TUVALU STATE OF ENVIRONMENT REPORT 2022

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TUVALU MO TE ATUA

DEPARTMENT OF ENVIRONMENT TUVALU

Inform ENVIRONMENTAL INFORMATION FOR DECISION MAKING

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

TUVALU STATE OF ENVIRONMENT REPORT 2022

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EXECUTIVE SUMMARY

The Tuvalu State of Environment Report presents an overview across four thematic areas: Environmental Governance, Coastal and Marine, Atmosphere and Climate, and Built Environment. The report uses the 'Drivers, Pressures, State, Impact and Response' model to describe the environment. As far as possible the report is based on quantitative data relating to the state of the environment, supplemented by stakeholder input to describe causal relationships and environmental effects. The report presents:

- *a description of key drivers and pressures on the environment*
- *an assessment of the current state of the environment*
- *a description of current responses and future recommendations for each thematic area.*

Environmental Drivers and Pressures

Several drivers generate pressure on Tuvalu's environment. The most significant are the following:

- *The nation's population has nearly tripled in the last 100 years – from less than 4,000 in the 1920's, to almost 11,000 today. This impacts Tuvalu's environment through a variety of mechanisms, including through expansion of urban areas, habitat destruction, increased pressure on natural resources (particularly drinking water and marine fish), and increased waste generation and pollution.*
- *The nation's gross domestic product has more than quadrupled in the last 30 years – from less than US$9 million in 1990 to nearly US$43 million in 2018. This has generated opportunities for consumption of luxury imported goods such as cars and motorbikes, and processed foods (and associated plastic packaging).*
- *With an average elevation of around 1 m above sea level, and a total land area of only 26 km2, Tuvalu is one of the world's most vulnerable nations to the impacts of global climate change. While the precise local impacts are not yet known, they are likely to include sea level rise, changes in sea surface temperature and pH (which inhibit growth of coral), changes in the frequency and severity of tropical cyclones, and changes in air temperature and rainfall patterns.*

These high-level drivers of change underpin activities that place pressure on the environment and natural resources, including pollution, inadequate waste management, invasive alien species, urban development and extraction of marine resources.

The State of Tuvalu's Environment

Environmental governance in Tuvalu is handled by the Department of Environment, part of the Ministry of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster, previously under the Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour. Governance of the waste sector is handled jointly by the Department of Waste Management and Kaupules (Department of Rural Development), under the Ministry of Home Affairs and Rural Development. The state of environmental governance in Tuvalu was assessed using indicators associated with Ministerial budget allocations, compliance with Multilateral Environmental Agreement reporting obligations, the implementation of Environmental Impact Assessment regulations and the enforcement of environmental laws.

While challenges to effective environmental governance remain, significant efforts are being made by the Government of Tuvalu to provide adequate resources, comply with international obligations and implement national legislation.

As a nation made up of coral atolls and reef islands, Tuvalu's eco-systems are dominated by marine environments. The state of Tuvalu's ecosystems was assessed using indicators associated with forest cover, wetlands (particu-

larly shallow marine wetlands), coral cover, water quality, protected areas, commercial and artisanal fisheries, invasive alien species and threatened species.

Tuvalu has successfully established a system of protected areas (largely locally managed) and is home to populations of various globally threatened species, and at least one endemic species. The Pacific Islands Forum Fisheries Agency considers Tuvalu's commercial pelagic fisheries to be sustainable, although their management is challenging and some illegal, unreported, and unregulated fishing persists. The situation is less positive, however, in terms of inshore lagoon and groundwater quality, and management of invasive alien species. There is also some evidence to suggest that current levels of offtake by Tuvalu's artisanal fisheries are unsustainable. Insufficient data was available to accurately determine trends in coral cover.

Climate change adaptation is a priority issue for Tuvalu. The nation is one of the world's most vulnerable to the impacts of climate change, as it is extremely low lying with a limited land area. The state of Tuvalu's resilience to climate change was assessed using indicators associated with greenhouse gas emissions, consumption of ozone-depleting substances, renewable energy, deaths and financial losses associated with climate change, and funding availability for climate change adaptation (and to a lesser degree, mitigation).

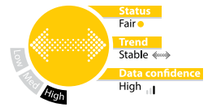
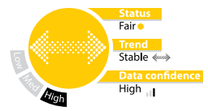
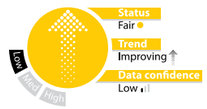
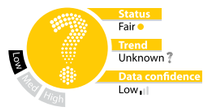
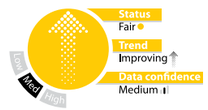
Levels of greenhouse emissions are very low (largely due to Tuvalu's small population size) and consumption of ozone-depleting substances is low and falling. Significant investment is being made into the development of renewable energy generation (particularly solar power) and significant funding has been made available in recent years from international sources for climate change adaptation. To date no deaths have occurred and limited financial losses suffered that are directly attributable to climate change. This may be a reflection of the success of Tuvalu's climate change adaptation efforts. However, future deaths and financial losses may be inevitable.

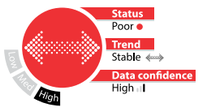
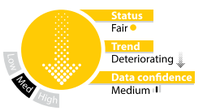
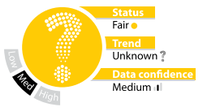
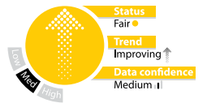
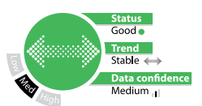
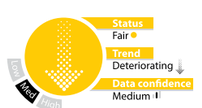
Effective waste management is a serious challenge for Tuvalu, particularly as the human population grows, consumption of imported goods increases and local landfill sites exceed their capacity. The state of Tuvalu's waste management was assessed using indicators associated with generation of municipal solid waste, waste capture by national collection services, recycling and sewage treatment. The European Union has made a significant investment of €6.8M for more effective waste management systems.

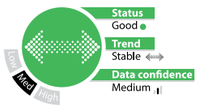
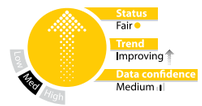
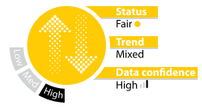
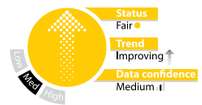
An appropriate legislative framework for waste management is in place. Levels of per capita waste generation are not particularly high, and a good system of waste collection is being implemented (reaching about 90% of households). However, existing landfills are over-capacity (with limited opportunities for meaningful expansion), and illegal dumping and burning of waste still occurs. With regards to marine plastic pollution there is currently no data available. Important efforts are currently being made to institute a national recycling programme, however arrangements for offshore processing of recovered materials are yet to be confirmed. What's more, existing systems for managing human waste (septic tanks which readily leak their contents into the surrounding soil) are causing significant pollution of groundwater and inshore lagoon water, with associated public health and economic impacts.

Tuvalu has established an appropriate legislative and policy framework for environmental management, including the *Environment Protection Act (2008)* and policy documents including Te Kete-National Strategy for Sustainable Development "Te Kete" 2021-2030, Te Kakeega III – National Strategy for Sustainable Development 2016 to 2020, Tuvalu Integrated Waste Policy and Action Plan: Towards Cleaner and Healthier Islands 2017 - 2026, and Te Kaniva – Tuvalu Climate Change Policy (2012). These policy documents include priority goals, objectives, and strategies and actions for achieving these objectives. Many of the environmental issues highlighted by this report could be addressed through implementing these priority actions.

Table 1
Summary themes, indicators, status and trends and response and recommendations for the Tuvalu State of Environment Report 2022

THEME	INDICATORS	STATUS AND TRENDS	RESPONSE AND RECOMMENDATIONS
ENVIRONMENTAL GOVERNANCE	MINISTRY BUDGET ALLOCATIONS		• Increase or at least maintain the Department of Environment's annual budget in order to better achieve national objectives, mitigate the impact of pressures on the environment, and maintain ecosystem services
	MULTILATERAL ENVIRONMENTAL AGREEMENTS		• Investigate the potential to streamline MEA reporting requirements and data management to reduce reporting burden on DoE and other departments
	APPROVED DEVELOPMENT PLANS WITH CONDITIONS		• Review EIA regulations, and strengthen if necessary • Raise awareness of and increase compliance with EIA regulations, particularly on the outer islands • Build national capacity to monitor compliance with EIA conditions
	ENVIRONMENTAL CASES PROSECUTED		• Review existing environmental regulations • Systematic data collection from Kaupules on enforcement of PA regulations
BUILT ENVIRONMENT	PER CAPITA GENERATION OF MUNICIPAL SOLID WASTE		• Seek to reduce (or at least maintain) rates of per capita waste generation • Strategies for improving waste management should focus on waste capture, resource recovery, recycling, and offshore processing • Continue to implement priority actions defined by Tuvalu Integrated Waste Policy and Action Plan
	HOUSEHOLD WASTE CAPTURE RATE		• Continue to implement national collection services • Take steps to increase public understanding and change behaviours • Continue to implement priority actions defined by Tuvalu Integrated Waste Policy and Action Plan
	HOUSEHOLD WASTE RECYCLED		• Continue to develop national recycling system
	ACCESS TO AND QUALITY OF SEWAGE TREATMENT		• Continue to implement the priority strategies defined by Tuvalu's Sustainable and Integrated Water and Sanitation Policy • Develop and implement effective water quality control strategies

THEME	INDICATORS	STATUS AND TRENDS	RESPONSE AND RECOMMENDATIONS
COASTAL AND MARINE	NATIVE TREE COVER		• Expand the terrestrial protected area network to include the highest quality remaining forested land
	WETLANDS		• Expand the marine protected area network and improve the management effectiveness of marine protected areas • Establish and manage coral nurseries of corals found to be more resilient to increased water temperature • Continue mangrove replanting efforts
	LIVE CORAL COVER		• National monitoring programme to identify reliable trends in live coral coverage • Expand and strengthen the marine protected area network • Better regulation of inshore fisheries to combat unsustainable fishing practices
	LAGOON (MARINE) WATER QUALITY		• Improved water quality control strategies urgently needed • May be prohibitively expensive to improve or replace existing septic tanks • Composting toilets may be a more suitable alternative
	FRESHWATER QUALITY		• National groundwater quality monitoring system needed • Urgent need to address the causes of pollution • Promotion of composting toilets may be appropriate, if improving/replacing existing septic tanks is prohibitively expensive
	TERRESTRIAL PROTECTED AREAS MARINE PROTECTED AREAS		• Assess management effectiveness using Management Effectiveness Tracking Tool • Gap analysis of protected area coverage • Expand protected area network by establishing new protected areas and expanding existing protected areas • Improve protected area management effectiveness
	COMMERCIAL PELAGIC FISHERIES		• Continue to build the capacity of Tuvalu Fisheries Department to improve fisheries management and compliance • Combat illegal, unreported and unregulated fishing in Tuvalu's exclusive economic zone • Invest in fish processing facilities in Funafuti
	FISH BIOMASS		• Systematic monitoring of Tuvalu's artisanal fisheries • Assess the sustainability of current fishing levels • Review the effectiveness of existing management by Kaupules • Improve the effectiveness of fisheries management
	INVASIVE ALIEN SPECIES UNDER MANAGEMENT OR ERADICATED PRIORITY SITES WITH INVASIVE SPECIES MANAGED		• Global Environment Facility project 'Strengthening national and regional capacities to reduce the impact of invasive alien species on globally significant biodiversity in the Pacific' is soon to commence
	IUCN RED LIST SUMMARY STATUS OF THREATENED, ENDEMIC AND MIGRATORY SPECIES		• Surveys to determine conservation status of Tuvalu forest gecko • Develop a national Red List to inform national conservation priorities

THEME	INDICATORS	STATUS AND TRENDS	RESPONSE AND RECOMMENDATIONS
ATMOSPHERE AND CLIMATE	TREND IN GHG EMISSIONS		• Implement Enetise Tutumau priority actions • Prepare a third national greenhouse gas inventory to determine emissions trends
	TREND IN CONSUMPTION OF ODS		• Continue phase-out of Hydrochlorofluorocarbons
	RENEWABLE ENERGY		• Implement Enetise Tutumau priority actions
	CLIMATE-RELATED DEATHS CLIMATE-RELATED DISASTER LOSSES		• Implement strategies as defined by Te Kaniva – National Climate Change Policy
	FUNDING FOR CLIMATE CHANGE ADAPTATION/ MITIGATION		• Continued international investment required • Must be accompanied by capacity building
	CLIMATE CHANGE PREPAREDNESS (A) ADAPTATION PLANNING		• Further investment and support for climate change adaptation is needed • Better communication of long-range climate warnings and strengthened community disaster committees are needed • Capacity gaps remain in hydrology, forecasting and climate services
	(B) ADDRESSING IMPACTS AND VULNERABILITIES		
	(C) MAINSTREAMING CLIMATE ADAPTATION		

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ACRONYMS, ABBREVIATIONS AND GLOSSARY OF TUVALU LANGUAGE TERMS

ABT	Aichi Biodiversity Target
ACM	Asbestos Contaminated Material
ADB	Asia Development Bank
AFD	Agence Française de Développement
AIDAB	Australian International Development Assistance Bureau
AR5	IPCC Fifth Assessment Report
AusAID	Australian Agency for International Development
CBD	Convention on Biological Diversity
CCPDCU	Tuvalu Climate Change Policy and Disaster Coordination Unit
CFCs	Chlorofluorocarbons
CFU	Colony-forming Unit
CPUE	Catch Per Unit of Effort
CR	Critically Endangered (Red List category)
CSO	Civil Society Organisation
DoA	Department of Agriculture
DoE	Department of Environment
DPSIR	Driver-Pressure-State-Impact-Response
DWM	Department of Waste Management
EDF	European Development Fund
EDRR	Early Detection and Rapid Response
EEZ	Exclusive Economic Zone
ELV	End-Of-Life Vehicles
EN	Endangered (Red List category)
ENSO	El Niño Southern Oscillation
EU	European Union
Falekaupule	Community council / Traditional assembly of elders
FAO	Food and Agriculture Organisation
FCA	Funafuti Conservation Area
FFA	Pacific Islands Forum Fisheries Agency
GCCA	Global Climate Change Alliance
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoT	Government of Tuvalu
HCFCs	Hydrochlorofluorocarbons
IAS	Invasive Alien Species
IFRC	International Federation of Red Cross
ILO	International Labour Organization
IMP	Island Management and Monitoring Plan
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported, and Unregulated (fishing)
ISAAC	Institutional Strengthening in Pacific Island Countries to Adapt to Climate Change
ISSG	Invasive Species Specialist Group
IWLDP	Integrated Waste Levy Deposit Programmeme
JICA	Japan International Cooperation Agency
Kaupule	Executive arm of Falekaupule, with elected members
LDC	Least Developed Country
LMMA	Locally Managed Marine Area
METT	Management Effectiveness Tracking Tool
MFAT	Ministry of Foreign Affairs and Trade (New Zealand)
MFATTEL	Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour
MHEWS	Multi-Hazard Early Warning Systems
MICS	Multiple Indicator Cluster Surveys
Minamata Convention	Minamata Convention on Mercury
Montreal Protocol	Montreal Protocol on Substances that Deplete the Ozone Layer
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MPN	Most Probably Number
MPWIELMD	Ministry of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster
MSW	Municipal Solid Waste
Nagoya Protocol	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization
NAP	National Adaptation Plan
NAPA II	Second National Adaptation Programme of Action project
NBSAP	National Biodiversity Strategy and Action Plan
NCAS	National Compliance Action Strategy
NCD	Non-Communicable Disease
NEMS	National Environment Management Strategy
NEP	National Energy Policy
NIP	National Implementation Plan (Stockholm Convention)
Noumea Convention	Convention for the Protection of Natural Resources and Environment of the South Pacific Region (1986)
NSAP	National Strategic Action Plan for Climate Change and DRM
PA	Protected Area
Pulaka	Giant swamp taro Cyrtosperma chamissonis
PV	Photovoltaic
R2R	Ridge to Reef project
Ramsar Convention	Ramsar Convention on Wetlands of International Importance
Red List	IUCN Red List of Threatened Species
SAICM	Strategic Approach to International Chemicals Management
SIDS	Small Island Developing States
SOE	State of Environment
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programmeme
SSC	Species Survival Commission
Stockholm Convention	Stockholm Convention on Persistent Organic Pollutants
TANGO	Tuvalu Association of NGOs
TCAP	Tuvalu Coastal Adaptation Project
TC Pam	Tropical Cyclone Pam
TEC	Tuvalu Electricity Corporation
TFD	Tuvalu Fisheries Department
TIVA	Tuvalu National Integrated Vulnerability Assessment
TKIII	Te Kakeega III – National Strategy for Sustainable Development 2016 to 2020
TTF	Tuvalu Trust Fund
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa
UNCLOS	United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programmeme
UNEP	United Nations Environment Programmeme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VDS	Vessel Day Scheme
Vienna Convention	Vienna Convention for the Protection of the Ozone Layer
VU	Vulnerable (Red List category)
Waigani Convention	Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region
WCPFC	Western and Central Pacific Fisheries Commission

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MINISTER HON. AMPELOSA TEHULU

MINISTER FOR PUBLIC WORKS, INFRASTRUCTURE, ENVIRONMENT, LABOUR, METEOROLOGY AND DISASTER

(MPWIELMD)

Message from Minister of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster

Tuvalu and its natural environment whether it is land, marine, coastal and water ecosystems yield significant benefits to all the people of Tuvalu. We cannot separate the dependence of us humans and all living things with our natural environment, for instance, nearly half of the population of Tuvalu heavily depends on subsistence fishing and farming. Our environment has helped sustain our people by providing food, breathable air and natural resources.

Our natural environment is under severe stress due to human actions coupled with climate change and its impacts. All of us have to make an effort to protect our environment to ensure that our future generations can also enjoy the limited natural resources we have.

Tuvalu's State of Environment Report was first developed in 1993 to raise awareness among the people of Tuvalu on all environmental issues and to use the report in decision making. This year, the Department of Environment under the Ministry of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster (MPWIELMD) is pleased to present the 2nd Tuvalu State of Environment Report 2022.

The report will be a useful asset and tool to meet reporting obligations under all Multilateral Environment Agreements that Tuvalu has signed and to raise more awareness on the environmental challenges that we Tuvaluans face. In addition, the report will be an important step in the development of the new National Environment Management Strategy (NEMS) for the Department which will contribute to achieving outcomes under our National Strategy for Sustainable Development 2021-2030 "Te Kete".

I would like to sincerely acknowledge all the people who have contributed to producing the Tuvalu State of Environment Report. I also extend appreciation to the Secretariat of the Pacific Regional Environment Programmeme for their valuable role and partnering with us.

Message from Director General of SPREP

KOSI LATU
DIRECTOR GENERAL

SECRETARIAT OF THE PACIFIC REGIONAL ENVIRONMENT PROGRAMMEME

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

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

The Tuvalu State of Environment Report 2022 assesses and reports on four thematic areas with indicators summarising the state and trend of Tuvalu's environment and provides baseline information for new and emerging environmental challenges.

This report emphasises data-based conclusions and presents supporting evidence for all indicators.

This new baseline can help Tuvalu with national, regional and international reporting obligations, including multi-lateral environmental agreements (MEA) and sustainable development goals (SDG). This report has already informed environmental planning and decision-making and has guided the development of the 6th National Report to the CBD.

SPREP is pleased to have partnered with the Department of Environment in developing this document, as well as the many other agencies and civil society organisations that contributed to the consultative process. I acknowledge the financial support from the UNEP Inform Project, executed by SPREP.

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

SECTION 1.

INTRODUCTION, BACKGROUND, AND HIGHLIGHTS OF THE 2022 SOE REPORT

1.1 INTRODUCTION AND BACKGROUND

This Tuvalu State of Environment (SOE) report is intended to provide a high-level overview of the state of Tuvalu's environment in 2022. It identifies the key drivers of environmental change and the pressures that are producing change. It presents the available data for assessing the status and trend of a broad suite of measurable indicators, describes what is being done to address the key environmental challenges facing Tuvalu, and provides recommendations for addressing priority issues.

Due to its broad scope, it is not practical within the context of this report to provide a comprehensive analysis of each topic. Instead, it provides a summary of the key issues and presents some of the key data. For more detailed information on each topic, please refer to the References section.

This report uses the Driver-Pressure-State-Impact-Response (DPSIR) framework as recommended by the Food and Agriculture Organization (FAO) (and others) to provide a structure within which to present indicators for enabling feedback to policy makers on environmental quality and the impact of environmental policy.

'Drivers' are high-level forces such as economic and demographic factors that generate 'pressures' (immediate stressors such as pollution or overharvesting of natural resources) that create 'states' (physical, chemical, and biological). These 'impact' on ecosystem function and human health (for example) and can be mitigated through 'responses' (public policy, legislation, implemented projects, etc.).

This report organises measurable indicators into four thematic areas: Environmental Governance, Coastal and Marine, Atmosphere and Climate, and Built Environment.

Preparation of the 2022 SOE Report

The 2022 SOE report was prepared by Ecosure Pty Ltd between 2019 and 2021 for the Secretariat of the Pacific Regional Environment Programmeme (SPREP) and the Government of Tuvalu (GoT) based on analysis of relevant literature (both sourced online, and provided by stakeholders) and interviews (both in-person in Funafuti, Tuvalu, and remotely, via Skype) with relevant stakeholders (see Appendix 1 for list of stakeholders consulted).

Comparison of the 1993 and 2022 SOE Reports

Tuvalu's previous SOE report was prepared in 1993 by John Lane for SPREP with financial assistance from the United Nations Development Programmeme (UNDP) and the Australian International Development Assistance Bureau (AIDAB).

Part 1 of the report focused on Tuvalu's natural environment – geology and geomorphology, climate, land and coastal environment, and marine environment. Part 2 focused on the human environment – population and education. Part 3 focused on the economic and built environment – economic framework, infrastructure and industrial development, and pollution. Part 4 focused on environmental management – government administration, land tenure, environmental law, and environmental monitoring. Part 5 focused on priority programmes and projects.

Although the 1993 SOE report provides a detailed and useful overview of the environmental issues facing Tuvalu in the 1990s (many of which are still relevant today, such as increasing pressure on fisheries resources and inadequate management of household waste), and provides some recommendations for addressing them, it is lacking in quantitative data and external references in support of its assessments. It does not use measurable indicators to determine trends over time and relies heavily on anecdotal evidence and personal observations. In addition, some of its information is inevitably out of date, as global understanding of topics such as climate change has moved forward significantly in the last 28 years.

In comparison, this 2022 SOE report includes a much greater focus on quantitative data and external sources of information, is structured around four themes and 26 measurable indicators, determines 'status', 'trend', and 'data confidence' for each indicator, and uses the DPSIR framework.

1.2 READER'S GUIDE TO THE 2022 SOE REPORT

How to read the report

The report condenses a large amount of information on various aspects of the environment into a readable and actionable report. Given the broad spectrum of topics covered, the report has been broken into themes for ease of reading and synthesis. Symbols were designed for each indicator to summarise the State, Trend and Confidence in each assessment (see below).

Guide to the symbols used

This 2022 SOE report integrates many data sources and expert opinions. While much more data and knowledge have been generated since Tuvalu's 1993 SOE, significant data gaps remain. There may not be enough information available to make quantitative assessments of the state of an environment for every indicator using, for example, an index of 1-10, or a quantitative threshold figure, that could be compared across themes. Consequently, a generic index is applied, based on expert opinion and available data to inform 'Status' ratings of either 'Good', 'Fair', and 'Poor'.

Assessment symbols summarise the 'State' of each indicator. These symbols establish baselines to compare the state of each indicator for future assessments, including SOE reports. The symbol includes ratings for 'Status', 'Trend' and 'Confidence'. Figure 1 provides a guide to interpret the symbols and explains how the symbols were derived.

An environmental indicator is a measurement that provides insight into a matter of larger environmental significance. Indicators have two important defining characteristics that make them useful for environmental decision makers. First, they quantify information so its significance is readily apparent and so that trends can be determined overtime. Second, indicators simplify complex phenomena which helps in communicating messages to decision makers and the public. The efficient use of indicators attempts to strike a balance between understanding complex phenomena (monitoring) and implementing policy (management).

