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MINISTER

COOK ISLANDS THIRD NATIONAL COMMUNICATION

under the **United Nations Framework Convention on Climate Change**

DECEMBER 2019

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Cover Photo: Tongareva 2019.

Foreward

Kia Orana,

I am pleased to present this Third National Communication Report and share the steps the Cook Islands has taken to implement the United Nations Framework Convention on Climate Change ratified in 1993.

We have increased our strategic attention to planning for climate change and disaster risk management, and environmentally sound sustainable energy supply. We have also revamped our institutional arrangements and resourcing. My government's commitment to addressing climate change has meant the establishment of an office to coordinate and lead the work in these areas under my guidance.

Our greenhouse gas emissions are insignificant compared to the rest of the world and our second GHG Inventory confirmed our reliance on fossil fuels. Nevertheless, our response with the Cook Islands Renewable Energy Chart 2012 set a policy shift that has seen all but two of the islands in the Cook Islands now less dependent on fossil fuels.

We recognise that as a large ocean state with a mix of low-lying atolls, and high islands hosting economic and business hubs along our coastlines, science indicates the Cook Islands will see worsening climate changes and the need for significant adaptation efforts are required. They must be strength-based and locally-driven along with the global efforts to reduce GHG emissions and minimise global temperature increase exceeding 1.5°C.

In demonstrating our commitment, we are cognizant of the need for much greater, predictable and accessible, financial and technical support from our international partners to address this climate crisis, which is not of our doing, yet undermines our development priorities and threatens our sovereignty and existence.

Meitaki ma'ata to the many that have worked tirelessly to prepare this report. To the staff of the Climate Change Division of my office, the members of the National Climate Change and Disaster Risk Management Platform, other ministry colleagues, private sector counterparts, NGOs and communities —your contributions are very much appreciated. Acknowledgement also to the Global Environment Facility and partners' financial support, and the United Nations Environment Programme in its role as implementing agency, alongside the National Communications Support Programme.

What is clear, is that only through our networks, collaboration and bold actions can we hope to avert this climate change crisis faced by our country, region and planet.

Kia Manuia

HON. HENRY PUNA
PRIME MINISTER

Celebrating Women's Day

MESSAGE FROM THE DIRECTOR OF *Climate Change Cook Islands*

This Third National Communications (TNC) for the Cook Islands represents how much detail we believe we need to show the world on how our country is being impacted by a changing climate. Our national communication is our UN—sanctioned report to the global community of our situation, of the impacts, and of how we as a people are working to cope with those changes.

We recognise too that there are gaps, that a one size shoe does not fit all, where each of us across the globe are fundamentally different in many ways. Yet, we also find many commonalities, as small island developing states, firstly, both in the Pacific region, and then in other similar regions, such as the Caribbean and Indian Ocean regions.

Climate Change staff at the Brilliant Resilient workshop 2016. AF, GCF, GEF.

The Third National Communication covers primarily the period 2007-2014 and is supplemented with more recent information. While a lengthy document, it attempts to show how climate parameters such as temperature and rainfall patterns, are changing in our country. But we must recognise the country is also susceptible to El Niño-Southern Oscillation related events. All these variations while clouding the trending climate situation for us in the Cook Islands, still does not negate that change is ever-present. Several regional and international studies by respected institutions, such as CSIRO in Australia, and the IPCC demonstrate those changes at country and regional levels.

The government of the Cook Islands, since the early 1990s recognised that climate change is one of the most critical challenges of our lifetimes and beyond, and accorded climate change a high priority in 1992 at the Rio Earth Summit held in Brazil, attended by the Cook Islands delegation led by the—then Prime Minister for the Cook Islands, Hon. Geoffrey Henry. Again, last year in 2019, Prime Minister, Hon. Henry Puna, led the Cook Islands delegation to the UNFCCC's 25th Meeting of the Conference of the Parties (COP) to the Convention held in Spain. Between 1992 and 2019, despite significant socio-economic challenges, the Cook Islands has participated in major climate—related meetings, to better understand the science and nature of the global problem, but also to signal, the Cook Islands' intention to take part as a member of the global community to address climate change.

This TNC is the culmination of work put together by a team of experts–both government and non-government stakeholders –to highlight our climate vulnerability and our situation in terms of impacts on our primary and secondary sectors. It also details how the country is taking steps towards addressing climate change under the auspices of the United Nations Framework Convention on Climate Change.

Kia Manuia

MR. WAYNE KING
DIRECTOR, CLIMATE CHANGE COOK ISLANDS

Acknowledgements

The Director of Climate Change Cook Islands would like to acknowledge the contribution of the staff of the Climate Change division and all the staff of the Office of the Prime Minister, the members of the National Climate Change and Disaster Risk Management Platform (CC&DRMP), and those individuals, experts and institutions, and community groups in the Cook Islands, for their invaluable time and expertise in preparing this report. The dedication and contribution by these people is fundamental to deepening our understanding of climate change and future sustainable development of the Cook Islands.

This report has been compiled by CCCI and Akairo Consulting, drawing on other reports related to climate change in the Cook Islands. This includes the following reports prepared under the TNC:

- National Green House Gas (GHG) Inventory Report under the Third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC); Mitigation Assessment under the Third National Communication (TNC) to the United Nations Framework Convention for Climate Change (UNFCCC); Bob Lloyd and Srikanth Subbarao, Subbarao Consulting Services:
- Reports on National Circumstances, Climate Trends, Vulnerability and Adaptation; Raymond Newnham, Teariki Rongo and Dr Teina Rongo
- Report on Other Relevant Information, Constraints and Gaps; Dr Christina Newport

Particular mention must be made of Celine Dyer and Rima Moeka'a of CCCI and TNC project management team whose dedication and assistance was greatly appreciated. The contribution of previous CCCI Director Ana Tiraa and former PM Coordinator Patricia Tuara is also acknowledged along with Platform members and stakeholders who made specific contributions or who were consulted:

Arona Ngari, Charles Carlson, Tangi Tereapii, Vaine Wichman, Elizabeth Wright-Koteka, Pasha Carruthers, Professor John Hay, Niki Rattle, Apii Timoti, Kevin Hosking, Vaitoti Tupa and particularly the late Ms Mii Matamaki.

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KO, GEF R2R

KO, GEF R2R

Young fisherboy, Pukapuka

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The V&A team in Mitiaro – from left Viviane Taia, Teariki Rongo, Mama Mou, Dr Teina Rongo (back), Dr Rerekura Teaurere, Dr Christina Newport and Raymond Newnham 2019. GEF TNC

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Executive SUMMARY

The Cook Islands is a large ocean state situated in the central-south Pacific Ocean. The 15 islands are divided into the northern group and the southern group. They are a geological mix of sand cays, low-lying coral atolls, raised coral islands, and small volcanic islands. Only the main island of Rarotonga has peaks over 200 metres above sea level. The total land mass for the country is 236.7 square kilometres with an Exclusive Economic Zone (EEZ) of 1.97 million square kilometres.

The Cook Islands has been a party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1993. In reporting on its actions to respond to climate change, this Third National Communication (TNC) updates the circumstances reported in the Second National Communication (SNC). It covers the time period 2007 – 2014. Where possible, more recent information is provided.

The Cook Islands is a country characterised by two different development trajectories. The main island of Rarotonga is the commercial and governmental hub with matching infrastructure. There is a robust tourism industry and a developed private sector. Aitutaki also has a growing tourism industry.

The Pa Enua outer islands have much less developed infrastructure, small declining populations and a public sector-based workforce. There is a higher cost of living due to extra freight costs for all commercial products. The Cook Islands takes a multi-sectoral response to climate change but implementing activities must account for the disparity in resources between Rarotonga and the Pa Enua.

The Cook Islands has experienced significant economic growth in the past two decades. Overall health has improved with considerable work done to reduce the non-communicable disease burden. However, several challenges need to be considered when developing strategies for climate change adaptation. An ageing population in the Pa Enua driven by high levels of mobility within the nation and further afield, creates a unique context for climate change adaptation strategies.

The country is very active implementing climate change activities. Considerable effort is put into creating the enabling environment for these activities to occur. Policy development is ongoing, and the country is taking on the challenge of strengthening its public financial management systems to administer project funding and facilitate future use of climate financing.

The establishment of the Climate Change Cook Islands (CCCI) signalled an organisational re-structure to co-ordinating the country's climate change response. Mainstreaming of climate change is improving as government and non-government agencies incorporate climate change into their policies and plans.

CLIMATE TRENDS

The human, environmental and economic harms due to climate and weather changes are being increasingly felt. Sea temperatures are currently rising at .012 degrees per decade, and this is expected to increase. Air temperature and rainfall changes are also taking place with an effect on agriculture, livelihoods and infrastructure. Coral bleaching and ocean acidification are increasing with a detrimental effect on coral growth. All pose significant challenges for attention.

VULNERABILITY AND ADAPTATION

Assessments identified several issues common across the country. Maintaining food and water security in the face of rainfall changes, drought and saltwater intrusion was identified. Changing growing conditions reducing the availability and productivity of edible crops are of concern along with changing ocean and waterway conditions affecting sustainable access to marine resources and damaging habitats. Coping with extreme weather events such as cyclones and sea surge was also a concern, given they are likely to increase with global warming.

GREENHOUSE GAS EMISSIONS INVENTORY

This inventory reports Greenhouse Gases (GHG) from 2007-2014 utilising the 2006 Inter-governmental Panel on Climate Change IPCC Guidelines for Greenhouse Gas Inventories, IPCC Good Practice Guidance (GPG) 2000 and 2003 where appropriate; and producing time series data where possible for the years 2007-2014.

The key greenhouse gas emissions included carbon dioxide CO_2 from the energy sector with minor amounts of methane and nitrous oxide from agriculture and waste. Emissions were estimated to be around 73 Gg per annum (73 thousand tonnes per annum) which remained reasonably constant throughout the reporting period, 2007 to 2014. For the Cook Islands 83% (average 2007 – 2014) were CO_2 emissions, 10% methane, 4% N_2O emissions and 3% other gases.

The Cook Islands' 73 k t of CO_2 equivalent for around 18,000 persons is around four tonnes per capita or around 60% of the world average during the reporting period. In absolute terms the Cook Islands total CO_2 eq. emissions were round 0.00014% of world emissions.

Overall, future GHG reporting and data collection require further improvements. For example, it is noted that the sub-sectors of the energy sector had high uncertainty levels as no sectoral data was forthcoming from the fuel retailers.

MITIGATION MEASURES

Past mitigation measures have focused on reducing fossil fuel CO_2 emissions. Predominantly this was achieved through shifting electricity generation from diesel fuel generators to solar. This approach however has peaked unless storage capacity can be increased. In the transport sector, emissions could be reduced by shifting to an electric vehicle fleet. The waste sector could also shift from individual septic systems to centralised piped disposal. Currently all mitigation approaches are limited by funding.

RESEARCH AND SYSTEMATIC OBSERVATIONS

More attention is needed for the research and systematic observations for climate change. Several research programmes have been undertaken in the Cook Islands particularly with increasing attention on ocean space and marine resources. Research activities in agriculture, marine resources and meteorology have continued through government departments such as the Ministry of Agriculture (MOA), Ministry of Marine Resources (MMR) and Meteorological Services (MetS). However, challenges exist which limits the reach of research to ensure priorities are identified, implemented and disseminated. There is also no register of Cook Islands researchers available to support or undertake climate change-related work, or an online open access repository for works once they have been completed.

TECHNOLOGY TRANSFER

A full climate technology roadmap has yet to be completed although an earlier technology assessment does provide the basis for technological advancement. An enabling environment that facilitates technology transfer is being created and supported by institutional arrangements and policy measures to ensure adaptation and mitigation technologies are identified and pursued.

EDUCATION, TRAINING AND PUBLIC AWARENESS

Two projects reviewed the climate change education and training needs and identified several priority areas. This includes developing a climate change training and education strategy that includes the programming and costing of educational activities, and establishes a policy for education and policy needs. Analysis of the gaps in the training supply and priorities were also identified as an area for future development.

CONSTRAINTS AND GAPS

A number of constraints, gaps and related financial, technical and capacity needs exist. They require immediate attention in a holistic manner for ongoing and proposed climate change actions to be realised.

Nassau Children

Mitiaro water station

CONCLUSION

As a nation, the Cook Islands is meeting its climate change obligations. Adaptation interventions are prioritised to protect the people, livelihoods, environment and economy from climate change impacts. Emissions are being reduced with the shift to renewable energy sources. Institutional arrangements and policy mechanisms are in place. Funding and capacity constraints are ongoing along with the need for increased technologies, research and scientific observation support to inform climate change related decision making and actions.

Akakoukouanga MANAKO

E basileia moana nui te Kuki Airani i rotopu i te tua tonga o te Moana Nui o Kiva. Kua akatu'anga ia te tai ngauru ma rima (15) enua ki te pa enua tokerau e te pa enua tonga. Tuketuke te tupu'anga o teia au enua mei te enua 'one, makatea akaaka, makatea teitei e te maunga. Ko Rarotonga te enua maata e tona teitei pati te rua anere (200) metera i runga ake te vaito o te tai, e ko te katoa anga i te maatamaata o te enua maro e rua anere e toru-ngauru ma 'ono topata itu (236.7) tikuea kiromita. Te kotinga kimi puapinga takapini te Kuki Airani e tai topata iva ngauru ma itu mirioni (1.97) tikuea kiromita.

E mema te Kuki Airani no teia taokotaianga o te taui'anga reva tei karanga ia, United Nations Convention on Climate Change UNFCCC, mei te mataiti 1993 mai. Na roto te ripoti'anga i te au angaanga tei raveia no te taui'anga reva, te akaari nei teia ripoti Third National Communication (TNC) i te turanga tei tuke mei te ripoti rua Second National Communication (SNC). Kua tataia teia ripoti no runga i teia au mataiti 2007 – 2014. Kua taru katoa ia tetai au karere ou i tetai au tu'anga.

E rua turanga tuke no te kimi puapinga i te Kuki Airani. Ko te enua maata a Rarotonga, tei reira te katoa anga o te pitiniti kimi puapinga pera te kavamani nui, te ngai akato'anga pairere nui e te uāpu. Viviki katoa te tupu'anga o te turoto ma te mātutu i te au kimi anga puapinga. Ko Aitutaki katoa tetai e tere viviki ara te turanga kimi puapinga no te turoto.

Kareka te Pa Enua kare e matutu ana to ratou turanga kimi puapinga, te meangiti uatu ara te au tangata e te maata'anga o te ngai anga'anga tei roto i te kavamani. Oko maata te au apinga no te 'akā moni i te tutaki i te akau'anga i teia au apinga. Te rave nei te Kuki Airani i te au tuanga katoatoa o te taui'anga reva, inara, kia akamatakite ia te tuke i te oko o te au apinga mei Rarotonga e te Pa Enua.

Viviki te tupu anga puapinga o te Kuki Airani i teia au tuatau i topa. Mātutu te ora'anga kopapa no runga i te au anga'anga maata tei raveia no te akaiti mai te au maki piri kore. Inara, te vai nei rai tetai au ngai tu kauvi ka anoano kia akatanotano ia mate parani'anga te au anga'anga no te taui'anga reva. Maata atu te aronga pakari i te Pa Enua mei te mea e, e ngoio ua te teretere ki te pa enua mamao, te riro nei teia turanga i te akateia'a te akatanotano'anga i te au parani no te taui'anga reva.

Maroiroi te basileia i te rave te au angaanga no te taui'anga reva. Maata te akateateamamao tei raveia i taeria ai teia turanga. Na roto te tata anga i te au kaveinga tāpapa, e te akamātutu'anga te akateretere i te moni kia mako teia au turanga ei akapuapinga i te moni taui'anga reva no te tuatau ki mua.

Te akatupu'anga o te opati Tauranga Taui'anga Reva kua riro teia akataka'anga ei akakou mai te au anga'anga katoatoa a te basileia no te taui'anga reva. Te akatomo'anga i te manako o te taui'anga reva ki roto i te au parani e te kaveinga tāpapa a te au tipatimani o te kavamani e te au putuputu'anga tūkeke te aere papu nei tei reira ki mua.

REVA O TE KUKI AIRANI

Te manamanata i runga i te tangata, te tango natura e te anga'anga kimi puapinga tei akatupu ia e te taui'anga o te reva te kitea pu ia nei tei reira e te maata uatu nei. Te kake uatu nei te vaito maana o te moana ki te .012 tekiriti i te tai ngauru mataiti e kua irinaki ia e ka kake uatu rai tei reira ki runga. Te tau'i katoa nei te temeperetia e te ua te riro nei ei manamanata ki runga te anga'anga tanutanu, ora'anga tangata e pera te au ngai puapinga o te basileia. Te maata ua mai nei te akaputea o te kaoa, te moana tei'o ma te tamanamanata rikarika i te tupu'anga o te kaoa. E au tuanga ngatā teia ka anoano ia kia kimikimi matatio ia.

TURANGA MANAMANATA E TE AU RAVENGA PARURU

Na roto te kimikimi'anga kua kitea mai tetai au turanga tu kauvi i roto te basileia. Te akapapu'anga te turanga o te kai e te vai i te tuatau uaua, taime maro e te au ngai tanu tei tomo ia e te tai ko

teia tetai au manamanata tei kitea ia mai. Ko teia au akatuke'anga te riro nei i te akaiti mai i te kai, e manamanata teia turanga, pera katoa te akatuke'anga te turanga o te moana, te au kauvai tei riro ei arai te tika'anga ki teia au kai e te takinokino katoa i teia au ngai. Kua kitea mai e ko te tuanga paruru mei teia au manamanata mei te reva kinokino, uri'ia e te tai kake, kare teia turanga e mātutu ana mei te mea oki e ka maata uatu teia au manamanata tei akatupu'ia e te maana o teia nei ao.

TARE REVA AKAKOU MAANA

Ko teia ripoti no te reva akakou maana, kua tārē ia mai mei te mataiti rua tauatini e itu ki te rua tauatini e tai ngauru ma a (2007-2014) na roto i te ta'anga'anga'anga te takainga mei te mataiti rua tauatini e ono (2006) a te taokotai'anga IPCC Guidelines for Greenhouse Gas Inventories, IPCC Good Practice Guidance (GPG) mataiti rua tauatini (2000) e te rua tauatini e toru (2003) i rauka mai ei te akapapa'anga no te mataiti rua tauatini e itu ki te rua tauatini e tai ngauru ma a (2007-2014).

Te tare anga maata o te reva akakou maana i te Kuki Airani nei mei roto mai tei reira i te tuanga ta'anga'anga uira tei karanga ia e carbon dioxide, e iti ua te reva kino mei te tuanga o te tanutanu e pera katoa te tita. Te tamanako anga e itu ngauru ma toru tauatini tane i te mataiti (73 Gg per annum) o teia reva e tuku ia nei ki roto te mareva e kua aiteite ki teia ripoti no teia au mataiti rua tauatini e itu ki te rua tauatini e tai ngauru ma a (2007-2014). I te Kuki Airani e 83 patene te katoa anga i teia reva CO2 i tuku iatu ki roto te mareva i teia tare anga mataiti (2007-2014), e 10 patene e methane, e 4 patene e N2O, e 3 patene te au reva ke atu.

I te Kuki Airani e 73 tauatini tane te tare no te tai ngauru ma varu tauatini (18,000) tangata, ko te aite'anga mei te ā (4) tane i te tangata okotai, kia akaaite ia ki to teia nei ao katoatoa e 60 patene ki to teia nei ao katoatoa no te au mataiti o teia ripoti. Ko te aiteanga te katoa'anga te reva akakou maana ta te Kuki Airani i tuku ki roto te mareva e 0.00014 patene tei reira me kapiti iatu ki te puai a teia nei ao katoatoa.

Akara'anga atu ki mua, ko te ripoti GHG e te ko'iko'i'anga mai te au manako e mea tau kia akamātutu ia tei reira. Mei teia te akara'anga, kare e papu ana te tare inu no te mea ngatā te ko'iko'i mai te tare numero mei teia tuanga.

AKAITIANGA I TE TARE REVA KINO

Te au tuatau i topa ake nei kua akamou te au anga'anga ki te akaiti mai i te reva kino CO2 e tuku ia nei ki roto te mareva. Ko te maata'anga o teia anga'anga koia oki na roto te tieni anga te ta'anga'anga i te uira mei te inu ki te uira natura. Inara, kua tae teia ki tona kotinga no reira ka anoano ia te akamaata i tetai ngai no te akaputu i te uira natura. I te tua o te au apinga akaoro matini i runga te mataara, ka rauka te akaiti mai i teia reva kino na roto te tieni anga ki te au apinga akaoro e ta'anga'anga ara te uira natura. Te tua o te repo tangata, penei pa'a ka rauka te tieni mei te ngutuare tataki tai ki te tai no te katoatoa.

KIMIKIMI E TE AKARA MATATIO NO TE REVA

Ka anoano ia kia akamaata ia te tuanga kimikimi e te akara reva no te taui'anga reva. E maata te au kimikimi'anga tei raveia i te Kuki Airani nei no runga i te pae moana e te au mekameka o te tai. Te au kimikimi'anga e rave ia nei no te tanutanu, moana e te reva, te raveia nei na roto i te au tipatimani o te kavamani na ratou teia au anga'anga. Inara te vai nei tetai au tu kauvi tei kitea ia ei akaparuparu i teia tuanga kia kore e tae ki te openga o te porokaramu. Kare katoa e akapapa'anga ingoa no te au tangata Kuki Airani tei anoano i te rave i tetai kimikimi'anga no te turanga o te taui'anga reva e pera katoa kare e ngai no te vai atu i teia au puka ripoti i oti.

KITEUIRA PAPATI

Te kaveinga no te akatanotano i te kiteuira papati kare tei reira i anga iake, inara, kua rauka mai na roto i te kimikimi'anga tetai turanga no te opara atu i teia anga'anga ki mua. Ko te tango no teia anga'anga, te akamata nei tei reira na roto te au akano'ono'o'anga i roto te kavamani e te tata kaveinga kia papu te kiteuira no te tuanga akamātutu e te akaiti reva kino.

APII, TERENI E TE AKAMATAKITE KI TE KATOATOA

E rua taime i te akara matatio ia anga te turanga apii e te tereni no runga te taui'anga reva e kua kitea mai tetai au ngai puapinga. Koia oki ko te tata'anga i tetai kaveinga no te apii e te tereni no te taui'anga reva pera te akateateamamao porokaramu e te akatanotano te au tuanga o te moni no te au anga'anga apii. Ko te apii e te tereni tetai tuanga puapinga teia kia akamātutu ia no te tuatau ki mua.

AKAMATAKITEANGA

I te amani anga i teia ripoti e maata te au tuanga tukauvi tei kitea ia mai. Ka anoano ia kia akara matatio ia teia au tuanga puapinga i te anga'anga no te taui'anga reva no teia au tuatau ki mua.

AKAKO'UKO'U'ANGA

Te rauka nei i te basileia Kuki Airani i te rave i tana tuanga no te taui'anga reva. Akamātutu'anga no te oraanga tangata ko te mea puapinga teia ei paruru te iti tangata, pera te tango natura e te kimi puapinga mei te manamanata o te taui'anga reva. Kua topa mai te tare puai i te taui'anga ki te uira natura. Te au akano'ono'o'anga e te au kaveinga ki mua kua papa. Moni tauturu e te ravenga rave e au ngai teia ka anoano ua rae kia akamātutu ia, pera te kiteuira, kimikimi e te akara reva no te turu ite au tuku'anga tika e te au angaanga o te taui'anga reva.

1 NATIONAL CIRCUMSTANCES

1 NATIONAL CIRCUMSTANCES

1. INTRODUCTION

Greenhouse gas concentrations (GHG) continue to destabilise the atmosphere and interfere with the climate systems of all countries.

The Cook Islands is an independent island nation located in the Pacific region. Large ocean states, like the Cook Islands, have comparatively smaller greenhouse gas emissions than larger countries and are adversely affected by the reported changes taking place.

On 12 June 1992 at the Rio Summit on Sustainable Development the Cook Islands signed the United Nations Framework Convention on Climate change. The convention was ratified on 20 April 1993. It came into force for the Cook Islands on 21 March 1994. The Cook Islands completed its Initial National Communication (INC) in 1999. Gathering the necessary scientific baseline data related to climate change impacts and emissions began along with planning adaptation actions and mitigation measures.

An ongoing challenge for the Cook Islands has been the timely completion of its National Communications (NC) close to the reporting period. It is noted that this report primarily covers the period 2007 to 2014. In some instances, more recent information has been presented to balance earlier information with more recent material. Nevertheless, this TNC enables the Cook Islands to meet its obligations to the UNFCCC as well as building on the first and second updates of the Cook Islands national circumstances, vulnerabilities and impacts. Updates on adaptation activities, GHG inventory and mitigation measures since the SNC are also provided. The Fourth National Communication (FNC) will cover the 2015 – 2020 period.

Prepared during 2019 and completed early in 2020 this TNC occurs at a time when the global situation regarding climate change has changed considerably from the time when the SNC was published in 2011. In particular, the legally-binding 2015 Paris Agreement set an upgraded benchmark for an acceptable global average temperature increase since pre-industrial times of 1.5 degrees Celsius. In this regard, the TNC serves a vital role in facilitating Cook Islands efforts towards achieving sustainable development outcomes resilient to the impacts of climate change.

This report is presented in seven chapters. The report begins by setting out the key characteristics of the Cook Islands national circumstances. This is followed with a discussion of observed climate trends, projections and scenarios.

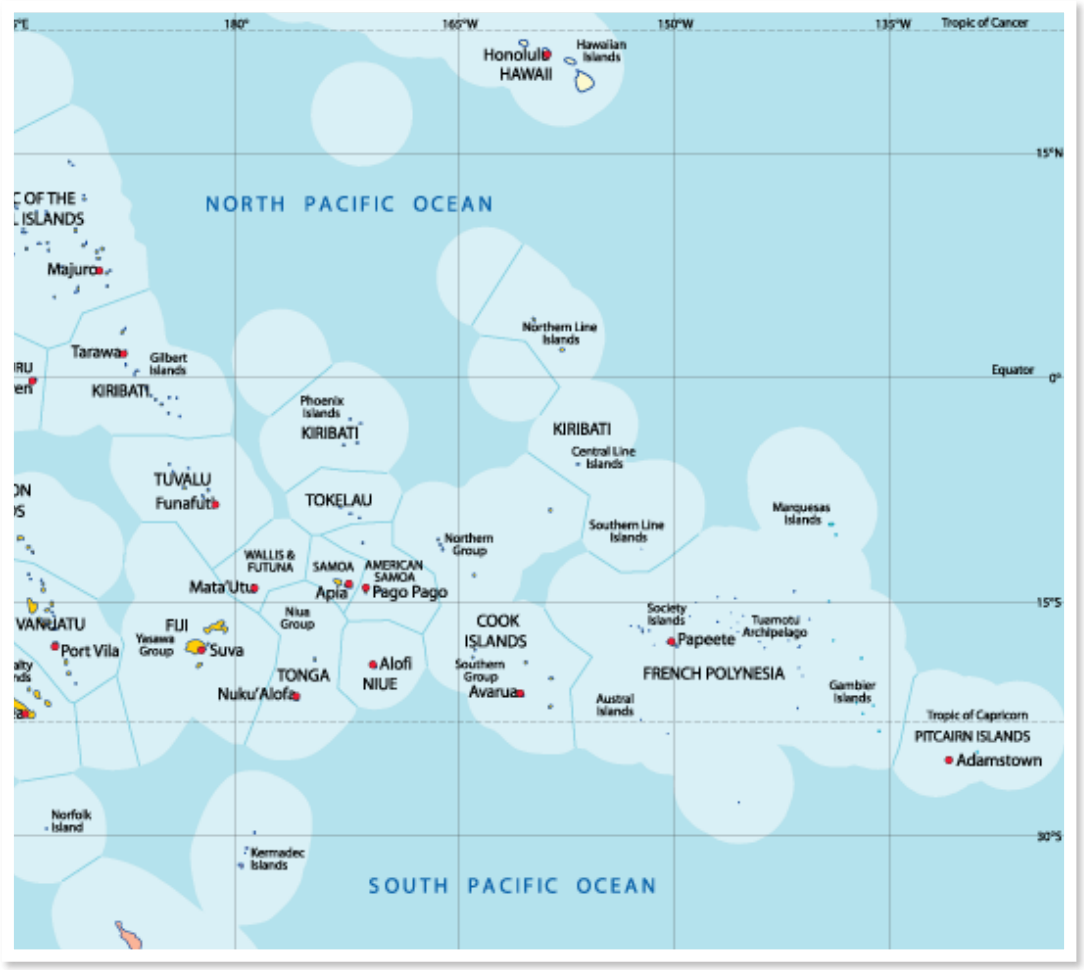
Vulnerability and adaptation details are set out in the next chapter. An inventory of greenhouse gas emissions is presented. This is followed by a chapter on mitigation measures. Other relevant information presented in chapter five covering the policy integration of climate change, technology transfer, research and systematic observations. Capacity-building and information sharing is also discussed. Constraints and gaps are examined in the next chapter before the final chapter on key conclusions.

2. NATIONAL CONTEXT

The Cook Islands is a large ocean state situated in the central-south Pacific Ocean. The country is bordered by French Polynesia to the east, Kiribati to the north, and Niue, American Samoa and Tokelau to the west. South of the country is open ocean to the Antarctic. The 15 islands are commonly divided into the Northern Group and the Southern Group (Figure 1).

The capital, Avarua, is on the main island of Rarotonga which holds more than 70% of the resident population. The international airport and main harbour is on Rarotonga which is also the administrative centre and location for the main offices of all the public service ministries and state-owned enterprises (SOE).

FIGURE 1: LOCATION OF THE COOK ISLANDS EXCLUSIVE ECONOMIC ZONE



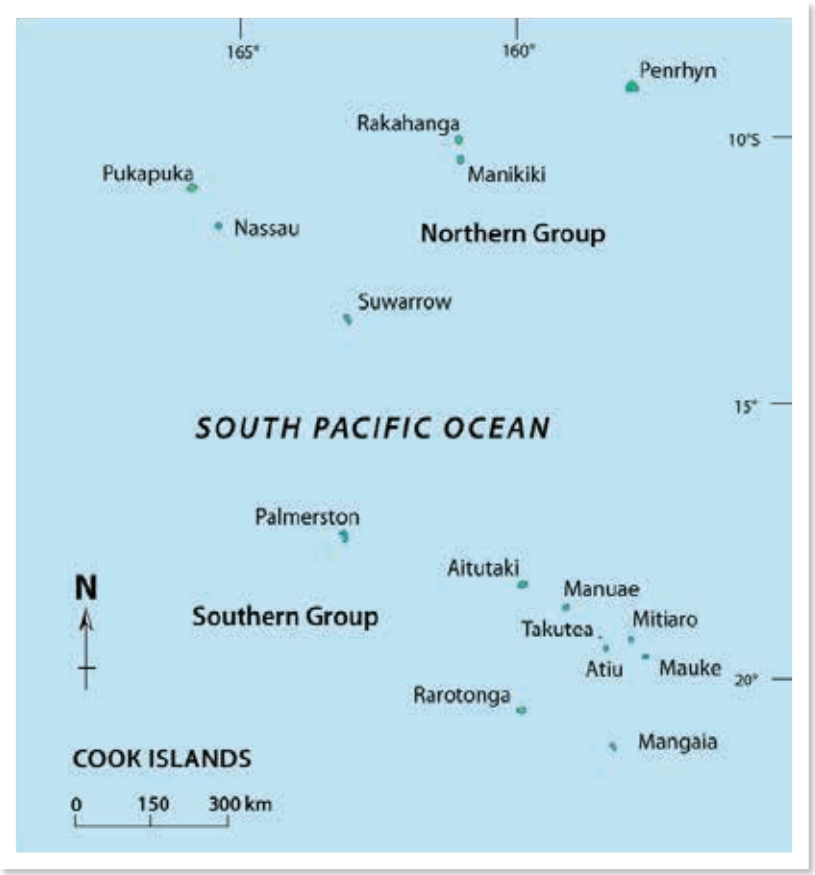
SOURCE: Tuna Pacific Magazine, Forum Fisheries Agency, December 2017.

The islands in the Cook Islands are a geological mix of sand cays, low-lying coral atolls, raised coral islands, and small volcanic islands. Only the main island of Rarotonga has peaks over 200 metres above sea level, and the total land mass for the country is 236.7 square kilometres.

The Cook Islands Exclusive Economic Zone (EEZ) measures 1.97 million square kilometres. There are negotiations being conducted to increase the sea-floor area controlled by the Cook Islands, by extending the claim over the continental shelf. This will not increase the size of the EEZ but will give the Cook Islands sovereign rights over the extra sea-floor area. This is of interest because of the potential for seabed minerals in that region.

The winds blow predominantly from the south-east during April to October and from the north and west during the months of November to March. The country lies in the cyclone belt, with the cyclone season being from November to April.

FIGURE 2: MAP OF THE COOK ISLANDS



SOURCE: De Ramon N'Yeurt, Antoine. (1999).

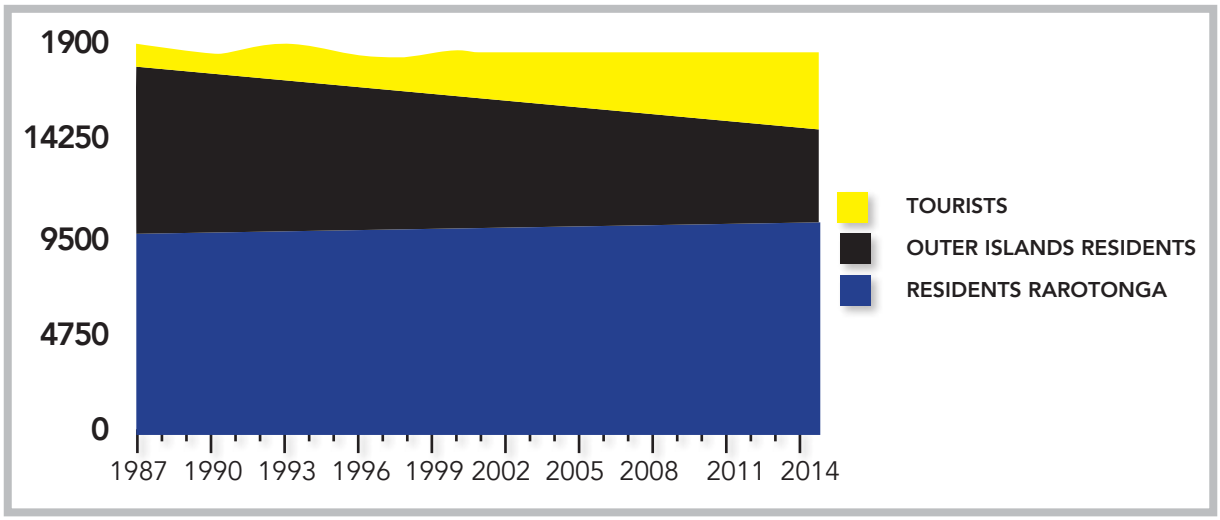
2.1 POPULATION TRENDS AND STATUS

The Cook Islands has an ageing population with an increasing migrant workforce. The population has been steadily declining due mainly to emigration, mostly to New Zealand and Australia. As New Zealand passport holders, Cook Islanders can move freely into New Zealand, and this option is exercised regularly by families looking for employment and higher education opportunities.

In 2001 the resident population was a little over 15,017 with over 70% of the people living in Rarotonga. In the 2011 census the resident population had declined to 14,974. By 2016 this had declined further to around 14,600 while at the same time tourist numbers have been increasing at approximately 5% per annum from around 1000 in 1990 to nearly 4000 in 2016 making the total population of the islands in any one year reasonably stable at around 18,000 persons. The population of the Pa Enua (outer islands) however, continues to decline.

While the overall resident population on Rarotonga has remained stable, the demographic composition of the population is changing. The growth in immigration means the Cook Islands is becoming more multi-cultural with nearly 12% of the resident population being of non-Cook Islands descent compared to only 5% 15 years earlier (see Table 1 below).

FIGURE 3: COOK ISLANDS POPULATION (ESTIMATED)



SOURCE: Statistics Department Cook Islands

The working population (aged between 15 and 59), has remained around 60% of the population since the late 1990s, however, in general the population is ageing. The number of people aged 60 and over is steadily increasing (by over 50%) whilst those under 15 has declined (by 20%). The increase is consistent across all islands, with the percentage in the Pa Enua[1] being slightly higher. Census data also shows that household sizes decreased by approximately 20% between 1996 and 2011 (4.4 persons to 3.5 respectively).

