THEME **Environmental Governance**

INDICATOR **Environment Ministry budget allocation**

DEFINITION	% of national budget allocated to Environment Ministry or equivalent
PURPOSE	Determine trends in prioritisation of environmental funding within government
DESIRED OUTCOME	Stable or positive trend; sufficient and sustainable financing to implement environmental programmes

Status
Poor to fair

Trend
Mixed

Data confidence
Medium


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PRESENT STATUS

At present, there is no regional target set for the share of environmental expenditure as a share of GDP.

Measuring the amount that a government allocates to the environment is challenging due to overlapping sector plans or integration of environmental management into a larger ministry without a corresponding public budget report that specifies 'environmental' spending. Some countries separate the management of fisheries and marine resources from that of other environmental and climate change response actions.

Mainstreaming environmental management throughout sector plans may be beneficial within a country's holistic sustainable development approach but complicates the external assessment of environmental spending. For example, Fiji included 'Regeneration of indigenous forest species' in its 2017/18 Forestry budget, and Tuvalu places "Ensure sound environmental protection in energy usage" within the national energy budget.

Regional use of this indicator would require national and regional agreement on the data used to assess each country's progress, particularly the type of funding defined as environmental management expenditure, such as funding for protection, conservation, monitoring, and restoration of ecosystems. Reporting on the committed versus actual operating budgets is also essential as there can be significant delays or differences in the funds actually dispersed. Identifying the core work of environmental ministries or departments can be a way forward for monitoring this indicator.

Using the information publicly available and quantifying the budget granted to the institution most similar to an environmental ministry or department, the expenditure on environmental management in 2019 formed 1.3% of the government's budget as an average across 11 of the 21 Pacific island countries and territories.

Based on assessments from at least 2015 to the latest available year for those countries or territories with published national budgets, we consider the present status to be *poor to fair*, based primarily on the presence of a stable or positive trend in at least half of the countries or territories with data. There is little information to address the second desired outcome: "sufficient and sustainable financing to implement environmental programmes" (see below). Trends are *mixed* among countries. The availability and clarity of the data provide *medium* confidence.

CRITICAL CONNECTIONS

The budgetary allocation to ministries or departments of environment is an indication of the priority placed by the state on the sustainable management and preservation of the country's environment and national resources. These resources are generally fundamental to Pacific economies and cultures. Pacific ecosystem resources and ecosystem services provide wealth, rewarding management efforts.

The budget links to enforcement levels, planning, and awareness of environmental issues by citizens and government officials. Although more development projects pass Foreign Affairs Ministries than environment projects, development and environmental health are intertwined.

Grant-based funding for ecosystem-based adaptation (EbA) to climate change is of growing importance in the region, although EbA is insufficient for all environmental management priorities as defined by Pacific leaders (see Regional Indicators: Climate resilience).

Measuring the investment of Pacific countries in their own environmental management will provide essential data to assess national policies and progress toward the SDGs. Defined priorities and actions must be accompanied by resources, including skilled personnel.

PRESSURES AND OPPORTUNITIES

There is a demand for environmental spending – regulatory, protective, and management – across government departments, but budget allocations still remain low.

Pacific spending on environmental management forms a small share of government expenditure, despite the fact that agriculture, forestry, and fishing account for about 15% on average of national GDP for Pacific island countries, reaching up to 25% for countries like Federated States of Micronesia and Vanuatu (World Bank's World Development Indicators, accessed July 2020). When the indirect income from natural resources is considered, such as from the sale of fishing licences or nature tourism, the contribution of the natural environment to Pacific economies often exceeds 50% of gross national income.

Environmental funding lacks clarity because a distinction is not routinely or comparably made between environmental management and development of an environment-related resource. Management spending can be 'hidden' within multiple sector budgets, such as those for forestry or waste management, and conversely the budget for a sector responsible for environmental management, such as fisheries or environment, can include funds spent on development or extraction (Govan 2015, 2017; SEI 2020).

Govan (2015) assessed recurrent government allocations for coastal resource management by fisheries and environment agencies in Fiji, Kiribati, Solomon Islands, Tonga, and Vanuatu and considered the budgets extremely low, equivalent to:

- USD 2 per person,
- USD 9 per square kilometre of territorial waters,
- USD 165 per square kilometre of reef, or
- USD 215 per kilometre of coastline.

Much of the budget was directed to staff salaries, and those staff were also expected to deliver across additional unrelated service areas (Govan 2015).

With the region's vulnerability to natural disasters, government budgets can be volatile. The IMF calculated a 46% average probability of Pacific island countries being hit by disaster in a year, with those disasters causing on average 14% damage to GDP when considering indirect and direct losses (Lee et al. 2018). Pacific islands now face expected annual direct losses of 0.5% to 6.6% of GDP to natural disasters, such as flooding and cyclone damage, with increasing risks under climate change (World Bank 2017, IPCC 2019), with localised damages and losses from individual storms far exceeding these estimates (e.g., 64% of Vanuatu's GDP for Cyclone Pam in 2015). Although Pacific budgets must retain flexibility for emergency response, careful planning is essential to ensure basic services, and creative approaches can bolster funding from other sources (Box 1.1).

A growing number of Pacific countries have introduced levies on polluting products, such as plastic bags, plastic bottles, or luxury vehicles with engine capacity over 3000 cc. These measures address Aichi Specific Indicator 3.2.1: Number of countries with national instruments on biodiversity-related taxes, charges and fees. The "polluter pays" principle can be used to support environmental clean-ups alongside sufficient resourcing for environment ministries to actively limit pollution and environmental damage, implement environmental policies, and to achieve each country's multiple environmental objectives. To only make polluters pay does not address broader impacts of an environmental mishap. In some cases, the polluter may not be readily identified, and a hazard must be immediately addressed. Gauging correct amounts for penalties and licencing at national and provincial/island level are important avenues to explore for sustainable finance. Stable, long-term funding in addition to polluter-payment mechanisms provides security for sustainable environmental management.

BOX 1.1: CREATIVE FINANCING FOR HEALTHY ENVIRONMENTS

Pacific island countries are embracing financial mechanisms to generate funds in country to support biodiversity conservation and climate action on the ground. Examples include:

- The Micronesia Challenge, a government-endorsed commitment in 2005 to conserve 30% of nearshore marine waters and 20% of terrestrial area by 2020. The Challenge came with financial pledges by Parties and was used generate international financial support. A regional financing mechanism was established, the Micronesia Conservation Trust.
- Palau Green Fee (2009, directed toward the Protected Area Network Fund) and Pristine Paradise Environmental Fee (2016, 2018 implementation, toward the National Marine Sanctuary)
- RMI Blue Fee (2016), with portions of tuna licensing fees allocated to finance the RMI Sustainable Finance Plan.
- A variety of levies on polluting materials, such as single-use plastics, or activities, directed toward national ministries for environmental management or climate resilience.

Research and innovation targeted at sustainability is another aspect of environmental management. In Europe, the Horizon 2020 Framework Programme introduced a target expenditure of 60% of the total framework budget[1] on research and innovation directed toward sustainable development. In this way, environmental considerations were built into the actions of a separate programme or sector.

[1] Horizon 2020 had a budget of 80 billion euros covering the period for 2014–2020.

In most countries around the world, progress toward the SDGs is weakest for the environment-related SDGs (Goals 12, 13, 14, and 15; Sustainable Development Report 2019 and 2020), with environmental management generally receiving less attention and funding than other sectors (Sethi et al. 2017). General government expenditure on environmental protection[1] accounted for 0.8% of GDP in the European Union in 2017 (Eurostat) and 0.15% in Latin American countries in 2018 (ECLAC). For comparison, the global average expenditure on energy is 8% of GDP (Institute for Energy Research 2010), and spending on energy R&D was about 0.04% of the GDP of the major economies in 2018 (IEA 2019).

An analysis of overseas development aid from 2013 to 2017 demonstrated that aid for 'general environmental protection' accounted for approximately 2% of the total development aid disbursed over that period, less than half of the amount spent on donors' administration costs (SEI 2020).

Pacific leaders have adopted the Sustainable Development Goals (SDGs), the Convention on Biological Diversity with its Aichi Targets (2011–2020), and other global, regional, and national commitments that rely on resourced environmental management. The Pacific regional framework supports efficient use of scarce resources through the Council of Regional Organisations of the Pacific[2], joint environmental project development, and a growing movement toward open environmental data sharing.

[1] *Environmental protection* defined as expenditure on waste management, water waste management, pollution abatement, protection of biodiversity and landscape, and research and development related to environmental protection.

[2] The CROP Agencies include Pacific Community, Pacific Islands Development Forum, Pacific Islands Forum Secretariat, Secretariat of the Pacific Regional Environment Programme, and the University of the South Pacific.

REGIONAL RESPONSE RECOMMENDATIONS

The range of economic demands on small, developing economies vulnerable to natural disasters necessitates a flexible approach grounded in strong partnerships. To ensure joint actions in their countries remained Pacific-driven, Pacific Leaders laid out key principles in the *Framework for Nature Conservation and Protected Areas in the Pacific Islands Region*, including Principle 4: financial sustainability.

Mainstreaming environmental sustainability throughout the line ministries is valuable. Quantifying the funding directed toward environmental management can be adapted to suit each country's governance system, but a clearly defined metric will help identify status and trends. The South-South cooperation and sectoral briefings facilitated by a mechanism like the Pacific Floating Budget Office could be used to support policy decisions regarding national budgets.

Using these approaches and existing national budget systems, countries can:

- Identify priority needs to be addressed with environmental management funds;
- Measure spending on environmental management, distinguishing national domestic and project funds and distinguishing committed and disbursed funds;
- Plan environmental spending, including preparedness such as disaster risk reduction and biosecurity as well as pollution levies; and
- Partner for environmental management, resourcing, and skilled teams.

INDICATOR IN ACTION SDGs 15.a.1, 15.b.1 · Ramsar (strategy 40) · SAMOA Pathway (article 90c) · Noumea Convention · Waigani Convention · Regional Environment Objective 4 · Pacific Islands Framework for Nature Conservation Objective 6

FOR MORE INFORMATION

National budgets are publicly available from official national websites for most Pacific islands. For regional budgets used here, please see Eurostat and the UN Economic Commission for Latin America and Caribbean.

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
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National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal.
pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

THEME **Environmental Governance**

INDICATOR **MEA Reporting Requirements**

DEFINITION	% of MEA reporting requirements met on time
PURPOSE	Determine if MEAs are being reported on
DESIRED OUTCOME	100% of MEA reporting requirements met on time or positive trend. PICTs successfully meet reporting obligations under MEAs in a timely manner, ideally using the State of Environment Reporting as the basis for responding to these reporting requirements

Status
Poor to fair

Trend
Mixed

Data confidence
Medium


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PRESENT STATUS

The number of multilateral environment agreements (MEAs) varies by country, with at least 20 MEAs for the Pacific islands region (Annex C). Pacific leaders have adopted the Convention on Biological Diversity with its Aichi Targets (2011–2020), the Sustainable Development Goals (SDGs), and several other global, regional, and national commitments that rely on resourced environmental management.

Information on MEAs can now be accessed on a web-based portal (https://www.informea.org/en), although not all available reports have been uploaded. Even within individual Convention systems, collations of existing reports are not up to date.

Reporting is lagging despite regional prioritization of the issues addressed by the MEAs (Table 2.1). For example, all Pacific island countries have submitted only their second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), but the next report is overdue for several countries. Only about 31% of the required MEA reports have been submitted in 2015 or more recently.

Based on MEA reporting being over five years out of date for more than half of MEAs as well as the lack of data for roughly half of the SDG indicators (Sustainable Development Report 2020), the present status of this indicator is considered *poor to fair* with *mixed* trends among countries. The availability and clarity of the data provide *medium* confidence; in some cases, the lack of access to submitted reports is under the control of the MEA secretariat.

For comparison, at the global level, 46% of parties to the Convention on Biological Diversity have submitted the most recent required report (due December 2018).

Support for Pacific reporting is provided in part through the African Caribbean Pacific Multilateral Environment Agreement 3 (ACP MEA 3) Project. The Global Environment Facility funds the Inform Project, which is creating a regional data portal and national data portals for the 14 Pacific island countries to help streamline data sharing and access to further support national and MEA reporting. The project is also creating online indicator reporting tools and defined national level indicators which address multiple reporting requirements.

PRESSURES & OPPORTUNITIES

Sustained monitoring using consistent approaches over the long term is essential for streamlined reporting and to identify patterns of ecosystem health. That said, adaptive management requires the flexibility to respond to new priorities and emerging issues. Meanwhile, the enormity and severity of pressing environmental needs and the impacts of climate change demand immediate results.

The sheer number of required reports and international meetings is challenging for countries with small bureaucracies that face limitations of qualified negotiators and human resources to implement action at home. With their small populations and limited environmental management resources, the islands face key challenges for knowledge management with high staff turnover and limited staff time for reporting. The Pacific vulnerability to natural disasters also extends to data and knowledge: both paper and digital records are susceptible to loss.

International climate and environmental problems are not yet tackled holistically, and implementation is often disjointed and unsustainable in the long run. Complicated reporting, unharmonized indicators, or global indicators that are not relevant for the Pacific region add to the MEA reporting burden.

Priorities of bilateral donors and partners are often swayed by geopolitical interests instead of addressing pressing needs of developing countries or international agreements (such as MEA targets). This problem is compounded by the Pacific region's heavy reliance on foreign aid, which can create competition within the region to access limited funds, disincentivizing collaboration, coordination, and cooperation.

At the global and regional level, a lack of data can lead to a lack of visibility of the need or opportunity present in the Pacific islands. For example, the 2020 Sustainable Development Report excluded nine Pacific island countries from the SDG Index due to insufficient data availability: Federated States of Micronesia (46% of values missing), Kiribati (44%), Marshall Islands (54%), Nauru (58%), Palau (57%), Solomon Islands (29%), Tonga (33%), Tuvalu (56%), and Samoa (21%).

TABLE 2.1: Most recent year of reporting from Pacific parties to international and regional MEAs relevant for environmental management, as of September 2020. Note: UNFCCC Non-Annex I Parties are required to submit their first National Communication within three years of entering the Convention, and every four years thereafter. Most Pacific island countries are due to submit their third NC. See https://unfccc.int/non-annex-I-NCs

INTERNATIONAL AGREEMENTS	REPORTING PERIOD	Cook Is	FSM	Fiji	Kiribati	Marshall Is	Nauru	Niue	Palau	PNG	Samoa	Solomon Is	Tonga	Tuvalu	Vanuatu
SDGs: Voluntary National Review	Varies		2020	2019	2018	In preparation (2021)	2019		2019	2020	2020	2020	2019		2019
BIODIVERSITY															
Convention on Biological Diversity (CBD)	Sixth National Report was due in 2018	2014	2015	2014	2015	2014	2019	2014	2019	2014	2014	2014	2014	2015	2014
Conv on International Trade in Endangered Species (CITES)	Due every 2 years			Regional (2018)					Regional (2018)	Regional (2018)	2017	Regional (2018)	Regional (2018)		Regional (2018)
Convention on Migratory Species (CMS)	Due every 2 years	2017		2017					2017		2019				
Convention on Wetlands (RAMSAR)	Due every 2 years			2015	2018	2018			2018	2018	2019				
World Heritage Convention (WHC)	Six year cycle (active: 2018–2024)			2015	2015							2015			
Convention on Underwater Cultural Heritage (UCH)	N/A (COP every two years)		None to date (ratified 2018)												
WASTE AND POLLUTION															
HAZARDOUS WASTE AND POLLUTION															
Basel Convention	Due annually	2004	2002		2006	2014	2004			2004	2016				
Stockholm Convention	Last due in 2018														
Minamata Convention	Due every three years after joining									Initial assess-ment underway	Initial assess-ment 2018				
ATMOSPHERIC POLLUTION															
Vienna Convention(MontrealProtocol)	Due annually	2019	2019	2019	2019	2019	2018		2019	2019	2019	2019	2018	2019	2019
SHIP-BASED POLLUTION															
London Convention Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	Due annually, including NIL if no incidents.														
CLIMATE CHANGE															
UNFCCC	Due every 4 years*	2011	2013	2014	2013	2015	2014	2014	2019	2019	2010	2017	2012	2015	2016
LAND DEGRADATION Z															
UNCCD	Due every 4 years	2018	2014	2018	2014	2002	2018	2014	2018	2018	2018	2014	2014	2014	2014
REGIONAL AGREEMENTS															
Waigani Convention	Due every 2 years	2013	2013	2013	2013		2013	2013	2013	2013	2013	2013	2013	2013	2013
Noumea Convention	Due every 2 years					In process					2019				

Not a party; no report required | Current: within last 2 years (2018-2020) | Recent: within last 2 to 5 years (2015-2017) | Outdated: more than 5 years ago

The most concerning gaps are the lack of data to measure regional priorities of climate change, ocean and seas or "life below water", and quality education (UN ESCAP 2019). Both lack of data and lack of time to gain and share expertise can reduce Pacific representation. For example, in the production of the second world ocean assessment under the UNCLOS Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects, only one of the hundreds of authors and peer-reviewers is a representative of the Pacific islands. Building up institutional capacity in the Pacific islands can equip Pacific people to contribute to regional and global dialogues.

Internal approval processes are a common bottleneck in the publication of State of Environment reporting, in some cases delaying the publication by years. Other national level challenges include a lack of central coordination of MEA funding and implementation and the development of mechanisms at the national level to satiate obligations under the MEA, rather than translating the global messages into a "language" that is understood and adopted at the local level.

There has been a move toward streamlined, Pacific-specific reporting. The Pacific regional framework supports efficient use of scarce resources through the Council of Regional Organisations of the Pacific[1], joint environmental project development, and a growing movement toward open environmental information sharing. One example of integrated regional reporting is the first quadrennial Pacific Sustainable Development Report released in 2019, which highlights progress made in the Blue Pacific region towards achieving sustainable development within the context of seven or more frameworks and conventions.[2] The Pacific Data Ecosystem, founded by SPREP and SPC, supports cooperative knowledge management.

Many Pacific countries require financial and technical support to be in full compliance with the MEAs and frameworks to which they are a Party. Such support should be in line with Principle 2: "Conservation from a Pacific Perspective" of the Framework for Nature Conservation and Protected Areas in the Pacific Islands Region.

[1] The Pacific Community, Pacific Islands Development Forum, Pacific Islands Forum Fisheries Agency, Pacific Islands Forum Secretariat, Secretariat of the Pacific Regional Environment Programme, and the University of the South Pacific

[2] Framework for Pacific Regionalism and national development plans and reflected in the 2030 Agenda and the SDGs; the SIDS Accelerated Modalities of Action (S.A.M.O.A.) Pathway; the Paris Agreement; the Addis Ababa Action Agenda; the Sendai Framework for Disaster Risk Reduction; and the Global Partnership for Effective Development Cooperation, alongside the 2012 Pacific Leaders Gender Equality Declaration

REGIONAL RESPONSE RECOMMENDATIONS

The range of reporting demands on small Pacific communities necessitates a flexible approach grounded in strong partnerships. For more about the financial sustainability required to meet the needs of environmental management, please see Regional Indicator: Environment Ministry budget allocation.

SPREP has long provided ad hoc technical backstopping, review, and coordination for Pacific island countries reporting to MEAs as well as working with convention secretariat officers to deliver multinational interventions in the Pacific. Coordinated and consistent SPREP support to Pacific island countries for MEA reporting, data collection and analysis, and Council of Parties (COP) preparations can support on-time reporting with better coordination across MEA indicators and sub-regional and regional interventions at COPs.

Pacific island nations continue to work together to achieve commitments at the regional and international levels. Just as essential is cooperation and coordination among government agencies within the individual Pacific islands to include the relevant stakeholders and link environment and development departments. Mainstreaming environmental efforts throughout the line ministries is valuable both for effective environmental management and for consistent, accessible data collection regarding the required indicators.

Building on existing national structures, countries can:

- Identify gaps for sustainable and timely environmental reporting;
- Share data and information products to support national and regional knowledge management;
- Create centralised data services to assist with monitoring and evaluation of conservation and management activities and to provide accessible data and indicators for environment information;
- Collaborate through South-South learning for information collection and analysis, reporting, and open and timely sharing of environmental information;
- Support the development of sustained, consistent regional coordination for MEA reporting
- Prioritise and measure spending on environmental management, distinguishing national and project funds;
- Plan for sustained environmental reporting under island conditions, including preparedness and disaster risk management;
- Negotiate for relevant and meaningful indicators for Pacific islands; and
- Partner for harmonised environmental management and reporting.

INDICATOR IN ACTION

SDG 12.4.1, 17.16, 17.18, 14.9.1 • All MEAs to which Pacific islands are Party • SAMOA Pathway • Pacific Roadmap for Sustainable Development • Pacific Regional Environment Objectives 1.1, 2.2, 3.1, 4.2, 4.3 • Pacific Islands Framework for Nature Conservation Objective 6

FOR MORE INFORMATION

InforMEA: https://www.informea.org/

Sustainable Development Report: https://www.sdgindex.org/

UN ESCAP (2019) Progress on the road to sustainable development in the Pacific: Executive Summary. United Nations Economic and Social Commission for Asia and the Pacific. ESCAP/RFSD/2019/INF/6.

SPREP PROE

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For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

THEME **Environmental Governance**

INDICATOR **Terrestrial wildlife protection**

DEFINITION	Level of extractive terrestrial wildlife use by humans
PURPOSE	Increase the safety to species, ecosystems, and people from the sustainable use of terrestrial wildlife
DESIRED OUTCOME	Monitored and sustainable use of wildlife with stable populations; zero use of protected species

Status
Fair

Trend
Unknown

Data confidence
Low

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PRESENT STATUS

The full range of wildlife use in the Pacific islands region is outside of the scope of the present indicator. Many wildlife species are used in modern Pacific societies, on land, at sea, and in coastal areas. Wildlife is used for subsistence, traditional ritual, and in a range of industries, including the aquarium and seashell trade, decorative arts, agrifood, tourism, pet trade, and more (see Box 3.1). Timber, the most widely traded wildlife commodity globally, and fisheries are dominant sectors for Pacific wildlife trade. Birds are traded extensively by some Pacific countries, especially parrots for the pet trade. Some wildlife, such as fisheries species, are examined deeply by agencies within the Council of Regional Organisations of the Pacific. Here, we focus on examples of wildlife that are of particular importance to the region and particularly under-served by CROP agencies.

In this summary, we focus on extractive use of birds and bats in the Pacific islands region. Extractive use, sometimes also called consumptive use, involves taking a wildlife species or parts out of the wild, whether eaten or not (IUCN, 2020). The status of extractive use of defined wildlife species and its management can serve as a proxy for the dependence on, resilience of, and population trends of Pacific wildlife. For future analyses of this indicator, the Pacific islands may wish to identify a regional list of target species for management and monitoring.

In this first assessment of human use of birds and bats in the Pacific islands region, we focused on two main questions:

- What is the share of bat and bird species that are traded, hunted for hide/feathers/teeth/etc., or eaten?
- What is the share of Pacific island countries with accessible legislation governing the international or national trade, consumption, or use of wild bird and bat species?

The present status of this indicator was designated as *fair*. The trend is *unknown*, and the availability of data is *low*. For bats, 42% of the bat species in the Pacific islands that are known to be used for human consumption are at risk (with a Red List status of Vulnerable or worse), and the populations of 48% of them are known to be declining (see below). For birds, only 14% of the 610 bird species in the Pacific islands on the Red List with recorded human use/trade are designated at risk, but 46% of them are known to have declining populations (IUCN 2020).

At present, there is a lack of data and information on the domestic use or governance of domestic use of wildlife in the Pacific islands. There is more information about international trade, particularly the trade in endangered species. As a proxy for the management of wildlife use, Table 3.1 presents a summary of publicly accessible legislation in the Pacific island countries and territories that addresses terrestrial wildlife use or trade.

In some cases, a country might have a policy or commitment to the Convention on Biological Diversity (CBD), such as a National Biodiversity Strategy and Action Plan (NBSAP), or other multilateral agreement but not have national legislation clearly defining what species are protected and rules around use of other species. If a country addresses domestic wildlife management through an NBSAP, the country might not identify a need for separate legislation on wildlife use or consumption. Even in cases with a policy or legislation, its use and enforcement require sustained political will and resources. To identify the share of Pacific NBSAPs that address and monitor domestic use of these species, for domestic or international trade and consumption, a comprehensive review of NBSAPs would be needed.

WHY DOES WILDLIFE USE MATTER?

Using wild species can positively or negatively affect human health and wellbeing. Bushmeat and wild seafood are a valuable resource in many countries and communities, providing local sources of protein. Feathers and other wildlife products are important for local tradition and arts. However, wildlife can be an incubator of infectious disease and can be susceptible to diseases spread by humans.

Wildlife that is sustainably harvested from healthy, intact ecosystems is considered less likely to contribute to the spread of infectious disease (UNEP & ILRI 2020; Gibb et al. 2020). In contrast, greater interactions with stressed wildlife in damaged ecosystems are a direct threat to human health.

Using wild species can shape our relationship with nature. The hunting or consumption of wildlife can, if undertaken sustainably, lead to greater awareness of ecological principles. Undertaken with little consideration, however, wildlife consumption can harm populations and the ecosystem services that they provide.

Those who spend time with wildlife can share that information in the form of traditional knowledge and/or citizen science. Those who overuse without due attention can lower resilience, worsen inequalities, and threaten the health of species populations, the environment, and people.

HOW IS WILDLIFE USE GOVERNED?

Wildlife use can be broken down into individual use, like subsistence hunting, or trade involving the transfer of wildlife or wildlife parts from one person to another within a country or across international borders. A wildlife trade law might not provide protection for all wildlife from all types of consumption or from other drivers of population decline.

For the international trade of species designated as Endangered on the IUCN Red List (see Regional Indicator: IUCN Red List summary) and listed on special appendices, the Convention on the International Trade in Endangered Species (CITES) provides some protection for member countries. However, CITES does not relate to the domestic (within-country) use or trade of such species, except to the extent it might be included in an assessment of sustainability of trade for a CITES Non-Detriment Findings requirement. Importantly, CITES only regulates the use of defined, CITES-listed species, a small fraction of wild species. For example, there are only 1,279 species of birds listed on CITES Appendix II compared with over 11,000 species of birds in existence and 2,508 bird species designated as near threatened to critically endangered.

CITES has annual reporting requirements to monitor illegal international wildlife trade. As of September 2020, seven Pacific island countries were signatories to CITES but no country had submitted a report to CITES (see Regional Indicator: MEA reporting requirements). Four of these seven countries are still finalising their CITES legislation.

Wildlife protection and wildlife trade (domestic or international, with international trade in reference to CITES) are managed under separate legislation in some countries (Table 3.1). As an outside example, New Zealand uses two sets of legislation: one for protecting all wildlife while allowing hunting of some species, mostly introduced species, and a separate piece of legislation for managing CITES trade. In contrast, Solomon Islands has a piece of legislation primarily directed at managing CITES-listed species plus some highly threatened endemic species listed in their legislation, but no general legislation to protect all other wildlife. This could leave a gap in that any other species could be legally traded without a permit, hunted, or killed.

Protections might also refer to specific locations. The highest level of protection of wildlife is for a species to be absolutely protected under the law regardless of whether the individual is present in a protected area, such as a reserve, or not. This method is used in New Zealand for all native species of animal. Exceptions are commonly made relating to game and pests.

Legislation can therefore focus on species or on ecosystems and locations. For example, only specific, listed endangered species are protected in American Samoa (Table 3.1). In the Commonwealth of Northern Mariana Islands, it appears that the ecosystems in which endangered and threatened species occur are provided protection. In cases where ecosystems are protected without defined protection for wildlife species, it is not always clear if certain species or all wildlife could be targeted outside of the protected areas.

In some cases, accession to CITES or derived legislation is the only legislation a country has relating to terrestrial wildlife or wildlife outside of key fisheries species. Generally, under that legislation specific to international trade, that protection is only afforded to defined species (on CITES Appendices). Governance of international or domestic trade does not provide general protection for wildlife within country: for example, people might be able to catch and keep birds for pets but just not trade them unless they have a permit.

TABLE 3.1: Legislation on the conservation and protection of wildlife in Pacific island countries and territories.

This collation is a non-comprehensive, desk-based summary of information that was publicly available online using standardised text searches of the Pacific Island Legal Information Institute database (http://www.paclii.org) and the Pacific Law & Policy Database on Coastal Fisheries & Aquaculture (https://www.spc.int/CoastalFisheries/Legislation/main) in August and September 2020 using the specified search terms. New Zealand's wildlife legislation is shown for comparison. A key difference is in the protection of all wildlife by default unless permitted use is specified (as done in New Zealand) versus wildlife uses assumed to be permitted unless use is specifically prohibited for a defined species, location, or purpose.

COUNTRY	LEGISLATION NAME AND YEAR	RELEVANT REGULATIONS	SUMMARY OF WHAT IS PROTECTED AND WHAT IS NOT	COMMENTS
New Zealand	Wildlife Act 1953 Trade in Endangered Species Act 1989	Marine Mammals Protection Act 1978	Wildlife Act: All wildlife is protected unlesss specified in schedules 1-6 (for hunting, listed introduced species not protected, and species that can be farmed). Certain other species may also be given a lower level of protection to facilitate limited harvest or to manage adverse effects they cause. The Act also provides protection to a small number of terrestrial invertebrates and marine species (other than marine mammals), as listed in Schedule 7 or 7A. Trade in Endangered Species Act 1989 regulates CITES trade in NZ.	Wildlife Act: All native wildlife is protected except where specified in schedules, such as for hunting; the Act prescribes penalties for illegally taking or injuring wildlife. Use of protected species is via a permitting system. Management of international trade in line with CITES is considered separately under the Trade in Endangered Species Act.
Cook Islands	Conservation Act 1975 Environment Act 1994–95 Environment Act 2003	Environment (Atiu and Takutea) Regulations 2008 Environment (Mitiaro) Regulations 2008	Environment Act(s): Applies only to the islands of Rarotonga, Atiu, and Aitutaki. Outer islands are exempt unless specified. Environment Regulations: All native species are protected unless otherwise specified	Acts and Regulations are sometimes specified to an island or group of islands. The Environment Regulationsprotect all native wildlife and place prohibitions on the importation/introduction of new species onto the islands. Unless otherwise given permission by Authorities, introducing an exotic plant or animal requires prior approval.
Federated States of Micronesia	Pohnpei State Endangered Species Act 1975 Pohnpei State Marine Sanctuary and Wildlife Refuge Act 1999	Yap State Code 1987 Title 18	PSMSWR Act 1999: Protects both marine and terrestrial environments for the proper thriving of species that depend on these areas. The Act does not manage use outside of these specified areas.	Yap State Code 1987: Allows for hunting/harvesting seasons for certain species. ESA 1975: Protects all wildlife considered endangered including prohibition for commercial trade and export. Subsistence use for cultural purposes allowed.
Fiji	Endangered and Protected Species Act 2002 Environment Management Act 2005	Endangered and Protected Species Regulations 2003	EPSA 2002: Regulates and controls the International and domestic trade, possession and transportation of species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). EMA 2005: enforces protection of natural resources through sustainable use and development of natural resources	EPSA 2002: Allows Fiji to enforce the 3 Appendices in the CITES. All flora and fauna listed by CITES are banned from trade. EMA 2005: Does not necessarily focus on wildlife (flora and fauna) per se but allows for the "...preservation and protection of natural water bodies and areas of significant indigenous vegetation and significant habitat of indigenous fauna".
Kiribati	Wildlife Conservation Ordinance 1975 Recreational Reserves Act 1996	Birds fully protected throughout the Gilbert Islands Order 1979 Shark Sanctuary Regulations 2015	WCO 1975: Wild birds and animals can be declared fully or partially protected, excluding fish. An area can be declared a wildlife sanctuary and the sanctuary or an area within the sanctuary a closed area where the take of wildlife is prohibited without a license. SSR 2015: Bans commercial harvest of sharks RRA 1996: Protects and preserves land particularly recreational reserves	WCO 1975: Take of wildlife whether from in a sanctuary or in a closed area is permitted with a license granted by the Minister. There is no mention of provisions for any marine flora and fauna. Order 1979: Birds on the schedule are fully protected in the 1979 Order. RRA 1996: Gives some protection to wildlife within these recreational reserves through the regulations the Act imposes.