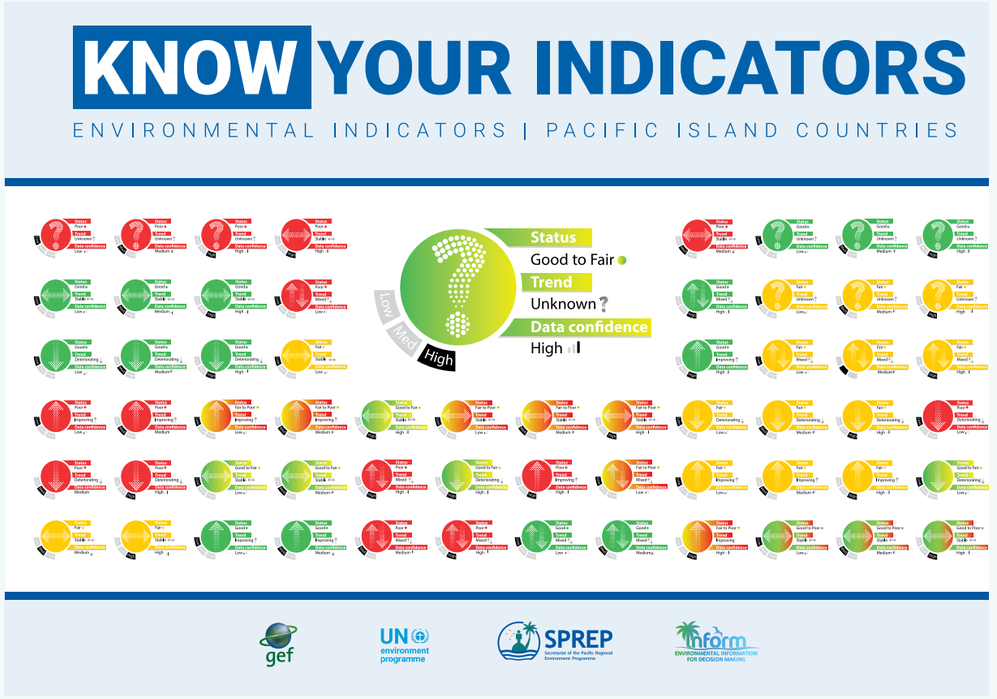
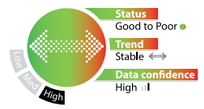
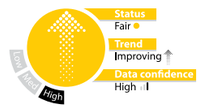
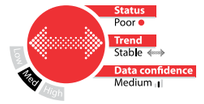
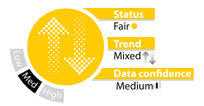
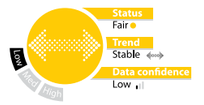


Figure 1
Guide to interpreting the indicator symbols

	CATEGORY	DESCRIPTION	HOW IS IT DERIVED?	SYMBOL EXAMPLE
STATE (CAN BE A RANGE)	**GOOD**	The level to which the indicator meets or exceeds (good), is close to meeting (fair) or is well below (poor) a given standard for healthy ecosystems, habitats, species, airsheds, watersheds or an urban environment.	Assessment is based on 1) recent trends, 2) comparison with similar jurisdictions, and 3) comparison with 'healthy' habitats and systems. Where limited data exists to make an assessment based on these criteria, expert opinion is used.	
	FAIR			
	POOR			
TREND	**IMPROVING**	The state of the environment related to this indicator is getting better.	Trends show a significant increase, or based on weight of evidence that indicators are improving.	
	DETERIORATING	The state of the environment related to this indicator is getting worse.	Trends show a significant decrease, or based on weight of evidence that indicators are worsening.	
	STABLE	The state of the environment related to this indicator shows there is no detectable change.	Trends show no significant increase or decrease, or, based on weight of evidence that indicators are stable.	
	MIXED	The state of the environment related to this indicator shows a mixed trend: sometimes the state is getting better, worse, or there is no change.	Used primarily for sub-topics with multiple indicators, or in cases where data shows two distinct trends.	
	UNDETERMINED	Not enough data exists to determine trend.	Insufficient data available to generate trend.	
CONFIDENCE	**HIGH**	Data is of high quality and provides good spatial and temporal representation.	Trusted and comprehensive time series and/or national level data sources are used to determine confidence trend.	
	MEDIUM	Data is either lower quality, geographically sparse or limited temporally.	Data is derived from many sources, and is not always consistent, with some extrapolation necessary.	
	LOW	Data does not meet any of the above criteria.	Data is very coarse and outdated, and limited to single country sites.	

1.3 RELEVANCE TO INTERNATIONAL TARGETS

The topics covered by this SOE report are directly aligned with the Convention on Biological Diversity's (CBD's) Aichi Biodiversity Targets (ABTs) (see Appendix 2) and the United Nations' (UN's) Sustainable Development Goals (SDGs) (Appendix 3). It is particularly relevant to:

- *ABT-1 on awareness raising*
- *ABT-2 on integrating biodiversity values into national planning and reporting*
- *ABT-5 on loss of natural habitats*
- *ABT-6 on sustainable fishing*
- *ABT-8 on pollution*
- *ABT-9 on Invasive Alien Species (IAS)*
- *ABT-10 on coral reefs*
- *ABT-11 on protected areas (PAs)*
- *ABT-12 on threatened species*
- *ABT-19 on knowledge sharing*
- *SDG-6 on water and sanitation*
- *SDG-7 on energy*
- *SDG-12 on sustainable consumption and production*
- *SDG-13 on climate change*
- *SDG-14 on marine resources*
- *SDG-15 on ecosystems and biodiversity.*

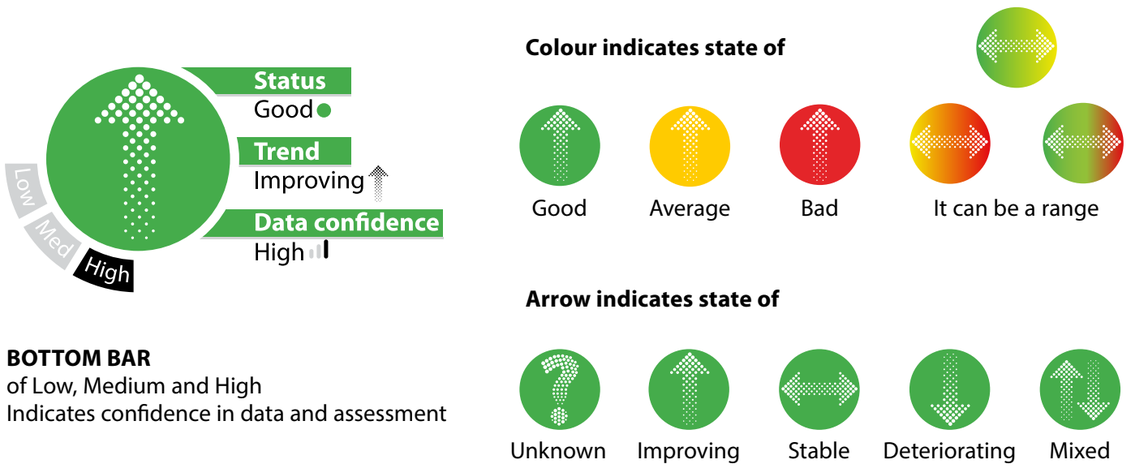


Figure 2
Sections of an indicator symbol

SECTION 2.

DRIVERS AND PRESSURES ON TUVALU'S ENVIRONMENT

2.1 DRIVERS OF ENVIRONMENTAL CHANGE

In common with many small island developing states (SIDS), the principal drivers of environmental change in Tuvalu include population growth, economic development and changing patterns of consumption, and climate change.

Population growth

Tuvalu's most recent full census was conducted in 2012. It reported a total population of 10,782, with about half (50.4%) residing in Funafuti. This represented an increase of 1,221 since the previous census in 2002, an average annual increase of 1.2% (Government of Tuvalu 2013).

A national Population and Housing Mini-Census was conducted in 2017, which reported a total population of 10,654 (a decline of 128 since 2012) (Figure 3: Population growth 1921-2017 (national data)) (Government of Tuvalu 2017).

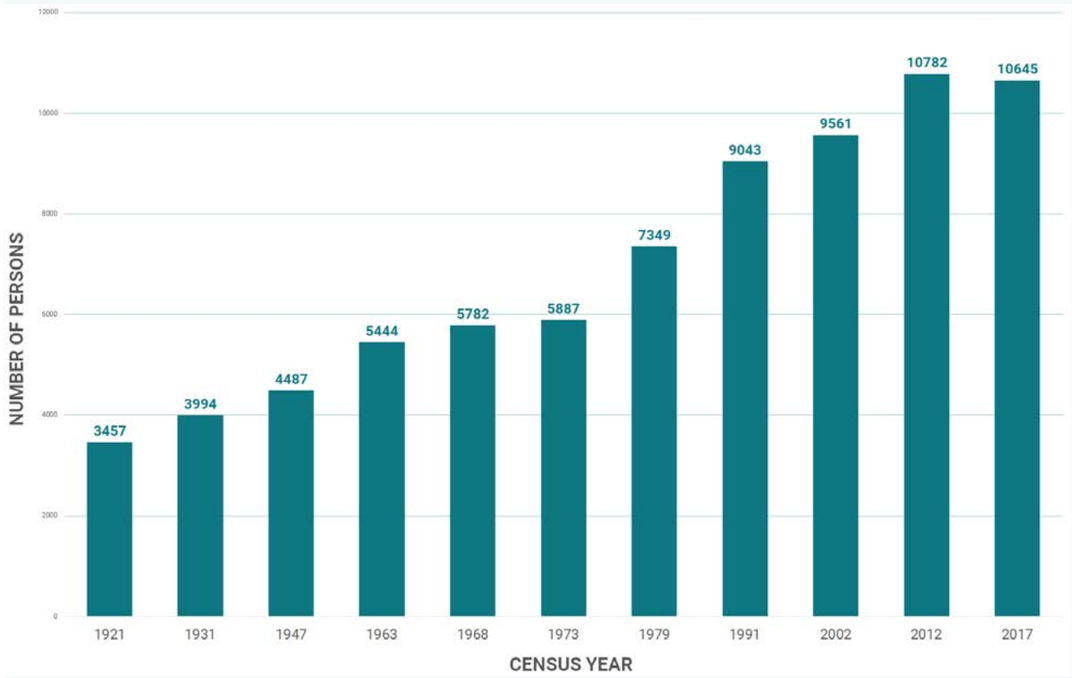


Figure 3
Population growth 1921-2017 (national data)
(Source: Tuvalu 2017 Population and Housing Mini-Census Preliminary Report)

The World Bank's population data for Tuvalu shows a very similar trend, with the nation's population steadily rising from around 5,500 in 1960, to more than 10,000 in 2005, to around 11,000 in 2019 (Figure 4: Population growth 1960-2018 (World Bank data)) (World Bank 2018).

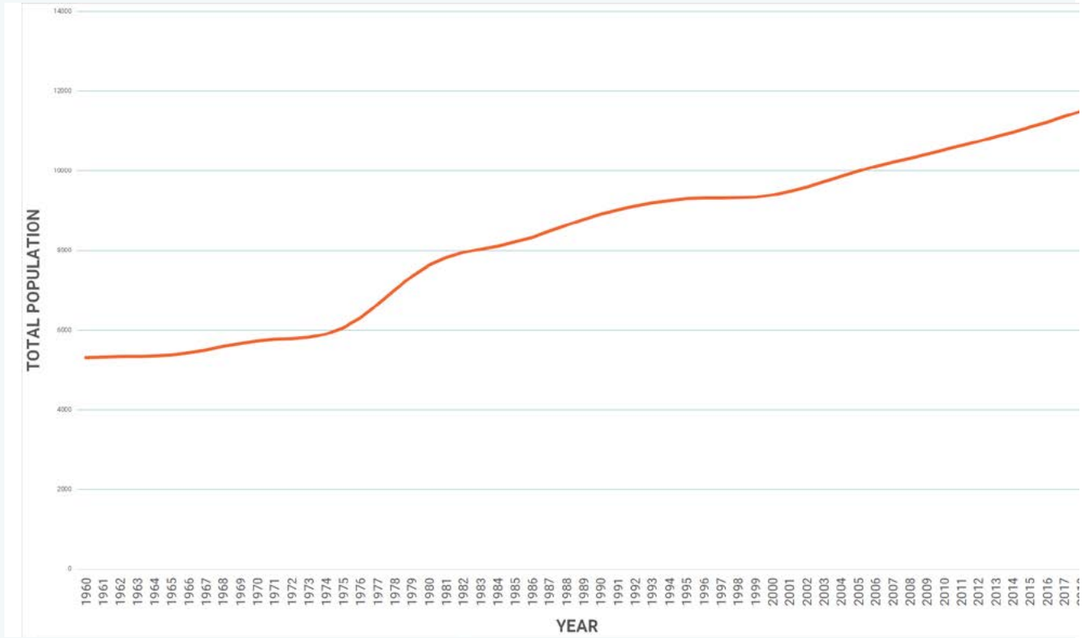


Figure 4
Population growth 1960-2018 (World Bank data)
(Source: World Bank (2019)

Tuvalu experienced significant internal migration between 2002 and 2012, with the outer islands experiencing an average annual population decline of 0.9% (and some individual islands experiencing average annual population declines as high as 2% (Nanumaga) and 2.6% (Niulakita)), and Funafuti experiencing an average annual population growth of 3.1% (Table 2 Population size, change, distribution, and density by island 2002-2012 (Source: Tuvalu 2012 Population and Housing Census Analytical Report)) (Government of Tuvalu 2013). This represents significant urban migration from the outer islands to the nation's capital.

Table 2
Population size, change, distribution, and density by island 2002-2012
(Source: Tuvalu 2012 Population and Housing Census Analytical Report)

ISLAND	AREA (KM2)	POPULATION		POPULATION CHANGE 2002 – 2012			POPULATION DISTRIBUTION (%)	DENSITY (PERSON PER KM2)
		2002	2012	TOTAL	%	R*		
FUNAFUTI	**2.8**	**4,492**	**6,152**	**1,660**	**37.0**	**3.1**	**57.1**	**2,205**
OUTER ISLANDS	**22.8**	**5,069**	**4,630**	**-439**	**-8.7**	**-0.9**	**42.9**	**203**
NANUMEA	3.9	664	556	-108	-16.3	-1.8	5.2	144
NANUMAGA	2.8	589	481	-108	-18.3	-2.0	4.5	173
NIUTAO	2.5	663	606	-57	-8.6	-0.9	5.6	240
NUI	2.8	548	542	-6	-1.1	-0.1	5.0	192
VAITUPU	5.6	1,591	1,558	-33	-2.1	-0.2	14.5	278
NUKUFETAU	3.0	586	536	-50	-8.5	-0.9	5.0	179
NUKULAELAE	1.8	393	324	-69	-17.6	-1.9	3.0	178
NIULAKITA	0.4	35	27	-8	-22.9	-2.6	0.3	64
TUVALU	**25.6**	**9,561**	**10,782**	**1,221**	**12.8**	**1.2**	**100**	**421**

**Average annual rate of growth (%)*

Although the total population decreased by 1.3% between 2012 and 2017, continuing rural to urban migration generated an average annual population growth of 3% in Funafuti and average annual population declines of more than 6% on some outer islands (Table 3 Population size, change, and density by island 2012-2017 (Source: Tuvalu 2017 Population and Housing Mini-Census Preliminary Report)) (Government of Tuvalu 2017).

Table 3
Population size, change, and density by island 2012-2017
(Source: Tuvalu 2017 Population and Housing Mini-Census Preliminary Report)

ISLAND	AREA (KM2)	POPULATION		POPULATION CHANGE 2002 – 2012			POPULATION DISTRIBUTION (%)	DENSITY (PERSON PER KM2)
		2012	2017	TOTAL	%	R*		
FUNAFUTI	**2.8**	**5,436**	**6,320**	**884**	**16.3**	**3.0**	**1,941**	**2,257**
OUTER ISLANDS	**22.8**	**5,204**	**4,187**	**-1,017**	**-19.5**	**-4.3**	**228**	**184**
NANUMEA	3.9	612	512	-100	-16.3	-3.6	157	131
NANUMAGA	2.8	551	491	-60	-10.9	-2.3	197	175
NIUTAO	2.5	694	582	-112	-16.1	-3.5	278	233
NUI	2.8	729	610	-119	-16.3	-3.6	260	218
VAITUPU	5.6	1,542	1,061	-481	-31.2	-7.5	275	189
NUKUFETAU	3.0	666	597	-69	-10.4	-2.2	222	199
NUKULAELAE	1.8	364	300	-64	-17.6	-3.9	202	167
NIULAKITA	0.4	46	34	-12	-26.1	-6.0	115	85
TUVALU	**25.6**	**10,604**	**10,507**	**-133**	**-1.3**	**-0.3**	**416**	**410**

**Average annual rate of growth (%)*

The nation's total population is expected to continue to increase over the next 20 years. It is forecast to reach 13,300 by 2025 and 15,600 by 2035 (Secretariat of the Pacific Community (SPC) 2013). Although the population is very small by global standards (the only independent state with a smaller population is Vatican City), Tuvalu's limited land area (25.9 km^2) results in high population densities (currently more than 2,000 persons/km^2 on Funafuti, and a national average of more than 400 persons/km^2).

A growing and increasing urbanised population exerts significant pressure on Tuvalu's environment through mechanisms including consumption of natural resources, carbon emissions, waste generation, and habitat destruction and degradation.

Economic development and changing patterns of consumption

Tuvalu faces various constraints to economic development, including the large distances between islands, isolation from key regional and international markets, limited land area, a small population and a narrow natural resource base (Government of Tuvalu 2015). Currently considered a Least Developed Country (LDC) by the United Nations Conference on Trade and Development (UNCTAD), the national economy relies on aid from international donors. Additional revenue is generated by taxes, customs duties, the sale of commercial fishing licenses, income from the Tuvalu Trust Fund (TTF) (which grew from US$35.1 million in 1999 to US$124.7 million in 2017), sale of postage stamps to collectors and the licensing of the 'dot tv' internet domain name (Government of Tuvalu 2015).

However, Tuvalu's economy has been growing steadily since 2000, with gross domestic product (GDP) estimated at US$43 million in 2018 (Figure 5: Tuvalu GDP (US$) 1990-2018)) (World Bank 2018).

Figure 5
Tuvalu GDP (US$) 1990-2018)
(Source: World Bank (2018))

Tuvalu's economy is heavily dependent on marine resources. Fish are Tuvalu's main export, and income from commercial fishing licenses, access fees, and related investments generates a significant proportion of government revenue (more than 86% in 2018) (see Indicator 2.8. Commercial pelagic fishes). Commercial fishing has the potential to generate pressures on Tuvalu's environment in the form of unsustainable harvesting of natural resources.

The population has limited opportunities for income generation – the main sources are wages (particularly employment in the public sector) and remittances from family members working overseas. Other sources of income include rent of land and property, and the sale of crops, fish and livestock. The population living below the national poverty line was 26.3% in 2010 (World Bank 2018).

A higher proportion of the population is engaged in subsistence agriculture and fishing on the outer islands than on Funafuti. The national rate of participation in the labour force remains low at 49.3% in 2017 (down from 59.4% in 2012), with a higher participation rate among men than women (58.5% and 39.7% respectively).

As Tuvalu's economy has grown, local patterns of consumption have shifted from a reliance on locally produced consumables (such as fish, pigs, swamp taro and breadfruit), to greater consumption of imported processed foods (such as dried noodles, processed meat and rice) and luxury products (including cars and motorbikes). Consumption of imported processed food generates pressure on the environment in the form of increased waste generation, and negative public health impacts in the form of increased rates of non-communicable diseases (NCDs) including obesity, diabetes and heart disease.

Climate change

Tuvalu is one of the world's most vulnerable countries to the impacts of climate change (see Theme 3. Climate Change), due to being extremely low-lying (the average elevation of all islands is only about 1 m above sea level), relying on the collection of rainfall for freshwater for drinking and household use, and having an economy based largely on exploitation of natural resources that are vulnerable to changing climate conditions (commercial fisheries) (Government of Tuvalu 2015).

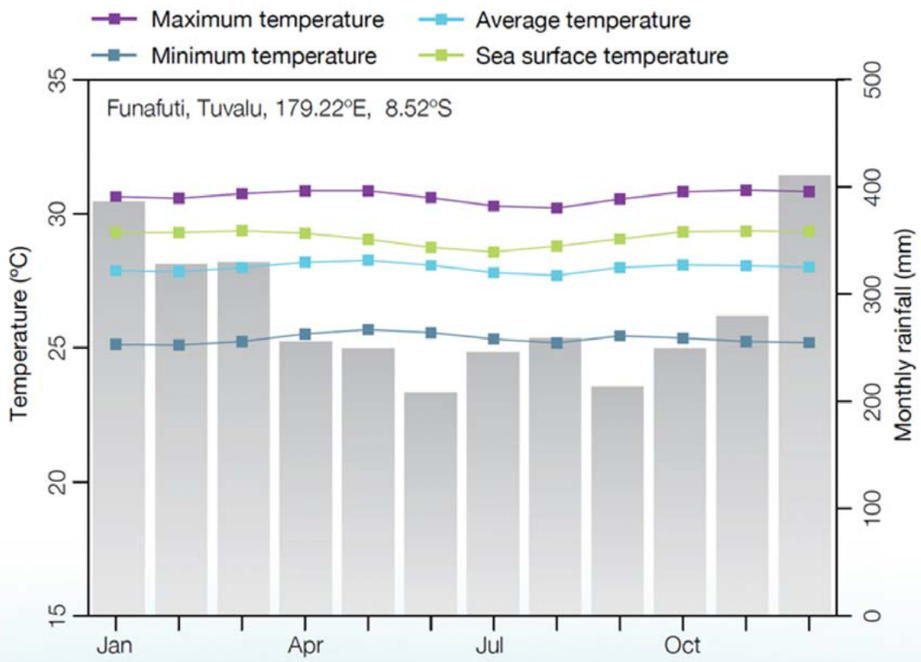


Figure 6: Seasonal rainfall and temperature at Funafuti.

Figure 6
Seasonal rainfall and temperature in Funafuti
(Source: Australian Bureau of Meteorology and CSIRO)

A changing climate is likely to impact Tuvalu's environment through a combination of changes to sea level, the frequency and intensity of extreme weather events, ocean surface temperature and island air temperature, ocean pH, and changing rainfall patterns (Australian Bureau of Meteorology and CSIRO 2011) (Table 4).

The nation has a tropical climate, characterised by a wet season (including periodic tropical cyclones) from November to April and a dry season from May to October. The mean annual rainfall in the southern islands is 3,400 mm, and in the northern islands 2,900 mm. Air temperatures are 25 - 30 °C throughout the year (Figure 6: Seasonal rainfall and temperature in Funafuti) (Australian Bureau of Meteorology and CSIRO 2011).

Both annual and seasonal mean air temperatures have been rising in Funafuti since 1950 (Australian Bureau of Meteorology and CSIRO 2011) (Figure 7: Annual average temperature: Funafuti, 1950-2005). The average minimum air temperature has risen by 0.24 °C/decade and average sea surface temperature has risen by approximately 0.13 °C/decade since the 1970s. Global climate models indicate that this is likely to continue (or accelerate) throughout the 21st Century.

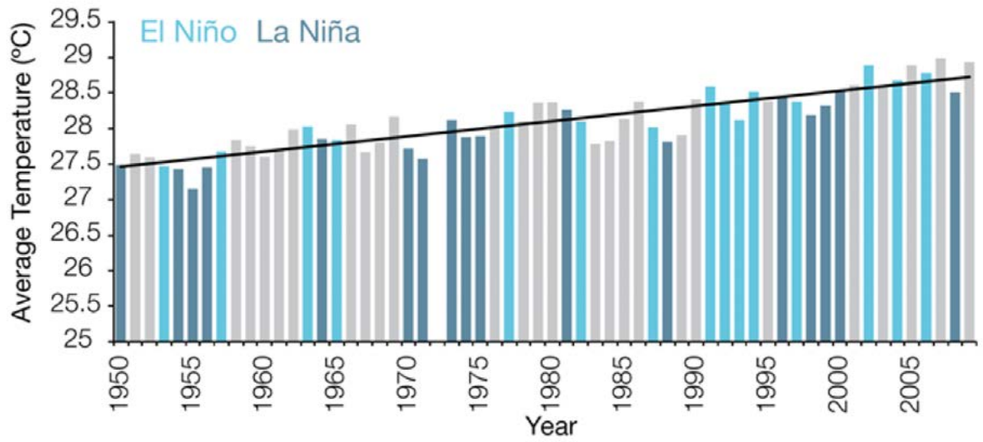


Figure 7: Annual average temperature for Funafuti. Light blue bars indicate El Niño years, dark blue bars indicate La Niña years and grey bars indicate neutral years.

Figure 7
Annual average temperature: Funafuti, 1950-2005
(Source: Australian Bureau of Meteorology and CSIRO)

Tuvalu's rainfall patterns are strongly influenced by the El Niño Southern Oscillation (ENSO) Index, with less rainfall during La Niña years. Prolonged periods of reduced rainfall are not uncommon; in 2011 a state of emergency was declared due to a severe shortage of fresh water following six months of no rainfall, requiring international humanitarian assistance (Gheuens et al. 2019).

The likely impacts of climate change on patterns of rainfall in Tuvalu are not certain, however annual and seasonal mean rainfall is likely to increase, due to the intensification of the South Pacific Convergence Zone. The intensity and frequency of days of extreme rainfall is likely to rise, while the incidence of drought is likely to decrease.

Tropical cyclones are the main extreme weather events that affect Tuvalu (see Indicator 3.4. Climate-related deaths and Indicator 3.5. Climate-related disaster losses), often causing widespread flooding and inundation, and serious damage to infrastructure, property and agricultural land. Between 1969 and 2007, a total of 33 tropical cyclones passed within 400 km of Funafuti (an average of eight cyclones/decade) (Australian Bureau of Meteorology and CSIRO 2011).

Climate change is likely to result in a decreased or unchanged frequency of tropical cyclones worldwide (Intergovernmental Panel on Climate Change (IPCC) 2014), however the average intensity of tropical cyclones in the Pacific may increase (Christensen et al. 2013 and Thomas et al. 2017).

Global sea levels are currently rising an average of 3.3 mm/year (NASA 2019). The rate of sea level rise recorded by the Funafuti tide gauge is greater than this, at an average of 3.9 mm/year over the past 40 years (Kench et al. 2018). The extremely low-lying nature of Tuvalu's islands makes them highly vulnerable to relatively small increases in sea level – potentially impacting food and water security, housing and infrastructure, human health and biodiversity.

CLIMATE RISKS	IMPACTS ON TUVALU
CYCLONE-GENERATED WINDS, STORM SURGES AND SWELLS	• Tropical cyclones are the main extreme event affecting Tuvalu (nearly half of the countries population were temporarily displaced following Tropical Cyclone Pam in March 2015) • 33 tropical cyclones passed within 400 km of Funafuti between 1969/70 and 2006/07 • In the future may become less frequent, but more intense • Future cyclone impacts will be strengthened by other climate impacts such as sea level rise, saline intrusion and reduced coastal protection from degraded coral reefs
SEA LEVEL RISE	• Tuvalu's sea level rose by approximately 4mm per year over the past 40 years (Kench et al. 2018), compared to the global average of 3.3 mm per year (NASA 2019) • Tuvalu's islands are very low-lying, and therefore highly vulnerable to coastal inundation, leading to saltwater intrusion and damage to infrastructure and houses, etc. • Under a medium emissions scenario, a 13-29 cm increase is expected before 2050 and 29-67 cm before 2090 (Australian Bureau of Meteorology and CSIRO 2011)
TEMPERATURE AND EXTREME HEAT	• Temperatures have increased since 1950, and will continue to do so in the future • By 2030, under a medium emission scenario, temperature may increase in the range of 0.4-1.0°C (Australian Bureau of Meteorology and CSIRO 2011) • Extreme heat will have health implications, with the increased burden of heat-related illness linked to climate change being borne by children, the elderly, people with chronic illness or disability (WHO 2015)
OCEAN IMPACTS (INCLUDING SEA SURFACE TEMPERATURE AND OCEAN ACIDIFICATION)	• Tuvalu's economy, livelihoods, food security and dietary health depend largely on marine resources (Preston et al 2016) • Revenue from fishing licenses is the primary source of non-aid revenue to the government (Government of Tuvalu 2018) • Tuvalu's sea surface temperature has risen by approximately 0.13°C per decade since the 1970s (Australian Bureau of Meteorology and CSIRO 2011) • Ocean acidification has increased, leading to coral bleaching and reduced coral growth leading to reduced coastal protection, loss of biodiversity and fish stocks (CMEP 2018) • Tuvalu is one of the most vulnerable reef-dependent communities to the effects of ocean acidification in the region (Johnson et al. 2016) • Projected changes in ocean circulation are expected to alter the timing, location, and extent of the upwelling processes on which most oceanic primary productivity depends, with resultant impacts on fisheries (Johnson et al 2017)
RAINFALL	• Rainfall patters are strongly influenced by ENSO • Likely impacts of climate change on rainfall patterns are not clear, however the intensity and frequency of days of extreme rainfall are projected to rise (Kharin et al. 2013) • Water storage is extremely limited in Tuvalu, meaning that even short periods without rain can lead to water stress

Table 4
Current and future climate change impacts on Tuvalu

2.2 PRESSURES ON TUVALU'S ENVIRONMENT

2.2.1 Inadequate waste management

Waste management is one of the most significant environmental issues facing Tuvalu. Despite per capita waste generation not being high in comparison with global averages (see Indicator 4.1. Per capita generation of municipal solid waste), the nation's small land area and high human population density result in limited land availability for waste management solutions such as waste treatment and disposal sites, and recycling and reuse facilities (Sagapolutele et al. 2019). The GoT has taken steps to address this issue, including enacting appropriate national legislation (see Theme 1) and providing a national waste collection service that reaches a high proportion of Tuvaluan households (see Indicator 4.2).