TABLE 1: RESIDENT POPULATION TRENDS

ITEM	1996	2001	2006	2011	% Change since 1996
Resident Population	18071	15017	15324	14974	-17.14%
% Female	48.35	48.31	48.96	49.98	+3.37%
% Male	51.65	51.69	51.04	50.02	-3.16%
% 60+	8.3	10.0	11.0	13.0	+56.6%
% Aged 15-59 Years	55.9	55.9	58.0	58.0	+3.7%
% Aged 0-14 Years	35.9	34.1	31.0	29.0	-19.2%
% Population Non - Cook Islanders	4.59	6.50	8.80	11.95	+160.3%
Household Size (Person Per Household)	4.4	4.0	3.7	3.5	-20.45%
Internet At Home	Unrecorded	13.2%	19%	40.6%	

SOURCE: Department of Statistics, (2011). Ministry of Finance and Economic Management, Cook Islands.

[1] This is the Maori name given to distinguish all the other islands in the Cook Islands apart from Rarotonga

The demographic shifts have several climate change implications on a national scale. First, an ageing population indicates that a significant portion of the population may struggle to adapt to the impacts of climate change. Secondly, as household size decreases, some of the informal support networks from an extended family living in the same house, are removed from the more vulnerable sectors of society. It is likely that this will be felt more keenly in the Pa Enua leading to continued internal mobility (movement within the country) as well as increased immobility of the most vulnerable as climate change continues to impact on these communities.

2.2 INDIGENOUS LEADERSHIP

The traditional leadership structure of the Cook Islands still exists and is recognised by the local communities. On some islands, access to land and other resources is still controlled by the Ariki[2] (traditional chief). In 1966 the government legislated to establish a 15-member Are Ariki, House of Ariki and later the Koutu Nui[3] to advise government on land and customary matters as well as other matters of national importance. Both bodies are involved in consultations on important national issues. In 2016 the Are Ariki celebrated its 50-year anniversary as a legislated body of the government. Engagement on climate change-related matters with the traditional leaders is essential in determining actions and acceptance.

2.3 POLITICAL SITUATION

2015 marked the 50-year anniversary of the Cook Islands independence as a self-governing state in free association with New Zealand. Constitutionally, this innovative arrangement at the time ensured Cook Islands authority over all its own affairs.

The Cook Islands retained citizenship and foreign affairs assistance from New Zealand which annexed the Cooks in 1901.

The Cook Islands is a parliamentary democracy. Queen Elizabeth II is the Head of State. The Queen's Representative, Sir Tom Marsters presides over a Parliament of 24 elected members, with elections held every four years. The elected political party governs through the Prime Minister and five ministers who make up the Cabinet.

The 2014 election was won by the Cook Islands Party (CIP) with 13 seats. The Democratic Party (DP) won eight and the new One Cook Islands party (OCI) won two seats. In 2018 the CIP retained power for a third term by forming a 13-seat coalition with the one seat from the OCI and two seats from independent candidates. Nevertheless, the country has enjoyed a three-term period of parliamentary stability from which it has governed climate change risks to national development and participated in the international climate change arena.

2.4 RELIGION

Religious beliefs are an important part of Cook Islanders' daily lives and is a significant institution of Cook Islands society. Over 92% of the population assign themselves as belonging to a religious group which is predominantly Christian.[4]

Christianity is considered one of three Cook Islands foundational pillars alongside indigenous culture and western democracy as the basis of modern Cook Islands society with potential to contribute a response to climate change.

[2] High Chief

[3] The Are Ariki (House of Ariki) is the forum for the High Chiefs to meet and discuss issues. The Koutu Nui is the forum for the lesser title holders known as rangatira and mataiapo.

[4] Cook Islands Census 2011, Department of Statistics, Ministry of Finance and Economic Management, Cook Islands.

Mitiaro community consultation 2013

2.5 EDUCATION

Schooling is compulsory in the Cook Islands until the last term of the year a child turns 16. Literacy and numeracy levels are high with English and Cook Islands Māori being the main languages taught in the schools. In 2014, 87% of children achieved at or above the expected literacy standard in the Natioanl Certificate of Eduactional Achievement NCEA Level 1 (Year 11) and 85% of Cook Islands children achieved the recommended numeracy standard.[5]

2.6 HEALTH

The Cook Islands has a publicly-funded health system that provides free[6] health services including public health services, primary care, and some secondary care. The main hospital is on Rarotonga, which provides most of the primary and secondary care for the country. The coverage of care in the Pa Enua is mixed. Aitutaki has a resident medical team and satellite hospital site whilst the other islands have nurse-led clinics. Nurses in the Pa Enua provide most of the care, and medical evacuations are used when necessary.

Currently, tertiary care is not available in country for example dialysis or cancer treatment. To meet this need Te Marae Ora, (Ministry of Health) has a memorandum of understanding with Counties Manukau District Health Board in New Zealand. This allows the Cook Islands to send high-need, complex cases to New Zealand for care.

Overall, the health status of Cook Islands people is good despite rising exposure to some non-communicable diseases. In 2016, life expectancy at birth for men and women was 69.6 years and 77.6 years respectively. The total fertility rate has dropped from three in 2007 to 2.4 in 2016, which is still above replacement levels. The number of cases with heart disease, some respiratory diseases and specific infectious diseases, dropped between 2015 and 2016. However, there has been an increase in the number of people diagnosed with diabetes, some of whom carry other non-communicable disease co-morbidities.

[5] NCEA is the National Certificate of Educational Achievement and is part of the New Zealand curriculum and qualifications system.
[6] Most health services are publicly funded for Cook Islands residents. Tourists and other visitors may be charged a small fee for treatment.

2.7 COMMUNICATION AND TECHNOLOGY

Communication and technology in the Cook Islands continue to advance, particularly in private and commercial activities. The internet is increasingly the medium for personal social interaction and engaging with communities on social issues such as climate change. Cook Islanders are increasing their uptake of communications technology with 91% of households having a cell phone and 40.6% having internet access at home.

A National Information and Communication Technology Policy 2015 – 2020 (ICT Policy) was adopted with the vision, "ICT will be effectively utilised to achieve sustainable improvements in social, economic, cultural, and good governance thus improving the quality of life of all Cook Islands people[7] This includes the installation of a trans-Pacific fibre-optic cable to improve connectivity.

3 THE ECONOMY

The Cook Islands has a private sector-led service-based economy. Tourism is the primary industry supplemented by fisheries and financial services.

The economy has been growing steadily since an economic reform period in the late 1990s. The global financial crisis caused a brief downturn during 2007 and 2008, but the economy has since bounced back quickly.The Cook Islands economy has continued to improve with 4.7 percent growth in the 2012 calendar year.[8]

As a result of continued growth and positive economic performance, the Organisation for Economic Cooperation and Development (OECD) is likely to determine the Cook Islands' high-income status as it has exceeded the World Bank's high income threshold since 2010.[9] Such a determination means the Cook Islands will graduate from the Development Assistance Committee (DAC) eligibility.

An influence on the Cook Islands economy is the New Zealand economy. The New Zealand dollar (NZD) is the Cook Islands' main currency, and fluctuations in the NZD can greatly impact on the returns of the tourism industry which is the Cook Islands' main foreign exchange earner.[10] Fluctuations in the NZD can also impact on the cost of goods imported into the country. In 2014, New Zealand was the main source of imports into the Cook Islands (66.7%)[11] and the source of the largest tourist numbers (67.1%).[12]

In 2016, the Cook Islands had an inflation rate of 2.9%, with overall inflation being under 4.3% for most of the previous decade. Between the March quarter in 2014, and the March quarter in 2015, inflation increased from 2.8 to 3.6%. This was largely driven by increases in the cost of tobacco and food.

In the period 2013/2014, $141.9 million dollars of imports were brought into the Cook Islands. This was an increase of 4.9% from the previous year. Most of the imports were food and live animals at 24.7% followed by machinery, transport and equipment at 21.7%. Imports were projected to decline after 2014 due to a decline in the importation of machinery and equipment. In contrast, exports grew to $21.6 million dollars driven by an increase in the exportation in fish. It is estimated that $0.63 of every dollar earned in the economy comes from foreign sources, mainly tourism.

The real gross domestic product (GDP) of the Cook Islands declined 1.2% in 2013/2014. The main drivers of this were the falls in finance and business services, and construction at -2.1 and -1.3% respectively. This shift illustrates how sensitive the Cook Islands economy is to relatively small changes in single industries.

[7] P.7. Government of the Cook Islands. 2015. Cook Islands National Information Communication and Technology Policy. https:// pafpnet.spc.int/attachments/article/537/Cook%20Islands%20National%20Information%20and%20Communication%20Technology%20Policy.pdf downloaded 30 November 2019.

[8] 2014 Pre-Election Economic and Fiscal Update, MFEM.

[9] P.5. Bertram, G., (2016). Implications of the Cook Islands Graduation from Development Assistance Committee (DAC) eligibility.

[10] There are also some Cook Islands low denomination coins and a $3 note.

[11] Overseas Trade Statistics, Statistics Department, MFEM.

[12] Migration Statistics Tables, Statistics Department, MFEM

3.1 EMPLOYMENT

The private sector is the largest employer at 65% of all employees. This is followed by the Public sector with 31%. The government is the largest single employer in the Cook Islands.[13] On Rarotonga, with a larger percentage employed by the public sector is only 19%, but in the Pa Enua, the percentage of the workforce employed by government is over 50%.

3.2 TOURISM

Tourism continues as the largest industry in the Cook Islands accounting for about 60% of the economy.[14] Tourist numbers continue to grow, with a record number of 121,574 visitors arriving in 2014. This was a 3% increase on 2013 and an annualised 4% increase over the five-year period from 2009.

3.3 AGRICULTURE

Cook Islands residents continue to grow food crops for subsistence and/or commercial purposes.

In 2016 24.4% of all households engaged in some agricultural activity. However, this percentage is projected to increase as the increasing tourist numbers stimulates a demand for locally-grown agricultural products. As well as the commercial agricultural activity, another 62% of households in the country engage in some form of agricultural activity for household consumption.

Agricultural exports are no longer a key source of revenue for the Cook Islands. In 2014, 97% of the value of agricultural exports were of noni and approximately NZ$10,000 of maire. Papaya and taro are no longer exported due to a lack of treatment facilities necessary to meet quarantine requirements.

3.4 MARINE RESOURCES

Fishing remains an important part of social and cultural life in the Cook Islands. Over 42% of households in 2011 engaged in fishing activity, whether for subsistence or commercial purposes. This figure is likely to have been higher, however, ciguatera fish poisoning has rendered reef fish inedible on Rarotonga for much of the 2000s. While the importance of fishing to maintaining food security and health in the Cook Islands is significant, fish consumption has declined with increased reliance on imported and processed goods.[15]

The value of fisheries exports has grown dramatically. This is based on the catch of Cook Islands flagged vessels fishing in the Indian Ocean and one full-time commercial operator based in the country targeting larger offshore fish species. This is valued at approximately NZ$18.2 million. In addition, closer in-shore, artisanal fishers caught approximately 218 tonnes of fish in 2014. The artisanal catch is all sold domestically for an estimated value of NZ$2.2 million.

The Cook Islands black pearl industry is also an important contributor to the economy of the country. Presently however, production is dropping, and the export value is minimal. Farmers in Manihiki now concentrate on selling domestically in Rarotonga, rather than exporting.

3.5 INFRASTRUCTURE

Infrastructure in the Cook Islands is diverse in size and composition across its islands. Rarotonga has three-storey buildings, reticulated water systems, sealed roads, the main international airport, and a container port. The Pa Enua mostly has coral sand roads, single-storey buildings, household water tanks, and small harbours that cargo is lightered to and from land.

[13] P. 17, MFEM. 2011. Cook Islands Census.
[14] P. 30, MFEM. 2015. Cook Islands Government Budget Estimates 2014/2015. Book 1.
[15] Solomona et al., 2009; Rongo and van Woesik, 2012.

Domestic housing throughout the country is predominantly concrete floors with mostly concrete block walls. More than 97% of houses have iron roofing with most houses located around the periphery of the islands, within 300 metres of the sea.

The ongoing development and maintenance of major prioritised infrastructure is managed through its National Infrastructure Implementation Plan (NIIP).

For decades, diesel-powered generators on each island have been the main source of electricity. In 2011, the Cook Islands government set a target of 50% renewable energy generation for electricity by 2015 and 100% by 2020. Solar-powered electrical supply for all the northern group islands is on track to be completed in 2015 and planning has begun for rolling a similar project out for the islands in the southern group, apart from Aitutaki and Rarotonga.

3.6 WATER

The Cook Islands government is currently undertaking some significant projects in the area of water. The water reticulation system on Rarotonga is undergoing a major overhaul at a value of NZ$90 million. Intakes are being expanded, storage areas constructed, and the distribution system is being up-graded. A project subsidising household water tanks for Rarotonga has also been implemented.

Similarly, in the Pa Enua, plans are in place to upgrade community water tanks and subsidies provided to households purchasing their own water tanks. Projects to improve wastewater treatment on Rarotonga have also been initiated.

3.7 TRANSPORT

On Rarotonga, the main sealed road circles the island around the outside, close to the lagoon. Container-carrying trucks, buses, private vehicles and bicycles all compete with pedestrians for space as there are few footpaths. There is also an inner-road which is narrower and does not completely circle the island.

Public transport in the Cook Islands consists of one bus company on Rarotonga utilising diesel-powered buses. The company provides an hourly schedule running around the outside-road on Rarotonga. There are no trains or trams.

Private transport in Rarotonga and the rest of the southern group is based around cars and motorbikes. In the northern group, using motorised boats on the lagoons and motorbikes on land is the norm. The individual islands are linked by inter-island shipping and small 18-seater planes. International flights land only at Rarotonga Airport where the domestic airline is also based.

There are few electric vehicles in the Cook Islands. This is an area for development as part of the 100% renewable energy electricity target aimed at reducing GHG emissions.

TABLE 2: COOK ISLANDS EXPORTS BY VALUE FOR 2014

EXPORT PRODUCT	TOTAL VALUE (NZD
Fish	$20,441,000
Pearls	$364,000
Agricultural	$326,000
Other	$145,000
TOTAL	**$21,276,000.**

SOURCE: Overseas Trade Statistics, December Quarter, 2014, Department of Statistics, MFEM

4 BIODIVERSITY

Cook Islands biodiversity is an important element of the country's terrestrial and marine environments. The biodiversity is contained in habitats that are facing increasing pressure from human interaction. Building for homes or tourist accommodation, over-harvesting, nutrient loading in lagoons, and the introduction of invasive species are all impacting native species and the ecosystem functions.

Endemic species to the Cook Islands includes 20 flowering plants, six land birds, 12 land snails, and a largely unknown number of invertebrates.[16] In particular, some marine invertebrate species such as hard corals, are poorly documented.

While impacts of climate change such as sea level rise, thermal stress, and ocean acidification are expected to increase[17] the loss of biodiversity and ecosystem functions are also expected to worsen in the Cook Islands. The loss of salt crystals used for seasoning and drying fish, shorter low tide durations limiting access to the reef flat for rod fishing and collecting shellfish and snails; rougher sea conditions restricting access to the open ocean for fishing and offloading cargo; and sediment build-up in lagoons reducing lagoon health, are changes noted by residents as indicators associated with climate change impacts.[18] Such changes have a key bearing on the well-being of the coastline and food security.

Terrestrial flora and fauna changes in the southern Cook Islands indicate population decline associated with drought conditions over the last 30 years. For example, the dragonfly populations that thrive around wetland areas, have declined. As important predators of sand flies and mosquitoes, their decline could have human health implications due to increased transmission of vector-borne diseases due to increased mosquito populations.[19]

Another example is the pupu (golden shell: Orobophana pacifica) that rely on moderately wet conditions to survive. These snails collected after rainy periods for making necklaces have declined over the last two decades.[20] Changes also include decline in some plants that grow around swamp areas, and changes in fruiting trees.

In the northern Cook Islands changes include increased grass and other weed cover over recent decades due to prevailing wet conditions after the 1980s. Residents also recorded lushness of vegetation as evidenced in the coconut palm fronds.[21]

Changes in marine resources were also recorded. As the bulk of the diet in the Pa Enua is from the sea, residents have been acutely aware of changes. These include a decline in juvenile reef fish, marine flora such as sargassum, and the loss of umoemoe – a type of parrotfish that was an important food source.[22]

Overall, comprehensive investigations into the Cook Islands biodiversity is needed to better understand the extent of climate-driven changes. With the instigation of the Cook Islands marine park, ensuring more effective management efforts of the flora and fauna, is also needed.

5 CLIMATE CHANGE IN THE COOK ISLANDS

The Cook Islands climate change policies and their implementation across the public and private sectors are outlined in this section. This includes the development of these policies over time as well as a critique of potential for future growth.

5.1 KEY CLIMATE CHANGE POLICIES AND PLANS

The overarching national guide for development in the Cook Islands is set out in Te Kaveinga Nui: The National Sustainable Development Plan 2011-2015 (NSDP). The NSDP sets out eight national goals to help guide and focus the country's development activities.

[16] Cook Islands National Biodiversity Strategic Action Plan (Draft) Pg 6 n.d.

[17] Rongo, T., & Dyer. C. (2015). Using local knowledge to understand climate variability in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands.

[19, 22] Rongo, T., & Dyer. C. (2015). Using local knowledge to understand climate variability in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands.

The impacts of climate change will affect the achievement of the NSDP and although climate change is mentioned as a part of several goals, the specific NSDP goal linked to climate change is **Goal 5: *Resilient and Sustainable Communities.***

This goal is stated as:

"A Cook Islands where our people are resilient to disasters and climate change to achieve sustainable livelihoods"

The NSDP is the overall guide, but more specific policy statements are required to enable linkages between the NSDP goals and various sector outputs and activities.

Up until 2011, climate change policy and activities in the Cook Islands were the responsibility of the National Environment Service (NES). The National Environment Strategic Action Framework 2005-2009 (NESAF) was the guiding document for the NES. The NESAF was environmentally-focused, but also set some goals for climate change activities including, facilitating the integration of renewable energy into the national energy generation system. Similarly, one of the programme objectives was the integration of climate change adaptation and mitigation considerations into national planning and policies.

The Climate Change Cook Islands Office (CCCI) was established in 2011 as a division of the Office of the Prime Minister (OPM). This coincided with the Renewable Energy Division also being established in the OPM. Instituting these offices reflected the growing awareness and importance of climate change as a cross-cutting issue and shift away from government's "piecemeal and fragmented"[23] approach.

The functions of the Cook Islands Meteorological Service (CIMS) were transferred from the Cook Islands Police Service (CIPS) to the Ministry of Transport (MOT). The diplomatic focal point remained with the Ministry of Foreign Affairs and Immigration (MFAI).

The need for a more coordinated response to climate change was a factor in the development of the Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation 2011-2015 (JNAP). This document links Goal Five of the NSDP to the climate change sector activities. The JNAP takes an integrated approach to guide the Cook Islands' response. Disasters and climate change are considered as risks to the country's sustainable development including its people and environment.

The JNAP combined the Cook Islands Adaptation planning effort with DRM. At the same time, the Cook Islands Renewable Electricity Chart (CIREC) 2011 became the main document for climate change mitigation efforts. The REC was built on the Cook Islands aim to reduce its carbon emissions in line with the country's commitment to the Kyoto Protocol. The REC outlined how the Cook Islands would achieve the goal of a national electricity generation system powered totally by renewable energy. This would equate to a reduction of 34% of national emissions based on 2006 levels.[24]

Development and implementation of plans for climate change activities had not been matched by policy development. In order to address the lack of an overall climate change policy, a review of the policy setting for climate change activities in the Cook Islands was carried out in 2013.[25] The review looked at existing policies and found that while there were some good policies in place in a few sectors, they were not all linked to each other. The report recommended that a new policy framework be created which would bring together climate change and disaster risk management within a national sustainable development context.

The integration of development, climate change, and disaster risk management was encapsulated in Kaveinga Tapapa: Climate and Disaster Compatible Development Policy 2013-2016.[26] The policy provided linkages between the NSDP and a range of sector policies including the JNAP. Kaveinga

[23] C. Newport & T. Tutangata (2011) Mangoes in July – Cook Islands Public Service Climate Change Functional Review Report 2011, Pg 5.
[24] Cook Islands Intended Nationally Determined Contributions, Fig One, Pg One.
[25] Cook Islands Climate Change Policy Assessment Report, Akairo Ltd., 2013,

Tapapa defined goals, objectives and monitoring requirements for the framework. The policy would integrate adaptation, mitigation and development systems and activities to achieve development outcomes.

Kaveinga Tapapa encapsulated this approach in one policy statement:
"Ensure that the sustainable development of the Cook Islands is actively pursued by our people through a climate and disaster resilient approach that has the capacity to manage climate and disaster risks and reduce our emissions in the context of sustainable development."

Mainstreaming of climate change into strategic plans and sector policies was also reviewed in 2013.[27] Eight sector plans and policies were reviewed. The report used seven criteria to assess the level of mainstreaming. A case study of the renewable energy project was also presented as an example of how mainstreaming had led to implementation of climate change-related activities.

The review found that climate change objectives were stated in most of the reviewed sectors and that the objectives, strategies and outcomes were compatible across the sectors. However, the responsibility for delivering on those objectives was less clearly defined and the linkages between the sectors was not evident.[28]

Reviewed in 2018, Kaveinga Tapapa was replaced with a 10-year Climate Change Policy 2018-2028. The new policy emphasises a climate change approach which uses national systems to implement activities and advocates the role of the aronga mana (traditional leaders), private sector and NGOs in the national response to climate change.

6 THE COOK ISLANDS AND THE UNFCCC

The Cook Islands signed the UNFCCC on 12 June 1992 and the Kyoto Protocol on 16 September 1998. The country has been an active participant in the Convention of the Party (COP) meetings since the outset and has endeavoured to send a cross-sectoral representation to the COP meetings.

The Initial National Communication (INC) under the UNFCCC, was completed in October 1999. It was compiled with the assistance of the Pacific Islands Climate Change Assistance Programme (PICCAP) and advocated a cross-sectoral approach to dealing with climate change. Field studies were undertaken and the country's first reports on greenhouse gas emissions were compiled along with a national assessment of vulnerability to climate change and sea level rise.

The Second National Communication (SNC) was completed in December 2011. As well as updating the information on mitigation and adaptation activities, the SNC described how the Cook Islands had developed and implemented its cross-sectoral approach to climate change.

The Cook Islands Intended Nationally Determined Contributions (INDCs) were developed in response to the anticipated commitments of the Paris Conference of Parties (COP) scheduled for December 2015. The INDCs set some conditional and unconditional targets in adaptation and mitigation which are fair and ambitious, given the Cook Islands circumstances.

The Cook Islands also began preparing its first Readiness Support Proposal to the Green Climate Fund (GCF). The funding support is to assist the country to prepare a proposal for accreditation to the GCF which will enable direct access to the GCF. This approach by the Cook Islands government is following the same pathway in gaining accreditation as a National Implementing Entity (NIE) to the Adaptation Fund.

[26] Kaveinga Tapapa: Climate and Disaster Compatible Development Policy 2013-2016, Office of the Prime Minister, 2013.
[27] Review of mainstreaming of climate change into national plans and policies: Cook Islands, SPC, 2013.
[28] ibid, P. 2 Table One

7 COOK ISLANDS AGENCIES ACTIVE IN CLIMATE CHANGE

The cross-cutting nature of climate change requires a multi-sectoral response to planning and implementing climate change projects. As the awareness of the potential impacts of climate change and the potential funding assistance have both increased, the Cook Islands government reviewed the existing organisational structure. This has resulted in a change to the way the Cook Islands has organised and coordinated its climate change response.

7.1 THE NATIONAL CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLATFORM

Following the creation of the CCCI in 2011, the responsibility for coordination of climate change activities shifted to that office. The National Climate Change Country Team (NCCCT) then became the Climate Change and Disaster Risk Management (Platform) with the CCCI as its secretariat. The Platform is a forum for climate change stakeholders to meet and present projects and activities being implemented in the climate change area. Meetings are normally held on a quarterly basis, and while the Platform does not have a decision-making role, stakeholders discuss and provide technical, thematic and sectoral advice and feedback to the respective agencies carrying out projects. Members for thematic working groups are also drawn from platform representatives. Members include government, private sector, NGO, academic and development partner organisations, and individuals.

7.2 CLIMATE CHANGE COOK ISLANDS

The Climate Change Cook Islands (CCCI) office is a division of the Office of the Prime Minister and is now the organisation responsible for co-ordinating the country's response to the impacts of climate change. The CCCI is responsible for meeting the Cook Islands' obligations under the UNFCCC, including compiling the Third National Communication (TNC).

The CCCI office also implemented the Strengthening the Resilience of our Islands and our Communities to Climate Change (SRIC-CC) project, which was funded through the Adaptation Fund. The project is aimed at improving the adaptation and disaster risk reduction measures at the community level in the Pa Enua.

The SRIC-CC project has four components:

1. Strengthening and implementing climate change adaptation and disaster risk reduction at national level.
2. Strengthening capacities for climate change adaptation and disaster risk reduction in the Pa Enua.
3. Implementing climate change adaptation and disaster risk reduction measures in the Pa Enua.
4. Climate change adaptation knowledge management.

The project began in 2012 and was completed in 2018.

7.3 RENEWABLE ENERGY DIVISION

Also newly created and housed in the Office of the Prime Minister is the Renewable Energy Development Division (REDD). It is responsible for achieving the targets in the REC and the consequential decrease in the Cook Islands' emission levels. Electricity generation is the present focus, and transport powered by renewable energy is expected to be the next focus sector.

Installation of solar-powered electricity generation systems for the northern group, began in October 2014 and was completed by mid-2015. Each of these projects is a solar–diesel hybrid system that aims to generate at least 90% of electricity demand from solar with the diesel only operated as a backup.

The installation of the systems in the southern group islands of Mauke, Atiu, Mitiaro and Mangaia were completed at writing of this report. Aitutaki and Rarotonga are still a work in progress.

7.4 TE APONGA UIRA

Te Aponga Uira (TAU) is the government-owned supplier of electricity in the Cook Islands. It participates on the Renewable Energy (RE) Project Steering Committee and provides technical support and advice at the planning and rollout of the solar project in the Cook Islands. Currently, through a memorandum of understanding with each of the Pa Enua island governments, TAU provides technical support and capacity building to the renewable energy workers.

7.5 NATIONAL ENVIRONMENT SERVICE

The NES has the mandate to protect, manage and conserve the environment of the Cook Islands. Initially, the NES was the agency responsible for climate change. However, as the scope of climate change activities began to grow outside the NES mandate, the agency initiated the Functional Review in 2010 which led to the creation of the CCCI division within the OPM. This relocation to the OPM also elevated the status of climate change issues in the Cook Islands.

Prior to the shift, the NES had developed the SRIC-CC project and afterwards NES staff assisted with the development of the Vulnerability and Adaptation Assessments. Some of the activities of NES that are not directly centred on climate change still have flow-on benefits for climate change, such as managing waste management collections for e-waste and ozone depleting substances, environment and biodiversity health.

7.6 EMERGENCY MANAGEMENT COOK ISLANDS (EMCI)

EMCI is another division of the OPM and works closely with CCCI. The EMCI focus is on disaster risk management and reduction, but there has been a regional initiative to combine disaster management activities with climate change activities. In the Cook Islands, this approach is being applied by the JNAP and the SRIC-CC project and is supported by the Kaveinga Tapapa policy framework mentioned above.

7.7 MINISTRY OF FINANCE AND ECONOMIC MANAGEMENT

The Development Coordination Division (DCD) of the Ministry of Finance and Economic Management (MFEM) is responsible for managing the flow of funds into the Cook Islands from international donors. In December 2014, MFEM lodged its application to the board of the Adaptation Fund (AF), to be accredited as a National Implementing Entity (NIE) for the fund. This is the culmination of a three-year programme of capacity development which has focussed on reviewing and strengthening policies, procedures and national management systems.

The main benefit of attaining NIE status is that the Cook Islands will be able to apply directly to the Adaptation Fund. This will streamline the application process and reduce the administrative cost of implementing climate change projects.

7.8 COOK ISLANDS METEOROLOGICAL OFFICE

The necessity of accurate and timely scientific information for making good decisions is a crucial part of the Cook Islands' response to climate change. The Meteorological Office (MetO) is the Cook Islands' main climate-science organisation and is the country's representative on the IPCC, as well as chair of the CC&DRMP.

7.9 MINISTRY OF HEALTH

The Ministry of Health (MoH) is the main provider of health services in the Cook Islands and maintains the public hospital on Rarotonga and smaller clinics throughout the Pa Enua. The ministry also develops health sector policy and implements public health awareness campaigns.

In 2012 the MoH, with the assistance of the World Health Organization (WHO), finalised a Climate Change and Health Adaptation Plan. The plan outlined key recommendations for integration of climate change into the health sector and identified the highest priority climate-sensitive diseases in the Cook Islands. These are: vector-borne diseases (e.g. dengue fever), water-borne diseases (causing diarrhoeal

illness), fish poisoning (ciguatera), heat-related illness, respiratory diseases and the health impacts of extreme events such as cyclones.[29]

7.10 INFRASTRUCTURE COOK ISLANDS

Following the merging of the Ministry of Works and the Office of the Minister of Outer Islands Administration to form the Ministry of Infrastructure and Planning in 2009, this ministry was renamed as Infrastructure Cook Islands (ICI). Infrastructure Cook Islands has a broad range of responsibilities and maintains the roading, water supply networks and solid waste management on Rarotonga. It also supports the Pa Enua Councils in their maintenance of the same infrastructure on their respective islands. Infrastructure Cook Islands also have a policy and regulatory function, in relation to the Building Code which has since been updated in 2018 by the Building and Strengthening Resilience of Pacific BSRP and ICI project.

The incorporation of climate-related issues into infrastructure is well advanced in the Cook Islands and ICI are currently implementing projects in coastal management, sea-level rise, and vulnerability reduction. Looking ahead, the Cook Islands National Infrastructure Investment Plan, which is before Cabinet, has included an assessment of the potential impacts of climate change on the Infrastructure sector and the individual infrastructure projects being proposed for the next 10 years.

7.11 MINISTRY OF MARINE RESOURCES

The Ministry of Marine Resources (MMR) is responsible for the conservation, management and development of the living and non-living marine resources of the Cook Islands. The ministry is responsible for the resources found in the EEZ, lagoon waters and inland waters.

In 2012, the MMR was the recipient of a European Union (EU) funded adaptation project that was managed by the Global Climate Change Alliance: Pacific Small Island States (SPC EU GCCA: PSIS). The primary focus of the project was pearl farming on Manihiki.

Over a period of four years, the MMR was to install an advanced water quality monitoring buoy in the Manihiki lagoon, refurbish the MMR laboratory and provide funding for two additional technical staff; one position on Rarotonga and the other on Manihiki.

The aim of the project is to provide additional technical information and expertise that will assist pearl farmers in the northern atolls to make their operations more resilient to the impacts of climate change.

7.12 MINISTRY OF AGRICULTURE

The Ministry of Agriculture (MoA) has a broad remit to be responsible for the development of agriculture in the Cook Islands. Climate change is a key component of this and in 2009 the MoA worked with Food and Agriculture Organization (FAO), to look at the impact of climate change on food security in the Cook Islands. The ministry has also begun trial planting of certain climate change-resilient crop types.

7.13 NON-GOVERNMENT ORGANISATIONS

Non-Government Organisations (NGOs) are also involved as implementing agencies for climate change activities. They may work with the Cook Islands government or directly for a regional or international organisation. The Cook Islands Red Cross (CIRC) and the Cook Islands National Council of Women (CINCW) have both been recently active in this area.

The CIRC implemented a project in the Pa Enua entitled "Preparedness for Climate Change Programme". This involved creating for each community a plan of activities to prepare for and reduce the risks of climate change. The CINCW has assisted with the conducting of Vulnerability and Adaptation Assessments in the northern group island of Tongareva.

In recent times the active environmental NGO, Te Ipukarea Society (TIS), has increased its focus by adding climate change as a thematic area in its strategic plan. A new environmental NGO, Te Korero

[29] Climate Change and Health Adaptation Plan for the Cook Islands, Cook Islands Ministry of Health, May 2012.

o te Orau (KO), was recently established and participates in the delivery and advocacy work of climate change activities.

The Aronga Mana as a collective of traditional leaders is also engaged in implementing projects particularly for their local knowledge and observation of climate and environmental changes.

7.14 REGIONAL AND INTERNATIONAL ORGANISATIONS

Regional and international organisations are an essential part of the Cook Islands climate change response. By providing funding, materials or technical expertise, these organisations have helped to implement adaptation and mitigation activities, develop policy and procedures, and build capacity within the country.

Overseas Development Assistance (ODA) totalled NZ$63.7 million in the 2014/15 annual appropriation (Budget). Of this, NZ$4.46 million was designated directly for the climate change sector. The actual ODA figure for climate change-related activities would be higher though, as this does not include funding provided for the energy and infrastructure sectors.

Regional and international organisations who have participated in activities include inter alia: the New Zealand and Australian governments under their Development Assistance Programmes and agencies; United Nation agencies such as the Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP) and the Adaptation Fund; Council of Regional Organisations in the Pacific (CROP) agencies such as the Secretariat of the Pacific Community (SPC);the South Pacific Regional Environment Programme (SPREP), the University of the South Pacific (USP), as well as development banks such as the Asian Development Bank (ADB). A list of projects is contained in Section 8.4.

Managing the engagement with the international sector in climate change is difficult for small island states like the Cook Islands. Small populations mean personnel numbers are low and staff travel long distances to attend meetings. It is common that one person will have responsibility for managing issues that larger countries dedicate to a whole team. Nevertheless, the Cook Islands is building capacity to meet these challenges and to manage the interaction with the large climate-financing agencies following accreditation to the Adaptation Fund and the Green Climate Fund in 2015 and 2018 respectively.

7.15 SUMMARY

The Cook Islands is characterised by two interrelated development trajectories. This is due to the geographical and economic differences between the Pa Enua and Rarotonga. The main island of Rarotonga is the commercial and governmental hub with matching infrastructure but also with an international airport and harbour. The island has a rapidly-growing tourism industry and a developed private sector.

The Pa Enua islands have much less developed infrastructure, small populations that are declining and a workforce dominated by public sector jobs. These islands experience a higher cost of living due to extra freight costs for all commercial products. The Cook Islands is implementing a multi-sectoral response to climate change, but the implementation of activities must account for the disparity in resources between Rarotonga and the Pa Enua.

The country is very active in climate change activities and considerable effort is being put into creating the enabling environment for these activities to occur. Policy development is ongoing, and the country is taking on the challenge of strengthening its public financial management systems to administer project funding and facilitate future use of climate financing as it becomes available.

The establishment of CCCI prompted an organisational re-structure to co-ordinate the country's climate change response. Mainstreaming of climate change is improving as government ministries and non-government agencies incorporate climate change into their policies and plans as they are developed.

8 CLIMATE TRENDS AND SITUATION

This section provides an update of the Cook Islands climate. This includes data collection, current climate, and regional weather patterns.

8.1 CLIMATE DATA COLLECTION

The national agency responsible for monitoring climate in the Cook Islands is the Cook Islands Meteorological Service (CIMS). The CIMS operate eight weather stations throughout the country. The Tongareva weather station in the Northern Group (9°01' S, 157° 59' W) and the Rarotonga weather station in the Southern Group (21°13'S, 159° 46' W) are taken as climate reference stations for the monitoring of climate change.

8.2 CURRENT CLIMATE

The climate of the Cook Islands is tropical and determined in the main by the ocean without the impact of any significant land mass. There is a noticeable difference in climate between the northern and southern group due to geographical location. Little diurnal or seasonal variation to temperature occurs in the northern group, but these variations are much more evident in the southern group.

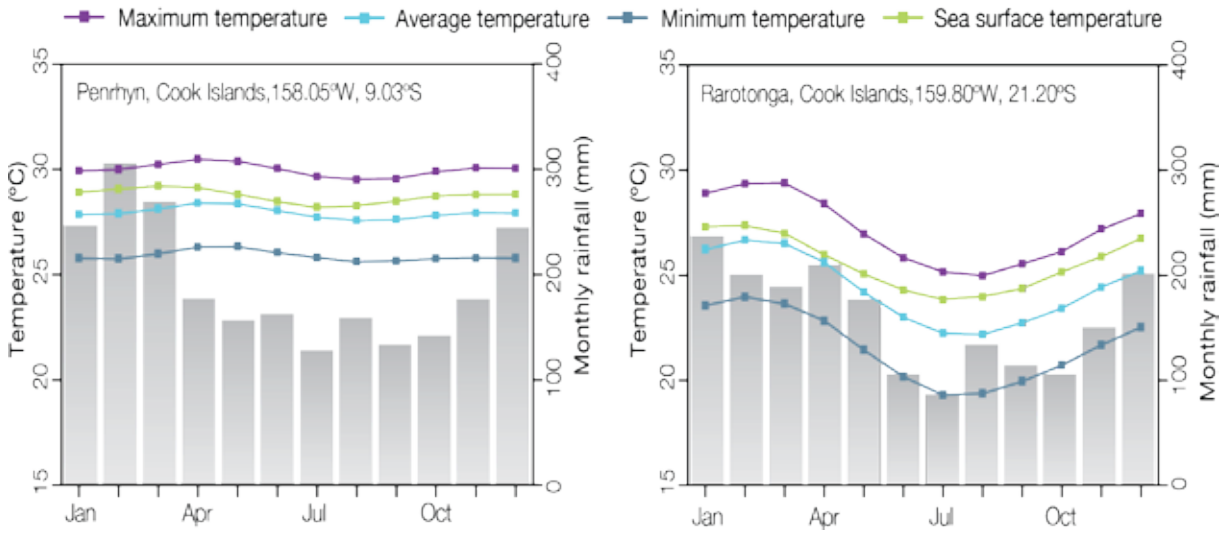
There is a distinct wet season from November to April when two-thirds of the average annual rainfall of 2000 mm occurs. However, there is substantial variation in rainfall from year to year in the Cook Islands. There has also been little change in extreme daily rainfall since the mid-1930s.

