> <li>ciguatera (marine pollution)</li> </ul> </li> <li>Invasive species – competition for survival – bottle vine and mile a minute</li> </ul>	<ul> <li>Ignorance – people cut down valuable trees because they don't understand the usefulness and role in coastal protection etc</li> <li>Demand, tariff protection</li> <li>Increased users of lagoon</li> <li>Multiple unplanned changes - waste water, sedimentation</li> <li>Inland – albizia, bottle vine invasion</li> <li>Uplands</li> <li>Wetlands – Sedimentation etc – reduced water.</li> <li>Lagoon environment – fish poisoning, species loss</li> </ul>
<ul> <li>Loss of Valuable trees – reduced coastal protection</li> <li>Agriculture – piggeries pollution</li> <li>Lagoon food basket – almost gone         <ul> <li>reduced species</li> <li>ciguatera (marine pollution)</li> </ul> </li> <li>Invasive species – competition for survival – bottle vine and mile a minute</li> </ul>	<ul> <li>Ignorance – people cut down valuable trees because they don't understand the usefulness and role in coastal protection etc</li> <li>Demand, tariff protection</li> <li>Increased users of lagoon</li> <li>Multiple unplanned changes - waste water, sedimentation</li> <li>Inland – albizia, bottle vine invasion</li> <li>Uplands</li> <li>Wetlands – Sedimentation etc – reduced water.</li> <li>Lagoon environment – fish poisoning, species loss</li> </ul>

- Infrastructure
- Commercial sector
- Tourism

• Increased demand for land, housing, commercial activities

4. PROBLEM: Ecosystem Degradation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flora and fauna and wetlands

Root Causes - Social, Economic, Legal Institutional and Political

- Tourism and population growth
- Growth of commercial operations
- NES ETA regulations
- Unplanned expansion no urban planning and land use zones
- Increasing and new demand for land
- Land tenure complex mix of traditions in a new setting
- Agriculture sector policy 'confusion', viability cheap imports

Table 18: Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of eutrophication.

5. PROBLEM: Eutrophication				
Environmental Impacts	Socioeconomic Impacts			
Algal bloom	• Tourism			
Groundwater contamination	Commercial business decline			
Lagoon water contamination	Community affected / food source/ income			
Marine life/ecosystem affected	Negative publicity/ social media			
Stormwater runoff	Imported chemicals			
Immediate Causes	Underlying Causes			
<ul> <li>Increased use of unsafe and contaminated water</li> <li>Heavy rainfall and flooding</li> </ul>	<ul> <li>Climate change</li> <li>Pesticides/Weedicide use</li> </ul>			
Stormwater pollution	Septic seepages			
·	Poor wastewater management			
	Bad drainage systems			
Linkage to other environmental problems	Geographical Locations of impacts			
<ul> <li>Nutrients 'leaked' into streams / swamps due to bad practice (Tikioki/Arapuao), lessons learned</li> <li>Regulations for piggeries to be strengthened</li> </ul>	<ul> <li>Muri</li> <li>Tikioki</li> <li>Mave (Edgewater)</li> <li>Rutaki (Rarotongan)</li> </ul>			
Root Causes				
Poor building construction/infrastructure				
Bad farming and land use practices				
Lack of proper EIAs before building and development	opment projects			

- Tourism influx
- Lack of expertise and enforcement on sustainable development practices

#### 5. PROBLEM: Eutrophication

#### Key sectors contributing to problem

- Tourism
- Agriculture
- Infrastructure
- Communities

Table 19: Environmental and socioeconomic impacts, immediate and underlying causes, root causes, linkage to other environmental problems, and geographical location relating to the identified problem of solid and liquid waste management.

	5. PROBLEM: Solid and Liquid Waste Management				
Env	vironmental Impacts	Socioeconomic Impacts			
• • • •	Algae bloom Groundwater contamination Lagoon water contamination Marine life/ecosystem affected Stormwater runoff Non degradable products do not degrade	<ul> <li>Lack of knowledge / public awareness on imported products (used oil, batteries, waste oil)</li> <li>Stench pollution to environment</li> <li>Affects Tourism industry</li> <li>Disease outbreaks</li> </ul>			
Im	mediate Causes	Underlying Causes			
• • •	Lack of awareness Flooding and inundation Heavy rainfall Ignorance of communities and households Climate change	<ul> <li>Poor drainage systems – commercial and domestic</li> <li>Poor septic constructions</li> <li>Insufficient drainage and treatment</li> <li>Lack of compliance</li> </ul>			
Linkage to other environmental problems		Geographical location of impacts			
•	Increase of market vendors	<ul><li>All markets</li><li>Rarotonga</li></ul>			
KO	ot causes				

- Lack of proper planning infrastructure/developments
- Lack of proper consultations
- Natural disasters
- Over population of coastal areas
- Lack of firm enforcement

#### Key Sectors contributing to problem

- Communities
- Tourism
- Municipality

# 8. OPTIONS FOR REFORM AND ACTION

"The ultimate success of projects and initiatives to combat pollution throughout the Pacific relies on empowering island populations to better manage the problems themselves. It's not enough to give them equipment, show them how to use it and then leave them to it. The key to making real change is to upskill the people, to build their knowledge and understanding. That's quite an iterative process, and one that takes time." (Dr. Julie Hall, NIWA regional manager).