Waste collected on each of Tuvalu's islands and atolls is transported to nationally managed landfill sites. However, these sites have limited capacity for processing waste, there is little control over the type of waste that is dumped, and there are no pollution control measures in place (some even lack boundary fencing) (Sagapolutele et al. 2019).

Due to limited public understanding of the importance of environmentally friendly waste management practices, waste is often dumped, burned or buried, leaving it susceptible to dispersal into the environment (impacting both ecosystem and human health).

Funafuti's landfill serves the majority of Tuvalu's population. Until its capacity was increased by 1,100m3 in 2020, it was overcapacity. Although some equipment has been recently acquired for compacting waste and resource recovery, it will likely exceed capacity once again between 2025 and 2032 (Sagapolutele et al. 2019).

Tuvalu faces a variety of challenges to improving its current waste management processes. In addition to limited land availability and ongoing disputes with landowners regarding rates for leasing land, Tuvalu's private sector is small and has limited capacity in terms of equipment, capital, and other resources (Government of Tuvalu 2016).

Efforts to improve waste management have been supported in recent years by international donors including the European Union (EU) (direct budget support of €6.8 million), Asian Development Bank (ADB), the New Zealand Ministry of Foreign Affairs and Trade (MFAT), the Australian Agency for International Development (AusAID), and the Republic of China (Taiwan). The Tuvalu Integrated Waste Policy and Action Plan 2017-2026 (the successor to the 2005 Tuvalu Integrated Solid Waste Plan) defines 20 strategic actions associated with six strategic goals (Government of Tuvalu 2016):

- *Strengthened institutional systems to address gaps in waste management.*
- *The stakeholders fully understand the merits of proper waste management and co-share the responsibility of managing wastes.*
- *Established strong partnerships between the public and the private sector in the delivery of waste services.*
- *Delivered waste services follow best practice and cost-effective approach tailored to local conditions with continuous improvement.*
- *Enhanced capacity of waste practitioners.*
- *Waste activity outcomes are reported and disseminated to relevant stakeholders.*

Pollution

Tuvalu has very limited freshwater resources, relying heavily on collection of rainwater (stored in large tanks) for household use. Coral atolls typically accumulate a thin, fresh or slightly brackish, groundwater 'lens' due to rainwater permeating the coralline soil and floating hydrostatically on saltwater below. This groundwater is potentially an important resource for Tuvalu, particularly in times of infrequent rainfall (Government of Tuvalu 2013). Unfortunately, Tuvalu's groundwater is not potable, due to pollution from inappropriately constructed ('bottomless') household septic tanks, and can only be used for washing pig pens and similar uses (see Indicator 2.5. Freshwater quality) (Fujita et al. 2013).

This source of pollution is also impacting the water quality of Tuvalu atoll lagoons (particularly Funafuti lagoon), through elevated *E. coli* levels and changes in the ecological structure of the microbial community due to elevated nutrient availability at affected sites (Fujita et al. 2013) (see Indicator 2.4 Lagoon water quality). As benthic foraminifera are an important source of sediment deposition, this has the potential to impact rates of coastal erosion (potentially exacerbating the impacts of sea level rise associated with climate change).

Unfortunately, it is likely to be cost-prohibitive to repair or replace Tuvalu's existing septic tanks. Developing centralised sewage processing systems on Tuvalu's most populated atolls and islands would require major investment and may not be feasible given the nation's geology and geography. Instead, environmentally friendly alternatives such as composting toilets should be considered.

Invasive Alien Species

Tuvalu's native biodiversity is threatened by a variety of IAS, including the following (Atlas of Living Australia 2018):

- *rats (Rattus spp., a major threat to nesting birds and other native species)*
- *cane toads (Rhinella marina)*
- *the coconut scale insect (Aspidiotus destructor) which damages food crops including breadfruit, sweet potatoes, and coconut*
- *termites Neotermes rainbowi (which can damage coconut palms)*
- *pink mealybug Maconellicoccus hirsutus (which feeds on breadfruit)*
- *the kou leafworm (Ethmia nigroapicella)*
- *yellow crazy ant (Anoplolepis gracilipes)*
- *weeds (such as mile-a-minute Mikania micrantha, burgrass Cenchrus echinatus, Lantana camara and trailing daisy Sphagneticolaa trilobata)*
- *seaweed (Sargassum polycystum)*
- *crown of thorns starfish (Acanthaster planci).*

National capacity for biosecurity is very limited including in terms of human resources, equipment, training and financial resources (Global Environment Facility 2017). Tuvalu's *Environment Protection Act (2008)* mandates the control and eradication of IAS to the Department of Environment (DoE), however in practice this is handled by the Department of Agriculture's (DoA) Plant Protection section.

Challenges associated with combating IAS in Tuvalu include (Global Environment Facility 2017):

- *a lack of information on the biology of many invasive species*
- *a lack of monitoring of high-risk areas*
- *a lack of understanding of the major threats posed by pests*
- *limited personnel and infrastructure*
- *absence of, or inadequate protocols, such as those to warn of threats, predict invasiveness of new species at the border, maintain quarantine procedures and set priorities for management*
- *inadequate legislation and enforcement*
- *inadequate funding.*

Urban development

Tuvalu's limited land area and growing population (particularly in Funafuti) results in a significant proportion of land being used for urban development including housing, transport infrastructure (including the Funafuti airstrip), and other urban uses such as retail, schools, churches, hospitals, government offices and landfill sites. This generates significant pressure on the environment both through the destruction of natural habitat (very little undisturbed habitat remains) to make space for urban development and to provide building materials, and through increased waste generation and pollution.

Marine ecosystems are threatened by anthropogenic pollution (see Indicator 2.4. Lagoon water quality) associated with urban development, and by land reclamation work implemented to increase Tuvalu's land area available for development. Lagoon sediment is widely used as a source of construction aggregate and for land reclamation work. In addition to damaging Tuvalu's lagoon ecosystems, this extraction potentially increases Tuvalu's vulnerability to coastal erosion.

Extraction of marine resources

The extraction of marine resources forms the foundation of Tuvalu's economy, generating revenue for the national government (through the sale of fishing licences, access fees, etc.), incomes for its citizens, and representing a major source of protein for local people – supporting nutrition and national food security (Government of Tuvalu 2015).

However, the sustainable management of marine resources is very challenging, due to difficulties associated with ensuring compliance throughout a vast Exclusive Economic Zone (EEZ) (749,790 km^2), limited national capacity for fisheries management (in terms of equipment, human and financial resources), and limited national-level regulation of Tuvalu's artisanal fisheries (largely devolved to island Kaupules) (Government of Tuvalu 2018).

Commercial pelagic fisheries generate pressure on Tuvalu's environment principally through the harvesting of target species and bycatch. Although tuna catches in the Western and Central Pacific are high and growing, the Pacific Islands Forum Fisheries Agency has assessed them as currently being sustainable (see Indicator 2.8. Commercial Pelagic Fisheries) (Pacific Islands Forum Fisheries Agency 2019).

Artisanal fisheries generate pressure on Tuvalu's environment also through direct offtake of target species and bycatch, but also through habitat destruction (in the case of trawling, dynamite fishing, and other destructive fishing techniques). Although data is very limited, there are indications that current levels of extraction by Tuvalu's artisanal fisheries are not sustainable (see Indicator 2.9. Fish biomass) (Alefaio et al. 2018).

SECTION 3.

STATE OF TUVALU'S ENVIRONMENT, IMPACT, AND RESPONSE

3.1 THEME 1. ENVIRONMENTAL GOVERNANCE

Table 5
Environmental Governance highlights

INTRODUCTION

At the national level, responsibility for conservation and management of Tuvalu's environment is held by the DoE, currently under the Ministry of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster. However, other parties also play important roles in national environmental governance, including the DoA, Tuvalu Fisheries Department (TFD), Department of Waste Management (DWM) (under the Ministry of Home Affairs and Rural Development), Department of Local Government, Tuvalu Meteorological Service and Tuvalu Electricity Corporation (TEC).

Key national legislation for environmental governance includes the following:

- *Environment Protection Act (2008)*
- *Marine Pollution Act (2008)*
- *Ozone Layer Protection Act (2008)*
- *Biosecurity Act (2017)*
- *Conservation Areas Act (1999)*
- *Marine Resources Act (2017)*
- *Waste Operation and Services Act (2009)*
- *Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019*
- *Waste Management (Litter and Waste Control) Regulation 2018*
- *Waste Management (Levy Deposit) Regulation 2019*
- *Environment Protection (Environmental Impact Assessment Regulations 2014 (Revised 2017)*

Key national policy documents for environmental governance include the following:

- *Te Kakeega III (TKIII) – National Strategy for Sustainable Development 2016 to 2020*
- *Te Kaniva – Tuvalu Climate Change Policy (2012)*
- *National Environment Management Strategy (NEMS) 2015-2020*
- *National Biodiversity Strategy and Action Plan (NBSAP) 2012-2016*
- *Enetise Tutumau 2012-2020: Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu*
- *Tuvalu Integrated Waste Policy and Action Plan: Towards Cleaner and Healthier Islands 2017-2026*
- *Tuvalu Electricity Corporation Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu 2012-2020*
- *Tuvalu National Energy Policy (2009)*
- *Sustainable and Integrated Water and Sanitation Policy 2012-2021.*

At the sub-national level (island level), responsibility for environmental governance is held by Kaupules, guided by Island Management and Monitoring Plans (IMPs), aligned with the objectives and strategies defined by TKIII.

INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
1.1 MINISTRY BUDGET ALLOCATIONS	Status: Fair; Trend: Stable; Data confidence: High; Effect: High	• DoE previously under Ministry of Foreign Affairs, Trade, Tourism, Environment, and Labour (MFATTEL) • Now under Ministry of Public Works, Infrastructure, Environment, Labour, Meteorology and Disaster (MPWIELMD) • Ministerial budget allocations have remained stable at 5% of national budget since 2015	• Increase or at least maintain the DoE's annual budget in order to better achieve national objectives, mitigate the impact of pressures on the environment, and maintain ecosystem services
1.2 MEA REPORTING REQUIREMENTS	Status: Fair; Trend: Stable; Data confidence: High; Effect: High	• Most relevant MEAs are managed by DoE, with the exception of the UNFCCC and MEAs concerning waste management and fisheries	• Investigate the potential to streamline MEA reporting requirements and data management, to reduce reporting burden on DoE
1.3 APPROVED DEVELOPMENT PLANS WITH CONDITIONS	Status: Fair; Trend: Improving; Data confidence: Low; Effect: Low	• DoE has developed templates for development proposals, including EIA requirements • To date, only a small number of development projects have been required to prepare EIAs	• Review EIA regulations • Raise awareness of and increase compliance with EIA regulations, particularly on the outer islands • Build national capacity to monitor compliance with EIA conditions
1.4 ENVIRONMENTAL CASES PROSECUTED	Status: Fair; Trend: Unknown; Data confidence: Low; Effect: Low	• Very limited information available • Anecdotal evidence of Kaupules enforcing PA bylaws and isvsuing fines and other penalties	• Review existing environmental regulations • Systematic data collection from Kaupules on enforcement of PA regulations

INDICATOR 1.1
MINISTRY BUDGET ALLOCATIONS – MINISTRY OF FOREIGN AFFAIRS, TRADE, TOURISM, ENVIRONMENT & LABOUR

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		NA	NA	NA

DEFINITION

Percentage of national budget allocated to Environment Ministry or equivalent.

STATUS AND TREND DISCUSSION

Until September 2019, Tuvalu's DoE was under MFATTEL. Data on Ministerial budget allocations is available since 2015 from national budgets published by the Office of the Auditor General of Tuvalu. Since 2015 the Ministry's budget has grown from AU$3.2 million to AU$4.9 million, however has remained relatively stable at around 5% of the national budget (Figure 8: MFATTEL annual budgets (AU$) as a proportion of national annual budgets) (Government of Tuvalu 2014, 2015, 2016, 2017, and 2018).

Since the September 2019 general election, the DoE has been under the newly formed Ministry of Public Works, Infrastructure and Environment. Budget data for 2020 is not yet available.

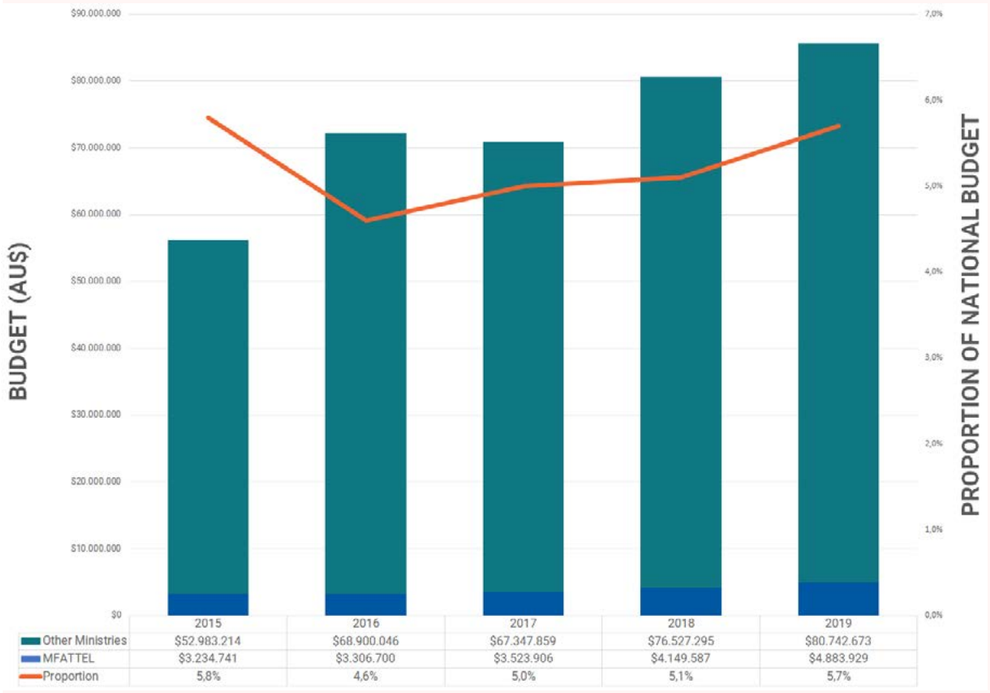


Figure 8
MFATTEL annual budgets (AU$) as a proportion of national annual budgets (Source: Office of the Auditor General of Tuvalu)

IMPACT

Annual budget allocations for the MFATTEL have not been high, particularly given the breadth of the Ministry's mandate. For comparison, the 2019 budget for the Ministry of Health was about 2.5 times larger, at AU$12.2 million (Government of Tuvalu 2018). Annual budget allocations for the DoE comprise only a small fraction of the Ministry's total budget. However, it is promising that the Ministry's budget has increased since 2015 in proportion with the growing national budget.

An adequately funded DoE will be more effective at achieving Tuvalu's national goals and objectives as defined by the NEMS 2015-2020, NBSAP and TKIII.

RESPONSE AND RECOMMENDATIONS

It is recommended to increase or at least maintain the DoE's annual budget (as a proportion of the national budget) in order to facilitate the achievement of national environmental objectives, mitigate the impact of pressures on Tuvalu's environment, and maintain the ecosystem services that support the national economy, food security, health and other sectors.

INDICATOR 1.2
MULTILATERAL ENVIRONMENTAL AGREEMENTS REPORTING REQUIREMENTS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		NA	NA	NA

DEFINITION

Percentage of MEA reporting requirements met on time.

STATUS AND TREND DISCUSSION

Tuvalu is a party to a variety of Multilateral Environmental Agreements (MEAs), including the following (Table 6 MEAs ratified by Tuvalu).

Table 6
MEAs ratified by Tuvalu

CONVENTION/PROTOCOL/AGREEMENT	YEAR RATIFIED BY TUVALU
International Convention for the Prevention of Pollution from Ships	1973
South Pacific Forum Fisheries Agency Convention	1979
Convention for the Protection of Natural Resources and Environment of the South Pacific Region (Noumea Convention)	1986
United Nations Framework Convention on Climate Change (UNFCCC)	1992
Vienna Convention for the Protection of the Ozone Layer (Vienna Convention)	1993
Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol)	1993
United Nations Convention on the Law of the Sea (UNCLOS)	1996
Agreement on Straddling Fish Stocks and Highly Migratory Species	1997
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD)	1998
Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter and the London Protocol	2000
Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (Waigani Convention)	2001
Kyoto Protocol to the UNFCCC	2001
CBD	2002
Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention)	2004
The International Plant Protection Convention (IPPC)	2005
Strategic Approach to International Chemicals Management (SAICM)	2006
Paris Agreement	2016
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (Nagoya Protocol)	2018
Minamata Convention on Mercury (Minamata Convention)	2019

CONVENTION	DEPARTMENT RESPONSIBLE	SUMMARY OF REPORTING REQUIREMENTS	STATUS OF REPORTING
CBD and Nagoya Protocol	Department of Environment	• NBSAPs • National Reports	• Revised NBSAP in preparation • 6NR was submitted in 2020
UNFCCC and Kyoto Protocol	Department of Climate Change	• Annual Greenhouse gas (GHG) inventory • National communications including supplementary information	• Second National Communication submitted in 2015, including 2014 GHG Inventory • Intended Nationally Determined Contributions submitted in 2015
Minamata Convention	Department of Environment	• Full reports submitted every four years • Short reports submitted every two years.	• Minamata Initial Assessment will be completed in 2020 • No overdue reports
Montreal Protocol	Department of Environment	• Annual statistical data on Ozone Depleting Substances (ODS) submitted to the Ozone Secretariat	• No overdue reports
Noumea Convention	Department of Environment	• National reports submitted to SPREP every two years	• No overdue reports
Stockholm Convention	Department of Environment	• National Implementation Plans (NIPs) • National reports submitted every four years, including data on production, import, and export of relevant chemicals	• NIP was reviewed and updated in December 2019. Yet to be endorsed by the government and lodged with the Stockholm Convention Secretariat. • 4NR was due in August 2018. Assessment has been carried out, but report is yet to be submitted
UNCCD	Department of Environment	• National reports, including data on progress towards five strategic objectives	• No overdue reports • Need to re-submit national report, including updated data
Vienna Convention	Department of Environment	• Summary report submitted every two years, on measures taken towards implementation of the Convention	• No overdue reports
Waigani Convention	Department of Waste Management	• Notification of any transboundary movement of waste • Report any confirmed illegal traffic of waste	• 2018-19 report overdue

Table 7
Status of national reporting to MEAs

Many conventions have associated reporting obligations. To comply with these obligations, Tuvalu government departments are assigned responsibility for preparing and submitting reports (Table 7 Status of national reporting to MEAs).

IMPACT

Responsibility for ensuring compliance with and reporting to most MEAs is held by DoE (apart from agreements concerning climate change and waste management, which are managed by the Department of Climate Change and Department of Waste Management, respectively). While many reports have been submitted on time, some reports have been unfortunately submitted late. This is largely due to the large number of MEAs handled by DoE, and the very small number of staff working within DoE (and other government departments). Reporting requirements (templates, data, format etc.) vary widely between MEAs, meaning that each report must be prepared individually, generating a significant workload for government staff. This issue is exacerbated by a relatively high rate of staff turnover within government departments, which impacts institutional memory.

RESPONSE AND RECOMMENDATIONS

- *Investigate potential opportunities to streamline MEA reporting processes by DoE and other Tuvalu government departments, to reduce reporting burden on staff.*
- *Review data requirements of MEA reporting, seeking to simplify data management.*
- *Invest in training for departmental staff to build capacity for MEA reporting.*

INDICATOR 1.3
APPROVED DEVELOPMENT PLANS WITH CONDITIONS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	2, 4, 5, 7	11.4, 11,6, 11.a, 11.b, 12.2, 12.b	Noumea convention Rio Decleration	SAMOA Pathway

DEFINITION

Percentage of approved development proposals that have conditions imposed.

STATUS AND TREND DISCUSSION

Requirements for EIA are defined by the 2017 amendment to Tuvalu's Environment Protection (Environmental Impact Assessment) regulations. Since 2017, DoE has worked to ensure that all development projects are implemented in accordance with these regulations. This has included developing templates for development proposals, sharing information about requirements for EIA, and monitoring compliance with EIA regulations. EIA requirements vary between projects depending on the scale and intensity of likely impacts.

To date, only a small number of projects have been required to produce EIAs. The GCF-funded Tuvalu Coastal Adaptation Project (TCAP) developed EIAs for land reclamation work on three islands – Nanumea, Nanumaga and Funafuti. These have been reviewed and approved with conditions.

Other current development projects are being monitored by DoE for compliance with EIA regulations – the Kainaki II Seawall project, the Niutao Port Harbour project, and the Nukulaelae Port Harbour project.

Anticipated upcoming development projects that are yet to prepare EIAs include the Tuvalu National Gymnasium Center, the Islands Gym Facility, domestic airports, and a new Funafuti International Airport.

IMPACT

Tuvalu has appropriate EIA regulations in place to ensure that development projects avoid, minimise, and mitigate any negative environmental impacts. However, these regulations have only been implemented in recent years. Processes for EIA review and approval are still developing, and work is needed to monitor compliance with development conditions.

RESPONSE AND RECOMMENDATIONS

- *Review EIA regulations, and strengthen if necessary*
- *Undertake initiatives to raise awareness of and increase compliance with EIA regulations, particularly on the outer islands*
- *Build national capacity to monitor compliance with EIA conditions.*

INDICATOR 1.4
ENVIRONMENTAL CASES PROSECUTED

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	4, 6	11.4	Noumea convention Rio Decleration on Environment and Development	SAMOA Pathway

DEFINITION

Number of environmental cases prosecuted.

STATUS AND TREND DISCUSSION

Responsibility for enforcing PA regulations is delegated to Kaupules. Although this is not centrally documented, and very limited information is available, anecdotal evidence suggests that Kaupules do actively enforce such bylaws and issue penalties.

For example, in 2020 two fishermen were caught illegally fishing within Funafuti Conservation Area (FCA). In response the Funafuti Kaupule confiscated their fishing equipment, issued a fine of $500, deported them to their home island, and banned them from Funafuti for five years.

Insufficient information is available to determine trends in prosecution of environmental cases.

IMPACT

Insufficient information is available to assess the effectiveness of enforcement by Kaupules. However, very limited anecdotal evidence suggests that at least some Kaupules do enforce PA bylaws, and that penalties issued are an effective deterrent.

RESPONSE AND RECOMMENDATIONS

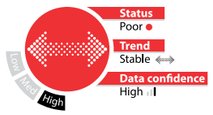
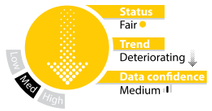
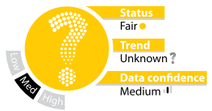
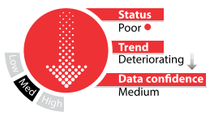
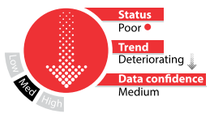
- *Review existing environmental regulations and penalties*
- *Assist Kaupules in enforcing protected area bylaws and raising public awareness*
- *Improve documentation of law enforcement by systematically collecting information from Kaupules*

3.2 THEME 2. COASTAL AND MARINE

INTRODUCTION

Tuvalu is a small Polynesian island nation comprising nine extremely low-v coral atolls and reef islands with a total land area of only 26 km^2, distributed along a nearly 600 km chain in the western Pacific Ocean. As such, Tuvalu's terrestrial biodiversity and ecosystems are very limited and under significant pressure associated with high human population density (resulting in habitat destruction/degradation, the spread of IAS, and pollution of groundwater and lagoon water). With no freshwater wetlands, Tuvalu's wetlands are dominated by brackish and shallow marine ecosystems, particularly coral reefs and mangroves.

Tuvalu's marine environment comprises six ecosystem types – oceanic, outer reef, lagoonal, back reef, lagoon floor, patch reefs, and natural channels between the ocean and lagoon. Marine resources (particularly commercial and artisanal fisheries) form the backbone of Tuvalu's economy, local livelihoods and food security. Although these resources are extensive, there are indications that limited national capacity for effective management of natural resources is resulting in unsustainable levels of extraction.

INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
2.1 NATIVE TREE COVER		• Very little forested land • Remaining forest is heavily disturbed • Dominated by introduced species	• Expand the terrestrial PA network to include the highest quality remaining forested land
2.2 WETLANDS		• No freshwater wetlands • Coral reefs, mangroves (two species) and possibly some seagrass	• Expand the Marine Protected Area (MPA) network and improve the management effectiveness of MPAs • Establish and manage coral nurseries with temperature tolerant individuals of native coral species • Continue mangrove replanting and land remediation efforts
2.3 LIVE CORAL COVER		• Fringing and patch reefs, dominated by *Acropora* corals • Cover highly variable, with a national average of 65% (2008)	• National monitoring programme to identify reliable trends in live coral coverage • Expand and strengthen the MPA network • Better regulate inshore fisheries to combat unsustainable fishing practices
2.4 LAGOON WATER QUALITY		• Funafuti lagoon polluted by domestic wastewater • High levels of nutrients • Key source of pollution is 'bottomless' household septic tanks • Significant risk to human health	• Improved water quality control strategies urgently needed • May be prohibitively expensive to improve or replace existing septic tanks • Composting toilets may be a more suitable alternative
2.5 FRESHWATER QUALITY		• Tuvalu's freshwater is limited to thin, brackish groundwater lenses floating hydrostatically on saltwater below • Limited data available, but generally not fit for human consumption • Polluted by 'bottomless' septic tanks and leachate from waste disposal sites • Impacts on human health and access to drinking water	• National groundwater quality monitoring system needed • Urgent need to address the causes of pollution • Promotion of composting toilets may be appropriate, if improving/replacing existing septic tanks is prohibitively expensive
2.6 MARINE PROTECTED AREAS **2.7 TERRESTRIAL PROTECTED AREAS**		• Nine PAs established, one on each of Tuvalu's nine islands • 19% of Tuvalu's terrestrial area protected, but less than 1% of its marine area • FCA and eight Locally Managed Marine Areas (LMMAs) • Compliance with PA regulations appears good, despite limited management capacity	• Assess management effectiveness using Management Effectiveness Tracking Tool (METT) • Gap analysis of PA coverage • Expand PA network by establishing new PAs and expanding existing PAs • Improve PA management effectiveness

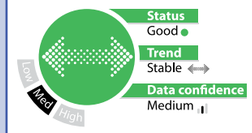
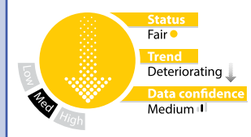
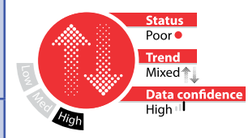
INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
2.8 COMMERCIAL PELAGIC FISHES		• Critical to Tuvalu's economy – the primary source of non-aid government revenue • Industrial purse-seiners and long-liners targeting four species of tuna – skipjack, yellowfin, bigeye, and albacore • More than 100,000 mt caught in 2018 • Pelagic tuna fishery is believed to be sustainable	• Continue to build the capacity of TFD to improve fisheries management and compliance • Combat Illegal, Unreported, and Unregulated (IUU) fishing in Tuvalu's EEZ • Invest in fish processing facilities in Funafuti
2.9 FISH BIOMASS		• Marine resources are the foundation of local livelihoods, food security and nutrition • An essential source of protein • Limited data available, however quantitative and anecdotal evidence of declining Catch per unit effort (CPUE)	• Systematic monitoring of Tuvalu's artisanal fisheries • Assess the sustainability of current fishing levels • Review the effectiveness of existing management by Kaupules • Improve the effectiveness of fisheries management
2.10 IAS UNDER MANAGEMENT **2.11 PRIORITY SITES WITH IAS MANAGED**		• Tuvalu is impacted by a large number and variety of IAS • National capacity for biosecurity is very limited • No species and no sites are currently under dedicated management	• Global Environment Facility (GEF) project 'Strengthening national and regional capacities to reduce the impact of IAS on globally significant biodiversity in the Pacific' recently commenced • Need for greater public awareness and enforcement capacity
2.12 IUCN RED LIST SUMMARY **2.13 STATUS OF THREATENED, ENDEMIC OR MIGRATORY SPECIES**		• 1,361 taxa known to occur in Tuvalu have been assessed by the Red List • 111 of these are threatened • One species is Critically Endangered (Beck's Petrel), 13 are Endangered, and 97 are Vulnerable • Several migratory species (predominantly seabirds) • One endemic species, the Tuvalu forest gecko (***Lepidodactylus tepukapili***)	• Surveys to determine conservation status of Tuvalu forest gecko • Develop a national Red List to inform national conservation priorities

Table 8
Coastal and Marine highlights

INDICATOR 2.1
NATIVE TREE COVER

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	5, 7	6.6, 12.2, 15.1, 15.2, 15.5		SAMOA Pathway 90, 94

DEFINITION

Percentage native tree cover of total land area.

STATUS AND TREND DISCUSSION

Tuvalu's nine atolls and reef islands have a combined total land area of only 26 km^2 (2,600 ha). The nation's relatively high population density (a national average of 410 persons/km^2 and over 2,000 persons/km^2 on Fongafale islet, Funafuti) means that a significant proportion of this land is required for residential purposes, other urban development, cultivating crops for subsistence consumption (such as pulaka pits), landfill sites for waste disposal, and the Funafuti airstrip. The little forested land that remains is highly disturbed and dominated by non-native introduced species such as coconut palms (Thaman 2016). As a result, the status of native tree cover is assessed as 'poor'.

The 2015 FAO Global Forest Resources Assessment Country Report estimated Tuvalu's forested land at 1,000 ha (33.3% coverage) and reported that it has been stable since 1990 (FAO 2015). However, this data is based solely on Thaman & Whistler (1994), and as such is likely outdated.

TKIII reports that Tuvalu's proportion of forested land declined from 43% in 2000 to 33.3% in 2005 (based on SPC data) as a result of land clearance for construction, erosion and saltwater inundation. It states that although no recent estimates are available, it is possible that Tuvalu's forest cover has increased slightly in recent years, as a result of tree planting initiatives implemented by community groups and Civil Society Organisations (CSOs) such as TANGO (Government of Tuvalu 2016).

IMPACT

Tuvalu's very limited native tree cover limits the provision of ecosystem services that forested land can provide, including shade from the sun, windbreaks, soil development and limiting erosion, timber for construction and traditional handicrafts, fuelwood, rainwater capture, cultivation of medicinal plants, and carbon sequestration. It also results in limited habitat for terrestrial fauna such as the endemic Tuvalu forest gecko, *Lepidodactylus tepukapili*, and roosting and nesting habitat for threatened seabirds (Thaman 2016, Thaman and Whistler 1994).

RESPONSE AND RECOMMENDATIONS

- *Expand Tuvalu's terrestrial PA network to include the highest quality remaining forested land and that which provides the most environmental value.*

INDICATOR 2.2.
WETLANDS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	5, 6, 14	6.6, 12.2, 15.1, 15.2, 15.5	Noumea convention Rio Decleration on Environment and Development	SAMOA Pathway 90, 94

DEFINITION

Percentage cover of wetlands and mangroves.

STATUS AND TREND DISCUSSION

The Ramsar Convention on Wetlands of International Importance (Ramsar Convention) defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (The Ramsar Convention Secretariat 2014).

As a result of their geomorphology, Tuvalu's coral atolls and reef islands almost entirely lack freshwater wetlands, with no rivers or streams, or freshwater marshes, lakes, or ponds. Instead, the wetland types found in Tuvalu consist of shallow marine wetlands such as extensive coral reefs (see Indicator 2.3. Live coral cover), some mangroves, and possibly some seagrasses (Ellison 2009).

Although extensive, Tuvalu's coral reefs show considerable variation in live coral coverage (see below) and are threatened by the impacts of climate change (particularly changes in sea surface temperature and pH), pollution and overfishing (Collen and Garton 2004).

Two species of mangrove are found in Tuvalu – black mangrove (*Lumnitzera littorea)* and red mangrove (*Rhizophora stylosa)*. The 2015 FAO Global Forest Resources Assessment Country Report estimated Tuvalu's area of mangroves in 2015 at 40 ha (declined from 50 ha in 1990), based on data from FAO Forestry Paper 153 (Table 9 Tuvalu's mangrove coverage) (FAO 2015, FAO 2007).

Table 9
Tuvalu's mangrove coverage
Source: FAO Global Forest Resources Assessment Country Report

	1980	1990	2000	2005
MANGROVE	50 ha	50 ha	40 ha	40 ha

Tuvalu's mangroves are threatened by urban development, including land reclamation, and the construction of ports and associated infrastructure.

Ellison (2009) reports the presence of one seagrass species in Tuvalu – Thalassia hemprichii. However, no data appears to be available on area of seagrass extent or key threats.

The 2011 SPC report Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change (Bell et al. 2011) reported that Tuvalu had 3,175 km2 of coral reefs and 0.4 km2 (40 ha) of mangroves.

One notable inland wetland area on Fongafale islet is Tafua pond, located at the north eastern end of Funafuti airstrip. This large pond (1.39 ha), surrounded by mangroves, is likely to be a relic of a much larger low-lying wetland area that was filled during the construction of the airstrip by US forces in 1942. While it has a largely marine ecology, the salinity of Tafua pond likely fluctuates with the tide and levels of rainfall. In recent years the pond has been increasingly used to dispose of the effluent from nearby pig pens. The resulting input of organic nutrients has led to the rapid growth of algae (eutrophication), which have depleted levels of dissolved oxygen causing fish kills in the pond.

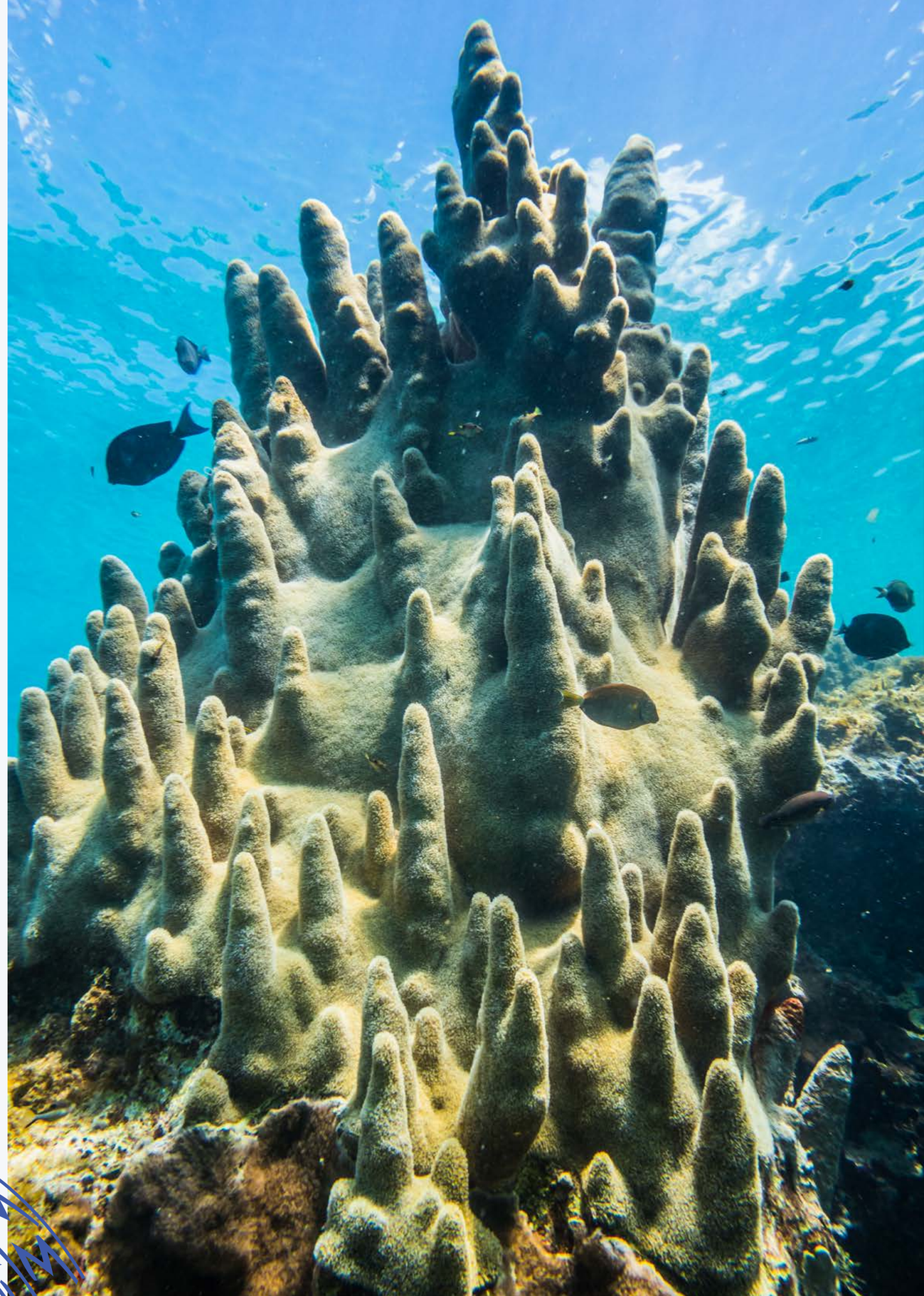
IMPACT

Tuvalu's corals and shells of associated benthic foraminifera are the main source of sediment deposited on Tuvalu's beaches (Collen and Garton 2004). They provide critical ecosystem services including limiting coastal erosion (by both promoting sediment deposition and by absorbing the energy of oceanic wave action). Healthy coral reefs may be able to grow at a sufficient rate to keep pace with the predicted sea level rise associated with global climate change (Kayanne et al. 2005). If Tuvalu's coral reefs are seriously damaged (for example bleaching due to rising sea surface temperatures), the nation will be more at risk from the impacts of climate change and will lose essential habitat for the reef fish upon which local livelihoods and food security depend.

Tuvalu's mangroves also play an important role in reducing coastal erosion and providing breeding and nursery grounds for many species of fish (Webb 2005).

RESPONSE AND RECOMMENDATIONS

- *Better protect Tuvalu's coral reefs by expanding the MPA network, increasing the management effectiveness of MPAs and by regulating inshore fisheries to combat unsustainable fishing practices*
- *Continue the efforts of the Ridge to Reef (R2R) in establishing and managing coral nurseries of corals found to be more resilient to increases in water temperature*
- *Continue the efforts of TANGO and other CSOs in planting mangroves in priority sites.*



INDICATOR 2.3.
LIVE CORAL COVER

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 14.2, 14.5,	RAMSAR	SAMOA Pathway 90

DEFINITION

Percentage live coral cover in coastal and marine environments.

STATUS AND TREND DISCUSSION

Tuvalu's nine islands comprise five true coral atolls (with a continuous eroded reef platform surrounding a central lagoon), three reef islands (made up of sand and coral materials), and one island with characteristics of both an atoll and a reef island (Table 10 Tuvalu's coral reefs). The islands are subject to constant change through the growth of living coral, and erosion and accretion resulting from wave action. Tuvalu's shallow marine environments are dominated by fringing and patch reefs, with water depths increasing rapidly with distance from the shore. The coral atolls are characterised by a perimeter of coral islands and coral reefs surrounding extensive lagoons comprised of coralline sand flats and intermittent coral heads (Sauni 2002).

Table 10
Tuvalu's coral reefs
Source: Sauni (2002). The status of the coral reefs of Tuvalu

ISLAND	REEF TYPE	AREA OF REEF PLATFORM (HA)	AREA OF ISLETS (HA)	AREA OF BEACHES (HA)	AREA OF REEF FLAT (HA)	AREA OF LAGOON (HA)	TOTAL AREA (HA)
NANUMEA	Atoll	1,710	366	21	1,323	325	3,745
NANUMANGA	Patch	413	301	71	98	-	883
NIUTAO	Patch	306	235	2	69	-	1,495
NUI	Atoll	1,601	352	22	1,228	337	3,540
VAITUPU	Atoll/Patch	906	529	17	361	109	1,922
NUKUFETAU	Atoll	2,559	331	65	2,163	9,093	14,211
FUNAFUTI	Atoll	3,696	275	27	3,398	20,521	27,917
NUKULAELAE	Atoll	1,404	183	33	1,188	2,377	5,185
NIULAKITA	Patch	74	42	8	24	-	148
TOTAL	**-**	**12,669**	**2,614**	**266**	**9,852**	**32,762**	**59,046**

The FCA baseline survey in 1997 reported generally low coral cover (10-20% at most sites), but up to 55% cover at control sites outside the FCA (Kaly 1997).

The second FCA marine survey in 1999 reported that coral cover varied between 0% and 76% at sites within the FCA, and between 0% and 99% at sites outside the FCA (Kaly 1999)

Sauni (2002) reported that Tuvalu's lagoon reef slopes and channels were dominated by *Acropora* corals including *A. nobilis* and *A. florida*. Ocean-side terrace habitats were rich in coral cover and diversity, with staghorn and other *Acropora* corals and species of *Montipora*, *Favia, Fungia, Hydnophora, Montastrea, Pocillopora verrucosa* and *P. edyouxi*. Average coral cover in Funafuti was estimated at 40% but varied significantly between monitoring sites.

Status of Coral Reefs of the World (2004) (Wilkinson 2004) reported live coral cover to vary between 0% and 70%, and to have declined by 9% since the last surveys (potentially due to strong wave action created by stormy conditions in late 2002). Between 1997 and 2003 live coral cover at monitoring sites appeared to be relatively stable at 20-30%. Branching *Acropora* species were the most common coral species, followed by table *Acropora*. *Porites* spp. were sparsely distributed on reef flats and gentle reef slopes.

Status of Coral Reefs of the World (2008) (Morris and Mackay (eds.) 2008) reported national average coral cover of 65% (range 55-98%).

The Tuvalu Marine Life project (implemented by Alofa Tuvalu with the TFD) conducted field surveys in Nanumea, Nukulaelae, and Funafuti in 2010. It reported that Funafuti atoll had high (20-50%) coral cover throughout both lagoonal and outer reef sites (Table 11 Live hard coral cover and dominant growth forms recorded in Funafuti), and that hard coral cover was lower on the surveyed outer islands (Table 12 Live hard coral cover and dominant growth forms recorded in Nukulaelae and Nanumea) (Job and Ceccarelli 2012). In Nukulaelae, coral cover ranged from 0-13%, with an average of 6% (dominated by *Acropora* staghorn branching coral). In Nanumea, coral cover ranged from 2-22%, with an average of 11% (with an even representation of encrusting (*Montipora*), massive (*Porites* spp.), and bushy (*Pocillopora*) growth forms).

Table 11
Live hard coral cover and dominant growth forms recorded in Funafuti
Source: Tuvalu Marine Life Scientific Report (2012)

STATUS	STATION	LIVE CORAL COVER	DOMINANT GROWTH FORM
FCA	Fuafatu flat	7%	Acropora branching coral
FCA	Fuafatu slope	34%	Acropora branching coral
FCA	Fuafatu lagoon	15%	Acropora branching and plate-forming coral
FCA	Fualopa flat	0.1%	Encrusting coral
FCA	Fualopa slope	9%	Encrusting coral
FCA	Fualopa lagoon	7%	Acropora branching coral
FCA	Tefala flat	2%	Encrusting coral
FCA	Tefala slope	12%	Acropora branching and plate-forming coral, encrusting coral
FCA	Tefala lagoon	14%	Acropora branching coral
Outside FCA	Tepuka flat	0.1%	Acropora branching coral
Outside FCA	Tepuka slope	58%	Acropora branching coral
Outside FCA	Tepuka lagoon	5%	Acropora branching coral
Outside FCA	Fualefeke flat	1%	Acropora and non-Acropora branching coral
Outside FCA	Fualefeke slope	35%	Acropora branching coral
Outside FCA	Fualefeke lagoon	19%	Acropora branching coral
Outside FCA	Teafualiku flat	5%	Acropora branching coral
Outside FCA	Teafualiku slope	24%	Acropora branching coral
Outside FCA	Teafualiku lagoon	27%	Acropora branching coral

Table 12
Live hard coral cover and dominant growth forms recorded in Nukulaelae and Nanumea
Source: Tuvalu Marine Life Scientific Report (2012)

STATUS	STATION	LIVE CORAL COVER	DOMINANT GROWTH FORM	STATION	LIVE CORAL COVER	DOMINANT GROWTH FORM
Conservation Area	NKLCA1	5%	Table	NNMCA1	14%	Encrusting
Conservation Area	NKLCA2	13%	Branching	NNMCA2	16%	Other
Conservation Area	NKLCA3	9%	Other	NNMCA3	9%	Other
Conservation Area	NKLCA4	4%	Branching	NNMCA4	11%	Encrusting
Conservation Area	NKLCA5	0%	-	NNMCA5	11%	Encrusting
Outside Conservation Area	NKLOCA1	7%	Branching	NNMOCA1	22%	Other and massive
Outside Conservation Area	NKLOCA2	8%	Branching	NNMOCA2	2%	Massive
Outside Conservation Area	NKLOCA3	4%	Massive	NNMOCA3	3%	Massive
Outside Conservation Area	NKLOCA4	3%	Branching	NNMOCA4	9%	Massive
Outside Conservation Area	NKLOCA5	3%	Branching			

The 2011 report Status of Coral Reefs of the Pacific and Outlook (Chin et al. 2011) reported that occasional monitoring of Funafuti's reefs suggested that they were stable (84% of reefs considered to be at low threat), however that long-term trends and patterns of reef resource use were unknown.

Unfortunately the 2018 report Status and Trends of Coral Reefs of the Pacific produced by the Global Coral Reef Monitoring Network did not include Tuvalu, due to a lack of time series monitoring data (Moritz et al. (eds) 2018).

IMPACT

While some data is available for live coral coverage in Tuvalu since at least 1997, it is difficult to interpret trends due the variety of sampling sites used, and potential variations in sampling methodologies. What is clear, however, is that Tuvalu has relatively extensive coral reefs, which display wide local variations in extent of live coral coverage. Although it is not possible to accurately determine trends in coverage with the available data, they may be declining as a result of increased storm damage, impacts of climate change, crown of thorn starfish outbreak, land-based pollution, and destructive fishing practices (Morris & Mackay 2008). If this is the case, Tuvalu will eventually lose the ecosystem services that coral reefs provide, including combating coastal erosion, and providing habitat for the inshore fisheries resources upon which local livelihoods and food security depend.

RESPONSE AND RECOMMENDATIONS

- *Establish a national monitoring programme to identify reliable trends in live coral coverage.*
- *Better protect Tuvalu's coral reefs by expanding the MPA network, improving the management effectiveness of MPAs and regulating inshore fisheries to combat unsustainable fishing practices.*

INDICATOR 2.4. LAGOON WATER QUALITY

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	8, 10	6.3, 6.6	Noumea Convention	SAMOA Pathway 64-65

DEFINITION

Enterococci levels across water sample sites.

STATUS AND TREND DISCUSSION

Five of Tuvalu's nine islands are coral atolls comprising a ring of small islets surrounding a shallow lagoon. The capital, Funafuti, includes the densely populated Fongafale islet, upon which more than half of the nation's population of 10,507 (2017 mini-census) reside (Government of Tuvalu 2017).

Fujita et al. (2013) assessed "anthropogenic impacts on water quality of the lagoonal coast of Fongafale islet, Funafuti atoll, Tuvalu" by conducting field surveys sampling water quality at six points and measuring water temperature, electrical conductivity, salinity, dissolved O_2, pH, redox potential, and *E. coli* levels.

The study found that sediments on Fongafale's lagoon coast had "$2.7x10^4$ more microbial biomass, significantly different microbial community structure, and low microbial diversity, when compared to an undisturbed natural coastal sediment", indicating that pollution of this site is chronic.

At low tide, *E. coli* numbers were found to range from $3.2x10^3$ to $2.7x10^4$ MPN/100 mL (most probable number of *E. coli* bacteria per 100 mL of sediment – referring to the statistical probability of the number of organisms present) at several sampling sites, and at high tide ranged from $5.5x10^2$ to $1.2x10^3$ MPN/100 mL. Japanese water quality criteria recommend that the number of colon bacteria (such as *E. coli*) should not exceed $1.0x10^3$ MPN/100 mL for bathing beaches. The highest numbers of *E. coli* recorded by this study are 27 times higher than this recommended maximum.

The primary source of this pollution is likely to be domestic wastewater. In 2013 Fongafale was home to 639 households, of which 424 households had buried septic tanks and 163 households had pit toilets. There is no centralised sewage treatment system. Although septic tank construction specifications require them to be sealed, it appears that most (if not all) septic tanks constructed in Tuvalu are 'bottomless' and therefore able to leak into the surrounding substrate. During ebb tides, wastewater leaking from septic tanks and pit toilets flows into lagoon waters. Additional sources of pollution may include animal waste from piggeries, and detergents and chemical fertilisers (Newland 2018).

The Australian Government's Guidelines for Managing Risks in Recreational Water (2008) notes that raw sewage has *E. coli* concentrations of 10^6-10^7 MPN/100 mL and classifies water with more than $5x10^2$ MPN/100 mL as "D" (having a significant risk of high levels of illness transmission) (Table 13 Risk of illness associated with Microbial Assessment Categories) (Note: CFU (colony-forming unit) refers to the actual number of organisms present, rather than the most probable number (MPN)).

Table 13
Risk of illness associated with Microbial Assessment Categories
Source: Australian Government Guidelines for Managing Risks in Recreational Water (2008)

CATEGORY	ENTEROCOCCI (CFU/100ML)	ILLNESS RISK*
A	≤40	GI illness risk: <1% AFR illness risk: <0.3%
B	41-200	GI illness risk: 1-5% AFR illness risk: 0.3-1.9%
C	201-500	GI illness risk: 5-10% AFR illness risk: 1.9-3.9%
D	>500	GI illness risk: >10% AFR illness risk: >3.9%
* GI = gastrointestinal illness; AFR = acute fever and rash		

More recently, water quality surveys and analysis were conducted in 2018 as part of the R2R project (Newland 2018). Water quality samples were taken at 13 sites including 10 within Fogafale lagoon, and analysed for turbidity, dissolved oxygen, nitrogen (nitrates, nitrites and ammonia), phosphorus (phosphase), and *E. coli*. The study found elevated levels of N-Nitrate, P-Phosphase, N-Ammonium, and *E. coli*, particularly at sites close to the most densely populated parts of Funafuti (Letasi). The average N-Nitrate concentration at Letasi was 0.348mg/L, about 100x greater than the guideline value of 2-8ug/L specified by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

IMPACT

Anthropogenic pollution of lagoon seawater is a major issue for atoll conservation, as corals and shells of benthic foraminifera are the major producers of sand. The sediment produced by a healthy ecosystem counteracts the impacts of wave action, limiting coastal erosion. Similarly, coral reefs on the ocean side of atolls act as a natural breakwater, protecting the coast from wave action. Healthy coral reefs can grow upwards by as much as 400 mm/100 years, potentially keeping pace with predicted sea-level rise associated with climate change (Kayanne et al. 2005).