The wetter and hotter period from November to April also coincides with the cyclone season. The trade winds normally blow from the south-east during the drier period from May to October. This will change to blowing mainly from the north-west during the cyclone season.

8.3 SOUTH PACIFIC CONVERGENCE ZONE

The Cook Islands climate, and the amount of rainfall, can vary greatly from year to year because of the influence of the South Pacific Convergence Zone (SPCZ). The SPCZ also has different impacts on the two groups of islands within the country.

FIGURE 4: SEASONAL RAINFALL AND TEMPERATURE AT TONGAREVA AND RAROTONGA



SOURCE: Current and Future Climate of the Cook Islands, 2015, pg. 2

The SPCZ is an important climatic feature in the region, because it determines the seasonal distribution of rainfall and cyclones in the South Pacific. On average, the SPCZ lies to the west and south of the northern group but north of the southern group stretching in a northwest to southeast orientation.

During the wet season (November to April), the SPCZ is active, bringing unsettled weather and

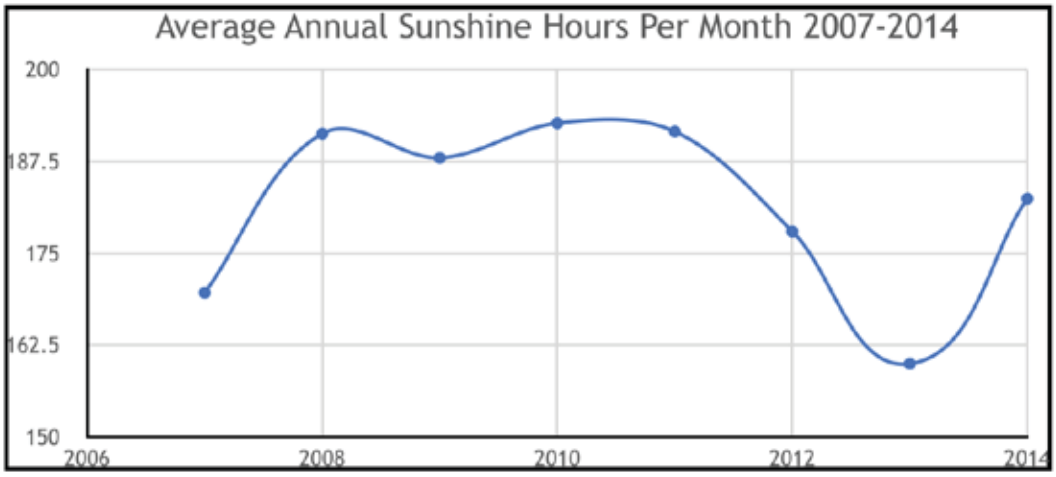
rain over the Cook Islands, which is also the region's cyclone season. During the dry season (May to October), the SPCZ is weak and roughly lies to the north of the southern group bringing dry southeast trade winds over the region.

A slight displacement in the SPCZ location can cause drastic changes to rainfall distribution and the frequency of extreme weather events in the region. In particular, the SPCZ position varies from its mean location during the two phases of the El Niño Southern Oscillation (El Niño and La Niña), moving a few degrees northward during El Niño events, increasing the probability of drought conditions in the southern group but wet conditions to the northern group. On the contrary, a southward displacement during La Niña events increases the probability of drought conditions in the northern group and wet conditions in the southern group. The eastward migration of the western Pacific warm pool during El Niño events also increases the probability of cyclones in the Cook Islands, with a contrasting effect during La Niña events.

8.4 SUNSHINE HOURS

The Cook Islands has an average annual sunshine hours per month of between 150 and 200 as illustrated in Figure 5 for the period 2007-2014. Over the same period, the lowest recorded hours in a month was 73 and the highest at 265 hours.

FIGURE 5: AVERAGE ANNUAL SUNSHINE HOURS PER MONTH IN RAROTONGA, 2007-2014



SOURCE: Cook Islands Meteorological Office

8.5 TROPICAL CYCLONES

Analysis of a recently completed database of 143 tropical cyclones in the Cook Islands revealed a minimum average frequency of 0.8 cyclones per cyclone season between 1820 and 2006, with a more-precise frequency of 1.8 cyclones per season from the beginning of satellite monitoring of cyclones in 1970. The Southern Group are more than twice as frequently affected by cyclones as the Northern Group, with the island of Palmerston having the greatest number of encounters.[30]

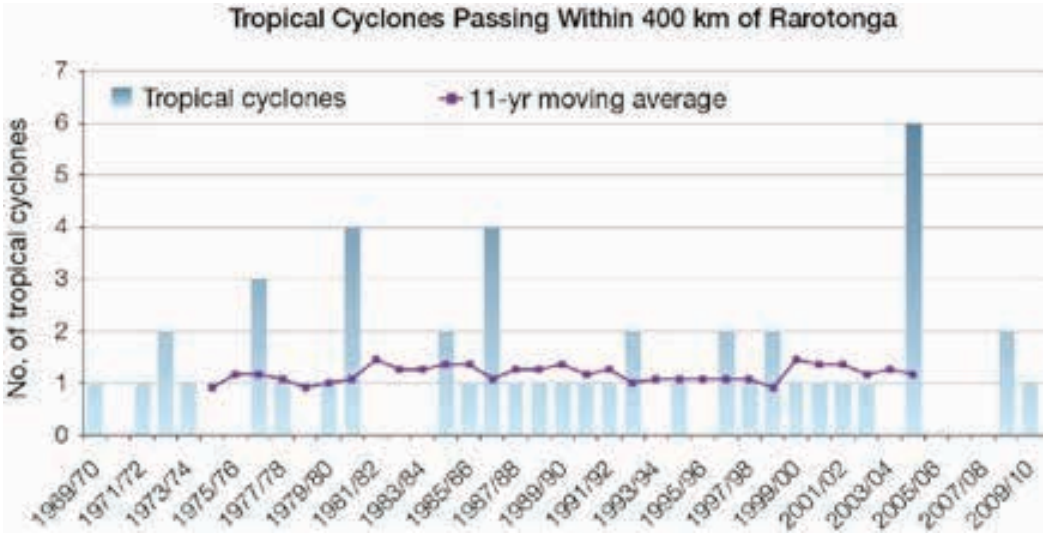
As Figure 6 below illustrates, the number of cyclones can vary greatly from year to year with none in some seasons and as many as six in some years. Over the period from 1969/1970 to 2009/10, 56% of cyclones have occurred during El Nino years and only 13% occurred during La Nina years.

Based on the 24 cyclones that have passed through the Cook Islands since 1955, it is estimated that the average cost to the country of a cyclone is currently in the region of NZ$6.5 million.[31]

[30] Historical Tropical Cyclone Activity and Impacts in the Cook Islands: de Scally, Fes A., Pacific Science, 62(4) : pp 443-459

[31] Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (JNAP) 2011-2015, pg 6.

FIGURE 6: TROPICAL CYCLONES PASSING WITHIN 400 KM OF RAROTONGA PER CYCLONE SEASON



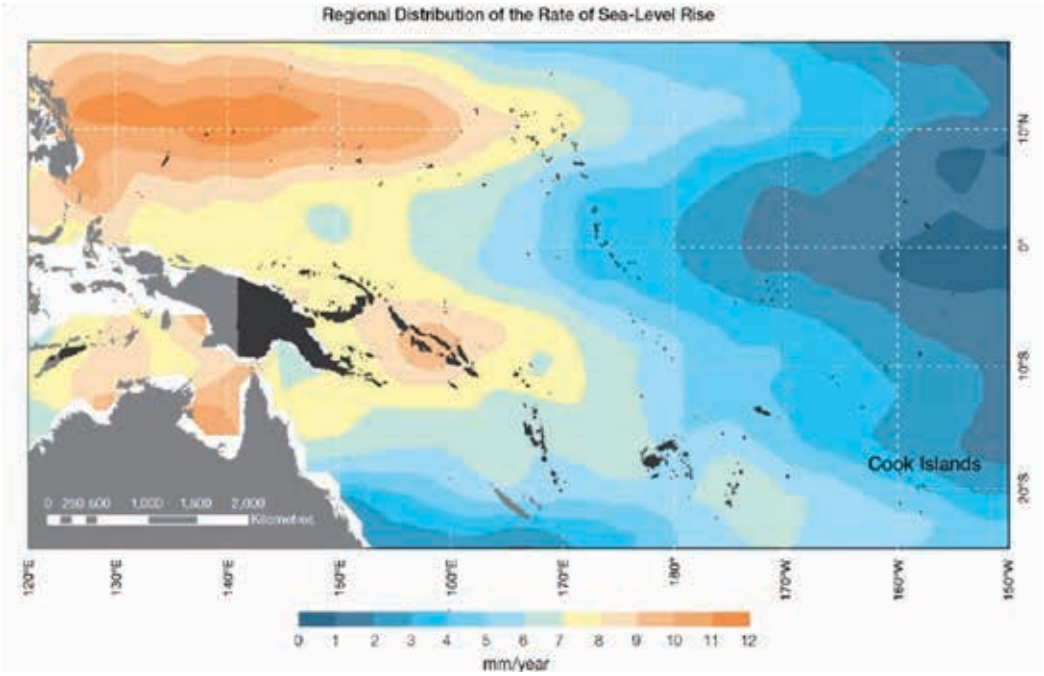
8.6 SEA LEVEL RISE

The sea-level rise near the Cook Islands, measured by satellite altimeters since 1993, is about 4mm per year (Figure 7). This is consistent with the global average of 3.2 ± 0.4 mm per year. For the Cook Islands, this indicates a long-term trend of rising sea levels.

Maximum tides tend to occur between March and April at Rarotonga, and February and March at Tongareva. These higher tides and short-term raised water levels combine to produce the highest likelihood of extreme water levels between January and April, peaking in March, at both locations.

Seven of the 10 highest water levels recorded occurred during an El Niño at both locations and these events were between the months of November to March, especially at Rarotonga. The five highest sea-level events at Rarotonga and four highest events at Tongareva were associated with tropical cyclones. These results strongly indicate that extreme sea-level events in the Cook Islands are more often associated with tropical cyclones or high wave events, than with tides or interannual sea level variability.

FIGURE 7: REGIONAL DISTRIBUTION OF THE RATE OF SEA-LEVEL RISE



SOURCE: ABM/CSIRO, 2011, PG 33.

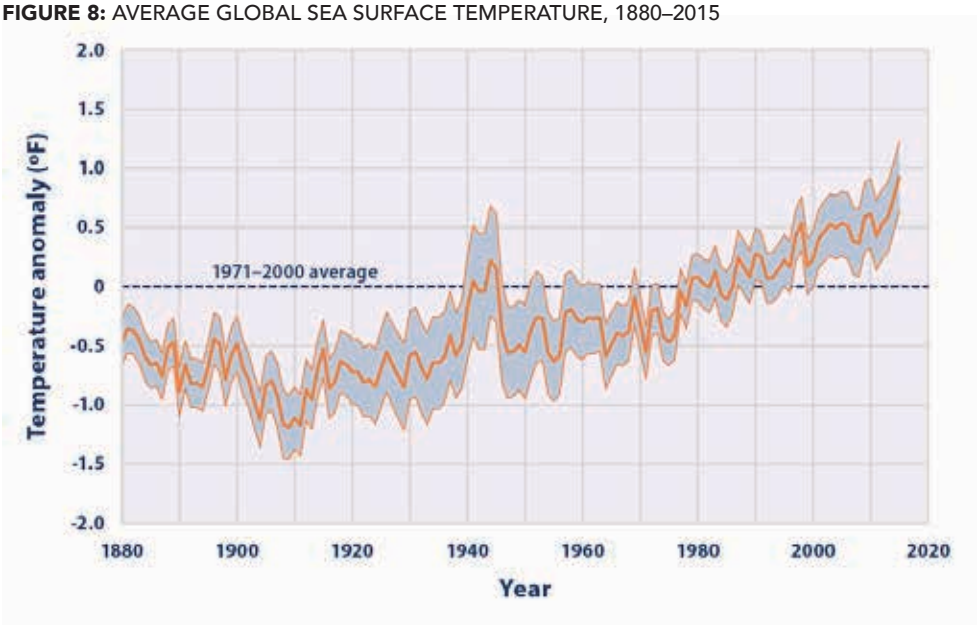
8.7 SEA SURFACE TEMPERATURE

Figure 8 shows the change in global average sea surface temperature since 1880, using a 30-year average as a baseline for comparison. The shaded band shows the range of uncertainty in the data, based on the number of measurements collected and the precision of the methods used. The information depicts a 30 year cooling-warming-cooling pattern up to the mid-1970s. But since then, the average sea surface temperature has continued to rise.

Historical changes in sea-surface temperature around the Cook Islands are consistent with the changes for the wider Pacific region. Water temperatures remained relatively constant from the 1950s to the late 1980s. This was followed by a period of more rapid warming of approximately 0.12°Celcius per decade from 1970 to the present.

In the Cook Islands, impacts on the marine environment associated with elevated sea surface temperatures have included coral bleaching and bacterial outbreaks in the lagoons. In Manihiki, the latter led to mass mortalities of pearl oysters.

FIGURE 8: AVERAGE GLOBAL SEA SURFACE TEMPERATURE, 1880–2015



SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION WEBSITE, JUNE 2013

8.8 OCEAN ACIDIFICATION

The ocean absorbs around 30% of carbon dioxide (CO_2) released into the atmosphere. As more CO_2 is released into the atmosphere, more is taken up by the ocean, which changes ocean chemistry and the pH of the ocean drops. This change has a significant impact on marine ecosystems by decreasing the availability of carbonate ions needed by calcifying organisms like corals, shellfish, and many marine plankton, to build their skeleton.

Research indicates that certain levels of saturation of calcium carbonate materials are required for healthy coral reef ecosystems to develop. It is suggested that seawater aragonite saturation states above 4 were optimal for coral growth and for the development of healthy reef ecosystems. Values from 3.5 to 4 are adequate for coral growth, and values between 3 and 3.5 are marginal. Coral reef ecosystems were not found at seawater aragonite saturation states value of less than 3.[32] In the Cook Islands region, the aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 4.1 ± 0.2 by 2000.

[32] Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (JNAP) 2011-2015, pg 6. .

9 CLIMATE PROJECTIONS

This section sets out projected climate changes under three scenarios.

In Table 3 below, data from a range of climate change models has been utilised to make climate projections based on three emissions scenarios:

1. Low, marked in blue;
2. Medium, marked in green;
3. High, marked in purple.

Projections are given for three 20-year periods centred on 2030 (2020–2039), 2055 (2046–2065) and 2090 (2080–2099), relative to 1990 (1980–1999). Confidence in the projections is also given.

This means that there is not one single projected future for the Cook Islands, but a range of possible futures. These projections also refer to an average change over the whole country based on projections for the region around the Cook Islands.

TABLE 3: PROJECTED CHANGES IN CLIMATE ASPECTS IN THE COOK ISLANDS UNDER THREE SCENARIOS

Climate Aspect	NORTHERN GROUP			SOUTHERN GROUP			Confidence Level
	2030	2055	2090	2030	2055	2090	
Surface Air Temp (celcius)	+ 0.6 ± 0.4 + 0.8 ± 0.4 + 0.7 ± 0.2	+1.1 ± 0.4 +1.4 ± 0.5 +1.4 ± 0.4	+1.5 ± 0.6 +2.2 ± 0.8 +2.6 ± 0.6	+0.6 ± 0.4 +0.7 ± 0.4 +0.7 ± 0.3	+1.0 ± 0.5 +1.3 ± 0.6 +1.3 ± 0.4	+1.3 ± 0.6 +2.0 ± 0.8 +2.5 ± 0.7	Moderate
Sea Surface (celcius)	+ 0.6 ± 0.3 + 0.7 ± 0.4 + 0.7 ± 0.4	+ 0.9 ± 0.4 + 1.2 ± 0.5 + 1.3 ± 0.6	+ 1.3 ± 0.5 + 2.0 ± 0.8 + 2.3 ± 0.8	+ 0.6 ± 0.3 + 0.6 ± 0.3 + 0.7 ± 0.3	+ 0.9 ± 0.4 + 1.1 ± 0.4 + 1.2 ± 0.4	+ 1.3 ± 0.4 + 1.9 ± 0.5 + 2.3 ± 0.7	Moderate
Aragonite Saturation State	+ 3.6 ± 0.2 + 3.6 ± 0.2 + 3.6 ± 0.1	+ 3.4 ± 0.2 + 3.3 ± 0.2 + 3.3 ± 0.2	+ 3.3 ± 0.1 + 2.9 ± 0.3 + 2.7 ± 0.1	+ 3.5 ± 0.1 + 3.5 ± 0.1 + 3.5 ± 0.1	+ 3.3 ± 0.1 + 3.1 ± 0.1 + 3.1 ± 0.1	+ 3.1 ± 0.1 + 2.7 ± 0.1 + 2.5 ± 0.1	Moderate
Mean Sea Level (cm)	+ 10 (5 - 15) + 10 (5 - 15) + 10 (4 - 15)	+ 18 (10 - 26) + 20 (10 - 30) + 19 (10 - 29)	+ 31 (17 - 45) + 38 (19 - 56) + 38 (19 - 58)	+ 10 (5 - 15) + 10 (5 - 15) + 10 (4 - 15)	+ 18 (10 - 26) + 20 (10 - 30) + 19 (10 - 29)	+ 31 (17 - 45) + 38 (19 - 56) + 38 (19 - 58)	Moderate
Rainfall (%)	+ 3 ± 8 + 4 ± 9 - 3 =13	+ 5 ± 12 + 6 ± 25 + 6 ± 26	+ 6 ± 22 + 8 ± 33 + 9 ± 37	+ 1 ± 11 + 3 ± 10 + 5 ± 9	+ 2 ± 8 + 3 ± 13 + 5 ±11	+ 5 ± 14 + 6 ± 13 + 8 ± 24	Low

SOURCE: Australian Bureau of Meteorology & CIRSO 2011, Climate Change in the Pacific Report.

9.1 SURFACE AIR TEMPERATURE

Temperatures have warmed and will continue to warm with more extremely hot days in the future. The increase in temperatures in the northern group is projected to be slightly higher than in the southern group. Night-time temperatures will also continue to increase.

9.2 OCEAN ACIDIFICATION

Ocean acidification has been increasing in the Cook Islands waters and it is projected to continue to increase and threaten coral reef ecosystems. Under the medium scenario, by 2055 aragonite saturation states will have dropped below 3.5 and by 2090, there may not be enough aragonite in the ocean for coral reefs to grow.

As CO_2 is less soluble in warmer waters, it is projected that less of an impact will occur at equatorial latitudes.

The impact of acidification change on the health of reef ecosystems is likely to be compounded by other stressors including coral bleaching, storm damage, nutrient-loading, and fishing pressure.

Today, more than a billion people rely on food from the ocean as their primary source of protein. In the Cook Islands, both jobs and food security depend on the fish and shellfish in the lagoons and oceans.

9.3 SEA LEVEL RISE

Sea level in the Cook Islands has risen and will continue to rise throughout this century. By 2055 all models are predicting an increase of between 10 to 30 cm.

Year to year variability will continue along with extreme sea-level events. The sea-level rise combined with natural year-to-year changes will increase the impact of storm surges and coastal flooding. As tropical cyclones are projected to become more intense, extreme sea-level events linked to these may become more dangerous.

9.4 SEA SURFACE TEMPERATURE

Sea surface temperatures are projected to increase at a slightly lower rate to air temperatures. This rate of change however, is projected to be much faster than the 0.12°celcius decade up to present. Consequently, it is also predicted that coral bleaching will become an annual event rather than the 4-7-year cycles observed in the last few decades. [33]

9.5 RAINFALL

Average annual rainfall in the Cook Islands is not projected to change significantly, but rainfall patterns are projected to change over this century with more frequent and more intense extreme rainfall days. Rainfall may decrease in the dry season in the northern group. There is uncertainty around projected changes in the South Pacific Convergence Zone (SPCZ), so there is only low confidence in rainfall changes for the Cook Islands.

9.6 TROPICAL CYCLONES

In the Cook Islands region, projections tend to show a decrease in the frequency of tropical cyclones by the late 21st century, but a possible shift towards more intense categories. There is likely to be an increase in the average maximum wind speed of cyclones by between 2% and 11% and an increase in rainfall intensity of about 20% within 100 km of the cyclone's center.

9.7 EL NINO SOUTHERN OSCILLATION

El Niño and La Niña events will continue to occur in the future, but there is little consensus on whether these events will change in intensity or frequency. They will remain the dominant mode of natural climate variability in the Pacific and continue to be an important influence on the variability of the Cook Islands climate through their impact on the SPCZ.

9.8 SUNSHINE HOURS

It is not anticipated that there will be much change to the sunshine hours. However, the patterns of cloud cover are changing as the climate changes. It is anticipated that more extreme hot days will mean more harsh sunshine.

[33] Hoegh-Guldberg, O., Mumby, P.J., Hooten, A.J., 2007. Coral reefs under rapid climate change and ocean acidification. Science 318, 1737–1742

10 SUMMARY

The Cook Islands as a nation has experienced significant economic growth in the past two decades. Overall health has improved with considerable work done to reduce the non-communicable disease burden. However, the Cook Islands face several challenges that will need to be considered when developing strategies for climate change adaptation. An ageing population in the Pa Enua driven by high levels of mobility within the nation and further to New Zealand and Australia, creates a unique context for climate change adaptation strategies.

The climate of the Cook Islands is tropical and determined in the main by the ocean without the impact of any significant land mass. There is a noticeable difference in climate between the northern and southern group due to geographical location.

The environmental harms due to meteorological and climatic changes are being increasingly felt. The acidification of the ocean, which is detrimental to the future of the coral reefs, and ocean warming, pose significant challenges which need to be considered.

Evidence continues to show shifts in weather patterns. Climatic trends and projections indicate sub-regional changes are of concern with more frequent and intense extreme rainfall days. There is likely to be more intense tropical cyclones with an increase in the average maximum wind speeds and rainfall intensity. Rising sea surface temperatures are expected to coincide with an increase in coral bleaching, rising sea levels, and an increase in the intensity, duration and frequency of extreme weather events.

Climate Change
INDICATORS IN THE COOK ISLANDS


Pukapuka January 2015


February 2016 (storm surge)


June 2019


Pukapuka rain floods 2018 Credit: Brian Opo

Tongareva 2015

Saltwater intrusion Pukapuka 2015

Coral bleaching 2015/16

2 VULNERABILITY AND ADAPTATION

VULNERABILITY AND ADAPTATION 2

2.1 INTRODUCTION

Addressing the vulnerability and sustaining island community resilience to climate change impacts is a continuing priority for the Cook Islands. Increasing community resilience to climate change impacts has certainly improved in the Cook Islands since the SNC. However, with the model predictions of climate impacts expected to worsen, it is highly likely that climate change will continue to negatively affect Cook Islands people, livelihoods and environment.

Considering that the Cook Islands contribute insignificant amounts of greenhouse gas to the overall global emission, clearly it is important that a significant amount of resources are directed towards adaptation efforts. Focusing adaptation investment is required to address the impacts and reduce vulnerability to the adverse impacts of climate change identified through national, sub-regional and island specific assessment plans. Building adaptive capacity has also been identified as a key priority in regional, national, sub-national and island level policies and plans.[34]

A systematic review of the literature combined with community meetings and surveys are critical to develop a vulnerability and adaptation assessment. Such an assessment is also important to raise the awareness of the impacts of climate change and climate variability in the respective communities and relevant stakeholders. Climate change is considered a cross-cutting concern for communities with a host of economic, social, health, and environmental implications. Table 4 below summarizes potential areas of vulnerability to the impacts of climate change that was adapted from previous NCs. There are four key factors that are influenced by climate change, these include variations in temperature, rainfall, extreme weather events and sea level rise.

Children from Rarotonga
—KO-Korero o te Orau, an indigenous NGO

Grating coconut
KO-Korero o te Orau, an indigenous NGO

[34] The Pacific Island Framework for Action on Climate Change 2006 – 2015 (PIFACC) the National Sustainable Development Plan (NSDP 2016-2020), and the Joint National Action Plan for Climate Change and Disaster Risk Management (JNAPII 2016-2020), Kaveinga Tapapa – Cook Islands National Climate and Disaster Compatible Development Policy 2013-2016, and the Cook Islands Climate Change Policy 2018-2028

TABLE 4: SUMMARY OF CLIMATE CHANGE VULNERABILITIES

	EXTREME WEATHER EVENTS	RAINFALL	SEA LEVEL RISE	TEMPERATURE
Coastal Zones Infrastructure and Coral Reefs	Wave damage to coastal infrastructure, erosion, increased sediment Re-suspension	Runoff nutrient and terrigenous sediments, increased debris to lagoons, lower salinity	Erosion, increased storm surges, damage to coastal infrastructure	Coral bleaching, algal blooms, anoxic conditions in lagoons, coral disease
Marine Resources & Fisheries	Damage to coastal infrastructure and vessel, stock loss, flare-up of ciguatera poisoning	Shifts in marine resources	Reef drowning, loss of intertidal communities	Algal Blooms, migratory and distribution changes
Water Supply and Quality	Water pollution, infrastructure damage	Drought, flooding, contamination, blockages	Increased salinity of freshwater table	Increased demand, compromised quality
Agriculture, Food Security and Diet	Damage to infrastructure, agriculture crops, and other resources for handicrafts	Damage to agriculture crops, Increased prevalence of invasive species and disease	Salt water intrusion of low-lying agriculture lands	Increased prevalence of invasive species and disease, loss of crops
Biodiversity (Terrestrial & Marine)	Casualties, habitat damage, displacement, food loss following, stress & social disruption	Favourable mosquito breeding conditions	Degradation of habitats and breeding sites	Increased prevalence of invasive species, species distribution
Human Health and Wellbeing		Increased gastrointestinal and vector borne diseases	Impact on coastal infrastructure, housing etc.	Emergence of tropical disease, heat stress, productivity impacts
Cross-cutting Socio-Economic considerations	Damage to critical infrastructure, relocation of people, disruption of education and social services, affecting vulnerable groups like the disabled, children, and women. Lack of insurance cover. Economic losses from productive sectors and food insecurity.	Damage to some infrastructure, reduced tourism attractiveness, and economic consequences from health issues.	Loss of land, traditional livelihood and culture, social & gender implications, investment diverted	Reduces tourism attractiveness, an increases energy demand (cooling). Particularly of concern for already vulnerable groups the disable,

2.2 VULNERABILITY AND ADAPTATION ASSESSMENT

The vulnerability and adaptation assessment (V&A) examined the vulnerabilities of communities, their existing strengths and resources as well as other ways or options available to augment community resilience to climate change impacts. Increasingly, government and its domestic and external development partners are addressing adaptation activities despite ongoing resource constraints and other competing development needs.

V&A assessments, covering mainly the Pa Enua of the northern group (Manihiki, Tongareva, Pukapuka and Rakahanga) and one southern group island (Atiu) were carried out between 2009 and 2013.

Consequently, community adaptation projects and programme priorities were identified. These activities aimed to address priority issues of each island to cope with changes in the event of temperature rise, decrease or increase of rainfall, extreme weather events and sea level rise.

The V&A assessments adopted a participatory community-based approach. The methodology was conducted by a small team (two to four members). Relevant skills of the team included a good level of understanding of climate change and related matters, ability to identify adaptation activities, community engagement and able to converse in Māori and English.

Three key methods used were:

- Mini-workshop with island leaders
- Community awareness campaign
- Household and geospatial mapping

These three activities were integral for each of the island assessments.

2.2.2.1 MINI WORKSHOP

The workshop was the first activity conducted. Stakeholders included the Mayor for the island, Deputy Mayor, Executive Officer (previously the Islands Secretary), Island Councilors, traditional leaders, community leaders, and government employees from different sectors such as Marine, Agriculture, Health, Environment and so forth. At each of the meetings held, the participants were taken through the five steps of the Cook Islands climate change and disaster risk assessment.

STEP 1 - Event and Outcome Risks: to identify event risk which is the "risk of occurrence of any particular hazard or extreme event" for example flood, drought, increased hurricane intensity. As well as the resulting outcome risk or "the risk of a particular outcome" for example loss of life, loss of income, loss of property, increase in pests/disease, increase in water/vector borne disease. These outcome risks were listed in the two previous national communication reports, the Cook Islands Second National Communication (SNC) and the Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (JNAP).

Community leaders would determine the priority risk against the event risks. For each island assessed, the top three would depend on what is a priority for that island. For example, on Atiu, severe weather events, change in rainfall patterns, and increased climate variability were the outcome risks selected by those present. For Atiu, this is reflected in the adaptation programmes and activities in the V&A and such activities as the review and implementation of the building code, design and construction of cyclone centres.

STEP 2 - Estimate Severity of Impact: In the context of climate change adaptation, event and outcome risks are prioritised and an estimation of the key elements of each risk is specified (by location if possible).

Participants choose to include non-financial criteria such as the loss of life, effect on GDP, impact on social capital and quality of basic services, environmental impacts or any other relevant measure that is suited to best express the potential impacts in measurable terms.

Step 3 - Estimate Event probability: Prioritised event and outcome risk from step 2 are discussed further. The participants would estimate the frequency or probability of an event based on their own expert judgment as a resident living on these islands. This includes their indigenous knowledge retained through oral history and passed on from generations ago.

Step 4 - Identify priority risks and vulnerable communities: Based on the outcomes from steps 1-3, the leaders then identified the top three priority risks, and identified districts/communities that are vulnerable to the top three priority risks affecting their sector. Some of the island communities identified the whole island as vulnerable.

Step 5 - Identify possible intervention options to address priority risks: From the prioritised event and outcome risks, the most vulnerable communities were identified before proposed policy options were introduced and discussed. These policy options become the community adaptation action plans.

2.2.2.2 COMMUNITY AWARENESS CAMPAIGN

The community awareness campaign is carried out and selected issues from the mini-workshop is included. Usually this is a general environmental and climate change awareness activity. The local team would present the causes and impacts of climate change and climate variability as an introduction to the session and from there the public would highlight what they considered the important issues resulting from events of climate change and how it should be addressed. Information from this session is included in the V&A assessment report.

2.2.2.3 HOUSEHOLD AND GEOSPATIAL MAPPING

The household survey and geospatial mapping are the final activities on island for the V&A Team. Information for the household survey was collected through a prepared questionnaire and carried out by the V&A assessment team. The geospatial mapping baseline was normally carried out prior to the island visit, where key population and geographical information including resources available like soil, topography and vegetation will be obtained for each island and used as a baseline for the onsite mapping of resources useful for the V&A assessment. Any new data gaps were identified and included in the V&A assessment final report.

2.2.2.4 DELIVERY APPROACH

To deliver the V&A assessment, it was recognised that the most effective means of engaging with stakeholders was by using the Māori language of the Rarotonga dialect. There were attempts to make all presentations at the workshops and awareness-raising campaigns in the local language. Given the technical nature of the information available on climate change, the approach was not always received favourably because technical language was still used, and this kept the quieter participants from free engagement in the process. However, overall, the use of mixed language was better than fully engaging in the English language. For those V&A team members fluent in the Māori language it provided them with the freedom to express their opinions and observations without the limitations posed by using English as a second language.

This was appropriate particularly where their views were based on the local knowledge. This process increased the local participation and engagement of the community.

2.2.2 SUMMARY OF V&A ASSESSMENTS FINDINGS

A summary table of the five V&A assessments findings is presented in the appendix.

Analysis shows food and water security were common priorities for these islands. For example, the assessments show that maintaining food-bearing plants after salt water intrusion, and with limited fresh water, and climate change impacts, was a key adaptation priority. Introducing hybrid crops that are pest, drought, and climate resilient was identified as a key coping strategy. Coping with extreme weather events through improved policy and regulations, providing cyclone shelters and climate-proofing public infrastructure was also identified. These and other findings are discussed below.

2.3 COASTAL ZONES – INFRASTRUCTURE AND CORAL REEFS

Coastal zones are of critical importance to the Cook Islands as most people live along the coast. These zones also contain associated infrastructure to support communities, public facilities and commercial activities. Equally important, is the coral reef ecosystems that flank the coastline. Coral reefs play an essential role in protecting low-lying coastal areas from strong wave action and erosion. This delicate ecosystem provides many benefits, especially to island inhabitants whose lifestyle and culture have been reliant on ocean resources for centuries. Such benefits include food, recreational opportunities,

medicinal products, and provides a major attraction for the tourism industry, which is the backbone for the Cook Islands economy.

2.3.1 COASTAL ZONES VULNERABILITY AND IMPACTS

Coastal zones are critical zones when considering the impacts of climate change. Coral reefs and coastal areas are considered the first line of defence against storm surges. When these zones are compromised, the impact to the Cook Islands would be significant especially as most people live on the coast. In addition, major infrastructure, government buildings, businesses, harbours, and airports are all located in this zone.

The slow onset impacts of climate change such as sea level rise plays an important role in the loss of coastlines and the flooding of low-lying atolls of the northern Cook Islands. For example, in Pukapuka, saltwater intrusion of agriculture lands has caused some taro swamps to be abandoned.

Coastal zones are also vulnerable to the impact of flood events during intense rainfall. Flooding can cause the erosion of coastlines, while runoff can deliver huge amount of terrigenous sediments and associated nutrients to the marine environment, which is detrimental to marine habitats and biodiversity.

2.3.2 COASTAL ZONES ADAPTATION

Since the SNC, several development projects have been undertaken in Cook Islands coastal areas. The impacts of the five cyclones in 2005 that damaged major infrastructure throughout the Cook Islands resulted in increased climate-proofing measures. For example, improvements to the harbours in Mitiaro and Mauke were prioritised by the Cook Islands government and included as part of New Zealand's aid programme support in 2006 towards the Cook Islands Recovery and Reconstruction Plan. Improvement work on the two harbours was completed in 2012. Similarly, the Pacific Adaptation to Climate Change (PACC) regional project funded through shared financing with Austrailan Aid (AUS Aid), GEF, and the Cook Islands Government undertook climate proofing work on the Mangaia harbour and the island's coastline following damage it sustained from cyclones Meena and Nancy in 2005. The project set out to develop a stronger and safer harbour, able to withstand current and future climate-related threats and was completed in 2013.

On Rarotonga, the rock revetment along the coast of the Maire Nui drive way in Avarua was part of climate-proofing the township area from storm surges. The improvement of the old Avatiu harbour and the development of the new Avatiu marina have been completed since the SNC when design options where examined. A coastal adaptation needs assessment was carried out and protection measures for the neighbouring communities of Ruatonga and Avatiu were considered.[35] In Muri, a WATSAN sanitation pilot scheme saw the installation of new sanitation systems with ongoing monitoring of the systems. A similar upgrade was conducted across Aitutaki with work beginning in 2013.

In addition to physical infrastructure initiatives, attention has been given to community and national level plans, strategies and regulations. For example, the National Solid Waste Management Strategy 2013 – 2016 has been completed and endorsed in principle by Cabinet. Communities provide input into their respective island sustainable development plan which includes coastal infrastructure and adaptation options. However, as identified in the SNC, the building code and environment impact assessment (EIA) procedures require attention to reflect adaptation options.

The Environment Act 2003 which applies to some, but not all, islands also requires revision, so that all infrastructure projects have climate-proofing considerations included.

The natural or autonomous adaptation of coral reefs in the Cook Islands also needs further attention to determine natural adaptive response to higher sea surface and air temperature.

[35] Refer to p.45, Second National Communication

Future adaptation plans for this focus area include continued climate-proofing of airports and runways as well as passages, ports and harbours. There is a need to strengthen sanitation infrastructure to address health and environmental risks on all islands, including risks related to climate change.