COUNTRY	LEGISLATION NAME AND YEAR	RELEVANT REGULATIONS	SUMMARY OF WHAT IS PROTECTED AND WHAT IS NOT	COMMENTS
Marshall Islands	Revised Code 08 CAP 3 (Endangered Species Act 1975) Revised Code 33 CAP2 (Marine Mammal Protection Act 1990)		ESA 1975: Threatened and endangered species are protected. Export and import restrictions are also imposed MMPA 1990: Protects marine mammals listed in the Act and minimises mortalities caused by commercial fishing activities	No specific legislation for the conservation of wildlife.
Nauru	Fisheries Act 1997 Coastal Fisheries and Aquaculture Act 2020		General conservation and management of marine resources	No specific legislation for the conservation of wildlife apart from fisheries-related legislations.
Niue	Wildlife Act 1972 Environment Act 2015		WA 1972: Full or partial protection of any species of animal EA 2015: Establishment of protected areas	EA 2015: Established protected areas protect all flora and fauna in that area.
Palau	Endangered Species Act 1975 (Environmental Protection – Title 24)		ESA 1975: To protect and foster the well-being of these plants and animals by whatever means necessary to prevent the extinction of any species or subspecies in the Republic	ESA 1975: The minister has the authority to issue regulations and include a list of flora and fauna as endangered or threatened. CITES is mentioned in the importation of endangered or threatened species but not mentioned in their export, which may be authorised by the Minister upon issuance of a permit.
Papua New Guinea	Fauna (Protection and Control) Act 1966	Conservation and Environment Protection Authority Act 2014	FPCA 1966: wildlife fully protected with exceptions of an issued permit CEPAA 2014: Offers some protection by prohibiting the removal of any wildlife within a reserve	FPCA 1966: wildlife protection is determined through the type of conservation area. A protected area fully protects wildlife, whereas a wildlife management area may allow the taking of wildlife through a permit issued by the governing authority.
Samoa	Animal Ordinance 1960 Lands, Survey and Environment Act 1989		AO 1960: provides for the control and importation of animals and animal products LSEA 1989: All wildlife is protected including migratory animals	AO 1960: Any animal can be declared partially or fully protected.
Solomon Islands	Wildlife Protection and Management Act 1998	Wildlife protection and management regulations 2008	1998 Act set up for implementing CITES trade. Two schedules: Sch. I prohibited from trade, Sch II trade-controlled species	No general protection for all native species, only those specified in Schedule I. This includes all flying foxes and bats, 25 species of birds, and all parrots except 5 species listed in Sch II for trade.
Tonga	Birds Preservation Act 1915	Environment Management Act 2010 Parks and Reserves Act 1976	BPA 1915: forbids take (kill, shoot, capture, take, or destroy) of bird species in the First Schedule. EMA 2010: ensure observance of international environmental obligations, conservation, and protection of biological diversity, etc. PRA 1976: parks or reserves can be declared to protect, preserve, or maintain any valuable feature, and use and entry can be restricted.	Protected birds include all listed birds, whether imported or indigenous, and their eggs and offspring. Eleven birds listed in the Schedule have protection for part of or the entire year. Take may be permitted. No other legislation for terrestrial wildlife, other than regarding protected areas and reserves.
Tuvalu	Wildlife Conservation Act 1975	Environment Protection Act 2008 Conservation Areas Act 1999	WCA 1975: full or partial protection of declared animals or birds (not fish) including their meat, skin, shell, or any part however cured, treated, polished, carved, or otherwise. EPA 2008: implementation of international environment-related conventions regulating the protection of biodiversity. CAA 1999: areas can be declared for the purpose of preservation of biological diversity, including for species which are endemic, threatened, or of special concern.	Prohibition to hunt, kill, capture, or possess animals or birds and to search, take, willfully destroy, break, or damage eggs and nests. It is not clear which, if any, animals or birds have been declared as protected, partially or otherwise.

COUNTRY	LEGISLATION NAME AND YEAR	RELEVANT REGULATIONS	SUMMARY OF WHAT IS PROTECTED AND WHAT IS NOT	COMMENTS
Vanuatu	Wild Bird (Protection) Act 1962 International Trade (Flora and Fauna) Act 1989	National Parks Act 1993	WBA 1962: protection of individuals or eggs of bird species listed in S2 and the partial protection of species listed in S3,4. Hunting at night for any bird species at any time is unlawful. ITA 1989: provides for the implementation of CITES NPA 1993: protection and preservation in their natural state of areas which meet certain purposes (such as habitat of threatened species).	Protection against killing, harm, capture, sale, purchase, and export without a permit.
Territory/Protectorate				
American Samoa	Endangered Species – Natural Resources and Environment Ecosystem Protection and Development Chapter 7 of Title 24 1982 (Amended 1990) Endangered Species Act 1973 (USA)		Directive for an endangered species list in American Samoa as decided by the American Samoa Natural Resources Commission	The chapter is named Endangered Species and covers any species of fish, plant life, and wildlife that may be considered endangered by the commission unless otherwise considered a pest.
Commonwealth of the Northern Mariana Islands	Endangered Species Act 1973 (USA) Commonwealth Code 2 Div.5 CAP.1 (Fish, Game and Endangered Species Act)	Title 85: Department of Lands and Natural Resources Ch 85-30, SubCh 30.1 (amended, 2009) – Non-commercial fish and wildlife Regulations	ESA 1973: provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide for the conservation of such endangered species and threatened species, and to take steps to achieve the purposes of the treaties and conventions set forth in subsection (a). – pg1 Sec. 2 (b) Purposes	The term "fish and wildlife" or "wildlife" as defined in the Act or regulations refers to all members of the animal kingdom. This includes migratory and nonmigratory animals.
Guam	Title 5 – Guam Code Annotated Ch 63 Fish, Game, Forestry & Conservation		Take of wildlife is monitored with the use of permits and licenses.	Wildlife; a list of species is not readily available.
French territories: **French Polynesia (FP),** **New Caledonia (NC),** **Wallis and Futuna (WF)**	France: Environmental Code Legislative part Article L110-1 to L713-9), Book VI: (Articles L611-2 to L656-1) (2016), in addition to specific codes and laws of the given territory.	FP: Environmental Code (legislative: 2017, regulatory: 2018) NC: provincial environmental codes (Northern, 2008, Southern, 2009; Loyalty islands 2016)	FP: uses a list of species; non-specified wildlife appears to be available for uncontrolled use. NC: codes, or territorial regulations, manage hunting and fishing via species, periods, and quota. The codes list protected or invasive species with various prohibitions. Regular (~2 years) review to adjust to the local situation. WF: environmental code (2006) and regulations addressing fishing (2005), including Trochus and sea cucumbers. The fishing regulations also manage the method, such as prohibiting destructive fishing.	FP: bans irresponsible wildlife photography of priority species, as part of controlling consumptive use. NC: codes integrate customary practices, such as use of protected species in ceremonies. Recent effort to translate the objectives and constraints under the Nagoya Protocol, incl. genetic resources, into local regulations. Loyalty Islands use territorial regulations and plan to enact their full environment code re. wildlife in 2021.
Tokelau	Territorial Sea and Exclusive Economic Zone Act 1977	Biosecurity Rules 2003	BR 2003: To control the introduction and spread of exotic pests and diseases.; to protect the environment and the agricultural production of Tokelau. To provide "for biosecurity services for the import and export of animals and plants" TSEEZA 1977: Prescribing measures for the protections, preservation, conservation, and management of the marine environment of the territorial sea and the zone	BR 2003: Legislation to manage the unnecessary introduction of exotic species and to control and manage the pests and diseases already found in Tokelau. TSEEZA 1977: Tokelau is made of many atolls and emphasises the conservation, protection, preservation, and management of its marine environment. Provisions in the Act are generalised and will be enforced until the Governor-General enacts regulations for the conservation of these resources.

The following standard terms were used to search the public databases: *English*: wildlife, flying fox, hunting, wildlife conservation, conservation, preservation, protected species, endangered species; *French*: faune, renard volant, chasse, conservation de la faune, préservation, les espèces protégées, les espèces menacées.

PRESSURES AND OPPORTUNITIES

In addition to value in their own right and status as totem species, Pacific bats and birds play important roles as seed dispersers, in nutrient mobilisation, and in pollination with long-distance movement across islands.

Birds and bats also contribute to island economies across multiple sectors. This contribution can be indirect, such as the benefits provided by their aesthetic qualities or services to agriculture, or direct through sales or consumption.

Both birds and bats are eaten in the region. Bushmeat cannot be thought of simply as survival food. Rather, the consumption of local wildlife is linked to status, tradition, ritual celebration, and complex beliefs and practices about health, sustainability, and our relationship with nature. For example, bushmeat consumption in Samoa is practiced by the wealthy, with the top 10% of households based on financial income consuming 43% of all wild pigeon meat (Stirnemann et al. 2018). Cooperative research and management involving local experts can both identify population trends and encourage sustainability (Oedin et al. 2019).

Similarly, the consumption and trade of other wildlife parts, such as live animals, feathers, fur, and teeth, is complex. Behavioural change to manage wildlife consumption must account for the drivers of consumption. Management measures to ensure the sustainability of use and the long-term survival of Pacific species must account for the multiple, related drivers of wild population trends in a changing world.

Consumption of wildlife is part of our resource footprint and affects SDG 11.3.1, the 'Ratio of land consumption rate to population growth rate'. Wildlife consumption can alter wildlife populations for decades or more (see 'Birds').

Declines in wildlife populations are a global concern (WWF 2020) with the largest single driver considered to be habitat loss, with climate change exacerbating the impacts of changing land use, growing human populations, and growing human alterations of ecosystems. Although direct wildlife consumption is only one of the pressures faced by Pacific species, this consumption exists within a changing web of pressures. The contribution to wildlife decline from illegal trade and use is unknown in the Pacific. There are suspected links with logging which provides ready access to displaced wildlife.

In the past, the sustainability of wildlife consumption has relied heavily on the existence of healthy native habitat. Today, the availability of essential habitat with sustainable levels of pressure cannot be guaranteed, even for species that have tolerated past hunting pressure.

Even in cases where use has historically been sustainable, a combination of consumption with extreme events, changing environmental conditions, and changing socio-economic conditions can threaten the survival of Pacific species. To conserve species in such contexts, bans or regulations on wildlife use can be introduced that are defined for an area, a period of time, or a combination of factors (see Regional Indicators: Protection). Such management measures are part of Pacific traditions.

Birds

Throughout the Pacific islands, birds are used for food, cultural ritual, decorative arts, the pet trade, and many other purposes of social, cultural, and economic importance. Pigeons and megapodes (ground-dwelling birds) are perhaps the most commonly known birds used for bushmeat and eggs today, but many species are used for their feathers or are bycatch during hunting for other target species.

Since the early occupation of the islands, birds have been important food sources. For example, "Megapodes are a socio-culturally, historically and economically important family of birds for many peoples in the Indo-Pacific. Their eggs are an abundant and predictable resource and are heavily harvested" (Sinclair et al. 2010 and references therein). Traditional ecological knowledge of megapodes in Melanesia is also the subject of one of the few comparisons and integrations of scientific and traditional knowledge (Sinclair et al. 2010).

To the best of our knowledge, there has been no regional summary of the share of bird species present in the Pacific islands today that are hunted (for meat, eggs, feathers, or other parts) or traded. Of the 1,262 bird species (Class Aves) on the IUCN Red List associated with the Pacific islands region, 610 species have recorded use or trade for human food (272 species), medicine (3), other household goods (10), handicrafts or jewellery and other uses (40), pets or display animals (498), and sport or specimen hunting (105) (IUCN 2020).[1] Of these 610 species, the populations of 279 species are declining, 217 species are stable, 52 species are increasing in abundance, and the population trends of 53 species are unknown. At least 78 of the species are at risk.

There are known problems with bird trade from the Pacific islands. For example, over 54,000 CITES-listed birds were traded from the Solomon Islands between 2000 and 2010 by being falsely stated as captive-bred when they were in fact caught from the wild (Shepherd et al. 2012).

Historically, wildlife products such as feathers and fur or hides were important parts of the trade of luxury goods throughout Melanesia, Polynesia, and Micronesia. For example, the tevau feather currency made in the Solomon Islands relied on the red feathers of scarlet honeyeaters *M. c. sanctaecrucis*, with a roll of currency requiring feathers from over 300 birds (Houston 2012). Headdress production using red feathers of the Vulnerable Pesquet's Parrot *Psittrichas fulgidus* requires approximately 8% (3,200 birds) of the wild population each year, and now more parrots are represented in headdresses than can be found in the wild in Papua New Guinea (Nugi & Whitmore 2020). Today, such consumption is combined with other pressures on wild populations.

International trade or poaching from outside of the region also impacted Pacific wildlife populations. Spennemann (1998) demonstrated that "between 1897 and 1914 over 3.5 million seabirds were killed on islands in the central Pacific Ocean" to satisfy international demand for feathers, and this consumption has left traces in the distribution of the birds still measurable a century later.

[1] Note that these values include all species in the Aves class, including seabirds.

CRITICAL CONNECTIONS

Birds and bats play a key role in Pacific island ecosystems and also play a role in our food security, cultural heritage, and interactions with nature today.

Access to and interactions with nature give us many benefits and are part of our traditional, cultural, and spiritual practice, promoting wellbeing and physical exercise with associated benefits for mental health. Some of our most important economic sectors, like tourism, take advantage of these benefits. Sustainable practices that help us encounter nature without consuming it can give us many of the benefits of engaging with wildlife without placing direct pressure on wild animals. Many of the challenges that bird and bat species face are the same as those that affect humans and our health. Land-use change, climate change, and invasive species are the top threats to Pacific resilience, for us and for wildlife. In some cases, overuse of wild species can even contribute to greenhouse gas emissions through removal of native trees or degradation of forests.

Just like focusing on hunting alone is not enough to save Pacific birds and bats, focusing on human health alone is not enough to address the underlying causes of our health status and our resulting relationship with wild foods. Focusing on hunting or on environmental change as a technical problem is not enough: we must consider the socio-cultural context of human-induced drivers of ecological change. Indeed, ecological balance was a key component of the *Healthy Islands* vision declared by Pacific health ministers in 1995 (WHO, 2015).

When we work to save ecosystems, we all benefit.

BOX 3.1: ARE SEA TURTLES SAFE FROM OVER-USE?

Marine turtles are an iconic representative of the many coastal and marine wildlife species used in the Pacific islands. Turtles are important to Pacific cultures—as indicated throughout the archaeological and historical record—for subsistence and ritual food, cultural and traditional activities, and export (Allen 2007).

All marine turtles are recognised internationally as species of conservation concern. Of the world's seven marine turtle species, six occur in the Pacific islands region and are on the IUCN Red List of Threatened Species as follows:

Leatherback *(Dermochelys coriacea)*:	Critically endangered (West Pacific subpopulation)
Hawksbill *(Eretmochelys imbricata)*:	Critically endangered
Loggerhead *(Caretta caretta)*:	Vulnerable
Green *(Chelonia mydas)*:	Endangered
Olive ridley *(Lepidochelys olivacea)*:	Vulnerable
Flatback *(Natator depressus)*:	Data Deficient

Green and hawksbill turtles are the most widely recorded species, with confirmed records in nearly all Pacific island countries and territories.

All species of marine turtles are listed in Appendix 1 of CITES, prohibiting the international trade of the animals and their parts due to the threat of extinction.

Although subsistence hunting of turtles may have been sustainable in the past, the combination of increasing human populations, the introduction of new harvesting technologies, and loss of traditional knowledge and practises appears to have shifted that balance (Humber et al. 2014).There is added pressure from other threats such as pollution, invasive species, bycatch, and climate change.

Interventions by CITES have reduced the global trade of turtle products, but direct take of turtles is still widespread throughout the Western Pacific (Humber et al. 2014). Some islands have restricted their take to subsistence only but there is evidence of common illegal captures for domestic and international trade (see Vuto et al. 2019 for an example). The form of legal direct take varies throughout Pacific countries and territories as do the management tools used, including permits, size limits, species-specific rules, seasonal closures, marine sanctuaries, and moratoria. For more information on legislation protecting turtles, see Maison et al. (2010).

Empirical data are limited throughout the Pacific, making assessments difficult. From March 2020 to October 2021, SPREP is undertaking a Pacific marine turtle extinction risk analysis through the Bycatch and Integrated Ecosystem Management project funded by the European Union. The analysis will attempt to consider all sources of mortality to determine if marine turtles in the Pacific are being overused, to identify turtle bycatch rates, and to identify the major drivers of turtle population decline. This project will be at the Regional Management Unit and country level, with a focus on Fiji, Papua New Guinea, Solomon Islands, Tonga, and Vanuatu.

Compiled by Hannah Hendriks and Unity Roebeck

BOX 3.2: PROTECTION LEADS TO RECOVERY IN THE SOLOMON ISLANDS

The foraging and nesting grounds of sea turtles are often separated by thousands of kilometres, but adult turtles periodically make the journey from their foraging grounds back to their natal nesting beaches for the purposes of breeding. In part because of the decades between their hatching and return to lay their own eggs, turtles are sensitive to land-use change and over-harvesting.

The Arnavon Islands, between Isabel and Choiseul Provinces in the Solomon Islands, is the largest rookery for hawksbill turtles in the oceanic South Pacific. This rookery has been severely overexploited over the past 150 years, beginning with Roviana people from New Georgia collecting hawksbills for their shells to trade with European whalers throughout the 1800s.

In 1976, in response to a critical decline in the hawksbill population, the Solomon Islands government declared the Arnavons a sanctuary and commenced turtle monitoring at the islands. However, this top-down, government-led initiative was not supported by the traditional owners. In 1982, a local community member burned down the government infrastructure, and intensive turtle harvesting resumed.

In 1991, local resource owners and the Choiseul and Isabel provincial governments, with support from The Nature Conservancy, worked together to re-establish the Arnavons sanctuary and to conduct routine beach monitoring and turtle tagging to better understand the status of the rookery. In 1993, the Solomon Islands Fisheries regulations were amended to ban the sale, purchase, and export of any turtle product, halting large-scale trade in hawksbill turtle.

Learning from the past, modern regulations were created in consultation with resource owners and users, facilitating traditional use for valuable resources such as megapode eggs, alongside conservation of Arnavons terrestrial and marine habitats and preservation of the critically endangered hawksbill turtles. After extensive community consultations to plan for the Arnavon's future, the Arnavon Community Marine Conservation Area was established in 1995, with the island group renamed as the Arnavon Community Marine Park when it was declared as the Solomon Islands first national park in 2017. It is now illegal to take turtle eggs or destroy their nests during the breeding seasons of June to August and November to January, but subsistence take of turtles is still permitted.

Collaborations between community rangers and researchers produced 4,536 beach surveys and 845 individual turtle tagging histories from the Arnavons between 1991 and 2012. The long-term monitoring showed encouraging results: the first known evidence of recovery for a western Pacific hawksbill rookery. Both the number of nests laid at the ACMCA and the remigration rates of turtles doubled between 1995 and 2012. Beach monitoring also confirmed that nesting on the Arnavons occurs throughout the year, with peak nesting activity coinciding with the austral winter, and many of the hawksbill turtles that nest at the site actually forage in distant Australian waters.

The recovery of a regionally important rookery for one of the most charismatic and endangered species in the Pacific demonstrates the value of a multi-pronged approach to conservation involving inclusive, participatory community engagement, supportive policy, and a long-term commitment by civil society.

Compiled by The Nature Conservancy, Melanesia Program

Source: Hamilton et al. (2015) Solomon Islands largest hawksbill turtle rookery shows signs of recovery after 150 years of excessive exploitation. PLOS ONE 10(4): e0121435. DOI:10.1371/journal.pone.0121435

Bats

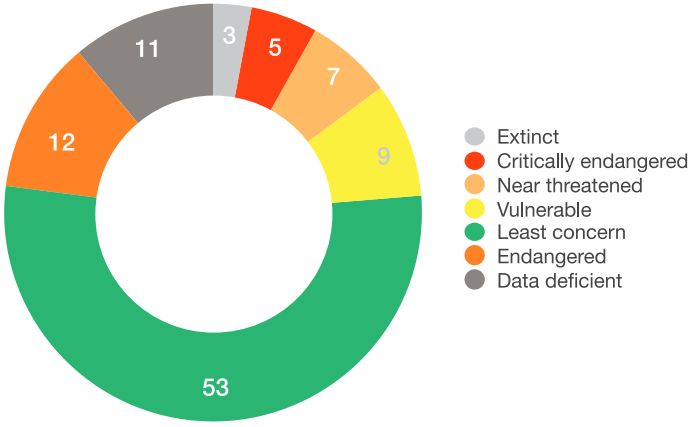
As of 2016, 40 bat species were known to be hunted, making the Pacific islands the region with the highest proportion of hunted bat species, globally (Mildenstein et al. 2016). Bats are eaten in American Samoa, Commonwealth of the Northern Mariana Islands (CNMI), Cook Islands, Federated States of Micronesia (FSM), Fiji, Guam, New Caledonia, Niue, Palau, Samoa, Solomon Islands, and Vanuatu (Mildenstein et al. 2016, Stirnemann et al. 2018, Oedin et al. 2019). Bat teeth are also valued as a decoration and traditional currency in the Solomon Islands (Lavery & Fasi 2019). Hunting and trade are linked: for example, illegal trade of bats hunted in FSM and taken to Guam and CNMI persisted after the 1989 CITES enactment with records up to 2008 (Hayes & Engbring 2020).

In total, 132 bat species present in 15 Pacific countries and territories are listed on the IUCN Red List (IUCN 2020; Figure 3.1). Of those, 21 species have been identified as needing law/policy intervention, and 65 species need land/water protection. The population trends of 59 species are unknown, 32 species are stable, and 40 species are declining (IUCN 2020). As of 2020, 50 bat species present in the Pacific islands region were identified as used for human food (48 species) and handcrafts, jewellery, or art (5 species); 42% of these species are at risk with 14 endangered or critically endangered, and the populations of 48% of these species are known to be in decline.

On islands, bats are 'keystone' pollinators and can spread pollen and seeds over long distances, thereby playing a crucial role in the diversity and survival of plant species on islands (Fleming et al. 2009).

In Fiji, "foraging densities of the Pacific flying fox *Pteropus tonganus*, an important seed disperser, were four times higher in agricultural habitats than in remnants of dry forest, illustrating a strong preference for foraging on abundant food resources in farmland. Resource subsidies provided by farmland were responsible for sustaining high abundances of the species despite severe deforestation across the region"

FIGURE 3.1: Number of bat species in the Pacific islands on the IUCN Red List, by category.



(Luskin 2010). However, the bats would only roost in native forest fragments, showing that native forest is essential for the bats to survive.

Hunting, habitat loss, and climate change are considered among the top threats to bat species worldwide (Frick et al. 2019). Bats are vulnerable to cyclones and the resulting food scarcity. Over 60% of bat species threatened by invasive species are on islands (Frick et al. 2019), and measures to control invasive plants have great benefits for bats alongside other species (Krivek et al. 2020).

Islands are important for bat biodiversity with 60% of species found on islands and 27% endemic to islands, and a greater share of island endemic bats are threatened (Conenna et al. 2017). Bats are the only native terrestrial mammals in 13 Pacific island countries and territories (Carvagal & Adler 2005; IUCN 2020). (Members of eight island groups lacked any native terrestrial mammals: French Polynesia, Kiribati, Line Islands, Marshall Islands, Nauru, Pitcairn, Tokelau, and Tuvalu [Carvagal & Adler 2005].) Despite their value, bats are rarely explicitly included in legislative and regulatory environmental plans and may be missing in the selection of priority landscapes for conservation.

REGIONAL RESPONSE RECOMMENDATIONS

In keeping with the stated goals of Pacific Leaders for sustainable use of environmental resources, countries can take action to:

- Identify needs and gaps in measurements or response to the consumption of terrestrial wildlife,
- Identify needs and gaps in the governance of and legislation regarding wildlife protection, use, and trade,
- Measure the consumption of terrestrial wildlife, including estimates of poaching or illegal trade,
- Plan for sustainable management of wildlife consumption in the context of other pressures, including extreme events, invasive species incursions, and climate change, among others, and
- Partner for environmental management alongside human health management.

Using a One Health approach requires leaders, managers, and knowledge holders to combine knowledge and data collection across multiple sectors to achieve better environmental management for better health outcomes. In the case of wildlife consumption where there is a direct link between human health and wild species through food and physical contact, information and monitoring can directly benefit health and healthcare planning in the Pacific islands region.

INDICATOR IN ACTION SDG 15.1, 15.5, 15.7, 15.c, 12.2, 2.1 • Convention on the Trade of Endangered Species (CITES) • Convention on Biodiversity • Convention on Migratory Species • Noumea Convention (article 14) • Pacific Regional Environment Outcomes 2.2, 2.3, 4.2 • Pacific Islands Framework for Nature Conservation Objectives 2, 5

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SPREP PROE

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THEME **Land**

INDICATOR **Native forest cover**

DEFINITION	Percentage native forest cover of total land area
PURPOSE	Indicates the suite of environmental values associated with forests (e.g. biodiversity, carbon sequestration, subsistence hunting)
DESIRED OUTCOME	Stable or positive trend in tree cover, or reduced rate of tree cover loss

Status
Fair to good

Trend
Mixed

Data confidence
Medium


Guadalcanal interior forest, Solomon Islands © Stuart Chape

WHAT KIND OF FOREST COVER?

- **Total**: all trees, any species or age.
- **Primary**: intact mature forest, dominated by native species. Original forest.
- **Native-dominated**: native Pacific species, typically under protection from invasive species, including invasive predators that affect the dispersal of native plant seeds.

PRESENT STATUS

The status of the region's forests was deemed Fair to Good, with the majority of Pacific islands still having relatively high forest cover, higher than the global average. The area of unlogged primary forest varies across the region, with large areas in Papua New Guinea (PNG) and countries like Cook Islands and Kiribati having no primary forest left (see Table 4.2).

With the increase in deforestation in many countries, especially in the larger islands of Melanesia, particularly PNG and Solomon Islands, the overall extent of forest coverage and quality is deteriorating. Melanesia accounts for the majority of the land area within the Pacific islands region. However, in the smaller countries and territories, there has generally been either no significant change or in some cases a small increase in forested area: such increases in forest area have most often been due to increases in commercial forest plantations or increased coverage of secondary re-growth forest, both of which have lower biodiversity value than native forests. The overall trend when looking at pressures on forests is therefore mixed.

Papua New Guinea ranked third in the list of countries with the fastest-growing rates of tropical primary rainforest loss in 2018 according to Global Forest Watch.[1] The Solomon Islands government is also concerned about the growing rate of tree cover loss, especially from 2014 to 2017.

[1] Of countries with over 100,000 hectares of primary forest. See: https://blog.globalforestwatch.org/data-and-research/world-lost-belgium-sized-area-of-primary-rainforests-last-year

Only 16% of forests in Oceania are in protected areas.

FAO 2020

CRITICAL CONNECTIONS

Pacific forests provide essential ecosystem services. Freshwater supply and quality, lagoon water quality, and national carbon accounting rely on well-managed, monitored native forests.

Our forests provide food and raw materials for subsistence and cultural traditions, help maintain clean water and the local climate, maintain soil fertility and productivity, and regulate erosion and the amount of sediment reaching coastal waters and affecting coral reef habitats. Changes in forest type have been associated with changes in coastal water quality and ocean species abundance.

Losses of native forests are tied to losses of biodiversity values and the ecological services provided by forests and watersheds, including food security and climate resilience, most notably through the sediment trapping, wave/flood protection, and coastline stabilization of mangrove forests but also the stability of native forest species.

Encroachment into island forests, including mangroves, for development undermines progress towards SDG 11.3.1: Ratio of land consumption rate to population growth rate.

Pacific forests are vulnerable to the impacts of climate change. Changes in rainfall patterns may result in more severe and longer droughts, increasing or creating susceptibility of forests to wildfires and long-term ecosystem change. Increasing global and regional temperatures will decrease the range of high-altitude cooler climate forests, especially cloud forests. Higher-intensity cyclones will have greater impact on forest integrity.

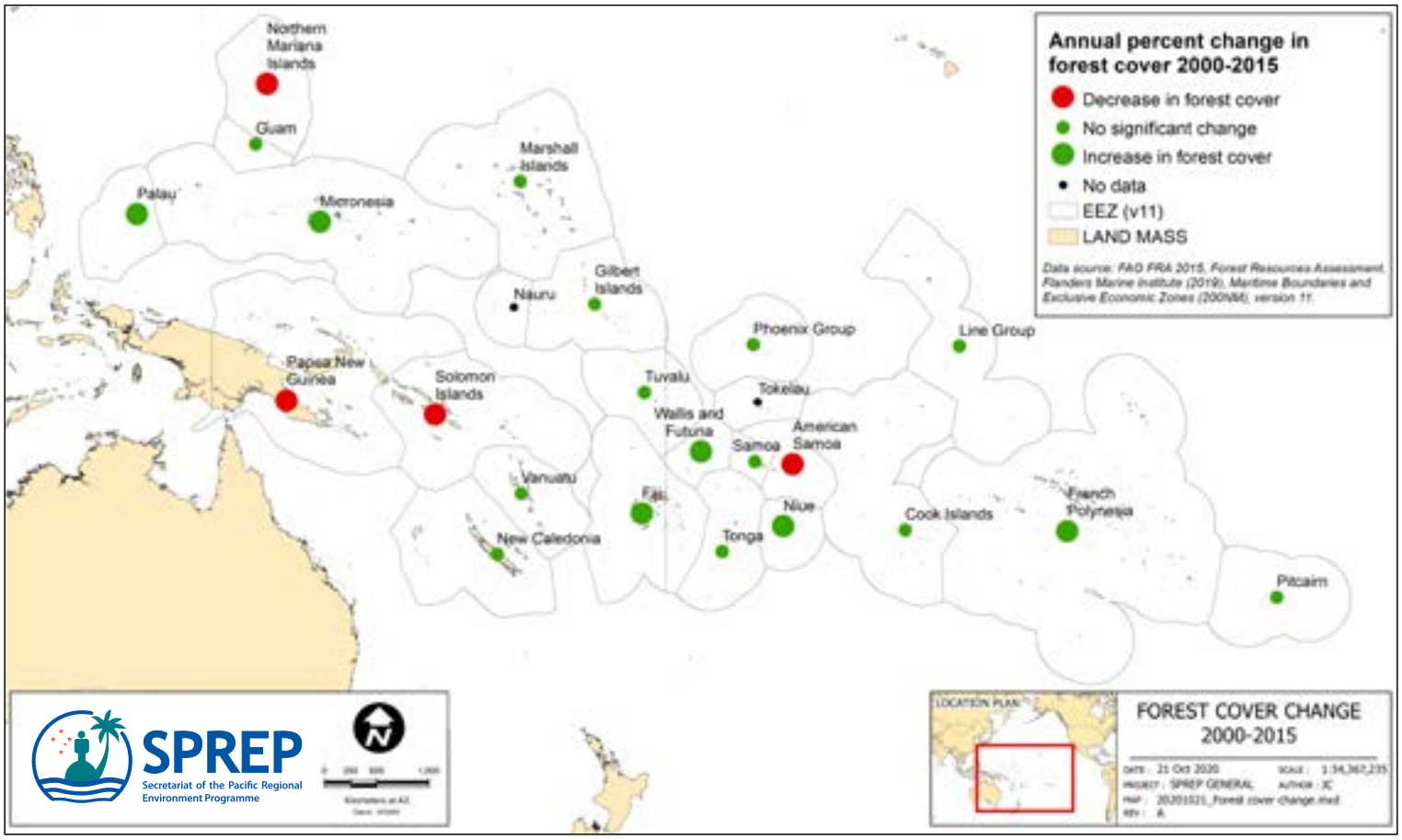

FIGURE 4.1 Total forest cover change in Pacific island countries and territories.