Coral reefs can be affected by wastewater discharge and waste disposal – increasing the concentration of nutrients and therefore negatively impacting foraminifera through habitat changes and/or the collapse of algal symbiosis (Osawa et al. 2010). The resulting decrease in sediment supply has the potential to contribute to decreased sedimentation and increased coastal erosion.

The high levels of *E. coli* recorded in Fongafale's coastal lagoon water pose a significant risk to human health.

RESPONSE AND RECOMMENDATIONS

- *There is an urgent need for the development and implementation of effective water quality control and monitoring strategies in Tuvalu.*
- *As it is likely to be prohibitively expensive to improve or replace existing septic tanks, it may be more appropriate to promote composting toilets as a less polluting alternative.*
- *Community education initiatives to promote behaviour change.*
- *A robust lagoon health monitoring programme should be developed, with regular sample collection at multiple sites, to build a more detailed understanding of spatial and temporal variations in lagoon water quality.*

INDICATOR 2.5. FRESHWATER QUALITY

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	8, 14	6.1, 6.3, 6.6; 14.1	Basel Convention, UNCCD	SAMOA Pathway 64-65

DEFINITION

Escherichia coli levels across freshwater sample sites.

STATUS AND TREND DISCUSSION

As noted in Indicator 2.2. Wetlands, Tuvalu lacks freshwater wetlands, with no streams, rivers, lakes, or marshes. Coral atolls generally develop a shallow fresh (or slightly brackish) groundwater 'lens', as a result of rainwater permeating porous coralline soils and floating hydrostatically on saltwater below. In the case of Tuvalu's atolls (particularly densely populated Funafuti), this limited groundwater is generally not suitable for human consumption, as a result of pollution from 'bottomless' septic tanks and waste leachate (see Indicator 2.4. Lagoon water quality) (Fujita et al. 2013) and is mainly used for washing pig pens and similar tasks. In times of extreme water stress (for example no rainfall for several months), this groundwater is sometimes used for household tasks such as cooking.

Little quantitative data is available on freshwater quality.

IMPACT

Polluted groundwater has the potential to negatively impact the health of Tuvalu's residents (Gheuens et al. 2019). More than 70% of households are at "high" or "very high" risk of faecal contamination of drinking water, based on recorded *E.coli* levels (UNICEF 2020).

The country is almost entirely dependent on rainwater for drinking (UNICEF 2020) (collected and stored by households in large plastic tanks which are susceptible to pollution by bird guano), and groundwater could serve as a useful water source during times of drought. This could become more important in the future if climate change results in changing rainfall patterns for Tuvalu (Australian Bureau of Meteorology and CSIRO 2011).

RESPONSE AND RECOMMENDATIONS

- *Implement a national groundwater pollution monitoring system.*
- *Take steps to improve the quality of Tuvalu's groundwater through addressing the causes of pollution (particularly the use of 'bottomless' septic tanks).*
- *As it is likely to be prohibitively expensive to improve or replace existing septic tanks, it may be more appropriate to promote composting toilets as a less polluting alternative.*

INDICATOR 2.6 TERRESTRIAL PROTECTED AREAS

AND INDICATOR 2.7. MARINE PROTECTED AREAS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 6.6 12.2 14.2, 14.5 15.1, 15.2, 15.5		SAMOA Pathway 58, 80, 94

DEFINITION

Percentage of land area formally protected for conservation

DEFINITION

Percentage of EEZ formally protected for conservation

STATUS AND TREND DISCUSSION

PAs and MPAs are globally recognised as effective management tools for conserving biodiversity and as such are recognised across multiple international policy processes including the 2030 Agenda for Sustainable Development, the CBD, and the Ramsar Convention.

To date, Tuvalu has established nine PAs, one associated with each of the nation's nine islands. This network consists of one MPA established under national legislation (the *Conservation Areas Act (1999)* and Funafuti Conservation Area Order), and eight LMMAs (Table 14 Tuvalu's PA network). Covering a total area of nearly 240 km^2, these PAs predominantly cover marine areas (235 km^2), however five PAs also include a terrestrial component (FCA, Vaitupu LMMA, Nukulaelae LMMA, Nukufetau LMMA, and Nui LMMA). This terrestrial area only covers a total of 5 km^2, or 2% of the total area of these five PAs.

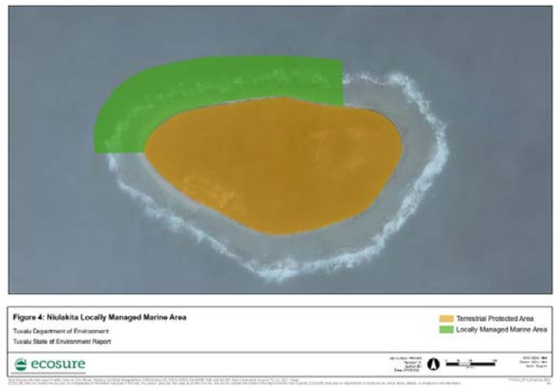
In terms of PA coverage, ABT-11 aims to protect at least 17% of terrestrial areas, and at least 10% of coastal and marine areas by 2020. Tuvalu's PA network currently covers about 19% of its terrestrial area (26 km^2), but less than 1% of its marine area. Given that Tuvalu's EEZ extends over 749,790 km^2 of the Pacific Ocean, and the nation's limited capacity for PA management, a target of 10% is not realistic at the national level (a more appropriate target of 1% is suggested).

NAME	TYPE	AREA (KM2)			MAP
		LAND	MARINE	TOTAL	
FCA	MPA	0.08	40	40.08	
Vaitupu LMMA	LMMA	0.455	1.5	1.955	

Table 14
Tuvalu's PA network
Source: Ridge to Reef project

NAME	TYPE	AREA (KM2)			MAP
		LAND	MARINE	TOTAL	
Nukulaelae LMMA	LMMA	1.65	31.85	33.5	
Nanumea LMMA	LMMA	0	5.2	5.2	

NAME	TYPE	AREA (KM2)			MAP
		LAND	MARINE	TOTAL	
Nukufetau LMMA	LMMA	1.01	133.97	134.98	
Nui LMMA	LMMA	1.65	18.12	19.77	

NAME	TYPE	AREA (KM2)			MAP
		LAND	MARINE	TOTAL	
Niutao LMMA	LMMA	0	1.68	1.68	
Niulakita LMMA	LMMA	0	0.21	0.21	

NAME	TYPE	AREA (KM2)			MAP
		LAND	MARINE	TOTAL	
Nanumaga LMMA	LMMA	0	2.078	2.078	
Total		**4.845**	**234.61**	**239.45**	

MPAs are recognised as an effective tool for protecting threatened marine and coastal ecosystems, allowing depleted breeding stocks of fish and invertebrate species to regenerate and become re-established, providing a foundation for sustainable fisheries.

Tuvalu's LMMAs generally consist of a core no-take zone and a surrounding management zone in which some fishing is permitted (including fishing using traditional methods). Management, monitoring and enforcement of LMMA regulations is carried out by the community members themselves, guided by IMPs.

FCA was established in 1996, with support of SPREP, in response to reported increases in fishing pressure and the threat of deteriorating environmental quality in Funafuti lagoon (Berdach 2003). It was established to conserve the terrestrial and marine biodiversity resources of Funafuti atoll based on sustainable use principles, including the protection of habitats, conservation of threatened species and improvement of the quality of fisheries resources.

FCA covers 40 km^2 of the western portion of Funafuti lagoon, including six small islets. Its boundary is defined by a line 50 m seaward of the ocean-side reef crest, and the 30 m depth contour on the lagoon side (Figure 9: Funafuti Conservation Area). Its boundaries encompass about 20% of the total coral reef area of the lagoon and are home to many of the 400 species of fish and 36 species of coral that are known from Funafuti lagoon (Berdach 2003).

Despite only including a small land area, the islets of FCA include about 40% of the total area of threatened native broadleaf forest found on Funafuti atoll, home to 22 species of seabirds and shorebirds, two species of land birds (mostly using the islets for nesting or roosting) (Watling 1998). In addition, coconut crabs can be found on these islets, and sea turtles are known to nest on the islet beaches.

The PA consists purely of a no-take zone, without a buffer zone. Although there appears to be a high level of compliance with PA regulations (little illegal fishing), limited enforcement of PA regulations indicates that this compliance is largely voluntary. Although both the *Conservation Areas Act (1999)* and the Funafuti Kaupule Byelaws include heavy penalties for violating FCA regulations (fines of up to AU$5,000 or imprisonment for up to 28 months for each violation), for the few violators that have been apprehended to date, only minimal fines have been imposed.

Figure 9
Funafuti Conservation Area
(Source: NASA)

IMPACT

Tuvalu's PA network has an important role to play in terms of biodiversity conservation and provisioning of ecosystem services (particularly safeguarding the fish stocks upon which local livelihoods and food security depend). While Tuvalu has successfully established a network of PAs with both terrestrial and marine components, and compliance with PA regulations appears high, there are gaps in terms of management capacity, monitoring and enforcement (for example, to date PA boundary demarcation has only been completed for FCA and Nukulaelae LMMA). If these are not addressed, the long-term effectiveness of these PAs may be jeopardised.

RESPONSE AND RECOMMENDATIONS

- *Quantify the management effectiveness of Tuvalu's PAs using a management effectiveness assessment tool (METT).*
- *Conduct a gap analysis of Tuvalu's PA network coverage to ensure that critical ecosystems and habitat types are not being inadvertently omitted.*
- *If appropriate, expand the PA network by establishing new PAs and/or expanding existing PAs.*
- *Take steps to improve the management effectiveness of PAs, such as preparing dedicated management plans, employing PA management staff, and providing them with equipment and training (e.g. enforcement, monitoring).*
- *Clearly demarcate remaining PA boundaries and provide clear signage. This will support understanding of where the conservation area is and hence compliance and enforcement.*

INDICATOR 2.8.
COMMERCIAL PELAGIC FISHES

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		2.4  14.4, 14.7, 14.c . 	UN Fish Stocks Agreement	Convention for the conservation and management of highly Migratory fish stocks in the western and central Pacific Ocean; SAMOA Pathway 53, 58, 59, 63

DEFINITION

Trends in captures of tuna species.

STATUS AND TREND DISCUSSION

Commercial pelagic fisheries are critical to Tuvalu's economy. Indeed, Tuvalu is often characterised as one of a handful of fishery-dependent small island states whereby the whole economy, livelihoods, food security, and dietary health depend largely on marine resources (Preston et al. 2016).

The nation's commercial pelagic fisheries comprise industrial purse-seine and longline tuna fisheries (particularly skipjack tuna), operating within the EEZ, generally undertaken by foreign vessels operating under access agreements. These include (but are not limited to) foreign fishing vessels from Japan, South Korea, New Zealand, Taiwan and the United States. In 2018, 309 vessels were granted licenses (Government of Tuvalu 2018).

Table 15
Licenses issued by gear and for support vessels (2014-18)
Source: TFD 2018 Annual Report

YEAR	LONGLINE	PURSE SEINE	POLE AND LINE	FISH CARRIER	BUNKER	TOTAL
2014	43	146	12	15	3	219
2015	26	188	1	34	7	256
2016	66	165	3	41	1	276
2017	115	202	0	40	0	357
2018	78	186	0	45	0	309

Since 2013, fishery access and license fees paid by industrial fishing vessels catching tuna in Tuvalu's EEZ have been the primary source of non-aid revenue to the Government (Table 16 Government revenue) (Government of Tuvalu 2018).

Table 16
Government revenue (AU$)
Source: TFD Annual Reports

YEAR	GOVERNMENT REVENUE FROM FISHERIES LICENCES, VDS, AND RELATED FEES	AS A PROPORTION OF TOTAL GOVERNMENT REVENUE	TOTAL GOVERNMENT REVENUE
2013	-	-	$33,663,817
2014	$14,800,000	35.3%	$41,973,736
2015	$31,400,000	59.1%	$53,110,526
2016	$33,000,000	46.4%	$71,097,923
2017	$26,000,000	40.9%	$63,505,802
2018	$51,000,000	86.1%	$59,233,205

TFD's Ocean Division manages a Vessel Day Scheme (VDS) under which trained observers are deployed to ensure the catch for each foreign vessel complies with the license and access agreements.

Between 2010 and 2014 there was an increasing trend in the total value of catch from offshore fisheries. The total value of catch from purse-seine and longline fishing reached US$149 million in 2012. This figure was lower in 2014 at US$132 million (AU$161 million) with a total of 96,898 million tonnes (mt) of fish being caught in the Tuvalu EEZ (SPC 2015).

Catch by domestic fleet

Tuvalu's current domestic pelagic fishing fleet consists of three vessels – two longliners (FV Pakasoa and FV Tuipuga) and one purse-seiner (FV Taina). In 2018 the purse-seiner made an estimated total catch of 10,995 mt in 2018, 9,271 mt (84.3%) of which was skipjack tuna (Government of Tuvalu 2018). This was significantly higher than the 2017 catch (Table 17 Purse-seine catches by domestic fleet). Tuvalu's two longliners made an estimated total catch of 294 mt in 2018, 118 mt (40.1%) of which was albacore tuna (Table 18 Longline catches by domestic fleet) (Government of Tuvalu 2018).

Table 17
Purse-seine catches by domestic fleet
Source: TFD 2018 Annual Report and WCPFC Tuna Fisheries Yearbook 2017

YEAR	BIGEYE CATCH		SKIPJACK CATCH		YELLOWFIN CATCH		TOTAL CATCH (MT)
	MT	%	MT	%	MT	%	
2009	86	1.9	4,028	91.0	314	7.1	4,428
2010	171	1.6	7,986	75.7	2,397	22.7	10,554
2011	200	2.7	5,952	80.3	1,265	17.1	7,417
2012	363	3.3	7,794	70.5	2,897	26.2	11,054
2013	260	2.3	9,688	84.9	1,468	12.9	11,416
2014	171	2.9	5,046	84.9	726	12.2	5,943
2015	60	1.3	4,288	93.5	238	5.2	4,586
2016	141	2.3	5,418	89.6	488	8.1	6,047
2017	245	3.4	4,146	77.7	1,252	18.9	3,586
2018	345	3.1	9,271	84.3	1,379	12.5	10,995

Table 18
Longline catches by domestic fleet
Source: TFD 2018 Annual Report and WCPFC Tuna Fisheries Yearbook 2017

YEAR	ALBACORE CATCH		BIGEYE CATCH		SKIPJACK CATCH		YELLOWFIN CATCH		TOTAL CATCH (MT)
	MT	%	MT	%	MT	%	MT	%	
2011	184	32.0	105	18.3	-	-	286	49.7	575
2012	435	18.9	1,408	61.3	-	-	453	19.7	2,296
2013	169	41.9	120	29.8	-	-	114	28.3	403
2014	78	40.0	76	39.0	0	0.0	41	21.0	195
2015	97	21.3	187	41.0	6	1.3	166	36.4	456
2016	52	18.4	103	36.5	3	1.1	124	44.0	282
2017	175	38.3	111	24.3	7	1.5	164	35.9	457
2018	118	40.1	63	21.4	12	4.1	101	34.4	294

CATCH BY FOREIGN VESSELS

Foreign flagged purse-seiners made an estimated total catch of 89,589 mt in Tuvalu's EEZ in 2018, of which 83,820 mt was skipjack tuna (93.6%), 4,541 mt was yellowfin tuna (5.1%), and 1,228 mt was bigeye tuna (1.4%) (Table 19 Purse-seine catches by foreign vessels) (Government of Tuvalu 2018).

Foreign flagged longliners made an estimated total catch of 3,931 mt in Tuvalu's EEZ in 2018, of which 1,314 mt (36.2%) was bigeye tuna, 1,280 mt (35.3% was yellowfin tuna, and 1,037 mt (28.5%) was albacore tuna (Table 20 Longline catches by foreign vessels) (Government of Tuvalu 2018).

Table 19
Purse-seine catches by foreign vessels
Source: TFD 2018 Annual Report

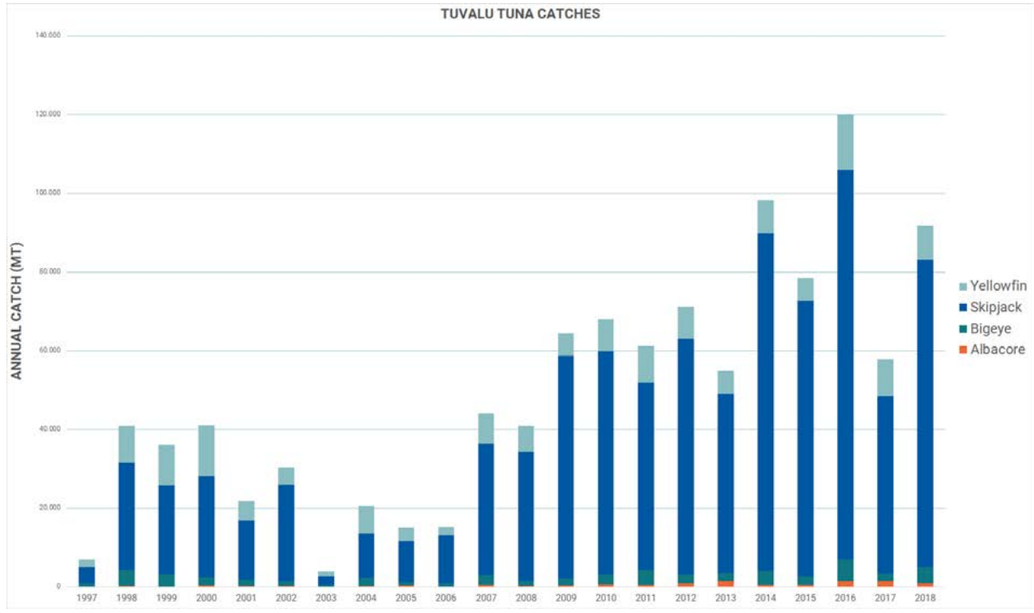
YEAR	BIGEYE CATCH		SKIPJACK CATCH		YELLOWFIN CATCH		TOTAL CATCH (MT)
	MT	%	MT	%	MT	%	
2017	770	1.3	52,960	90.2	4,966	8.5	58,696
2018	1,228	1.4	83,820	93.6	4,541	5.1	89,589

Table 20
Longline catches by foreign vessels
Source: TFD 2018 Annual Report, 2017 Annual Report

YEAR	ALBACORE CATCH		BIGEYE CATCH		SKIPJACK CATCH		YELLOWFIN CATCH		TOTAL CATCH (MT)
	MT	%	MT	%	MT	%	MT	%	
2017	1,713	43.8	441	11.3	1,755	44.9	3,909	1,713	43.8
2018	1,037	28.5	1,314	36.2	1,280	35.3	3,931	1,037	28.5

The Pacific Islands Forum Fisheries Agency (FFA) records catch data on the four main commercial species caught in the Western and Central Pacific Fisheries Commission (WCPFC) Convention Area, that is, albacore (Thunnus alalunga), bigeye (Thunnus obesus), skipjack (Katsuwonus pelamis) and yellowfin (Thunnus albacares) (Figure 10: Tuvalu tuna catches) (Government of Tuvalu 2019, SPC 2017).

Figure 10
Tuvalu tuna catches
(Source: FFA)



According to the GEF-funded Oceanic Fisheries Management Project's 2018 Transboundary Diagnostic Analysis of the Western Pacific Warm Pool Large Marine Ecosystem, the Western and Central Pacific Oceanic fisheries are currently assessed as sustainable (Vousden 2018, Oceanic Fisheries Management Project 2016).

Furthermore, the 2019 'report card' on the state of health of tuna fisheries in the Western and Central Pacific Ocean states that all four species that are economically important in the region are being fished sustainably – 'none is being overfished and overfishing is not occurring' (Pacific Islands Forum Fisheries Agency 2019).

IMPACT

Tuvalu's commercial pelagic fisheries are critical to the national economy (Government of Tuvalu 2019). They represent Tuvalu's key natural resources, main export, main non-aid source of government revenue and generate employment for Tuvaluan nationals (as official observers). While it is encouraging that tuna fisheries in the Western and Central Pacific are currently considered to be sustainable, the 2018 Transboundary Diagnostic Analysis noted that stocks of commercially important species are declining (Vousden 2018). These fisheries will only remain sustainable if steps are taken to:

- *improve fisheries management and compliance*
- *understand, assess, model and adapt to the impacts of climate change on the fish stocks*
- *base fisheries management on a better understanding of the oceanic ecosystem, and*
- *identify, mitigate and reduce land and marine-based pollution and activities that impact on the migratory tuna stocks.*

RESPONSE AND RECOMMENDATIONS

- *Continue to build the capacity of TFD to improve fisheries management and compliance.*
- *Combat IUU fishing in Tuvalu's EEZ.*
- *Invest in fish processing facilities in Funafuti to generate additional revenue and local employment.*

INDICATOR 2.9.
INSHORE FISH BIOMASS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	 	 2.4  14.4, 14.7, 14.c .	UN Fish Stocks Agreement	SAMOA Pathway 53, 58, 59, 63

DEFINITION

Trends in inshore fish capture rates.

STATUS AND TREND DISCUSSION

In addition to forming the backbone of Tuvalu's economy (through government revenue from commercial fisheries licenses, access agreements and related sources), Tuvalu's marine resources also provide the foundation of local livelihoods, food security and nutrition (Preston et al. 2016). Fish and other seafood (including lobsters, shellfish and molluscs) are an essential source of protein for Tuvaluans (particularly those living in the outer islands) (McCubbin et al. 2017). In 2004 and 2005, the urban per capita fish consumption in Tuvalu was 68.8 kg/person/year, and in rural areas 147.7 kg/person/year (Crawford et al. 2011).

Domestic fishing is dominated by subsistence and small-scale commercial activities (estimated 93% of households participating), using a variety of techniques (a total of 22 different methods, but mostly trolling for tuna and catching reef fish with handlines and gillnets). All fish, regardless of size, are caught and consumed. Traditionally, artisanal fishing was conducted using canoes dug out of Fetau (*Calophyllum inophyllum*) and Puka (*Hernandia nymphaeifolia),* but these are now being replaced by modern timber-constructed boats with outboard motors. The annual domestic artisanal fishery production is approximately 1,100 mt, which indicates a per capita fresh fish consumption of approximately 100 kg/year (Alefaio et al. 2018).

Catch data on Tuvalu's subsistence and artisanal fishery sector is incomplete, due to regular informal bartering. There is no systematic monitoring of inshore catches, with fishermen typically selling their catch either from home, the roadside, or in small markets. As a result, we must rely on proxies such as the size of fish caught or CPUE from government surveys. It is very likely that pressure on Tuvalu's inshore fisheries is growing as the nation's human population expands (Alefaio et al. 2018).

The *Falekaupule Act (2008)* mandates management of Tuvalu's coastal fisheries to island Kaupules, with technical assistance provided by TFD's Coastal Fisheries Section. The TFD Corporate Plan calls on the Coastal Fisheries Section to assist Kaupules to improve management of coastal fisheries in order to maintain livelihoods, food security, and dietary health. One mechanism through which TFD does this is through conducting creel surveys on Funafuti and the outer islands to:

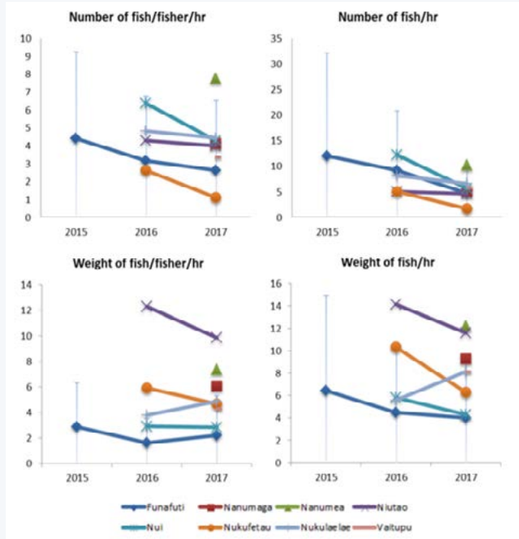
- *identify the size, contribution and importance of each type of coastal fishery*
- *profile the fishing approaches being used, fishing gear, landing sites, fishing grounds and the needs of fishers*
- *measure the catches being made, including numbers, sizes and weights*
- *assess the health of the fishery in terms of the proportion of fishes landed which are smaller than the length at maturity, and changes in CPUE*
- *identify stressed fisheries, if present, and recommend appropriate management.*

During the TFD's second creel survey (2015-17), local fishers reported anecdotal evidence that Tuvalu's inshore fisheries are unsustainable. Of fishers surveyed, 69% reported that their catches have declined in the past five years, and 61% reported that the average size of fish caught has decreased. On Funafuti in 2016, catches of 20 commonly fished species were recorded having more than 50% of the individuals below size at maturity. These included acanthurids, drummers, emperors and snappers, indicating that these species are being removed from the population before they have been able to reproduce (Alefaio et al. 2018).

The second creel survey also produced baseline CPUE data for Tuvalu's inshore fisheries for all of Tuvalu's islands aside from Niulakita (Figure 11: CPUE by island and year for four forms of catch and effort) (Alefaio et al. 2018). Healthy fisheries should yield more fish per hour than stressed fisheries and require less effort to obtain. CPUE was expressed using the following units:

- *Number of fish per fisher per hour fished (No/F/Hr)*
- *Weight (kg) of fish per fisher per hour fished (Wt/F/Hr)*
- *Number of fish per hour fished (No/Hr)*
- *Weight (kg) of fish per hour fished (Wt/Hr).*

Figure 11
CPUE by island and year for four forms of catch and effort
(Source: TFD Creel Survey Report No.2)



IMPACT

Tuvalu's inshore fisheries are critical to supporting local livelihoods and national food security (Government of Tuvalu 2016). While only limited data is available, trends of increasing CPUE suggest that current practices may not be sustainable. If this is the case, it will have significant impacts on household incomes and nutrition (Sauni and Sauni 2005). Decreasing catches will create a greater reliance on imported processed food products, which could have public health consequences (increased rates of NCDs) and increase generation of waste (food packaging).