In addition to the proposition to designate part of the Cook Islands EEZ as a marine-managed area in 2010, there are plans to build the resilence of marine ecosystems to lessen the impacts of climate change. Discussions with the various stakeholders are ongoing to determine how to marry economic development aspirations with conservation objectives. [36]

CASE STUDY: CLIMATE PROOFING MANGAIA HARBOUR
- Pacific Adaptation to Climate Change Project
- Cook Islands (PACC – CI) 2009 – 2013

The PACC project supports the integration of climate change risks into policy frameworks and the implementation of community-based adaptation measures throughout the Pacific.

The Cook Islands PACC project focused on coastal management on Mangaia by climate proofing the harbour. Mangaia has lacked a harbour since it was damaged by cyclones in early 2005. Hence, PACC restored and strengthened the existing harbour. PACC CI is also incorporating current and future climate change impacts to make the harbour stronger and better able to withstand future cyclones and storms. The work on the Mangaia harbour was completed in 2013.

The project is funded by GEF-Special Climate Change Fund and AusAID and implemented by the Ministry of Infrastructure and Planning in partnership with SPREP. This project is set to reduce climate induced degradation and erosion of coastal areas and infrastructure.

Mangaia harbour (Photo by PACC_ CI)

[36] https://www.maraemoana.gov.ck/about-marae-moana/what-is-marae-moana/

Mitiaro forereef, 2014.

3 COASTAL ZONES, CORAL REEFS AND COASTAL INFRASTRUCTURE FUTURE ADAPTATION PLANS

- Implement the new building code for the construction and operation of residential, tourism and industrial structures and enforce a mandatory requirement to sign off any construction completion report between the builder and the building control or equivalent expert at ICI.
- Implement the new ICI Act to ensure new investments in infrastructure, housing, construction and agriculture outside hazard zones to minimise vulnerability, reduce repair costs and decrease disruption to economic activities.
- Involve landowners in all infrastructure projects from inception to completion stage and include them in areas where solutions are being sought to address issues that have adverse impact on the community and ecology.
- Update regularly the EMCI DRM/Disaster Risk Reduction (DRR) survey form covering household details, population data, building structure and climate change information, water and sanitation, mobilisation capacity, communication technology, building photos and location.
- Continue to support the enforcement of the Environment Act 2003 and include the requirement by the proponent to provide regular monitoring reports to the NES as part of the environmental management plan under the project permits and project approvals.
- Update regularly GIS information for each island identifying areas that are vulnerable to flooding and storm surge
- Preparation and development of project proposals for funding for the design and construction of appropriate coastal protection systems from flooding and storm sea-surge damages e.g. for Avatiu and Avarua townships
- Community groups to carry out coral replanting activities especially heat-resistance corals.
- Develop appropriate communications strategies to raise awareness regarding poor land management as a cause of soil degradation and erosion affecting the coastal zone including coral reefs.

2.4 MARINE RESOURCES AND FISHERIES

Fish and other food marine invertebrates underpin food security in the Cook Islands. Fish consumption is at least two times greater than the global average, especially in the Pa Enua. However, on Rarotonga, access to fish needs to be increased to provide the 35 kg per person per year recommended for good nutrition. Fisheries and aquaculture are also an important source of revenue and job opportunities for the government and people of the Cook Islands respectively. Offshore fisheries through licensing fees is an important source of revenue for the Cook Islands, contributing up to 10% of the country's annual GDP. Other marine revenue generating activities include pearl farming on Manihiki, and artisanal fishing on all the islands to supply the local market.

Mitiaro paua (clam)

2.4.1 MARINE RESOURCES VULNERABILITIES AND IMPACTS

Elevated sea surface temperatures have been reported to cause coral death through bleaching.[37] Bleach events from regional warming are notable during El Niño events in the northern Cook Islands group. While in the southern group, bleaching during El Niño events tend to occur as a result of extreme low tides where coral is exposed for an extended period during the day.

FIGURE 9: SOUTHERN COOK ISLANDS

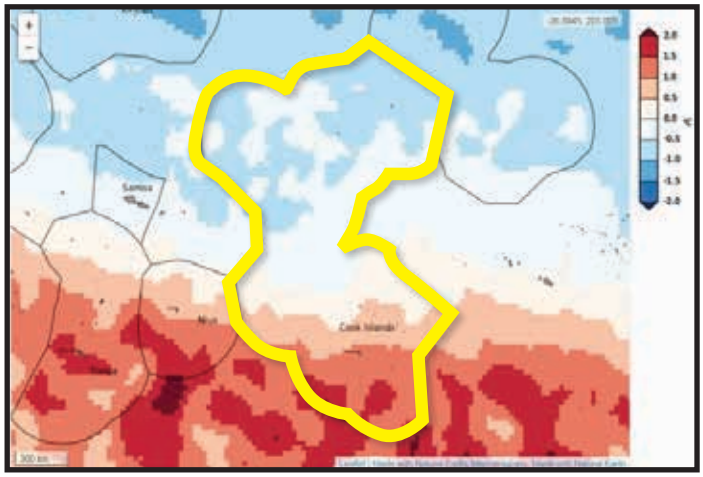
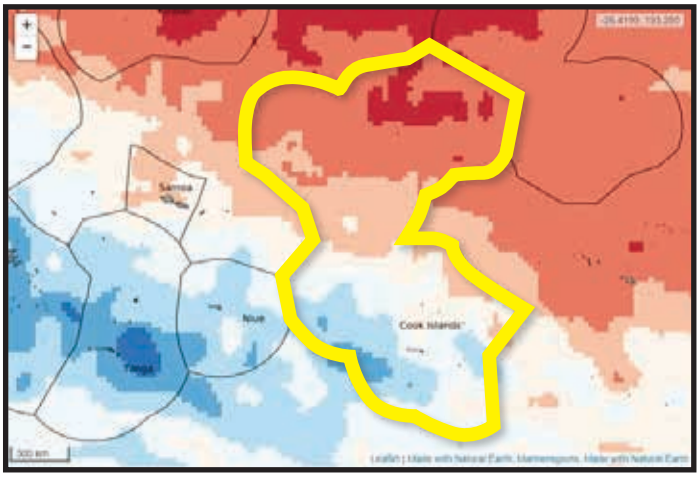


FIGURE 10: NORTHERN COOK ISLANDS



Source: http://cosppac.bom.gov.au/products-and-services/ocean-portal/)

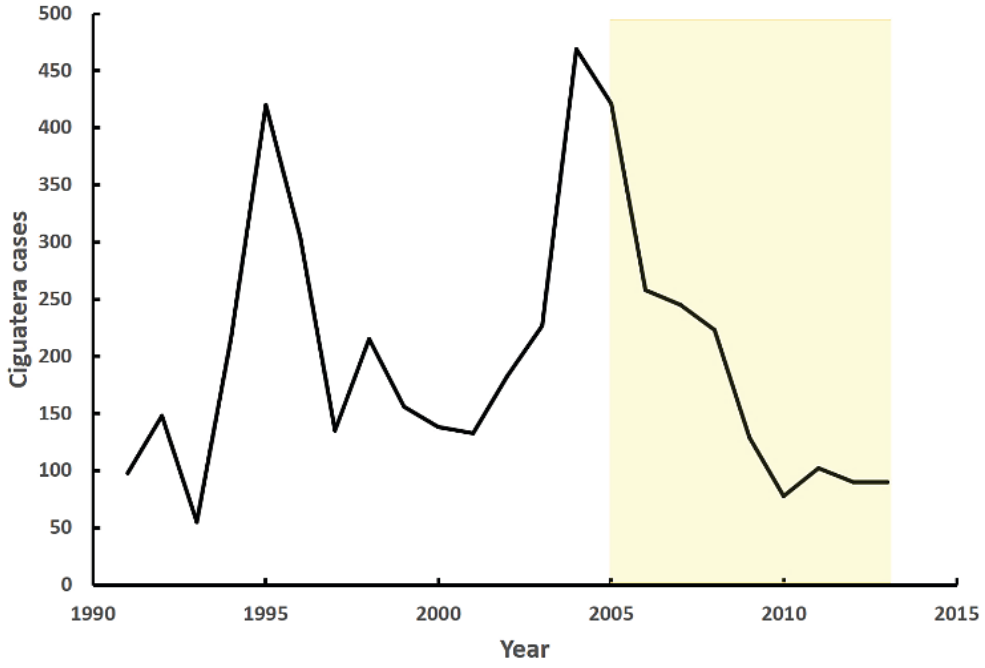
Bleaching from regional warming for the southern group usually occur during La Niña events. During these anomalous temperature increases, temperatures can exceed the tolerance level of coral species (25°C – 29°C), which can lead to extensive bleaching events.

Figure 9 and 10 above show the monthly temperature anomalies showing the contrasting climate effects between the northern and southern Cook Islands that was taken from the month of December 2009 (left) and December 2011 (right) during an El Niño and a La Niña event respectively.

[37] Hughes, T. P. et al. Global warming transforms coral reef assemblages. Nature 556, 492–496, https://doi.org/10.1038/s41586-018-0041-2 (2018).

Ciguatera poisoning, a form of ichthyo-serotoxins, occurs when reef fishes inadvertently ingest dinoflagellates that produce ciguatoxins. Ciguatera poisoning is characterised by various symptoms, including gastrointestinal, neurological, and cardiovascular disorder. Although the incidence of ciguatera fish poisoning has continued to be a problem on Rarotonga and Aitutaki since the SNC, there has been an overall decline since the 2005 cyclones *(see Figure 11)*. Recent research indicates that ciguatera fish poisoning was linked to reef disturbance events, mainly cyclones.[38]

FIGURE 11: CIGUATERA POISONING CASES FROM 1993 TO 2013



The yellow block in the Figure 11 indicates the overall decline in incidence from 2005 to 2013. Many of the impacts on the coastal areas are anthropogenic in nature. For example, on Aitutaki, dredging activities in the harbour and other locations within the lagoon has led to increased sedimentation within the lagoon. On other islands, dredging associated with harbour improvements has increased sediment delivery to the marine environment and likely caused damage to marine life. Furthermore, outbreaks of the coral predator the crown-of-thorns starfish, arguably driven by human-induced nutrient inputs to the marine environment, caused extensive damage to Aitutaki's fore reef between 2008 and 2013.[39]

The passing of the Seabed Minerals Act in 2009 was the beginning of the development process to explore the possibility of mining sea bed minerals in the Cook Islands EEZ. There are currently developments in this area to help government to understand the adverse environmental impacts of such a possibility with the help of relevant local and international agencies who have some expertise in this area.

Further strategic planning relevant to addressing climate change impacts was also undertaken by the Ministry of Marine Resources. The Marae Moana Policy 2016 (MMP 2016) and Marae Moana Act 2017 (MMA 2017) were put in place along with the Ministry of Marine Resources 2017 – 2021 Strategic Plan (MMRSP 2017-2021), to oversee the sustainable management of the Cook Islands marine sector.

[38] Rongo, T., van Woesik, R. (2012). Socioeconomic consequences of Ciguatera poisoning in Rarotonga, Southern Cook Islands. Rarotonga, Cook Islands. Harmful Algae Volume 20, December 2012, pp 92-100

[39] Bruckner, A.W. (2013) Mitigating the impacts of an Acanthaster planci (Crown-of Thorns starfish, COTS) outbreak on coral reefs in Aitutaki, Cook Islands. Khaled bin Sultan Living Oceans Foundation Publication # 9

2.4.2 MARINE RESOURCES ADAPTATION

Activities to support marine resources adaptation are currently underway. Enhancing pearl production in Manihiki lagoon is one area of activity, in particular, targeting existing pearl farmers and the pool of local seeding experts and strengthening support to the Island Council, Manihiki Pearl Farmers Association and the Cook Islands Pearl Authority. Robust development and implementation of a pearl farm management and lagoon management plan is currently underway. This provides scope to prioritise and undertake research to improve the productivity of pearl farming. The Ministry of Marine Resources has also worked on sustaining the production capacity and independence of the pearl industry. Monitoring the bone fishing industry on Aitutaki to ensure sustainability has become an important part of the tourism industry on that island and is running successfully.

Research programmes into the effects of climate change on migratory fish throughout the Pacific is currently being carried out by SPC. The results will inform future policy decisions around resource management. In addition, the Ministry of Marine Resources will build monitoring projects for the different fish species that have commercial and recreational value with reef health indicator species. These efforts will help the development and implementation of the appropriate management plans for lagoons, coral reefs, and migratory species.

Alternative economic industries related to marine resources are being developed. Eco-tourism is one such area that could include the development of dive-and-snorkel attractions involving giant clams, fish and coral. Once an economic value is assigned to resources in this way incentives exist to ensure their long-term survival.

The proposition to establish a marine-managed area within the Cook Islands Exclusive Economic Zone in 2010 is an important step towards securing a better future for marine resources in the Cook Islands to cope with the challenges of potential exploitation (i.e., deep sea mining, overexploitation of offshore fisheries) and climate change.

3. MARINE RESOURCES AND FISHERIES FUTURE ADAPTATION PLANS

- Continue research programmes into the effects of climate change on migratory fish throughout the Pacific. This is currently being carried out by SPC. The results will need to inform future policy decisions around resource management within the EEZ.
- Continue to build monitoring projects for different reef health indicator fish species, and from this, develop and implement management plans.
- Promote fish farming, especially tilapia in the southern group, and milk fish in the northern group to supplement fish meat during times of bad weather and as an alternative in case of ciguatera fish poisoning on those islands.
- Promote aquaponics practice around tilapia farming.
- Contribute to global monitoring programme to identify the sources of pollution by persistent toxic substances so that action plans may be developed to eliminate or reduce the emissions from such sources that contribute to marine life degradation.
- Phase out unsustainable fishing practices such as purse seining and encourage the implementation of sustainable fishing effort schemes.

- Development of alternative economic industries related to marine resources such as eco-tourism including further development of dive-and-snorkel attractions sites and protecting those sites from land-based pollution activities such as any proposed sewer outfalls and the release of nutrients from other sources into the lagoons.
- Review the current Environment Act to ensure any further development in the sea bed minerals sector is environmentally friendly and sustainable.

2.5 WATER RESOURCES

Previous NCs described the inadequate supply of water as a vulnerability of the Cook Islands. Investigations into alternative sources has been conducted and surveys of the Pa Enua have taken place. Measures to improve storage capacities and improve catchment capabilities have been completed and work to complete the same has been commenced on Rarotonga's water resources vulnerabilities.

Water supply was given a high priority by both the government and communities. This is evident not only in the national plans and budget estimates for this period but also as part of the common proposed activity in V&A assessments and island strategic plans of the Pa Enua.

For Rarotonga, it was inevitable that increasing visitor numbers meant a higher priority was given to the provision of safe and clean drinking water to protect tourism, the country's number one economic sector. Unlike the Pa Enua, Rarotonga has access to ground water and surface water through natural catchments. However, current demand has increased water supply vulnerability due to climate variability.

For the Pa Enua, water security is an area of extreme vulnerability. The low-lying islands of the north are particularly sensitive due to water supply being dependent on rainwater harvesting. Ground water on these islands is very limited and the quality easily affected by sea water intrusion during high seas. There were attempts to do ground water investigation for the islands of Aitutaki, Atiu, Mitiaro and Mangaia under aid-funded technical assistance programmes.

2.5.1 WATER RESOURCES ADAPTATION

V&A assessments for the Pa Enua and island strategic plans identified the need to increase water storage capacity. This could be achieved through the rehabilitation of useable existing community water tanks, the provision of new water tanks, and improving collecting capabilities at both the community and household level. On most islands as well as on Rarotonga, UV-treated and water filtering stations have been installed through community efforts and these have been well utilised.

Under the Strengthening the Resilience of our Islands and Communities to Climate Change (SRIC-CC) programme, six 45,000 litre cement water tanks were proposed and constructed on Pukapuka to replace old tanks, supplying storage for 270,000 litres of water. These new water tanks were identified for instalment in areas accessible to the villages. The same type of water tanks were constructed for Rakahanga (5), and Manihiki (2), and eight are planned for Tongareva along with two catchment buildings. This project also installed filtered water stations on Rakahanga.

The government under the NSDP 2011-2015 Priority Area 2 strategy (to improve access and quality of water to our communities) formed Te Mato Vai, the Cook Islands water partnership with the governments of the People's Republic of China and New Zealand for the water supply upgrade on Rarotonga. Work on the rehabilitation of the 12 water intakes on the island to increase storage capacity, and the construction of treatment plants, is currently in the pipeline for implementation. The work planned will also replace all trunk mains and local reticulation to the boundaries of all properties served by the current network.

A regulation to reserve the water catchment area behind the Takuvaine water intake was put in place in 2006 under the Environment Act 2003. A committee of management was appointed to oversee this regulation. The committee of management is also responsible for ensuring the quality of water entering the water intake is of the highest quality. One purpose of the reserve is to see how this type of management regime can help protect water catchment areas feeding into the water intakes contributing to Rarotonga's water supply. Activities protecting the water catchment include maintaining creeks and drainage around taro-planting areas to reduce contamination of the water intake from erosion during times of flooding and excessive rainfall. The Takuvaine Water Catchment committee is still very active today.

The importance and need for water conservation practices were also highlighted in the V&A and island strategic plans. The 2011 New Zealand Aid-funded water project on Mauke was an example of a water supply project utilising ground water resources with a strong water conservation component. The project provided water meter recording devices for the 229 households on the island. Each month the 151 occupied household meters are read and recorded to monitor water consumption to calculate the average monthly usage. From these recordings, households with high consumption recordings of above 7200 litres per person per month are visited and internal leakages identified, or over-usage discussed. The common problems identified were faulty toilet flushing systems and wasteful use. Fortunately Mauke is the only island with a metered reticulation system so it is able to monitor and manage water consumption to help maintain its underground reservoir.

2. WATER RESOURCES FUTURE ADAPTATION PLANS

- Government to give highest priority to water supply for the low-lying islands of the northern group.
- Drinking water stations should be a compulsory component when planning and delivering water projects in the Pa Enua as well as waste water management training. The monitoring of water stations to be part of the role of public health officers as they are present on all islands, and training and relevant tools should be provided to them to enable them to efficiently monitor the water stations.
- Phase out plastic tanks for drinking water in the Pa Enua due to preference expressed by Island Councils for storage options suited to climate and conditions.
- With the new building code, introduce and enforce building requirements for water tanks and rainwater collection systems for all new buildings.
- Put programmes in place to increase the number of households with water tanks and ensure water tank maintenance.
- Using the experience of the Takuvaine Water Catchment Reserve and its management plan, establish similar management regimes for each of the water catchments on Rarotonga to achieve safe and sustainable watershed management.
- Regular water quality testing, publication of results and create ongoing public awareness programmes on the need for good, clean water.
- Implementation of safe and sustainable water filtration technology and avoid the use of chemicals at the source.
- Use household water meters to monitor water consumption and to ensure water conservation is practised by household owners.
- Replanting of trees for soil stabilisation around water catchment areas and hills.

- Encourage watershed management, including protection of the cloud forest of Rarotonga in partnership with landowners. Develop a conservation area in the centre of Rarotonga in partnership with landowners, encompassing permitted activities and a moratorium on development at higher altitudes to protect watersheds.
- Develop ground water resources, monitoring salt water intrusion and looking for additional sources for times of long periods of drought.

2.6 AGRICULTURE, FOOD SECURITY AND DIET

V&A and strategic island plans have identified agriculture and food security as important areas of focus to assist local food supply and find substitutes for some imported foods like rice, bread, cabin bread, corned beef, tinned fish and frozen vegetables.

2.6.1 AGRICULTURE VULNERABILITIES

For Rarotonga, the management of water catchment harvest and how much water is stored and used is an important consideration. The high dependency on imported foods on both Rarotonga and the Pa Enua has become a feature of the lifestyle in the Cook Islands as less people are growing their own food. In the case of fishing on Rarotonga, ciguatera fish poisoning in the 1990s may have contributed to the decline in fishing activities especially in the lagoon and on reefs. This and land availability may be responsible for the decline in home-grown food and the shift to a reliance on imported foods.

The Pa Enua to some extent has continued to live off the land and sea, however, the declining population make it more difficult to maintain this lifestyle. For the southern group islands, increasing numbers of free-range livestock, especially pigs, have become a menace to growers, and the spread of noxious weeds have become harder to control.

Access to water supply is a major issue for farmers in the southern group islands. As a result, those engaged in growing local foods have maintained traditional food crops like taro, tarua, bananas, kumara, and maniota. Rukau-viti and pota-taro are also grown to help provide more balanced food options. These traditional foods are grown where not much water is required, as they are normally grown in the wetlands. Farmers with the capacity to grow vegetables like tomatoes, cucumbers, beans, and fruit do so for semi-subsistence and commercial purposes. However, most fruit and vegetables supplied are imported and available either frozen or processed.

Traditional crops and growing areas are vulnerable to flooding, causing root crops to rot. In times of drought, growth can be slow with low yields.

On Rarotonga, the more fertile lands and areas of wetlands are now being used for housing and other purposes, reducing the availability of traditional planting lands, and leading to a decline in locally grown food. In the Pa Enua, large areas of taro growing are now overgrown due to owners leaving the island. In the northern group, lower numbers of young people make it hard to rebuild planting areas inundated by sea surge during high sea events.

Some low-lying northern group islands like Pukapuka, Nassau and Rakahanga continue to grow traditional crops despite the difficulties faced. Kuru trees, pawpaw, lime and bananas are grown in compost trenches or pits to provide their staples and to substitute for rice, bread and fruits. Pulaka, rukau-viti and taro-rukau are also grown to add to the diet with the introduction of hydroponic agriculture, through funded programmes, helping to supply vegetables to assist with a balanced diet. However hydroponic growing is considered unsustainable due to the cost and transportation of nutrients used.

Raising livestock continues to be part of the daily life of our people, with pigs and chickens being raised in the northern group, and pigs, chicken, goats and to a lesser extent, cattle, in the southern group. With extreme temperatures in the northern group, livestock are susceptible to disease. Coconut and puka leaves are normally fed to livestock in the north.

The use of expensive imported pig food is used in the southern group to help give livestock a more balanced diet and improve the quality of the meat. Watergrass is also used to feed pigs to help supplement their diet. On makatea islands, most pig owners raise their livestock free range giving rise to problems caused by wandering animals.

2.6.2 AGRICULTURE ADAPTATION

The first two NC have described ways and initiatives to help with adaptation activities and V&As. Island strategic development plans identified ways where the Pa Enua can build capacity to adapt to changes in the environment caused by climate change -allowing residents to continue to supply traditionally-grown foods. Actions include improving and maintaining access to planting lands as well as maintaining traditional water wells and springs in the wetland areas to maintain ground moisture during times of drought. Improving drainage in wetland areas to help dissipate excess water during times of floods has also been implemented.

Aid projects, like the SRIC-CC hydroponics project, are designed to build resilience in the Pa Enua and have been implemented in the northern group. For the islands of Pukapuka, Rakahanga and Manihiki, the hydroponic project improved access to fresh vegetables. Although, not a sustainable agriculture system for the northern group islands, a revolving fund from the sale of the produce, allows the island administration to ensure the initiative is supplied with the nutrients required to sustain the hydroponics.

For Pukapuka, the income from the sale of produce provides the second largest income for the island, solar power being the first. The hydroponics project is situated next to the school which allows students to learn how to operate the initiative. There was interest to experiment with other fruit-bearing crops to increase vitamin-related foods on the island which are currently limited to lime, kuru and pawpaw.

Initiatives to support reforestation of the receding coastline across the whole of Pukapuka with coconut trees and traditional resilient tree species like tamanu, tou and puka trees, was supported through aid funding. This initiative contributes to the future supply of coconut for livestock and food security with the replacement of old coconut trees.

The training of young people to grow food is an area neglected by funding initiatives. A decreasing focus on agriculture in schools leaves training responsibility with families. Despite the heavy reliance on imported food and substitutes like rice and bread and imported frozen vegetables from stores, little or no attempt to build resilience for agriculture has been made. More initiative is needed to re-introduce agriculture into the schools.

The Ministry of Agriculture continues to develop crop banks via regional and international organisations. These banks serve to protect local varieties of foods, mainly, taro, bananas and kumara, which are stored overseas and accessible if required. It is important for the ministry and communities to ensure current and future generations know how to grow these traditional crops and also acquire the taste to eat them.

V&As and island strategic development plans continue to highlight the importance of training young people to be able to grow and eat local food, building and maintaining access to planting lands, building capacity to sustain agriculture.

3 AGRICULTURE, FOOD SECURITY AND DIET FUTURE PLANS

- Teaching agriculture at school is the place for our younger generation to learn about planting and to continue this through their youth at the community level. This can be beneficial for those living on low-lying islands with poor soil and as well as for those living on the higher islands with good soil for planting. This can also be expanded to the community through the establishment of home gardens.
- Continue involvement with SPC programmes to conduct regional research into developing species of crops which are resistant to changing climates and more suited to withstand higher levels of salinity. Also encourage the use of the SPC gene bank to aid in the recovery of agriculture following extreme weather events.
- Continue to encourage household agriculture for food security in the Pa Enua.
- Continue to develop niche markets for viable crops and commodities for domestic use, import substitution, and/or export, as well as strengthen biosecurity policies and control structures. The development of such a market will be crucial to reinvigorating the agriculture sector in the Cook Islands.
- Continue to encourage investment by the private sector throughthe processing of fruit crops into other marketable commodities such as juice and jams that have a longer shelf-life and are easier and lighter to transport.
- Continue to explore drilling bore holes for possible water sources during drought
- periods to assist farmers as was tried in Ruaau, Rarotonga.
- Promote hybrid-cropping to growers. This involves the use of crops that are resistant to pests and infestations due to increased temperatures, or using crops that can stand long periods of droughts or use less water.
- Promote with growers the concepts of biological agriculture - the incorporation of sustainable agricultural practices and the planting of crops based on soil suitability and local conditions. This can minimise greenhouse gas emissions from the degradation of land by agriculture.
- Continue remediation of known contaminated sites and improved regulations for life-cycle management of imported products that become hazardous waste at end-of-life. This includes government procurement policy to purchase "green" products with extended producer responsibility, and re-export of hazardous waste under the Basel Convention for environmentally sound disposal.

2.7 BIODIVERSITY – TERRESTRIAL AND MARINE

Biodiversity conservation is an important area under climate change as it is integral to the food chain and the wellbeing of ecosystems both in the water and on land. Development on Rarotonga and Aitutaki is putting increasing pressure on the biodiversity on each island. In the case of the Pa Enua, there is also pressure on biodiversity from the low numbers of people able to keep the land free from the uncontrolled growth of noxious invasive species that were either intentionally or accidentally introduced. An example of these species are acacia and pine on the makatea islands. Wandering animals in the Pa Enua have also impacted on the biodiversity there.

2.7.1 BIODIVERSITY VULNERABILITIES

Traditionally-used plants, especially tree species that are very good ground anchors, have decreased in the northern group islands. With the focus on income-generating activities there is lesser attention given to replanting these tree species that would assist in holding the land on the coastline, and preventing coastal erosion in the face of sea level rise and extreme weather events.

The V&As and island strategic plans have identified replanting schemes, especially for the northern groups as a priority. Tree species such as the tamanu, pukatea, tou and coconut are not being replanted as a normal on-going activity on those islands, except when funded via an aid project. As a result, efforts to look after these trees are poor.

On Rarotonga, there is an attempt to replant these tree species along the coastline of Avarua, but only on public areas. With the increase in tourism accommodations, especially along the coastline of Rarotonga and Aitutaki, these tree species have been removed and then replanted making the coastline vulnerable to any coastal erosion for the next 50 years.

Traditional medicine practitioners have expressed concern that some medicinal herbs are now hard to find. Examples of this is the pueikao (Mauke) or nuroa (Mitiaro). Practitioners say, the shade- tolerant plant is usually found in areas that are damp but not in the wetlands. Long spells of drought have impacted negatively on this plant and other similar plants.

Temperature shifts are projected to have an enormous impact on tuna migration. Tuna are more abundant in the warmer waters of the northern group and a shift in temperature will affect the distribution of tuna in our waters.

The National Environment Service has carried out surveys on coconut crabs to measure their number and distribution on makatea islands. The results indicate there are fewer coconut crabs as they are much easier to harvest (with the presence of new roads and infrastructure) making them more visible, especially during full moon, as they cross towards coastal areas to spawn. It is understood changes in temperature can cause shifts in mating cycles for some organisms, and with an already reduced population of coconut crabs, this species could be vulnerable and should be protected with managed harvesting.

Green turtles, the most common species in the Cook Islands, are frequently observed in the waters and on the shores of some of the islands, particularly Aitutaki, Manuae and the northern group islands. They are rarely seen on Rarotonga. On Mauke they are seen from July to December. Receding coastlines due to sea level rise will affect turtle breeding sites and increasing development of the coastline on Aitutaki will also affect turtle breeding sites on that island.

The Pa Enua is also prone to fires especially during long periods of dry weather. Parts of Maunga Pu on Aitutaki are frequently burnt. On the makatea and atoll environment, the high organic groundcover is a fire risk and a threat to biodiversity on those islands.

There are also threats to local plant biodiversity from the spread of invasive species and these have been noted under the SNC. Combatting invasive species was also identified by most of the islands in their V&As and island strategic plans as a threat to food crops and biodiversity.

2.7.2 BIODIVERSITY ADAPTATION

V&As and island strategic plans identified marine reserves, rā'ui, replanting of trees along the coastline, and maintaining traditional knowledge, as key actions required by most island communities and government. Disaster risk management plans cover bush fires and their management.

Traditional medical practitioners group Te Rito O Te Vairakau Māori from the southern group islands, encourages the use of traditional medicine as a means to maintain the knowledge on plant species used for medicine. This will help people know the importance of these plants and work to protect them, especially old trees and the places they are found.

Most of the islands where coconut crabs are found have imposed local management policies or rā'ui on the harvest of coconut crabs. Mauke has set aside an area of its makatea for the protection of the species. The Atiu Island Trust continues to protect the island of Takutea as a wildlife sanctuary.

3 BIODIVERSITY (TERRESTRIAL AND MARINE) FUTURE ADAPTATION PLANS

- Creating awareness and putting in place management regimes on species and areas of significant biodiversity, followed by appropriate legislation, is a recommendation that is found in most island strategic plans. Teaching children about the environment by linking them to the land and the sea should be carried out on all islands. The teaching of appropriate traditional knowledge through practical activities should be the focus of any environmental training programme.
- Continue to encourage the planting of local tree species such as tamanu, tou, miro, pukatea and coconut for medicinal and other traditional use, and to help combat erosion of coastal areas.
- Continue to create awareness about fires near bush areas, makatea and motu, especially during times of dry weather.
- Encourage tourism accommodations on Rarotonga and Aitutaki where turtles are found to be nesting or where potential nesting could occur, to accommodate any potential nesting sites and incorporate them into their business as part of their activities.
- Encourage and support traditional medicine practitioners to practise their craft, not only for health care service but also to protect and preserve knowledge on local plants and to help people understand their importance.
- For government to support sustainable tuna fishing practices so that fishers can continue to benefit from this resource and feed their families and the communities they live in.
- For islands to adopt the Pukapuka and Nassau conservation practices that is carried out for the coconut crabs on their respective islands.
- Ongoing support to the Ministry of Agriculture Biosecurity programme on all islands by providing ongoing training of local officials and creating awareness within the communities to secure their full cooperation to keep new pests out.

CASE STUDY: PARTNERSHIP APPROACH TO CLIMATE CHANGE AND VECTOR BORNE DISEASES ***- SRIC Adaptation Fund and Ministry of Health Partnership 2013***

Building partnerships between government departments and Climate Change projects are deemed the most effective means of delivering relevant climate change services to Pa Enua communities. By integrating climate change information with relevant social or health service training it was possible to share costs as well as reduce time and participation demands on small communities.

In an effort to strengthen communities against vector borne diseases from climate change, Public Health Officers from around the Cook Islands congregated on Rarotonga to undertake a training workshop. This was made possible through a signed partnership arrangement between SRIC and the Ministry of Health.

Participants were introduced to the concepts of climate change by Ana Tiraa, Director, Climate Change Cook Islands.

Charles Carlson from Emergency Management Cook Islands spoke on preparedness for disasters whilst William Tuivaga from SRIC explained the connection between SRIC and communities in delivering climate appropriate projects at the grassroots level.

By building the capacity of Health staff, the initiative is expected to strengthen the resilience of Pa Enua people in the roll out of the Ministry of Health's Vector borne Disease strategy in 2014.

2.8 HUMAN HEALTH

Non-communicable diseases (NCDs) such as cardiovascular disease, diabetes, respiratory problems and risk factors such as hypertension and obesity are the leading causes of morbidity and mortality in the Cook Islands. In 2015, the Cook Islands was identified by the World Health Organization as having some of the highest rates of obesity in the Pacific.[40] The health and well-being of the people of the Cook Islands is an important consideration in the event of climate change, and every attempt must be made using available technology, appropriate local as well as modern medical practice and advice, to build our resilience to changes as a result of climate change.

2.8.1 HUMAN HEALTH VULNERABILITIES

There are numerous health vulnerabilities brought about by climate change. Temperature increases can increase the risk of tropical disease, heat stress and impact productivity; increased rainfall can cause increased gastrointestinal and vector-borne disease; extreme weather events can cause stress and social disruption; and rise in sea level can impact on coastal infrastructure and housing.

Extreme weather events like heat waves, cyclones, floods, and droughts can create ideal conditions for the spread of water and animal borne diseases. Climate change can increase the risk of mosquito-borne infections, particularly dengue fever. Heavy rainfall caused by climate change, in the La Niña phase, can create new pockets of standing water, which provide ideal breeding grounds for mosquitoes. Warmer temperatures, meanwhile, allows viruses to replicate more quickly and be transmitted almost immediately after they infect a mosquito. As temperatures increases, mosquitoes mature faster and bite more frequently thus increasing transmission rates.

[40] https://edition.cnn.com/2015/05/01/health/pacificislands-obesity/index.html

Climate change can threaten water supplies. Increased flooding, for instance, can introduce contaminants into the drinking water of an entire intake which can affect water sources. Diarrhoeal diseases can be spread through contaminated food or drinking water. Droughts bring on lack of water for proper hygiene which can lead to skin diseases.

While climate change is often thought of as a long-term existential threat, for residents of small island nations, it's an immediate public health challenge (SNC).

2.8.2 HUMAN HEALTH ADAPTATION

To reduce vulnerability to the effects of climate change on human health and wellbeing, people must be healthy. The environment must be kept healthy to sustain our capacity to reduce the impact of overuse. Communities must be prepared for extreme weather events.

V&As on most islands have identified the need to improve the supply and quality of water, the importance of food security, and support services to sustain these needs. There are currently ongoing health programmes that contribute to this adaptive capacity.

- Smoking cessation services.
- Clinical services to address cardiovascular and obesity-related illness.
- Health education campaigns to address diet, water, and basic hygiene.
- Ongoing compliance activities under the Public Health Act 2004 by the Ministry of Health to monitor waste water treatment.
- Tutaka notice programme of household inspections aimed at reducing mosquito breeding sites and failing septic tanks
- Water quality testing programme run by the Ministry of Marine Resources also contributes as a monitoring tool to ensure water quality is conducive to a healthy marine environment. This is an important activity, particularly on Rarotonga and Aitutaki where the lagoons are used for recreation for tourists and food sources.
- The Public Health drinking water testing programme for water filtering stations and intakes, also contribute as a monitoring tool to ensure drinking water is safe and clean.

The EMCI disaster risk management planning programme has prepared communities in the case of any disasters through extreme weather events. This is also achieved through its DRM and DRR database development to ensure accurate and relevant data is collected and updated for quick access, and for assistance to be delivered for where and when needed.

3 HUMAN HEALTH FUTURE ADAPTATION PLANS

- Support for health programmes as mentioned above and access to health care services - both conventional and traditional - would be recommended for all islands. Improved water quality and supply, food security and maintaining traditional foods and ensuring environmental safety is a priority.
- Investment in toilet systems that utilise minimal to zero water would assist with the supply of water as nearly 50% of water used in the household is for toilet flushing.
- The use of local traditional medicine is an area that can be strengthened through encouraging practitioners in this area to safely practise their medicine. In the Pa Enua, local traditional practitioners continue the use of their medicine and contribute to health care due to their isolation and high costs to maintain effective conventional health care services.
- Ongoing review of DRM plans must be sustained, and practice runs to test the plans is a must.
- Education programmes on household water treatment options (filtration, boiling water) for times when water quality is low.
- Provide training for food storage and processing techniques to improve food security, and the livelihoods of family households isolated from the availability of food products.
- In partnership with Ministry of Agriculture, continue promoting locally grown produce – production and consumption.
- Ongoing monitoring of vectors to be done quarterly especially if vectors become resistant.
- Continue the testing of the quality of the drinking water using WHO standards quarterly. Notifiable conditions are checked regularly on a weekly basis with types of action to be taken to manage any outbreaks.
- School inspections to be conducted after heavy rain and flooding to monitor the school septic tanks. There is bound to be an overflow of sewerage. Increase in rain due to future climate change may also increase flooding.
- Community inspections to take remedial action especially after heavy rain and flooding to monitor household septic tanks near wetland areas or low-lying areas in the villages.
- School heath survey of all students at all levels to be done every three years looking at all health- related aspects of the children and seeing if the change in climate might have an influence on children's health.