AVAILABLE DATA INDICATE LOSSES IN PRIMARY FOREST

The FAO Global Forest Resource Assessments 2015 dataset reports primary forest cover for 16 of 22 countries and territories in 2010, but data for the rate of change in primary forest cover are only available for 9 of the 22 over 2000 to 2015 (Table 4.1). Only the Federated States of Micronesia reported an increase in primary forest cover (of 0.64% for FSM, all data points predating 2010). Data for this rate of change are available for 11 countries and territories over 2010 to 2015, with Fiji, Commonwealth of the Northern Mariana Islands, and PNG still showing losses in primary forest cover.

Global Forest Watch provides a data alternative for some countries (Table 4.1). The GFW satellite-based method is more accurate for larger areas.

Our knowledge of invasive species impacts on native Pacific biodiversity also underlines the concern for Pacific primary forests (see *Regional Environment Indicator: Invasive Species*).

TABLE 4.1 Tree cover loss based on >75% canopy density

COUNTRY/TERRITORY	LOSS SINCE 2000 (%)	GLOBAL FOREST WATCH SUMMARY
Vanuatu	0.95	From 2001 to 2018, Vanuatu lost 10.5 thousand hectares of tree cover, equivalent to a 0.95% decrease in tree cover since 2000, and 3.97 Mt of CO_2 emissions.
New Caledonia	1.1	From 2001 to 2018, New Caledonia lost 7.63 thousand hectares of tree cover, equivalent to a 1.1% decrease in tree cover since 2000, and 2.68 Mt of CO_2 emissions.
Federated States of Micronesia	1.3	From 2001 to 2010, Micronesia lost 72 hectares of tree cover, equivalent to a 1.3% decrease in tree cover since 2000.
Palau	1.6	From 2001 to 2018, Palau lost 602 hectares of tree cover, equivalent to a 1.6% decrease in tree cover since 2000 and 346 kt of CO_2 emissions
Fiji	2.8	From 2001 to 2018, Fiji lost 33.5 thousand hectares of tree cover, equivalent to a 2.8% decrease in tree cover since 2000 and 14.3 Mt of CO_2 emissions.
Papua New Guinea	3.3	From 2001 to 2018, Papua New Guinea lost 1.32 million hectares of tree cover, equivalent to a 3.3% decrease in tree cover since 2000 and 715 Mt of CO_2 emissions.
Solomon Islands	5.9	From 2001 to 2018, Solomon Islands lost 159 thousand hectares of tree cover, equivalent to a 5.9% decrease in tree cover since 2000 and 83.2 Mt of CO_2 emissions.

Source: Global Forest Watch, accessed May 2020.

DATA GAPS PERSIST

The best existing regional data for this indicator are the metrics 'forest cover' and 'primary forest cover' from the FAO Forest Resource Assessment 2015. 'Forest cover' includes all tree species, whether native, agricultural plantation, or invasive, despite the very different ecosystem services provided by these different forest types.

In many Pacific countries, there has been a change in forest quality even if only a small change in forest area. Here, we focus on primary forest, which can be thought of as original forest. Only 1.6% of the forests in Oceania (including Australia and New Zealand) are primary forest (FAO 2020).

For some countries, the most recent real measurements were collected in the 1990s. Given the population growth and potential land-use change in the last 20 to 30 years, updated accurate assessments of forest extent, health, and presence of native species are essential for informed planning.

Across most of the Pacific Islands, there has been minimal change reported by the FAO in primary forest cover in the past 10 years (Table 4.2). A few countries drive the loss of over 40% of the region's primary forest since 1990, at a rate of –2.11% per year, compared with 2.6% of the world's primary forest lost at a rate of –0.10% (FAO 2015). Fiji, PNG, Solomon Islands, and Vanuatu have net log/timber exports and the forestry sector is a significant contributor to the national economy.

Only French Polynesia shows a substantive increase of total forest cover (2.63%) from 1990 to 2015.

The rate of deforestation in the region as a whole presents an unsustainable trend. However, the Pacific loss is less than the global average since 1990, with 1.9% of the region's forest area lost between 1990 and 2015, at a rate of –0.08% loss, compared with 3.1% of the world's forest lost at a rate of –0.13%.

TABLE 4.2 Total and primary forest cover and rate of change, 1990–2015 (most recent year). ha = hectares – indicates no data available

	TOTAL FOREST					PRIMARY FOREST			
	AREA (1,000 ha)			CHANGE (%)		AREA (1,000 ha)			CHANGE (%)
Country/region	1990	2010	2015	2000–2015	2010–2015	1990	2010	2015	2000–2015
American Samoa	18.4	17.7	17.5	-0.19%	-0.19%	–	–	–	
Cook Islands	14.4	15.1	15.1	0.00%	0.00%	0.0	0.0	0.0	
Fiji	952.9	992.9	1017.2	0.25%	0.48%	489.5	420.2	411.4	-0.53%
French Polynesia	55.0	155.0	155.0	2.63%	0.00%		40.0	40.0	
Guam	25.0	25.0	25.0	0.00%	0.00%	–	–	–	
Kiribati	12.2	12.2	12.2	0.00%	0.00%	0.0	0.0	0.0	
Marshall Islands	12.6	12.6	12.6	0.00%	0.00%	8.2	8.2	8.2	0.00%
Micronesia, Federated States	63.6	64.1	64.3	0.04%	0.04%	39.6	48.4	48.4	0.64%
Nauru	0.0	0.0	0.0			0.0	0.0	0.0	
New Caledonia	839.0	839.0	839.0	0.00%	0.00%	431.0	431.0	431.0	0.00%
Niue	20.6	18.6	18.1	-0.53%	-0.54%	–	5.6	5.6	
Northern Mariana Islands	33.6	30.3	29.5	-0.53%	-0.55%	10.1	8.2	7.7	-1.10%
Palau	38.2	40.3	40.3	0.12%	0.00%	–	–	–	
Papua New Guinea	33627.0	33573.0	33559.0	-0.01%	-0.01%	31329.0	20345.0	17599.0	-2.53%
Pitcairn	3.5	3.5	3.5	0.00%	0.00%	–	–	–	
Samoa	130.0	171.0	171.0	0.00%	0.00%	–	0.0	0.0	0.00%
Solomon Islands	2324.0	2213.0	2185.0	-0.25%	-0.25%	1105.4	1105.4	1105.4	0.00%
Tokelau	0.0	0.0	0.0			0.0	0.0	0.0	
Tonga	9.0	9.0	9.0	0.00%	0.00%	4.0	4.0	4.0	0.00%
Tuvalu	1.0	1.0	1.0	0.00%	0.00%	–	–	–	
Vanuatu	440.0	440.0	440.0	0.00%	0.00%	–	–	–	
Wallis and Futuna Islands	5.8	5.8	5.8	0.02%	0.03%	0.0	0.0	0.0	
Oceania	**38625.7**	**38639.2**	**38620.1**	**-0.16%**	**0.18%**				

Source: FAOSTAT http://www.fao.org/faostat/en/#data/RL

Log loading dump, Choiseul, Solomon Islands © Stuart Chape

PRESSURES AND OPPORTUNITIES

The unique biodiversity in the islands and our strong dependence on forests for stable, resilient island ecosystems increase the concern about forest changes. Tropical forests still dominate the world's forest loss (FAO 2020).

Logging and forestry pressure vary substantially among the countries, but all suffer increasing pressure from invasive species, which directly harm forest plant species as well as native birds that distribute seeds.

Forest quality may be significantly reduced due to large increases in 'open forests' and forests dominated by introduced invasive species (FAO 2020). Areas of primary forest (higher quality) may decrease, while areas of planted forest increase: in some cases, this may cause an overall net increase in forest area that masks the biodiversity and ecosystem losses.

Papua New Guinea and the Solomon Islands are the two largest sources of tropical lumber imported by China, accounting for half of China's imported tropical logs (Global Witness, 2018). In 2017, Solomon Islands exported over 3 million cubic metres of logs, over 19 times a conservative estimate of the annual sustainable harvest (Global Witness, 2018). Natural forests will be exhausted by 2036 under the current rate of logging, according to a report commissioned by the Solomon Islands' Ministry of Finance.

Native forest cover and vegetation are more resilient to extreme weather and can buffer the impacts of extreme events.

REGIONAL RESPONSE RECOMMENDATIONS

Many data gaps remain that undermine accurate regional assessments and sustainable forest management. To address these challenges and seize the opportunities that healthy forests present for our region, Pacific countries can:

- **Measure** forest area and native forest species over repeated time increments. Quantifying the change in forest quality is also important to monitor changes in forest ecosystem services because these services differ substantially between native forests and secondary forests, monoculture plantations, and other forest types.
- **Plan** to protect native forests for social and cultural functions, carbon capture, as well as soil and water conservation. Active management plans, harmonised across sectoral goals, can increase the sustainability of national forest management.
- **Enforce** protection from illegal or unsustainable forest practices, clearly distinguished from defined permitted use and access to forest resources. Given the pressures from invasive birds and rats on native plant seeds, necessary protections extend beyond simple declaration of boundaries.
- **Partner** for restoration of native forests, ensuring development partners understand and share the prioritization of native species and primary forest.

INDICATOR IN ACTION **SDGs** 6.6, 15.1, 15.2 • **UNFCCC** • **CBD** • **Ramsar** • **SAMOA Pathway** 94 • **Regional Environment Objectives** 1.2, 2.2 • **Pacific Islands Framework for Nature Conservation Objectives** 3, 4, 5

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Pacific Environment Portal; see https://pacific-data.sprep.org/

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THEME **Land**

INDICATOR **Freshwater Quality**

DEFINITION	*E. coli* levels in water samples
PURPOSE	*E. coli* are indicators of faecal contamination in freshwater bodies and are associated with a range of possible human diseases. High levels of *E. coli* can be associated with cloudy water and decreased dissolved oxygen
DESIRED OUTCOME	*E. coli* threshold at or below globally accepted standards for drinking and bathing water, which is none detectable per 100 mL for both *E. coli* and total coliforms for drinking water; standards vary for bathing and swimming water

Status
Fair

Trend
Mixed

Data confidence
Medium

Freshwater canoe trip, Samoa. © Charles Netzler

PRESENT STATUS

There are active drinking water or freshwater monitoring programmes in 11 of 14 Pacific countries and 6 of 7 territories. The primary challenge is the regularity and frequency of sampling, the capacity to process samples accurately in country, and the official response process to the findings. There is no regional data collation for this proposed indicator, to date.

Escherichia coli occurs naturally in human and animal intestines and therefore can be used as a proxy for untreated sewage contamination or other pollution.[1]

E. coli or general coliform presence has been confirmed in a large number and proportion of samples across many Pacific island countries and territories. Although data are limited (medium confidence), the rates of contamination observed, along with the prevalence of waterborne diseases, imply that the status of this indicator is fair with mixed trends among the Pacific countries and territories.

National standards for drinking water vary or may not be independently defined. Specific tropical standards might help local authorities make well-informed decisions about the presence of naturally occurring coliform bacteria, not all of which are human pathogens.

It is important to note that water quality is a complex issue and one indicator alone is insufficient to fully describe the safety and utility of water for all aquatic life and human uses. However, a single indicator can be used as a proxy for other types of contamination that threaten the general health of the waters. Established monitoring series also provide clues about long-term patterns and facilitate additional sampling when resources are available.

Conventional water pollutants are defined by the USA Environmental Protection Agency's Clean Water Act of 1977 as biochemical oxygen demand, total suspended solids, faecal coliform, oil and grease. Additional water quality parameters to consider in water monitoring programmes include temperature, dissolved oxygen, pH, turbidity (cloudiness, a proxy for sediment loads), total nitrogen and/or total phosphorus (which can indicate fertiliser run-off and other pollution), and *Enterococci* (see Regional Indicator: Lagoon water quality).

REGIONAL WATER AND SANITATION STATISTICS IN THE PACIFIC ISLAND COUNTRIES

As of 2017, the most recent year reported:

- 55% of people have access to at least basic drinking water service
- 30% of people have access to at least basic sanitation services
- 52% of people are served by unimproved sanitation

Source: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, 2020, https://washdata.org/

[1] Some countries measure *Enterococci* bacteria instead of *E. coli* or faecal coliforms. The World Health Organization (WHO) metric of 140 *Enterococci* per 100 millilitres of sampled water corresponds roughly to 250 faecal coliform per 100 mL.

Piula freshwater pool, Samoa. © Charles Netzler

CRITICAL CONNECTIONS

Freshwater quality is an indicator, product, and starting point for human and ecosystem health.

Poor water quality directly harms human health but also threatens food security, with the risk of contaminating crops or seafood while they are growing or during food preparation.

Poor (or the perception of poor) water quality impacts tourism, just as tourism can increase pressure on limited sanitation systems and can increase plastic waste through bottled water consumption. Cooperation is essential for sufficient and safe water supplies.

Freshwater supply and quality and lagoon water quality rely on well-managed native forests and wetlands. Traditional agroforestry and climate-smart agriculture are powerful tools in smart and safe water management. These methods might include taro swamps, shade-grown crops, composting (which can redirect 40% of waste from landfill, on average), and other tools.

Ecosystem-based development solutions can help communities take advantage of the benefits of these complex connections.

PRESSURES AND OPPORTUNITIES

The quality of fresh water on islands is heavily impacted by land-based pollutants through improper sewage disposal, inputs into rivers and streams, and runoff from agriculture. Both human and animal faecal matter, commonly from animals kept near streams or coasts, are hazards for this indicator. In some Pacific countries, mining and industrial waste threaten drinking water and agricultural water resources.

Water limitation is a growing concern under climate change and population growth. Freshwater resources on atolls and coral and limestone islands are generally limited to groundwater, rainwater and surface reservoirs, and countries like Nauru, Niue, Kiribati, Tonga, Tuvalu, and the Republic of the Marshall Islands have no significant surface water resources, relying heavily on rainwater harvesting and desalination. The resilience of both freshwater systems and infrastructure to climate change are of growing importance.

The health of nearshore and terrestrial water resources are closely linked on islands. The common practice of piping untreated sewage outfalls into rivers and nearshore ocean ecosystems can place coastal drinking water sources on land at risk (see Regional Indicator: Access to and quality of sewage treatment).

E. coli and pathogenic microbes can grow in tropical conditions, threatening stored water supplies such as rainwater tanks. The limited freshwater resource on many islands (SPREP, 2016) and growing demand from larger populations, combined with increasingly variable freshwater replenishment due to climate change and salinization from sea level rise, make the quality and quantity of freshwater resources a management priority.

Access to clean water is essential for basic health and disease prevention, a fact thrown into the spotlight during the COVID-19 pandemic. At the time of writing, the full impacts of the COVID-19 pandemic and its relationship with freshwater and sanitation management in the Pacific islands are not known, but the links between freshwater and health are many. Pacific islands already face significant health challenges that relate to freshwater and sanitation that can add to or supersede the pandemic. Flood events can cause spikes in diarrhoea and other diseases caused by bacteria and viruses transmitted in contaminated water, as already observed in Pacific islands in recent years. The World Health Organisation predicts that diarrhoea and other diseases are likely to be exacerbated by climate change, contributing to an estimated 250,000 additional deaths globally each year between 2030 and 2050 (WHO 2018).

Healthy forests and wetlands naturally filter water and support clean, safe fresh water for island ecosystems and communities. Freshwater ecosystems and species are some of the most under-studied in the Pacific islands region (see Regional Indicator: IUCN Red List summary).

NATIONAL RESPONSE RECOMMENDATIONS

For bathing water directives, sampling at least monthly is required. Because *E. coli* levels can change rapidly and high values are common after rain events, one high value may not require the closure of an area or water supply source but should start a process of additional sampling or precautionary measures.

An essential element of a strong water quality monitoring programme is the response mechanism. National managers must define the actions required if a high value is observed and the requirements for an area or water source to be deemed acceptable again. Cooperation across sectors can support timely responses for safer communities.

REGIONAL RESPONSE RECOMMENDATIONS

The recommendations made in the Pacific Regional Action Plan on Sustainable Water Management remain valid (WHO, 2016). Along with guidance for finance, technology and training, and other aspects of sustainable water and sanitation systems, the Plan recommends the following actions for water resources management:

- strengthen the capacity of small island countries to conduct water resources assessment and monitoring as a key component of sustainable water resources management;
- implement strategies to use appropriate methods and technologies for water supply and sanitation systems and approaches for rural and peri-urban communities in small islands; and
- implement strategies to improve the management of water resources and surface and groundwater catchments (watersheds) for the benefit of all sectors including local communities, development interests, and the environment.

A GEF-funded Pacific programme has advocated mainstreaming gender into Integrated Water Resources Management (IWRM) with a toolkit and recommendations for the type and nature of engagement, including gender-disaggregated data collection and inclusion during planning because of the intensely gendered nature of water and sanitation management.

From an environmental perspective, regional priorities include efforts to:

- measure freshwater and drinking water quality regularly, building in-country capacity to run analyses and maintain effective laboratory standards;
- plan to monitor and respond to fresh water quality metrics, drawing on multi-sectoral cooperation to respond to samples that exceed the safety threshold;
- enforce protection of freshwater sources and ecosystems through land-use management and community co-operation as well as enforce protection of communities via rapid-response mechanisms to indicators of contamination; and
- partner for sustainable freshwater ecosystem management.

INDICATOR IN ACTION

SDGs 6.3, 6.6 • Basel Convention • United Nations Convention to Combat Desertification • SAMOA Pathway (64–65) • Noumea Convention (Article 7) • Pacific Regional Environment Objectives 2.1, 3.1, 3.4 • Pacific Islands Framework for Nature Conservation Objective 2

FOR MORE INFORMATION

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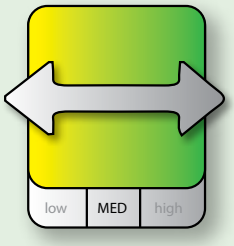
THEME **Land**

INDICATOR **Land under cultivation**

DEFINITION	% of total arable land that is under cultivation
PURPOSE	Tracks the area of arable land that is developed for agriculture
DESIRED OUTCOME	Stable trend in area under cultivation. A decreasing area under cultivation might affect food security and an increasing trend under area under cultivation implies some conversion of natural vegetation to agriculture



Status
Fair to good

Trend
Stable

Data confidence
Medium

Palm oil plantation Guadalcanal, Solomon Islands © Stuart Chape

PRESENT STATUS

Agriculture is a foundational industry in Pacific island economies and central to the independence of island communities. Together, agriculture, forestry and fishing provide from 3% to over 25% of the GDP of Pacific island countries, with a regional average of 17% (World Bank 2020), and agriculture accounts for a large share of employment (ADB 2015).

The status of the region's land under cultivation was deemed *fair to good*, based on national estimations in national State of Environment reporting (seven countries) and given the use of over 20% of land for agriculture in over half of the islands.

It is important to note that the share of cropland is neither good nor bad in itself; rather, the perception of quality depends on perspective, where for example an economic perspective could judge whether the share of agricultural land is sufficient for income or livelihood purposes and an environmental perspective could judge whether the share of agricultural or natural land, and the treatment of that land, is sufficient for national biodiversity and environmental targets. The method of agriculture strongly affects the biodiversity within the agricultural area and the impacts on surrounding areas. Generally, a plantation has lower biodiversity than the primary forest or natural ecosystem that it replaced.

The trend in the share of land under cultivation is considered *stable* for the region. The UN Food and Agricultural Organization (FAO) reports no change in the share of agricultural land since 2012 in any Pacific island (FAO 2019). However, for some islands, the most drastic change in farming or land use occurred in the 1980s with changing economies or in the 1990s with the introduction of diseases such as the taro blight in Samoa (Cook Islands 2018; Samoa MNRE 2013).

The share of agricultural land in the total land area grew by 0.3% in Melanesia, declined by 1% in Micronesia, and declined by 1.3% in Polynesia between 2000 and 2017. Among the countries and territories, the change ranged from a 13.7% loss in the Cook Islands (the next largest decline was of 6.7% in Tuvalu) to an increase of 4.2% in Tonga, with a crude average of a 1.3% decline in agricultural land as the share of total land area among countries and territories.

As Pacific populations grow, the same amount of agricultural land might be insufficient to feed the population. This population growth, altered lifestyles, or development pathway decisions might change the reliance of Pacific islands on domestic versus imported food. This nutritional independence is a known factor of fisheries management (see Regional Indicator: Commercial pelagic fish) and must be a factor in Pacific management of human health and natural environments.

CRITICAL CONNECTIONS

In addition to the impacts on food security, the share of islands under cultivation directly affects our freshwater supply and quality, lagoon water quality, and national carbon accounting.

Many sustainable land-use practices can provide high-value agricultural products, such as shade-grown coffee, vanilla, or cacao, and reduce the input costs for farmers who use regenerative agricultural systems where species nurture each other and the soil for long-term productivity.

Our forests provide food and raw materials for subsistence and cultural traditions, help maintain clean water and the local climate, maintain soil fertility and productivity, and regulate erosion and the amount of sediment reaching coastal waters and affecting coral reef habitats. Plantation forests are a type of cultivation, and changes in forest type are associated with changes in coastal water quality and ocean species abundance.

Climate change is a threat to food security on some Pacific islands, with the productivity of agricultural crops affected by long-term climate and extreme events (for example, ADB 2015). The quality of soils and water for crops is also impacted by climate change and its related stressors, such as sea level rise.

The share of land used for cultivation, hardscaped for development, or managed as a natural ecosystem shapes a country's progress towards SDG 11.3.1: Ratio of land consumption rate to population growth rate.

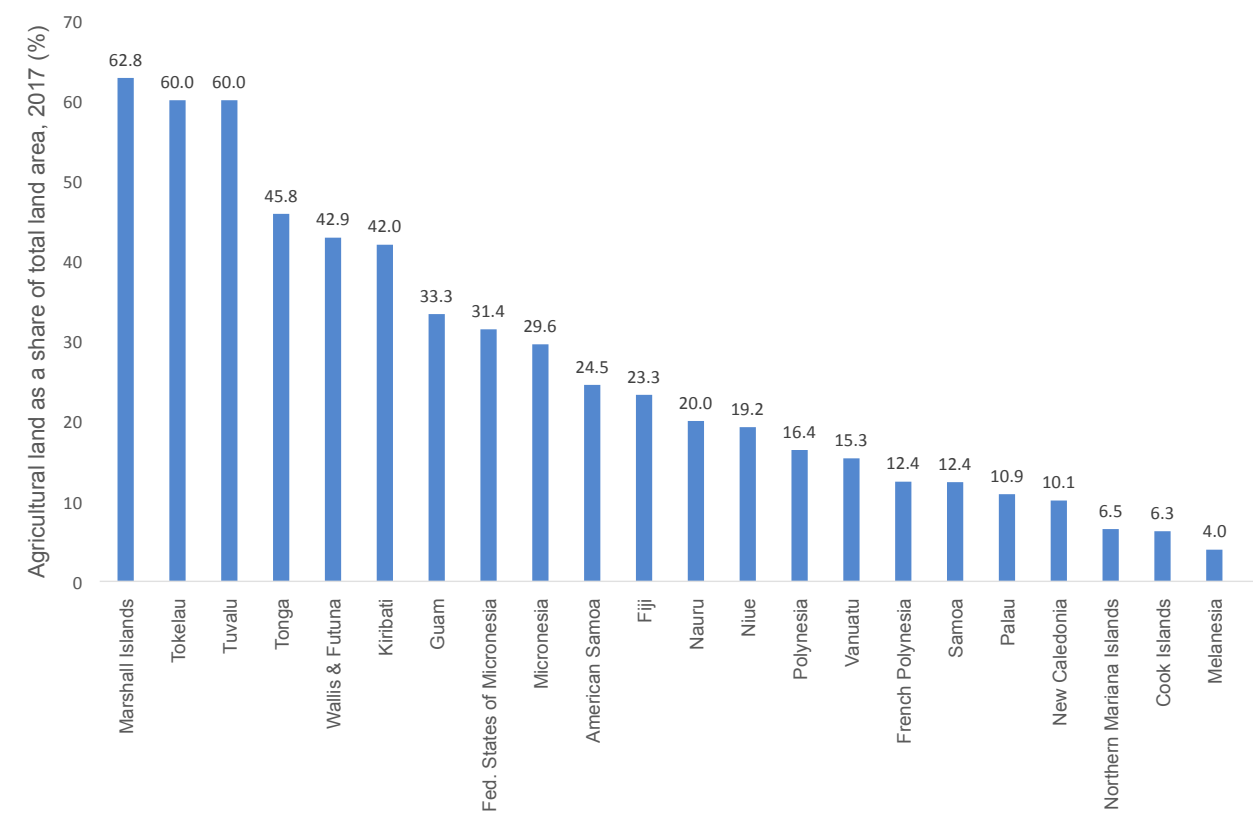


FIGURE 6.1: Agricultural land as a share of total land area in Pacific island countries and territories, 2017 or closest year (%). The share of agricultural land is often highest for the most land-limited countries, such as the atoll nations. Source: FAO (2019)

PRESSURES AND OPPORTUNITIES

Land in the Pacific islands is heavily modified, with the first navigators and settlers bringing plants and animals with them (e.g. Spriggs 2010). For example, only 1.6% of the forest in Oceania (including Australia and New Zealand) is primary forest (FAO 2020; see Regional Indicator: Native forest cover).

The biggest land-use change in terms of loss of forest cover for agriculture on Pacific islands happened between 1975 and 1990, and the trend has been more stable since. As development proceeds and populations grow, the land use is continuing to change at a rapid pace in many islands with lesser focus on conversion to agricultural land but a greater focus on conversion to hardscaped or 'developed' land.

New tools and technologies, such as remote sensing, could help Pacific people measure and monitor land-use changes over time. Freely available satellite imagery, like Copernicus Sentinel data, allows for detection mapping of land-use change. Various companies and organisations in the region can provide or support this service. Although the share of agricultural land is stable, the uses, quality, and habitats on other land areas in the Pacific islands are changing in step with changing Pacific societies.

Even the status of a given share of agricultural land can vary given differences in soil quality and other factors relating to geological conditions and agricultural management techniques. In their national State of Environment reporting, Pacific islands are beginning to consider other factors such as the share of cultivation in newly converted or ecologically sensitive areas, the type and quantity of agricultural chemicals used (which can involve hazardous residues, see Regional Indicator: Hazardous waste), the use of crop rotation or fallow periods, and the practice of burning to clear land as factors that can affect long-term sustainability of agriculture alongside biodiversity goals.

Island geography places unique challenges to sustainable agriculture. The unique biodiversity in the islands is threatened by invasive species, many of which were introduced deliberately or accidentally through agriculture (see Regional Indicators: Invasive species). The tropical sun is a particular challenge to soil nutrients under some agricultural practices, such as tilling and exposed soil between crop rows, because the essential ingredients for plant growth can break down under direct sunlight.

Household-scale to national-scale practices can jointly address soil fertility and waste management on islands through the re-use of natural materials in food and yard wastes (see Regional Indicators: Household and municipal waste generation and capture). Nearly half of all landfilled waste in Pacific islands is green waste (food and yard residues) that could form nutritious compost as a natural fertilizer, avoiding methane release from anaerobic degradation in landfill conditions (SPREP 2016; see Regional Indicator: Greenhouse gas emissions).

The genetic diversity of many Pacific food crops is maintained in the Centre for Pacific Crops and Trees, the only regional genebank. Innovation and preservation of cultivars that are suited to island conditions and resilient to climate change will be essential for future Pacific agriculture.

The Palau Policy to Strengthen Resilience in Agriculture and Aquaculture (Kitalong et al. 2015) set a goal for local production of food to meet 50% of Palau's needs by 2020.

REGIONAL RESPONSE RECOMMENDATIONS

Active management plans, harmonised across sectoral goals, can increase the sustainability of island ecosystems and agriculture. In addition to cultivated land, countries can consider measuring other land uses over repeated time increments. Quantifying the designated land use as well as the surface conditions (natural/permeable with or without native or other vegetation, hardscaped, built upon, and so on) will help identify changes in ecosystem structure and services over time.

Pacific islands are encouraged to:

- Monitor land under cultivation, including investments in monitoring of land use over time using available technologies;
- Plan to manage arable land for food security, social and cultural functions, carbon capture, as well as soil and water conservation;
- Enforce protection from illegal or unsustainable land-use practices. Given transboundary pressures such as those from invasive species and wind- or water-transported pollutants, necessary protections extend beyond simple declaration of boundaries; and
- Partner for restoration of land arability and of priority ecosystems, ensuring development partners understand and share the prioritization of native species and long-term soil health.