RESPONSE AND RECOMMENDATIONS

- *Implement systematic monitoring of Tuvalu's artisanal fisheries and use the data to assess the sustainability of current fishing pressure.*
- *Review the effectiveness of existing management of inshore fisheries by Kaupules, and (if necessary) take steps to improve the effectiveness of this management (for example by banning unsustainable and destructive fishing practices, or imposing bag and size limits).*

INDICATOR 2.10. INVASIVE ALIEN SPECIES UNDER MANAGEMENT OR ERADICATED

AND INDICATOR 2.11 PRIORITY SITES WITH INVASIVE SPECIES MANAGED

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	 	 6.6  15.1, 15.5		SAMOA Pathway 95

DEFINITION

Percentage of priority invasive species eradicated from defined areas or under formal management.

DEFINITION

Percentage of priority sites with invasive species management.

STATUS AND TREND DISCUSSION

According to the Global Register of Introduced and Invasive Species (published by the IUCN Species Survival Commission's (SSC) Invasive Species Specialist Group (ISSG)) a total of 83 IAS are found in Tuvalu, comprising 14 animal species, 68 plant species, and one virus (banana bunchy top virus) (Atlas of Living Australia 2018).

Although key IAS have been identified and pathways are largely understood, no targeted strategies for control or eradication have been developed or implemented, and only limited measures are in place for preventing future IAS introduction and establishment (Global Environment Facility 2017).

To date, no management plans have been produced for controlling or eradicating IAS, and no sites are managed specifically for IAS. However, management of IAS is recognised as a priority theme in Tuvalu's NBSAP 2012-16, with objectives of establishing management plans to control and eradicate IAS and improving national capacity for biosecurity.

IMPACT

IAS generate a wide range of impacts, including on native biodiversity (through competing with, predating on, or modifying the habitat of native species), the economy (including through negative impacts on agriculture and fisheries production), and human health and well-being (for example by spreading diseases) (Global Environment Facility 2017).

RESPONSE AND RECOMMENDATIONS

DoE is soon to commence a GEF-6 project titled "Strengthening national and regional capacities to reduce the impact of IAS on globally significant biodiversity in the Pacific", implemented by the United National Environment Programmeme (UNEP) and executed by SPREP, that focuses on Tonga, Niue, Republic of Marshall Islands and Tuvalu. This project will strengthen institutional frameworks and capacities for IAS management, establish national systems for prioritising IAS management, implement programmemes for IAS risk reduction, Early Detection and Rapid Response (EDRR), eradication, control, and restoration, and establish a Pacific Islands regional support framework for IAS management.

INDICATOR 2.12. IUCN RED LIST SUMMARY

AND INDICATOR 2.13. STATUS OF THREATENED, ENDEMIC OR MIGRATORY SPECIES

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 15.5, 15.7, 15.C		SAMOA Pathway 90, 94(d)

DEFINITION

Number and types of species listed as threatened on the IUCN red list and a summary of their threats.

DEFINITION

Population abundance of identified species.

STATUS AND TREND DISCUSSION

As a Pacific Island nation, Tuvalu's biodiversity is dominated by marine species, including more than 600 species of fish. The nation's avian fauna is dominated by seabirds such as petrels, shearwaters, and terns (some of which are migratory). There are no indigenous land mammals, amphibians, or freshwater fish. The native terrestrial fauna is largely made up of insects, land crabs, and a few species of lizard (including Tuvalu's only endemic species, the Tuvalu forest gecko *Lepidodactylus tepukapili*, known only from Fuakea and Tepuka islets, Funafuti). There are 362 species of plants recorded in Tuvalu, of which only 59 are likely to be indigenous (Government of Tuvalu 2014, Thaman et al. 2017).

As of June 2020, a total of 1,451 taxa known to occur in Tuvalu have been assessed by the IUCN Red List of Threatened Species™ (the Red List). Of these, 1,428 taxa are animal species, and 23 are plants (IUCN 2020).

Of the taxa assessed, 118 taxa have been assessed as threatened, the majority of which are corals. That is, their conservation status falls into one of the Red List's three threatened categories – Vulnerable (VU), Endangered (EN), or Critically Endangered (CR) (IUCN 2020) (Figure 12: Threatened species by taxonomy).

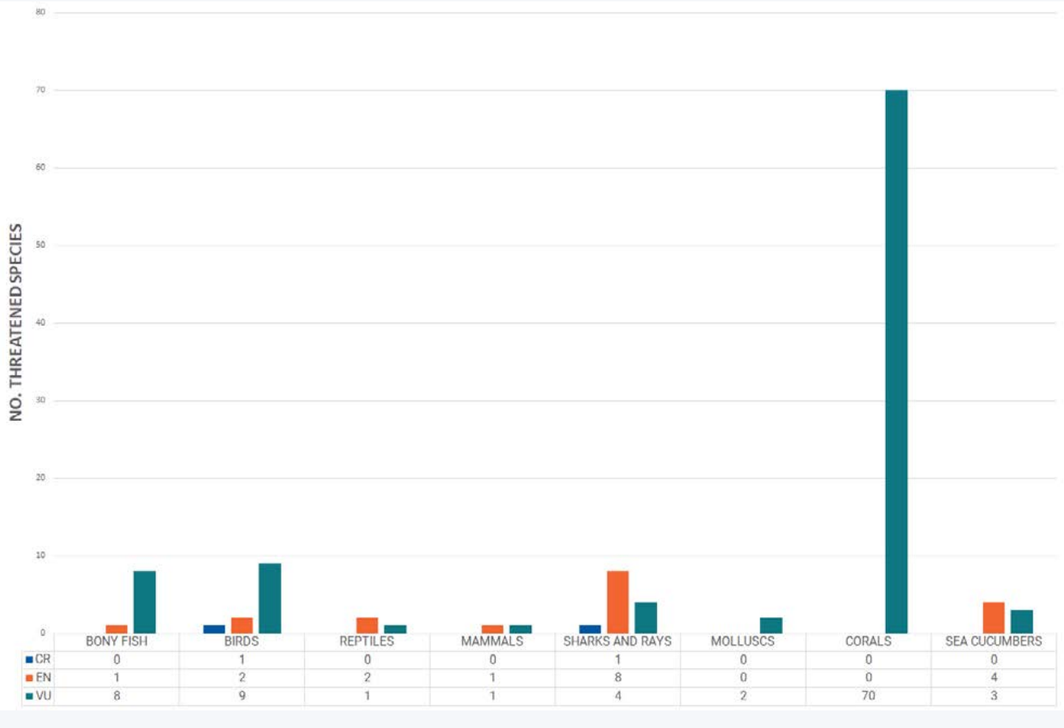
Of the threatened species found in Tuvalu:

- *Two are CR – Beck's petrel (Pseudobulweria becki) and oceanic whitetip shark (Carcharhinus longimanus)*
- *18 are EN, including green turtle (Chelonia mydas), whale shark (Rhincodon typus), longfin mako (Isurus paucus) and phoenix petrel (Pterodroma alba)*
- *98 are VU, including thorny seahorse (Hippocampus histrix), white-winged petrel (Pterodroma leucoptra), blue marlin (Makaira nigricans), ocean sunfish (Mola mola) and leatherback turtle (Dermochelys coriacea).*

The Tuvalu forest gecko is yet to be assessed by the Red List.

A summary of the most significant threats to various taxonomic groups can be found in Table 21 Key threats by taxonomic group.

Figure 12
Threatened species by taxonomy
(Source: Red List website)



	BONY FISH	BIRDS	REPTILES	MAMMALS	SHARKS AND RAYS	MOLLUSCS	CORALS	SEA CUCUMBERS
CR	0	1	0	0	1	0	0	0
EN	1	2	2	1	8	0	0	4
VU	8	9	1	1	4	2	70	3

IMPACT

Despite the impacts of threats including overharvesting, pollution, invasive species and climate change, much of Tuvalu's biodiversity is relatively well protected, with only a small number of species assessed as being globally threatened (IUCN 2020). This is likely due to the fact that Tuvalu's biodiversity largely comprises marine species – distributed over Tuvalu's vast EEZ.

Marine species in Tuvalu's shallow marine environments and terrestrial species generally face greater threats, particularly through overharvesting and pollution. However, Tuvalu has a relatively small human population (more than half of whom resides in Funafuti), with pollution relatively localised to population centres and landfill sites.

RESPONSE AND RECOMMENDATIONS

- *Conduct surveys to better understand the distribution and abundance of the Tuvalu forest gecko.*
- *Develop a better understanding of national-level conservation priorities through a national Red List process.*

Table 21
Key threats by taxonomic group
Source: Red List website

TAXONOMIC GROUP	KEY THREATS
MARINE MAMMALS	• Biological resource use (fishing and harvesting marine resources – including bycatch) • Climate change and severe weather (habitat shifting and alteration) • Pollution
BIRDS	• Biological resource use (fishing and harvesting marine resources) • Biological resource use (hunting and trapping terrestrial animals) • Climate change and severe weather (habitat shifting and alteration) • Climate change and severe weather (storms and flooding) • Pollution • Invasive species
BONY FISH	• Biological resource use (fishing and harvesting marine resources) • Climate change and severe weather (habitat shifting and alteration) • Pollution
SHARKS AND RAYS	• Biological resource use (fishing and harvesting marine resources) • Climate change and severe weather (habitat shifting and alteration) • Pollution
REPTILES	• Biological resource use (fishing and harvesting marine resources) • Climate change and severe weather (habitat shifting and alteration) • Pollution
CORALS	• Pollution • Climate change and severe weather (temperature extremes) • Climate change and severe weather (storms and flooding) • Invasive species

3.3 THEME 3. ATMOSPHERE AND CLIMATE

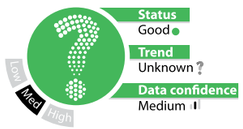
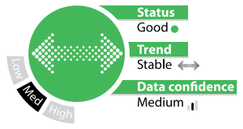
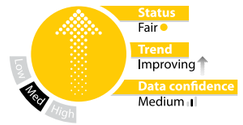
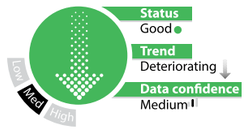
INTRODUCTION

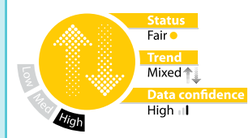
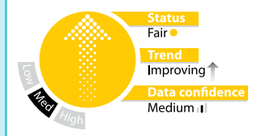
Tuvalu is one of the world's most vulnerable countries to the impacts of global climate change. All of the nation's nine atolls and reef islands are extremely low-lying, with an average elevation of about 1 m above sea level, and a maximum elevation of less than 5 m. This makes the nation particularly vulnerable to sea level rise and the impacts of tropical cyclones. Total land area is only 26 km^2, with a very high human population density and very limited agricultural land. Deposition of sediment and protection from erosion by wave action is dependent upon the health of Tuvalu's coral reefs, which are vulnerable to changes in ocean surface temperature and pH. The nation is dependent on rainwater as a source of freshwater, having very limited fresh groundwater unsuitable for human consumption. As a result, climate change mitigation and resilience are priorities for the GoT, and the nation seeks to be a world leader in limiting GHG emissions and promoting renewable sources of energy.

It is relatively simple to develop measurable indicators for climate change mitigation – here we include trends in GHG emissions and electricity generation from renewable sources. It is more challenging to measure climate-related financial losses and changes in vulnerability to the impacts of climate change. Although we include indicators on climate-related deaths and losses, funding for climate change adaptation, and community-level vulnerability to climate change, relatively limited data is available on these topics.

Moreover, the impacts of climate change can likely already be seen in the status and trends of indicators under Theme 2. Island and Ocean Ecosystems – particularly with regards to live coral cover (indicator 2.3), water quality (indicators 2.4 and 2.5), fisheries (indicators 2.8 and 2.9), invasive species (indicators 2.10 and 2.11) and threatened species (indicators 2.12 and 2.13). As such, these indicators can themselves function as proxy indicators for climate change vulnerability.

Table 22
Atmosphere and Climate highlights

INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
3.1 TREND IN GHG EMISSIONS		• National GHG emissions are tiny on the global scale • Most recent national GHG inventory published in 2015 • 61% of emissions can be attributed to energy sector (including electricity generation and transport) • Insufficient data to determine trends	• Implement Enetise Tutumau priority actions • Prepare a third national GHG inventory to determine emissions trends
3.2 TREND IN CONSUMPTION OF OZONE DEPLETING SUBSTANCES		• A party to the Montreal Protocol • chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) • Import of CFCs ceased in 2000 • Member of Montreal Protocol Pacific Island Countries Network • In process of phasing-out consumption of HCFCs	• Continue phase-out of HCFCs
3.3 RENEWABLE ENERGY		• Electricity generation traditionally from diesel fuel • Plans to achieve 100% generation from renewable sources by 2025 • Currently about 65% of electricity generation through renewable sources • Significant investment in solar power	• Implement Enetise Tutumau priority actions
3.4 CLIMATE-RELATED DEATHS 3.5 CLIMATE-RELATED LOSSES		• One of the world's most vulnerable countries to the impacts of climate change • To date no deaths directly attributable to climate change • Difficult to estimate financial losses to date • Likely to be significant future financial impacts and potentially loss of life	• Implement strategies as defined by Te Kaniva – National Climate Change Policy
3.6 FUNDING FOR CLIMATE CHANGE ADAPTATION		• Funding secured in recent years from a large number of international donors • More than $15 million in the last three years • Resulting in increased national resilience to the impacts of climate change	• Continued international investment required • Must be accompanied by capacity building

INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
3.7 CLIMATE CHANGE PREPAREDNESS 3.7A ADAPTATION PLANNING 3.7B ADDRESSING IMPACTS AND VULNERABILITIES 3.7C MAINSTREAMING CLIMATE ADAPTATION	  	• Effective National Adaptation Planning processes are in place and the country has the capacity to access climate finance. • A proposal is underway to develop an updated National Adaptation Plan • Tuvalu has the capacity to monitor current climate impacts effectively and early warning systems and disaster risk management processes are in place. • Climate change vulnerabilities are assessed systematically, and possible future impacts are well understood. • Climate change considerations have been incorporated into key national level development plans and EIA legislation; a process supported by the provision of accessible climate change information	• Further investment and support for climate change adaptation is needed • Better communication of long-range climate warnings and strengthened community disaster committees are needed • Capacity gaps remain in hydrology, forecasting and climate services.

INDICATOR 3.1.
TREND IN GHG EMISSIONS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 7.2 11.b 13.2	UNFCCC	SAMOA Pathway 43

DEFINITION

Trend in annual GHG emissions.

STATUS AND TREND DISCUSSION

With a total population of less than 11,000, Tuvalu's GHG emissions are insignificant both on a global scale (representing less than 0.01% of total global emissions) and on a per capita basis. However, as one of the world's most vulnerable countries to the impacts of climate change (particularly sea level rise and changes in rainfall patterns), Tuvalu wishes to become a world-leader in reducing carbon emissions (through moving away from fossil fuels and investing in renewable energy) (Government of Tuvalu 2012).

As a signatory to the UNFCCC, Tuvalu has produced two national GHG inventories. The first was based on data from 1994 but was severely limited due to a lack of available data (Government of Tuvalu 1999). Although it reported total annual emissions of 4.69 Gg CO_2-e (almost entirely CO_2 produced by the energy sector), this figure was based on incomplete data and should therefore not be used for determining trends in emission.

Tuvalu's second national GHG inventory was published in 2015, based on emissions data from 2014 (energy sector) and 2002 (other sectors) (Government of Tuvalu 2015). It included updated emissions factors, estimation parameters and criteria to estimate GHGs. This report included estimates for more categories and the data presented was much more complete than the 1994 national GHG inventory.

While the second national GHG inventory reports higher emissions for all sectors than the first national GHG inventory (total 18.467 Gg CO_2-e), this likely represents both 'genuine' increases in emissions (due to population growth and the growth of fuel-driven sectors such as road transport and national navigation), and 'non-genuine' increases resulting from improvements in the data. As a result, we cannot make direct comparisons between the two inventories, and should treat the data from the second national GHG inventory as a baseline for future assessment (Government of Tuvalu 2015).

Of the total 2014 emissions of 18.467 Gg CO_2-e, 11.214 Gg (61%) can be attributed to the energy sector. The main GHGs emitted by Tuvalu are CO_2 (60.4% of total emissions), CH_4 (16.4%), and N_2O (23.1%) (Figure 13: National CO2-e emission by direct GHG (%), 2014).

The energy sector (which includes the transport sub-sector) produces 100% of Tuvalu's CO_2 emissions. CH_4 emissions are largely produced by the waste sector (74.7%), although the agriculture sector also makes a significant contribution (24.7%). N_2O is primarily produced by the agriculture sector (90.7%), with the waste sector producing 8.7%.

Tuvalu's electricity generation is predominantly through diesel-fuelled generators, which are a major source of Tuvalu's CO_2 emissions. However, since 2012 there has been significant donor-investment in developing renewable energy sources (particularly the development of rooftop solar photovoltaic systems, see Indicator 3.3. Renewable energy) (Hemstock and Radanne 2006). In 2015 Tuvalu generated 6,353.71 MW of electricity, 5,553.34 MW of which (87%) was through diesel generation of that 5,306.06 MW (84%) was generated in Funafuti. Tuvalu's reliance on diesel fuel for energy generation makes the country vulnerable to fluctuations in the price of diesel on the international market (Hemstock and Radanne 2006).

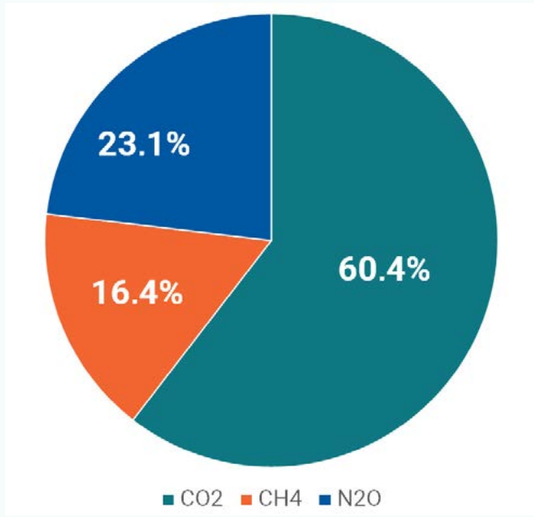


Figure 13
National CO2-e emission by direct GHG (%), 2014
(Source: GoT Second GHG inventory)

Following electricity generation, transport (including road transport and national navigation) is the next largest contributor of emissions in Tuvalu (40.5% of national CO_2 emissions associated with fuel combustion). While emissions from national navigation (inter-island shipping using both small outboard engine powered boats and three government owned ships) accounts for a much larger share of emissions than road transport, emissions from road transport are growing with the rising use of imported vehicles (cars and motorbikes).

Of the 4.62 Gg CO_2-e produced by Tuvalu's agriculture sector in 2002, 3.9 Gg comprise N_2O, resulting from enteric fermentation by grazing animals.

Emissions by Tuvalu's waste sector (total 2.64 Gg CO_2-e in 2002) are largely made up of CH_4 (2.27 Gg), resulting from the breakdown of organic elements of solid waste.

IMPACT

Although there is currently insufficient data to accurately determine trends in Tuvalu's GHG emissions, significant steps have been taken to reduce Tuvalu's dependence on diesel fuel for electricity generation. Given that this represents the principal source of national CO_2 emissions, it is likely that GHG emissions from this source are falling.

However, population growth and Tuvalu's growing economy are likely resulting in increasing GHG emissions associated with road transport and inter-island shipping. It is not clear to what degree this increase is counteracting decreasing GHG emissions associated with investment in renewable energy.

RESPONSE AND RECOMMENDATIONS

- *Continue to implement the priority activities defined by the Enetise Tutumau Implementation Strategy.*
- *Initiate preparation of a third national GHG inventory, to allow identification of trends in emissions since 2014.*

INDICATOR 3.2.
TREND IN CONSUMPTION OF OZONE DEPLETING SUBSTANCES

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 7.2 11.b 13.2	Montreal Protocol	Samoa Pathway 45

DEFINITION

Trend in consumption of ozone depleting substances (ODS).

STATUS AND TREND DISCUSSION

Tuvalu is a party to the Vienna Convention and the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol), and has ratified five amendments to the Montreal Protocol (Table 23 Tuvalu ratification of ozone treaties).

Table 23
Tuvalu ratification of ozone treaties
Source: Government of Tuvalu

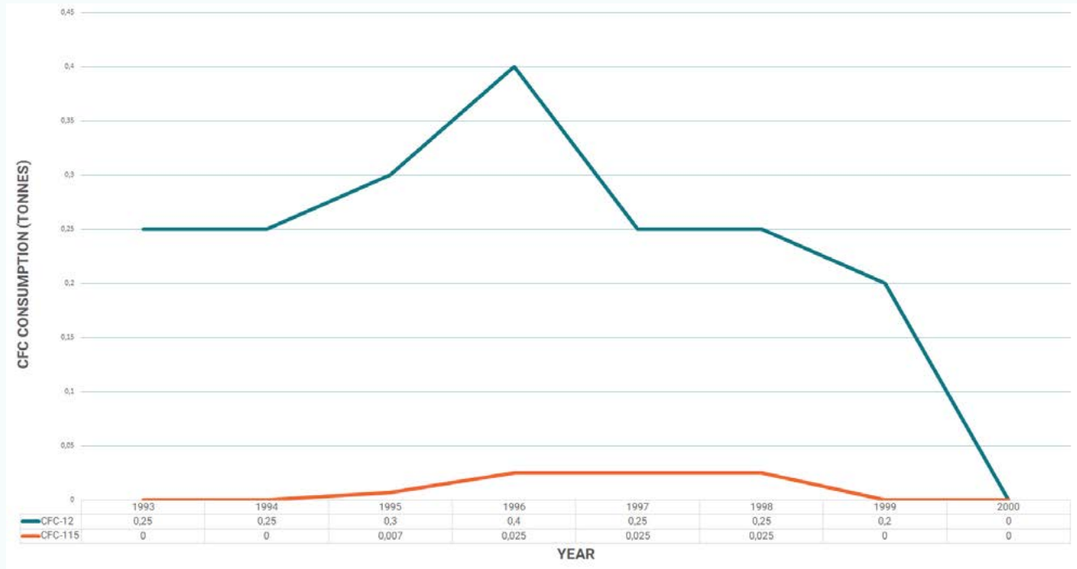
OZONE TREATY	DATE OF RATIFICATION
Vienna Convention (1985)	15 July 1993
Montreal Protocol (1987)	15 July 1993
London Amendment (1990)	31 August 2000
Copenhagen Amendment (1993)	31 August 2000
Montreal Amendment (1997)	31 August 2000
Beijing Amendment (1999)	04 October 2004
Kigali Amendment (2016)	21 September 2017

As a developing country, Tuvalu is listed under Article 5 of the Montreal Protocol, and therefore provided with assistance to phase-out consumption of CFCs by 2010, HCFCs by 2030, and HFCs by 2024.

According to Tuvalu's 2010 National Compliance Action Strategy (NCAS) to implement the Montreal Protocol, only two types of ODS are known to have been imported into Tuvalu – CFCs and HCFCs, both in very small quantities. All consumption of these substances is through the refrigeration and air conditioning service sector (Government of Tuvalu 2010).

Until 1999, CFCs (particularly CFC-12 but also CFC-502) were imported via Fiji for refrigeration purposes (Sale-Mario et al 2004). Fiji's decision to cease import of CFCs from 2000 meant that imports to Tuvalu also ceased at this time (Figure 14) (Government of Tuvalu 2010).

Figure 14
Consumption of CFCs in Tuvalu (tonnes)
(Source: NCAS)



NB. CFC-502 is a mixture of 51.2% CFC-115 and 48.8% HCFC-22. It is reported here as its components

YEAR	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
IMPORT QUOTA	1.64	1.64	1.48	1.48	1.48	1.48	1.48	1.07	0.53	0

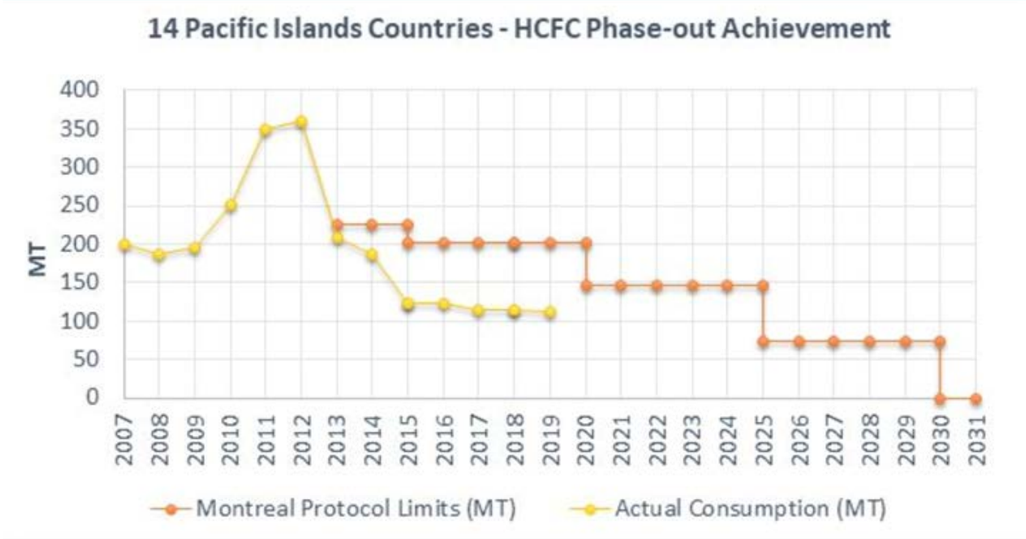
Table 24
HCFC phase-out schedule (tonnes)
Source: NCAS

Between 2000 and 2010, Tuvalu's use of HCFCs increased slightly, due to the increased use of HCFC-22 in air conditioning and refrigeration equipment (Government of Tuvalu 2010). Since 2013, an annual quota system has been implemented to regulate the import of HCFCs and ensure a complete phase-out by 2030 (Table 24 HCFC phase-out schedule (tonnes)).