2.9 CROSS CUTTING SOCIO-ECONOMIC CONSIDERATIONS

There are several potential direct and indirect adverse effects related to temperature rise, rainfall variation, extreme weather events, and sea level rise that may not be captured within a purely sectoral analysis of climate change vulnerability and adaptation. These issues and proposed adaptation options for them will need to be given in-depth consideration (studies and research) to the cross cutting socio-economic aspects in the future.

Overall development of the Cook Islands also determines how climate change will impact the country and its communities. Linkages between climate change and development are increasingly recognised. These socio-economic development patterns will determine vulnerability to climate change and our capacity for adaptation to climate change. The impacts of climate change on our natural systems in turn influence development patterns.

The economy of the Cook Islands continues to be characterised by a very large number of imports and proportionally a very small number of exports. Tourism continues to be the major industry of the Cook Islands with the current annual average of 120,000 visitors per year and expected to continue to increase. The marine sector's chilled and fresh fish dominates exports. Live fish and pearl exports, which increased from 2011-2014, follow closely behind.

As mentioned in the previous NC, holistic consideration of how land and economic losses, food and water insecurity, investment, traditional livelihood and culture, social and gender implications, across all sectors due to climate change will affect the viability of the country and potential overall adaptation, has yet to be undertaken.

2.9.1 CROSS CUTTING VULNERABILITIES AND IMPACTS

Climate change and associated natural disasters, such as floods, droughts, cyclones and storms, affect women differently from men, and often more severely as women in the Cook Islands have the responsibility of making sure there is food in the home, and the home is clean and hygienic. As mentioned in the previous NCs, men and women have distinct roles and responsibilities in the home that give rise to differences in both vulnerability and the ability to cope with the consequences of climate change, including disasters. As a result, vulnerable groups such as women are likely to be faced with problems such as food insecurity, loss of livelihood, and hardship due to environmental degradation that may lead to displacement and relocation.

Recognising that the physical impacts of climate will disproportionately impact on the lives of women is an important consideration. A number of gender-differentiated impacts have been identified.

Women on the Pa Enua are reliant on natural resources as either the main source of income for their households or to supplement it. For example, maire in Mauke, Mitiaro and Mangaia, the rito (young coconut fronds used in handcrafts) of the northern group, and increasingly, coconut oil for medicinal or general use purpose, are now being sold at craft shops, trade fairs and the Punanganui market on Rarotonga. The impact of climate change on the supply of these natural resources will affect the income levels of the Pa Enua involved.

The number of pupu shells on Mangaia continues to decrease, leading to a reduction in the amount of necklace ei produced for sale. As another activity of women, this directly impacts on the income levels of those households which has a flow-on effect on the economy of the island. Maire as a source of income for some households on Mauke is also on the decline. By the end of 2013, the export of maire to the Hawaii market had ceased due to reduced supply in the wild caused by prolonged dry conditions.

There has been an increase in the production of medicinal coconut oil in the Pa Enua. The quantity produced is small, but the supply is continuous. Mauke's mori-pi or akari-pi labelled as Mauke Miracle Oil is a popular product at the market. It is primarily sold to local residents who send the product to their families abroad.

The gathering of sea food, especially from the reef, is carried out by women and children. Referred to in Mauke and other southern group Pa Enua as angota, this delicacy not only contributes to the household but is sold locally and also to community function caterers on the Pa Enua as well as on Rarotonga. Aid-funded private and government workshops, conferences and official visits are a feature of the Pa Enua as well as Rarotonga, and food for kaikai or katikati, is provided as a part of maintaining cultural food practices around hospitality and generosity.

Makers of handicrafts, fresh flower ei and coconut oil also benefit along with caterers of functions as their products are sold onisland or offisland, as gifts to foreign and local workers at conferences and workshops in the Pa Enua. After the fall of the maire export market, maire continues to be supplied to Rarotonga from Mauke, Mitiaro and Mangaia for important functions.

Further research on the impact of climate change on the economic stability of women and other vulnerable groups is required.

2.9.2 COMMUNITY WELLBEING

Key climate related hazards affecting the Cook Islands are cyclones, storm surge, floods and droughts. The Cook Islands lies within the "cyclone belt" and its vulnerability to cyclones was emphasised in 2005 when the country was hit by five consecutive cyclones in just four weeks causing damage estimated at NZ$20 million.

Prior to this, cyclone Sally extensively damaged Rarotonga in January 1987 and in November 1997 cyclone Martin destroyed about 90 percent of the houses and killed 19 people on Manihiki. Cyclone Martin furthermore, caused people to leave the island and move to the main island Rarotonga. Some families also migrated to New Zealand. In 2010 cyclone Pat caused significant damage to 75 percent of homes on Aitutaki. A year later during the next cyclone season some residents were still living in tents, or had migrated, due to a longer than expected aid-supported rebuilding process.

Extended droughts have also led to pressures on families. Such events also result in disruptions to basic services including water, sanitation, and electricity as well as schooling, healthcare, sporting and cultural events, and other aspects of community well-being.

Relocation within the country or beyond, loss of food sources, having inadequate water and livelihood as a result of climate change impacts, has implications that require further consideration of the circumstances where people and services are forced or voluntarily relocated due to food, water and livelihood insecurities brought about by climate change. This includes examining how climate change impacts threaten the sustainable habitability of islands and coastal areas for human settlement. Examining the implications such as land availability, ownership, protection and maintenance of important sites and graves, as well as losses associated with culture, sense of identity, traditional knowledge and the ties of people to land and ocean, can inform possible policy actions and adaptation measures.

2.9.3 TOURISM

Tourism development in the Cook Islands is based primarily on Rarotonga and Aitutaki. The associated infrastructure and services are mainly located on the coastal areas with residences, businesses and government services. These areas would be significantly impacted by increased storm surges and cyclonic events.

The Cook Islands natural environment provides the foundation for the long term economic and social wellbeing of the nation. As the Cook Islands key industry, tourism is reliant upon the attractive ambience of the natural environment of the islands.

Tourism Cook Islands is responsible for the development of this sector and its objective is to promote and develop tourism in the Cook Islands to achieve sustained growth, in a manner that is economically viable, socially and culturally acceptable, and environmentally sustainable.

Tourism is at risk from climatic fluctuations in the short term and from climate change over longer timeframes. Climate-related impacts upon tourism services, such as water, energy, the marine environment, as well as Cook Islands culture, has not been previously quantified (SNC). Through its sub-industry councils, the sector has integrated best environment practices with tourism development. As such it has a waste management policy, water and energy policy that is practised by the various sub-industries within the industry such as accommodation sector, the restaurant sector and tour operators. A change in weather and climate conditions would require the tourism industry to develop future opportunities that are responsive to those changes.

Farewelling families and friends, Pukapuka 2016.

2.9.4 ENERGY DEMAND

Previous NCs have identified the need for a more environmental, friendlier energy source to reduce the country's use of fossil fuel-driven energy supply. By 2011, the Cook Islands government policy to transform the nation's electricity supply to 50% renewable energy by 2015 and 100% by 2020 started with the establishment of the Renewable Energy Commission to oversee the implementation of this policy and later the Renewable Development Division (REDD) in the Office of the Prime Minister (OPM). By 2012 scoping missions to all the Pa Enua including Rarotonga were completed. Project concept documents for renewable energy on each island were drawn up and negotiations for funds commenced. Once up and running, there will potentially be a huge decrease in the volume of imported fuel as power generation takes up a large proportion of that import.

Cooling systems have become an important office equipment and these cooling systems are increasing in use on Rarotonga and to a lesser extent Aitutaki, especially in the months from November to April where daily maximum temperature can exceed 29 degrees celsius. The demand for air conditioning and cooling fans to be turned on during this time increases, contributing to increased energy consumption. With the expected increase in temperature over the coming years, the demand for cooling systems will continue to increase.

The use of electrical appliances in the Pa Enua has also increased demand for electricity and therefore the demand for fossil fuel on all inhabited Pa Enua. The increase is mainly in the area of refrigeration for food preservation, lighting, and electrical equipment such as power tools and fans.

It is anticipated that fossil fuel import will continue to cater for transport needs, such as shipping, land and air transport.

2.9.5 DISASTER RISK MANAGEMENT

DRM remains a key priority as articulated in the National Sustainable Development Plan (NSDP 2011 - 2015) where it is now strongly linked with climate change. Goal 5 - 'A Cook Islands where our people are resilient to disasters and climate change to achieve sustainable livelihoods'. Policy guidance is spread across the four objectives: i) Strong governance arrangements for DRM and CCA; ii) High quality risk information is available to inform planning and implementation; iii) Effective preparedness,

response and recovery; and iv) Resilience built through effective Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Following a policy decision in 2010 to harmonise DRM and CCA, the DRM National Adaptation Plan (NAP) was reviewed and updated by a Joint DRM and CCA NAP (2011 - 2015) which has been reviewed and updated (2016 - 2020).

The Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation was published in early 2012. A dedicated Climate Change Division ('Climate Change Cook Islands') was established in the OPM and is resourced through a combination of government funding (staff) and donor funds (programmes). EMCI and CCCI are now engaging in joint programming. A National Platform for CC and DRM has been established. The Cook Islands government has been successful in securing significant project-linked funding for DRM and CC.

A national contingency fund - Disaster Emergency Trust Fund - has been established with an initial NZD200000 allocation from government. Capacity-building initiatives are on-going, and DRM committees now exist at the village-level in Rarotonga. Disaster coordinators have been designated in the Pa Enua and disaster management focal points have been designated in all ministries and agencies.

Achievements of the intention to 'improve planning and budgeting by strengthening linkages at the national, sectoral and agency levels and integrating climate change and disaster risk management into budgeting processes' have been moderate. Advances in this regard include budget labelling of certain types of infrastructure projects into a new category for 'climate change adaptation', the advancements made with respect to the conversion to renewable energy, gender and climate change policy, and government's agreement to institutionalize the staffing costs of the new climate change division.

The Aitutaki cyclone recovery programme was successful in systematically incorporating risk reduction approaches into its design.

The establishment of the Disaster Emergency Trust Fund has served to reduce delays in emergency response, and tsunami signage and sirens have strengthened levels of preparedness.

2.9.6 MAINSTREAMING GENDER INTO POLICY FRAMEWORKS

Gender perspectives on climate change with regards to agriculture, fisheries, food and water security and livelihoods, will continue to be a consideration in the design of programme proposals and activities (SNC).

Improving and strengthening the capacity of women to contribute to climate change adaptation strategies is necessary as directed in the National Gender policy (SNC). This requires conducting studies and research to understand the differential vulnerability of women and men towards climate change impacts and how they respectively respond to climate stresses; ensure an equitable participation of women and men in climate change adaptation programmes, especially at the community level in the Pa Enua; provide information, build and strengthen the capacity of women to be prepared and respond to natural disasters and climate change impacts; ensure gender perspective and women human rights are properly integrated in climate change strategies, and that funding mechanisms favour gender responsive initiatives.

The Cook Islands social impact fund (SIF) administered by the Ministry of Internal Affairs has identified women, the elderly, the disability and youth as vulnerable sectors that require assistance under the fund. Activities include building and strengthening resilience to hardship as a result of climate change.

All members of the communities, including the vulnerable, disadvantaged and minority groups will benefit from awareness-raising and training activities, through participatory consultation processes engaging community organisations (NGOs) and social institutions, such as village councils, church, youth, and women's groups.

Internationally recognised principles of gender equity as well as appropriate traditional practices can be applied, with gender analysis tools during implementation of programmes and individual activities.

CASE STUDY: CLIMATE CHANGE KNOWLEDGE AND THE SILVER SURFERS - ***GCCA PSIS Programme (2013-2014)***

The European Union Global Climate Change Adaptation programme for Pacific Small Islands States (EU-GCCA PSIS) included week-long tablet-based training courses as part of the project. Lessons on how to sign up to and use Facebook as well as introducing students to communications programmes like email, video sharing and voice technology such as Skype.

Much of the working-age population are working away from their islands leaving behind a relatively large ageing population to bring up young children.

While climate change evidence is common knowledge, Cook Islands researchers were surprised to find that information was not well documented. Of concern was that even though grandparents are bringing up many of the islands' youngsters, children surveyed as part of the project were found not to be holding on to this traditional knowledge.

As such knowledge rests mainly with individuals it is also not being transferred between generations. This project provides modern means for generations to communicate with each other and pass on this important information before it is lost.

The project has enabled silver-haired internet surfer students to publishing news, pictures and chats online fromtheir own Facebook accounts that they created during the training. They even have a Facebook page called Rauti Para. "It refers to the 'old leaf' about to drop off of a certain traditional plant, the Ti".

The class in full concentration 27 = 31 Jan 2014 (Photo by Celine Dyer)

7 FUTURE ADAPTATION PLANS TAKEN INTO CONSIDERATION SOCIO ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

- Continue to evaluate the impact of climate change on the natural resources that vulnerable groups use, through feasibility and environmental impact assessment studies for economic and social benefits and how these resources can be sustained in the face of climate change.
- Examine impact of climate change and potential threat of displacement and relocation for communities to inform possible policy actions and adaptation measures.
- Tourism to continue to invest in economically viable, socially acceptable and environmentally sustainable tourism development.

- Government to reach transfer of the nation's electricity supply to 50% renewable energy by 2015 and 100% by 2020.
- Continue the application of gender analysis tools, use recognised principles of gender equity during implementation of programmes and individual activities.
- Continue to seek further contribution to the established Disaster Emergency Trust Fund to maintain capacity-building initiatives for DRM
- To enable adaptation options to be implemented, the following actions have been identified as being of high priority through the JNAP:
    - Continue to incorporate climate change adaptation and disaster risk management into sectoral/community plans and continue to review regularly and develop local level action plans.
    - Identification of coastal areas vulnerable to storm surge and flooding using climate and sea surge modelling.

2.10 SUMMARY

Addressing vulnerability and sustaining island community resilience to climate change impacts is a continuing priority for the Cook Islands. The Cook Islands situation with regards to increasing community resilience to climate change impacts has certainly improved. It is reasonable to state that with increased knowledge learnt through experience since the INC, and from analysing data collected to help understand these issues, there is consensus as to what needs to be done as reflected in future adaptation plans and programmes.

V&As, Development and Community Plans have identified food and water security, strengthened ability to cope with extreme weather events, the need to protect the natural resources from degradation are important to support adaptation efforts.

Nikao Seawall

3 NATIONAL INVENTORY OF GREENHOUSE GASES

NATIONAL INVENTORY OF GREENHOUSE GASES 3

3.1 INTRODUCTION

This GHG inventory communicates to the UNFCCC Conference of Parties (COP) the anthropogenic emissions for the Cook Islands by sources and removals by sinks, of all greenhouse gases (GHGs) not controlled by the Montreal Protocol. This inventory is the next in line after the Cook Islands reported to the UNFCCC its first GHG inventory as part of the Initial National Communication (INC) based on 1994 figures. This was followed by the second GHG inventory under the Second National Communication (SNC) based on 2006 figures.

This inventory reports greenhouse gases from the years 2007-2014 utilising the 2006 IPCC Guidelines for Greenhouse Gas Inventories, IPCC Good Practice Guidance (GPG) 2000 and 2003 where appropriate, and producing time series data where possible for the years 2007-2014.

3.2 REPORTING BACKGROUND

As noted earlier, this National Communication written in 2019, occurs at a time when the global situation regarding climate change has changed considerably from when the SNC was compiled. In particular, the 2015 Paris Agreement (PA) set an upgraded benchmark for an acceptable global average temperature increase since pre-industrial times of 1.5 degrees Celsius. This benchmark was largely due to the instance of the low-lying Pacific Island nations, including the Cook Islands, whose existence is increasingly under threat. In addition, the IPCC 2018, 1.5-degree report has stressed the extreme urgency of CO_2 reduction mitigation to meet this target. The Kainaki II Declaration for Urgent Climate Change Action Now was signed in Tuvalu in August 2019 by Pacific nations including the Cook Islands. This declaration stated: "We note with grave concern and fear for our collective future that global greenhouse gas emissions continue to rise, reaching record levels; and based on current trends, without urgent action, we will exceed 1.5°C by as early as 2030 and reach 3°C or more by the end of this century".[41] Finally, the situation on the ground (August 2019) with extensive forest fires in both the ArCtic and the Amazon suggests that the situation is indeed grave.

3.3 OVERVIEW

The Cook Islands main greenhouse gas emissions comprises of carbon dioxide from the energy sector, with minor amounts of methane and nitrous oxide from agriculture and waste. Forestry emissions were omitted from this report but could be between the negative 170 gigagrammes per annum, as reported in the SNC and a small positive emission from land use conversion. Overall positive emissions were estimated to be around 73 Gg per annum (73 thousand tonnes per annum) which remained reasonably constant throughout 2007 to 2014.

In comparison, the total world emissions (2010 from IPCC 2014) were around 49 gigatonnes comprised of: 65% CO_2 emissions from fossil fuels, 11% CO_2 FOLU emissions, 16% methane emissions, 6% nitrous oxide emissions and 2% other gases. For the Cook Islands 83% (average 2007 – 2014) were CO_2 emissions, 10% methane, 4% N_2O emissions and 3% for other gasses. Agriculture, Forestry and Other Land Use (AFOLU) emissions for the TNC were not calculated. With a world population of around seven billion people in 2010 the global emissions amount to an average of around seven tonnes of CO_2 eq. per annum per person. Thus, the Cook Island's 73 k t for around 18,000 persons works out at around four tonnes per capita or around 60% of the world average during the reporting period. In absolute terms the Cook Islands total CO_2 eq. emissions were around 0.00014% of world emissions.

[41] Refer to paragraph 6, page 1 of the Kainaki II Declaration for Urgent Climate change action now. https://assets.documentcloud.org/documents/6280849/Kainaki-II-Declaration.pdf downloaded 31 October 2019.

The table below shows the GHG emissions for the years 2007 – 2014. The values have been rounded to one significant figure to indicate the limits imposed by data uncertainties. In sectoral terms, it was estimated that the energy sector might be reliable to ±10% with agriculture and waste to ±30%. All care was taken to ensure uncertainties were reduced. To significantly improve the outcome for future reports the recommendations for future data collection, detailed in this chapter, would need to be followed. It should be noted that the sub-sectors of the energy sector also had high uncertainty levels as no sectoral data was forthcoming from the fuel retailers. In most instances proxy data had to be used to calculate emissions for these sub-sectors including land transport, air transport, marine transport, and other energy use. The electricity sub-sector had good data provided by Te Aponga Uira (TAU), the electricity provider on Rarotonga.

TABLE 5: COOK ISLANDS TOTAL GHG EMISSIONS 2007-2014 (GG)

Cook Islands GHG Emissions all gasses CO_2 equivalent Gg									
	2007	2008	2009	2010	2011	2012	2013	2014	AVERAGE
CARBON DIOXIDE	57.3	57.6	56.8	59.9	62.4	62.5	60.7	66.3	60.4
METHANE	7.6	7.1	7.0	6.9	6.8	6.6	6.5	6.4	6.9
NITROUS OXIDE	3.4	3.3	3.1	2.9	2.6	2.5	2.4	2.4	2.8
OTHER GASSES (HFC)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
TOTAL	70.8	70.5	69.3	72.2	74.3	74.0	72.1	77.6	72.6

Emissions have remained reasonably constant over the reporting period with the annual increase being dominated by a gradual increase in CO_2 emissions from the land transport sector (see Figure 12).

FIGURE 12: COOK ISLANDS: TOTAL CO_2 eq.. EMISSIONS TIME SERIES 2007-2014 (Gg)

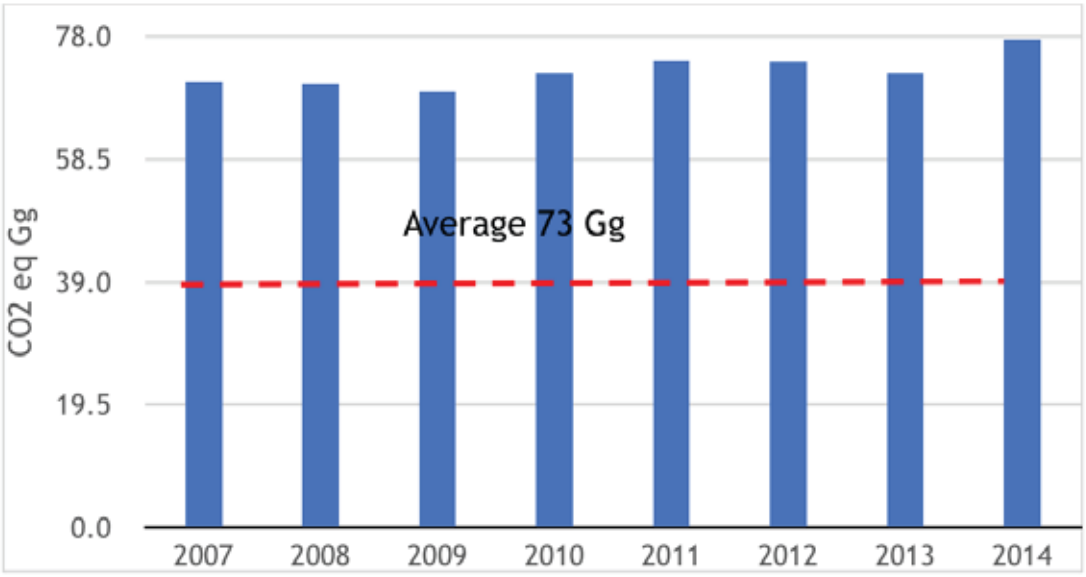
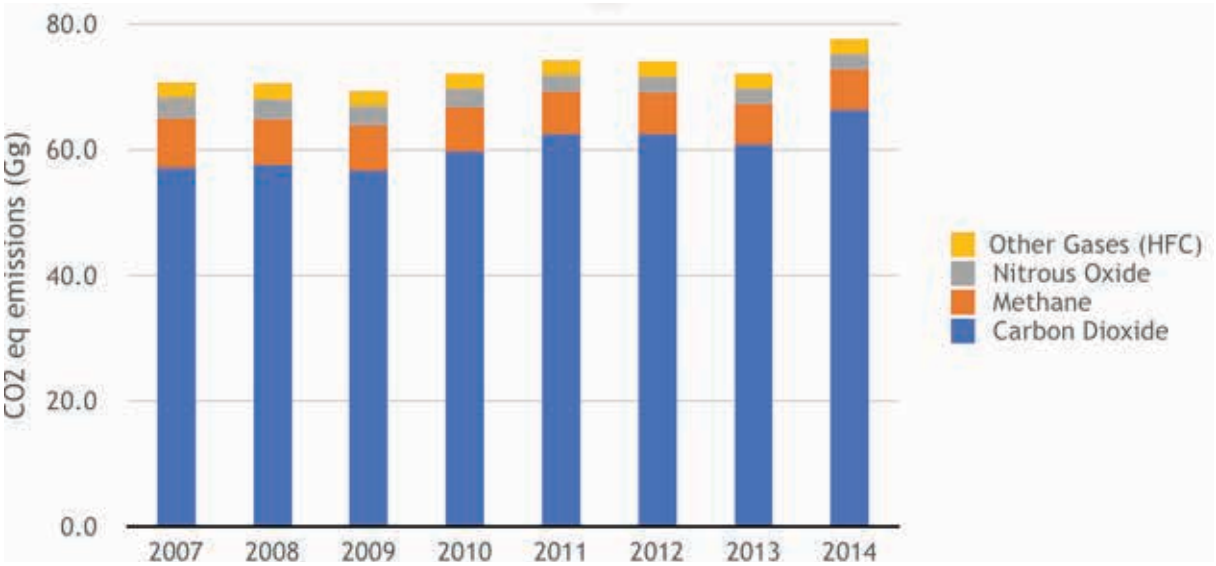


FIGURE 13: COOK ISLANDS: TOTAL EMISSIONS BY GAS TYPE



The graphs below show the yearly and aggregate behaviour in more detail. Figure 13 shows the emissions by carbon dioxide, methane, nitrous oxide and other gases.

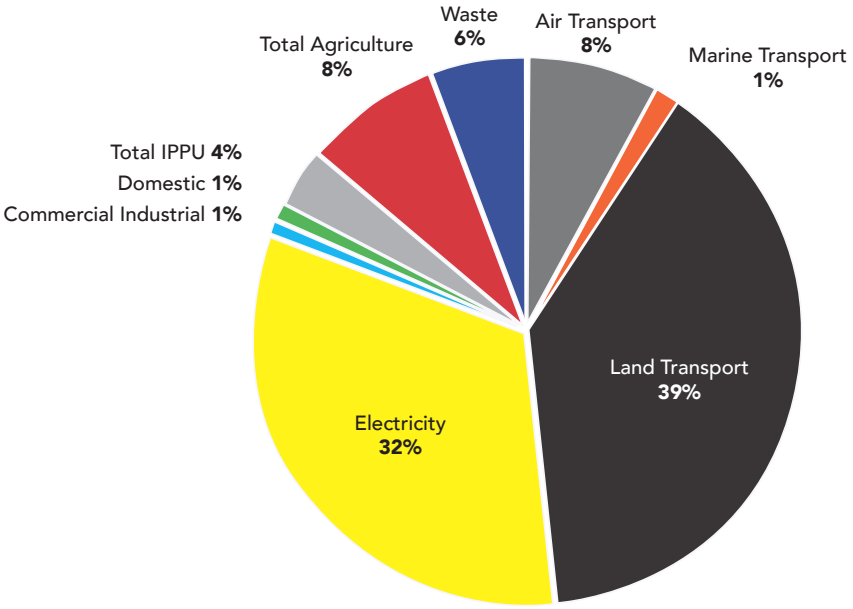
GHG emissions for energy, agriculture, waste and IPPU sectors are shown in Figure 14.

FIGURE 14: COOK ISLANDS: TOTAL GHG EMISSIONS BY SECTOR (GG)

The average total of GHG emissions by sector is shown in Figure 15. The energy sector made up of land transport and the electricity subsectors produce the most GHG emissions averaging 71% of total GHG emissions.

COOK ISLANDS: GHG EMISSIONS BY SECTOR (AVERAGE 2007-2014)

FIGURE 15: COOK ISLANDS: GHG EMISSIONS BY SECTOR (AVERAGE 2007-2014)



3.4 SECTORAL EMISSIONS

Emissions by sector are discussed. These include: energy, industrial processes, agriculture, carbon dioxide removals (forestry) and waste.

3.4.1 ENERGY

The sectoral data was entered into standard IPCC sectoral model spreadsheets.These spreadsheets were cut down versions of the IPCC 2006 removing categories not needed for the Cook Islands. This gave a sectoral breakdown of the Cook Islands energy CO_2 emissions for the period 2007 until 2014. The data from these spreadsheets are sumarised in the tables and pie charts. The non CO_2 emissions for this sector were negligible and outside the estimated accuracy of the main CO_2 emissions. Note that the value allocated to marine transport was estimated for scheduled and unscheduled inter-island transport (people and freight), and tourism, and as such, could be subject to errors of omissions. Two stroke fuel use, which includes outboard motors, bruschcutters and miscellaneous motor spirit devices (up to 5% of motor spirit imports) has been allocated to the domestic sector. Five% of diesel fuel use has been allowed for off-road equipment and allocated to industrial consumption. Air transport is only for national flights.

TABLE 6: COOK ISLANDS: ENERGY SECTOR GHG EMISSIONS (GG)

COOK ISLANDS GHG EMISSIONS (GG)										
	2007	2008	2009	2010	2011	2012	2013	2014	AVERAGE	% OF SUB SECTOR
AIR TRANSPORT	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	95%
MARINE TRANSPORT	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	14%
LAND TRANSPORT	24.8	25.2	24.0	26.7	29.1	30.3	30.3	31.4	27.7	47.4%
TOTAL TRANSPORT	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	58.4%
ELECTRICITY	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	58.4%
COMMERCIAL INDUSTRIAL	70.8	70.5	69.3	72.2	74.3	74.0	72.1	77.6	77.6	39.2%
DOMESTIC	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	1.1%
TOTAL ENERGY	55.7	55.9	53.9	58.0	60.3	61.1	60.7	61.9	58.4	100%

The table shows the key sources in the energy sector are land transport and electricity production with other sectors including domestic, commercial, industrial, sea and air transport making the balance. The sectoral breakdown does not change very much from year-to-year over the period 2007 to 2014.

3.4.2 INDUSTRIAL PROCESSES AND PRODUCT USE

The SNC reported on emissions from lubricants and refrigerants (HFCs) only as there is no industrial emission of GHG in the Cook Islands. Import data obtained for the TNC did contain lubricants but the data from customs imports for refrigerants was not deemed reliable and so was omitted from this report.

TABLE 7: COOK ISLANDS: AGRICULTURE SECTOR GHG EMISSIONS (GG)

	SNC				TNC					
	2006	2007	2008	2009	2010	2011	2012	2013	2014	AVERAGE
Enteric Fermentation	1430	1156	1135	1114	1093	1061	1051	1040	1030	1100
Manure Management	2196	1979	1874	1769	1664	1505	1453	1400	1348	1600
N_2o From Manure	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
B From Livestock	3361	3261	3078	2895	2620	2528	2440	2352	2264	2700
Total Co_2 Eq Tonnes	7000	6400	6100	5800	5400	5100	4900	4800	4600	5400

3.4.3 AGRICULTURE

Standard IPCC spreadsheets were used to calculate methane emissions from enteric fermentation and manure management. Similarly, standard IPCC spreadsheets were used to calculate nitrogen (N_2O) emissions from manure and livestock.

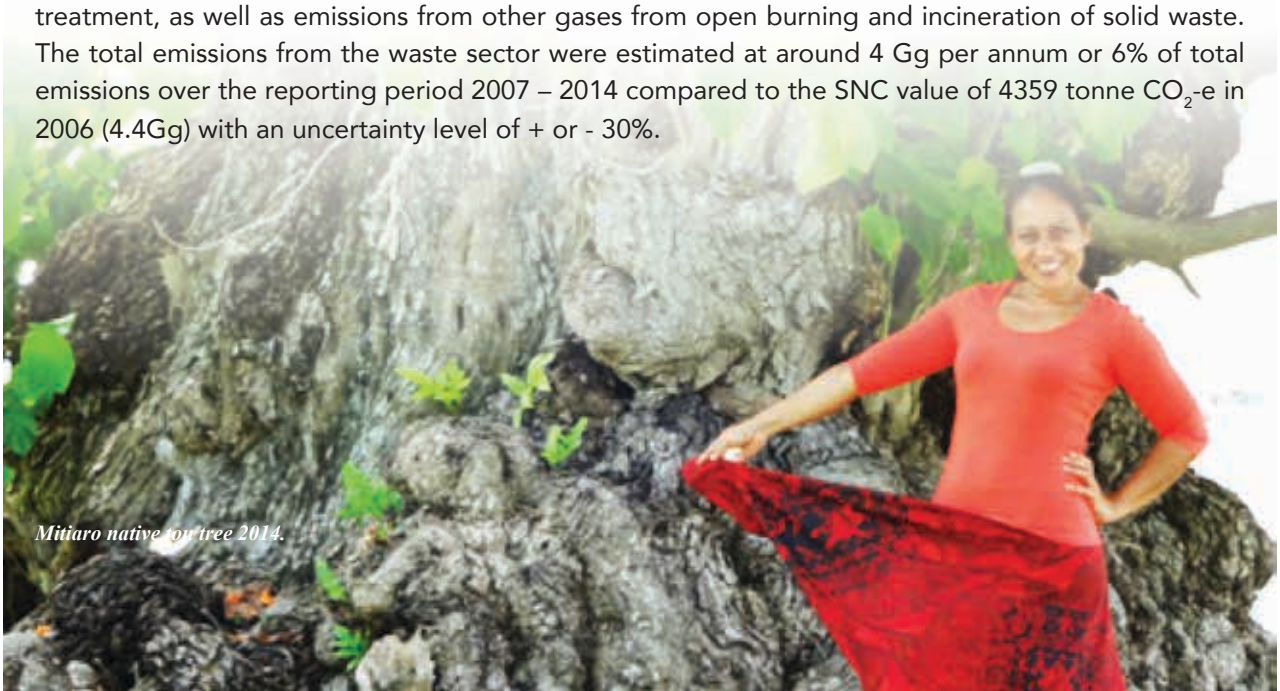
The average emissions over the reporting period amount to around 5.5 Gg of CO_2 eq. or around 8% of total CO_2 eq. emissions. Table 7 shows emissions have been declining over the reporting period.

3.4.4 CARBON DIOXIDE REMOVALS (FORESTRY)

Regarding land use change, the SNC noted "Unfortunately there is no data on the annual changes in forest area for the Cook Islands. This means that, for the purposes of the GHG inventory, it is assumed that there was no change in the total area of forested land during the inventory period. Anecdotal evidence suggests that some conversions may be taking place (i.e. from forest land to settlement land), but without any accurate data it is not possible to estimate the resulting GHG emissions". This lack of data continues through the TNC and so forestry removals were not reported.

3.4.5 WASTE

This category of emissions includes methane emissions for solid waste disposal and wastewater treatment, as well as emissions from other gases from open burning and incineration of solid waste. The total emissions from the waste sector were estimated at around 4 Gg per annum or 6% of total emissions over the reporting period 2007 – 2014 compared to the SNC value of 4359 tonne CO_2-e in 2006 (4.4Gg) with an uncertainty level of + or - 30%.



Mitiaro native fig tree 2014.

3.4.6 GHG ESTIMATES

The data for the final fuel quantities were then converted, using standard IPCC conversion factors, to GHG emissions for the years 2007 to 2014 as per the standard IPCC spreadsheets of which the data for 2014 is given in Table 8 below.

TABLE 8: ENERGY EMISSIONS 2014, (EMISSIONS ENERGY FRCA 2015)

2014 COOK ISLANDS

SECTOR Energy

CATEGORY Fuel combustion activites

CATEGORY CODE 1A [a]

SHEET 1 of 4 (CO_2 CH_4 and N_2O from fuel combustion by source categories Tier 1)

	ENERGY CONSUMPTION					CO_2		CH_4		N_2O	
	A	B1	B2	B3	C	D	E	F	G	H	I
	Consumption	Conversion Factor [b]	Consumption Gg	Conversion Factor [b]	Consumption	CO_2 Emission Factor	CO_2 Emissions	CH_4 Emissions Factor	CH_4 Emissions	N_2O Emission Factor	N_2O Emission
	(Volume litres x 10^6)	Density (kg/litre)	B2=A*B1	(TJ/unit)	(TJ)	(kg CO_2/TJ)	Gg CO_2)	(kg CH_4/TJ)	Gg CH_4)	(kg N_2O/TJ)	(Gg N_2O
					C=A*B		E=C*D/10^6				I+C*H/10^6
LIQUID FUEL											
Land Transport gasoline	7.619	0.74	5.64	44.3	250	69300	17	3	0.000075	0.6	0.000150
Other uses gasoline	0.381	0.74	0.28	44.3	12	69300	1	3	0.000024	0.6	0.000007
Total Motor Gasoline	8.000		5.92	44.3	262	69300	18	3	0.000079	0.6	0.0000157
Aviation Gasoline	0.004	0.73	0.00	44.3	0	7000	0	3	0.000000	0.6	0.000000
Aviation Kerosene	2.174	0.81	1.76	44.1	78	71500	6	3	0.000023	0.6	0.000047
Total Aviation	2.178		1.76		78		6	3	0.000023	0.6	0.000047
Domestic Kerosene	0.010	0.81	0.01	43.8	0	71900	0	3	0.000000	0.6	0.000000
Total Electricity	8.090	0.87	7.04	43	303	71400	22	3	0.000091	0.6	0.000182
On road land transport diesel	5.099	0.87	4.44	43	191	71400	14	3	0.000057	0.6	0.000114
Off road land transport diesel	0.255	0.87	0.22	43	10	71400	1	3	0.000003	0.6	0.000006
Marine Transport	0.300	0.87	0.26	43	11	71400	1	3	0.000003	0.6	0.000007
Mining diesel	0/000	0.87	0.00	43	0	71400	0	3	0.000000	0.6	0.000000
Food processing diesel	0/000	0.87	0.00	43	0	71400	0	3	0.000000	0.6	0.000000
Other diesel	0/000	0.87	0.00	43	0	71400	0	3	0.000000	0.6	0.000000
Total Gas Diesel Oil	13.744	0.87	11.96	43	514	71400	38	3	0.000154	0.6	0.000308
Total land transport	12.718		10.07		441		31		0		0.000000
LPG autos	0.000			47.3	0	63100	0	1	0.000000	0.1	0.000000
Total transport	15.196	0.87	12.10	43.00	529.53	74100.00	37.84	6.00	0.00	1.20	0.00
LPG domestic											
LPG commercial				47.3	0	63100	0	1	0.000000	0.1	0.000000
LPG industrial				47.3	0	63100	0	1	0.000000	0.1	0.000000
Total LPG	0.000		1.50	47.3	71	63100	4		0.00		0.00
Total domestic	0.391		0.29		12.84		0.89		0.00		0.00
Total industry	0.255		0.22		10		1				0.000000
Total Commercial	0.000		0.00		0		0				0.000000
Total industry and commercial	0.255		0.22		10		1		0.000003		0.000000
TOTAL	23.932		21		925		66		0.0003		0.0005

3.5 SUMMARY

Overall, the main greenhouse gas emissions consists of carbon dioxide from the energy sector with small amounts of methane and nitrous oxide from agriculture and waste. Emissions were estimated to be around 73 Gg per annum (73 thousand tonnes per annum) which remained reasonably constant throughout the reporting period, 2007 to 2014. For the Cook Islands 83% (average 2007 – 2014) were CO_2 emissions, 10% methane, 4% N_2O emissions and 3% other gases.