Sugar cane fields in the dry season, Nadi, Fiji. © Stuart Chape

INDICATOR IN ACTION

SDGs 2.4, 6.6, 11.3, 15.1, 15.5, 15.7, 15c · UN Convention to Combat Desertification · Convention on Biological Diversity 7, 10, 12 · Noumea Convention · Regional Environment Objective 2.2 · Pacific Islands Framework for Nature Conservation Objectives 4, 5

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
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THEME **Coastal and Marine**

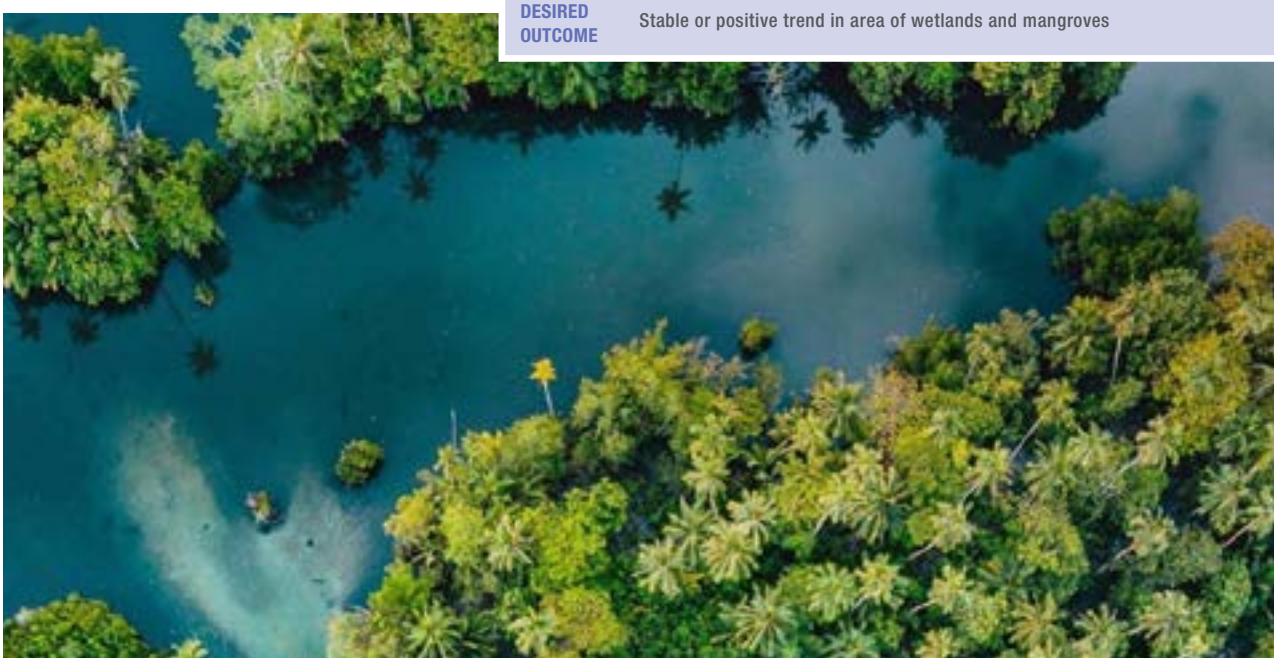
INDICATOR **Wetlands**

DEFINITION	% cover of wetlands, mangroves, and seagrass
PURPOSE	Wetlands, mangroves and seagrass provide ecosystem services not provided by other ecosystems (such as nurseries for economically important fish species, natural flood mitigation and water filter systems). They also support plants and animals not found in other ecosystems.
DESIRED OUTCOME	Stable or positive trend in area of wetlands and mangroves

Status
Fair

Trend
Deteriorating

Data confidence
Low



Mangroves, Samoa.
© David Unoi

PRESENT STATUS

The Pacific island region has diverse wetlands, such as the classic coastal ecosystems of mangrove forests, salt marshes, coral reefs, and seagrass beds along with rivers, freshwater lakes, and swamps (SPREP 2016). However, these wetlands are understudied. Land-use change and environmental change can alter the areal extent and condition of wetlands, and the pace of these changes vary among Pacific islands.

The amount of the region's wetland cover was deemed fair relative to an island baseline with intact forests and watersheds. Wetland records across the region are patchy, leading to a low data confidence ranking. With significant threats, especially from land-use change and climate change, the overall trend in the extent of wetland coverage is considered to be deteriorating.

Ten sites in six Pacific island countries are listed as Ramsar Convention on Wetlands sites, meeting nine criteria for identifying Wetlands of International Importance. These six countries are Fiji, Kiribati, Marshall Islands, Palau, Papua New Guinea, and Samoa.

Mangroves and coral reefs are arguably the Pacific wetlands with the most data and monitoring. For more about Pacific reefs, see Regional Indicator: Live coral cover. Mangrove areas were mapped in part under the MACBIO - Marine and Coastal Biodiversity Management in Pacific Island Countries and the Mangrove Ecosystems for Climate Change Adaptation & Livelihoods (MESCAL) projects, with national reports available via the Global Mangrove Alliance.[1]

The tropical Pacific contains 25% of the world's coral reefs and 3% of the world's mangroves (Gilman et al. 2006).

[1] http://www.mangrovealliance.org/, with the Global Mangrove Data Portal at https://gma-panda.opendata.arcgis.com/

CRITICAL CONNECTIONS

Wetlands support many Pacific communities and countless cultural traditions. Nearshore wetlands are uniquely important for Pacific women, who harvest food and use wetland resources for art, such as dyed barkcloth (tapa).

Wetlands provide a broad range of ecosystem services, across the full spectrum of supporting, provisioning, regulating, and cultural services. The difficulty in quantifying all wetland ecosystem services in economic terms should not stop us from protecting those services and acknowledging their value. The impacts of Pacific wetlands on our societies, identity, and wellbeing are valid, with socioeconomic flow-on effects.

Healthy wetlands are valuable and save money that would otherwise be lost to storm and flood damages. Upland wetlands can help prevent erosion and spread of pollution, protecting sensitive downstream wetlands. Connected by water, wetlands manifest the availability and quality of freshwater and links to coastal nearshore systems.

Wetlands that are protected from local stressors are considered more resilient to chronic impacts of climate change. Healthy, connected local ecosystems can support climate resilience: for example, healthy wetlands can buffer pH changes and temperature extremes as well as contribute to lower erosion and better water quality during storm events.

Given the economic, cultural, and livelihood reliance on wetlands and the economic drivers of wetland degradation, efforts to conserve and restore wetlands must begin with addressing the needs and values of Pacific communities.

HOW MUCH OF OUR WETLANDS ARE PROTECTED?

There is no coherent, single dataset for a comprehensive regional assessment of Pacific wetland coverage. Existing mapping attempts have been uncoordinated and haphazard (or driven by opportunity).

For this report, SPREP conducted a spatial analysis comparing wetland coverage and protected area coverage across the Pacific islands region (Table 7.1).

At the time of writing (July 2020), the most comprehensive coverage of corals, seagrasses, and mangroves for the Pacific islands region is provided in the global distribution maps managed by the UN Environment World Conservation Monitoring Centre (UNEP-WCMC):

1. Coral reefs (2018 v4): http://data.unep-wcmc.org/datasets/1 *The data are a compilation from multiple sources including the Millennium Coral Reef Mapping Project, IMaRS-USF and IRD (2005), IMaRS-USF (2005), and Spalding et al. (2001).
2. Mangroves (2010 v3): https://data.unep-wcmc.org/datasets/5 *A collaborative project of the International Tropical Timber Organization, International Society for Mangrove Ecosystems, Food and Agriculture Organization of the United Nations, UNEP-WCMC, United Nations Educational, Scientific and Cultural Organization's Man and the Biosphere Programme, United Nations University Institute for Water, Environment and Health, and The Nature Conservancy.
3. Seagrasses (2018 v6): https://data.unep-wcmc.org/datasets/7 *The sixth update to the data layer used by Green and Short (2003).

These spatial datasets were used because these datasets are both (1) available at a regional scale and (2) updated on a regular basis, which allows for monitoring over time. That said, the existing global and regional datasets have limitations regarding accuracy, completeness, scale, boundaries, and other factors, particularly in the rapidly changing Pacific region. National datasets are more accurate but, in most cases, not publicly available for this type of regional analysis. To increase the accuracy of monitoring, it will be important to share national datasets on wetlands, including mangroves, corals, and seagrass.

TABLE 7.1: Share of Pacific island wetlands in existing designated protected areas in 2020. Source: SPREP, UNEP-WCMC, and WDPA

WETLAND TYPE	SHARE OF WETLAND IN DESIGNATED PROTECTED AREAS (%)	DATA CONFIDENCE
Coral reefs	31%	Medium
Mangroves	12%	Medium
Seagrass	17%	Low

Note: The seagrass map was based on suitable habitat zones, not confirmed presence of seagrass. The spatial map of protected areas is based on the 2020 World Database of Protected Areas and does not include the newly designated marine protected area in Niue (2020).

The Allen Coral Atlas team is currently working on a more detailed dataset for coral reefs and seagrasses, with a target of providing data for the whole region in 2021.

The level of protection afforded by existing formal protected areas varies across the Pacific islands region. Enforcement, monitoring, and adaptive management to conserve and restore protected ecosystems remain as priority areas of action (see Regional Indicators: Protected Areas).

PRESSURES AND OPPORTUNITIES

Wetlands are essential to humans and nature. About 40% of the world's known species are associated with wetlands (Ramsar 2018). One-fifth of the world's largest fisheries depend on seagrass, and 10% of the organic carbon sequestered in the ocean is buried in seagrass beds (Unsworth et al. 2019, Fourqurean et al. 2012). Coral reefs are the marine ecosystem most threatened by climate-related ocean change, especially ocean warming and acidification (IPCC 2019).

Pacific wetlands are particularly important for local fisheries, cultural uses, and carbon cycling. Wetlands support many iconic Pacific species. Coral reefs are themselves a major tourism draw in addition to stabilising island shorelines and supporting fisheries.

Wetlands regulate the local and global climate. Like many natural ecosystems, wetlands both suffer and buffer the effects of climate change. Carbon storage in wetlands, such as mangrove forests and seagrass beds, can rival or exceed the carbon storage of non-wetland forests (Ramsar 2018). The destruction of wetlands can release greenhouse gasses. Quantification and valuation of wetland and 'blue' carbon storage is in early stages in the Pacific; for one example, USD 1.3 million worth of carbon was estimated to be stored in the mangroves of the Solomon Islands, calculated as part of the MACBIO project.

The pace of wetland loss is extreme. Around the world, wetlands are being destroyed three times faster than forests (Ramsar 2018). As one example, seagrass beds are essential to species like turtles and dugongs but about 7% of the global seagrass beds is disappearing each year (UNEP 2020).

In the context of the strong dependence of wetlands on local conditions and local management decisions, regional partnerships are also important to address the transboundary threats to wetlands of ocean warming, ocean acidification, and pollution. Freshwater wetlands are subject to rapid changes during extreme weather events.

With Pacific population increases and the demand for altered land-use, potentially with more hard-scaping, most pressures on wetlands are likely to rise. Policy visions and listed protections are underway, including spatial protection, but defining protected areas does not necessarily protect wetlands from direct threats and does not protect them from transboundary hazards. For more about spatial protection of Pacific ecoregions, including wetlands, see Regional Indicators: Protected Areas.

Pacific capacity for wetland measurement, monitoring, and management has been addressed in multiple, but uncoordinated projects. There are significant logistical challenges to mapping wetland coverage, at least ground-truthing remotely sensed measurements.

Afulilo, Samoa. © Charles Netzler

REGIONAL RESPONSE RECOMMENDATIONS

Because wetland health is closely linked with human health and water quality, global climate, and physical disturbance, the required actions for managing healthy wetlands must extend from global to local levels. Diverse, healthy Pacific wetlands require joint action within an integrated management structure to effectively address the findings of the scientific community and the expertise of Pacific people.

Coherent management plans from land to sea will be essential for Pacific wetland health. The use of a watershed as a management unit has specific benefits for wetland management.

At the regional level, countries can commit to:

- Measure wetland area over repeated time increments;
- Control pollution and human-derived physical disturbance;
- Plan to protect wetlands for inclusive food security, shoreline protection, and social and cultural functions;
- Enforce protection, building partnerships among sectors with jurisdiction over the elements of wetland areas and resources, such as the fisheries and tourism sectors, as well as between land and marine managers; and
- Partner for protection and restoration of wetlands.

INDICATOR IN ACTION SDG 14.2, 14.5 · Ramsar Convention on Wetlands · SAMOA Pathway (Article 58e) · Noumea Convention · Regional Environment Objectives 2.1, 2.2 · Pacific Islands Framework for Nature Conservation Objective 4

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SPREP PROE

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THEME **Coastal and Marine**

INDICATOR **Live Coral Cover**

DEFINITION	% of live coral cover in coastal and marine environments
PURPOSE	Indicator of overall health of reef ecosystems. These ecosystems provide important services for humans
DESIRED OUTCOME	Stable or positive trend in live coral cover

Status
Poor to fair

Trend
Deteriorating

Data confidence
Low


Tuvalu reef. © Peter McDonald

PRESENT STATUS

Simplifying coral reef ecosystems to a single number for a country, or for a region, runs counter to our knowledge of the complexity and variability that characterise healthy reefs in a healthy oceanscape.

The Pacific island region has very diverse corals and many types of reefs. Due to differences in the coral shapes and associated community of species, it is not possible to identify a single value as a health threshold for live coral cover. Instead, we can look for changes in live coral cover at a given reef, along with changes in species abundance and other factors that characterise a coral reef system.

That said, the regional average for coral cover was 26% in 2018 according to the *Status and Trends of Coral Reefs in the Pacific*, which only included data from 75 sites, a very low sampling density for a very large, diverse region with over 27,000 islands and an even greater number of reefs. There is a large amount of variability in coral cover among islands and habitats, in part due to the low sample number and representativeness of sites studied to date. Coral cover has been relatively stable over the past two decades in the Pacific Island Region, with a decrease of only 3% in the last 18 years.

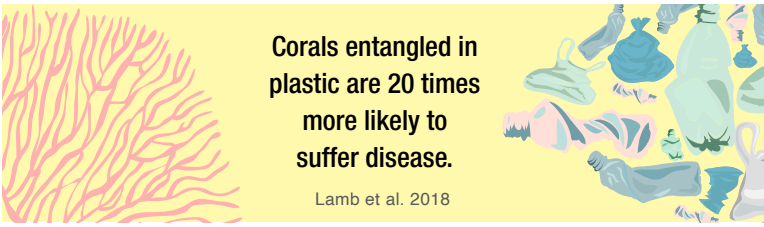
Studies suggest that the Pacific coral cover baseline (before recent change) could be higher than the 26% average reported in 2018 (Bruno 2013, Eddy et al. 2018). For healthy reef ecosystem services, a live coral cover closer to 30% or more might be needed; ongoing research is seeking to identify meaningful Pacific targets.[1] In the Western Indian Ocean, fish biomass drops off considerably and precipitously at sites with live coral cover below about 25% (McClanahan et al. 2011).

High variability in coral reef cover among the studied sites also supports the idea that reef health is driven by local factors, not just global changes. Local management actions can support local coral ecosystems and help to mitigate the inevitable effects of global change, at least in the near future.

Information from national sources, the *State of Conservation in Oceania* regional and national reports, and the growing body of research from Pacific reef scientists are essential to help managers identify reef health baselines and gaps in research and management. Regional and global reports by the Global Coral Reef Monitoring Network (GCRMN) help give global visibility to local reefs and compare only consistent datasets to produce regional-scale findings.

Declines in live coral cover have been an issue of concern in the Pacific islands region for many years. For example, Bruno & Selig (2007) showed approximately 20% mean coral cover for the southwestern Pacific and approximately 22% to 23% mean coral cover for the western Pacific, with a downward trajectory in live coral cover.

The status of the region's live coral cover was deemed fair, with the majority of Pacific islands still having relatively high live coral cover compared to an estimated historical baseline. Records across the region are patchy, leading to a low data confidence ranking. With significant threats, especially from climate change and natural disasters, the overall trend in the extent of live coral coverage is considered to be deteriorating.



[1] Wildlife Conservation Society (Fiji), Dr Stacy Jupiter and Dr Sangeeta Mangubhai, pers. comm.

Currency of corals

- Without reefs, annual flooding damages could double and frequent storm damages could triple in cost (Beck et al. 2018).
- Globally, coral reef value decreases by 3.8% when coral cover falls by 1% (Chen et al. 2015).
- As the ocean warms and coral reefs decline, a global loss of tourism and recreation value in the near future (2031–2050) of almost USD 3 billion per year (constant 2000 values) is projected under RCP 2.6 and up to USD 5.8 billion per year under RCP 8.5 (IPCC 2019).

CRITICAL CONNECTIONS

Pacific corals are important for the ocean and for the whole planet. Reefs provide a broad range of ecosystem services, across the full spectrum of supporting, provisioning, regulating, and cultural services. The difficulty in quantifying all reef ecosystem services in economic terms should not stop us from protecting those services and acknowledging their value. The impacts of reefs on our societies, identity, and wellbeing are valid, with socioeconomic flow-on effects.

Healthy reefs are valuable and save money that would otherwise be lost to storm and flood damages. Maintaining healthy coastal wetlands like coral reefs is the most cost-effective method of preventing shoreline erosion and avoids many costly problems associated with shoreline hardening, such as seawalls (Ferrario et al. 2014).

Reef conservation, restoration, and potential adaptation interventions are complex. However, in Indonesia, "there is high confidence that reefs with high species diversity are more resilient to stress, including bleaching" (Ferrigno et al. 2016). Boosting reef biodiversity benefits both reefs and local communities. Healthy, connected local ecosystems can support climate resilience.

Regime shifts in reef ecosystems can alter the species available for use. In some cases, shifts to more algal cover may be accompanied by more herbivorous fish. We must support our communities to take advantage of these changes in a sustainable way.

Coral reef health and island health rely on each other. Coastal development can cause direct physical impacts on coral reefs as well as changes in the movement of water and sediment in the nearshore ecosystem. Waste management and nutrient pollution also affect the balance of algae and coral on reefs. Lagoon water quality relies on management on land, from sustainable agricultural practices to the preservation of native forests, both upland and coastal.

PRESSURES AND OPPORTUNITIES

Corals form iconic Pacific wetlands (see Regional Indicator: Wetlands). Nearshore coral reefs are home to some of the most iconic and important Pacific wildlife that form the foundation of local food security, livelihoods, economies, and—through the production of sand and protection from waves—the island shorelines themselves.

Coral reefs are the marine ecosystem most threatened by climate-related ocean change, especially ocean warming and acidification (IPCC 2019). In the warming ocean, marine species are moving poleward by 30 to 50 kilometres per decade, but corals and island reef ecosystems are less mobile and more geographically constrained.

The projected future of coral reefs significantly differs between low-emission and high-emission future scenarios. Should global warming surpass 2°C, over 99% losses of coral reefs are expected (IPCC 2019). By 2050, almost all reefs in the Pacific are predicted to be rated as threatened, with more than half rated as at high, very high or critical. Cumulative impacts, including pressures from human use, reduce the capacity of reefs to keep pace with sea level rise (IPCC 2019).

However, the Pacific region contains several hope spots for reefs. For example, unlike other places that have seen repeated events, Fiji seems to have been spared repeated large-scale bleaching. The summer maximum sea surface temperatures in Fiji often align with the local cyclone season, during which storms can cool waters down (Mangubhai et al. 2019). Reefs in Fiji, New Caledonia, and Palau are under long-term study by local scientists and demonstrate strong resilience to climate change (e.g. Adjeroud et al. 2018, Mangubhai et al. 2019).

In the context of the strong dependence of reefs on local conditions and local management decisions, regional partnerships are also important to address the transboundary threats to coral reefs of ocean warming, ocean acidification, and pollution, including plastic debris (see Regional Indicator: Marine plastic pollution).

With Pacific population increases and the demand for altered land-use, potentially with more hard-scaping, most pressures on reefs are likely to rise. Human presence is connected to reef health: for example, low reef-builder cover (coral and coralline calcareous algae) was observed on reefs around inhabited islands (Smith et al. 2016). There are signs that marine protected areas can help maintain or restore live coral cover (e.g. Ziegler et al. 2018). In 2020, marine protected areas in the Pacific encompassed about 31% of the total coral reef area of the Pacific; see Regional Indicators: Wetlands and Protected Areas.

Acknowledging the multiple, emerging threats to corals, the post-2020 CBD framework draft action (target 1) includes language around integrity; measures of live coral cover could help identify sites with high integrity (once appropriate thresholds are defined). Ecological integrity is an important concept, particularly for ecosystems in which humans play a strong role. Because of their proximity to coasts, coral reefs are heavily impacted by human activities and are underrepresented in the approximately 13% of the ocean classified as marine wilderness (Jones et al. 2018).

Scientific knowledge of Pacific reefs is limited. Such knowledge would have national, regional, and global value, and growing the scientific capacity for Pacific reef research will require investment in local experts. Existing time series on many reefs are not sufficient to identify changes in reef health over time. Data for standard indicators such as coral recruitment and turf algal cover are limited. Globally, Fisher et al. (2015) estimated that 32% of all named marine species occur on coral reefs and that approximately 75% of the species that inhabit coral reefs are yet to be identified. Reefs may host more than 9 million species worldwide (Plaisance et al. 2011).

To date, we have limited evidence of the relative costs and benefits of proposed reef interventions, considering economic, ecological, social, and cultural dimensions. However, the threats to corals are outpacing our scientific knowledge, making comprehensive climate action essential to reduce warming even as we continue to learn ways to help corals survive.

Because reef services have been free, conservation actions are often assumed to be a cost burden. Instead, we can recognise their value. The innovative insurance policy on the Mesoamerican Reef[1], the first insurance policy on natural infrastructure, is an example of creating financial tools that support people and nature in the face of disaster.

REGIONAL RESPONSE RECOMMENDATIONS

Because reef health is closely linked with global climate, local water quality, and physical disturbance, the required actions for managing healthy coral reefs must extend from global to local levels. Diverse, healthy Pacific reefs require joint action within an integrated management structure to effectively address the findings of the scientific community and the expertise of Pacific people. Coherent management plans from land to sea will be essential for coral health.

Recommendations for linking biophysical and socio-cultural data for effective nearshore management have been created based on a survey including Pacific reef managers (Wongbusarakum et al. 2019). The International Coral Reef Initiative defined a set of recommended indicators at the global level (ICRI 2020), but capacity to measure and report against these indicators varies.

At the regional level, countries can commit to:

- Measure live coral cover over repeated time increments and across a range of reef habitats and geographies. Quantifying the change in coral lifeform and genera is also important because reef ecosystem services differ among types of corals;
- Mitigate pollution, including sediments, nutrients, and plastics; greenhouse gas emissions; and unsustainable harvest considering method, gear, and seasonal harvest rates;
- Plan to protect coral reefs for inclusive food security, shoreline protection, and social and cultural functions;
- Enforce protection, building partnerships with the fisheries and tourism sector as well as between land and marine managers; and
- Partner for restoration of coral reefs, ensuring development partners understand the natural spatial distribution of corals. Efforts spent introducing corals into other ecosystems with inappropriate conditions may be wasted as the corals will perform poorly and other native species may be displaced.

REEF COMMUNITIES ARE CHANGING

Porites appears to be a winner coral genus at the Pacific scale, surviving all disturbances and growing at the expense of other genera. A 20-year survey shows that *Porites* was a minor genus in terms of cover in the 1990s, but it represents nearly 50% of the average live coral cover in the Pacific islands region after 2010. Many *Porites* form relatively smooth masses, whereas others like *Porites rus*, *Porites cylindrica* and *Porites compressa* are very common inshore species that can form complex structures that support associated fish and invert communities.

Source: *Status and Trends of Coral Reefs in the Pacific*

[1] See https://meam.openchannels.org/news/meam/can-we-insure-our-way-healthier-oceans-and-ocean-communities

Aganoa Reef, Samoa. © Lagi Reupena

INDICATOR IN ACTION SDGs 14.2, 14.5 • Ramsar Convention • SAMOA Pathway (58e) • Pacific Regional Environment Objectives 2.1, 2.2 • Pacific Islands Framework for Nature Conservation Objective 4

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

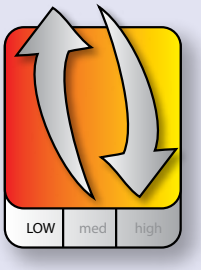
National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org

THEME **Coastal and Marine**

INDICATOR **Lagoon Water Quality**

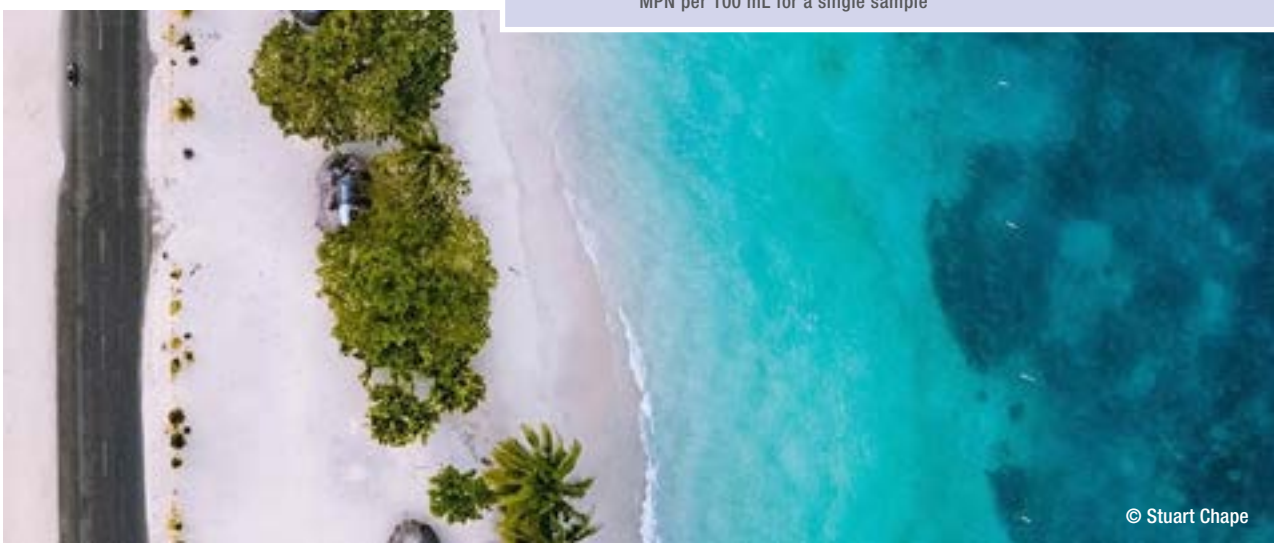
DEFINITION	*Enterococci* levels in water samples
PURPOSE	*Enterococci* are bacteria found in the intestines of animals and humans and indicate the presence of faecal pollution in coastal waters
DESIRED OUTCOME	*Enterococci* levels are within the safe threshold for marine recreation at all monitored sites. Current United States EPA thresholds are <110 cfu or 130 MPN per 100 mL for a single sample



Status
Poor to fair

Trend
Mixed

Data confidence
Low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PRESENT STATUS

Enterococci are used as an indicator for the microbiological quality of marine waters from the standpoint of human health. The same bacterial group is also commonly used as an indicator for safe consumption of shellfish. The safety thresholds differ by the type of use, such as swimming or consumption of seafood from the marine area.

There are active coastal water monitoring programmes in 7 of 14 countries and 6 of 7 territories (Table 9.1). Pacific islands need greater in-country capacity to test for *Enterococci* and to sustain regular monitoring. There is no regional data collation for this proposed indicator, to date.

Although data on this specific indicator are sparse (*low* data confidence), the available data indicate a deteriorating trend in some countries and rural areas combined with some improvements in urban water management (*mixed* trend). Many countries have a high incidence of samples exceeding the defined threshold; the present status is considered *fair to poor*.

The impact of this indicator on safe tourism and recreational use, safe consumption of nearshore seafood, and safe drinking water for coastal communities (see Regional Indicator: Fresh water quality) make this indicator a priority for human health.

It is important to note that water quality is complex and one indicator, such as *Enterococci* levels, alone is insufficient to fully describe the safety and utility of marine waters for all aquatic life and human uses. However, a single indicator can be used as a proxy for the general health of the waters. Established monitoring series provide clues about long-term patterns and facilitate additional sampling when resources are available. The regional indicator is used to provide visibility to the issue and a general baseline.

CRITICAL CONNECTIONS

Beyond the direct health risks of enterococcal bacteria to humans, poor water quality has direct and indirect relationships with island communities, economies, and ecosystems.

Poor water quality leads to degradation of important fish stocks and impacts tourism. Coral reefs and seagrasses suffer from algal overgrowth and turbid waters. These wetlands affect shoreline stability, tourism, fisheries, and more. Pollution crosses the on-paper boundaries of protected areas.

Combinations of these impacts are not simple sums but form complex and unpredictable ‘cascades’ of impacts.

The ecosystems at risk are also essential allies against pollution. Healthy wetlands can help filter and clean water supplies for people and ecosystems. Freshwater supply and quality as well as lagoon water quality rely on well-managed native forests.

Coastal development decisions can threaten pollution or benefit from the ecosystem services of nearshore environments. Encroachment into island forests, including mangroves, for development hampers SDG 11.3.1: Ratio of land consumption rate to population growth rate.

Climate adaptation measures can increase or decrease pollution, with hardscaping typically increasing and ecosystem-based solutions typically decreasing pollution. The resilience of facilities near waterways and coastlines should ensure they remain functional as long as possible to maximise their value but also to avoid coastal disturbances that cause pollution.

TABLE 9.1: State of coastal and/or nearshore water quality monitoring in Pacific island countries and territories.
Data were not publicly accessible (–) for some countries or some factors, in a desk-based assessment using publicly available information.
E. coli: Escherichia coli

COUNTRY/ TERRITORY	STATUS	ACTIVE WATER QUALITY MONITORING PROGRAMME	ACTIVE MONITORING OF MICROBES AS WATER QUALITY METRIC	IN-COUNTRY CAPACITY TO MEASURE MICROBE LEVELS	MONITORING FREQUENCY	SOURCE
American Samoa	2018: all tested stream miles "not supporting" safe swimming; ~30% of tested were 'fully supporting' of aquatic life	Yes	Yes (*Enterococci*)	Yes (*Enterococci*)	–	AS EPA: https://www.epa.as.gov/water-quality
Commonwealth of the Northern Mariana Islands	21% of CNMI coastal miles contaminated with *Enterococci* in 2018, of these 17.8 miles surround Rota and 32.7 miles surround Saipan. Improvement in LaoLao watershed	Yes	Yes (*Enterococci*)	Yes (*Enterococci*)	–	2018 Commonwealth of the Northern Mariana Islands 305(b) and 303(d), Water Quality Assessment Integrated Report; US EPA; EPA (2019) *Implementing Best Management Practices and a Conservation Action Plan Helps Restore the LaoLao Watershed*
Cook Islands	Poor, deteriorating, medium data confidence	Yes	?	No?	–	National Water Policy (2016), State of Environment (2018)
Federated States of Micronesia	No data; but known uncontrolled sewage discharge	–	–	–	–	State of Environment (2018)
Fiji	–	–	–	–	–	
French Polynesia	2017: about half of beaches unsafe for swimming	Yes	Yes (Coliforms, *E. coli*, faecal *Streptococci*)	Yes (*Enterococci*)	–	www.hygiene-publique.gov.pf/spip.php?article75
Guam	–	Yes	Yes (*Enterococci*)	–	weekly	Burdick et al. (2008) State of coral reef ecosystems of Guam.
Kiribati	–	Yes	No	Yes	–	STDF/PPG 657 (2019) Feasibility study.
Nauru	Biological and industrial pollution concerns	No?	–	–	–	
New Caledonia	2017: 20% insufficient (13 of 61 tests)	Yes	Yes (*Enterococci*)	Yes (*Enterococci*)	In swimming season	DASS NC; see https://tinyurl.com/y8o9jxzd
Niue		Yes	No	no?	–	State of Environment (forthcoming)
Palau	Fair to good; mixed	No	Yes (coliform)	Yes (coliform)	–	State of Environment (2018)
Papua New Guinea	Of concern; 2010: 28-44% of samples in East Sepik Province were 'poor' for *E. coli* and enterococcus	initial (WHO kits)	–	initial (WHO kits)	–	
Republic of Marshall Islands	in 2014, only 6 of 18 coastal sites met standards (see Inform data portal)	Yes?	Yes (*Enterococci*)	Yes (*Enterococci*)	–	RMI EPA (2014) Water quality monitoring, Nov 2014.
Samoa	No data (turbidity a concern in downstream sites, 2013)	Yes	–	–	weekly for boreholes, 21 of 26 are chlorinated	
Solomon Islands	Fair, deteriorating, medium data confidence	No	No	–	–	State of Environment (2019)
Tokelau	–	–	–	–	–	
Tonga	2015 contamination of coastal sites with coliforms	No	No	–	–	State of Environment (2019)
Tuvalu	–	–	–	–	–	An islet off Funafuti showed *E. coli* contamination of coastal sediments/water (Fujita et al. 2013)
Vanuatu	Port Vila contaminated	Yes	Yes (*E. coli*)	–	–	Willie (2018)
Wallis & Futuna	Poor quality during rainy season (7 poor and 10 medium out of 17 sites in 2015; none 'good')	Yes	Yes (*E. coli*)	–	–	Wallis & Futuna (2016)

PRESSURES AND OPPORTUNITIES

The health of nearshore and terrestrial water resources are closely linked on islands. If the large country of Papua New Guinea is excluded, 90% of the remaining Pacific Islanders live within 5 km of the coast. Everyone in the coral atoll nations of Tokelau and Tuvalu lives within one kilometre of the ocean (Andrew et al. 2019).