Options and actions proposed will be gender and socially inclusive, considering the priorities and needs of all sectors of communities, including men, women, youths, traditional leaders, and other vulnerable sectors of the communities.

Table 20 presents the highlighted issues and options for reform, for the way forward.

Table 20: Identified options for reform of each environmental problem.

PROBLEM	OPTIONS FOR REFORM
Deterioration of water quality	1. Reviewing of policies
	2. People taking ownership of the environmental issues, ensuring that viable and appropriate long-range plans are followed
	3. Improved water management
	4. Capacity building - lack of capacity and expertise including human and technical resources in the water sector, both government and private sector.
Stress on ground and surface	1. Groundwater remediation
water resources	2. Subsistence and commercial food supply mapping and planning
	3. Ensuring that appropriate awareness is mainstreamed within the knowledge pools
Deforestation, Riparian and Vege-	1. Long-term planning of forest resources
tation Clearance	2. Ongoing trainings and capacity building - provide training to staff of the Ministry of Agriculture, and to farmers' organizations and individual; and training on methods to reduce water runoff and settle sediments before they enter streams.
	3. Cultivation of crops such as bananas and other plants, which will significantly reduce soil erosion and the flow of sediments downstream into the Muri Lagoon.
	4. Ensuring that community-level decision-makers are given the knowledge and the right tools to make informed decisions
Ecosystem Degradation – near	1. Long-term planning
shore, terrestrial and surface wa-	2. Empowering community level decision makers
ter, inland flora and fauna, lagoon flora and fauna and wetlands	3. Coral reef restoration to restore natural breakwater functions, dissipating wave energy
	4. Mangrove afforestation, reforestation, restoration, conservation as a natural buffer

Eutrophication	1. Amendments and standardizing building and construction laws (review of operations & infrastructure)
	2. Composting
	3. Cap on waste discharge (fertilizers, sewage, wastewater etc) - Big companies, tourism sector and municipalities ought to reduce pollution and desist from discharging waste into water systems so as to reduce the amount of toxins and nutrients ending up in the waters
Solid and Liquid Waste Manage-	1. Site containment
ment	2. Amendments and standardizing building and construction laws
	3. Government investment into facilities and technical expertise
	4. Strengthening laws and regulations against non-point water source pollution

# 9. RECOMMENDATIONS

- 1. There is a need for review and support for pilot testing of water quality, monitoring for agricultural chemicals (pesticides) and analysis to determine if these are having a significant negative impact on the lagoon or reefs. Ground truth results and data through necessary socioeconomic and biological assessments and environmental impact assessments (EIAs).
- Reviewing of policies and stronger enforcement measures harsher penalties and fines on companies and institutions that illegally discharge waste into the lagoon and coastal areas.
- 3. Reduced use of fertilisers; and increased controls/penalties for animal waste and septic seepages from communities and households.
- 4. Targeted, gender and socially inclusive awareness workshops/materials and capacity building (on a consistent basis) is necessary particularly for resource users, landowners, tourism operators and other stakeholders. This should be conducted by the relevant authorities with information and current statistical evidence. Government investment into facilities/resources and technical expertise.
- 5. Transparency and close collaborations between stakeholders are pivotal for addressing the existing environmental and socioeconomic problems and to strengthen the use of R2R approaches in the policy, regulatory and institutional frameworks governing land and resource use in the Cook Islands. Collaboration between stakeholders to include women, youth, and other vulnerable groups in communities.
- Tax incentives or disincentives on imported eco-tourism products, for example a rebate on environmentally friendly products (bicycles, solar systems, sewage systems, etc.) and/or higher taxes on environmentally harmful products (e.g., quad bikes that degrade remote areas).
- 7. Building laws there is perhaps a need for technical and administrative expertise on infrastructure and standardisation of building and construction laws for cyclone resistance and for minimising of wastewater and septic discharges into the environment.