The Cook Islands 73 k t for around 18,000 persons works out at around 4 tonnes per capita or around 60% of the world average during the reporting period. In absolute terms the Cook Islands total CO_2 eq. emissions were around 0.00014% of world emissions.

Overall, future GHG reporting and data collection require further improvements. For example, it is noted that the sub-sectors of the energy sector had high uncertainty levels as no sectoral data was forthcoming from the fuel retailers. Such improvements would also need to take account of possible modifications when the COP24 IPCC rulebook becomes available.

Mauke Island police officer.

Mitiaro Island school children.

1. FUTURE ACTIONS

- In the longer-term liaison will need to be followed up with the Statistics Office to find a way to convert the Cook Islands Statistics Office database into a usable repository suitable for regular GHGI determination.
- It would be advisable that some form of transparent quality control of the Customs Department import data be implemented. To assist with this, there may be an enhanced role for advice and training from development partnerships with the likes of the New Zealand Customs Service or alternate agency.
- That sectoral data for future GHGIs be obtained by the Cook Islands Statistics Office directly from the Cook Islands oil and gas retailers. Pro forma spreadsheets used by the NZ Department of Energy would be suitable for this process.
- A quality control regime be established, as per the IPCC 2006 guidelines, for the GHGI to ensure the integrity of the data collection. All data to be cross-checked where possible and uncertainties estimated. Significant figures in the final results should be adjusted accordingly.
- Care be taken when calculating domestic emissions to ensure that international transport be excluded from results as per IPCC 2006 guidelines. In order to obtain more accurate data in the energy sub-sectors (particularly marine transport) it is recommended that the devised modified NZ proforma spreadsheets be used to collect the appropriate data from the energy retailers.

4 MITIGATION MEASURES

4.1 INTRODUCTION

The Cook Islands has many pressing priorities and development challenges despite its improved economic situation. In taking an integrated approach, its emission reduction efforts must also contribute positive development impacts and provide multiple benefits that make sense in island contexts.

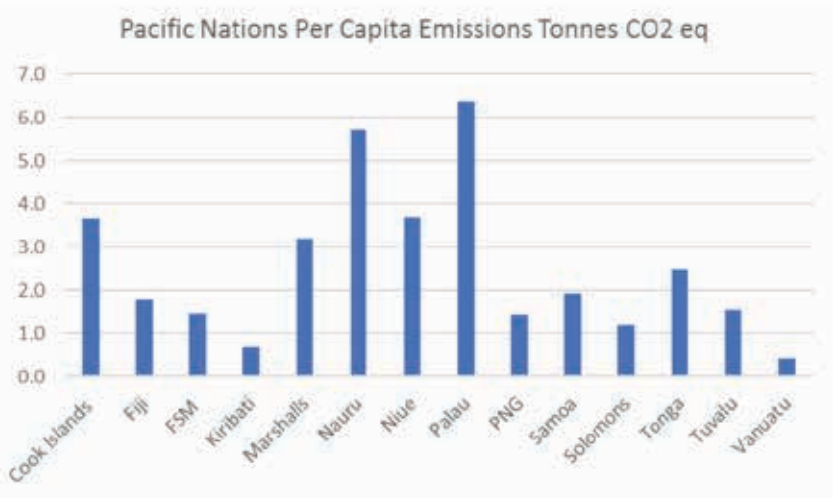
Since the INC, mitigation efforts have advanced. This includes establishing a fit-for-purpose enabling environment with mandated institutional arrangements, regulatory frameworks, stakeholder networks and personnel. As a result, the Cook Islands has been able to access funding support and implement mitigation activities.

This chapter reports on measures to mitigate climate change in accordance with Article 12, paragraphs 1(b) and (c) of the Convention. Following on from the results of the GHG inventory in the previous chapter, mitigation measures are presented along with key regulatory and institutional measures that have been put in place since the SNC.

4.2 CONTEXT OF COOK ISLANDS EMISSIONS

The overall CO_2 equivalent emissions in the Cook Islands are miniscule in terms of the world's total emissions (around 0.00014%) but the country's per capita emissions for CO_2 in the energy sector have been hovering around 4 tonnes per annum for the past decade compared to the world average of around 6 tonnes per capita per annum and 10 to 20 tonnes per capita per annum for some of the richer countries. In terms of the Pacific, the Cook Islands is the third highest emitter per capita after Palau and Nauru, as shown in the figure below.

FIGURE 16: PACIFIC NATIONS PER CAPITA EMISSIONS TONNES CO_2 EQ



From a global perspective, to reduce emissions sufficiently to keep below 1.5 degrees of global warming, time is rapidly running out. For developing countries, including the Cook Islands, urgent signals from the developed countries both that they can reduce their own emissions by the required amount and that they are serious about financially assisting the developing countries to do the same, are required. A specific difficulty here relates to the tourist sector which is vital for the Cook Islands economy. If the developed world does not act to reduce emissions in line with the IPCC 1.5 report (close to 50% reductions in all fossil fuel emissions by 2030 and net zero by 2050) and the Kainaki II Declaration for Urgent Climate Change Action Now, which was signed in Tuvalu in August 2019 by Pacific nations (including the Cook Islands), then there would be difficulties for the tourist sector in the Cook Islands.

4.3 PAST STRATEGIES FOR MITIGATION

The Cook Islands has had a formal mitigation strategy in place for the past decade or so. The main aim has been to reduce fossil fuel CO_2 emissions in the energy sector.

In turn the energy sector mitigation has been almost entirely concentrated in the electricity sector with a move from diesel-fuelled generation to various renewable options concentrating on solar photo-voltaic (PV).

In terms of mitigation options, the electricity sector has been an obvious target as a readily available opportunity exists by substituting renewable energy options for fossil fuel-powered generation. The extent of the renewable energy penetration is, however, reaching the limit imposed by grid stability and without introducing substantial storage, it is unlikely that further substantial gains can be made.

There are options in the transport sector, but these are more difficult to implement, especially in an economy that is intent on growing and catering for tourist preferences. Electric vehicles are, however, becoming more prevalent worldwide and are eminently suited to the Cook Islands due to the small commuting distances present on the more populated islands.

Economy-wide energy efficiency measures have also been identified in all earlier reports as low hanging fruit that are usually cost-effective to implement.

4.4 FUTURE MITIGATION OPTIONS

The key mitigation options for the Cook Islands are summarised below:

4.4.1 ENERGY SECTOR

Options for the electricity sector have been well covered in existing reports with the main problem being the Rarotonga grid. It is thought unlikely that the 100% RE option can be fulfilled unless large amounts of funding are secured, and substantial storage introduced to the required scale. Further efforts on a piecemeal approach, as suggested by the electricity supplier Entura, are also waiting on funding options.

4.4.2 ENERGY EFFICIENCY

Options here have also been well covered as part of the Cook Island government's REDD initiatives in energy efficiency. Funding needs to be sought to provide energy audits for industry and commercial sectors and to provide training programmes for energy auditing.

4.4.3 TRANSPORT SECTOR

Mitigation options in the transport sector have not been promoted as much as they could in the Cook Islands to date. Here, it is thought important to deal with the increase in the number of privately-owned vehicles by investigating tariff options. In addition, a long-term plan needs to be put in place to change the present vehicle fleet to all electric vehicles. Such a transition would have to coordinate with the electricity sector plan to move to renewables. Finally, the possibility of moving public transport options to electric vehicle modes needs to be investigated.

4.4.4 AGRICULTURE SECTOR

Little opportunity is seen in this sector for meaningful emissions reductions due to the overall decline in this sector.

4.4.5 WASTE SECTOR

The conversion of the current household septic tank waste disposal system to a piped system with centralised disposal could provide opportunities for emissions reductions. Other solid waste disposal options currently being pursued should of course be continued.

4.5 BARRIERS FOR MITIGATION OPTIONS

There are many barriers for effective mitigation options in the Cook Islands. The IPCC[42] ***lists some common barriers including;***

- **Capital:** Access to capital is limited. The capital costs of renewable energy technologies are generally higher than those of conventional technologies. Also, owing to the risks perceived for new technologies, financing costs will tend to be higher.
- **Trade barriers:** Although many countries are revising their trade policies in order to liberalise markets, substantial tariff barriers remain in many cases for imports of (emission reducing) foreign technologies including energy supply equipment.
- **Vested Interests:** National interest groups such as powerful extraction and construction companies can influence technology choices in favour of conventional technologies.
- **Institutional and administrative difficulties:** Such difficulties exist in terms of developing technology transfer contracts, which can be a necessity to qualify regional construction companies as potential partners of the entrepreneurship.
- **Regional Cooperation:** There is a need for greater regional cooperation among developing countries, both in research and development (R&D) work and in the international commercial contracting network.
- **Access to information:** Developing countries have in general poor access to information. It is one thing to recognise that the information and technology desired are available but is quite another issue to gain access to them.
- **Differing needs:** The needs of the developing countries are quite different to those of the developed countries. Developing countries are generally still focused on large capacities of cheap, reliable power with low technical risk, and have new technologies as a lower priority. In addition, most developing countries rate development as a higher priority than reducing emissions.
- **Economic incentives:** Incentives for donors are weak mainly when energy demand is scarce and scattered. This barrier can be minimised by the additional potential value gained through JI/ CDM schemes.

4.6 FUTURE MITIGATION OPTIONS

The key mitigation options for the Cook Islands are summarised below:

- **Energy Sector:** Electricity well covered in existing reports with the main problem being the Rarotonga grid. It is though unlikely that the 100% RE option can be fulfilled unless large amounts of funding are secured. Further efforts on a piecemeal approach as suggested by Entura is also waiting on funding options.
- **Energy Efficiency:** Continuing the REDD initiatives in energy efficiency.
    - Funding be sought to provide energy audits for industry and commercial sectors.
    - Funding to be sought to provide training programs for energy auditing.
- **Transport sector:** Deal with the increase in number of privately-owned vehicles by investigating tariff options. Look at developing a long-term plan to change the present vehicle fleet to all electric vehicles. Such a transition would have to coordinate with the electricity sector plan to move to renewables. Investigate moving public transport options to electric vehicle modes.
- **Agriculture sector:** Little opportunity is seen in this sector for meaningful emissions reductions.

[42] http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=202

- **Waste sector:** The conversion of the current household septic tank waste disposal system to a piped system with centralised disposal could provide opportunities for emissions reductions. In addition to septic waste, other solid waste disposal options currently being pursued should of course be continued.

4.7 CONCLUSION

With the hindsight of the 2015 Paris Agreement and the present commitments from the countries of the world leading to a projected temperature increase in excess of 3 degrees Celsius, it is difficult to be optimistic in terms of conclusions for any specific country such as the Cook Islands. Nevertheless, there are options for the Cook Islands to do its mitigation share. The key barrier, however, is securing the required finance for technology needs. In addition, island states like the Cook Islands need to see some real action from developed countries both to give incentive to their own efforts and to spearhead mitigation measures, such as electric vehicles and solar PV. These can then be effectively transferred to developing countries and island states such as the Cook Islands.

Mauke

5 OTHER RELEVANT INFORMATION

OTHER RELEVANT INFORMATION 5

5.1 INTRODUCTION

This chapter covers: policy integration; transfer of technologies; research and systematic observation; education, training and public awareness; capacity-building; and information and networking.

5.2 CLIMATE CHANGE INTEGRATION INTO POLICIES

As presented in chapter one, substantial policy work has taken place and a range of policy documents have been developed during this period to integrate climate change into the Cook Islands development context at national and sector levels.

Additionally, a legislative review was also carried out.[43] This review recommended that DRM and CC should have an integrated act (joint legislation) instead of developing a separate act for CC. This review also recommends amendments to the Environment Act 2003 to transfer the role as operational focal point for GEF from NES to CCCI but still recognise the important role NES plays in climate change. To date, no legislative changes have taken place despite another legal review recommending separate climate change legislation.[44]

Further integration is set to gain momentum with policy activities planned to integrate: climate change into the national development planning framework;[45] climate finance into national budget planning; climate-related statistics; and further integration of climate change into sub-national/island level development plans.

Integration of climate finance within the national public financial management system was also initiated during this reporting period. This policy intention was part of government's advocacy for the use of government's own systems to administer donor funds. As such, the government set out to become a National Implementing Entity (NIE) of the Adaptation Fund (AF). This was achieved in 2015. The Cook Islands has also obtained accreditation to the Green Climate Fund (GCF) after the GCF board considered the Cook Islands application in 2018. The Cook Islands Climate Change Country Programme 2018 – 2030 was released in March 2019.

Climate change continues to be integrated into the environment-related policy and planning. Despite the shift of national coordination to the new Climate Change division of the Office of the Prime Minister (OPM), the National Environment Service administer activities integrated into the National Environment Strategic Action Framework (NESAF) 2009 and current 2015 draft. As operational focal point to the Global Environment Fund (GEF), NES maintains the status quo whilst climate change operational matters shifted to the Climate Change office.

Overall, the integration of climate change into the policy fabric of the Cook Islands has gained momentum during this reporting period with several policies designed and implementation initiated. Key to ensuring policy intents are operationalised, tangible commitments such as funding and technical support are essential.

[43] Cook Islands Red Cross, 2013. Legal Analysis of the Frameworks for Disaster Risk Management and Climate Change in the Cook Islands. Disaster Risk Management and Climate Change. Cook Islands Red Cross.
[44] Powell, G. (2013). An overview of possible climate change legislation. (Unpublished paper).
[45] The 2016 – 2020 NSDP has included climate change as Goal 13.

5.3 TECHNOLOGY TRANSFER

5.3.1 BACKGROUND

A summary of activities related to the transfer of and access to, environmentally-sound technologies and know-how is presented below. This also includes information on the development and enhancement of local capacities, technologies and know-how, and measures relating to enhancing the enabling environment for the development and transfer of technologies.

5.3.2 TECHNOLOGY ROADMAP

Since the SNC (2011) and the SNC mitigation technology needs assessment (TNA 2008), and the Adaptation Technology Needs Assessment (2008), a full climate technology roadmap has yet to be realised. This involves completing a technology needs assessment, barrier analysis and action plan to assist in establishing environmentally-sound technology projects and programmes to facilitate the transfer of relevant technologies and know how. Nevertheless, the Cook Islands continues to reiterate its focus on proven mitigation technologies offering no-regret investments by private and public sector sponsors.[46]

The 2008 assessments provided the basis for ensuring technology advancements during the reporting period of this TNC. This is particularly so with benefits for renewable energy in power generation using wind and solar PV generators.

Accordingly, the energy audit report identified that the large-scale implementation of all technology options required strengthened institutional arrangements and frameworks to enable private sector and market-led dissemination.[47]

The Cook Islands Stocktake Report (2014) identified the importance of technology transfer towards ensuring knowledge, information and resources among the various stakeholders including users and entities. Where technology transfer shows a suitable fit and application, these are considered important in contributing to project sustainability and building island communities capacity and resilience.

With the support of United Nations Environment Programme (UNEP) and Climate Technology Centre and Network (CTCN), a full TNA is scheduled to take place in 2018/19 along with a barrier analysis and action plan as part of establishing a climate technology roadmap. A project team to carry out this work is led by Climate Change Cook Islands (CCCI) and supported by the Central Policy and Planning office (CPPO) of the Office of the Prime Minister.

5.3.3 ENABLING ENVIRONMENT

Several measures have been undertaken to strengthen an environment that facilitates technology transfer.

Institutional arrangements include the National Renewable Energy Committee that was formed in 2007 to lead RE sector policy, planning, management and coordination. In 2011 an Energy Commissioner was put in place to ensure concerted and coordinated effort, and progress in the sector. The Renewable Energy Development Division (REDD) of the Office of the Prime Minister (OPM) was also established to provide strategic direction through policy planning and regulatory framework.

The division also provides sector oversight to implementing agencies such as Rarotonga's public electricity supply entity - Te Aponga Uira (TAU), the private sector and consumers.[48]

Several policy measures have been set. Te Kaveinga Nui – National Development vision and the first National Sustainable Development Plan 2007 – 2010 (NSDP) set targets for renewable energy.

[46] Government of the Cook Islands. (2007). Disaster risk management national action plan. Rarotonga, Cook Islands: Government of the Cook Islands

[47] National Environment Service. (2009a). Energy audit and draft energy efficiency guidelines. Rarotonga, Cook Islands: Government of the Cook Islands.

[48] Office of the Prime Minister. (2012). Te Atamoa o te Uira Natura. The Cook Islands Renewable Energy Chart Implementation Plan. Rarotonga, Cook Islands: Government of the Cook Islands

The second NSDP 2011-2015 gave further direction to the energy sector through Goal 3: Energy Security. The government sharpened its focus on renewable energy and energy efficiency with a commitment to fulfill 50 percent of the country's energy by 2015 (50/15) and 100 percent by 2020 (100/20). [49]

Strategies to achieve this include:

- Strengthen the institutional framework of the energy sector.
- Utilise only proven technology.
- Provide incentives for renewable energy.
- Upgrade existing energy infrastructure.
- Build our capacity in the energy sector.

As noted in chapter one, the Cook Islands renewable energy chart and implementation plan 2012 (CIREC) for the energy sector was adopted as part of instigating these strategies. The plan guided action and engaged development partner support. Potential sources of renewable energy were assessed. Criteria considered maturity of technology, social and environment sustainability and levelised lifecycle cost [50] (2012, p.3). Implementation costs took account of technology requirements, upgrade to existing infrastructure and project management. Divided in two components – Project Sister Islands and Project Rarotonga.

The 2009 energy audit assessed the consumption and possible energy reductions in domestic homes, commercial (including tourist accommodation) and government buildings. This included use of incandescent lamps and fluorescent, use of low-efficiency refrigeration and air conditioning (NES, 2009a).

The third NSDP 2016 – 2020 reiterates country commitment to renewable energy in Goal Six – Improve access to affordable, reliable, sustainable, modern energy and transport. (CI Gov, 2016, p.31).

5.3.4 MITIGATION TECHNOLOGY

No update to the Technology Needs Assessment for Mitigation (TNA-M) has been undertaken since 2008. A new assessment is underway and expected to be finalised in 2020. More details will be provided in the next National Communication (NC).

Technology development and transfers have advanced over the past 10 years. Solar PV technology is the main renewable energy option being pursued. Other technology options include wind and biomass.[51] Mitigation technology developments are discussed earlier in chapter four. Collectively technology options and barriers are expected to be considered as part of developing a climate technology roadmap scheduled to take place in 2020.

This will also include attending to the outcomes of the 2015 Paris Agreement (PA) and the Cook Islands Nationally Determined Contributions (NDCs) as part of its ambition to reduce GHG emissions through mitigation and adaptation.

5.3.5 ADAPTATION TECHNOLOGY

No follow up Technology Needs Assessment for Adaptation (TNA-A) has taken place since 2008. The report identified priority sectors such as health, water, agriculture and the coast. Respective technologies as well as related barriers and the means to overcome these were also identified.

[49] Government of the Cook Islands. (2011). Second National Communication under the United Nations Framework Convention on Climate Change. Rarotonga, Cook Islands: Government of Cook Islands. P.27

[50] Takes into account all costs, from the cost of construction, cost of fuel or repairs to the cost imposed by emissions from the project. See J.M.K.C. Donev et al. (2018). Energy Education - Life-cycle cost [Online]. Available: https://energyeducation.ca/encyclopedia/Life-cycle_cost. [Accessed: July 2, 2019].

[51] National Environment Service. (2008a). Mitigation technology needs assessment. Rarotonga, Cook Islands: Government of the Cook Islands

The 2014 Stocktake report identified some critical areas still to be addressed such as; water sustainability, continuing coastal and foreshore activities, biodiversity both terrestrial and marine ecosystems.[52] Technology training remains necessary in order to progress the climate-related activities and build capacity. Of importance is the need to identify appropriate individuals on their respective islands to undertake technology training. For example training has been provided to island government personnel with the roll out of renewable energy installations. However, such training needs to continue to ensure competencies are relevant and current.[53] Acknowledging technology know-how using indigenous knowledge to understand climate variability[54] has been an important development during this period as shown with the study carried out in 2014 as a partnership of the SPC EU GCCA PSIS and AF UNDP Samoa, SRIC CC projects.

An indication of technologies to consider for the next TNA process can be drawn from the Cook Islands Stocktake report 2014. Technology development was demonstrated in the PACC project in the reconstruction of the Mangaia harbour. The coastal calculator methodology made it possible to construct harbours to island specifications. Ongoing and new areas of concern were also identified. These related to improved policies and processes, improved data sharing, improved inter-island transportation, improved inclusion of marginalised stakeholders, systematic use of indigenous languages in the delivery of awareness-raising programmes, including use of local examples. This should also include undertaking V&A approaches that synthesise bottom-up participatory approaches. There should be improved access to funding sources and greater integration of CC and DRM into sub-regional and Island Sustainable Development Plans.

- Addressing the need for a coordinated centralised data bank to collate all marine ecosystems data in order to prevent duplication and confusion and making data accessible to the public.
- Water infrastructure is an expensive development but there is still a lack of water policy on all the islands.
- The high cost of and unreliable transportation to the northern group is a major hindrance to the effective delivery of climate change and disaster management projects and programmes.
- EMCI must include disability concerns into their plans and improve coordination amongst relevant stakeholders.
- Climate change awareness programmes are more effective when delivered in the local Māori language particularly when scientific terminology is involved. The use of local examples should be exemplified, and awareness programmes should reach all the diverse sectors in the community, such as churches, uniformed organisations, youth and sports associations and civil society.
- Future policy development must be based on science and research for meticulous decision-making.
- Synthesise strengths from the USP EU GCCA participatory approach and the NES V&A approach in order to facilitate strong ownership from the Pa Enua. Simplifying the steps and encouraging more involvement in the process allows for stronger partnerships and firms up adaptation implementation plans. Key concerns and proposed activities from all the V&A assessments ought to be integrated into the respective Island Development Plans and annual budgeting process to generate continuity and momentum translating these into concrete actions at the grassroots level within specific timeframes.

[52] Climate Change Cook Islands. (2014). Cook Islands stocktake report. Rarotonga, Cook Islands: Government of the Cook Islands p.10

[53] EU PACTVET report & personal communication – Vaine Wichman and Akaiti Maoate

[54] Rongo, T., & Dyer. C. (2015). Using local knowledge to understand climate variability in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands

- Vulnerability and adaptation assessments ought to be carried out every three years to monitor and update local situation and ongoing climate change adaptation and mitigation measures. The assessment should become an automatic undertaking by island governments and agencies, and ties in with their overall aims to strengthen Island Sustainable Development Plans (ISDP).
- Building capacity to access funds is pertinent to ensure the steady flow of funding for ongoing climate change and related on-ground projects and to meet our country obligations under UNFCCC.
- Climate change and disaster management must be reflected in the Pa Enua ISDPs to demonstrate a unified and coordinated effort in addressing the adverse impacts of climate change.[55]

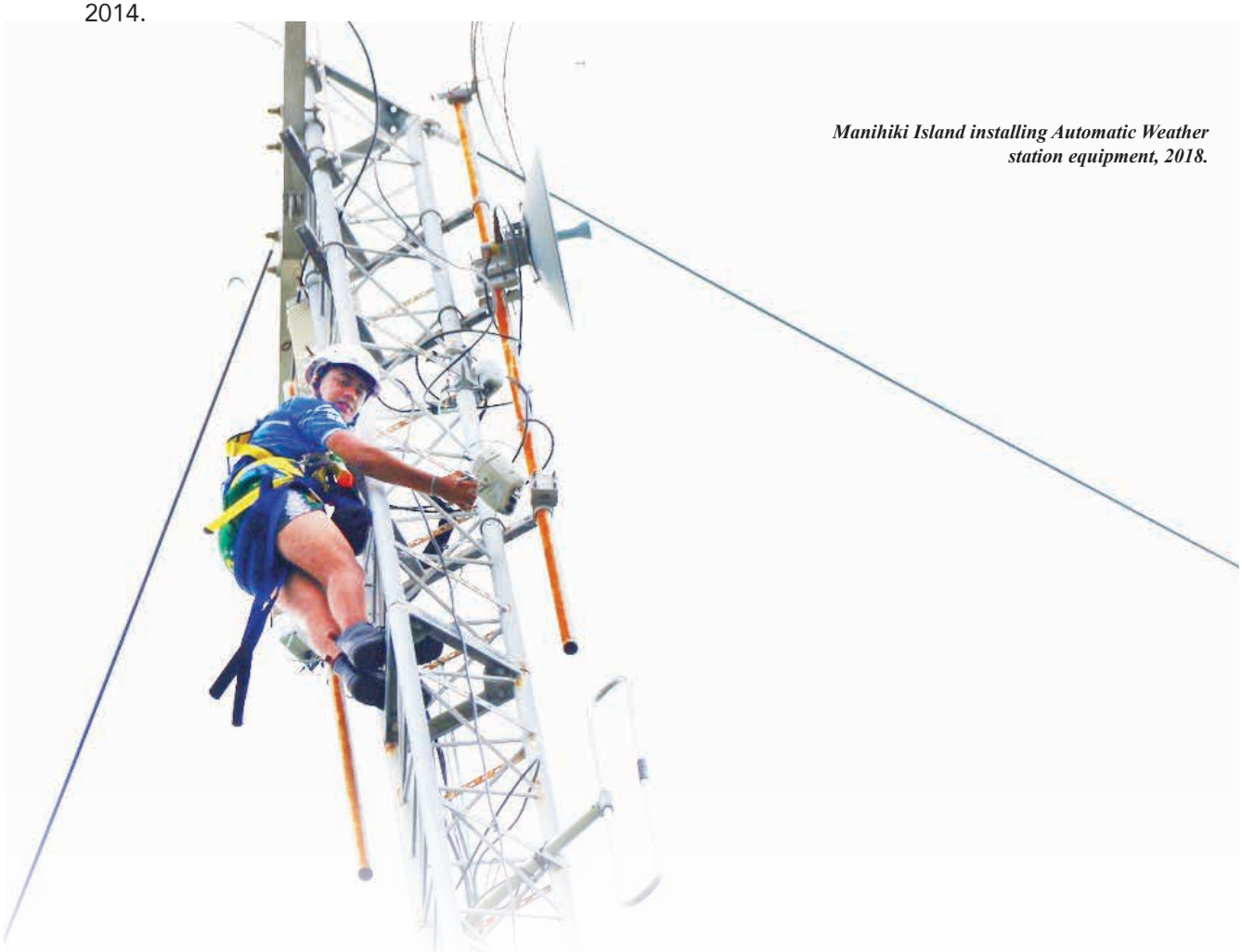
Attention to the 2014 priority areas has increased through recent policy and projects. These include: the NES – NBSAP, the Ridge to Reef (R2R) project and Marae Moana policy and action plan. The 2019 TNA – reiterates attention to include: waterways – coastal and terrestrial ecosystems and agriculture – climate resilient food security sectors. It is possible that other priority sectors and solutions such as nature-based solutions may emerge in the consultation process of the Technology Roadmap.

Overall, considerable technology transfer has taken place in the energy sector and electricity generation on all inhabited islands.

5.4 RESEARCH AND SYSTEMATIC OBSERVATIONS

5.4.1 INTRODUCTION

This section provides information on climate change research and systematic observation, including the Cook Islands participation in, and contribution towards, activities and programmes of national, regional and global research networks and observing systems. The period of review is from 2007 to 2014.



Manihiki Island installing Automatic Weather station equipment, 2018.

[55] P.Å10 CI Gov, 2014. Cook Islands Stocktake report.

Several research programmes have been undertaken in the Cook Islands. This has seen the continuation of research activities in agriculture, marine resources and meteorology through government departments such as the Ministry of Agriculture, Ministry of Marine Resources and Meteorological Services.

Environmental monitoring continues to take place through the Ministry of Marine Resources (MMR) laboratory. This is carried out in collaboration with the Ministry of Health (MoH) and the National Environment Service (NES).

5.4.2 NATIONAL RESEARCH

Since the SNC, graduate and doctoral researchers have undertaken climate-change related research work. Nineteen (19) applications were approved by the National Research Committee (NRC) between 2007 and 2014.

- Most research work was carried out in the southern group islands - (16) - with three registered projects carried out in the northern group island of Manihiki. Seventeen applications were in Rarotonga and with 11 registered to carry out research on two or more islands.[56]
- The approved research projects were undertaken by a mix of Cook Islands (6) and non-Cook Islands nationals (13) covering a range of disciplines and approaches. Topics include for example:
- Holocene sea-level change and coastal evolution.
- Socio-cultural responses to climate change.
- Contribution of traditional knowledge of Cook Islands Māori to minimise the impacts of future extreme weather.
- The impact on a changing climate and ocean: on food security and pearl farming in Manihiki.

TABLE 9: REGISTERED RESEARCH PROJECTS WITH NATIONAL RESEARCH COMMITTEE REGISTER

2007	2008	2009	2010	2011	2012	2013	2014
0	1	2	1	8	4	1	6

Total Permits issued 2007 - 2014 : 19

- Measuring resilience to climate change in corals.
- Climate change migration.

The national research permit process is administered by the Central Policy and Planning Office (CPPO) of the Office of the Prime Minister (OPM). The CPPO also provides secretariat support to the NRC who assess and approve research permit applications. A nominal fee is charged but not to Cook Islanders undertaking research in the country. Resources to support research and systematic observation are limited. This includes having resources available to ensuring research priorities are identified, permit requests align with these priorities, and research results are appropriately disseminated.

The SNC reported that a new area that would benefit from research attention was the impact of climate change on people's internal movements with particularly focus on the effect on Rarotonga[57] as the economic and administrative hub of the country. The priority action of the 2016 JNAP sets out to conduct research on the impact of sea level rise in order to support policies to address climate and disaster-related displacement and migration.[58] EMCI confirm that funding to support this action has yet to be obtained.

[56] Refer to Appendix 8.6 for description of approved research permits

[57] Government of the Cook Islands. (2011). Second National Communication under the United Nations Framework Convention on Climate Change. Rarotonga, Cook Islands: Government of Cook Islands p.80

[58] Government of the Cook Islands, (2016). The Cook Islands 2nd joint national action plan for disaster risk management and climate change adaptation 2016-2020. Rarotonga, Cook Islands: Government of the Cook Islands. P.62

In 2013, CCCI published a useful bibliography on climate change (CC) related publications conducted in the Cook Islands. While it notes that it may not provide a comprehensive list, over 200 published and unpublished papers were included covering a range of CC related topics.[59]

The list also includes written material that were commissioned through a range of government and development partner programmes and projects. Such activities generally do not require permitted registration with the NRC. There is also no register of Cook Islands researchers (emerging and experienced) available to support and/or conduct research activities. There is also no online open access depository for completed research works available to assist inquiries for information.

Overall, more attention is needed in establishing a prioritised CC-related research agenda and system.

By taking account of academic, government, development partner activities along with sector and thematic research and systematic observation needs, existing interests and strengths can be enhanced through additional resources and support.

5.4.3 METEOROLOGICAL SERVICES

The Cook Islands Meteorological Service continues to provide recent climate data for the national climate database. Data is also provided to support regional and international organisations and networks such as the World Meteorological Organization (WMO), and the National Institute of Water and Atmospheric Research (NIWA).

5.4.4 REGIONAL RESEARCH AND OBSERVATIONS

Regional research and observation activities that includes the Cook Islands continue to be undertaken.

Participation in regional activities includes the Cook Islands Meteorological Service Office (CIMSO) as a member of the Regional Meteorological Services Directors until 2011 and the establishment of the Pacific Meteorological Council. This included the Pacific Islands Meteorological Strategy 2012 – 2021 facilitated through the Pacific Meteorological Desk and Partnership of SPREP.

The Cook Islands participates in regional research and observation activities as part of the Pacific Islands Global Climate Observing System (PI-GCOS) and Pacific Islands Global Ocean Observing System (PI-GOOS) activities such as the Upper Air Programme for the Cook Islands (Rarotonga and Tongareva) and the Oceans Observing System of SPREP.

Active since 2004 and based with the Secretariat of the Pacific Regional Environment Programme (SPREP), Apia, Samoa, it provides an interface to the local, regional and international aspects of climatological and meteorological areas of interest.

The Cook Islands participated in the Pacific Climate Change Science Programme (PCCSP) in 2011. The Cook Islands country report produced under this programme identified serious concerns. These included evidence of increasing temperatures and rainfall, rising sea levels, and increases in the frequency, intensity and duration of extreme events (Australian Bureau of Meteorology and CSIRO (2011).[60]

CIMSO supports regional and international organisations. For example, the Cook Islands continues as a member of the WMO. Data is provided and a broad range of atmospheric research and South Pacific wide monitoring information is made available to the country.

As part of the South Pacific Sea level and climate monitoring project, the Cook Islands sea level fine resolution acoustic measuring equipment (SEAFRAME) was established in 1994 with a monitoring station at Avatiu harbour. This has provided to date 25 years of data about sea level, wind speed

[59] Climate Change Cook Islands. (2013). Bibliography on climate change related publications conducted in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands

[60] Australian Bureau of Meteorology and CSIRO, 2011. Climate Change in the Pacific: Scientific Assessment and new Research. Volume 2: Country Reports.

direction, wind gust, air and water temperature and atmospheric pressure. This data contributes to the regional observational network and towards global models implemented by the IPCC and other research organisations. In addition, the information contributes to Cook Islands information needs.

These include the production of tide charts[61] and lunar calendar that assists the fishing community and the agriculture sector. It also enabled sea level data following tsunami such as the sea level increases following the Samoa earthquake in 2009.

Monitoring surveys are carried out by the Australian Bureau of Meteorology to re-check data as part of the COSPPac programme which offers technical support to Pacific countries for essential weather, climate and ocean information collection and analysis (COSPPac, 2015).[62]

5.4.4.1 CLEWS – CLIMATE INFORMATION AND EARLY WARNING SYSTEMS

In 2010 the Cook Islands released the National Action Plan for Disaster Risk Management 2009 to 2015 under Goal Four: maintain effective early warning systems identified the need 'to improve weather and climate forecasting using modern ICT technology and appropriate capacity building' (2010, p.55). The development of an Early Warning System and technologies continues as a key priority.

Automated weather stations signal a shift from a manual to automated process. Nine (9) automatic weather stations have been installed and upgraded on the islands of Atiu, Mangaia, Mauke, Mitiaro, Rarotonga, Manihiki, Rakahanga, Tongareva, and Pukapuka. It is anticipated that Nassau, Palmerston and Suwarrow will be installed 2019/20. Funding for the automation was sourced through the Adaptation Fund (AF) and Disaster Resilience for Pacific Small Islands Developing States (RESPAC).

Access to real-time climate information is a key component at national and community level. For example, rainfall data has now been added to the weather bulletin. This is televised daily through ongoing private sector sponsorship.

The data from the CLEWs will complement EMCI geoportal data collection and weather information service. This includes providing information on an hourly basis catering for aviation safety.

The improved data and forecasts for rainfall and temperature, will assist other government departments such as Infrastructure Cook Islands (ICI) and Ministry of Agriculture (MoA) will be better equipped to plan water storage requirements. The Ministry of Health (MoH) will be enabled to provide better advice on vector-borne diseases such as zika and dengue.

As part of modernising data collection, analysis, and dissemination, the CLEWS contribute to the development of a new online application made available for various uses. The application makes use of CLEWS information that is accessed via a cloud-based storage system and managed by NIWA.

5.4.5 MARINE RESEARCH

The marine sector has engaged in a range of research and systematic observations.

Research with international organisations continues. The MMR continues to engage with the SPC as a key partner. This includes research into migratory patterns of fish species within the CI EEZ. In 2013 the Living Oceans Foundation (LOF) researched the coral reefs of Rarotonga, Palmerston and Aitutaki.