Both human and animal faecal matter, commonly from animals kept near streams or coasts, can carry *Enterococci*. This indicator is a proxy for sewage and the typical components it carries, such as excessive nutrients, sediments, heavy metals, endocrine disruptors, pathogens, and pharmaceuticals.

The common practice of using untreated sewage outfalls into rivers and nearshore ocean ecosystems threatens both fresh and marine water quality. At present, active planning still relies on ocean dilution: a 2019 project plan for the Solomon Islands says "The sewage outfalls will be extended to about 700 meters from the shoreline and will discharge at depths of more than 40 meters, in order to ensure adequate dilution and dispersion, thus minimizing water quality impacts on beach and fringing reef areas" (World Bank 2019). Beyond improving centralised sanitation or sewerage on Pacific islands, which requires resources to build and maintain wastewater-treatment plants and related infrastructure like sewers, new sanitation technologies and approaches can help improve marine water quality (see Regional Indicator: Access to sewage treatment).

In addition to improper sewage disposal, the quality of lagoon water is highly impacted by land-based pollutants via inputs into rivers and streams and runoff from agriculture or hard-scaped urban surfaces. There may be limited water circulation in lagoon areas, making them susceptible to even short-term changes in anthropogenic pollution.

Seasonal flooding, sea level rise, and natural disasters place people and ecosystems at risk from wastewater and waterborne pollution. Poor lagoon water quality affects fish populations, nutrient cycles, and the capability of lagoon systems to protect the shoreline from storms and erosion.

Healthy wetlands form natural buffers and filters, slowing or stopping the spread of harmful contaminants. Conservation and restoration of wetlands and buffer vegetation alongside streams and waterways has benefits for fresh water quality.

Finding and responding to pollution sources

The Ministry of Marine Resources of the Cook Islands collects stream samples on a monthly basis at four regular, long-term sites on Aitutaki and eight on Rarotonga. In addition to gut bacteria, they look at stream clarity and nitrogen (NO_3 and NH4) levels, with high levels typically coming from sewage, animal manure and inorganic fertilisers. For Rarotonga, the 2018 State of Environment report identified a 'deteriorating' trend based on declining dissolved oxygen levels and decreasing stream-water clarity. Their routine monitoring in different parts of the streams can provide essential evidence for the location of pollution inputs and therefore will show the results of management changes.

The Federated States of Micronesia have connected stream water management with the control of leptospirosis, a disease endemic in many Pacific countries. Rodents, pigs and dogs can contaminate streams with *Leptospira* bacteria, placing people at risk when they swim or use the stream water for gardens or crops. Pohnpei's response actions to use dry litter piggeries and keep animals away from streams have direct human health benefits alongside reductions in water pollution.

In 2018, the monitoring programme in American Samoa tested 32 of 41 watersheds, which serve >95% of the human population, and assessed the water quality for purposes of safe swimming, protecting and enhancing ecosystems, and safe fish consumption. The tested lengths of streams and ocean shorelines were categorised by level of acceptability for specific uses. All tested stream miles were reported as 'not supporting' safe swimming, due to pathogen indicators. About 30% of the tested waters were 'fully supporting' of aquatic life, but 38% of waters had insufficient data to make an assessment. Unacceptable levels of *Enterococci* were found in streams of 22 watersheds and ocean shorelines of 25 watersheds.

Harnessing innovation to manage our water

Simple tools can assist national managers for routine, frequent monitoring. A growing number of open-source tool building guides, such as OpenCTD Rev2, and communities are available, such as Public Lab and Oceanography for Everyone.

Once a monitoring programme is initiated with consistent sampling and long-term support, adding other types of measurements to the programme is easier. For example, to supplement bacterial measurements, a Secchi disk can be purchased or made using readily available materials and can be used to measure water clarity or turbidity (DOC 2016). Although typically the Secchi depth is measured from a boat, it is possible to use the horizontal Secchi distance with a team of two snorkelers or divers.

Training and technology transfer are essential components of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030). The greater challenge will be creating and sustaining ways for resource managers to respond and incorporate monitoring efforts into local and national decision-making.


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NATIONAL RESPONSE RECOMMENDATIONS

For bathing water directives, sampling at least monthly is required. Because *Enterococci* levels can change rapidly and high values are common after rain events, one high value may not require the closure of an area or water supply source but should start a process of additional sampling or precautionary measures.

An essential element of a strong water quality monitoring programme is the response mechanism. National managers must define the actions required if a high value is observed and the requirements for an area or water source to be deemed acceptable again. Cooperation across sectors can support timely responses for safer communities.

REGIONAL RESPONSE RECOMMENDATIONS

The recommendations made in the *Pacific Regional Action Plan on Sustainable Water Management* remain valid (WHO, 2016). Broadly, countries are encouraged to:

- Measure coastal water quality at regular intervals, using consistent methods to allow data comparisons while building in-country capacity to run analyses and maintain effective laboratory standards;
- Plan to reduce impacts from human populations by preventing raw wastewater releases using alternatives such as treatments, leach pits, or sanitary wetlands, ensuring that hazards of wastewater are incorporated into national disaster risk management and climate change adaptation plans;
- Plan to ensure rapid and effective responses to coastal and lagoon water quality metrics;
- Enforce protection of coastal water quality through land-use management and community co-operation and enforce protection of communities via rapid-response mechanisms to indicators of contamination; and
- Partner for sustainable water resource management from ridge to reef. Management and enforcement are better supported if cross-sectoral plans provide jurisdictional resources to the entity responsible for monitoring coastal water quality.

Enterococci or coliforms?

Bacteria that infect humans can be counted as bacterial colony-forming units (cfu) that grow on a solid culture plate from a defined volume of seawater or via the most probable number (MPN) method using liquid culturing.

Although *Enterococci* are considered a more suitable indicator for marine waters, some countries measure the abundance of faecal coliforms instead. The WHO metric of 140 *Enterococci* per 100 millilitres corresponds roughly to 250 faecal coliform per 100 millilitres. The 2012 US EPA recreational water (swimming) standard is 35 cfu per 100 millilitres for *Enterococci* in marine or fresh waters or 126 *E. coli* cfu per 100 millilitres for fresh waters.

INDICATOR IN ACTION **SDGs** 14.2, 14.5 • **Ramsar Convention** • **SAMOA Pathway (64–65)** • **Noumea Convention (Indicator 7)** • **Regional Environment Objectives** 2.1, 2.2 • **Pacific Islands Framework for Nature Conservation Objective 2**

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SPREP PROE

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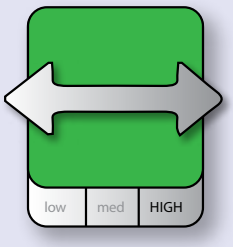
THEME **Coastal and Marine**

INDICATOR **Commercial Pelagic Fish**

DEFINITION	Trends in biomass of tuna species
PURPOSE	Track the health of this important component of the ocean ecosystem
DESIRED OUTCOME	Stable biomass catch



Status
Good

Trend
Stable

Data confidence
High

CRITICAL CONNECTIONS

The many social and socio-environmental benefits of pelagic fisheries are threatened by losses of Pacific biodiversity and ecosystem health. There has been significant effort to ensure that the economic benefit from fisheries resources is directed to Pacific people; these benefits must also be used to support the Pacific environments, species, and ecosystems that underpin the fishing economy.

With their time at sea, fishers are important allies in the journey to understand, measure, and monitor Pacific species. Fishing vessels can also carry modern data collecting instruments to monitor biological, chemical, and physical processes in the ocean, particularly important in the vast and remote Pacific region. The rate of bycatch and status of threatened species that are at risk from fishing gear are useful proxies for the health of Pacific biodiversity and fishing practices.

Fishing and fishing vessels are a potential source of waste, including plastics, that affect marine life and the people using those marine species. Between 2013 and 2017, WCPFC observer reports of waste disposal, including fishing nets, fell from 48.8% of reports in 2013 to 9.2% of reports in 2017 on vessels monitored by observers, showing reduced fisheries-based marine pollution at least on observer-monitored vessels (Ewell et al. 2020).

Tuna are an essential component of Pacific food security, itself integral to island resilience and independence. The safety of tuna as a food relies on international cooperation to prevent pollution: for example, women in six Pacific island countries showed high body loads of mercury linked with their seafood-intensive diet and the far-reaching, transboundary nature of mercury pollution (Bell 2017).

PRESENT STATUS

Fishing is a complex topic with many species and ecosystem components as well as social, cultural, political, and economic components. Here, we focus on the defined indicator regarding tuna, considering the biomass of these pelagic fish as well as the ecosystems that support these fish. For information about coastal and nearshore fisheries, please see Regional Indicator: Coastal fish biomass.

The dominant Western and Central Pacific Ocean industrial fisheries include skipjack tuna (*Katsuwonus pelamis*; last assessed in 2019), yellowfin tuna (*Thunnus albacares*; assessed in 2017), bigeye tuna (*T. obesus*; assessed in 2017/2018) and South Pacific albacore tuna (*T. alalonga*; assessed in 2018) (Brouwer et al. 2019; FFA 2019). Pacific bluefin tuna are rarely caught by Pacific islands fleets or in the Exclusive Economic Zones (EEZs) of Pacific island countries.

At the global level, these four species are listed on the IUCN Red List as follows:

SPECIES	COMMON NAME	GLOBAL STATUS	POPULATION TREND
Katsuwonus pelamis	skipjack	Least concern	stable
Thunnus albacares	yellowfin	Near threatened	decreasing
Thunnus obesus	bigeye	Vulnerable	decreasing
Thunnus alalonga	albacore	Near threatened	decreasing

Data regarding tuna biomass and catch in the Pacific islands region are routinely collected and reported by the Western and Central Pacific Fisheries Commission (see WCPFC Tuna Fishery Yearbooks), Pacific Islands Forum Fisheries Agency (FFA), and key partners including the Oceanic Fisheries Programme of the Pacific Community (SPC) Division of Fisheries, Aquaculture and Marine Ecosystems. Data are available for the WCPFC area and some national stocks at the Pacific Data Hub at https://pacificdata.org/. Although fisheries summary data are provided with annual interpretation, it is more difficult to obtain biomass estimates of natural populations, in addition to the fisheries catch, for each Pacific country. Nevertheless, the quality and availability of data regarding tuna populations represents one of the best data management systems in the Pacific islands region.

Based on the concept of maximum sustainable yield, all four main tuna stocks are considered healthy by the WCPFC and FFA. In 2017, the assessment of bigeye tuna populations resulted in a positive upgrade of the stock status. The present status of this regional indicator is considered *good*. The overall tuna catch is increasing with increasing or stable trends in the catch of most species, without overfishing; for this reason, the trend is considered *stable*.

From a fisheries perspective, it is considered satisfactory that the fish stocks are available and within the measure of maximum sustainable yield. From an ecosystem perspective, it is concerning that all major pelagic stocks in the region are fully exploited and that the populations of three of the main species are declining.

Discussions of this indicator should consider the desired outcome: stable catch in terms of biomass alongside reliable income and food security for Pacific people. One projection suggested tuna must supply 25% of the protein demand for Pacific food security by 2035 given the projected shortfall from coastal fisheries in 16 of 22 Pacific island countries and territories (Bell et al. 2015). The Regional Roadmap for Sustainable Pacific Fisheries adopted by Pacific Islands Forum Leaders in 2015 called for an additional 40,000 tonnes

of tuna to be available for regional consumption in 10 years, by 2025. The actual take for consumption within the region is not adequately reported, although one estimate from 2016 suggested 29,000 tonnes entered local market, equivalent to 0.8% of the total catch by locally based vessels in the region (SPC 2020).

From projected climate change scenarios and forecasted temperature patterns, we expect to see uneven trends in countries within the region benefiting from the tuna resource. Layering on the uncertain impacts of ocean acidification, pollution, and other environmental challenges alongside the known role of tuna as keystone pelagic species, there is cause for concern for the Pacific Ocean ecosystems under continued socio-ecological change alongside continued fishing pressure.

Management must consider these factors to ensure that Pacific people and Pacific ecosystems are resilient into the future.

National trends in the biomass of tuna species might differ from the regional trend given where tuna live, which shows evidence of spatial variation with climate change. For example, the Cook Islands (State of Environment Report 2018) consider that albacore and skipjack remain vulnerable even though catches are within maximum sustainable yield, bigeye tuna are considered overfished, and yellowfin are considered fully exploited. The overall increase in total tuna catch is interpreted as more pressure on this natural resource. In response, the Ministry of Marine Resources increased their effort for data collection and fisheries observers on long liners.

PRESSURES & OPPORTUNITIES

The EEZs of Pacific island countries and territories provide about 30% of the world's tuna catch, with Pacific catch counting more than 1.5 million tonnes in 2016 (Johnson et al. 2018). License fees for foreign distant-water fishing vessels have increased by 400% in the last two decades, creating economic gains for the islands, but comparable future increases are less likely (White et al. 2018; Bell et al. 2015).

Illegal, unreported, and unregulated (IUU) fishing is a direct threat to tuna populations and to other Pacific species. The large size of Pacific EEZs and limited capacity for enforcement are priority challenges in the fight against IUU fishing.

Fishing is expected to be the largest pressure on tuna populations at least until the middle of this century. That said, attention to other drivers of ecosystem health will benefit tuna populations and attention to sustainable fishing practices will benefit many other marine species and ecosystems.

Whether the catch is 'sufficient' to meet the needs of Pacific people and goals of Pacific governments depends not only on the biomass of the fish species but also on the human population growth and the balance of economic benefit. In the Pacific, multiple organisations take on the task of advocating for equitable socio-economic benefits from tuna fisheries.

In contrast, the environmental aspects of tuna fisheries are less known and receive fewer management resources. Tuna rely on the underlying health of many species and marine environments. In turn, sustainable fishing practices benefit Pacific biodiversity as a whole.

Unintentional harm to non-target species is perhaps the most obvious hazard associated with tuna fisheries, although progress has been made to reduce bycatch and protect threatened Pacific species (see Regional Indicator: Status of migratory species of concern). Bycatch is addressed through the use of Conservation Management Measures and alterations in fishing gear or practices, including the location and time of fishing with specific gear. The present WCPFC ban on the use of either shark lines or wire traces in longline sets may help reduce the catch of silky and oceanic whitetip sharks, but a ban on both would be more effective (Brouwer et al. 2019).

Tuna are caught in large commercial fisheries and small-scale tuna fisheries, some of which use fish-aggregating devices (FADs) that can affect the rate of bycatch (Box 10.1). Fishing gear, including FADs, as well as vessel fuel and wastes are potential contributors to Pacific pollution levels, carbon emissions, and air quality. Marine pollution and ship-derived air pollution affects human and marine life in the Pacific islands.

Climate change will have direct and indirect effects on tuna (Johnson et al. 2018). These changes will have varying impacts across the region: "Cook Islands, French Polynesia, Fiji and Vanuatu might benefit from future opportunities for greater engagement in supply chains. The progressive eastward shift in skipjack tuna is likely to have negative effects on the contributions of tuna fishing to government revenue and tuna processing to GDP for other nations in the western Pacific (e.g. Papua New Guinea, Solomon Islands)" (Johnson et al. 2018). Our knowledge of the impacts of ocean acidification on juvenile and adult tuna is only emerging.

Practices onboard, including sustainability and conservation measures, are monitored by fisheries observers. Since 2010, 100% observer coverage of the purse seine fleet has been mandated with a temporary exception in 2020 due to the COVID-19 pandemic. In contrast, less than 5% of the roughly 3,000 longline vessels in the WCPO carried observers as of 2018. On a small number of vessels, observers can face intimidation or worse: observers reported intimidation or obstruction on only 1.5% of trips in 2017, down from nearly 6% in 2013, although the WCPFC stopped reporting of crew mistreatment in 2015 (Ewel et al. 2020). The Association of Professional Observers notes ten deaths of Pacific island fishery observers at sea in the past decade. To protect regional observers, the 2017 *Conservation and Management Measure for the protection of WCPFC Regional Observer Programme Observers* was adopted by WCPFC Members. The security of onboard observers is essential for the sustainable management of healthy tuna populations and other Pacific biodiversity.

BOX 10.1: IMPROVING THE SUSTAINABILITY OF FADS

The Western and Central Pacific Ocean has the largest number of drifting fish-aggregating devices (FAD) deployments in the world with over 30,000 deployed each year (Escalle et al. 2019 and references therein). Nearshore FADs can help improve access to tuna by small-scale fishers (Bell et al. 2018).

However, FADs can create entanglement and bycatch problems and contribute to marine pollution. These are significant hazards to priority Pacific migratory species (see Regional Indicator: Status of migratory species of concern), and bycatch avoidance is a key consideration in FAD design, specifically referenced in the 2018 WCPFC *Conservation and Management Measure of Sea Turtles*.

There has been less effort in the Pacific to ensure the use of biodegradable FADs, which can reduce pollution and shorten the time of bycatch risks although even biodegradable FADs can cause damage to fragile habitats such as coral reefs. In 2019, the International Seafood Sustainability Foundation (ISSF) released a Non-Entangling and Biodegradable FADs Guide. The first two workshops in the Pacific region were held in Federated States of Micronesia and Papua New Guinea in 2019 supported by ISSF and Common Oceans ABNJ Tuna Project. Skills and available biodegradable materials to replace FADs after storm damage or wear can be assets for the resilience of small-scale fishers (Bell et al. 2018).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REGIONAL RESPONSE RECOMMENDATIONS

The environmental aspects of fish and their habitats and supporting ecosystems are considered by three main CROP agencies in the Pacific: the Pacific Islands Forum Fisheries Agency, Pacific Community, and the Secretariat of the Pacific Regional Environment Programme.

At the regional scale, Pacific islands and partners are encouraged to:

- Identify needs for the biomass assessments of tuna populations and the underlying physical and biogeochemical forcing of tuna populations;
- Measure spending on environmental aspects of fisheries management, distinct from development and infrastructural aspects;
- Conserve and restore essential habitat and ecosystems that support tuna;
- Monitor and report the biomass and health of natural tuna populations, in addition to fisheries catch, to identify priority habitats, source species, and systems for management of tuna life stages;
- Mitigate illegal, unreported, and unregulated fishing to protect Pacific biodiversity and economies;
- Measure the pollutant levels within tuna and the related impacts on human populations;
- Maintain and strengthen positive environmental management within the fisheries fleet in the Pacific region using Conservation Management Measures and other approaches to ensure the safety of Pacific biodiversity and of the regional observers who influence and report compliance;
- Increase the coverage and compliance with fisheries observers on the longline fleet;
- Plan environmental management of tuna populations and tuna-dependent economies, including preparedness such as disaster risk reduction;
- Partner to address transboundary issues affecting tuna, such as pollution and global greenhouse gas emissions; and
- Partner for holistic management of tuna populations as part of Pacific ecosystems.

INDICATOR IN ACTION

SDGs 2.4, 14.4, 14.7, 14.c • UN Fish Stocks Agreement • SAMOA Pathway • Noumea Strategy 2015 (*New Song*) • Convention for the conservation and management of highly migratory fish stocks in the western and central Pacific Ocean • Pacific Regional Environment Objectives 2.1, 2.2 • Pacific Islands Framework for Nature Conservation Objectives 2, 5

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SPREP PROE

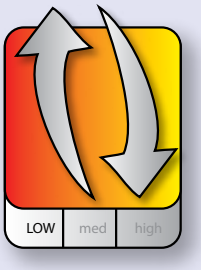
The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org

INDICATOR Coastal fish biomass

DEFINITION	Fish biomass for inshore fish populations
PURPOSE	Indicates inshore fish population status and reef health
DESIRED OUTCOME	Stable level of biomass; or juvenile fish are not overrepresented in markets



Status
Poor to fair

Trend
Mixed

Data confidence
Low

PRESENT STATUS

Inshore fish populations are complex, exist in variable and rapidly changing ecosystems, and are harvested and impacted by a broad range of users, making their management complex.

Coastal and inshore resources used for food, livelihoods, and cultural purposes are diverse and include more than the generic 'fish' as finfish. These resources are used by different people within Pacific societies; for example, women dominate in the collection and use of sea vegetables, crab, and shellfish, and coastal invertebrates are priorities for the cultural and commercial arts. For the purpose of this indicator summary, we focus on inshore vertebrate fish but as a proxy for the wide range of other organisms and resources.

At the regional level, coastal fish biomass data are limited and are not regularly collated in a single regional mechanism; historical assessments found 'average-to-low' or 'poor' condition of demersal fish stocks in about half of the studied sites (Johnson et al. 2018). Catch data are not reliable alone for coastal fish biomass measures due to the anticipated underestimation of subsistence catch. National State of Environment reports contain fish biomass assessments: several countries see the impacts of fishing pressure, declining sizes of fish particularly reef finfish, and boosts in fish biomass in areas with spatial protection or with lower fishing pressure due to risks of ciguatera poisoning or culture and diet shifts.

> **"The populations of many Pacific island countries and territories are growing but coastal fisheries resources, which provide the primary or secondary source of income for up to 50 per cent of households and 50–90 per cent of the animal-sourced protein consumed, are declining."**
>
> Noumea Strategy (SPC 2015)

As of 2015, large areas of the Pacific islands region were not under effective coastal fisheries management with at least 90% of coastal communities lacking viable coastal fisheries management systems (SPC 2015).

At the regional level, the status of this indicator was considered *poor to fair* with a *mixed* trend among sites. Due to the scattered and limited data available in a region with diverse coastal fish populations and heavy reliance on them, the confidence in the available data was ranked *low*.

Offshore oceanic fisheries have received a greater share of scientific monitoring and assessment than inshore fish populations. For more about oceanic fish, please see Regional Indicator: Commercial pelagic fish. Coastal ecosystems are also essential to the early life stages of many pelagic species.

1 Quoted in The Guardian, 11 June 2020, "'I raised hell': how people worldwide answered the call of World Oceans Day"

CRITICAL CONNECTIONS

Coastal fisheries, livelihoods, economies, and Pacific identities are intertwined. Coastal fish populations, their uses, and their users are diverse, and fisheries management must represent the communities who rely on them. Pacific men, women, and youth have different interactions with coastal species and ecosystems. There is a growing push to mainstream considerations of inclusivity in national and project-based management, for equitable access to benefits and decision making (SPC 2015).

Community-led and ecosystem-based approaches to coastal management are in line with Pacific traditions and with the best of modern, inclusive fisheries management.

Sustainable fisheries take has innumerable benefits for Pacific ecosystems and biodiversity. In today's changing world, sustainable fishing practices alone might not be sufficient to ensure the survival of Pacific fisheries. We can no longer expect stable fish biomass without attention to ecosystem health from land to sea.

Maintaining and restoring healthy coastal ecosystems and biodiversity will support Pacific people and the Pacific development pathway. In contrast, the loss of biodiversity and habitat has disproportionate, poorly quantified, and emerging impacts on coastal fish biomass with flow-on effects for people.

The dominant threat of climate change affects habitats and species through ocean warming, extreme events, and ocean acidification. These factors can change the prevalence of disease and where species live, including the ranges of invasive species.

We know much less about marine invasive species compared to terrestrial invasives. We do already know that invasive species on land affect watersheds and coastal environments, including water quality. Ridge-to-reef or watershed scale management can support coastal fisheries from the habitat up.

Waste management is a fisheries problem, with land run-off affecting water quality and with plastics already found in the guts of most studied Pacific species (see Regional Indicator: Marine plastic pollution). Fisheries itself can be part of the waste management problem through discarded or abandoned fishing gear and through practices such as the use of car batteries as weights or anchors.

Today's threats to coastal fish and habitats are both local and global, area-based and transboundary. Unified regional approaches have a unique power in calling for international protection of marine life and habitats. Pacific leaders recognize this protection as essential to their chosen development pathways. As an anonymous conservation coordinator in Hawai'i said, "Subsistence fishing is their birthright; the degradation of the marine environment is a violation of this right."[1]

PRESSURES & OPPORTUNITIES

The biomass of fish is only one factor when considering fisheries sufficiency: the demand for fish by a growing human population with changing demands must be considered. A stable trend in coastal fish biomass might be insufficient to feed a growing Pacific population if traditional dependence on ocean foods is maintained (SPC 2015). Eleven of the 21 Pacific countries and territories are projected to have 'fish deficits' by 2035 with another five expected to face challenges in redistribution (Bell et al. 2009; six of nine Pacific members of the Commonwealth, see Table 5.4 in Govan 2017).

Tuna might be needed to supply 25% of the demand for Pacific food security by 2035 given the projected shortfall from coastal fisheries in 16 of 22 Pacific island countries and territories (Bell et al. 2015). A study in 38 USA-affiliated Pacific islands showed a relationship between human population density and steep size spectra of reef fish (Robinson et al. 2016), providing more evidence that growing populations and fishing intensity is changing reef communities and affecting local food security.

In combination with fishing pressure, coastal fish in the Pacific islands face the challenges of habitat loss, climate change, invasive species, and pollution, particularly water quality and marine plastics. Many of these new threats cross boundaries.

Fish populations depend on other species and habitats for their survival, with their requirements varying throughout their life stages. Coastal fish habitats, particularly vegetated wetlands, are declining throughout the Pacific islands region; for more, see Regional Indicator: Wetlands. To save habitats and species, spatial protection can be a powerful tool and has a long traditional history in the Pacific; for more, see Regional Indicators: Protection of Pacific spaces..

Community-led and community-based approaches focused on maintaining and restoring habitats and source populations, in combination with diversified fishing, are recommended as a key element of sustainable Pacific fisheries and food security (Bell et al. 2018). With Pacific traditions of land tenure and community management, spatial protection of fishing areas has been adopted at many sites and times in the islands

serving as a global example (Box 11.1). Sustaining and monitoring the impacts of this protection, on fisheries and on all sectors of society, is a key information challenge for the islands (Michalena et al. 2020).

Disaster risk management at the subsistence, artisanal, and local commercial fisheries scale is essential in this remote and vulnerable region. Coastal habitats, fisheries fleets, and coastal infrastructure such as ports can suffer heavy impacts from natural disasters, such as flooding and cyclone damage, with these risks increasing under climate change. Coastal fisheries are also an essential ingredient of resilience and food security under any disruption, as early findings during the COVID-19 pandemic are already illustrating (LMMA Network 2020).

Aquaculture is still relatively uncommon in the Pacific islands region, but communities are exploring culturing options as part of their local food systems (for example, see Kinch et al. 2019).

Only 8% of coastal communities receive coastal fisheries management support (Govan 2017) despite their dependence on fishing. Support for development is rarely distinguished from support for actions to improve ecosystem health. In addition, many national budgets report combined instead of disaggregated accounts of income from agriculture, forestry, and fishing, which together contribute about 15% on average of the national GDP for Pacific island countries, reaching up to 25% for countries like Federated States of Micronesia and Vanuatu (World Bank's World Development Indicators). For more about budgeting for environmental management, see Regional Indicator: Environment Ministry budget allocation.

BOX 11.1: COMMUNITY CONSERVED AREAS (SUCH AS LMMAS)

A large share of land and marine areas in the Pacific islands region are under customary ownership and traditional land tenure. Community engagement is not only beneficial, as it is in other regions, but is also part of a long-standing Pacific tradition.

A Locally Managed Marine Area (LMMA) is an area of nearshore waters and its associated coastal and marine resources that is largely or wholly managed at a local level by the coastal communities, land-owning groups, partner organisations, and/or collaborative government representatives who reside or are based in the immediate area. LMMAs place communities at the centre of marine management.

As of 2017, over 600 communities spanning 7 countries had established 420 community managed areas, most of which include some form of 'closed' marine protected area (MPA). The primary motivation has been the "community desire to maintain or improve livelihoods, often related to perceived threats to food security or local economic revenue." In Fiji, more than 250 villages had established LMMAs by 2009, covering some 10,745 square kilometres of coastal fisheries, or more than 25% of Fiji's inshore area. Most anecdotally report rapid and appreciable increases of marine resources within closed areas, and an increasing body of literature confirms these observations.

This traditional approach to conservation, in the form of community conserved areas, must be considered when assessing protected area coverage. These areas have played a fundamental role in the conservation of biodiversity in the Pacific islands region and will continue to do so. LMMAs are a contributor to biodiversity conservation, and their implementation by over 600 communities in the region represents a unique achievement. However, while important, LMMAs cover only approximately 13,000 square kilometres, making a relatively small contribution to the overall protected area.

Source: LMMA statistics from Alifereti Tawake, 2017

REGIONAL RESPONSE RECOMMENDATIONS

In accord with national and regional recommendations from the Noumea Strategy (*New Song*; SPC 2015) and other national and regional frameworks, Pacific island countries and territories and their partners are encouraged to focus their efforts on the following tasks to support progress towards the desired outcome:

- Identify needs for inshore fish population measurement and management, in consultation across sectors and with consideration of sustainable self-reporting or citizen science;
- Monitor coastal fish populations in terms of biomass and individuals, recording size-at-sale and size-at-age data for market fish, and collate biomass data at the regional level;
- Conserve and restore essential coastal fish habitat, in consultation and ensuring sustainable access of priority stakeholders for priority uses;
- Measure spending on the environmental aspects of fisheries management as separate from the governance and development or infrastructure of fisheries;
- Facilitate learning exchanges among countries, particularly for effective fish biomass monitoring;
- Plan for management of inshore fish populations under changing conditions, including aspects of resilience and preparedness such as disaster risk reduction and food security in the context of extreme events;
- Partner for environmental management of inshore fish populations, their essential habitats, and the ecosystems and biodiversity that support inshore fish populations; and
- Partner for mitigation of regional and transboundary hazards that threaten coastal fish populations, with attention to the Pacific priorities of climate change, invasive species, and waste management.