Table 21: Identified environmental problems and relevant aspects for decisions makers

	Deterioration of water quality	Stress on ground and surface water resources	Deforestation, Ri- parian and Vege- tation Clearance	Ecosystem Deg- radation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flo- ra and fauna and wetlands	Eutrophication	Solid and Liquid Waste Manage- ment
Key sectors con- tributing to the problem	<ul> <li>Agriculture</li> <li>Tourism accommodation</li> <li>Poor infrastructure- drainage</li> <li>Chemical/ household detergents</li> </ul>	<ul> <li>Agriculture</li> <li>Tourism – numbers</li> <li>Communities         <ul> <li>Unreported leaking pipes deterioration of water pipe</li> </ul> </li> <li>Tourism - accommodation</li> <li>Infrastructure/ Construction</li> </ul>	<ul> <li>Unplanned expansion inland and coastal strips</li> <li>Growth in population</li> <li>Tourism</li> <li>Housing</li> <li>Forestry</li> </ul>	<ul> <li>Agriculture</li> <li>Infrastructure</li> <li>Commercial sector</li> <li>Tourism</li> <li>Increased demand for land, housing, commercial activities</li> </ul>	<ul> <li>Tourism</li> <li>Agriculture</li> <li>Infrastructure</li> <li>Communities</li> </ul>	<ul> <li>Communities</li> <li>Tourism</li> <li>Municipality</li> </ul>

	Deterioration of water quality	Stress on ground and surface water resources	Deforestation, Ri- parian and Vege- tation Clearance	Ecosystem Deg- radation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flo- ra and fauna and wetlands	Eutrophication	Solid and Liquid Waste Manage- ment
Linkage to other environmental problems	<ul> <li>Health Issues <ul> <li>water borne</li> <li>diseases/poor</li> <li>sanitation</li> </ul> </li> <li>Affects schools, <ul> <li>accommodation –</li> <li>closures</li> </ul> </li> <li>Low productivity <ul> <li>for agriculture</li> </ul> </li> <li>Harmful algal <ul> <li>bloom</li> </ul> </li> </ul>	Not specified	<ul> <li>Loss of flora and fauna</li> <li>Impact on groundwater catchment</li> <li>Sedimentation of lagoon – destroys coral and fish life</li> <li>Introduced invasive species (more dominant e.g., creepers, albizia, ornamental palms (spread by pigeons)</li> <li>Coastal tree removal – coastal erosion</li> </ul>	Not specified	<ul> <li>Nutrients 'leaked' into streams / swamps due to bad practice (Tikioki/Arapuao), lessons learned</li> <li>Regulations for piggeries to be strengthened</li> </ul>	Increase of market vendors

	Deterioration of water quality	Stress on ground and surface water resources	Deforestation, Ri- parian and Vege- tation Clearance	Ecosystem Deg- radation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flo- ra and fauna and wetlands	Eutrophication	Solid and Liquid Waste Manage- ment
Geographical loca- tion of impacts	<ul> <li>Muri</li> <li>Parengaru</li> <li>Tikioki</li> <li>Totokoitua</li> </ul>	Avana	Not specified	Not specified	<ul> <li>Muri</li> <li>Tikioki</li> <li>Mave (Edgewater)</li> <li>Rutaki (Rarotongan)</li> </ul>	<ul><li> All markets</li><li> Rarotonga</li></ul>
Ridge-to-reef con- tinuum affected	<ul> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>	<ul> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>	<ul> <li>Hills and Mountains - plantations</li> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>	<ul> <li>Hills and Mountains - plantations</li> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>	<ul> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>	<ul> <li>Waterways</li> <li>Populated Areas</li> <li>Coral reefs/ Lagoons</li> </ul>

	Deterioration of water quality	Stress on ground and surface water resources	Deforestation, Ri- parian and Vege- tation Clearance	Ecosystem Deg- radation – near shore, terrestrial and surface water, inland flora and fauna, lagoon flo- ra and fauna and wetlands	Eutrophication	Solid and Liquid Waste Manage- ment
Relevant institu- tional legal factors	<ul> <li>IWRM Policy (GEF/SOPAC)</li> <li>Environment Act (National Environment Service [NES])</li> <li>Marine Resources Act (The Ministry of Marine Resources [MMR])</li> </ul>	<ul> <li>IWRM Policy (GEF/SOPAC)</li> <li>Environment Act (National Environment Service [NES])</li> <li>Marine Resources Act (The Ministry of Marine Resources [MMR])</li> </ul>	<ul> <li>IWRM Policy (GEF/SOPAC)</li> <li>Islands Government (Office of the Prime Minister)</li> <li>Environment Act (National Environment Service [NES])</li> <li>Land Use Act (1969)</li> <li>Cook Islands Ministry of Agriculture National Forest Policy</li> <li>Forest Resource Assessment (2010)</li> </ul>	<ul> <li>IWRM Policy (GEF/SOPAC)</li> <li>Islands Government (Office of the Prime Minister)</li> <li>Environment Act (National Environment Service [NES])</li> <li>Marine Resources Act (The Ministry of Marine Resources [MMR])</li> <li>Land Use Act (1969)</li> <li>Cook Islands Ministry of Agriculture National Forest Policy</li> </ul>	<ul> <li>IWRM Policy (GEF/SOPAC)</li> <li>Islands Government (Office of the Prime Minister)</li> <li>Environment Act (National Environment Service [NES])</li> <li>Marine Resources Act (The Ministry of Marine Resources [MMR])</li> <li>National Sanitation Policy (WATSAN)</li> </ul>	<ul> <li>Islands Government (Office of the Prime Minister)</li> <li>National Sanitation Policy (WATSAN)</li> </ul>