Also, in 2013 a Cook Islands marine park research team carried out a rapid marine assessment of the fore reefs of five islands in the southern group – Aitutalik, Atiu, Manuae, Mitiaro and Takutea. The team comprised of individuals from NES, CCCI of OPM, Te Ipukarea Society (TIS) and Pacific Islands Conservation Initiative. The expedition was supported by Oceans 5 and the Waitt Institute.

[61] Refer to http://oceanportal.spc.int/portal/library/ for Cook Islands- Rarotonga 2019 Tide predictions calendar.
[62] Refer to http://cosppac.bom.gov.au/ Climate and Oceans support Programme in the Pacific for more information.

The purpose was to assess the health of coral reefs within the proposed Cook Islands Marine Park. Results showed coral communities of Manuae, Mitiaro, Takutea and Atiu were relatively healthy with good coverage of hard corals. By contrast, Aitutaki showed significant decline in coral health, most notably on the fore reef due to crown-of-thorns starfish (COTS) infestation and coral disease (CI Gov, 2013).

Another example is the coral bleaching heat stress gauges,[63] managed through NOAA, monitors ocean temperature data identifying periods of where coral is vulnerable to bleaching. Investigative work also continues as part of the clam-breeding project in Aitutaki and tilapia fish farming project.

At a national level, agencies continue to collaborate in research areas. For example, the MOH, NES and MMR operate a water quality testing regime. The three agencies coordinate and regularly collect water samples for testing and analysis at the MMR laboratory. Analyses are regularly collated and disseminated on a monthly basis among stakeholders.

This work involves data collection at lagoon and stream sites on Rarotonga. In the past, an annual report card was prepared and distributed as part of annual Lagoon Day public awareness raising activities. More recently these events have not been implemented due to insufficient funding. Project funds are currently being sought to reinstate this initiative with possible implementation on other islands. Specific climate change-related research in the marine sector appears ad-hoc and limited. With various policy documents now in place for the sector such as Marae Moana, Marine Sector Policy and Plan, and Ministry of Marine Resources Strategic Plan 2017 – 2021, these institutions are well placed to determine and direct climate research priorities in this sector.

However, an opportunity exists to further climate change activities with the United Nations proclaiming 2021-2030 as the decade of Ocean Science for Sustainable Development to support efforts to reverse the cycle of decline in ocean health. The decade will gather ocean stakeholders worldwide behind a common framework that will ensure ocean science can fully support countries in creating improved conditions for sustainable development of the ocean.

The formulation of climate change related ocean research priorities can be pursued. MMR welcomes research activities and can provide some technical support to research candidates. This may include office accommodation and access to some research equipment. Due to budget constraints, the ministry is not able to provide funding.

The release of MMR policies and strategies and OPM's Marae Moana policies and legislation identifies research priorities and a basis to pursue research activities. Other climate-related research raised during consultations included further examination of the ocean as a carbon sink and the use of the fish aggregating devices (FADs) located in coastal zones used by artisanal fishers as an option to collect additional ocean/wave data.

The MMR underwent an institutional strengthening exercise that was completed in 2010 and funded by the New Zealand Aid programme. Activities included public dissemination and awareness raising about lagoons. Water quality data that was collected and analysed by MMR was released as a report card with traffic light coding to report on water quality from various sites around Rarotonga. The Lagoon Day initiative was a successful collaborative event that involved a range of community and government agencies with educative and interactive sessions for schools, communities and businesses. The event has not been held since 2015. Sustainable funding is required to revive the Lagoon Day. Nevertheless, water quality data continues to be collected by the NES and MoH. Analyses continue to be regularly distributed to a range of stakeholders.

[63] https://coralreefwatch.noaa.gov/vs/gauges/northern_cook_islands.php

With the development of Marae Moana policy (2016) and action plan (2018), a key policy objective is to foster a culture of investigation and research. The 2018 – 2021 Action Plan for the Management of Marae Moana (MM) recognises the pressure climate change places on our global oceans (2018a, p.3). Under the Ridge to Reef (R2R) project the MM works with CCCI to integrate climate change resilience into decisions for protected area sites and management, enhancement of reef connectivity, establishing coral reef refugia, and supporting coastal and riparian forest protection and planting (2018a, p.15).

5.4.6 AGRICULTURE RESEARCH

Research of genetic material and local varieties continues to be undertaken.

The collection of genetic material and local varieties is ongoing. These are conserved at the Centre of Pacific Crops and Trees at SPC. Varieties of taro and plantain bananas are conserved. In addition, the MOA maintains some materials from the SPC Centre. These include sweet potatoes, taro and bananas that are used for evaluation and breeding purposes.

As part of the UNDP R2R programme, the MOA is setting up crop banks on the respective southern Pa Enua. This initiative will conserve important food crops and medicinal plants.

The SNC report indicates government plans to relocate the agriculture station to Mauke. This has not eventuated. However, the MOA will require at least five acres in the Pa Enua to maintain the plant genetic resources of important crops for food security and nutrition.

Since 2015 the MOA continues to promote the use of green manure crops, organic matter and reduced use of highly hazardous solutions including overuse of certain pesticides in crop production to minimise nitrous gas emissions in the sector.

5.4.7 OTHER RESEARCH

A 2013 review of climate change-related publications found a wide range of investigations of different sectors and themes had been undertaken. Examples covered include: paleo climate, oceanography, cyclones, climate proofing, coastal fisheries, offshore fisheries, agriculture, greenhouse gases, hydrology, climate change meetings and conventions, coral reef ecosystems, disaster risk management, financing and coastal management.[64] These included some academic work along with government and donor project-funded studies.

For example, research was carried out under the Pacific Adaptation Strategy Assistance Programme (PASAP) funded by the Australian Agency for International Development (AusAID). A coastal adaptation study aimed to understand the risk posed by changes to sea level and wave behaviour on coastal infrastructure and community in the Avarua area of Rarotonga. The PASAP included a study that aimed to build local capacity to understand the science and manage the risk assessment and planning process.[65]

An additional study for Rarotonga was commissioned as an extension to the original WRL project. This study, titled "A Qualitative Climate Risk Assessment for Avatiu Port and Connected Infrastructure", uses Avatiu port as a case study for implementing a qualitative climate risk assessment methodology that can later be applied to other Pacific ports. The study identified the current means of managing vulnerability and risk to natural hazards, and it is working effectively for the port. The adaptive capacity of the port to future climate-related events also appears well-managed. Similar climate proofing of other connected infrastructure is warranted.[66]

[64] Refer to Climate Change Cook Islands. (2013). Bibliography on climate change related publications conducted in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands.

[65] Cox, R., Panayotou, K., & Cornwell, R. (2013). Climate risk assessment for Avatiu Port and connected infrastructure. WRL Technical Report 2013/15. Manly Vale, New South Wales, Australia: Water Research Laboratory. P.1

[66] Hemstock, 2016, Cook Islands In-Country Scoping Mission Report. EU PacTVET project on Sustainable Energy and Climate Change Adaptation

In the event of a direct hit by a cyclone, significant damage across all infrastructure can be expected. Extended loss of services and a long and expensive recovery could result. The study also identified that further assessment and planning was required to determine the capacity of the various infrastructure, businesses and port to survive and recover.[67]

Research has also been carried out by OPM under the SPC EU GCCA PSIS and AF UNDP Samoa, SRIC- CC project in relation to local knowledge amongst indigenous Cook Islands Māori in the Cook Islands. A questionnaire survey was conducted to collect information on changes in various biological and physical systems over people's lifetimes to understand climate variability. Such information would be useful in developing strategies for infrastructure and resource management.[68]

5.4.8 CONCLUSION

Overall a more systematic and integrated approach to climate-related research is required. Efforts are underway within and between sectors. For example, collaboration between the marine and agriculture sectors is underway with the GEF R2R project. Recent efforts have also been made by a range of interested individuals and organisations to reinvigorate the Cook Islands Research Association (CIRA), its membership and research agenda along with its relationship with the NRC which is responsible for approving research permits to undertake research in the Cook Islands. Climate change is a key theme on the CIRA research agenda.

5.5 EDUCATION, TRAINING AND PUBLIC AWARENESS

5.5.1 INTRODUCTION

Since the SNC and noting the overlap of reporting for this period from 2007 – 2014 the time lapse in preparing this report, there have been several activities related to climate change education, training and public awareness done as part of UNFCCC article 6.

5.5.2 LEARNING & TRAINING NEEDS ASSESSMENTS

Two key learning needs assessments have been undertaken.

Under the 2012 SRIC-CC project a DRR and CCA learning needs assessment was carried out. Its objectives were to collate all information on local and overseas training and related courses in DRM and CCA available and relevant to the Cook Islands residents as well as complete an assessment of training needs to ensure climate-related resilience of the Pa Enua is enhanced (P4SD, 2013a, p.4).

Needs were grouped into seven strategic business areas as follows:

- Programming and project management.
- Policy development and implementation.
- Law making and enforcement.
- Education.
- Data analysis and management.
- Technical assessment and development.
- Specific technical knowledge transfer.

Specific needs were identified.

[67] Cox, R., Panayotou, K., & Cornwell, R. (2013). Climate risk assessment for Avatiu Port and connected infrastructure. WRL Technical Report 2013/15. Manly Vale, New South Wales, Australia: Water Research Laboratory. P.26

[68] Rongo, T., & Dyer. C. (2015). Using local knowledge to understand climate variability in the Cook Islands. Rarotonga, Cook Islands: Government of the Cook Islands p.4

Rakahanga students coral monitoring training 2014.

The report identified that further work was required to develop a CC training and education strategy. Some of the key tasks identified include:

- Programming and costing training and education activities over the short, medium and long term.
- Coordination and stakeholder engagement to ensure alignment with staff training programmes for capacity development.
- Liaison with preferred learning institutions to tailor and confirm training options, course information and local delivery options.

The assessment also identified the need for a climate change education and training policy framework to manage identified needs, establish baselines and monitor the impacts over time (P4SD, 2013b, p.17).

The second assessment arose out of an EU PACTVET scoping mission in 2016.[69] Implemented by SPC with USP, the mission sought to:

- Identify present and future market demand in the Cook Islands for training.
- Map existing training supply in the Cook Islands.
- List priorities for future project activities including selection of partner TVET institutions.

[69] Hemstock, 2016, Cook Islands In-Country Scoping Mission Report. EU PacTVET project on Sustainable Energy and Climate Change Adaptation.

In using the business areas identified by the 2013 assessment, priority sector areas and cross-cutting training topics were identified. Sector areas included: sustainable energy, climate change and transferable skills. The 2016 report prioritised those for immediate attention. The list of priorities is listed in the Appendix 8.6.

In order to take these priorities forward, further planning is needed to synthesise these gaps and needs with formal training course development and qualifications.

Stakeholders agreed that the Cook Islands Tertiary Training Institute (CITTI) should lead continuing such developments – designing and implementing courses with support from USP and other appropriate education and training providers. This should include discussion around issues of regional accreditation as part of formulating formal training opportunities that are fit for purpose and particularly the Cook Islands context. This is because the Cook Islands qualifications framework recognises Pacific and New Zealand qualification standards.

In support of CITTI, assistance is being provided through the PACE and EUGCCA+SUPA project. The recent appointment of a research assistant to the USP CI campus to facilitate activities will greatly contribute to addressing these priorities.

5.5.3 FORMAL EDUCATION

Climate change-related activities in formal education covering compulsory and tertiary education are provided through the Cook Islands Ministry of Education. This includes CITTI as the national tertiary training provider.

5.5.4 MINISTRY OF EDUCATION

Science is designated as one of the eight essential learnings in the Cook Islands curriculum framework (2002). Climate change comes under the Enua e te Rangi (Earth and Sky) strand of the science curriculum (2006). Aspects such as changes to the environment – natural and manmade, fossil fuels and pollution can be found in the science, social science and Māori curricula.

A number of 'possible learning and assessment activities' addressed within this context that are relevant to climate change include:

- Doing a beach study to investigate the effects of storms, wave actions etc.
- Investigating the debate on climate change.
- On a map, mark in the ocean currents and prevailing winds and discuss with reference to migration across the Pacific.
- Talk about the stories relating to the formation of your island and draw the landscape features on a map.[70]

The science and social science curriculum are due for review in 2019.

An Education for Sustainable Development (ESD) and Education for International Understanding (EIU) student conference was held in 2010. Sixteen schools attended the conference themed Taporoporo No Apopo (Keeping Alive for Tomorrow).[71]

The event was repeated from 5 - 7 June 2018 in Rarotonga with the theme: "Ei rangatira no teia ra no te uki apopo – A leader of sustainability today, for a better tomorrow". Participants attended from Rarotonga and Pa Enua Tonga schools. Around 105 students (from Year 6 to Year 8) and 15 teachers attended the conference. Research topics presented included: pollution – plastics, climate change, reviving of spring water, reserved areas – ra'ui, recycling, solar energy, reviving of the marae, and water cycles. It is hoped funding will be available for the 2020 ESD conference.

[70] Refer to https://www.pacificclimatechange.net/country/cook-islands and MOE Consultations (June and July 2019).
[71] https://www.iucn.org/content/cook-islands-conference-education-sustainable-development

It is considered that climate change be integrated into Education for sustainable development (ESD) rather being a stand-alone issue to be addressed. This is to avoid the risk that climate change is seen only as a science subject rather than a cross-cutting concern.

Activities undertaken through the Ministry of Education and implemented in schools also include the UNESCO Sandwatch programme 2008 - 2009. As a science education scheme, students, teachers and local communities work together to monitor their coastal environments; identify and evaluate threats, problems and conflicts facing them,[72] and develop sustainable approaches to address them[72] which is ongoing. This is a unit of learning that schools can implement as part of meeting curriculum aims.

Similarly, another initiative available to schools is the UNESCO - the Canoe is the People programme and manual. Promoting the traditional knowledge of Pacific voyaging and navigation – schools can implement units of learning in line with national curriculum goals.

Since 2017 the MOE has had an annual event with the Japanese government. In 2019, five students were selected to participate in the Youth Ambassadors for World Tsunami Awareness Day in Japan. The students chosen from Year 10 joined students from other countries to achieve the following:

- To learn about the history of tsunami in Japan and the initiatives to prevent and reduce damage from earthquakes and tsunami.
- To exchange knowledge about the threat of disasters.
- The chosen theme was: "Increase awareness; preparedness for disasters and prompt evacuation". Students carried out a research with their peers at their own respective schools for their presentation which included action plans to promote disaster awareness.

Individual schools continue to set their own programmes in line with the aims of the curriculum. In 2019 Avarua School set their unit of work around climate change with Dr Teina Rongo and Korero o te 'Orau (KO) NGO as part of the GEF UNDP R2R project.

At the tertiary level, the MOE administers government and donor-funded scholarships and awards. Prioritising climate change-related programmes of study for such awards would assist in capacity-building efforts.

5.5.5 UNIVERSITY OF THE SOUTH PACIFIC USP – COOK ISLANDS CAMPUS

Through the European Union Global Climate Change Alliance (EU GCCA) project, USP offered a range of capacity-building, community awareness and informal training courses. The purpose of these activities was to develop and strengthen capacity to adapt to the impacts of climate change.

Climate change-related qualifications have been developed and offered. For example, the EU GCCA (at the regional level) took a lot of the positives from the V&A experiences and the community engagement work communities did with their own adaptation programs (in Tongareva this was water security and coastal security). These scaled up the best practices and commonalities of lessons learnt. From this, a regional qualification in resilience was developed. In addition, the integrated climate change adaptation assessment that was also developed, is available as a base teaching manual for PICs customise to their specific country context.[73]

[72] http://www.unesco.org/new/en/natural-sciences/priority-areas/sids/sandwatch/ and MOE Consultations (July 2019),

[73] Personal Communication, Vaine Wichman, Cook Islands In-Country Research Assistant USP & USP EU-GCCA project (2017) Phase I Final report

5.5.6 INFORMAL TRAINING AND PUBLIC AWARENESS

Several agencies publish news releases, brochures and promotional material to raise awareness using different means and media.

Public awareness raising of climate change activities undertaken include those led by government agencies:

- Up until 2015 the MMR and NES have hosted the Takitumu Lagoon Day. This coincided with the release of annual water quality report cards. This provided an opportunity to publish information about the health of the lagoon from sites around Rarotonga about water quality.
- NES has completed the Māori translation of climate change and environment brochures for awareness raising and training purposes.
- NES delivers sessions in schools in support of school units.
- MOA – use of social media, radio talks and information-sharing materials.
- Delivering training to agriculture staff, farmers and communities on Rarotonga and the Pa Enua to minimise the impact of climate change through better managing and increasing soil organic matter. Topics covered include: soil organic matter management, increasing use of composted materials, green manure to enhance soil water and nutrient retention. This is especially important to support crop growth during extended periods of dry weather due to changing climatic conditions. This was delivered as part of the FAO project "Assistance to Enhance Horticultural Crop Production & Improve Resources Management for Sustainable Livelihoods" carried out from 2014 – 2016.
- During Lagoon Days, MOA promoted the use of vetiver grass for protection of soils on sloping lands.

The CIMS also undertook several activities:

- Made use of its online presence and social media to provide the public and sectors with climate and weather information. This includes a new website released in 2019 and maintaining a Facebook page. This page is averaging 200 hits daily with a high of 6000 hits in January 2019.
- CIMS works with EMCI to provide information and raise awareness during the cyclone season.
- There is a need to identify what other services CIMS can provide to the community via radio station and frequency modulation (FM) broadcasting. This has been further exasperated with the decommissioned Matavera radio transmitter in Rarotonga and no amplitude modulation (AM) transmission frequency now available to broadcast the national radio station to the Pa Enua.
- Up-and-coming events where CIMS is able to support public awareness events include:

Providing climate and weather information for each island tere pāti (traveling group) that periodically come to Rarotonga for Te Maeva Nui (Constitutional Celebrations held in August).

2020 year of Ocean Science and start of Decade of Ocean Science to promote ocean activities including those associated with Marae Moana.

In addition, the CCCI as the operational focal point carried out various activities:

- Conducted awareness workshops in the Pa Enua island governments, communities including primary schools and tablet training for seniors facilitating access to weather information. It also engages with civil society groups to deliver climate change awareness on mainland Rarotonga. Awareness programmes include training of students in the Pa Enua to do coral monitoring, using technology (tablets) to access weather information and share information to other islands and overseas, along with activities associated with the annual Earth Hour Day. CCCI also works in partnership with other government agencies to raise awareness on climate change and its impacts on health, food security, traditional food and education.

- Translated a booklet on climate variability into the Māori language.
- Produced a video documentary on climate variability and traditional knowledge in the Cook Islands.
- Produced a climate change newsletter highlighting climate change information and activities.
- Maintains and updates the climate change Facebook page.

Civil society partners also undertook CC related awareness raising activities such as:

- The Cook Islands Voyaging Society (CIVS) using the voyaging canoe, Marumaru Atua as a platform to foster conservation, ocean and climate change education in schools and the wider community.
- Korero O Te 'Orau (KO), an indigenous environmental NGO, piloted a climate change project at Avarua Primary school and it is still ongoing. It also runs a school holiday programme Atui'anga ki te Tango for children reconnecting to the environment and learning basic climate-related traditional knowledge and practices.
- Cook Islands Red Cross sponsorship of Miss Cook Islands pageant. Since 2015 the titleholder of Miss Cook Islands attends an international conference or workshop as a youth ambassador. In 2015, Natalia Short travelled to Geneva to the International Conference of the Red Cross/Red Crescent Movement with the Cook Islands government and delivered a statement on behalf of the Pacific National Society.
- In a disaster risk management strengthening resilience initiative, TIS carried out a 'Learning by Doing' project in Pa Enua schools where students are introduced to various weather instruments and taught how to interpret weather patterns.

Overall, a range of formal and informal training activities have taken place along with public awareness activities undertaken by government and non-government agencies. However, there is a need to ensure a consistent national training policy platform is in place to measure training impacts (P4SD, 2013a). Further attention is needed to ensure formal qualifications and courses are provided as part of building local capacity in a range of sectors. Additionally, preparing a capacity registry of skills available within, and from outside, the country may be worth establishing as part of a national climate change education and training policy framework. This would help to establish baselines and monitor the effectiveness of training and education over time (P4SD, 2013a and b).

5.6 CAPACITY BUILDING AT THE NATIONAL REGIONAL AND SUB-REGIONAL LEVELS

This section provides information on how capacity-building activities related to decision 2/CP.7 are being implemented. The scope for capacity building is broad covering a range of needs and areas of the convention.[74]

In building capacity across these areas, several initiatives and actions have been undertaken and are reported below. These provide a sample of activities to demonstrate the extent to which capacity-building has been addressed and what needs remain.

The following sub-sections presents an update on different sector capacity activities as well as capacity gaps and needs for attention.

[74] (a) Institutional capacity building, including the strengthening or establishment, as appropriate, of national climate change secretariats or national focal points; (b) Enhancement and/or creation of an enabling environment; (c) National communications; (d) National climate change programmes; (e) Greenhouse gas inventories, emission database management, and systems for collecting, managing and utilising activity data and emission factors; (f) Vulnerability and adaptation assessment; (g) Capacity building for implementation of adaptation measures; (h) Assessment for implementation of mitigation options; (i) Research and systematic observation, including meteorological, hydrological and climatological services; (j) Development and transfer of technology; (k) Improved decision-making, including assistance for participation in international negotiations; (l) Clean development mechanism; (m) Needs arising out of the implementation of Article 4, paragraphs 8 and 9, of the Convention; (n) Education, training and public awareness; (o) Information and networking, including the establishment of databases

Lagoon Day 2012.

Lagoon Day 2014.

5.6.1 CLIMATE CHANGE RELATED RESEARCH

Capacity needs were identified in national research coordination and management. The OPM is responsible for providing secretariat support to the NRC and for managing and promoting research to inform national policy. There is support from CCCI and MM divisions of the OPM in identifying CC related needs and resources. The USP is also able to provide coordination support through its academic research mandate. The recent renewal of the CIRA is also emerging as a contributor to Cook Islands climate change-related research capacity.

Development of a national CC related research agenda would facilitate research interests, priorities and target resources.

5.6.2 SYSTEMATIC OBSERVATION – COOK ISLANDS METEOROLOGICAL SERVICE

Capacity needs for research and systematic observation were also identified by the CIMS. There are 11 staff (including two women) averaging 25 years. Recruitment and retention are ongoing challenges. Given the technical nature of work and positions, training is essential. CIMS provides meteorology observing training in-house. The Fiji Meteorological Centre provides further specialised training. This includes gauging the competency of staff for certification. This has been an area of focus for CIMS since 2018. This forms part of the International Civil Aviation Organisation (ICA) requirements for Part 1.74 Aviation Meteorological Service Organisations Certification.

It is also important to recruit staff with a Bachelor of Science degree who are then able to undertake a 54-week Diploma in Meteorology. This level of capability is key to ensuring staff progression and a succession pathway can be pursued as well as setting a salary banding commensurate with the technical capacities required.

Capacity needs include:

- A policy for CIMS and the Ministry of Transport (MOT) to enhance its services and protocols for sharing the data it collects.
- Monitoring devices of weather monitoring systems installed on outer inter-island boats. This will enable data about sea conditions, waves, and storm surges to be sent via satellite.
- Support from the Green Climate Fund (GCF) to assist with monitoring wave and weather conditions on the west coast of Rarotonga. This includes technology in the form of moored buoys to collect wave activities such as storm surge.
- Data sharing support with the Geoportal held by EMCI and linked to the CIMS system. This will enable information to be shared while CIMS continue to provide weather warning information on their website.
- Daily flight support to collect data from Rarotonga. Since the end of 2018 the CIMS has suspended the upper air daily flight release. This consists of a wind-finding and radio-sonde.

Climate change students workshop 2016. AF&GEF R2R

School Holiday Programme. KO - Korero o te Orau, an indigenous NGO 2019, GEF R2R

Wind speed and direction data at different altitudes is collected. Temperature, humidity and atmospheric pressure at different altitudes is collected with the radio-sonde. Funding through the GUAN Global Upper Air network with support from the United Kingdom and Japan to support the costly expense of consumables came to an end. Further funding has yet to be obtained. $200,000 is needed annually to meet costs.

- Support to achieve Aviation Regulation accreditation by June 2020. This means addressing capacity needs to ensure quality systems, technology and staff are in place. In order for the CIMS to be able to obtain accreditation to Part One 7.4 of the Aviation regulation, it must demonstrate that its operations – including the daily flight — meet the quality standards of this regulation. Accreditation will enable CIMS to recover costs and offset operational costs such as the annual $200,000 needed for the daily flight consumables. This potentially offers CIMS an opportunity to recover 10% of its budget by charging airlines for information services.

Other CIMS-related constraints include:

- The need for additional monitoring equipment to be able to provide data on weather conditions on the western coast of Rarotonga as bad weather approaches from the west. Low pressure systems north of New Zealand that come from the tropics and move to the mid-latitudes can create a pounding effect on the ocean surface making waves bigger. When these coincide with high tide, waves wash across Rarotonga's western coastline, roads and properties causing damage and disrupting movement. Incorporated data can be used to notify public when these extra tides arrive. We will then be better able to put out early warning associated with these weather events that occur outside of the November to April cyclone season.

CLEWS communications operate using the internet with a back-up system in place. The second system is via the Broadband Global Area Network (BGAN)[75] with a satellite auto switch which is activated should a problem arise.

- Automated weather station malfunctions are managed by CIMS staff. However, Vodafone staff (the Cook Islands sole telecommunications service provider) on each island assist with any malfunction. A maintenance team check each automated weather station annually. The training and equipment are provided through the RESPAC and SRIC projects. With access to the internet CIMS can provide meta data and disseminate information in real time.

[75] The Broadband Global Area Network (BGAN) is a global satellite network with telephony using portable terminals. The terminals are normally used to connect a laptop computer to broadband Internet in remote locations, although as long as line-of-sight to the satellite exists, the terminal can be used anywhere.

5.6.3 ENERGY SECTOR

Capacity-building has progressed in the energy sector and there has been a shift to RE for electricity generation. -Institutional arrangements and new technology have been put in place along with the upskilling of the labour force in this sector.

However, capacity-building around the implementation of climate change risks on renewable energy technologies continues to be needed to ensure long-term operational effectiveness (CI Gov, 2011a, p.15).

An example of renewable energy capacity-building through South-south cooperation was undertaken in 2017. The collaboration between the Cook Islands government, Barefoot College in India and the Cook Islands National Council of Women (CINCW) provided an avenue to address gaps and challenges in gender and sustainable/renewable energy, and women's economic empowerment. Three Pa Enua women attended an intense six-month training course to undertake training as solar engineers. Skills in solar electrification, water heating, cooking and filtering water via solar-powered desalination methods were part of the training. Upon their return the women expect to build solar enterprises in their home islands (CINCW, 2017).

5.6.4 INFRASTRUCTURE

Capacity-building has taken place with physical infrastructure and developing a building code/ legislation with enactment expected in 2019.

Building capacity involves "learning by doing". An example of this was undertaken by TIS and funded through the AF UNDP Samoa, SRIC-CC project as technology transfer, and education training and awareness. Completed in 2018, the project took place in the Pa Enua with Automated Weather Stations and it took to training school students on how to read the instruments and record climate data for their respective island.

5.6.5 POLICY INTEGRATION

Capacity building efforts show that activities have been undertaken to maximise synergies between national priorities, the convention and other global agreements. This is seen with the links between national and sector policies, plans and international obligations.

The NBSAP strategy,[76] action plan, and capacity development plan makes links to the Aichi biodiversity goals and targets, and the Biodiversity theme – Ecosystem management and strategic goal – Conserve important ecosystems through a system of protected areas with regulated and monitored activities. Impacts of climate change on vulnerable ecosystems are minimised (Hilyard & Tairea, 2017, p.38). Some suggested actions included development of national park management plans, policies and legislation, national awareness campaign, GIS mapping of protected areas, engagement with traditional leaders and landowners to develop ra'ui programmes.

This is linked to the Marae Moana policy objective 1: Conservation and ecological sustainability where it is recognised that healthy ecosystems are resilient against the adverse impacts of climate change (CI Gov, 2018, p.9).

Together these linkages have been brought together in the design of the GEF UNDP R2R project with activities attending to fragile ecosystems, the high population demands of tourism on those land and water ecosystems and biodiversity.

[76] NES, 2017. Capacity Needs Assessment for Biodiversity Management: Strategy & Action Plan and Capacity Development Plan

5.6.6 OCEANS AND MARINE RESOURCES

An area to emerge as a priority for the Cook Islands relates to the ocean and marine resources. With policies being developed, climate change has been integrated into the action plan for the management of Marae Moana 2018 – 2021. The TNC can expect to bring greater attention to research needs including data management and dissemination between agencies as well as with different stakeholders.

5.6.7 TECHNOLOGY TRANSFER

As identified in the technology transfer section above, it is important to carry out training on technology and ensuring appropriate individuals are identified particularly in the Pa Enua to undertake the training and transfer knowledge to others on their islands.

Capacity-building of climate change staff and local consultants on IPCC guidelines, greenhouse gas, mitigation and adaptation issues and UNFCCC systems and procedures, are ongoing.

However, it is important to ensure capacity opportunities are not restricted to one or two people but spread across relevant and critical focal points. This would ensure a critical mass of individuals/ organisations are in place to successfully deliver on the NC commitments (CI Gov, 2014).[77] It would provide for continuity of work programme momentum and service delivery. It would also reduce the cost, time constraints and scheduling issues that result when bringing in overseas consultants.

What systems are in place to receive capacity-building opportunities may vary between focal points and sectors. It may be necessary to clarify what these processes are for disseminating capacity- building needs and opportunities, identifying and selecting options and candidate/nominees across sectors and institutions - civil society, private sector and government including youth, women, people with disabilities, and indigenous experts. For example, establishing a register of media personnel/educators suitable to undertake informal training and public awareness climate change - related activities from across government, civil society and private sector can facilitate disseminating information about capacity needs and opportunities. This would contribute to ensuring continuity and momentum when implementing climate change initiatives and would foster collaboration among stakeholders.

Finally, to reiterate the analysis of the 2014 Stocktake report, 'capacity-building was an essential element for the SNC and will continue under the TNC" (2014, p.14). The report's statement that 'Capacity-building should be an ongoing element for the development of the NC' (2014, p.14) continues to be pertinent.

5.7 INFORMATION AND NETWORKING

Information on the Cook Islands efforts to promote information sharing among other countries and regions as well as within the Cook Islands is provided below. This includes the Cook Islands participation and contribution to different networks as well as having access to and using information technologies for information exchange.

A change in institutional arrangements was the establishment of the CC and DRM Platform in 2011.

A CC newsletter has also been instigated and regularly shares information from the CC & DRM Platform. This is distributed via email to the Pa Enua and a range of stakeholders and interested parties.

CCCI also manages a Facebook page where current news and activities are posted regularly. Climate change information is also shared and presented in the Pa Enua through community workshops and school programmes.

Climate change stories are also shared on national media and featured in other international UNFCCC agencies communications and reports such as the Adaptation Fund 50th report.

[77] Refer to Stocktake Report

Another initiative is the Cook Islands' participation with the installation of an integrated Geo-portal for DRM which generates, manages and shares geo-spatial data, information and knowledge related to climate change and disaster management. The online mapping and document catalogue is expected to assist emergency response teams' decisionmaking in the event of a national emergency and for other climate change-related decision making purposes.

The Pacific Climate Change Portal is another avenue where the Cook Islands shares climate change and disaster risk management information.

Through membership to regional and international organisation and MEA obligations as national focal points, several agencies are engaged in networking and sharing information. For example, the CIMS is a member of the Pacific Meteorology Council. Non-state actors such as the CIRC is a member of the IFRC and environmental NGO - Te Ipukarea Society through its international network is a member of the International Union for Conservation of Nature (IUCN) and Birdlife International network and sharing information through the GEF has undertaken regional projects in Niue and Tokelau setting up community filtered water stations.

Tablet training for Mangaia seniors (Rauti Para project 2013/2014).

6 CONSTRAINTS AND GAPS

6 CONSTRAINTS & GAPS

6.1 INTRODUCTION

The constraints, gaps and related financial, technical and capacity needs are described in this concluding chapter. Also covered are proposed and/or implemented activities for overcoming the gaps and constraints, associated with the implementation of activities, measures and programmes envisaged under the convention. Constraints and gaps associated with the continuous preparation and improvement of National Communications are also included.

6.2 TNC PREPARATION SUPPORT

The TNC is an agreement made between the United Nations Environment Programme and represented by its Director, Economy division, an international inter-governmental organisation established by the General Assembly of the United Nations, Kenya, with Climate Change Cook Islands (CCCI) under the Office of the Prime Minister (OPM) executing agency, a government agency represented by its Chief of Staff in Rarotonga, Cook Islands.

UN Environment and Cook Islands Climate Change Cook Islands under the Office of the Prime Minister signed a Project Implementation Plan agreement (PIP) entitled "Cook Islands, Enabling Activities for the Preparation of Third National Communication under the United Nations Framework Convention on Climate Change".

6.2.1 COST OF THE PROJECT

The total cost of the project under this agreement is US$580,000 of which US$480,000 is GEF financing. The balance is funded by the Cook Islands government (in-kind). Financial documents and vouchers are prepared by the CCCI office and processed by the DCD unit.

Monitoring of tasks carried out for the TNC are managed by the Coordinator, Director and UNEP. Quarterly reports are sent to UNEP and DCD.

Cost to the GEF Trust Fund:	**US $480,000.00**
a) Preparation of the Third National Communications to the UNFCCC b) Retained by UN Environment for Monitoring and Evaluation (M&E)	**US $462,000.00** **US $18,000.00**
In-kind contribution from the Executing Agency	**US $100,000.00**
Total cost of the project:	**US $580,000.00**
(PIP Agreement 2015)	

A constraint has been identified in operationalising the thematic working group approach of the TNC. Thematic working groups were established but have been unsustainable. It became necessary to enlist technical assistance (locally and internationally) to conduct analyses, compile and report on the TNC.

This constraint was due in part to the competing demands place on focal points and group members. For many it appears that the climate change focal point/member role and duties are not formally recognised into the mandate, function and outputs of government and non-government agencies. Attention on how to further integrate the duties and tasks of thematic focal points into respective government and non-government agencies is needed for the ongoing implementation, monitoring and reporting on climate change in the Cook Islands.

6.3 CC RELATED ACTIVITIES & PROPOSED PROJECTS

Several activities related to CC have been provided by the Cook Islands and supported by GEF and other bilateral and multilateral institutions. A list of funded projects up to 2014 is included in the appendix 8.3.

In preparation for arranging for technical and financial support, priority activities are identified in the Cook Islands Climate Change Country Programme 2018 – 2030 (CICCCP), the Climate Change Policy 2018 - 2028, JNAP II 2016 – 2020 and sector plans.

6.4 OPPORTUNITIES FOR IMPLEMENTING ADAPTATION MEASURES

A demonstration adaptation project that took place was under the Pacific Adaptation to climate change programme (PACC). The programme set out to demonstrate best practice adaption in three climate sensitive areas: coastal zone management, food security and food production, and water resource management.

The Cook Islands Ministry of Infrastructure and Planning (National Implementing Agency) hosted a pilot project that came under coastal zone management of the PACC programme with partners SPREP (PACC Implementing partner), UNDP (Implementing Agency) and GEF (Funding Agency). Climate-proofing Mangaia harbour and protecting the island's coastline was identified after cyclone Meena in 2005 caused extensive coastal damage to Mangaia, swamping the harbour and damaging inland roads and the airport area. The project aimed to strengthen the Mangaia harbour to be more resilient to the impacts of climate change. A geo-spatial survey was carried out to inform design with construction taking place in 2012.

An innovation of the project was the coastal calculator tool to help with designing climate-proof infrastructure. The tool helps to ensure that the harbour can withstand cyclone and storm surges.[78]

Barriers to implementation included delays to the start of the implementation phase of the project due to limited availability of trained personnel, access to good machinery and availability of aggregate for the concrete works.[79]

The PACC programme meet the Cook Islands needs related climate change vulnerability and adaption. The SPREP (2015) demonstration guide showed upscaling and replication with the coastal calculator applied in other projects,such as climate-proofing Tukao and Tauhunu harbours on Manihiki, improvements to the Arorangi jetty, Rarotonga, and several environmental impact assessments.

6.5 DEVELOPMENT AND TECHNOLOGY TRANSFER

The specific technology needs and assistance the Cook Islands has received from its development partners and financial mechanism of the Convention is presented in the table below. Mitigation funding assistance has been provided from the following development partners during the 2013 – 2014 period.[80]

This assistance has supported the Cook Islands renewable energy ambitions to develop infrastructure and technical capacities, and systems. This has led to a transformation of the energy sector and reduced reliance on fossil fuels for electricity generation.