There are multiple active projects in the region and multiple agencies tasked with the management of Pacific fisheries. The environmental aspects of coastal fish and their habitats and supporting ecosystems are considered by two main CROP agencies in the Pacific: Pacific Community (particularly the Coastal Fisheries Programme in the Division of Fisheries, Aquaculture and Marine Ecosystems) and the Secretariat of the Pacific Regional Environment Programme. Regional non-governmental organisations are also key players, alongside national and community-led initiatives. Communication and harmonisation of efforts among all these actors is a growing priority for the region.

INDICATOR IN ACTION

SDGs 2.4, 14.4, 14.7 · SAMOA Pathway · Convention for the conservation and management of highly migratory fish stocks in the western and central Pacific Ocean · Noumea Strategy 2015 (*New Song*) · Regional Environment Objectives 2.1, 2.2 · Pacific Islands Framework for Nature Conservation 2, 5

FOR MORE INFORMATION

SPC Fisheries Newsletters, Women in Fisheries bulletins, and other information bulletins provide a source of island-specific information for the region; see: https://coastfish.spc.int/en/publications/bulletins

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SPREP PROE

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THEME **Coastal and Marine**

INDICATOR **Marine Plastic Pollution**

DEFINITION	% of plastic in waste audits, including beach clean-ups
PURPOSE	Determine trends in marine plastic pollution from land and at-sea sources
DESIRED OUTCOME	Stable or declining trend in proportion of plastic in waste audits

Status
Fair to poor

Trend
Mixed

Data confidence
Medium


© Valentine Vaeoso

PRESENT STATUS

Pacific data are limited, but existing data show high proportions of plastic in the waste stream (Table 29.1), as marine litter, and as microplastics present throughout Pacific marine ecosystems, including in the guts of fish and their prey (SPREP 2016, Markic et al. 2018). In a 2011 study, plastics formed 12% of the waste stream in Honiara (SPREP 2017).

Globally, the incidence of plastic in waste and marine litter is high: this means there is a strong likelihood of plastic waste challenges even where plastics have not yet been assessed. We consider the present Pacific status *fair to poor* with *medium* data confidence and abundance.

The trend is *mixed*: within the region and around the world, legislation and consumer practice are changing to discourage single-use plastics and littering (Table 12.2). However, Pacific ecosystems will continue to receive plastic waste inputs for years to come even if plastic use were stopped today. This is because marine plastics are transported at sea into the Pacific region, and micro- and macro-plastics are regularly lost from landfills into the ocean.

Plastics have been found in every environment, including the sediments and guts of animals in the deep sea. Marine plastic and microplastic pollution from land- and sea-based sources are identified as priority concerns by the global environmental community due to their persistent natures and their impacts. Microplastic pollution has been proposed as a planetary boundary threat (Galloway et al. 2017).

In 2016, many Pacific island countries and territories had no current systematic management plan or system for marine litter prevention, measurement, management and clean up/recovery (SPREP 2016). The *Cleaner Pacific 2025* strategy sets a regional target of zero marine pollution incidents by 2020 and 2025. Pacific island countries have started to transition to integrated waste management practices.

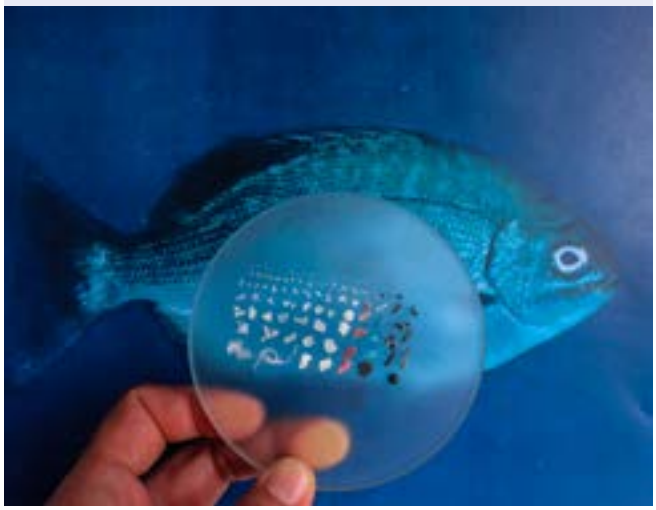
FISH ARE SWALLOWING MICROPLASTICS

A single Pacific chub fish from a remote area of the ocean contained the level of plastics that would be expected to be found in fish from polluted harbours. The reason for this is that plastics are carried on ocean currents from all over the South Pacific and accumulated in the subtropical gyre, close to Rapa Nui. The plastics in this fish might be from all coastal countries of the South Pacific and the boats that traveled the South Pacific.

Of the 34 fish species studied by Markic et al. (2018), 33 contained plastics in their guts. A 2020 study near Suva, Fiji, found microplastic contamination in sediments, surface water, and fish, with sewage outfall contributing to sediment microplastic burden.

We still do not know the full impacts of plastics on marine life or on our own health.

Source: Markic et al. (2018), Ferreira et al. (2020)



104 pieces of marine plastic retrieved from an individual Pacific chub (*Kyphosus sandwicensis*) fish from Rapa Nui, Easter Island. © Ana Markic

CRITICAL CONNECTIONS

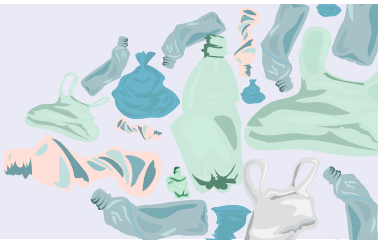
Quantifying and addressing marine plastic and microplastic pollution meets many overlapping national, regional, and global goals for social wellbeing, environmental protection, and economic benefits.

These benefits extend across the sectors and industries of:

- Local communities, where health and cultural practices can be rejuvenated by the use of local techniques and materials instead of plastic alternatives and the cost of clean-ups can be reduced;
- Health: environmental pollution is a major cause of mortality, particularly through contaminated air and water to which burning plastics contributes. The health impacts of microplastics are unknown, as is the level of contamination from unlined landfills via underground water to the ocean;
- Tourism, where partnerships can drastically reduce plastic waste production by tourism services (often outweighing local resident production) and sustainable practices attract ecotourism;
- Fishing and farming, where vessel and gear fouling is reduced and ecosystem health and species health are boosted by reduced pollution;
- Foundational ecosystem services, particularly essential for subsistence communities and countries dependent on natural resources;
- Invasive species management and protection of local biodiversity. Poor waste management can lead to the spread of invasive weeds and pests (such as fire ants), and plastic rafts can carry invasive species to Pacific coastlines.
- Reducing waste production reduces the carbon and energy cost of the consumption and management of plastic products/packaging and their alternatives, although the carbon emissions from energy generation, destruction of wetlands and forests, land-use change, and agricultural and industrial practices still outweigh household consumer product choices.
- Reducing local plastic consumption can create safer, healthier environments for coastal communities and marine ecosystems.

Corals entangled in plastic are 20 times more likely to suffer disease.

Lamb et al. 2018



Plastics cause at least USD 13 billion in damages to ocean ecosystems every year.

WEF 2016

In fish nurseries in Hawai'i, plastics outnumbered baby fish by seven to one.

Gove et al. 2019

A desktop gap analysis conducted in 2020 identified potential strengths and weaknesses in the national policy frameworks of 52 documents relevant to preventing plastic pollution in ten Pacific island countries. While a growing number of countries in the region are developing robust preventative measures such as import regulations, the study found considerable gaps and opportunities for strengthening plastic pollution policy frameworks. The gaps and recommendations include the faithful domestication of international and regional agreements into national legislation and policy; coherence across multiple levels of governance; specific reference to plastics in policy frameworks; a full life-cycle approach; enhanced science-policy interface with particular attention to the links between plastic pollution and human health impacts, climate change, and microplastics; the integration of indigenous sciences; sustainable public-private partnerships and financial mechanisms including return and repatriation schemes; expanded import regulations; and enforcement. Ultimately, a multilateral plastic pollution convention is needed to cap global virgin plastic production, establish global standards for the design of safe plastics, and provide scientific, financial, and technical assistance to develop tailored national plastic pollution prevention action plans and policy tools.

Source: Farrelly T, Borrelle S, Fuller S (August 2020) *Plastic Pollution Prevention in Pacific Island Countries: Gap analysis of current legislation, policies and plans.* London: Environmental Investigation Agency.

PRESSURES AND OPPORTUNITIES

Plastics are now pervasive in both products and packaging. At the consumer level, public demand for packaging is changing. However, plastics provide light-weight packaging that reduces spoilage in tropical conditions, important for growing Pacific populations and economies reliant on imported goods. Simple replacement of plastics with glass (made from sand, increasingly over-harvested globally), wood, or other alternative materials can bring additional disadvantages of greater weight, carbon and energy costs of production and transport, or reduced shelf-life of products.

The 16 Pacific countries and territories with data produced an average 0.89 kilograms of household waste per person per day, about 15% of which was plastic, in the measured years between 2009 and 2014 (SPREP 2016, World Bank 2018). Pacific countries have been moving to ban single-use plastics (Table 29.2). Between 2016 and 2020, the Cook Islands, Federated States of Micronesia, Fiji, Guam, New Caledonia, Niue, Palau, Republic of the Marshall Islands, Samoa, Tuvalu, and Vanuatu introduced new laws addressing single-use plastics (Table 29.2; SPREP, forthcoming). Regional guidelines for regulating plastics were produced by SPREP in 2018 with the Environmental Defenders Office NSW (SPREP 2018).

However, Pacific islands are recipients of waste from overseas sources via ocean currents. Transport of marine plastic litter on ocean currents into the region is expected to be high (Lachmann et al. 2017). Land is limited for covered landfills. Pacific tips are very susceptible to direct loss to the ocean via wind or water.

High-temperature incineration is a solution accepted in some countries, but poorly maintained or managed incinerators can release dangerous persistent organic pollutants when burning plastics, just like household burning of rubbish and organic garden waste. These persistent organic pollutants have direct human health risks and can travel long distances in air and waterways. Backyard burning or accidental ignition of landfills are sources of carcinogens, or cancer-causing chemicals, in the Pacific.

Fishing also brings a waste burden. In addition to the plastic components of abandoned, lost, or derelict fishing gear, illegal dumping of non-biodegradable wastes at sea has been reported from the longline and purse seine fleets by shipboard observers, with plastics present in 37% of the reported pollution incidents (Richardson et al. 2017). As of 2012, less than 5% of longliners carried observers, weakening estimates of potential waste dumping across the fleet.

The IMO's Marine Environment Protection Committee adopted an action plan in 2018 to reduce marine pollution including the dumping of plastics at sea, already prohibited under MARPOL and the London Convention and Protocol. A Conservation and Management Measure on Marine Pollution was adopted by the Western & Central Pacific Fisheries Commission that entered into force in 2019, prohibiting the discharge of plastics (but not including fishing gear), encouraging marine pollution research, and encouraging pollution prevention measures.

Marine plastic pollution, Honiara harbour, Solomon Islands. © Bradley Nolan

Over 100,000 Fish Aggregation Devices (FADs) which often contain plastic have been abandoned floating throughout the region, with bycatch risks including entrapment of totem species. In 2018, the Western and Central Pacific Fisheries Commission (WCPFC) adopted some recommendations on non-entangling and biodegradable FADs for bigeye, yellowfin, and skipack tuna fisheries (CMM2018-01) and are due to consider the issue again in 2020. Other regions have encouraged the avoidance of FAD fishing or the use of biodegradable materials in their construction; for detail, see the International Seafood Sustainability Foundation's *Non-Entangling and Biodegradable FADs Guide*.

The high cost of transport and low domestic demand for post-recycling reclaimed plastics hinders Pacific recycling. Safe removal that reduces resource consumption overall will benefit from partnerships to manage this cost, such as the Moana Taka partnership between SPREP and the China Navigation Company that takes advantage of empty cargo containers on return voyages.

There has been little standardised monitoring of impacts on marine species, especially in the Pacific islands region. In the Northeast Atlantic region, experts have developed a standardised assessment of marine plastics in guts of seabirds Northern Fulmar as an indicator of marine litter (see OSPAR Assessments and Provencher et al. 2019).

REGIONAL RESPONSE RECOMMENDATIONS

International action is necessary for transboundary issues of marine plastic pollution. Very little research has been done on land- and sea-based sources, fate, and impacts of marine litter in the Pacific region, which can be used to inform regional and national strategies and policy-making. Of particular relevance is the need for modelling and monitoring; investigations into abandoned, lost, or discarded fishing gear, including Fish Aggregating Devices; and identification of major marine litter accumulation and hot-spot areas in the region to allow for targeted recovery and clean-up efforts.

Marine litter minimisation and management programmes and projects require financing for appropriate coverage and success. This is especially the case for projects that target extensions of plastic waste management infrastructure to decrease sources of marine plastic litter. There are currently no national budgets allocated specifically for marine litter management in the Pacific islands region (SPREP 2016).

Effective management is mandatory for safe, sustainable disposal of plastic waste. Burning plastic releases dangerous persistent organic pollutants, like dioxins and furan, which do not break down, can travel long distances, and have known human health impacts.

To mitigate marine plastic pollution, Pacific leaders can:

- Participate within the *Cleaner Pacific 2025* strategy and action plan;
- Identify sources and trends using waste audits, citizen science, and landfill management tools such as weigh bridges;
- Measure plastic wastes and spending on waste and marine pollution management, including landfill management, cost of clean-ups and habitat rehabilitation, and cost-savings due to waste diversion from landfills;
- Plan for resourced management of marine litter and its impacts, including preparedness such as disaster risk reduction and biosecurity;
- Partner for reduced plastic pollution, including with development partners and with vessels active in their national waters;
- Innovate for return, recycling, and alternatives, with the engagement of local communities and businesses;
- Advocate for international action, especially from Pacific-rim countries, to prevent plastic pollution; and
- Commit to engaging in a circular plastics economy and engaging with proponents driving upstream changes.

TABLE 12.1: Plastic in household waste in selected Pacific island countries and territories. Adapted from SPREP (2016 and forthcoming). The unweighted regional mean from 15 sites was 16.5% plastic in waste (SPREP 2016).

COUNTRY/ TERRITORY	STATE OR MUNICIPALITY	YEAR	SHARE OF PLASTIC IN HOUSEHOLD WASTE COMPOSITION (%)
American Samoa	Tutuila island	2011	12.8
Federated States of Micronesia	Pohnpei	2017	15.8
	Yap	2017	9.2
	Chuuk	2011	22.5
	Kosrae	2017	29.5
Fiji	Nadi	2008	7.1
	Lautoka	2008	7.9
Kiribati		2016	13.0
Marshall Islands	Majuro and Ebeye	2017	15.8
Palau	Koror and Babeldaob	2017	8.0
Papua New Guinea	Port Moresby	2014	18.5
Samoa		2017	6.0
Solomon Islands	Honiara	2011	19.5
	Gizo	2011	25.2
Tonga	Vava'u	2012	13.4
Vanuatu	Shefa Province, Port Vila Municipal Council	2016-7	19.0

UNDERSTANDING WASTE IN TUVALU

At of mid-2020, Tuvalu has the most comprehensive assessment of waste production by category in the Pacific islands region. Each category of waste, including types of plastic, was assessed, allowing Tuvalu to identify priority wastes and benefits of specific management actions.

In August 2019, Tuvalu joined several other Pacific islands that have banned single-use plastics (Table 29.2). Tuvalu's Waste Management (Prohibition on the Importation of Single-Use Plastic) regulation is designed to prohibit the importation, manufacture, sale or distribution of certain single-use plastic.

If there is no substitution of single-use bags and bottles with other waste, Tuvalu will avoid 421 cubic metres of waste, 6% of the present total waste by volume. The baseline assessment at the beginning of the ban estimated daily plastic waste generation of 35.3 kilograms per household.

The approach used in Tuvalu will be the new standard for the region to provide the basic knowledge needed for effective and informed waste management. The PacWaste Plus project is conducting waste audits for all Pacific island countries by 2023, with data for other countries emerging in 2020.

Source: Sagapolutele et al. (2019)

TABLE 12.2: Existing single-use plastic management measures in Pacific island countries and territories. As of August 2020, there are bans or levies on selected types of single-use plastics in 11 of 14 countries and 6 of 7 territories.

COUNTRY/ TERRITORY	BAN/LEVY	MATERIALS CONTROLLED	YEAR ENFORCED	LEGISLATION OR SOURCE
Cook Islands	Ban	8 types of single-use plastics, including bags	2019	Cabinet approved policy 2018-2023
Fiji	Levy	single-use plastic shopping bags	2017	Environment and Climate Change Levy [Plastic Bags] Regulation 2017
Federated States of Micronesiaa	Ban	single-use Styrofoam and plastic food service items	2020	Public Law 21-76
Nauru	–	–	–	–
Niue	Ban	single-use plastic shopping bags	2020	Customs Import Prohibition (Plastic Shopping Bags) Order
Kiribati	–	–	–	–
Palau	Ban	single-use plastic shopping bags	2019	Plastic Bag Use Reduction Act (RPPL No.10-14) Executive Order No. 417 : zero disposable plastic policy for government buildings
Papua New Guinea	Ban	single-use plastic shopping bags	2014, renewed 2018	Environment (Ban on Non-Biodegradable Plastic Shopping Bags) Policy 2009; Environment (Control of Biodegradable Plastic Shopping Bag) Regulation 2011 implemented by Conservation and Environment Protection Authority since 2014
Republic of the Marshall Islands	Ban	single-use plastic shopping bags & Styrofoam food service	2017	Styrofoam and Plastic Products Prohibition Act 2016, Bill 28
Samoa	Ban	single-use plastic shopping bags	2019	Waste (Plastic Bag) Management Regulation 2018
Solomon Islands	Target: Ban in 2020	plastic straws, single-use shopping bags, PET bottles, Styrofoam plates and cups	Target: 2020	Consultation undertaken in November 2019. (MECDM; see also SPREP 2017)
Tonga	Levy	single-use plastic shopping bags	2013	Waste Management (Plastic Levy) Regulations 2013
Tuvalu	Levy	single-use plastic bottles under 1.5 litres, plastic plates, cutlery, food wrap, straws, cups and bags	2019	Waste Management [Prohibition on the Importation of Single-Use Plastic] Regulation 2019 and the Waste Management [Levy Deposit] Regulation 2019
Vanuatu	Ban	plastic straws, single use plastic shopping bags and polystyrene takeaway boxes	2018	Waste Management Act No. 24 of 2014
American Samoa	Ban	single-use plastic shopping bags	2011	Plastic Bag Ban Legislation A.S.C.A 25.2034
Commonwealth of the Northern Mariana Islands	Ban	single-use plastic shopping bags	2019	Senate Bill 21-37
French Polynesia	Ban	single-use plastic shopping bags (lightweight bags: 2020; all plastic bags: 2022)	2020	Rapport N0 13-2020, 14 May 2020 Session Administrative
Guam	Ban	single-use plastic shopping bags	2021	Choose to Reuse: Mungnga Ma Ayek I Plastek Act of 2018
New Caledonia		2019: single-use plastic shopping bags cups, glasses, cups, plates, cutlery, straws and cotton swabs 2020: food trays at point of sale 2022: food trays	2019	Loi du pays 2019-2; Gouvernement de la Nouvelle-Calédonie, “La fin des pochons en plastique”, 5 August 2019
Tokelau	–	–	–	–
Wallis & Futuna	Ban	single-use plastic shopping bags	2017	Article E 422-9 (2015); source

a The states of Yap (2014) and Pohnpei (2012) had existing bans on single-use plastic bags.

Bilum bags, Papua New Guinea © Pacific Trade Invest

INDICATOR IN ACTION

SDGs 3.9, 6.1, 6.2, 6.9, 12 · Basel Convention · SAMOA Pathway (58d, 68, 70-71) · Noumea Convention (Articles 5, 6, 7, 10) · Waigani Convention · Pacific Regional Environment Objective 3.1 · Pacific Islands Framework for Nature Conservation Objective 5

FOR MORE INFORMATION

Persistent organic pollutants: see Pacific Stop the POPs video and information.

The Inform Project hosts national and regional data portals for environmental information from Pacific island countries.

OSPAR Assessments: see https://oap.ospar.org/en/ospar-assessments/ OSPAR uses 'beach litter abundance, composition and trends', 'composition and spatial distribution of litter on the seafloor', and 'plastic particles in fulmar stomachs in the North Sea' as the three Marine Litter indicators within the 'Pressures from Human Activities" set.

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SPREP (forthcoming) Mid-term review report: Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016–2025. Bradley M (author). Apia, Samoa: Secretariat of the Pacific Regional Environment Programme.

SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal.
pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

Protection of Pacific spaces

Forest mangroves, Buena Vista Island, Solomon Islands. © Stuart Chape

Pacific protected areas

Pacific island countries and territories are well placed to lead in the protection of nature, with customary land tenure and vast expanses of ocean within their Exclusive Economic Zones (EEZs). Establishing protected areas has been used as a key mechanism for countries to conserve their biodiversity around the world and in the Pacific island countries and territories. Global targets were set for the percentages of land and ocean to be placed under protection as defined in Aichi Biodiversity Target 11 of the Convention on Biological Diversity (CBD) Strategic Plan 2011–2020: 17% of terrestrial and inland water, and 10% of coastal and marine areas. (Box 13.1). At the end of the decade for implementing the Aichi Targets, the Pacific islands region has achieved 6% coverage of terrestrial protection and 20% marine protection. The lower achievement for terrestrial protection can be attributed to the long time frames required to negotiate protected status in a region where land and resource ownership is predominately customary. By contrast, the region leads the world in the establishment of marine protected and managed areas in oceanic domains controlled by national governments. In addition to Aichi Target 11, the global Sustainable Development Goals (SDGs) also include percentage protection targets including SDG 14.5: by 2030, conserve at least 10% of coastal and marine areas. Within the region, Micronesia leaders declared the Micronesia Challenge to effectively conserve at least 30% of near-shore marine resources and 20% of terrestrial resources across Micronesia by 2020. That challenge has recently been renewed, with the aim to conserve 50% of marine resources and 30% of terrestrial resources by 2030. Commitments at national levels have also been significant. For example, both Fiji and Samoa have committed to conserving 30% of their EEZs, and the Cook Islands declared the Marae Moana Marine Park over its entire EEZ in 2017.

Context of protected areas in the Pacific islands region

Pacific people maintain strong ties to the environmental resources underpinning their cultures, livelihoods, and economies, part of the Blue Pacific identity endorsed by Pacific Leaders in 2017. Pacific leaders prioritise living with biodiversity, rather than creating or widening a gap between society and nature. These aims are referenced in regional frameworks including the Framework for Resilient Development in the Pacific (2016).

In general, due to land tenure arrangements and customary resource rights, co-managed protected areas between communities and states or non-governmental organisations (NGOs) and community conservation with government or NGO support is widely practised in the region and is likely the most appropriate governance models for protected areas in the Pacific islands region (SPREP 2013, Govan 2017). Certainly, protection of priority areas is a process that must involve concerned communities.

To ensure joint actions in Pacific countries remain Pacific-driven, the Pacific Islands Framework for Nature Conservation and Protected Areas 2014–2020 endorsed by SPREP Member countries and territories laid out key principles for nature conservation in the Pacific; the new Framework for Nature Conservation and Protected Areas 2021–2025 is to be submitted to the 10th Pacific Islands Conference on Nature Conservation and Protected Areas (Annex D). The Regional Indicator: Governance and equity of protected areas (see below) is designed to monitor the equitable, sustainable management of Pacific protected areas for the long-term benefit of Pacific people, ecosystems, and species.

Planning for protection

Defining protected areas through a spatial and social planning process that includes addressing conservation priorities such as Key Biodiversity Areas identifies the multiple, overlapping uses and users who rely on resources, services, and species from a defined place. This identification provides justification and direction for the amount and kind of protection, restoration, conservation, and engagement with the ecosystem.

When designating a protected area, decision-makers consider many factors, including information regarding the species and ecosystem services and their vulnerability to pressures, the presence of priority habitats and diversity of habitats, and socio-economic considerations such as the use of the area for subsistence, livelihoods and other economic activities, and cultural traditions. Accurately assessing and prioritising impacts requires inclusive approaches over time.

The quality of protection and of the area designated for priority habitats, species and uses must be considered alongside the size of the proposed protected area (Barnes et al. 2018). Assessments of protected area management effectiveness and long-term assessments of ecosystem health inside and outside of protected areas need to be combined with assessments of community wellbeing.

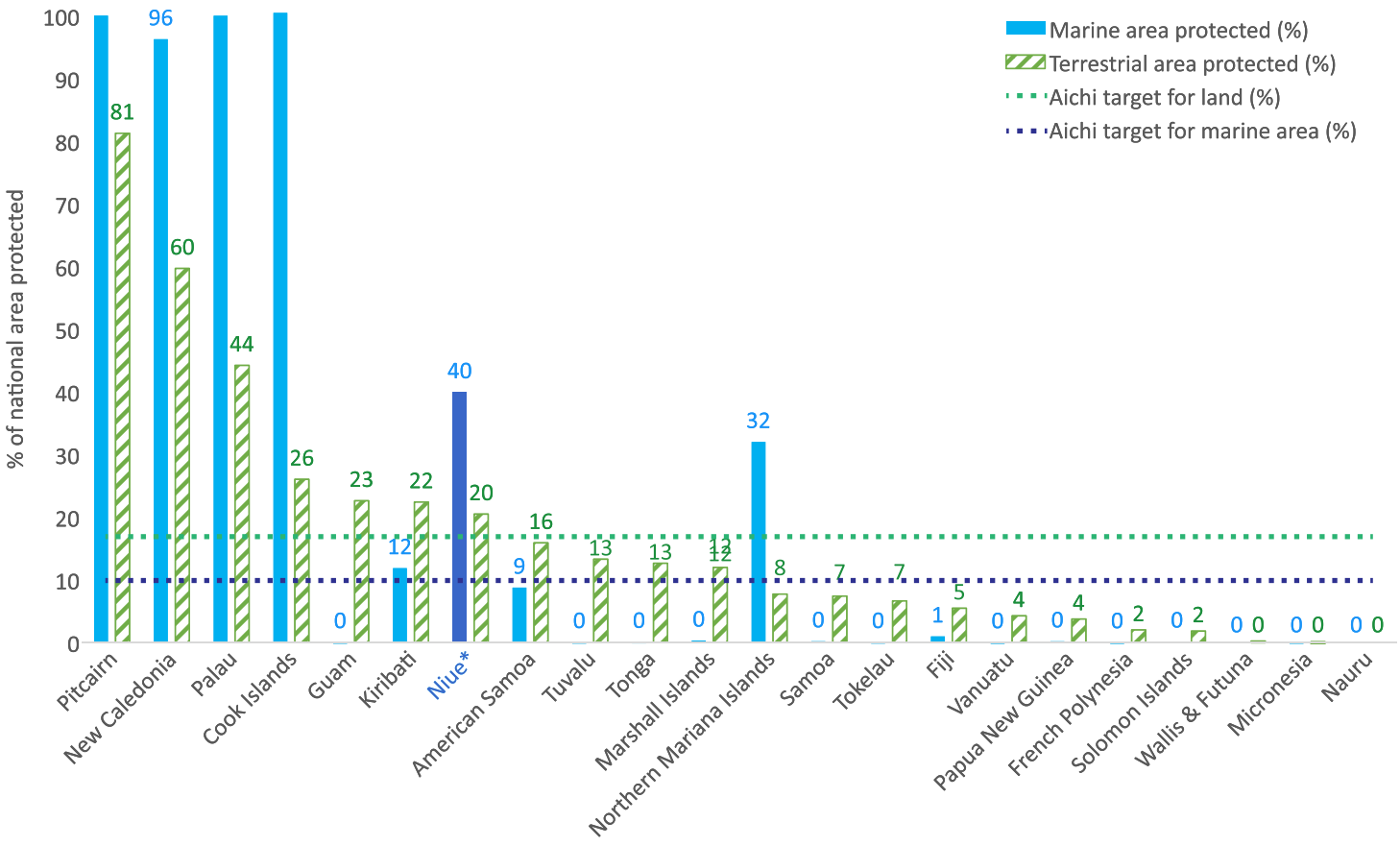


FIGURE 13.1. Percentage of terrestrial and marine areas protected by Pacific islands, arranged by protected area for land ecosystems. Approximately 40% of Niue's marine area will be protected under a new MPA established under the Niue Moana Mahu Marine Protected Area Regulations 2020; Niue is undertaking the process of formally updating its WDPA record. Source: World Database on Protected Areas (June 2020)

Measuring protection

For this assessment, official data supplied by governments and held in the World Database on Protected Areas (WDPA) were used. The WDPA is a joint project of the International Union for the Conservation of Nature (IUCN) and UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and is the most comprehensive global database on terrestrial and marine protected areas as defined using IUCN and CBD definitions.

The Pacific Islands Protected Areas Portal (PIPAP: https://pipap.sprep.org/) is the online data source for protected areas in the region, providing a network, management tools, and supporting information alongside nationally vetted datasets. Pacific data are now synchronised between the WDPA and the PIPAP.

However, there are information gaps for the Pacific as well as issues surrounding data quality, which temper conclusions about protected area coverage. Local management and protective measures used in the Pacific may not align with IUCN and CBD definitions, and therefore local conservation agreements or community management measures might not be counted in international datasets but still have meaningful benefits for local ecosystems (see Boxes 13.3 and 11.1) (Smallhorn-West & Govan 2018). Current efforts are underway to progressively address these information gaps.

The Biodiversity and Protected Areas Management (BIOPAMA) Programme is conducting separate analyses to create the forthcoming State of Protected and Conserved Areas in Oceania (SoPACA) report, funded by the European Union and the Organisation of African, Caribbean and Pacific States (Leverington et al. 2020). For more, see www.biopama.org

Most Pacific island countries and territories have updated their data in the WDPA within the last five years; only three have their most recent submission from 2010 or prior. Data for seven of the 14 Pacific island countries in the WDPA has been reviewed and updated up to 2020 through the SPREP partnership with UNEP-WCMC and with support from BIOPAMA. A key challenge is the wide-ranging classifications that each country uses for protected areas: a lack of standardization is a barrier to specific analyses on protected area types. Figure 13.1 presents the current state of data for marine and terrestrial protected area coverage for each country and territory.

UNEP-WCMC is now working with indigenous and local communities to self-report on territories and areas that are conserved by indigenous peoples and local communities. As of 2020, only 1% of the sites reported on the WDPA are reported as under such governance, which is known to be an underestimation. For more, see https://www.iccaregistry.org/.