The diagnostic analysis of the environmental problems in the Cook Islands involves identification and quantification of data collected from the relevant expertise and stakeholders in the IDA workshop. Priorities are then identified in a holistic approach due to the cross-sectoral nature of the analysis.

Table 21 outlines the environmental problems identified with key sectors contributing to the problem, linkage to other environmental problems, geographical location of impacts, R2R continuum affected and relevant institutional legal factors. There are detailed below.

# 9.1 Key Sectors Contributing to the Problem

Tourism is the most common sector contributing to all the six identified environmental problems, followed by agriculture and infrastructure related issues (such as poor drainage, deterioration of utilities like water pipes, construction, and unplanned expansions). Less common contributing factors include waste management in communities and pollutants such as chemical/household detergents.

# 9.2 Linkage to other environmental problems

The six environmental problems from the IDA workshop all had unique answers in terms of the "linkages to other environmental problems" noting that neither "stress on ground and surface water resources" nor "ecosystem degradation" had any answers.

In the context of this workshop, "linkages to other environmental problems" refers to problems that were separate and not related to the primary six environmental problems. Deterioration of water quality was linked to health issues (water borne diseases), closures of schools and accommodation facilities, low productivity for agriculture, and harmful algal blooms. Deforestation, riparian, and vegetation clearance is linked to loss of flora and fauna, impacts on groundwater catchments, sedimentation into lagoons, introduction of invasive species and coastal erosion. Eutrophication is linked to leakage of nutrients into streams and, solid and liquid waste management is affected by an increase in market vendors.

# 9.3 Geographical location of impacts

The most common geographical locations to be impacted by the six identified environmental problems were Muri and Tikioki. Other locations impacted were Parengaru, Totokoitua, Avana, Mave and Rarotonga.

Muri and Tikioki were affected by two out of the six environmental problems namely: deterioration of water quality and ecosystem degradation. The rest of the geographical locations were impacted by one of six of the identified environmental problems (refer to Table 21).

# 9.4 Ridge-to-reef continuum

The ridge-to-reef continuum was separated into hills and mountains (plantations), waterways, populated areas, and coral reefs/lagoons. In these areas, all six of the environmental problems had focused impacts on waterways, populated areas, and coral reefs/lagoons. Deforestation, riparian, and vegetation clearance; and ecosystem degradation were the two environmental problems out of the six in the diagnostic analysis that included the hills and mountains (plantations) (in addition to the rest of the continuum). With the diagnostic workshops carried out and data collected, it is undoubtedly certain that all six of the identified environmental problems affect the ridge-to-reef continuum and are cross-sectoral in nature.

# 9.5 Relevant institutional legal factors

Acts, policies, and mechanisms relevant to the environmental problems are outlined in Table 21.

- The IWRM Policy, the Islands Government Policy and the Environment Act were found to be relevant to five out of the six environmental problems.
- The Marine Resources Act was relevant to four out of the six environmental problems.
- The National Sanitation Policy, Cook Islands Ministry of Agriculture National Forest Policy, and Land Use Act (1969) was relevant to two out of the six environmental problems.
- The Forest Resource Assessment (2010) was relevant and specific to one environmental problem (deforestation, riparian, and vegetation clearance) out of the six.

The above information could inform decision makers in enacting of adequate policies that fit in current legislations. The consideration of the inclusion of the Gender Policy when working with Environmental Legislations is suggested.

# REFERENCES

Australian Bureau of Meteorology and CSIRO. 2011. Climate change in the Pacific: scientific assessment and new research. Volume 2. Country Reports. Commonwealth Scientific and Industrial Research Organisation, Australian Bureau of Metereology . Retrieved from https://www.pacificclimatechangescience.org/wp-content/uploads/2013/09/Volume-2-country-reports.pdf

Campbell I. B. 1982. Soils of Atiu, Cook Islands. New Zealand Soil Survey Report, 54.