[78] Refer to: https://www.sprep.org/news/adaptation-innovations-showcased-project-review-meeting CC Consultations June 2019)
[79] SPREP 2015 p. 17 https://www.sprep.org/attachments/Publications/CC/PACCTechRep13.pdf
[80] Refer to p.151 2014/15 Cook Islands MFEM Budget Book 1

TABLE 10: MITIGATION DEVELOPMENT PARTNER FUNDING 2013 - 2017

DEVELOPMENT PARTNER	PROJECT/INITIATIVE	BUDGET
Asian Development Bank	**Renewable Energy TA**	570,000
Asian Development Bank	**Promoting energy efficiency in the Pacific**	511,000
European Union	**Renewable Energy Grant (Southern Group)**	8,570,000
Japan (PEC)	**PV mini grids**	4,572,000
New Zealand	**Renewable Energy Programme Support**	10,800,000
New Zealand	**Atiu Generator Renewable Energy**	209,000
SIDS-DOCK	**Energy Transformation (Palmerston Island)**	2,330,000
SPREP (PIGGAREP)	**Power Sector Study**	127,000
		27,689,000

6.6 RESEARCH RELATED GAPS AND CAPACITY NEEDS

Attention to the institutional arrangements and the policy framework of national and sub-national climate change research capacity constraints is needed. This includes identifying research priorities, partnerships and funding to undertake relevant and meaningful studies that inform a Cook Islands research agenda in the first instance. As such, support activities that enhance existing processes of the OPM CPPO research registry, the NRC and sector/thematic research activities can be considered.

While the CLEWS and equipment is nearly all in place delivering early warning and risk information to all islands, ongoing activities and costs need attention to ensure the integrity of the system and data is maintained and extended. This includes a programme for regular maintenance and costs are integrated into the CIMS operating budget. This includes assistance for staff to be able to obtain and produce information from additional sites such as the Matavera wind turbine and Avana harbour entrance on Rarotonga.

6.7 TECHNOLOGY TRANSFER

It is expected that the climate technology needs assessment underway in 2019 will provide more detailed analysis of capacity needs and strategies. Indicative areas include monitoring verification and reporting (MVR) covering adaptation and mitigation.

Constraints related to land issues as part of technology transfer assessments include land availability, use and ownership embedded in customary land tenure and management systems. These cultural systems can operate simultaneously in cooperation with and in opposition to climate change-related initiatives that require access to customary land for water and sanitation reticulation sites or renewable energy facilities. The implication of forced displacement and climate change-induced migration is another land-related issue to be considered.

Mitiaro

6.8 OTHER NEEDS AND CONSTRAINTS

Other needs include:

- Improving the development of databases and data collection processing and management activities for GHG inventory to allow continuous updating and reporting.
- Climate finance - funding gaps have been identified in the Cook Islands Climate Change Country Programme. Further assistance will be needed to meet these actions. Considering the Cook Islands OECD graduation planned for 2020, further assistance will be needed to meet these priorities where traditional funding sources may require innovative approaches.

Other confirmed SNC capacity constraints that remain relevant include:

- Risk transfer and insurance.
- Sustainable institutional arrangements.
- Further integration in all planning and implementation.
- Policy and regulation enforcement.

6.9 CONCLUSION

A number of constraints, gaps and related financial, technical and capacity needs exist. They require immediate attention in a holistic manner for ongoing and proposed climate change actions to be realised.

7 CONCLUSION

As a nation, the Cook Islands continues to face severe impacts and increasing challenges associated with increased global warming. The direct and indirect impacts of climate change are prevailing matters of concern for the country. The geological mix of islands located amidst the Cook Islands sovereign waters, the marine resources as well as the population and development challenges require concerted effort to protect all that is the Cook Islands.

As a party to the Convention, progress has been made to reduce the negligible GHG emissions produced. Despite being a negligible emitter, further effort to build on current endeavours is underway with a comprehensive renewable energy programme.

Adaptation is still the priority for the Cook Islands despite the increasing costs and burden of taking the necessary adaptation actions. To ensure communities remain strong and thrive, the environment is protected, livelihoods and economies flourish, capacity support and resources remain essential contributors to addressing the identified constraints needs and gaps in this communication.

The Cook Islands anticipates the Fourth National Communication will demonstrate its effective implementation of the Convention in responding to climate change. This includes showing the extent to which constraints and gaps of this communication have been addressed, adaptation actions taken and mitigation efforts advanced to reduce GHG emissions.

Delivering cargo Nassau Island 2016.

7 APPENDICES

7.1 COOK ISLANDS MAORI GLOSSARY

Ei	Necklace or head crown made from fresh flowers, plastic flowers or other leaves and natural fibres worn by Cook Islanders
Enua e te Rangi	Earth and Sky
Kaikai/katikati	Act of eating and food for snacks
Kaveinga Tapapa	Direction of preparedness
Korero o te Orau	The knowledge of the land, sea, and sky of our nation
Koutu Nui	House of the Minor Chiefs of the Cook Islands
Kumara	Sweet potato
Maire	Ornamental creeper sought for its fragrance and cultural significance
Makatea	Coralline rock formation
Maniota	Arrowroot
Māori	Indigenous Cook Islander
Marae	Designated sacred area of cultural significance for ceremonies
Mori pi	Mauke name for coconut oil infused with the pi plant
Nuroa	Mitiaro name for a plant used in traditional medicine
Pa Enua	Outer islands
Pota taro	Mauke, Atiu and Mitiaro word for taro leaves
Pueikao	Mauke name for the nuroa plant used in traditional medicine on the island of Mitiaro
Puka/pukatea	Native tree with round black seeds commonly used for decorating costumes and making eis
Pupu	Tiny shells used for making shell creations and ei
Puraka	Hardy root crop of the taro family
Ra'ui	Traditional conservation systems
Rito	Straw strand prepared from young coconut leaves for weaving
Rukau viti	A variety of spinach
Tamanu	Pacific mahogany
Taporoporo no apopo	Conserve for tomorrow
Taro	Stable root crop
Taro rukau	Taro leaves
Tarua	Dry land taro
Te Aponga Uira	The national electricity supplier
Te Ipukarea	The home
Te Kaveinga Nui	The national development vision
Te Rito o te vairakau Maori	The pureness of traditional Māori medicine
Tere pāti	Travelling group
Tou	Native tree
Vaka Marumaru Atua	Name of the Cook Islands double-hulled voyaging vaka

7.2 ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AF	Adaptation Fund
AFOLU	Agriculture Forestry and Other Land Use
AUSAID	Australian Agency for International Development
BGAN	Broadband Global Area Network
BSRP	Building and Strengthening Resilience of Pacific
CC	Climate Change
CCA	Climate Change Adaptation
CC&DRMP	Climate Change & Disaster Risk Management Platform
CCCI	Climate Change Cook Islands
CDCDP	Climate and Disaster Compatible Development Policy
CI GOV	Cook Islands Government
CICCCP	Cook Islands Climate Change Country Programme
CIMS	Cook Islands Meteorological Service
CIPS	Cook Islands Police Service
CIRA	Cook Islands Research Association
CIRC	Cook Islands Red Cross
CIREC	Cook Islands Renewable Energy Chart
CITTI	Cook Islands Tertiary Training Institute
CIVS	Cook Islands Voyaging Society
CLEWS	Climate Information Early Warning Systems
COSPPAC	Climate and Oceans Support Programme in the Pacific
COTS	Crown of thorns starfish
CPPO	Central Policy and Planning Office
CROP	Council of Regional Organisations in the Pacific
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSO	Civil Society Organisation
CTCN	Climate Technology Centre and Network

DAC	Development Assistance Committee
DCD	Development Coordination Division
DETF	Disaster Emergency Trust Fund
DM	Disaster Management
DRM	Disaster Risk Management
DRM NAP	Disaster Risk Management National Action Plan
DRR	Disaster Risk Reduction
EEZ	Exclusive Economic Zone
EIU	Education for International Understanding
EMCI	Emergency Management Cook Islands
ENSO	El Niño-Southern Oscillation
ESD	Education for Sustainable Development
EU	European Union
EU GCCA	European Union Global Climate Change Alliance
EU GCCA+SUPA	European Union Global Climate Change Alliance Plus Scaling Up Pacific Adaptation
EU PACTVET	European Union Pacific African and Caribbean Technical and Vocational Education and Training
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
FFA	Pacific Islands Forum Fisheries Agency
FNC	Fourth National Communication
FOLU	Forestry and Other Land Use
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GHGI	Green House Gas Inventory
GIS	Geographical Information System
GUAN	Global Upper Air Network

ICI	Infrastructure Cook Islands
INC	Initial National Communication
INDC	Intended Nationally Determined Contributions
INTAFF	Ministry of Internal Affairs
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IUCN	International Union for Conservation of Nature
JNAP	Joint National Action Plan
JNAP I	Joint National Action Plan 1
JNAP II	Joint National Action Plan 2
MEA	Multilateral Environmental Agreement
MFAI	Ministry of Foreign Affairs and Immigration
MFEM	Ministry of Finance and Economic Management
MMR	Ministry of Marine Resources
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOT	Ministry of Transport
NBSAP	National Biodiversity Strategy and Action Plan
NC	National Communication
NCCCT	National Climate Change Country Team
NCD	Non-Communicable Diseases
NCEA	National Certificate of Educational Achievement
NES	National Environment Service
NESAF	National Environment Strategic Action Framework
NGO	Non-Government Organisation
NIE	National Implementing Entity
NIWA	National Institute of Water and Atmospheric Research (NZ)
NOAA	National Oceanographic and Atmospheric Administration (USA)
NSDC	National Sustainable Development Committee
NSDP	National Sustainable Development Plan
NZAID	New Zealand Aid Programme
NZD	New Zealand Dollar
ODA	Overseas Development Assistance
OECD	Organisation for Economic Cooperation and Development
OPM	Office of the Prime Minister
PACC	Pacific Adaptation to Climate Change
PaCE	Pacific Centre for Environment
PASAP	Pacific Adaptation Strategy Assistance Programme
PCA	Project Cooperation Agreement
PCCP	Pacific Climate Change Portal
PCCSP	Pacific Climate Change Science Programme
PIC	Pacific Island Countries
PICCAP	Pacific Islands Climate Change Assistance Programme
PIFS	Pacific Islands Forum Secretariat
PI-GCOS	Pacific Islands Global Climate Observing System
PI-GOOS	Pacific Islands Global Ocean Observing System
PRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PSAAP	Predictive Science Academic Alliance Programme
PSC	Public Service Commission
PSIS	Pacific Small Island States
PV	Photo-voltaic
R2R	Ridge to Reef
RE	Renewable Energy
REC	Renewable Energy Chart
RED	Renewable Energy Division
REDD	Renewable Energy Development Division
RESPAC	Disaster Resilience for Pacific Small Island Developing States
SDG	Sustainable Development Goals
SEA-FRAME	Sea Level Fine Resolution Acoustic Measuring Equipment

SIF	Social Impact Fund
SLR	Sea Level Rise
SNC	Second National Communication
SOPAC	Applied Geoscience & Technology Division of the Secretariat of the Pacific Community
SPC	Secretariat of the Pacific Community
SPC EU GCCA PSIS	Secretariat of the Pacific Community European Union Global Climate Change Alliance Pacific Small Island States
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment Programme
SRIC-CC	Strengthening the Resilience of Our Islands and Our Communities to Climate Change
SUPA	Scaling Up Pacific Adaptation
TAU	Te Aponga Uira
TIS	Te Ipukarea Society
TNA	Technology Needs Assessment
TNA-A	Technology Needs Assessment for Adaptation
TNA-M	Technology Needs Assessment for Mitigation
TNC	Third National Communication
ToT	Training of Trainers
TVET	Technical and Vocational Education and Training
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USP	University of the South Pacific
USP CI	University of the South Pacific Cook Islands
V&A	Vulnerability and Adaptation
WATSAN	Water and Sanitation
WMO	World Meteorological Organization

7.3 VULNERABILITIES AND ADAPTATION ASSESSMENT FINDINGS

The findings are based on the National Environment Service V&A assessment reports carried out between 2012 and 2013.

STRATEGIES AND MEASURES	ATIU	MANIHIKI ENUA	PUKAPUKA & NASSAU	RAKAHANGA HENUA	TONGAREVA HENUA
Coping with extreme weather events through the review and implementation of building code, design and construction of cyclone shelters, climate-proofing power supply network, wharves and airports.	X		X	X	X
Remove unoccupied dilapidated buildings as they are high risk during cyclones.	X				
Rebuild and on-going maintenance of rock walls/wharf within the lagoon.		X			X
Coping with maintaining food-bearing plants throughout the year in the event of salt water intrusion, limited fresh water and climate change by introducing hybrid crops that are resistant to pests brought about by increased temperatures, crops that can stand long periods of droughts or simply use less water.	X	X	X	X	X
Coping with long term afforestation of atoll lands with deep-rooted trees like tamanu through tree planting schemes.		X			
Control through removal and preventative measures of invasive plant/marine animal species affecting local and useful species.				X	
Coping with the lack of fruits vegetables that support health programmes to address NCDs, e.g. hydroponics and home gardens.		X	X	X	X
Coping with water shortages by increasing water storage through rehabilitation of useable existing tanks and providing new ones and improving or increasing collecting capability at the community and household levels to provide clean potable supply of water and applying water conservation to prevent wastage.	X	X	X	X	
Water security - improve traditional wells. Provide a way to test springs and well water to support potable water supply.	X		X	X	X

STRATEGIES AND MEASURES	ATIU	MANIHIKI ENUA	PUKAPUKA & NASSAU	RAKAHANGA HENUA	TONGAREVA HENUA
Coping with sea flooding and cyclones – coastal protection systems at wharfs and landing points and ongoing dredging for fill and coastal upgrade.		X	X		X
Coconut replanting scheme and around the coastline.			X	X	
Replanting of appropriate species to protect land loss from coastal erosion.			X	X	
Coping with the need for sustainable energy to support household through upgraded and better solar power and more efficient energy conservation technology rating for electrical appliances. Bring forward the renewable energy project for Tongareva.			X	X	X
Food security - traditional lifestyle to continue and improve waste management.	X	X			
Pearl biologist to be based in Manihiki to conduct research to determine the link between climate change and pearl farming.	X				
Promote 'rā'ui' system as well as putting in place good policies to sustain fishing on the reef and in the lagoon.	X				X
Using traditional knowledge and modern materials to sustain lake reserves for fish.	X				
Explore the use of aquaculture to provide alternative fish supply.			X	X	X
Explore the options of increasing the catch and export of fish jerky.				X	
Promote climate change in school and community activities.	X	X			
Introduce a pig eradicationprogramme.	X			X	
Developing gender equality and representation in decision-making places.					X
Developing a production and marketing plan and strategy to revive handicraft industry.					X
Developing gender equality and representation in decision-making places.					X

7.4 CC PROJECTS

The table below sets out a range of development partner-funded climate change projects carried out between 2007 and 2014.

TABLE 11: 2007 – 2014 CLIMATE CHANGE FUNDED PROJECTS

PROJECT NAME	YEARS	FUNDER	DESCRIPTION
Strengthening Disaster Management and Mitigation: Component Two - Preventative Infrastructure Master Plan	**2007**	ADB	Review, prioritisation and design of existing and future infrastructure projects on Rarotonga and the outer islands with a view to economic growth and 'climate-proofing'. Included a review of the Building Code, and the development of a Climate Risk Profile for the Cook Islands. Developed 111 project briefs, of which 44 were prioritised for the first 5 years. Projects at risk from climate change were identified and adaptation measures identified as well as a process for additional CC studies to test feasibility.
Cyclone Pat: Recovery and Reconstruction Project (Aitutaki)	**2010 - 2011**	NZAID, CIG	Estimated costs: NZD9.5million. NZAID contributed NZD5.5million.
Cyclone Emergency Assistance Project (CEAL)	**2005 - 2011**	ADB, CIG	ADB provided a loan of US$2.85 million to assist the government implement a comprehensive recovery programme following the five cyclones experienced in 2005. The total cost of the CEA Project is estimated at US$7.9 million.
Cyclone Recovery and Reconstruction (CRR) and Outer Island Development (OID) Programmes	**2007 - 2012**	NZAID, CIG	**INCLUDES:** • Building of new building for the CI Red Cross, which will double up as a cyclone safety shelter • Supply of new roofing sheets and rainwater tanks to households in Pukapuka, Nassau, Tongareva, Rakahanga • Repair of community tanks in Manihiki • Harbour wharf repairs: Mauke, Mitiaro • Manihiki CMCs refurbishment • Mauke water upgrade.
Pukapuka Cyclone Safety Shelter	**2011**	EU, CIG	Building of a modern, climate-proof emergency safety shelter.
Pacific Islands Climate Change Assistance Project	**1998 - 2001**	GEF SPREP UNDP	Assisted countries in preparation of their initial National Communications.
National Capacity Self-Assessment (NCSA)	**2006 - 2009**	GEF	Looked at capacity needs to address UN Multilateral Environmental Agreements, UNCCD, UNCBD and UNFCCC. Development and Final Report, May 2009.
Cook Islands Second National Communications Project	**2006 - 2010**	GEF UNDP CIG	A number of enabling activities including island specific Vulnerability and Adaptation Assessments for Mauke, Mitiaro and the community of Ngatangiia (Rarotonga)
National Adaptation Planning Assistance	**2009 - 2011**	Gov. of Italy GEF	Preparation of a Joint Climate Change Adaptation and Disaster Risk Management National Policy

PROJECT NAME	YEARS	FUNDER	DESCRIPTION
The Pacific Adaptation to Climate Change (PACC)	**2009 - 2013**	GEF UNDP CIG	To develop an Integrated Coastal Management Framework for the Cook Islands using an extensive process of assessments, training and consultations. ICMF scheduled for completion in 2013. To develop guidelines and to demonstrate how to integrate CC into coastal development planning (all relevant sectors) by conducting detailed studies (V&A + technical) at one pilot site (Mangaia harbour). To build a comprehensive communications and awareness of PACC at all levels. This project demonstrates a good working relationship between agencies and departments. NES developed the proposal and MOIP is implementing it.
Technology Needs Assessment – Adaptation 2009 (TNA-A)	**2009**	NES	Commissioned by the NES under the SNC as an enabling activity, this study looked at the technology needed for adaptation to climate change in health, water, agriculture, and the coastal zone (inclusive of infrastructure, tourism and biodiversity). It also looked at mitigation technology needs.
Development of Sustainable Agriculture in the Pacific.	**2007 – 2009**	FAO	Produced a case study report of climate change and food security for the Cook Islands. Commenced trial planting of certain crop types.
Food Security for Sustainable Livelihoods Programme (FSSLP).	**2010**	FAO	A food security assessment is currently being compiled for the Cook Islands. Focused in the southern group of islands.
Preparedness for Climate Change Programme	**2009**	CI Red Cross	Various activities planned for the outer islands e.g. documenting traditional methods of food preparation The CIRC has also programmed to start Vulnerability Community Assessments for each of the outer islands where the Assessments have not been completed
Managing Climate Change Risk in Cook Islands Vulnerable Communities (ADB-SGA-WWF)	**2010**	ADB Small Grants WWF	A pilot in 3 communities (Arutanga-Ureia in Aitutaki, Matavera and Rua'au districts in Rarotonga), carrying out participatory climate risk assessments using GIS, in order to develop methods and tools.
Community-centered Sustainable Development Programme	**2008 - 2012**	UNDP	Supported by UNDP, Sustainable Village Development Plans have been developed in Mauke and Mitiaro , and similar exercises are being planned for Aitutaki. These plans created good momentum for community engagement and participatory processes, and identified community needs and plans in agriculture, water, and coastal issues, but without integrating climate risks, and providing funds for actual implementation.

PROJECT NAME	YEARS	FUNDER	DESCRIPTION
Strengthening the Resilience of our Island Communities to Climate Change	**2012 - 2017**	Kyoto Protocol Adaptation Fund, UNDP	Stated outcomes are: To strengthen the ability of all Cook Islands' communities and the public service to make informed decisions and manage anticipated climate change driven pressures (including extreme events) in a pro-active, integrated and strategic manner. Efficient and effective support at national level for disaster risk reduction and adaptation initiatives in the Pa Enua. Key players in Pa Enua development have the capacity to reflect disaster risk management and adaptation considerations when planning, making decisions and during operations. Enhances resilience to climate change, including weather and climate related disasters for all inhabited Pa Enua. Lessons learned and best practices improved the effectiveness of initiatives to enhance the resilience of Pa Enua and other vulnerable communities. US$4.9 million (proposal phase) 5.38 million (implementation)
Climate Change Adaptation Institutional Structure Development	**2011/12**	Australian Department of Climate Change and Energy Efficiency (DCCE) Pacific Adaptation Strategy Assistance Programme (PASAP)	Establishment of a Climate Change Coordination Division within the Office of the Prime Minister. AUS$100,000 over 12 months.
Coastal Adaptation Needs for Extreme Events and Climate Change, Avarua, Rarotonga, Cook Islands	**2011/12**	Australian Department of Climate Change and Energy Efficiency (DCCEE) Pacific Adaptation Strategy Assistance Programme (PASAP)	The goal is to understand the coastal vulnerability of Rarotongan infrastructure and community in the study area, which includes Avarua and its harbours, to climate change-related sea level, wave and inundation impacts, and to identify needs and options for adaptive response to those changes. AUD$400,000 over 37 weeks
Piloting the Integration of Community Vulnerability Mapping and Adaptation Planning into the Development of a National Disaster Risk Management and Climate Change Policy	**2011/12**	Australian Department of Climate Change and Energy Efficiency (DCCEE) Pacific Adaptation Strategy Assistance Program (PASAP)	Community-based vulnerability risk mapping, adaptive capacity assessment, and adaptation planning will be undertaken in Rarotonga and 8 of the 12 inhabited outer islands in order to develop a site, island and community-specific baseline on vulnerability, risks and adaptive capacity.

PROJECT NAME	YEARS	FUNDER	DESCRIPTION
The USP-EU Global Climate Change Alliance	**2011-2015**	EU	The USP-EU GCCA project finalised and signed last December 2019 is a 4 year project allocating 8 million Euros to meet the challenges of climate change in the 15 Pacific ACP countries (Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, East Timor (Timor Leste), Tonga, Tuvalu, Vanuatu) through Capacity Building, Community Engagement, and Applied Research. The objective of this project is to develop and strengthen the Pacific ACP countries' capacity to adapt to the impacts of climate change. The project is being implemented by USP.
Global Climate Change Alliance: Pacific Small Island States (GCCA: PSIS)	**2011-Dec 2014**	EU	The project, funded by the European Union and implemented by the Secretariat of the Pacific Community supports the governments of nine small Pacific island countries, namely Cook Islands, Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Niue, Palau, Tonga and Tuvalu, in their efforts to tackle the adverse effects of climate change. The European Commission provided €11.4 million for the project, to address four key objectives: • Supporting countries to successfully mainstream climate change into their national and sector response strategies; • Implementing national adaptation activities; • Enhancing climate change information exchange with Pacific small island countries; and • Building regional capacity to deliver streamlined adaptation finance and targeted technical assistance to countries.
Promoting Energy Efficiency in the Cook Islands	**2012-2018**	International Institute for Energy Conservation (IIEC) as the Consulting firm	The Asian Development Bank (ADB), in cooperation with the Global Environment Facility (GEF) and the government of Australia, initiated a regional Technical Assistance project for Promoting Energy Efficiency in the Pacific (PEEP) in September 2008. This project is being conducted under GEF's Pacific Alliance for Sustainability and covers five Pacific developing member countries (PDMCs) - Cook Islands, Papua New Guinea, Samoa, Tonga, and Vanuatu. The first phase of PEEP (which concluded in May 2011) identified the potential for energy efficiency and defined a pipeline of specific energy efficiency projects for funding or co-financing by ADB, GEF and other sources. ADB and GEF have now initiated Phase 2 of PEEP. ADB has engaged the International Institute for Energy Conservation (IIEC) as the Consulting firm for Phase 2. The objective of PEEP Phase 2 is to implement energy efficiency (EE) measures in the five countries to: • Contribute to achieving the overall goal of 10% reduction in average monthly energy consumption in the residential, commercial and public sectors by 31 March 2015. • Establish the policy and implementation frameworks to move towards the goals of reducing fossil fuel imports by 10%, achieving total energy savings of 45 GWh, and reducing GHG emissions by 30,000 tonnes CO_2 equivalent per year by the end of 2018.

7.5 STAKEHOLDERS CONSULTED

NAME	ORGANISATION	NAME	ORGANISATION
Ana Tiraa	CCCI	**Patricia Tuara**	CCCI
Andreas Demmke	CISO	**Edwin Aperau**	MOA
Anne Herman	Consultant	**Mata Short**	CIRC
Apii Timoti	TAU	**Maeva Kirikava**	CI Police
Brian Tairea	MOA	**Graham Wigg**	Triad Petrol
Carl Hunter	MFAI	**Jim Armistead**	MFAI
Catherine Evans	Crown Law	**Tauturu Jones**	Community
Charlene Hoff	CPPO	**Rangi Mitaera-Johnson**	Private
Dallas Young	TAU	**Mitchell Tutangata**	ICT
Debora Mataio	R2R	**Curtis Williams**	NZHC
Dorothy Solomona	MMR	**Teariki Rongo**	MMR
Ewan Cameron	MFAI	**Amelia Fukofuka**	MFAI

NAME	ORGANISATION	NAME	ORGANISATION
John Henry	MP	**Phillip Strickland**	NES
John Jessie	Ports Authority	**Charlie Ave**	MOH
Junior Ngatokorua	MOT	**Andre Tuiravakai**	Ports Authority
Kevin Hosking	CISO	**Vaine Arioka**	BCI
Kevin Iro	Marae Moana	**Jacqui Evans**	Marae Moana
Liam Kokaua	TIS	**Rei Enoka**	MOT
Lydia Sijp	EMCI	**Greg Stanaway**	Pacific Resort
Maara Tetava	Police Commissioner	**Tuaine Unuia**	CISO
Maeva Maeva	CIs Police	**Keu Mataroa**	CICS
Mani Mate	DCD	**Tatiana Paulo**	DCD
Maria Henderson	Koutu Nui	**Teresa Arneric**	Rauti Para
Matt Blacka	UTS-NSW	**Noeline Browne**	Koutu Nui
Melina Tuiravakai	CCCI	**Tupe Short**	Private
Metua Vaiimene	Tourism	**Gerald McCormack**	Natural Heritage Trust
Mii Kauvai	MEC	**Fine T Arnold**	Red Cross
Mii Matamaki	NES	**Arona Ngari**	CIMS
Miimetua Nimerota	CPPO	**Arthur Taripo**	BCI
Muraai Herman	EMCI	**Krystina Tatuava**	MFEM
Nga Teao	INTAFF	**Ruth Pokura**	INTAFF
Ngapoko Ngatamaine	Customs office	**Vanessa Jenner**	DCD
Ngatuaine Maui	INTAFF	**Jim Nimerota**	CISO
Niki Rattle	CIRC	**Tangi Tereapii**	REDD
Nooroa Numanga	INTAFF	**Peter Tierney**	Consultant
Otheniel Tangianau	ICI	**Jaime Short**	ICI
Pasha Carruthers	NES/Private	**Vaine Wichman**	CINCW

NAME	ORGANISATION	NAME	ORGANISATION
Pat Farr	Disabilities Council	**Maria Tuoro**	MOA
Paul Maoate	ICI	**Matt Purea**	MOA
Professor John E Hay	USP	**Charles Carlson**	EMCI
Pua Hunter	ICT	**Ngarangi Teio**	CPPO
Puna Rakanui	Parliament	**Mia Teaurima**	PEU
Repeta Puna	MOC	**Terekino Vaireka**	RED
Roana Tataitini	MOH	**Sam Napa**	Pa Ariki Trust
Rutera Taripo	MOC	**Teresa Manarangi-Trott**	Consultant
Sam Beckett	NZHCM	**Imogen Ingram**	ISAAC
Tai Manuela	CPPO	**Valentino Wichman**	CPPO
Taputukura Mariri	CINCW	**Alanna Smith**	TIS
Tata Vaeau	MOH	**Tae Tutai**	MOH
Tatiana Kautai	Private	**Reboama Samuel**	CIRC
Taukea Raui	ICI	**Aketairi Roberts**	MOA
Teava Iro	Titikaveka Growers	**Tou Ariki**	Ui Ariki
Teina Rongo	CCCI	**Timoti Tangiruaine**	EMCI
Tessa Vaetoru	DCD	**Lavinia Tama**	DCD
Teuru Passfield	GEF SPG	**Kelvin Passfield**	TIS
Vaitoti Tupa	NES	**Elizabeth Wright-Koteka**	OPM

7.6 CLIMATE CHANGE RELATED TRAINING NEEDS

These needs are based on the Hemstock (2016) and P4SD (2013) reports.

Four sustainable energy priority areas are identified at basic to advanced levels:

TABLE 12: SUSTAINABLE ENERGY TRAINING PRIORITIES.

GAP/SKILL NEEDED	LEVEL	TRAINING TYPE/ INTERVENTION	WHO	CONTENT/ COMPETENCIES
Linesman	Trade Test	Technical	Utility	Linesman
Building/construction best practices	National Qual	Integrate in existing courses	CITTI with USP & SPC support	Building codes, environmental best practices
Training of Trainers (ToT) for solar PV system design skills Solar PV system installation skills Solar PV systems O&M skills	Advanced	Technical training for existing CITTI staff	EU PacTVET supported	Trained to international industry standards (grid connected and stand-alone systems)
Solar PV system design & installatio Solar PV systems O&M skills	Basic to advanced	Course design and implementation	Courses offered at CITTI	Content based on international standards for grid connected and stand-alone systems
Energy auditing and efficiency	Basic to advanced	Course design and implementation	Courses offered at CITTI	Energy audit Rational use of energy Labelling and appliance standards
Biogas system design, installation, operation and maintenance	Basic	Course design and implementation	Courses offered by NGO sector	Safety, installation, operation and maintenance, feedstock mixing, animal husbandry, use of digestate
Traditional marine transportation skills	Basic to advanced	Course design and implementation	Courses offered at CITTI	Wood carving and carpentry, sail-making, navigation, timber selection and sustainable harvesting
ToT for climate change identified needs	Advanced	Technical training for existing CITTI staff	EU PacTVET supported	Various – to be determined

Climate change priority areas included four gaps covering basic to advanced levels:

TABLE 13: CLIMATE CHANGE PRIORITY AREAS

GAP/SKILL NEEDED	LEVEL	TRAINING TYPE/ INTERVENTION	WHO	CONTENT/ COMPETENCIES
CC adaptation assessment	Basic to advanced	Course design and implementation	CITTI with USP & SPC support	V&A toolkits, community planning, GIS, community engagement
Ecosystem services and resource management (terrestrial and marine)	Associate degree & certificate of achievement	Integrate in existing courses at CITTI	CITTI with USP & SPC support	Various – to be determined
Disaster risk reduction and disaster response	Basic to advanced	ToT and course design and implementation	Courses offered at CITTI and in NGO sector	Various – to be determined
Climate science and meteorological services	Basic to advanced	ToT & course design and implementation	CITTI with USP & SPC support	Basic climate science, competencies based on International Meteorological Service standards – World Met Org support
Agriculture and food security	Basic to advanced	Course design and implementation – integration into existing CITTI programmes	Courses offered by NGO sector and CITTI	Crop resilience knowledge-based skills; Soil adaptability knowledge-skills; Crop seasonal cycles knowledge-based skills; Crop/food preservation skills – traditional skills; Pest/weed control skills; Knowledge-based and implementation skills on agri-forestry; General food handling and hygiene skills
Fisheries and food security	Basic to advanced	Course design and implementation – integration into existing CITTI programmes	Courses offered by NGO sector and CITTI	Sea-food processing and preservation; Knowledge-based skills on traditional sustainable fishing methods
GIS and spatial planning	Basic to advanced	Course design/ implementation – integration into existing CITTI programmes	CITTI with support from USP	GIS, Software use, planning, analysis, mapping
Water security	Associate degree & certificate of achievement	Course design and implementation - integrate in existing courses at CITTI	CITTI with USP & SPC support – GLAAS project input	Plumbing; Water collection and preservation skills; Water purification and testing skills; Watershed management; Enforcement of regulations

Three transferrable skill areas were identified:

TABLE 14: CLIMATE CHANGE TRANSFERABLE SKILLS

GAP/SKILL NEEDED	LEVEL	TRAINING TYPE/ INTERVENTION	WHO	CONTENT/ COMPETENCIES
Project management	Basic to advanced	Course design and implementation - integrate in existing courses at CITTI	CITTI with USP & SPC support	Sea-food processing and preservation; Knowledge-based skills on traditional sustainable fishing methods
Business skills	Basic to advanced	Course design and implementation - integrate in existing courses at CITTI	CITTI with USP & SPC support – can be offered in NGO sector	GIS, Software use, planning, analysis, mapping
Data analysis	Basic to advanced	Course design and implementation - integrate in existing courses at CITTI	CITTI with USP & SPC support – can be offered in NGO sector	Plumbing; Water collection and preservation skills; Water purification and testing skills; Watershed management; Enforcement of regulations

7.7 CLIMATE CHANGE RELATED RESEARCH PERMITS 2007

YEAR	RESEARCHER	RESEARCH TITLE	ISLANDS RESEARCHED
2007	Nil	n/a	n/a
2008	Dr Hiroshi Moriwaki	Study on the Holocene sea-level change and coastal evolution in the Cook Islands	Rarotonga
2009	Ilka Kottmann	Socio-cultural responses to climate change in the Cook Islands, Polynesia. An ethnographic case study	Rarotonga, Manihiki and Atiu
	Dr Hiroshi Moriwaki	Study on the Holocene sea-level change and coastal evolution in the Cook Islands	Rarotonga
2010	Ilka Kottman	Socio-cultural responses to climate change in the Cook Islands, Polynesia. An ethnographic case study	Rarotonga, Manihiki and Atiu
2011	Ilka Kottmann	Socio-cultural responses to climate change in the Cook Islands, Polynesia. An ethnographic case study	Rarotonga, Manihiki and Atiu
2011	Dr Hiroshi Moriwaki	Study on the Holocene sea-level change and coastal evolution in the Cook Islands	Rarotonga
	Prof Jonathan Nott & Prof James Goff	Collect one sediment core from a lagoon and 2 lime-stone stalagmites from limestones cave on southwest of Mangaia Island to derive a 1500 year high resolution (annual) history of tropical cyclones which can be used to better predict the impacts of global climate change on tropical cyclone behavior in this region	Mangaia
	Dr Teina Rongo	Climate oscillations and natural mortality in the Cook Islands	Rarotonga
	Marina Hetaraka	Traditional knowledge of Cook Islands Maori; Appreciating the contribution of traditional knowledge of Cook Islands Maori to minimize the impacts of future extreme weather.	Rarotonga & Aitutaki
	Ana Tiraa	Natural Resources Management practices aimed at maintaining healthy ecosystems, particularly inshore marine ecosystems, in an era of climate change using data from Matavera	Rarotonga

YEAR	RESEARCHER	RESEARCH TITLE	ISLANDS RESEARCHED
	Ceclie Rubow	Social and ethical aspects of Environment Change: Questions of Coastal Erosion	Rarotonga
	Kauta Theresse Ioaba	The impact on a changing climate and ocean: on food security and pearl farming in Manihiki	Rarotonga & Manihiki
2012	Juan Castilla	Assessing the effects of climate change on water resources under multiple sources of uncertainty	Rarotonga & Aitutaki
	Stephen Palumbi	Measuring resilience to climate change in corals of the Cook Islands	Rarotonga, Manihiki and Atiu
	Nimali S Thenuwara	Measuring resilience to climate change in corals of the Cook Islands	Manihiki
	Michele Rumsey	Understanding the Pacific's adaptive capacity to emergencies in the context of climate change	Rarotonga
2013	Melinda Allen	Prehistoric human-climate dynamics in the Cook Islands	Rarotonga & Aitutaki
2014	David Sear	Reconstructing Climate and Environmental Change in the South Pacific and Its Implications For The Future of Island Communities	Rarotonga & Aitutaki
	Anabel Lusk	Pursuing self-determined outcomes for climate change in the Cook Islands: Exploring the interface between government institutional directive and local community engagement in climate change decision-making	Rarotonga & Aitutaki
	David Glory	Pacific Island States and Climate Change: The Question of Adaptation in the Cook Islands	Rarotonga & Aitutaki
	Melinda Allen	The dynamics of Polynesian Voyaging: Interaction, Agency, and Climate Change at a Cook Islands Crossroads	Aitutaki
	Christina Newport	No te Orama ki te Ravenga - Illuminating the SIDS Policy Space in addressing Climate and Disaster risks to Sustainable Development - A Case Study of Cook Islands Resilience, Migration and Land Loss	Rarotonga
	Deanne Thomas	Climate Change and its Impact on Aotearoa and the Pacific: A resource for schools containing a student book and DVD	Rarotonga & Aitutaki

7.8 REFERENCES

The table below sets out a range of development partner-funded climate change projects carried out between 2007 and 2014.

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