TABLE 13.1: Formally designated protected areas (PAs) in the Pacific islands region. The total number of protected areas is regularly updated. The size (km²: square kilometres) of protected areas depends in part on the mapping system used; for this reason, slight variations in the reported coverage are to be expected. *Source: World Database of Protected Areas, October 2020; for EEZ: World Exclusive Economic Zones, version 11 (November 2019), Marineregions.org; for terrestrial area: United Nations Statistics Division; for Niue's marine protected area, Niue Moana Mahu Marine Protected Area Regulations 2020*

	NUMBER OF PAs	PAs WITH MANAGEMENT EVALUATIONS	TERRESTRIAL AREAS COVERED BY PROTECTED AREAS IN KM² (%):		MARINE AREAS COVERED BY PROTECTED AREAS IN KM² (%):		TOTAL EXTENT OF PAs IN KM² (%)		TERRESTRIAL AREA (KM²)	MARINE AREA[1] (KM2²)
American Samoa	14	0	33	(15.9)	35,458	(8.7)	35,491	(9)	199	405 830
Cook Islands	17	0	67	(26.0)	1,981,949	(100.5)	1,982,016	(100)	236	1 969 553
Northern Mariana Islands	27	2	38	(7.7)	247,322	(32.0)	247,360	(32)	464	763 626
Micronesia, Fed. States	5	1		(0.1)	475	(0.0)	475	(0)	702	3 010 644
Fiji	146	2	1,037	(5.4)	11,959	(0.9)	12,996	(1)	18 274	1 289 978
French Polynesia	10	1	74	(2.0)	207	(0.0)	281	(0)	4 000	4 766 689
Guam	10	0	15	(2.7)	37	(0.0)	52	(0)	549	208 234
Kiribati	13	2	231	(22.4)	408,797	(11.8)	409,028	(12)	726	3 440 220
Marshall Islands	16	0	34	(11.9)	5,388	(0.3)	5,422	(0)	181	2 001 566
Nauru	0	0		(0.0)		(0.0)		(0)	21	309 261
New Caledonia	115	1	11,419	(59.7)	1,320,501	(96.3)	1,331,920	(96)	18 575	1 175 971
Niue[2]	5	0	55	(20.4)	127,000	(40.0)	59	(0)	260	318 140
Palau	66	15	221	(44.2)	608,173	(100.0)	608,394	(100)	459	614 807
Papua New Guinea	57	41	17,248	(3.7)	3,344	(0.1)	20,592	(1)	462 840	2 399 638
Pitcairn	2	1	37	(81.2)	839,649	(100.0)	839,686	(100)	5	842 291
Samoa	99	0	238	(8.2)	191	(0.1)	429	(0)	2 831	130 480
Solomon Islands	92	1	530	(1.8)	1,879	(0.1)	2,409	(0)	28 896	1 605 325
Tokelau	3	0	1	(6.6)	10	(0.0)	11	(0)	12	320 548
Tonga	50	1	96	(12.6)	390	(0.1)	486	(0)	747	666 052
Tuvalu	9	0	6	(13.2)	214	(0.0)	220	(0)	26	753 133
Vanuatu	34	3	528	(4.2)	48	(0.0)	576	(0)	12 189	623 424
Wallis & Futuna	1	0		(0.2)		(0.0)		(0)	200	262 750
Total	**791**	**71**	**31,908**	**(5.7)**	**5,592,991**	**(20.3)**	**5,634,898**	**(20.1)**	**552 392**	**27,878,160**

[1] Exclusive Economic Zone (EEZ), part of the waters governed by a country. The disputed area of Matthew and Hunter Islands with 187,184 km² is not included in either New Caledonia or Vanuatu data here but is included in the sum of regional EEZs. Note that the EEZ area used by the WDPA to calculate the percentage of national territory protected differs slightly due to variations in map projections. The Pacific islands region also contains 31,116,075 square kilometres of High Seas, the open waters outside of the national jurisdiction of any country also known as International Waters or Areas Beyond National Jurisdiction.

[2] In 2020, Niue designated 127,000 km² of its EEZ as a new MPA, under the *Niue Moana Mahu Marine Protected Area Regulations 2020*. Niue is working with PIPAP (SPREP) to update its data in the WDPA.

BOX 13.1: PROTECTION DOES NOT STOP AT A PERCENTAGE

Although easy to quantify, the spatial extent of a protected area gives little information about its quality (of the area or of the protection provided) and the resulting impact on biodiversity. Equally, the achievement of designated protection of a defined area does not end the process of support to sustain effective management.

Effective protection of biodiversity, inside and out of protected areas, requires healthy natural resources and management resources. Just as the policy framework and societal engagement are essential for effective biodiversity conservation, so too are the ecological framework of the surrounding ecosystems and the ability of species to use connections among habitats. These connections ensure genetic diversity and replenishment from other populations of the species in and near the protected area. Healthy, connected Pacific landscapes and seascapes are essential for Pacific biodiversity.

Global environmental change, with its transboundary impacts and disproportionate burdens, makes the preservation of natural spaces even more essential, but more challenging. Cooperative national and international efforts to mitigate transboundary pressures, such as climate change and pollution, are increasingly important for Pacific islands.

Protected areas can be natural experiments to test management measures and progress toward the management objectives for which the protected area was established. Identification of these special areas must be followed by identification of the most appropriate and sustainable management actions, accompanied by evaluations of these management actions to increase our understanding of the drivers of ecosystem services and biodiversity loss or gain. In the Asia-Pacific region, spatial protection has not slowed the rate of species loss (IPBES 2018).

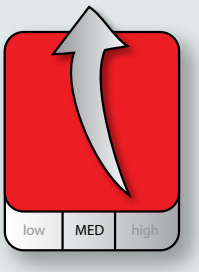
Reprieve from extraction, as in a no-take protected area, is not always enough to boost biodiversity. Growing evidence suggests that sustainable interactions of humans and biodiversity, often following customary law and traditional knowledge, are effective for reaching biodiversity goals (IPBES 2018).

Active, responsive, and adaptive management of natural areas, in alignment with Pacific traditions, can help support the resilience of people and the natural world.

THEME **Conservation and Protection**

INDICATOR **Terrestrial Protected Areas**

DEFINITION	% of land area formally protected for conservation
PURPOSE	Protected areas are established to protect biodiversity and ecosystem services from resource extraction and unsustainable harvesting
DESIRED OUTCOME	Positive trend in area protected; or all terrestrial ecosystems are adequately represented in the protected areas network; or ≥17% of land area is protected (Aichi Target 11)



Status
Poor

Trend
Improving

Data confidence
Medium

YUS Conservation Area. © Paul van Nimwegen

PRESENT STATUS

The Pacific islands have a total land area of approximately 546,220 square kilometres. Protected terrestrial areas cover 31,979 square kilometres of this land, nearly 6% of the total land across the region (Table 13.1).

Seven countries and territories have reached the terrestrial protection target of 17% set out under CBD Aichi Target 11: Pitcairn, New Caledonia, Palau, Cook Islands, Guam, Kiribati, and Niue (Figure 13.1). In addition, American Samoa, Tuvalu, Tonga, and Marshall Islands are approaching the target. Five countries and territories have a negligible proportion (less than 2%) of their land protected. This marks improvement since 2013 when only four countries had reached Aichi Target 11 and 5% of the total land in the region was within protected areas (SOCO 2017).

There is a *positive* trend in the designation of land area as protected, and there is *medium* confidence in the amount of available data on the spatial extent of areas labelled as protected. However, more commitment is required in the larger Melanesian countries to ensure adequate protection of terrestrial ecosystems.

Enforcing meaningful protection of those areas and monitoring the results remain challenging. Less than 1% of the protected land in the Pacific islands region has undergone the Protected Area Management Effectiveness (PAME) evaluation (see below; Table 13.1; WDPA 2020).

The amount of protected land increased for eight Pacific island countries and territories since 2013 (SOCO 2017).

It is relatively easy to measure the percentage of an area designated as protected. However, not all areas are equal: species populations, essential habitats, human uses, and human impacts are typically concentrated in certain areas (see also Regional Indicator: Key Biodiversity Areas). Climate change and invasive species remain the greatest threats to the biodiversity and habitats within terrestrial Pacific protected areas. Pacific managers are using protected status as a key criteria in the definition of priority sites for invasive species management (see Regional Indicators: Invasive species).

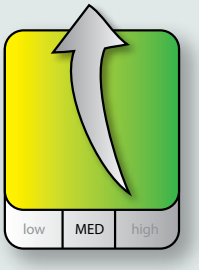
Connections among protected areas are essential for their survival, to maintain genetic diversity and 'restock' populations after a disaster, such as a bleaching or disease event. Globally, there has been a small but positive increase in the percentage of protected connected land from 6.5% in 2010 to 7.7% in 2018 (Saura et al. 2019). Regionally, Oceania showed the largest increase in the connectivity of protected land from 2010 to 2018, with the greatest changes in Australia and New Zealand but the largest proportion of connected land in Micronesia.

Pacific people are receptive to the protection of natural spaces and biodiversity. Over 80% of residents of Ngardmau State, Palau, reported positive livelihood, economic, and environmental benefits of the local system of protected areas (Marino & Uchel 2019). Over 20% of residents reported their perception of a positive change in the terrestrial environment under protection. In Tonga, the number of Special Management Areas more than doubled between 2016 and 2019 as communities sought to adopt this management approach (Smallhorn-West et al. 2020).

THEME **Conservation and Protection**

INDICATOR **Marine Protected Areas**

DEFINITION	% of EEZ formally protected for conservation
PURPOSE	Protected areas are established to protect biodiversity and ecosystem services from resource extraction and unsustainable harvesting
DESIRED OUTCOME	Positive trend in area protected; or ≥10% of EEZ is protected (Aichi Target 11)



Status
Fair to good

Trend
Improving

Data confidence
Medium

Funafuti Conservation Area, Tuvalu. © V. Jungblut

PRESENT STATUS

The Pacific islands region (including Pitcairn) has an area of ocean of approximately 58,994,235 square kilometres, which includes international waters and approximately 27,878,160 square kilometres of national exclusive economic zones (EEZs), 20% of the global EEZs. Protected marine areas cover 5,602,919 square kilometres[1] of this area, approximately 20% of Pacific EEZs. Less than 4% of the marine protected area of the Pacific islands region has undergone the Protected Area Management Effectiveness (PAME) evaluation (see Table 13.1; WDPA 2020).

Cook Islands, Commonwealth of the Northern Mariana Islands, Kiribati, New Caledonia, Palau, and Pitcairn have exceeded the marine target set out under CBD Aichi Target 11, with more than 10% of their waters protected (Figure 13.1). (Note that reports to CBD will combine a territory and its partner country.) In April 2020, Niue joined this group by passing the *Niue Moana Mahu Marine Protected Area Regulations 2020*, giving legal protection to 40% of Niue's EEZ. Most countries and territories (15 of 22) have less than 2% of their national waters protected. In 2017, the Cook Islands declared its entire EEZ as the multiple use Marae Moana Marine Park. In 2020, Palau's no-take national marine sanctuary took effect, covering 80% of the exclusive economic zone and augmenting the 40% of coastal habitats under protection or management.

Pacific marine protected areas account for over 48% of the protected marine area in the Asia-Pacific region but only 9% of the total marine area in the Asia-Pacific region. Globally, 11.4% of the ocean under national governance is within designated marine protected areas.

Types of protection vary. Restrictions, closures or mandated behaviours can be defined across space, seasons or other time periods, or species-specific. Locally managed marine areas (LMMAs) that build on participatory management and account for local needs, traditions, and self-governance have been a particularly effective Pacific innovation (Govan 2017; Box 11.1). Sanctuaries established for species or groups of species, such as whales or sharks, have been an effective conservation tool used in the Pacific islands region (see Regional Indicator: Migratory species of concern).

BOX 13.2: COMMUNITIES IN PALAU SUPPORT MARINE PROTECTION

The Palau International Coral Reef Center quantified the knowledge, perceptions, and support of communities living alongside protected areas. Using surveys, the managers could identify how people learned about the protected areas and how they felt affected. Among their findings:

	NGARCHELONG STATE	NGARDMAU STATE
People showed 'high' or 'extensive' levels of support for the state conservation areas	over 50%	over 60%
People saw some or great increase in the overall quality of the marine environment and the abundance of fish	over 40%	over 30%
People agreed that the conservation area was beneficial to their community	over 50%	over 80%

Source: Marino et al. (2019), Marino & Uchel (2019)

1 This value includes the 127,000 km² of Niue's newly designated MPA that is not yet formally registered in the WDPA; without this value, the marine area under protection is 5,475,828 square kilometres.

TRENDS IN MARINE PROTECTION

Large increases in marine protected areas have been established in the last five years in the Pacific islands region. However, assessment, monitoring, and enforcement remain challenges for these vast areas. The digital revolution may transform monitoring through the use of remote and long-distance sensing, but comprehensive enforcement and response measures, including enforcement capacity and legal actions, require long-term resourcing.

Comprehensive marine habitat mapping is still a developing science in the Pacific islands region. Although communities have rich traditional knowledge of species abundances, fishing techniques, and management practices, the information regarding seabed characteristics and habitat change is more limited and requires technological input.

Historically, the greatest pressures have been on pelagic marine species in the open ocean and on nearshore habitats. Emerging industries such as deep-sea mining now require leaders to consider the marine seabed as part of the connected seascape of Pacific oceanic and coastal ecosystems and habitats, including potentially as part of regional and national systems of protected areas.

Ensuring the sustainability of effective marine biodiversity protection is an ongoing process important for the Pacific progress toward the Sustainable Development Goals, ensuring that no one is left behind, particularly as there are differences among genders or other social groups in the access to marine spaces and use of marine resources in many Pacific cultures (Michalena et al. 2020).

BOX 13.3: PROTECTING THE HIGH SEAS

Approximately two-thirds of the world's ocean is outside of national waters, but only 1% of the high seas are protected from industry.

In 2015, the United Nations General Assembly adopted a resolution to develop an internationally binding legal instrument under United Nations Convention on the Law of the Sea for the conservation and sustainable use of biodiversity in areas beyond national jurisdiction. The draft text of the agreement is under negotiation, with the fourth substantive session of the intergovernmental conference scheduled for 2020 presently postponed.
See: www.un.org/bbnj/

Pacific leaders have called for protection of the high seas pockets between Pacific EEZs since the Noumea Convention (Govan 2017). Without designated high-seas MPAs, Pacific leaders have created protective measures through fishing regulations of fishing practices and gear, including the closure of these high seas pockets to purse seine fishing.

Indigenous peoples and local communities will disproportionately bear the burden of loss of biodiversity or ecosystem services from the global ocean commons, as can be seen from case studies of highly migratory species (Vierros et al. 2020; see Regional Indicator: Migratory species of concern).

CRITICAL CONNECTIONS

Global environmental change and human pressures have cascading impacts that are difficult or impossible to predict with our present knowledge. Simultaneously, the protection of biodiversity and use of ecosystem-based approaches have cascading co-benefits for our people and our islands.

Spatial protection of land and water areas are mutually beneficial. Ridge-to-reef approaches that weave together the management of land, invasive species, waste, agriculture, infrastructure, tourism, and other terrestrial activities can benefit the land and ocean ecosystems that support communities.

Long-term economic benefits may be supported by large, established systems of managed natural areas. Boosting biodiversity benefits everyone, as long as inclusive planning and monitoring approaches take into account the priorities of the diverse users. Effective management of protected areas is closely linked with the budget, resourcing, and staffing of skilled experts.

The tourism industry can be a key partner in the management of protected areas, built on a foundation of information sharing to ensure suitable habitats and sustainable access.

Protected areas are natural museums and laboratories, with educational and research possibilities. By preserving habitats and species, young generations can connect with their cultural history and learn about processes of change. Engagement is an essential ingredient for effective and efficient action in protected areas. Aligning the plan for uses of the space with societal needs, traditions, and cultural practice is one component; the cultural engagement of the management staff and decisionmakers is another.

Protection of natural land and forests is essential for preserving and restoring our most effective natural carbon sinks. Protection of biodiversity has acknowledged co-benefits for sustainable development, climate, and public health (Smith et al. 2018).

Acknowledging the advantages of connections among ecosystems and across management sectors can help us manage biodiversity and ecosystem services in the face of transboundary pressures on Pacific environments, including climate change, ocean acidification and warming, and pollution.

THEME **Conservation and Protection**

INDICATOR **Protected Area Management Effectiveness**

DEFINITION	% of formal protected areas (PA) and other area-based approaches where PA management effectiveness assessments (PAME) have been completed
PURPOSE	PAME evaluations can be defined as: "the assessment of how well protected areas are being managed – primarily the extent to which management is protecting values and achieving goals and objectives" (Hockings et al. 2006)
DESIRED OUTCOME	Increase in percentage of effectively managed protected areas and other area-based approaches

Status
Poor

Trend
Unknown

Data confidence
Medium


PAME assessment consultations, PNG. © Ann Peterson

PRESENT STATUS

Pacific island countries and territories are in the early stages of using Protected Area Management Effectiveness (PAME) assessment tools in the formally protected areas in the region.

In the Pacific islands region in mid-2020:

- Nine countries and territories have PAME assessments within part of their marine protected areas
- Eleven countries and territories have PAME assessments within part of their terrestrial protected areas
- Less than 4% of the protected marine area of the region has undergone PAME assessment
- Less than 1% of the protected land area of the region has undergone PAME assessment

Countries that have done PAME assessments have used different and adapted tools, such as RAPPAM in Samoa, the adapted Management Effectiveness Tracking Tool (METT) in PNG, or R-METT tool for Ramsar sites (Leverington et al. 2017). As observed in the PNG METT experience, tailoring the tool to specific contexts allows the assessment to be more relevant in that it adds value to the process, increases ownership of the process/results, and generates more information than direct application of a generic tool. The best tools are those that are simple, easy to use, targeted at relevant issues and the way that local management works, and incorporate local languages and terminology. In addition to or in replacement of formal tools from outside the region, local measures of management effectiveness might be identified for accurate and sustainable monitoring.

IMET (the Integrated Management Effectiveness Tool) was developed in the context of the BIOPAMA (Biodiversity and Protected Areas Management) programme to contribute to improving protected area management effectiveness and meeting conservation targets. This tool concerns the planning, monitoring, and evaluation of protected areas, and it directly supports managers in the field and in national agencies. The IMET tool is not yet widely used in the Pacific islands region.

Assessment is not an end result but rather a key step in protected area management. Regardless of the share of positive or 'negative' findings in an assessment, an effectiveness assessment can strengthen the protected area by equipping managers to adjust and redirect efforts. The effectiveness of community-managed PA systems is not well studied. At the regional and global level, we need more information to support communities to manage their own resources and to identify best practices. Pacific research can contribute to this body of knowledge.

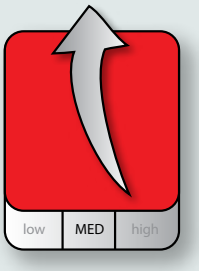
It is easier to identify where assessments have been done than it is to obtain and interpret assessment results. Information sharing and a coherent regional record of assessments is needed to assess the level of effectiveness of Pacific conservation and spatial protection.

With the present assessments, there are insufficient results to draw conclusions region-wide. It is expected that more than five countries within the region will conduct national PAME assessment processes by 2025. This includes several countries that have applied for funds through a small grant programme (IUCN Fiji pers. comm.).

THEME **Conservation and Protection**

INDICATOR **Key biodiversity areas protected**

DEFINITION	Percentage of land and marine areas identified as Key Biodiversity Areas that is covered by protected area
PURPOSE	KBAs represent the most important sites for biodiversity conservation worldwide and are identified nationally using globally standardised criteria and thresholds
DESIRED OUTCOME	Increase in protected areas or; all Key Biodiversity Areas are adequately represented in protected areas networks



Status
Poor

Trend
Improving

Data confidence
Medium


Savaii Upland Forest Samoa. © Stuart Chape

PRESENT STATUS

In the Pacific, KBAs have been identified in three biodiversity hotspots: Polynesia-Micronesia, East Melanesia Islands, and New Caledonia. These hotspots collectively include all Pacific island countries and territories (Table 13.2). At 25% or less, the overall proportion of KBAs even partially covered by protected areas in the Pacific islands region remains alarmingly low despite the significant increase in the coverage of IBAs and AZEs over the last several decades (Leverington et al. 2020; IPBES 2018).

IBAs have been identified across the Pacific islands region (Table 13.2), six of which are listed as IBAs in Danger (BirdLife International Datazone, October 2020). In 2017, 27% of IBAs in Oceania were under protected area coverage, considered alarmingly low (IPBES 2018).

In the Pacific islands, 26 EBSAs have been identified by Parties to the CBD and international and national NGOs (Figure 13.2). The majority of EBSAs overlap with more than one country and with international waters, with a combined area within the region of almost 13.8 million square kilometres.

Thirty-nine terrestrial ecoregions lie partially or fully within the Oceania region. Six of these have more than 17% of their extent within protected areas, while seven have less than 1% (Figure 3.5 in Leverington et al. 2020). Twenty-nine marine ecoregions and pelagic provinces lie partially or fully within the region. Thirteen of these have 10% or more of their extent within protected areas (Leverington et al. 2020).

WHAT IS A KEY BIODIVERSITY AREA (KBA)?

Sites contributing significantly to the global persistence of biodiversity, KBAs represent the most important sites for biodiversity worldwide and are identified nationally using globally standardised criteria and thresholds. KBAs include Important Bird and Biodiversity Areas (IBAs) identified by BirdLife International and Alliance for Zero Extinction (AZE) sites holding the last remaining population of one or more Critically Endangered or Endangered species, among other important sites identified for different taxonomic, ecological, and thematic subsets of biodiversity.

Another way of prioritising areas is provided by Ecologically or Biologically Significant Marine Areas (EBSAs): marine areas in need of protection in open-ocean waters and deep-sea habitats. EBSAs are targeted at a range of taxa and cover a wider area than IBAs, which are predominantly concerned with bird species.

The CBD uses these scientific criteria to identify an EBSA in need of protection: Uniqueness or Rarity; Special importance for life-history stages of species; Importance for threatened, endangered or declining species and/or habitats; Vulnerability, Fragility, Sensitivity or Slow recovery; Biological Productivity; Biological Diversity; and Naturalness.

FIGURE 13.2: Areas in the Western South Pacific that have Ecologically or Biologically Significant Marine Areas (EBSA) meeting Convention on Biological Diversity standards (https://www.cbd.int/ebsa/).

TABLE 13.2: Priority areas in the Pacific islands region, indicating the number and extent in square kilometres of key biodiversity areas (KBAs) and important bird areas (IBAs). Source: for KBAs, www.keybiodiversityareas.org; for IBAs, BirdLife Data Zone, http://datazone.birdlife.org

COUNTRY OR TERRITORY	NUMBER IDENTIFIED KBAS	AREA IDENTIFIED KBAS (KM²)	NUMBER IDENTIFIED IBAS	AREA IDENTIFIED IBAS (KM²)
American Samoa	7	18,217	7	1,821,817
Cook Islands	10	70,024	9	6,318,771
Federated States of Micronesia	58	150,101	15	14,850,304
Fiji	53	60,970	28	5,883,983
French Polynesia	70	215,218	57	21,905,489
Guam	3	46	3	4,663
Kiribati	29	1,092,084	25	34,131,963
Marshall Islands	15	107,407	10	10,725,104
Nauru	1	1	1	35
New Caledonia	62	183,766	54	16,673,485
Niue	1	41	1	5,400
Northern Mariana Islands	13	32,028	13	3,203,473
Palau	16	13,434	11	1,215,459
Papua New Guinea	132	328,766	5	25,198,632
Pitcairn	4	74	4	7,456
Samoa	8	1,103	6	101,072
Solomon Islands	37	19,608	11	905,298
Tonga	12	17,327	11	3,723,999
Tokelau	4	37,795	3	3,777,681
Tuvalu	0		0	0
Vanuatu	29	8,637	12	680,458
Wallis & Futuna	2	5,738	2	575,582
Total, Pacific islands region	**566**	**2,362,385**	**288**	**151,710,124**

THEME **Conservation and Protection**

INDICATOR **Governance and equity of protected areas**

DEFINITION	Who holds power, authority and responsibility and who is, or should be, held accountable
PURPOSE	Land management costs and benefits are shared fairly across governance types, e.g. community, government, and shared management
DESIRED OUTCOME	Governance and management of conservation areas equitably reflects land and resource ownership and responsibilities

Status
Unknown

Trend
Unknown

Data confidence
Low

Community consultations, Fiji. © V. Jungblut

PRESENT STATUS

At present, there is no consistent regional reporting toward this indicator. At the national level, this indicator is used to assess the distribution of measurable benefits and the needs of vulnerable groups. For regional comparisons, the priority groups or factors to be measured for this indicator could be more clearly defined.

The majority of Pacific sites that are established or under consideration as protected areas or community managed areas are community-owned, with defined systems of control and management supported by the government but driven by the local communities.

Globally, there is growing awareness of the need for justice and equity in sustainable protected area management, and there is a growing body of research demonstrating the benefits of participatory management, the greater health of ecosystems under traditional and indigenous management, and appropriate methods for inclusive spatial planning. The Theme on Indigenous Peoples, Local Communities, Equity and Protected Areas (TILCEPA) is an inter-Commission body of IUCN addressing social policy aspects of protected areas.

Under Aichi Target 11, signatories to the Convention on Biological Diversity were required to incorporate social equity into protected area management by 2020. In a 2016 survey, over half of respondents believed there were significant challenges in achieving this goal (Zafra-Calvo et al. 2019).

As IUCN notes, “achieving increased coverage, representativeness, effectiveness and equity through formally designated protected areas alone will, in many cases, be virtually impossible” (Borrini-Feyerabend et al. 2013). Co-creation and co-management of priority areas and related research can support more equitable governance for a broader group of stakeholders, and the traditional Pacific approach meshes well with this place-based, community-centred management. Ensuring that this broader approach to management does conserve biodiversity and ecosystem services, evidenced by long-term measurements, is a key challenge for this more inclusive but often more complex governance framework. It should also be noted that good governance, engagement, and equity for communities is a key component of the five-yearly *Framework for Nature Conservation and Protected Areas*.

THEME **Conservation and Protection**

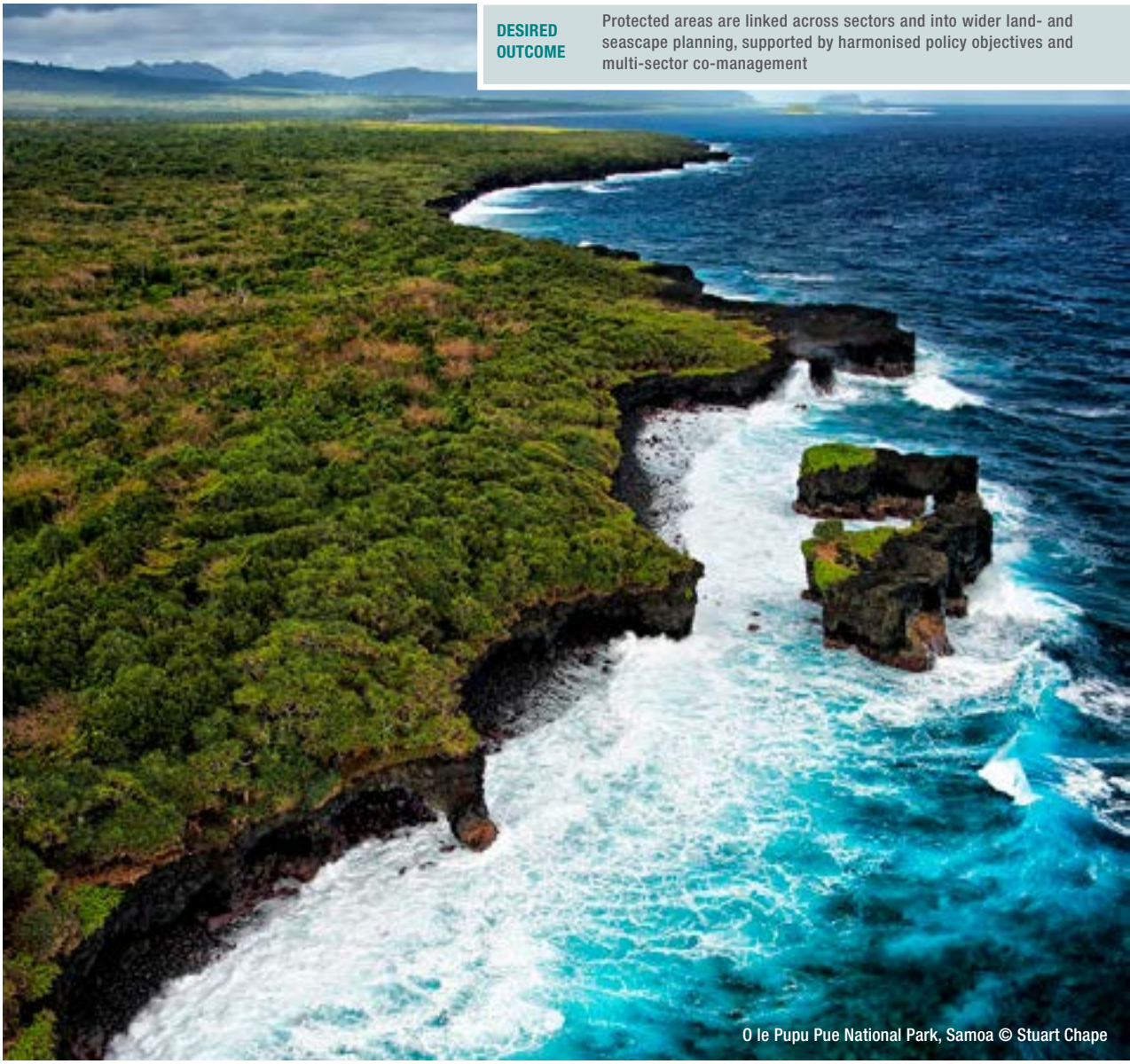
INDICATOR **Integration of protected areas into wider land and seascapes**

DEFINITION	Integration of protected areas into the wider landscapes and seascapes as well as into broader sectoral plans and policies, such as National Sustainable Development Plans or equivalent
PURPOSE	Greater benefits to people and nature from protected areas through efficient, holistic management with clear jurisdiction. Integrated landscape and seascape planning should take advantage of positive 'spillover' of benefits from protected areas and help reduce negative 'spills' of transboundary pressures into protected areas.
DESIRED OUTCOME	Protected areas are linked across sectors and into wider land- and seascape planning, supported by harmonised policy objectives and multi-sector co-management

Status
Poor to fair

Trend
Unknown

Data confidence
Low



O le Pupu Pue National Park, Samoa © Stuart Chape

PRESENT STATUS

All of the Pacific island countries have adopted the Sustainable Development Goals, which include targets for protecting 10% of national marine territory and protecting key terrestrial areas. The number of identified priority sites and designated protected areas is improving across the region while the countries are also moving toward coherent regional and national frameworks that address environmental management, such as the *Framework for Nature Conservation and Protected Areas*, *Framework for Resilient Development in the Pacific* and National Invasive Species Action Plans, among others.

National protected areas benefit from a range of environmental legislation in the Pacific, including the growing use of environmental impact assessment, controls on the import and use of specific pollution hazards such as plastics and agricultural chemicals, and traditional and modern measures to manage harvest from terrestrial and marine spaces.

Habitat mapping for integration into sectoral plans and long-term monitoring is still limited in many Pacific islands. For more about connectivity, an understudied aspect of Pacific protected areas, see the Regional Indicators for marine and terrestrial protected areas, above.

Many Pacific islands use sector-based management. Landscape- and seascape-scale management requires coordination among sector budgets and workplans, visions, and policy and legal frameworks. At the regional scale, Pacific Leaders have committed to this integrated approach through mechanisms such as the *Framework for a Pacific Oceanscape* (2010), *Framework for Resilient Development in the Pacific* (2016), and the Blue Pacific identity (2017).