- Carruthers P. 2009. Cook Islands Coastal Vulnerability Assessments: A Small Pacific Island Nation's Experience. Rarotonga, Cook Islands: Pacific Island Climate Change Assistance Program, Environment Service.
- Clement H. and Bourget L. 1992. Outline scheme for water development and management. Unpublished WMI report. Rarotonga: Ministry of Works.
- Cook Islands South Pacific. 2021. Cook Islands South Pacific. Retrieved from https://www.cookislands.org.uk/
- COP23 Fiji: UN Climate Change Conference. 2017. Retrieved from https://cop23.com.fj/cookislands/
- Crocombe R., Tongia M. and Araitia T. 2008. Absentee landowners in the Cook Islands: consequences of change to tradition. Secretariat of the Pacific Regional Environment Programme (SPREP).
- Fact Sheet Cook Islands. 2007. Gender Responsiveness Development for Food Security. Food and Agriculture Organization of the United Nations.
- Food and Agriculture Organization of the United Nations. 2021. Global Forest Resources Assessments.
- Friends I. 2004. Cook Islands priority environmental problems (PEC) report: a review and assessment of the priority environmental concerns. Secretariat of the Pacific Regional Environment Programme (SPREP).
- Guinotte J.M., Buddemeier, R.W. and Kleypas J.A. 2003. Future coral reef habitat marginality: temporal and spatial effects of climate change in the Pacific basin. Coral Reefs, 22, 551-558. doi:10.1007/s00338-003-0331-4
- HFA Monitor. 2012. National progress report on the implementation of the Hyogo Framework for Action (2011 2013) Interim.
- Hunnam P. 2013. Review of The International Climate Change Adaptation Initiative Pacific Programs in Climate Science and Adaptation Planning 2008 - 2013. Pacific Climate Change Program, Pacific Adaptation Strategy Assistance Program, Pacific-Ausralia Climate Change Science and Adaptation Program.
- IUCN. 2012, November 15. IUCN supports Cook Islands to create world's largest marine park. Gland, Switzerland. Retrieved from https://www.iucn.org/fr/node/12710
- IW:LEARN. 2021, May 7. About Us: Transboundary Diagnostic Analysis (TDA). Retrieved from UNDP/GEF Yellow Sea Project: http://yslme.iwlearn.org/about-us/transboundary-diagnosticanalysis-tda#:~:text=A%20Transboundary%20Diagnostic%20Analysis%20(TDA,both%20 environmental%20and%20economic%2C%20assessed.

- Lacanivalu L. 2016, November 21. Pacific Islands Report. Retrieved May 7, 2021, from Top Stories: http://www.pireport.org/articles/2016/11/21/algae-problem-cook-islands-lagoon-likelycaused-groundwater-runoff
- Lynch P. 2015, March 17). Global Island News. Retrieved November 20, 2017, from Global Island News Website: http://globalislandnews.com/deep-sea-mining-in-the-cook-islands/
- Marae Moana: Marine Park Map. 2021. Retrieved from Marae Moana: https://www.maraemoana. gov.ck/about-marae-moana/marine-park-map/
- MataioJ. and Syed S. 1993. Agriculture in the Cook Islands: New Direction. Insititute of Pacific Island Studies, The University of the South Pacific, Cook Islands Centre, Rarotonga and Suva.
- McCormack G. 2002. Cook Islands biodiversity strategy and action plan (NBSAP). Tonga: Cook Islands Government.
- McKean J. and Baisyet P. 1994. Watershed management of the Islands of the South Pacific: Tonga, Cook Islands, Pohnpei (Federated States of Micronesia) Palau. Field Document No. 5 November 1994, UNDP/FAO South Pacific Forestry Development Programme, RAS/92/361, USDA Forest Service.
- Myers N., Mittermeier R.A., Mittermeier C.G., da Fonseca G.A. and Kent J. 2000. Biodiversity hotspots for conservation priorities. Nature, 403, 853-858.

National Environment Service: Tu'anga Taporoporo Cook Islands. 2021. Protected Areas.

- N'Yeurt A. 1999. A Preliminary Illustrated Field Guide to the Common Marine Algae of the Cook Islands (Rarotonga and Aitutaki). Rarotonga: World Wide Fund for Nature.
- Pacific Community. 2007. Country Information. Retrieved May 7, 2021, from Cook Islands: http:// www.pacificwater.org/pages.cfm/country-information/cook-islands.html
- Pacific Community. 2015. Cook Islands 2012 Gender Profile. Noumea, New Caledonia.
- Pacific Islands Forum Secretariat. 2018. The Pacific Roadmap for Sustainable Development.
- Parakoti B. and Davie T. 2007. National Integrated Water Respurce Management Diagnostic Report. SOPAC.
- Passfield K. and Rongo T. 2011). Cook Islands 4th National Report to the Convention on Biological Diversity 2011. (Edited by Brider J., Munro E., and Temata T.)
- Pulea M. 1992. Strengthening Environment Management Capabilities in Pacific Island Developing Countries: Cook Islands Review of Environmental Law. South Pacific Regional Environment Programme.
- Sharma K.L. 2007. Public sector downsizing in the Cook Islands: some experience and lessons. University of the South Pacific, School of Economics.
- SOPAC. 2007. Integrated Water Resources Management in Pacific Island Countries: A Synopsis. Fiji: Dreamwise Limited.
- Space J. C. and Flynn T. 2002. Report to the Government of the Cook Islands on invasive plant species of environmental concern. Honolulu: USDA Forest Service.