Tuvalu is a member of the Montreal Protocol Pacific Island Countries Network, which was established in 2008 to support compliance with the Montreal Protocol, in recognition of these countries' unique social, economic and environmental characteristics. By 2016 these countries had achieved an 85% reduction in HCFC consumption since 2009, well ahead of their HCFC phase-out obligations (Figure 15: HCFC phase-out).

HFCs are widely used as alternatives to CFCs and HCFCs. Although they are not ODSs, they contribute to global climate change and are controlled under the Kigali Amendment. Having ratified the Kigali Amendment in 2017, Tuvalu will ban the import of HFCs by 2024.

Figure 15
HCFC phase-out
(Source: Montreal Protocol Pacific Island Countries network)



IMPACT

By ceasing consumption of CFCs and being close to completely phasing-out consumption of HCFCs, Tuvalu is contributing to global efforts to protect the ozone layer, protecting the planet's surface from harmful ultraviolet radiation emitted by the sun.

RESPONSE AND RECOMMENDATIONS

- *Continue efforts to completely phase-out national consumption of HCFCs and HFCs*

INDICATOR 3.3.
RENEWABLE ENERGY

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	3	7.2, 7.2, 7.a, 7.b	UNFCCC	Samoa Pathway 47-50

DEFINITION

Trend in percentage of annual national production of energy from renewable sources.

STATUS AND TREND DISCUSSION

Tuvalu has traditionally relied on imported diesel for electricity generation (see Indicator 3.1. Trend in GHG emissions), leaving the country vulnerable to fluctuations in the cost of imported fuel (currently 7-10% of GDP is spent on imported fuel) (Hemstock and Radanne 2006). Tuvalu's current electricity generation system consists of centralised diesel generators with associated medium and low voltage distribution networks – all owned and operated by TEC. Funafuti currently consumes about 85% of electricity generated by TEC (Government of Tuvalu 2012).

In 2004, the total energy consumption was 4.6 ktoe (kilotonnes of oil equivalent), with oil accounting for 3.8 ktoe and biomass 0.8 ktoe (Figure 16: Energy consumption). Annual energy consumption was more than 0.4 ktoe per capita (approximately 10% of per capita consumption in most industrialised nations) (Hemstock and Radanne 2006).

In 2012, Tuvalu was using 1.76 million litres of diesel fuel per year at a cost of AU$1.5/litre.

The economic impacts of this situation have prompted the development of policies aimed at reducing reliance on fossil fuels, and therefore reducing costs and increasing energy security.

The 2009 National Energy Policy (NEP) has a goal of promoting the use of renewable energy resources and cost-effective, equitable, reliable, accessible, affordable, secure and environmentally sustainable energy systems to improve the well-being of the people of Tuvalu.

Tuvalu's 2012 Master Plan for Renewable Electricity and Energy Efficiency ("Enetise Tutumau") aims for 100% of Tuvalu's electricity generation to be from renewable sources by 2020 (now extended to 2025), and to increase energy efficiency in Funafuti by 30%. Meeting this goal requires developing at least 6 MW of renewable electricity generation capacity (Government of Tuvalu 2012).

Since 2009 there has been significant investment in developing renewable energy sources in Tuvalu, including installing photovoltaic (PV) arrays and wind turbines. The Government's priority has been the outer islands, due to the cost and risk associated with transporting diesel fuel to these islands (although diesel generators will remain on these islands for the fore-

seeable future, as back-up systems). Initiatives implemented to date include:

- *a 40 kW rooftop solar system, donated by e8*
- *a 46 kW solar power system on a secondary school*
- *TEC's 2011 "1000 solar roof" programmeme which planned to install PV arrays over about half of the roof space on Funafuti*
- *signing the Majuro Declaration by the Pacific Islands Federation in 2013*
- *establishing the Renewable Energy and Energy Efficiency Unit with TEC*
- *the US$7 million Tuvalu Energy Sector Development Project funded by the World Bank, which commenced in 2014*
- *a 170 kW solar photovoltaic system installed on two government-owned buildings in Funafuti in 2015*
- *hybrid power systems installed on Nukulaelae, Nukufetau and Niu in 2015, with EU funding*
- *the ADB-funded Pacific Renewable Energy Investment Facility that was set up to support 11 small Pacific island countries to transition electricity generation to sustainable renewable sources, including installing additional solar capacity and battery storage systems*
- *the installation of 3,557 kW of solar power between 2008 and 2019, alongside 14,762 kWh of battery storage systems.*

In 2018, TEC generated a total of 1,453,302 kWh, of which 339,685 kWh (23%) were from diesel, 1,085,887 kWh (75%) were from solar, and 27,730 kWh (2%) were from other renewable sources. To the end of July 2019, TEC had generated a total of 846,299 kWh, of which 293,821 kWh (35%) were from diesel and 552,478 kWh (65%) were from solar (Tuvalu Electricity Corporation 2019). Although this data is too limited to allow identification of reliable trends, it does show that a significant proportion of Tuvalu's energy generation is already from renewable sources.

IMPACT

As one of the world's most vulnerable countries to the impacts of climate change, Tuvalu intends to become a world leader in reducing GHG emissions and promoting renewable energy. While a significant proportion of Tuvalu's electricity generation is still derived from fossil fuels, the majority is from renewable sources (mainly solar power), particularly on Tuvalu's outer islands.

RESPONSE AND RECOMMENDATIONS

- *Continue to implement Enetise Tutumau: Master Plan for Renewable Electricity and Energy Efficiency.*

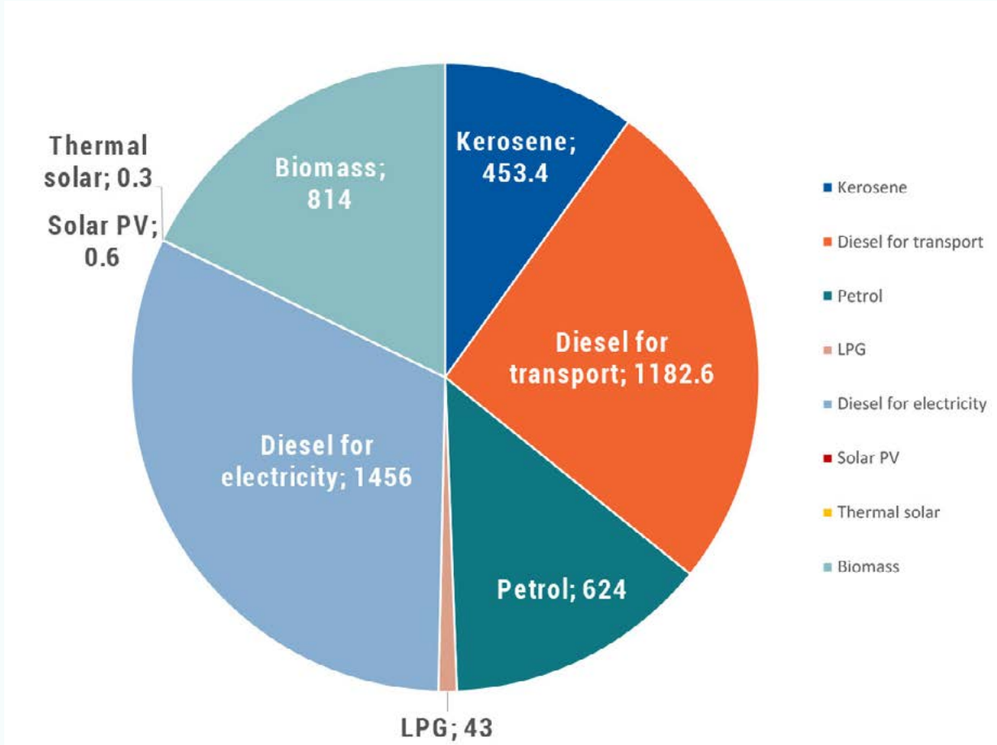


Figure 16
Energy consumption by source (toe)
(Source: Tuvalu Renewable Energy Study: Current Energy Use and Potential for Renewable Energies (2006))

INDICATOR 3.4. CLIMATE-RELATED DEATHS

DEFINITION

Number of annual climate-related deaths from declared disasters.

AND INDICATOR 3.5. CLIMATE-RELATED DISASTER LOSSES

DEFINITION

Total annual dollars of financial loss occurring due to climate-related disaster (cyclones, floods, landslides, drought) national government losses.

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		11.b 13.1	UNFCCC	Samoa Pathway 51-52

STATUS AND TREND DISCUSSION

Tuvalu is one of the world's most vulnerable countries to the impacts of climate change, particularly sea-level rise, changes in ocean temperature and pH, changes in patterns of rainfall, and changes in the frequency and intensity of extreme weather events (particularly tropical cyclones) (Government of Tuvalu 2012). As a result, Tuvalu is taking steps to both mitigate the effects of climate change (although its current level of GHG emissions are insignificant on a global scale) and adapt to the expected impacts of climate change (through building resilience).

To date there have been no deaths directly attributable to the impacts of climate change. This is potentially a result of the effectiveness of Tuvalu's current adaptation efforts and increased resilience. However, if rising temperatures result in more frequent and powerful tropical cyclones making landfall on Tuvalu's islands (as is anticipated), it seems inevitable that these will eventually result in increased human mortality.

The most serious extreme weather event to impact Tuvalu in recent years was the category-5 Tropical Cyclone Pam (TC Pam) which passed close to Tuvalu between 10th and 11th March 2015. The strongest cyclone on record to make landfall in the South Pacific region, TC Pam caused massive destruction to Tuvalu, Kiribati, Solomon Islands, and particularly Vanuatu (where 11 people died). Affecting almost half of Tuvalu's population, the 350 km/h wind gusts and 3.4 m 'king tides' caused an estimated AU$14 million in damage (more than 25% of Tuvalu's GDP), flooded significant parts of the nation (destroying crops and filling pulaka pits with sediment), and forced more than 300 people to evacuate their homes (World Bank 2015). However, tropical cyclones are a normal weather phenomenon, and as such the economic cost of TC Pam cannot be directly attributed to climate change.

IMPACT

Between March and May 2015, the World Bank and Government of Tuvalu conducted damage and loss assessments, with a focus on agriculture and food security, infrastructure, water supply, sanitation and hygiene, health, education, electricity, communications, and transport (Table 25: Summary of damage and losses).

SECTOR/SUBSECTOR	EXTENT OF DAMAGES	LOSSES (AU$)
AGRICULTURE AND FOOD SECURITY		
Crops and home gardens	-	957,729
Livestock	-	1,408,442
Fisheries	-	489,912
INFRASTRUCTURE		
Housing totally destroyed	24	768,000
Housing partially destroyed	17	174,080
Houses with minor damages	206	527,360
Local kitchens	117	350,720
Community kitchens	51	326,400
Community halls	9	416,000
Kaupule houses	5	12,800
Demolition, rubble removed	-	76,800
Seawall (m)	1,970	7,168,909
WATER SUPPLY, SANITATION, AND HYGIENE		
Water tanks	30	90,880
Toilets	61	58,560
Septic tanks destroyed	9	28,800
Septic tanks damaged	48	30,720
HEALTH/EDUCATION		
Hospitals/clinics damaged	3	211,200
Incinerator	1	96,000
Schools damaged	5	54,400
ELECTRICITY/COMMUNICATIONS		
Communication	-	171,962
Electricity	-	38,400
TRANSPORT		
Harbour/boat ramps	5	160,000
Roads (km)	10.5	336,000
	Total	**13,954,076**

Table 25
Summary of damage and losses
Source: Tuvalu TC Pam Recovery: Vulnerability Reduction Plan

There are a variety of mechanisms by which the future impacts of climate change are likely to generate economic losses for Tuvalu:

- *Changes in the frequency and severity of tropical cyclones may cause damage as described above.*
- *Changes in rainfall patterns may reduce availability of freshwater for human consumption.*
- *Changes in sea surface temperature and pH will damage coral, reducing rates of sediment production and therefore increasing coastal erosion due to wave action.*
- *Changes in water temperature are also likely to lead to changes in fish habitat and movement patterns, impacting Tuvalu's inshore and pelagic fisheries.*
- *Sea level rise will inundate land, damaging agricultural land, crops, vehicles and homes. Loss of agricultural land will increase reliance on imported food products.*
- *Given that much of Tuvalu's land is less than 2 m above sea level, extreme sea level rise could even generate incalculable economic losses in the form of the total loss of habitable land.*

It is difficult to accurately predict the scale of future economic losses and mortality associated with climate change, or to confirm if Tuvalu is already experiencing such losses. However, we can confidently predict that there will be losses, and that they are likely to be significant. If global growth remains on its current fossil-fuel intensive model, total climate change costs in the Pacific are predicted to reach 12.7% of annual GDP equivalent by 2100 (Asian Development Bank 2013).

RESPONSE AND RECOMMENDATIONS

Tuvalu's national responses to climate change are guided by Te Kaniva – Tuvalu Climate Change Policy 2012 (Government of Tuvalu 2012). This has a vision "to protect Tuvalu's status as a nation and its cultural identity and to build its capacity to ensure a safe, resilient and prosperous future". It aims to achieve this vision by guiding the implementation of strategies associated with the following goals:

1. Strengthening adaptation actions to address current and future vulnerabilities.
2. Improving understanding and application of climate change data information and site-specific impacts assessment to inform adaptation and disaster risk reduction programmemes.
3. Enhancing Tuvalu's governance arrangements and capacity to access and manage climate change and disaster risk management finances.
4. Developing and maintaining Tuvalu's infrastructure to withstand climate change impacts, climate variability, disaster risks and climate change projection.
5. Ensuring energy security and a low carbon future for Tuvalu.
6. Planning for effective disaster preparedness, response and recovery.
7. Guaranteeing the security of the people of Tuvalu from the impacts of climate change and the maintenance of national sovereignty.

INDICATOR 3.6.
FUNDING FOR CLIMATE CHANGE ADAPTATION

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 6.6 12.2 13.1 14.2, 14.5 15.1	UNFCCC	Samoa Pathway 51-52

DEFINITION

Total funds received for climate adaptation and mitigation projects

STATUS AND TREND DISCUSSION

Although Tuvalu's GHG emissions are insignificant on a global scale (see Indicator 3.1. Trend in GHG emissions), the nation is seeking to reduce its GHG emissions in order to set a global example.

Tuvalu's vulnerability to the impacts of climate change means that funding for climate change adaptation is a priority for the GoT. Since 2000, Tuvalu has received funding from a wide variety of international sources, including the Agence Française de Développement (AFD), ADB, APEC Climate Centre, the Australian Government, EU, GEF, the Global Climate Change Alliance (GCCA), Government of the Republic of Korea, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Government of Finland, International Federation of Red Cross (IFRC), International Labour Organization (ILO), Japan International Cooperation Agency (JICA), the Norwegian Government, UNDP, UNEP, United States Agency for International Development (USAID), SPC, SPREP, and Tokyo University (Government of Tuvalu 2015).

Tuvalu's 2019 (Table 26 2019 funding for climate change adaptation), 2018 (Table 27) and 2017 (Table 28) national budgets included the following projects approved by international development partners that include a focus on climate change adaptation.

Table 26
2019 funding for climate change adaptation
Source: Tuvalu 2019 budget

PROJECT	DONOR	2019 BUDGET (AU$)	
National Adaptation Programme of Action (NAPA II)	GEF/UNDP	$ 70,779	
Tuvalu Coastal Adaptation Project (TCAP)	GCF	$ 2,000,000	
Strengthening water Project	MFAT	$ 185,714	
Institutional Strengthening in Pacific Island Countries to Adapt to Climate Change (ISAAC) Project	USAID	$ 198,609	
Climate Change and Health Resilience	KOICA	$ 230,000	
Ridge to Reef project	GEF/UNDP	$ 974,026	
	Total	**$ 3,659,128**	

Table 27
2018 funding for climate change adaptation
Source: Tuvalu 2018 budget

PROJECT	DONOR	2018 BUDGET (AU$)	
NAPA II	GEF/UNDP	$ 541,161	
TCAP	GCF	$ 2,000,000	
Strengthening water Project	MFAT	$ 200,000	
Building safety Resilient in the Pacific	EU/SPC	$ 136,000	
ISSAC project	USAID	$ 152,420	
Ridge to Reef project	GEF/UNDP	$ 500,000	
	Total	**$ 3,529,581**	

Table 28
2017 funding for climate change adaptation
Source: Tuvalu 2017 budget

PROJECT	DONOR	2017 BUDGET (AU$)	
NAPA II	GEF/UNDP	$ 4,475,285	
TCAP	GCF	$ 2,674,725	
Strengthening water project	MFAT	$ 133,000	
Building Safety Resilient in the Pacific	EU/SPC	$ 200,000	
Ridge to Reef Project	GEF/UNDP	$ 500,000	
	Total	**$ 7,983,010**	

This indicates that (at least in recent years) significant resources have been made available from international sources to support climate change adaptation efforts in Tuvalu. Insufficient data is available to determine longer-term trends in funding availability.

IMPACT

By successfully raising funds from international development partners for projects aimed at climate change adaptation Tuvalu has been able to take steps to increase its resilience to climate change impacts, including through climate-smart development, strengthening the economy, identifying research priorities, education and public awareness, investing in renewable energy, and improving agricultural practices.

RESPONSE AND RECOMMENDATIONS

Continued international investment is needed to support Tuvalu's resilience to the impacts of climate change. However, given the size of Tuvalu's population (and particularly its public sector), it may have reached its absorptive capacity in terms of funding support. Proving a greater scale of funding may not be effective if it is not accompanied by technical support and capacity building, and may lead to dependency.

INDICATOR 3.7.
CLIMATE CHANGE PREPAREDNESS

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		11.5 13.1, 13.2 13.3	UNFCCC Sendai Framework for Disaster Risk Reduction	Samoa Pathway 11, 15, 31-46, 51, 52

DEFINITION AND METHODOLOGY

As Tuvalu is highly vulnerable to the impacts of climate change, it is important to track and measure the country's preparedness and progress on climate change adaptation. The three indicators, 'Adaptation Planning', 'Addressing Impacts and Vulnerabilities', and 'Mainstreaming Climate Adaptation' have been developed as composite indicators, drawing upon sub-indicators which were developed for a Pacific Climate Preparedness Scorecard. When combined, these indicators give an overall picture of how Tuvalu is progressing in regards to climate change adaptation and preparedness.

The methodology, developed for the Pacific Climate Preparedness Scorecard, draws upon a number of internationally recognised frameworks and is designed to provide a high-level assessment of climate change preparedness in each Pacific nation, across 14 indicators. The indicators have been compiled into a scorecard format with each evaluated against clearly defined "No", "Partial", or "Yes" criteria. The criteria were developed to be as objective and unambiguous as possible to allow the practitioner to make an accurate, evidence-based assessment. Sources of evidence which are used to inform each indicator are recorded alongside a short summary.

STATUS AND TREND DISCUSSION

Indicator 3.7a Adaptation Planning:

Effective National Adaptation Planning processes are in place and the country has the capacity to access climate finance.

Tuvalu has made good progress with adaptation planning, but given the size of the adaptation challenge further investments and support are needed. Tuvalu has a National Adaptation Plan (the Joint National Action Plan) (NAP) but this lapsed in 2016 and a proposal is underway to develop an updated Plan. Efforts have been made to engage key sectors and to develop stakeholder engagement processes as part of the National Strategic Action Plan for Climate Change and DRM (NSAP) and through current projects, however these processes have not been formalised. Tuvalu has been able to successfully access climate finance, working with an Accredited Entity (UNDP) to implement a medium-sized project (Tuvalu Coastal Adaptation Project, see Indicator 3.6 Funding for Climate Change Adaptation). Prioritisation of future adaptation activities aligned to the NAP is limited. There is currently no monitoring and evaluation framework or system for adaptation in place at the national level. It is anticipated that a national monitoring and evaluation framework will be developed under the planned NAP process, however this is likely around 2 years+ away.

Tuvalu is making good progress in several areas of adaptation planning, including the ongoing development of the proposal for a NAP, and the prioritisation activities and development of an monitoring and evaluation framework for climate adaptation that will be an important part of the NAP process.

The assessment of sub-indicators for this indicator can be found below:

ADAPTATION PLANNING: SUB-INDICATORS		NO	PARTIAL	YES
a.1	An up-to-date national adaptation plan (NAP; or Joint National Action Plan including an implementation plan) has been published and is being implemented.			
a.2	Adaptation action is coordinated at a sectoral level evidenced by sector adaptation plans or mainstreaming of adaptation into sector plans and policies			
a.3	Mechanisms are in place to facilitate inclusive involvement of stakeholders in national adaptation planning, including incorporation of views from sectors (horizontal) and sub-national level (vertical).			
a.4	A systematic prioritisation of adaptation activities (e.g. a Country Programmeme or project pipeline) has been undertaken with indicative costs and potential funders identified, endorsed by the relevant authority.			
a.5	Actions to address climate change adaptation are supported by a national level authoritative financial entity (e.g. a Ministry of Finance) which is able to facilitate access to international climate finance (the financial mechanisms of the UNFCCC - GEF, GCF and AF)			
a.6	A monitoring and evaluation (M&E) system or framework has been developed and implemented specifically to track climate change adaptation progress at national level (e.g. an M&E system for a NAP or JNAP).			

Indicator 3.7b Understanding Impacts and Vulnerabilities:

The country has the observational capacity to monitor current climate impacts effectively and early warning systems and disaster risk management processes are in place. Climate change vulnerabilities are assessed systematically, and possible future impacts are well understood.

Overall, Tuvalu's observation systems are sufficient to monitor weather and climate change, and the country has access to Multi-Hazard Early Warning Systems (MHEWS) with forecasts from various regional organisations such as RSMC-Nadi-Tropical Cyclone Centre. Emergency warnings are disseminated through radio and online channels, however Tuvalu has also recently installed HF radios on all islands to ensure warnings can be disseminated in the event of a power outage. Better communication of long-range climate warnings (such as for drought and El-Niño/La Niña phases) and strengthened community disaster committees have been identified as areas for improvement. The interpretation/elaboration of forecasts and warnings in Tuvalu mainly come from Fiji Meteorological Service, however Tuvalu is currently training additional staff to support forecasting. Tuvalu still has capacity gaps in hydrology (which is particularly important due to Tuvalu's reliance on the freshwater lens beneath the islands), forecasting and climate services.

Tuvalu has one of the most well-developed vulnerability and risk assessment processes in the region, with Integrated Vulnerability Assessments undertaken in eight out of nine islands in Tuvalu. Data is recorded systematically in the Tuvalu National Integrated Vulnerability Assessment (TIVA) Database, a system which is currently being enhanced. This comprehensive vulnerability data will support future adaptation planning and action, and highlight areas of high exposure and risk for implementation of adaptation interventions. Further, Tuvalu consistently uses the most up-to-date climate projections in their plans and policies, demonstrated in the National Strategic Action Plan (2012-2016), which drew on downscaled projections from the Pacific Climate Change Science Project, 2011, and the draft Tuvalu Climate Change Policy which references 2018 IPCC projections and modelling.

The assessment of sub-indicators for this indicator can be found below:

ADDRESSING IMPACTS AND VULNERABILITIES: SUB-INDICATORS		NO	PARTIAL	YES
b.1	Observational systems are in place to enable the monitoring of weather and climate change.			
b.2	The country has access to MHEWS and can effectively disseminate warnings to communities.			
b.3	An up-to-date Disaster National Disaster Management Plan (or equivalent) is in place. There is a clear coordination system that defines roles and responsibilities.			
b.4	Up-to-date scenarios and climate projections are used to inform national adaptation planning.			
b.5	A consistent approach to vulnerability assessments is used at an island level with a standardised methodology.			

MAINSTREAMING CLIMATE ADAPTATION:

Climate change considerations have been incorporated into key national level development plans and EIA legislation; a process supported by the provision of accessible climate change information.

Climate change considerations have been extensively and prominently incorporated into TKIII, with climate change impacts considered in relation to all 12 Strategic Areas. Specific climate change considerations have been included in the Environment Protection (Environmental Impact Assessment) Amendment Regulations 2017. The Tuvalu Climate Change Portal is currently being developed through the Pacific iClim2 project in partnership with the Tuvalu Climate Change Policy and Disaster Coordination Unit (CCPDCU). The Portal is not yet publicly accessible, however work to improve the Portal is ongoing. The effort Tuvalu has taken to integrate climate change impacts and considerations throughout the TKIII demonstrates the urgency Tuvalu is placing on climate change, and these considerations should be taken further into sectoral plans and processes.

The assessment of sub-indicators for this indicator can be found below:

MAINSTREAMING CLIMATE ADAPTATION: SUB-INDICATORS		NO	PARTIAL	YES
b.1	Climate change adaptation considerations are included in the country's Environmental Impact Assessment legislation (or in the developments approval document/consent licenses/approval conditions).			
b.2	National Development Plans (national strategic plans, national sustainable development plans, frameworks, or similar) consider the impacts of climate change.			
b.3	Climate change information and knowledge (including climate science; vulnerability and risk assessments; policies and plans; traditional knowledge; and information from civil society) is being collated and organised and is in publicly accessible formats.			

IMPACT

With climate change presenting an existential threat to Tuvalu, effective adaptation planning and preparedness for climate impacts must continue to be the top priority for the country. While Tuvalu has made strong progress on numerous components of climate change preparedness, including a very comprehensive vulnerability assessment process and consistently mainstreaming climate change considerations in national and sectoral plans, there is still much work to be done to ensure Tuvalu is as prepared as possible. The development of an effective National Adaptation Plan will be crucial to ensure appropriate adaptation actions can be implemented at the necessary time and are underpinned by a strong and relevant evidence base.

RESPONSE AND RECOMMENDATIONS

- *Develop a National Adaptation Plan and invest in the broader NAP process including the prioritisation of adaptation activities, the development of an M&E framework to track adaptation progress, and a systematic approach for engaging stakeholders to ensure adaptation actions consider the perspectives of all Tuvaluans*
- *Continue to build the capacity of the Tuvalu Meteorological Services with increased training opportunities for staff to improve forecasting capacity in the country, enhance capacity to monitor hydrology and ensure Tuvalu can access technological improvements.*
- *Update the National Disaster Management Plan, with clear descriptions of the roles and responsibilities of all actors (community, sectoral, national and international) and test the plan regularly*
- *Integrate the Tuvalu Climate Change Portal effectively with existing data and portals such as the TIVA database*
- *Continuing to strengthen the collation and analysis of climate observation data, Integrated Vulnerability Assessment data and climate projections can support the adaptation actions prioritised in the NAP, for example insurance-based mechanisms need timely and accurate data.*

3.4 THEME 4. BUILT ENVIRONMENT

INTRODUCTION

Management of municipal solid waste (MSW) is one of the most significant environmental issues facing Tuvalu. The nation's high population density and very limited land area means that limited land is available for disposing of solid waste.