- SPREP. 2014. Decision support tools for climate-resilient coastal development: A case study from the Cook Islands Pacific Adaptation to Climate Change (PACC) project. Apia: SPREP Library.
- SPREP. 2018. Cook Islands : Review of Natural Resource and Environment Related Legislation. Apia, Samoa.
- SPREP. 2020. Cook Islands State of the Environment Report 2018. Cook Islands National Environment Service.
- Sykes B. 2016. Flora of the Cook Islands. Kalaheo, Kaua'i, Hawai'i: National Tropical Botanical Gardens.
- Teariki Rongo, J.R. 2002. Environmental Impact Assessment Report for the Rakahanga, Tukao and Tauhunu harbour development project. An Island Friends Report funded by NZODA.
- Teina R., Evans J., Passfield K., Cramp J., Sudek M., Tautu B., . . . Hanchard B. 2013. Cook Islands Marine Park: coral reef survey of Aitutaki, Manuae, Mitiaro, Takutea, and Atiu in the southern Cook Islands. Government of the Cook Islands.
- Wood B. L. and Hay R. F. 1970. Geology of the Cook Islands. 82, 103.
- World Health Organization and UN-Water. 2014. UN-water global analysis and assessment of sanitation and drinking-water (GLAAS) 2014 report. Geneva, Switzerland: WHO Document Production Services.
## ANNEX 1:

### Guiding material for the IDA workshop

#### i. Preliminary list of environmental problems for the Cook Islands

Water systems	Exploitation of resources (liv- ing/non-living)	Global changes	Habitat and community modification	Pollution
Deterioration of water quality	Decline in com- mercial fish stocks	Coastal erosion	Habitat and biodi- versity changes	Eutrophication
Changes in hydro- logical flow	Deforestation	Changes in hydro- logical cycles	Invasive species	Microbiological
Stress on ground and surface water resources	Deterioration of soil productivity	Increase in cata- strophic events	Land degradation	Solid and liquid waste manage- ment
		Flooding	Ecosystem degra- dation (nearshore, terrestrial, surface water)	Suspended solids
		Sea level changes		

#### ii. Criteria for prioritising environmental problems

Criteria	Weighting (1 – 4)
Whole-of-island nature of a problem – geographical and temporal scale.	<ol> <li>1 = no importance</li> <li>2 = low importance</li> <li>3 = moderate importance</li> <li>4 = high importance</li> </ol>
Future risk of the problem – (in 10 years)	<ol> <li>1 = no importance</li> <li>2 = low importance</li> <li>3 = moderate importance</li> <li>4 = high importance</li> </ol>
Relationship with other environmental problems.	<ol> <li>1 = no importance</li> <li>2 = low importance</li> <li>3 = moderate importance</li> <li>4 = high importance</li> </ol>
Expected multiple benefits that might be achieved by addressing a problem.	<ol> <li>1 = no importance</li> <li>2 = low importance</li> <li>3 = moderate importance</li> <li>4 = high importance</li> </ol>
Progress in addressing this problem at the national level	<ul> <li>1 = high progress</li> <li>2 = moderate progress</li> <li>3 = low progress</li> <li>4 = no progress</li> </ul>
Urgency of addressing this problem	<ol> <li>1 = no urgency</li> <li>2 = low urgency</li> <li>3 = moderate urgency</li> <li>4 = high urgency</li> </ol>