With a growing GDP and improving connections to international markets, Tuvalu's population have increasing access to imported goods such as processed foods and luxury items. This is contributing to increasing generation of solid waste.

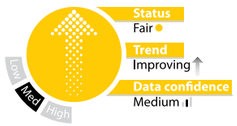
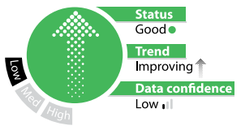
The nation has no centralised sewage collection or processing system, instead relying on the use of household septic tanks which are prone to overflowing at high tide, often 'bottomless', polluting groundwater and lagoon water, and impacting public health. The Tuvalu Multiple Indicator Cluster Surveys (MICS) found that only 8.7% of households in Tuvalu have access to drinking water that is free of *E.coli* (an indicator of faecal contamination) (UNICEF 2020).

Responsibility for waste management is held by DWM, working under the *Waste Operations and Services Act (2009)* and associated regulations (on litter control, single-use plastics and waste levy). Funding and technical support is currently provided by international organisations including the EU (European Development Fund (EDF) support for the implementation of Tuvalu's Integrated Waste Policy and Action Plan) and PacWaste (supporting the identification of stockpiles of asbestos contaminated materials (ACM).

TKIII identifies the major issues hindering waste management in Tuvalu as including limited management of landfill sites (including those on the outer islands), limited land availability for waste disposal, lack of equipment for processing waste, and lack of public awareness.

Steps are currently being taken to develop a national recycling system. Although some items are being collected and stored, arrangements are not yet in place for offshore processing of recyclable materials.

Table 29
Built Environment highlights

INDICATOR	STATUS AND TREND	KEY FINDINGS	RESPONSE AND RECOMMENDATIONS
4.1 PER CAPITA GENERATION OF MUNICIPAL SOLID WASTE		• Household waste dominated by green waste • Daily per capita MSW generation estimated at 0.43 kg on Funafuti • Per capita waste generation increasing in recent years • Landfill sites are already full, and increasing their size is not an effective long-term solution	• Strategies for improving waste management should instead focus on waste capture, resource recovery, recycling, and offshore processing • Continue to implement priority actions defined by Tuvalu Integrated Waste Policy and Action Plan
4.2 HOUSEHOLD WASTE CAPTURE RATE		• Approximately 90% of households are served by national waste collection service • Public understanding of the importance of proper waste management remains low, and as a result, widespread illegal dumping and burning of waste occurs	• Continue to implement national collection services • Take steps to increase public understanding, change behaviours, and enforce regulations • Continue to implement priority actions defined by Tuvalu Integrated Waste Policy and Action Plan
4.3 HOUSEHOLD WASTE RECYCLED		• In the process of establishing a national recycling system • Import levies are charged on 14 classes of products • This has the potential to dramatically improve Tuvalu's national waste management	• Continue to develop national recycling system, including provision of recycling services to outer islands
4.4 ACCESS TO AND QUALITY OF SEWAGE TREATMENT		• No centralised sewage treatment system – relies on septic tanks • Poorly constructed septic tanks lead to pollution of groundwater and lagoon water • Impacts on public health and economy	• Continue to implement the priority strategies defined by Tuvalu's Sustainable and Integrated Water and Sanitation Policy • Develop and implement effective water quality control strategies

INDICATOR 4.1.
PER CAPITA GENERATION OF MUNICIPAL SOLID WASTE

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
		 11.6 12.4		Samoa Pathway 71a,d

DEFINITION

Trend in average daily per capita generation of municipal solid waste.

STATUS AND TREND DISCUSSION

It estimated that in 2014 each household in Funafuti generated 23 kg of waste per week (or 0.37 kg/person/day) (Figure 17) (Government of Tuvalu 2016). Tuvalu's Integrated Waste Policy and Action Plan 2017-2026 reports that Funafuti's household waste was dominated by green waste (45.3% of total waste generated) – mainly *Pandanus*, breadfruit (*Artocarpus altilis*) and kanava (*Cordia subcordata*). Less data is available regarding waste generation on the outer islands, however a study on Nanumaga reported domestic solid waste generation of 0.33 kg/person/day, or a total of 1,080 m^3/year.

GROUP	WASTE NAME	TOTAL KG	AV. KG/ HH/WK	AV. KG/ HH/DAY	TOTAL VOL	AV. KG/ HH/WK	AV. KG/ HH/DAY	% WEIGHT
1 ORGANIC	1.1 PAPER AND CARDBOARD	49.2	2.24	0.32	831.15	37.78	0.25	9.56
	1.2 FOOD/KITCHEN	27.27	1.24	0.18	202.25	9.19	0.06	5.30
	1.3 GARDEN	233.23	10.6	1.51	2262.05	102.82	0.67	45.34
	1.4 WOOD/TIMBER	7.14	0.32	0.05	55.8	2.54	0.02	1.39
2 INORGANIC	2.1 GLASS	14.84	0.67	0.10	128.40	5.84	0.04	2.88
	2.2 ALUMINIUM CANS	3.96	0.18	0.03	73.65	3.35	0.02	0.77
	2.3 TIN CANS	20.45	0.93	0.13	292.65	13.3	0.09	3.98
	2.4 OTHER METALS	9.53	0.43	0.06	46.65	2.12	0.01	1.85
	2.5 PLASTIC BOTTLES AND CONTAINERS	0.15	0.01	0.00	3.75	0.17	0.00	0.03
	2.5.1 PET	8.40	0.38	0.05	240.90	10.95	0.07	1.63
	2.5.2 HDPE	0.62	0.03	0.00	12.90	0.59	0.00	0.12
	2.5.3 PVC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2.5.4 LDPE	0.03	0.00	0.00	0.12	0.01	0.00	0.01
	2.5.5 PP	1.11	0.05	0.01	28.05	1.28	0.01	0.22
	2.5.6 POLYSTYRENE	0.90	0.04	0.01	5.55	0.25	0.00	0.17
	2.5.7 OTHERS – NO # OR LABEL	15.28	0.69	0.10	226.77	10.31	0.07	2.97
	2.6 PLASTIC BAGS AND FILM	24.57	1.12	0.16	600.75	27.31	0.18	4.78
	2.7 ROCK AND SOIL	49.04	2.23	0.32	76.19	3.46	0.02	9.53
	2.8 LEATHER, TEXTILES, RUBBER AND VINYL FLOORING	42.27	1.92	0.27	542.70	24.67	0.16	8.22
	2.9 ALUMINIUM FOIL	3.16	0.14	0.02	44.70	2.03	0.01	0.61
	2.10 NAPPY/PADS	2.96	0.13	0.02	20.40	0.93	0.01	0.58
3 HAZARDOUS	3.1 BATTERIES, FLUORESCENT TUBES, SYRINGES, ELECTRONIC ITEMS, CHEMICAL RESIDUES, MEDICINES, FIBREGLASS AND GLUE	0.31	0.01	0.00	3.6	0.16	0.00	0.06
4 LARGE ITEMS	4.1 LARGE ITEMS	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 30
Household waste generated in Funafuti, 2014
Source: Tuvalu Integrated Waste Policy and Action Plan 2017-2026

The Integrated Waste Policy and Action Plan also reported a significant generation of bulky waste and end-of-life vehicles (ELV), and hazardous waste such as lead-acid batteries, various chemicals, used oil from transformers and healthcare waste. Tuvalu generates 5,000 litres of used oil per year, 80% of which is exported to Fiji's steel mill (Binney 2016).

The 2017 waste survey report (Sagapolutele 2017) estimated Tuvalu's daily waste generation at 0.42 kg per person per day – 60% green waste, 15% nappies, 7% plastics, 5% paper, 4% metals and glass, 2% textiles, and 3% other. These characteristics for household waste are within the range for developing countries outlined by the WHO Guides for Municipal Solid Waste Management in Pacific Island Countries (WHO 1996).

The 2019 Tuvalu Waste Audit reported that households on Funafuti generate 1,144 kg of waste per day, and other sources (such as commercial premises) generate 1,760 kg per day, giving a total daily waste generation of 2,904 kg (Sagapolutele et al. 2019). Although no data is currently available for Funafuti's population in 2019, if we assume an annual growth rate of 3% (as was observed between 2012 and 2017), we can estimate it at 6,705 persons. This would represent a per capita daily waste generation of 0.43 kg (Figure 17: Funafuti daily per capita solid waste generation (kg)).

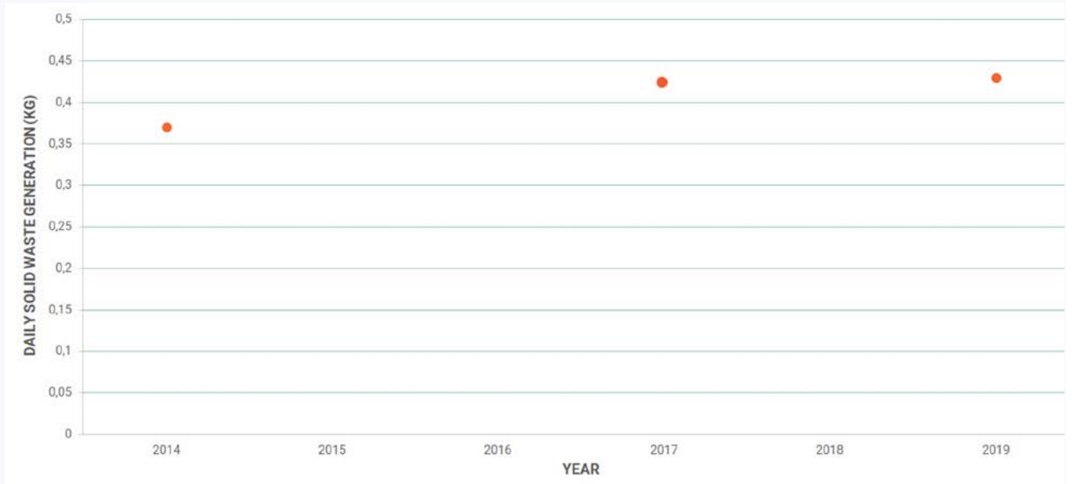


Figure 17
Funafuti daily per capita solid waste generation (kg)
(Source: Tuvalu Integrated Waste Policy and Action Plan, Sagapolutele & Binney, 2017, and 2019 Tuvalu Waste Audit)

Although the Integrated Waste Policy and Action Plan, 2017 waste survey and 2019 waste audit seem to indicate a trend of slowly increasing per capita solid waste generation, these studies may not have used consistent definitions or methodologies for measuring waste generation. As such, care should be taken in extrapolating trends from such limited data. It is likely that per capita waste generation is now decreasing, following the recent ban on the import of single-use plastics, the waste import levy, and increased awareness, education, and compliance efforts implemented by DWM staff.

IMPACT

According to the 2019 Tuvalu Waste Audit, almost 3,000 kg of MSW is being generated in Funafuti each day. This is resulting in 6-10 m^3 of household waste and 6-8 m^3 of non-household waste entering Funafuti landfill each day. Although the capacity of Funafuti landfill has recently been increased, depending on the resource recovery regime implemented and the degree to which waste is compacted, this additional landfill capacity is expected to be filled between 2025 and 2032 (Sagapolutele et al. 2019).

RESPONSE AND RECOMMENDATIONS

Tuvalu's current rate of per capita waste generation is well below both the global average (0.74 kg/person/day, according to the 2018 World Bank report What a Waste: A Global Review of Solid Waste Management), and the average for the East Asia and Pacific Region (0.95 kg/person/day) (Kaza et al. 2018). Although rates are forecast to increase globally by at least 40% between 2018 and 2050, this would still not result in an excessively high rate of MSW generation for Tuvalu.

This rate of MSW generation is only problematic for Tuvalu due to the nation's limited availability of land for waste disposal, and limited capacity for processing or recycling waste in-country. Tuvalu is seeking to reduce rates of waste generation and improve waste management through implementing the priority actions defined by the Tuvalu Integrated Waste Policy and Action Plan, including:

- *strengthening law enforcement to reduce the prevalence of illegal dumping and burning of waste*
- *banning the import of single-use plastics such as small water bottles and plastic cutlery*
- *public awareness programmemes that focus on "reduce, reuse, recycle, and recover"*
- *diverting waste from landfill through operating the recycling centre.*

Additional efforts could include implementing Extended Producer Responsibility regulations that require importers to collect used packaging or end-of-life products, or require importers to meet minimum standards for recyclability and energy efficiency.

INDICATOR 4.2. HOUSEHOLD WASTE CAPTURE RATE

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	8	6.3 11.6 12.4 14.1		Samoa Pathway 71a

DEFINITION

% household waste capture by authorised waste collection.

STATUS AND TREND DISCUSSION

Responsibility for collecting waste from households (and schools, government buildings, churches, and other institutions and commercial establishments) is held by DWM in Funafuti, and by Kaupules on the outer islands, based on Memoranda of Understanding (MoUs) between Kaupules and DWM. This includes green waste, bulky waste, e-waste, scrap metal and nappies. Household waste is stored in 80 or 120 litre plastic bins prior to collection (provided by the EU and other international donors) (Asian Development Bank 2014). Since 2015, collection services have been provided free of charge.

In Funafuti, 100% of households are provided with collection services. On the outer islands this figure is 80% (Government of Tuvalu 2016). Although this indicates a very high waste capture rate, it is not possible to determine what proportion of waste generated by each household is collected by this service (due to the prevalence of illegal dumping and incineration) (Asian Development Bank 2014). The estimated annual amount of collected municipal solid waste in Funafuti on an annual basis is 4,479m^3 (Sagapolutele 2017).

Waste is collected following a regular schedule, using flat-tray vehicles and taken directly to local landfill sites. In Fongafale, Funafuti (where the majority of the nation's population reside), general waste is collected twice per week, green waste is collected twice per week and bulky waste is collected once per week. On the outer islands, waste is generally collected twice per week (Sagapolutele et al. 2019).

Collected green waste is shredded at the composting facility that was established with support of the Taiwanese Technical Mission (Asian Development Bank 2014). Nappies are collected separately and disposed of in a designated section of the landfill. Although healthcare waste should be collected by the Department of Health and incinerated, Sagapolutele et al. (2019) found that the incinerator at the Princess Margaret Hospital is not currently operational.

Until recently, a lack of equipment for compacting waste resulted in waste entering landfills at a low compaction density (around 200 kg/m^3). As a result, in Funafuti 6-10 m^3 of household waste and 6-8 m^3 of non-household waste enters the landfill every day.

As Tuvalu's landfills are not lined, there is the potential for leachate from decomposing materials entering groundwater and lagoon water, impacting water quality.

Insufficient data is available to accurately estimate the proportion of household waste that is captured and processed, or trends over time. Although Tuvalu implements a relatively comprehensive national waste collection system, Tuvalu Integrated Waste Policy and Action Plan acknowledges that levels of public understanding of appropriate waste collection, processing, and disposal remain low, and illegal dumping (including in the ocean) and burning of waste regularly occurs. Illegal dumps can be readily observed along roads and next to the coast.

IMPACT

Although nearly all of Tuvalu's households are served by the national waste collection service, and a large volume of waste enters Tuvalu's landfills on a daily basis, the prevalence of illegal waste dumps and regularity of waste burning indicates that a significant proportion of generated waste is not currently being captured. This is producing problems regarding litter, with potential for public health and environmental impacts. DWM's awareness and enforcement/regulatory officers are working to increase public understanding and improve compliance with waste management regulations.

RESPONSE AND RECOMMENDATIONS

- *Continue to implement the priority actions specified by the Tuvalu Integrated Waste Policy and Action Plan, particularly those regarding enforcement of waste management regulations, public awareness of the importance of proper waste management and incentive mechanisms.*
- *Efforts should be made to monitor the impacts of leachate on lagoon water and groundwater quality.*
- *Improve waste storage at source, to address the difficulties encountered by collection crews during collection services resulting from poorly packed waste and damaged plastic bins.*
- *Consider the use of a prepaid rubbish bag to standardize waste storage (as has been successfully implemented in Vanuatu and Kiribati).*

INDICATOR 4.3. HOUSEHOLD WASTE RECYCLED

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	8	11 (11.6); 12 (12.4, 12.5)		Samoa Pathway 71a,d

DEFINITION

Annual trend in % national solid waste recycled or average daily per capita % of municipal solid waste recycled, as measured by operation of national recycling system

STATUS AND TREND DISCUSSION

In 2019, the Waste Management (Levy Deposit) Regulations were introduced in order to provide mechanisms for revenue collection through an import levy and provide a legal framework that encourages waste avoidance and resources recovery (Sagapolutele et al. 2019).

DWM is in the process of establishing a national recycling system, although it is yet to be fully implemented. The import of single-use plastics (including single-use plastic bottles under 1.5l, plastic plates, cutlery, and food wrap) has been banned, and an import levy is charged on 14 products including aluminium cans, PET bottles and batteries (the Integrated Waste Levy Deposit Programmeme (IWLDP)) (Table 31 Levied products and goods), with additional products planned for future inclusion. It is anticipated that the generated deposits will support a recycling programmeme for the levied waste items and support in-country appropriate treatments and disposal in/where the goods are unable to be exported overseas. The levy ranges from 5 cents per nappy to AU$2,000 for heavy construction equipment more than 10 tonnes. Currently, recyclable items (particularly aluminium cans) are being collected, compacted and stored by DWM, with overseas processing (potentially in Fiji) yet to be organised

IMPACT

When fully implemented, the national recycling programme will have a significant impact on the effectiveness of waste management in Tuvalu (Sagapolutele 2018). The Tuvalu Waste Audit Report asserts that if 100% of currently levied items are recovered, 14% of the current waste stream will be diverted from landfill to resource recovery (Sagapolutele et al. 2019).

Furthermore, almost 30% of the current waste stream consists of recyclable materials (particularly cardboard) that are not currently being considered by any recycling or recovery scheme.

RESPONSE AND RECOMMENDATIONS

Tuvalu should continue to develop its national recycling programmeme, including recovering all levied items, storing and compacting them, and arranging offshore processing of recyclables.

ITEM #	GOOD/PRODUCT DEPOSIT AMOUNT		FOR THE MANAGEMENT OF THE RESULTING WASTE (AU$)			
			REFUND AMOUNT	RECYCLING OPERATIONS SUBSIDY	ADMINISTRATION MANAGEMENT SUPPORT	
1	Mineral water, sweetened drinks and cooking oils come in PET bottles		10 cents / container	5 cents	0.25 cents	0.25 cents
2	Sweetened drinks and alcohol come in aluminium cans		10 cents / container	5 cents	0.25 cents	0.25 cents
3	Sweetened drinks, alcohol and cooking oil come in glass bottles		10 cents / container	5 cents	0.25 cents	0.25 cents
4	Lubricating oil		40 cents / litre	Nil	Nil	40 cents
5	Nappy		5 cents / unit	Nil	Nil	5 cents
6	Large white goods – refrigerators, freezers, washing machines, electric ovens (over 2 m^3 size)		$100 / unit	$50	$25	$25
7	Medium white goods – refrigerators, washing machines, electric ovens (between 1 m^3 and 2 m^3 sizes)		$60 / item	$30	$15	$15
8	Small white goods – microwaves, refrigerators, washing machines, etc. (smaller than 1 m^3 size)		$30 / item	$15	$7.50	$7.50
9	Construction heavy equipment – excavator, loader, trucks (more than 10 tonnes)		$2,000 / unit	$1000	$500	$500
10	Construction medium equipment – excavator, loader, truck (between 5–10 tonnes)		$1,000 / unit	$500	$250	$250
11	Construction small equipment – excavator, loader, truck (less than 5 tonnes)		$500 / unit	$250	$125	$125
12	Office and family vehicles		$400 / unit	$200	$100	$100
13	Motorbikes		$200 / unit	$100	$50	$50
14	Batteries	$10 / unit	$5	$2.50	$2.50	
		$30 / unit	$15	$7.50	$7.50	
		$60 / unit	$30	$15	$15	

Table 31
Levied products and goods
Source: Tuvalu Waste Audit Report (2019)

INDICATOR 4.4.
ACCESS TO AND QUALITY OF SEWAGE TREATMENT

LINKS TO REPORTING OBLIGATIONS	CBD	SDG	OTHER INTERNATIONAL CONVENTIONS	REGIONAL MEAS
	8	6.2, 6.3 6.A; 11.6		Samoa Pathway 64-65

DEFINITION

% of households connected to central sewage system or using sealed, non-polluting septic tanks.

STATUS AND TREND DISCUSSION

Tuvalu has no centralised sewage treatment system and instead relies on septic tanks and pit toilets. Water sealed flush toilets and septic tanks have long been promoted in Tuvalu as the most hygienic and safe way to dispose of human waste (promoted as an alternative to using the beach) (Lal et al. 2006).

In 2013, Fongafale islet (Funafuti) was home to 639 households, 424 of which used buried septic tanks that received domestic wastewaters including human waste. In addition, 163 households had pit toilets with a pour flush. As such, 92% of households on Fongafale had access to improved sanitation facilities (Fujita et al. 2013). Although similar statistics for 2019 are not yet available, it is likely that the proportion of households with improved sanitation facilities is similar, or higher.

Unfortunately, most (if not all) of these septic tanks were constructed without sealed bases (in contravention of their construction specifications). Coral atolls typically have a shallow groundwater lens (1-1.3 m below ground) and have highly permeable coralline soils. As a result, septic tank contents readily contaminate Tuvalu's groundwater and lagoon water following high tides (see Indicator 2.4. Lagoon water quality.

IMPACT

Inadequate sanitation negatively impacts the quality of Tuvalu's groundwater and lagoon water. Groundwater on most of Tuvalu's islands is unfit for human consumption, and is mostly used for washing pig pens, feeding pigs and flushing toilets. Lagoon water adjacent to populated areas is impacted by the influx of organic matter, which damages coral reefs and promotes the growth of algae.

Groundwater contamination by leaking septic tanks impacts human health, which subsequently impacts Tuvalu's economy (estimated cost in 2006 of $500,000/year). Given that this issue is exacerbated by Tuvalu's growing population, it is likely that the economic cost in 2020 is even higher.

RESPONSE AND RECOMMENDATIONS

Continue to implement the priority strategies defined by Fakanofonofoga Mo Vai Mote Tumaa – Tuvalu's Sustainable and Integrated Water and Sanitation Policy 2012-2021 (Government of Tuvalu 2013), particularly those regarding reducing pollution of groundwater.

Develop and implement effective water quality control strategies, including the promotion of composting toilets (replacing leaking septic tanks is likely to be prohibitively expensive).

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APPENDIX 1.
STAKEHOLDERS CONSULTED

#	NAME	ORGANISATION	POSITION
1.	Soseala Tinilau	Department of Environment	Director
2.	Tilia Tima	Department of Environment	Biodiversity Officer
3.	Reuben Kausea	Department of Environment	Information Knowledge Management Officer
4.	Hilary Boyes	Department of Environment	Volunteer (New Zealand)
5.	Ivy Tumua	Ridge to Reef Project	Project Coordinator
6.	Feagaiga Penivao	Ridge to Reef Project	LMMA Officer
7.	Tautalo Iese	Department of Fisheries	Acting Senior Fisheries Officer
8.	Selotia Tausi	Department of Agriculture	Acting Director
9.	Ebolini Mami	Department of Agriculture	Plant Protection Officer
10.	Kaai Fanoiga	Department of Education	Acting Director
11.	Falili Simeona	Department of Education	Pre-service Training Officer
12.	Emily Lafai	Department of Waste Management	Waste Regulatory Officer
13.	Taape Moriicao	Department of Local Government	Acting Director
14.	Fatasi Malologa	Lands and Survey Department	Director
15.	Eli Faleti	Tuvalu Meteorological Service	Climate Officer
16.	Teresa Lifuka-Drecala	TANGO	Director
17.	Luma Lotoala	TANGO	Project Manager
18.	Polu Tanei	Tuvalu Electricity Corporation	RE and EE Manager
19.	Namoto Kelisiano	Tuvalu Electricity Corporation	Generation Manager
20.	Pula Fangu	Tuvalu National Council of Women	Coordinator
21.	Andreja Vidal	EU Delegation for the Pacific	Project Manager - Climate Change, Energy, Circular Economy

APPENDIX 2.
AICHI BIODIVERSITY TARGETS

STRATEGIC GOAL A: ADDRESS THE UNDERLYING CAUSES OF BIODIVERSITY LOSS BY MAINSTREAMING BIODIVERSITY ACROSS GOVERNMENT AND SOCIETY	
	Target 1 By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.
	Target 2 By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.
	Target 3 By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.
	Target 4 By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.
STRATEGIC GOAL B: REDUCE THE DIRECT PRESSURES ON BIODIVERSITY AND PROMOTE SUSTAINABLE USE	
	Target 5 By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
	Target 6 By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.
	Target 7 By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
	Target 8 By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
	Target 9 By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.
	Target 10 By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.
STRATEGIC GOAL C: TO IMPROVE THE STATUS OF BIODIVERSITY BY SAFEGUARDING ECOSYSTEMS, SPECIES AND GENETIC DIVERSITY	
	Target 11 By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
	Target 12 By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.
	Target 13 By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
STRATEGIC GOAL D: ENHANCE THE BENEFITS TO ALL FROM BIODIVERSITY AND ECOSYSTEM SERVICES	
	Target 14 By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

	Target 15 By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
	Target 16 By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.
STRATEGIC GOAL E: ENHANCE IMPLEMENTATION THROUGH PARTICIPATORY PLANNING, KNOWLEDGE MANAGEMENT AND CAPACITY BUILDING	
	Target 17 By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.
	Target 18 By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.
	Target 19 By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.
	Target 20 By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

APPENDIX 3. SUSTAINABLE DEVELOPMENT GOALS

SPREP PRIMARY FOCUS: 13, 14, 15
SPREP SECONDARY FOCUS: 6, 11, 12

Ministry of Public Works, Infrastructure, Environment,
Labour, Meteorology and Disaster
GOVERNMENT OF TUVALU

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