#### iii. Criteria list for located priority site

Criteria	Rating	Weighting (1 – 4)	Score
Size of the affected area (as percent- age of the total national land area)	1- < 10sq.km 2- 10 to 100sq.km 3- 100 to 1000sq.km 4- 1000 to 10,000sq.km 5- >10,000sq.km	<ul><li>1 = no importance</li><li>2 = low importance</li><li>3 = moderate importance</li><li>4 = high importance</li></ul>	
Affected population (as percentage of national population)	1- < 1000 2- 1000 to 10,000 3- 10,000 to 100,000 4- 100,000 to 500,000 5- >500,000		
Extent to which the natural catch- ment, aquifer or receiving coastal and marine waters support the livelihood of local communities (e.g., subsistence or commercial farming, forestry, mining, tourism, fisheries)	<ol> <li>very low importance (&lt;10%)</li> <li>low importance (10-30%)</li> <li>average importance (30-50%)</li> <li>important (50-80%)</li> <li>very important (&gt;80%)</li> </ol>		
Extent to which the natural catch- ment, aquifer or receiving coastal and marine waters support the na- tional development (e.g., commercial farming, forestry, mining, tourism, fisheries)	<ol> <li>very low importance (&lt;10%)</li> <li>low importance (10-30%)</li> <li>average importance (30-50%)</li> <li>important (50-80%)</li> <li>very important (&gt;80%)</li> </ol>		
Extent to which the site is a recog- nized government priority (refer to National Sustainable Development Strategy, or other strategic action plans e.g., NEAPs)	<ol> <li>no, not a priority</li> <li>yes, low priority</li> <li>yes, medium priority</li> <li>yes, high priority</li> <li>yes, very high priority</li> </ol>		
Extent to which the site is of region- al and/or global significance and priority (see WWF ecoregions, IUCN categories, UNESCO world heritage sites, etc.)	<ol> <li>no, not a priority</li> <li>yes, low priority</li> <li>yes, medium priority</li> <li>yes, high priority</li> <li>yes, very high priority</li> </ol>		
Degree of Degradation at the site (e.g., type of degradation)	<ol> <li>1- very low</li> <li>2- low</li> <li>3- average</li> <li>4- high</li> <li>5- extremely high</li> </ol>		
Extent of degradation on catchment and/or aquifer and any receiving coastal and marine resources and systems	<ol> <li>very low</li> <li>low</li> <li>average</li> <li>high</li> <li>extremely high</li> </ol>		
Cultural or traditional value of the site	<ol> <li>1- very low</li> <li>2- low</li> <li>3- average</li> <li>4- high</li> <li>5- extremely high</li> </ol>		

Criteria	Rating	Weighting (1 – 4)	Score
Extent of community management at	1- very low		
the site	2- low		
	3- average		
	4- high		
	5- extremely high		

#### iv. Template for cause and impacts

Environmental Problem	Environmental Impacts and socio-economic consequences	Rank	Sector	Rank

#### v. Criteria for prioritising identified options for reform and action

Criteria	Rating	Weighting (1 – 4)	Score
Level of certainty that implementation will pro- duce the expected/desired outcome		<ol> <li>1 = no importance</li> <li>2 = low importance</li> <li>3 = moderate importance</li> <li>4 = high importance</li> </ol>	
Level of expected impact			
Feasibility of implementation			
Nationally appropriate approach			
Others			

# ANNEX 2:

## Globally threatened species that occur in the Cook Islands

<b>Threatened Coral Species</b>			
Acropora anthocercis	Staghorn coral	Leptoseris incrustans	Encrusting coral
Acropora globiceps	Staghorn coral	Montipora angulate	Montipora coral
Acropora horrid	Staghorn coral	Montipora australiensis	Montipora coral
Acropora microclados	Staghorn coral	Montipora calcarea	Montipora coral
Acropora palmerae	Staghorn coral	Montipora caliculata	Montipora coral
Acropora paniculata	Staghorn coral	Montipora lobulata	Montipora coral
Acropora polystoma	Staghorn coral	Pavona bipartite	Pavona coral
Acropora retusa	Staghorn coral	Pavona cactus	Pavona coral
Acropora speciosa	Staghorn coral	Pavona decussate	Cactus coral
Acropora striata	Staghorn coral	Pocillopora elegans	Pocillopora coral
Acropora vaughani	Staghorn coral	Turbinaria mesenterina	Pagoda coral
Alveopora allingi	Alveopora coral	Turbinaria reniformis	Yellow scroll coral
Alveopora verrilliana	Alveopora coral		
Threatened Fish, Turtle &	Whale Species		
Alopias pelagicus	Pelagic Thresher Shark	Cheilinus undulates	Humphead Wrasse
Carcharhinus Iongimanus	Oceanic Whitetip Shark	Thunnus obesus	Big-eye Tuna
Taeniura meyeni	Giant reef ray	Eretmochelys imbricate	Hawksbill Turtle
Isurus oxyrinchus	Shortfin Mako	Chelonia mydas	Green Turtle
Rhincodon typus	Whale shark	Caretta caretta	Loggerhead Turtle
Epinephelus lanceolatus	Giant Grouper	Balaenoptera musculus	Blue Whale
Plectropomus laevis	Black Saddled Coral	Balaenoptera borealis	Sei Whale
	Grouper	Physeter macrocephalus	Sperm Whale
Threatened Bird Species			
Pomarea dimidiate	Rarotonga Flycatcher	Todiramphus ruficollaris	Mangaia Kingfisher
Vini kuhlii	Rimatara Lorikeet	Vini peruviana	Blue Lorikeet
Collocalia sawtelli	Atiu Swiftlet	Aplonis cinerascens	Rarotonga Starling
Ptilinopus rarotongensis	Cook Islands Fruit Dove	Numenius tahitiensis	Bristle-thighed Curlew
Pterodroma leucoptera	Gould's Petrel		
Other fauna			
Partula hyaline	Polynesian Tree Snail	Emoia adspersa	Micronesian Skink

Threatened Plant Species			
Acrophorus raiatensis	Rarotonga Acrophorus	Cyrtandra rarotongensis	Rarotonga Cyrtandra
Asplenium schizotrichum	Polynesian Asplenium	Garnotia cheesemanii	Rarotonga Garnotia grass
Coprosma laevigata	Rarotonga Coprosma	Haloragis stokesii	Rarotonga Haloragis
Cyrtandra lilianae	Te Manga Cyrtandra	Psychotria whistleri	Rarotonga Psychotria
Radiogrammitis	Cloud grass fern	Sclerotheca viridifolia	Rarotonga Sclerotheca
cheesemanii		Nesoluma polynesicum	Polynesian Nesoluma

# ANNEX 3

## Summary of Data on Existing Protected Areas in the Cook Islands

Island	Name of Area	Current Natl.		Other	Total Area	a (ha.)
		Classification		Designations	Terrestrial	Marine
	Takitumu Con- servation Area	Nature Conserved Area	K	BA & IBA	155	0
	Highland Para- dise	Nature Reserve			32	0
Rarotonga	Nikao Social Centre	Recreation Reserve			0	25
	Takuvaine Water Catchment	Community Managed Area	a K	BA (candidate)	229	0
	Aroa Raui	Marine Reserve			0	32.5
	Tokerau Raui	Marine Reserve			0	4
	Pouara Raui	Marine Reserve			0	5
	Aroko Raui	Marine Reserve			0	71.1
	Titikaveka Raui	Marine Reserve			0	15
	Tikioki Raui	Marine Conserved Reserve	e		0	40
	Ootu Raui	Marine Reserve			0	220
	Motu Kitiu Raui	Marine Reserve			0	407
	Maina Raui 1	Marine Reserve			0	128
Aitutaki	Maina Raui 2	Marine Reserve			0	81
	Rapota	Bonefish spawning			0	307
	Takitaki	Bonefish spawning			0	253
	Papau	Bonefish nursery area			0	175
Takutea	Takutea Wildlife Sanctuary	Wildlife Sanctuary	K	BA & IBA	100	0
Mitiaro	Te Roto Nui	Wetland	Fi ai	reshwater lake nd swampland	114	0
		Sub-Tota	al — Se	outhern Group	630.0	1763.6
Suwarrow	Suwarrow Na- tional Park	National Park	KBA	& IBA	160	1240
	Motu Kotawa	Marine and Terrestrial Reserve			90	?
Pukapuka	Motu Ko	Marine and Terrestrial Reserve			300	?
Рикарика	Motu Uta	Marine and Terrestrial Reserve			50	?
	Motu Niua	Marine and Terrestrial Reserve			10	?
	Te Taha ki Raro	Lagoon			0	?
Rakahanga	Paerangi	Marine Reserve			0	?
handhangu	Te Kainga	Marine and Terrestrial Reserve			?	?
Manihiki	Lake Porea and Tepuka Roto	Salt-marsh lakes			?	0
		Sub-Tota	al — N	orthern Group	610.0	1240.0
			Total	– Cook Islands	1,240.00	3,003.60

## **ANNEX 4**

# Multilateral Environmental Agreements signed by the Cook Islands

#### Biodiversity

<u>Convention on Biological Diversity [CBD]</u>	An international legally binding treaty that was adopted in Rio de Janeiro in June 1992. The Convention has three main goals: conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources <i>see also</i>
Cartagena Protocol on Biosafety	On 29 January 2000, the Conference of the Parties to the Convention on Biological Diversity adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory. The Protocol contains reference to a precautionary approach and reaffirms the precaution language in Principle 15 of the Rio Declaration on Environment and Development. The Protocol also establishes a Biosafety Clearing-House to facilitate the exchange of information on living modified organisms and to assist countries in the implementation of the Protocol.
Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES]	Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants.
<u>Convention on the Conservation of Migratory</u> <u>Species of Wild Animals [CMS]</u>	Aims to conserve terrestrial, marine, and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale

Ramsar Convention on Wetlands of International importance	The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
World Heritage Convention	The World Heritage Convention aims to promote cooperation among nations to protect heritage from around the world that is of such outstanding universal value that its conservation is important for current and future generations

Cook Islands Ridge to Reef Island Diagnostic Analysis Technical Report