PRESSURES AND OPPORTUNITIES

The 2018 global IPBES report highlighted the ongoing loss of the planet's biodiversity as a result of climate change, population growth, poverty, human consumption of natural resources, land degradation, deforestation, invasive alien species, illegal trade in wildlife and non-timber forest products, rapid urbanisation, coastal pollution, poor governance of natural resources, and the impact of altered fire regimes. Most of these drivers of negative change also impact Pacific island countries and territories. Establishment and effective management of marine and terrestrial protected and other conserved areas is one of the mechanisms that can reduce biodiversity loss in the region. For the wider Asia-Pacific region, the IPBES report noted that although protected area coverage has increased substantially, existing protection still does not effectively target areas of important biodiversity, and progress is needed towards better overall management effectiveness.

Large-scale marine protected areas and species-specific conservation areas established by several Pacific island countries and territories, especially combined with comprehensive marine spatial planning and national ocean policies, are a significant contribution to the protection and sustainable management of marine environments. However, management effectiveness including the provision of adequate resources for monitoring and surveillance will be critical for ensuring the sustainability of these areas. In addition to existing threats, deep-sea mining is a looming threat to marine biodiversity and the effectiveness of protected marine areas across the region. The inadequate level of knowledge of deep-sea marine ecosystems, their species, and connectivity to other marine ecosystems should be a major concern to countries in contemplating DSM activities, especially in view of the poor environmental and social track record and high impacts of terrestrial mining in the region.

The low overall coverage of terrestrial protected areas and other conservation mechanisms, and therefore protection of terrestrial biodiversity, is a major concern in the region. Establishment of terrestrial conservation areas requires participatory engagement by traditional and resource owners, which can often be a necessarily long, complex process that addresses a range of conservation, social, and development issues. However, the process of engaging with communities, and the timescales required, to secure and maintain conservation commitments is struggling to keep pace with the need to address biodiversity loss. The major drivers of such losses have been deforestation and land degradation, invasive species, mining, increasing urbanisation, and destruction of mangroves and other shoreline coastal ecosystems that must be included in terrestrial conservation considerations. To these must be added the increasing impacts of climate change.

However, the imperative to address climate change impacts through adaptation and mitigation also provides an opportunity—and imperative—to protect ecosystems and the services that they provide. For example, forested catchments that provide freshwater resources, timber, and non-timber forest products for communities also provide habitat to a range of biodiversity, including endemic and threatened species. Healthy coral reefs and mangroves support coastal fisheries for income and food security and economic benefits through tourism. Maintaining these and other critical ecosystems for a longer time improves the prospects for community resilience in response to climate change. Formal establishment of protected and other conserved areas through community agreements and/or national legislative and regulatory mechanisms can provide the framework for long-term protection.

The growth in the number and extent of protected and other conserved areas suggests that the coverage of taxonomic groups, important biodiversity areas, and ecoregions should also increase alongside increases in the benefits from protection to a range of human users. However, these trends have not been adequately quantified. The state of coverage, representativeness, and connection of protected areas in the Pacific islands was analysed by Leverington et al. (2020).

According to IUCN best practice, governance arrangements for protected areas should be "tailored to the specifics of [their] context and effective in delivering lasting conservation results, livelihood benefits and the respect of rights" (Borrini-Feyerabend et al. 2013). The Pacific Islands region has a growing protected area system in the formal sense, building on centuries of traditional resource management, some of which had spatial components (SPREP 2013). The approaches now being developed at national levels are built on the feature of customary tenure and resource access, making use of existing community strengths in traditional knowledge and governance. Biodiversity protection is grounded in awareness by local users and communities of the need for action. Participatory management planning and community involvement during all phases, including planning and monitoring, have led to impressive improvements in ecosystems, such as marine biodiversity in and near locally managed marine areas (Box 8.3).

Around the world, vulnerable communities bear the burden of environmental degradation in disproportion to their impact. Protected areas are one tool to mitigate environmental degradation, and the equity of protected area management depends on the perspectives and priorities included during spatial planning.

INDICATOR IN ACTION

SDGs 6.6, 12.2, 14.2, 14.5, 15.1, 15.2, 15.4, 15.5, 15.9; for governance and equity: 5, 16 • UNCCD • Underwater Cultural Heritage Convention • Ramsar Convention • SAMOA Pathway (30, 58–59, 89–90) • Noumea Convention • Pacific Regional Environment Objectives 2.1, 2.2, 2.3 • Pacific Islands Framework for Nature Conservation Objectives 2, 3, 4, 6

FOR MORE INFORMATION

Pacific Islands Protected Area Portal at pipap.sprep.org

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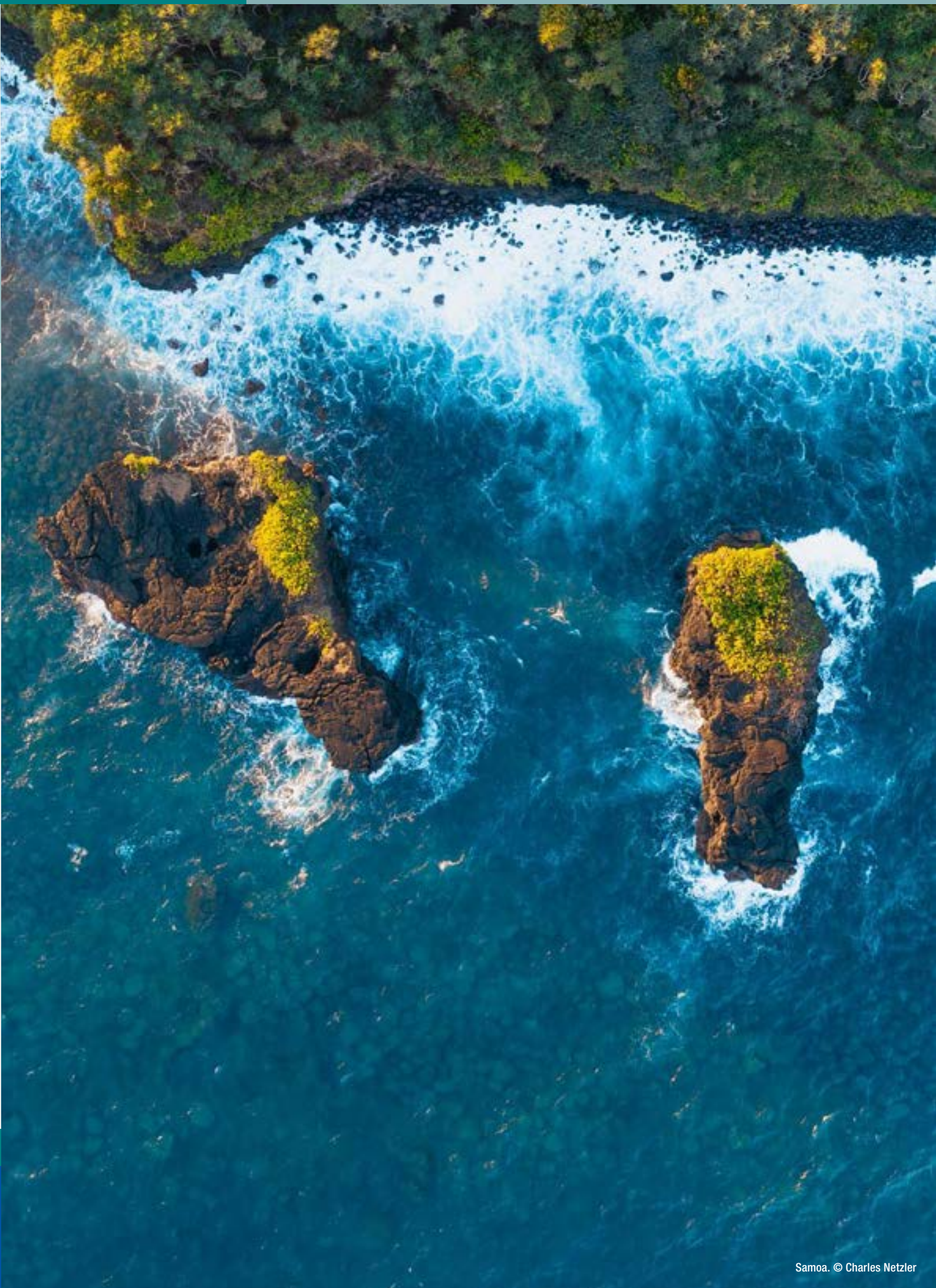
SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org



Samoa. © Charles Netzler

SECTION

Managing invasive species in the Pacific

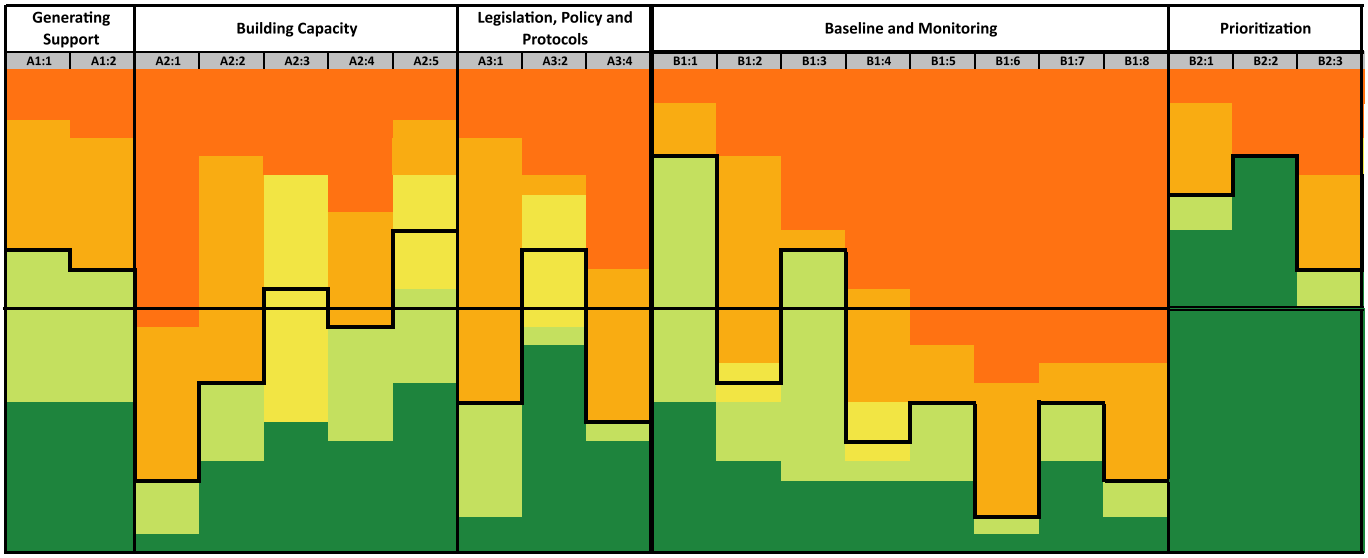
Invasive species are the primary cause of extinction on islands (IUCN Red List 2020, SPREP 2016, SOCO 2017). Invasive species have been formally identified as a threat for 1,531 species in the Pacific islands region to date (IUCN Red List, 2020).

Pacific leaders have established two core regional indicators for invasive species management. Efforts for invasive management are ongoing in almost all Pacific island countries and territories.

Invasive species management is recognised globally and is increasingly being used in Oceania to protect native biodiversity, natural resources, food security, economic development, human health, and ecosystem services, such as water resources, nutrient cycles, and regulated erosion and fire regimes.

Invasive species can be terrestrial, aquatic, or marine-based. The spread of invasive species can be facilitated by increasing trade, travel, and the transport of goods through the movement of, for example, ships, containers, cars, and soil. For more about threats to Pacific species, please see Regional Indicator: IUCN Red List Summary.

FIGURE 19.1: Progress toward the regional objectives, classified by achievement and divided among the three thematic areas of the Guidelines for Invasive Species Management in the Pacific (2009). All data are for 2019 with the following exceptions: Commonwealth of the Northern Mariana Islands (2018), Palau (2018), Phoenix Islands (Kiribati) (2018), Pohnpei (Federated States of Micronesia) (2017). The horizontal line represents 50%. Thick black lines represent the median for that particular objective. If the thick line is above the median, that means the region is over halfway to success for that objective indicator. Green to red: achieved to not achieved.



THEME **Biodiversity**

INDICATOR **Invasive species under management or eradicated**

DEFINITION	% of identified priority invasive species eradicated from defined areas or under formal management
PURPOSE	Indicates the effectiveness of invasive species eradication and management programs
DESIRED OUTCOME	All or positive trend in the number of priority species under management or eradicated

Status
Poor to fair

Trend
Mixed

Data confidence
High


Lantana (*Lantana camara*). © Posa Skelton

PRESENT STATUS

We focus on the concept of placing invasive species under formal management. It is difficult to quantify all invasive species within a country, let alone a site, because the exact number of invasive species is subject to rapid change without being easily identified as new incursions arrive, possibly daily. The percentage of new arrivals (if known) would most likely always be greater than the number of species that could be declared eradicated in any one year. The best measure may be the percentage of *identified priority* species under management or eradicated relative to the number of priority species.

Countries have made efforts to define priority species in their NISSAP, although priorities might shift rapidly and might differ among sites within a country.

The status of the region's invasive species management and eradication was deemed *poor to fair*, with the majority of Pacific islands having specific laws and action plans for invasive species management. About half of the Pacific island countries and territories have a specific National Invasive Species Strategy and Action Plan or equivalent, although many of these plans extended only to 2020.

The overall trend in the extent of invasive species management and eradication is considered to be *mixed*. Management measures are improving but the risk of invasive species is growing with increasing travel and movement of goods alongside co-occurring environmental pressures that reduce the capacity of native species to compete with invasive species. The situation with regard to invasive species in some countries is deteriorating regardless of further invasive species arriving.

The availability and quality of data was scored *high*, with growing efforts toward baseline and monitoring (see Figure 19.1). Data regarding the number of species and eradications are available from the Global Biodiversity Information Facility, the Global Invasive Species Database and the Database of Island Invasive Species Eradication (for vertebrate eradications). Information regarding policies and management actions are available from the Battler Resource Base of the Pacific Invasive Learning Network.

Regionally, at the start of 2020, there are:

- 116 priority invasive plant species management programmes
- 8 priority invasive plants species management programmes that resulted in eradication
- 67 occasions where biocontrol is being used to reduce invasive plant species impact
- 78 programmes where priority invasive animals are being managed
- 25 priority invasive animal programmes that resulted in eradication
- 85 occasions of eradicating a species of rat from an island
- 16 priority marine invasive management programmes
- 0 eradications of priority marine invasive species.

Managers have completed 183 vertebrate eradications involving 49 species on 134 islands in Oceania, including Australia and New Zealand.

Source: Database of Island Invasive Species Eradication

THEME **Biodiversity**

INDICATOR **Priority sites with invasive species managed**

DEFINITION	Number of priority sites with multi-invasive taxa management programmes
PURPOSE	Indicates the effectiveness of invasive species management in protecting ecologically valuable sites/protected areas
DESIRED OUTCOME	All sites or positive trend in the number of priority sites where invasive species are managed

Status
Poor

Trend
Deteriorating

Data confidence
Medium


Tava (*Pometia pinnata*) seedlings (regeneration). © Josef Pisi

PRESENT STATUS

The status of the region's prioritization of sites for invasive species management is *poor*. Prioritisation of specific sites varies from designated planting sites without invasive species management *per se* to priority sites with defined action plans and allocated resources. The roughly 5,000 hectares with plant or predator control cover a small fraction of the Pacific region.

The majority of Pacific islands have established national priorities (see Figure 19.1), and about half of the countries and territories have a National Invasive Species Strategy and Action Plan or equivalent, although many of these plans extended only to 2020. Establishing baselines and regular, sustainable monitoring programmes for these priority sites requires long-term support.

Not all Pacific priority sites currently address multiple taxa in direct management, but the management plans directly address multiple species and many are working towards managing multiple taxa. In terms of impacts, priority sites already address multiple taxa because the management of one invasive species, such as a rat species, has far-ranging benefits for the surrounding habitats as well as for other species, such as plants and birds.

PRESSURES AND OPPORTUNITIES

The presence of an invasive species management plan alone is not a complete measure of the risk or of the success of management actions. The policy efforts Pacific leaders have made requir e sustained national and regional support for the implementation of the national action plans and institutionalisation of core invasive species management roles.

Tropical conditions are amenable to a wide range of potentially invasive species, requiring constant vigilance, partnerships with host and destination countries, and resourcing of biosecurity measures.

The strong reliance on imported goods, with large-volume container trade, makes the islands susceptible to continued re-introduction of pest species. For this reason, ports and shipyards are a standard high-priority site for biosecurity and invasive species management.

The geographic remoteness of some Pacific islands is beneficial for the successful eradication of invasive species but also increases the cost and difficulty of long-term management measures.

The costs of invasive species management are lower than the costs to replace damaged infrastructure or ecosystem services. Control of the populations of introduced invasive species often costs less than engineering-based solutions to restrict their spread or impacts (ISAC 2016).

As part of the new PRISMSS initiative, the SPREP Invasive Species and PIPAP teams will be working to identify existing and most urgent areas of overlap between protected areas and priority sites for invasive species management. These efforts will build on existing invasive species management in the region, with information collected regularly (see Annex E for an example of the questionnaire).

CRITICAL CONNECTIONS

Invasive species can directly and indirectly threaten the health and abundance of native species. By eating seeds, eggs, and animals that would distribute native species, invasive species change the habitats, sounds, and appearance of our islands. Invasive species threaten protected areas, on land and at sea.

The presence of invasive rats has been linked to nearshore water quality and reef communities, including fish (Graham et al. 2018). Lagoon water quality relies on well-managed native forests, both upland and coastal.

Invasive species management helps to build climate resilience. For islands, invasive species management should be considered as one of the most important tools in programmes supporting adaptation and response. Assessment of success should also involve tracking national and project budgets (see Regional Indicator: Environment Ministry budget allocation).

Invasive species can be introduced to new sites on floating plastic debris and place an extra burden on waste management systems.

ERADICATING INVASIVES SAVES NATIVE SPECIES

The ko'ko', Guam Rail *Hypotaenidia owstoni*, is the second bird in history to recover from being declared extinct in the wild (IUCN Red List 2019). The accidental introduction of the brown tree snake (*Boiga irregularis*), which became invasive, devasted the populations of this small bird and changed the forests of Guam. With fewer birds, spiders became more abundant. Without birds to spread seeds, native plants and trees declined.

At the brink of extinction with only 21 individuals left in 1987, the ko'ko' were saved with the extreme measure of a captive breeding programme and 35 years of careful management. There is now a small population of ko'ko' established on Cocos Island, which remains free of brown tree snakes. With the invasive snakes still threatening mainland Guam, the rail population is still classified as Critically Endangered and may remain so unless the brown tree snake is eradicated.

Source: BirdLife and IUCN Red List 2019

Guam Rail © Andersen Air Force

REGIONAL RESPONSE RECOMMENDATIONS

Regional support is essential for a Pacific response to invasive species. Effective biosecurity combined with early detection and rapid response can substantially reduce the risk, and costs, of new invasions. The Pacific Regional Invasive Species Management Support Service (PRISMSS) is a coordinating regional mechanism to scale up invasive species management.

The management of species that have already arrived is key for the survival of Pacific species in fragile, small environments. Sustainability of invasive species management requires human capacity and resources for the targeted work, including the engagement of staff, decision-makers, and communities.

In addition to long-term monitoring of the defined indicators, key needs include training to increase the technical capacity of local staff, transportation of experts and materials throughout the large region, and technological capacity, including tools and compounds used for management.

The status of and effective management measures for marine invasive species is a significant data gap for the Pacific islands region, as it is globally. The 2017 entry into force of the Ballast Water Management Convention requires vessel retrofitting and adoption of safe ballast water practices to avoid transporting marine invasive species.

Acting regionally supports the critical need to:

- Measure and monitor the presence and impacts of invasive species, with attention to filling knowledge gaps on the results of the defined management actions and the socioeconomic impacts of invasive species;
- Plan to prevent movement of invasive species into and among the islands;
- Enforce protection of priority sites and species through partnerships with biosecurity, land-use planning, and communities with traditional knowledge and cultural uses of priority sites;
- Restore native species and habitats, with long-term monitoring of cascading impacts and benefits; and
- Partner for biosecurity, knowledge sharing of best practices, and regional resourcing of invasive species management and native habitat restoration.

INVASIVE SPECIES AFFECT INFRASTRUCTURE, HEALTH, AND ECONOMIES

Tamaligi (*Albizia falcataria*) are prone to wind damage, breaking more easily than native species. Large amounts of broken limbs and trees threaten infrastructure such as power lines, roads, and bridges and may stimulate flooding due to log jams created during extreme rain events (ISAC 2016).

Brown tree snakes (*Boiga irregularis*) have caused thousands of power outages in Guam, costing over USD 4.5 million per year in the 1990s in lost services (without considering repair costs and lost revenues; Fritts 2002). Estimated costs to the Hawaiian economy if the brown tree snake were to invade range from USD 500 million to over 2 billion annually (Schwiff et al. 2010).

Giant African snails (*Achatina fulica*) cause despair on many Pacific plantations and gardens (Stronge 2016). Invasive on all continents, these snails can devastate crops and carry rat lungworm *Anigiostrongylus cantonensis*, which causes eosinophilic meningitis in humans.

Tackling widespread invasives, Niue.
© Niue Department of Environment

INDICATOR IN ACTION SDGs 6.6, 14.c, 15.1, 15.8 · UNCCD · SAMOA Pathway (95) · Noumea Convention · Regional Environment Objectives 2.1, 2.3, 2.4 · Pacific Islands Framework for Nature Conservation Objective 5

FOR MORE INFORMATION

The SPREP Invasive Species Team supports the Pacific Regional Invasive Species Management Support Service (PRISMSS; www.sprep.org/invasive-species-management-in-the-pacific/prismss), Pacific Invasives Learning Network, and the Pacific Invasives Partnership, a working group of the Roundtable for Nature Conservation in the Pacific Islands.

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal.
pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

INDICATOR **Status of migratory species of concern**

DEFINITION	Population abundance of identified species
PURPOSE	Tracks the status of populations of priority species over time
DESIRED OUTCOME	Stable or positive trend in population size

Status
Poor to fair

Trend
Deteriorating

Data confidence
Medium

Blue shark. © Jim Anernethy

PRESENT STATUS

To date, there is no defined list of priority migratory species of concern (indicator species) at the regional level for the Pacific islands to direct efforts. The Regional Marine Species Action Plans (under revision; see below) and the regional CMS Memorandum of Understanding (2006) for cetaceans can be considered as part of regional level prioritisation. For birds, BirdLife's Datazone includes a list of migratory species for each country in the region. At the national level, priority species may be defined in the National Biodiversity Strategy and Action Plan (NBSAP) created as part of country efforts under the Convention on Biological Diversity.

Here, data for this indicator are based on the migratory species listed under the Convention on Migratory Species (CMS), to which four Pacific island countries are Party (see Annex C). As of September 2020, about 200 species managed under CMS were present in the Pacific islands region according to Species+, a portal for accessing key information on species of global concern that are listed in the Appendices of CITES and CMS, developed by UNEP-WCMC and the Convention on International Trade in Endangered Species (CITES) Secretariat.[1] Using CMS lists is a proxy but underrepresents the importance of migratory species to the region.

Tuna are not listed on CMS appendices and are excluded from consideration in this summary. Including the four species of tuna in the assessment conducted here does not alter the identified trends or share of migratory species at risk. For more information about tuna, please see Regional Indicator: Commercial pelagic fish.

For future assessments of this indicator, a defined list of priority migratory species could direct efforts. Given the Pacific Leader's stated priority of the ocean and marine life, as formalised in the Blue Pacific identity, Framework for a Pacific Oceanscape (2010), and other regional frameworks, we consider marine migratory species to be 'of concern'.

Population sizes are decreasing for half (51%) of the CMS-listed migratory species present in the Pacific; 31% have stable or increasing populations (Table 18.1). Of the 200 species listed, the status was reassessed in 2013 or a more recent year for 194 species. Population trends are unknown for 19% of all listed species (17% of terrestrial, 21% of marine).

Among marine migratory species, 79% are at risk[2] and 73% of these at-risk species show population declines. Of all marine migratory species, 58% have declining populations, 58% are at risk[2] with declining populations, and 6% are at risk with unknown population trends. The population status of three marine migratory species are worse in the Pacific than elsewhere in the species' range: humpback whales, loggerhead turtles and leatherback turtles, all iconic Pacific species.

Among terrestrial migratory species, 20% are at risk and 80% of these show population declines. Of all terrestrial migratory species, 48% are declining, and 15% are at risk with declining populations.

The species 'of concern' are, in this analysis, those considered at risk in Red List assessments; 80% of these at-risk species have declining populations. Based on these data, the status for migratory species of concern in Oceania is considered *poor* with a *deteriorating* regional trend.

The confidence in this information was rated *medium*: the IUCN Red List is the most comprehensive, reliable, objective and up-to-date resource for measuring a species' extinction risk, and the CMS Appendices are the recognised global mechanism for migratory species management. However, a small fraction of species that migrate are listed on CMS Appendices, and listed species have been nominated by governments with over-representation by popular megafauna. Gaps in data availability and quality remain.

Importantly, the trend in species status over time is not publicly collated for priority migratory species of the Pacific islands region. The exception is for bird species: BirdLife's Datazone assesses trends for each Red List release. IUCN Red List entries are intermittently updated and do not themselves report changes over time. For more information about Pacific species listed on the IUCN Red List, please see Regional Indicator: IUCN Red List summary.

[1] Species+: https://speciesplus.net/

[2] Species 'at risk' are ranked on the IUCN Red List as: Critically Endangered, Endangered, Vulnerable, and Near Threatened.

CRITICAL CONNECTIONS

Pacific migratory species have economic value, directly and/or via tourism. Data are not presently collected for the complex measurement of this value, but we do know of the significant cultural value of Pacific migratory species. In today's context of changing ecosystems and societies, both scientific and traditional, local knowledge of migratory species will be essential for sustainable management. For migratory species, research cooperation among countries is essential, and future conservation research must address research capacity limitations, national and regional prioritisation, and the integration of traditional knowledge and data-driven methods.

Native species such as seabirds shape forest health and nearshore marine ecosystem health. Ecosystem destabilisation and change due to the complex interactions among species is a growing threat on islands, with invasive species and habitat change disrupting the diets and populations of native species, dispersal of native seeds, and nutrient/carbon flows.

The majority of studied Pacific species have ingested plastic, with growing evidence that plastics affect the health and life of animals on land and at sea. Future management of migratory biodiversity must consider transboundary pollutants, such as plastics and mercury.

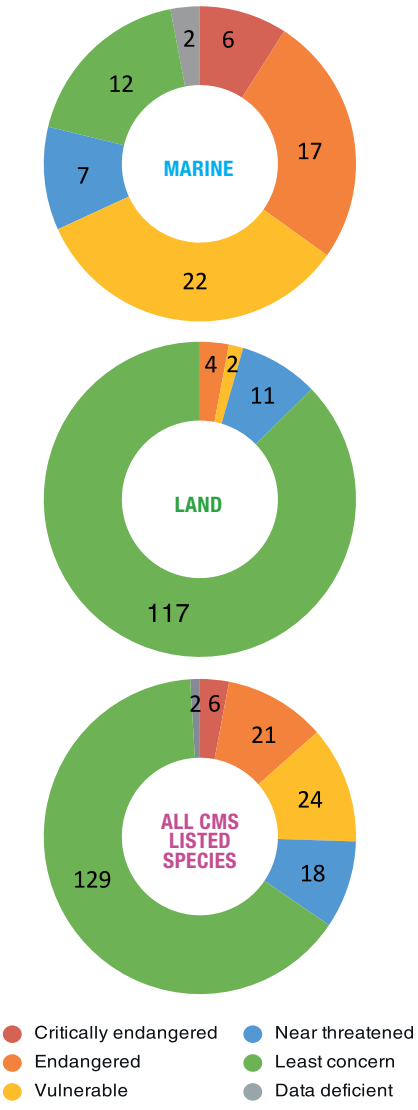
Migratory species cross vast areas and suffer transboundary impacts. However, networks of protected areas and their spillover benefits could provide refugia for some migratory species.

TABLE 21.1: Global population trends of the species listed on the Appendices of the Convention on Migratory Species that are present in the Pacific islands region. Data are the number of species. For 3 species, all marine, the Pacific subpopulations have a poorer status than the global population: Humpback whales are EN in the Pacific region (LC globally), with an increasing trend; Loggerhead turtles are CR in the Pacific region (VU globally), with a decreasing trend; Leatherback turtles are CR in the Pacific region (VU globally), with a decreasing trend. Source: Species+ and the IUCN Red List, July 2020

		POPULATION TREND				
	STATUS	STABLE	UNKNOWN	INCREASING	DECREASING	TOTAL
Marine	Total	4	14	10	38	66
	Critically endangered	0	0	0	6	6
	Endangered	0	0	2	15	17
	Vulnerable	3	1	3	15	22
	Near threatened	1	3	1	2	7
	Least concern	0	8	4	0	12
	Data deficient	0	2	0	0	2
Terrestrial	Total	36	23	11	64	134
	Critically endangered	0	0	0	0	0
	Endangered	0	0	0	4	4
	Vulnerable	0	0	0	2	2
	Near threatened	0	0	0	11	11
	Least concern	36	23	11	47	117
All	Total	40	37	21	102	200
	Critically endangered	0	0	0	6	6
	Endangered	0	0	2	19	21
	Vulnerable	3	1	3	17	24
	Near threatened	1	3	1	13	18
	Least concern	36	31	15	47	129
	Data deficient	0	2	0	0	2

Note: Shorebirds are categorised as 'terrestrial', whereas seabirds (albatross and petrel) are categorised as 'marine' species. Species included were those present in the 21 Pacific island countries and territories that are Members of the Pacific Regional Environment Programme, with the addition of Pitcairn. Each species that was present in Pitcairn was also present in at least one other Member country or territory.

TOTAL NUMBER OF SPECIES BY CATEGORY



WHICH SPECIES ARE MIGRATORY?

Migration habits exist across a spectrum, and the functional definition of 'migratory' may be expanded for the Pacific islands region due to the large habitat ranges of endemic species.

For example, albatross disperse over vast parts of the ocean after breeding but most species do not migrate according to the classic definition. The wandering albatross (*Diomedea exulans*) completes a true migration, the longest of any animal studied to date, with some individuals completing three circumnavigations of the globe in a year and travelling more than 120,000 kilometres (Weimerskirch et al. 2015). Even within a population, some individuals show partial migration.

Movement at a range of scales is essential for species survival. Conservation of these species requires cooperative management among the areas with the required habitats and the governance sectors responsible. For example, fruit bats move across islands seasonally to find suitable habitat with food, but these bats are not listed on CMS Appendices.

Migratory species can, in some cases, alter their migration patterns or decisions in response to environmental conditions and their health, and our understanding of Pacific migrations in the context of environmental change is limited (Weimerskirch et al. 2015 and references therein, Derville et al. 2019).

With their movements and the accompanying movements of carbon in their biomass, the birds, whales, and other migratory species of the Pacific islands region connect the North and South Pacific, Indian Ocean, Southern Ocean and beyond. For example, a study of 14 marine species tracked them to 86% of Pacific Ocean countries, and some spent three-quarters of their annual cycles in the high seas (Harrison et al. 2018).

For the purpose of this indicator, we focus on migratory species that cross national boundaries during their migration. The data refer to species listed under CMS.

RECOVERING WHALES FACE AN UNCERTAIN FUTURE

Humpback whales are a success story of a migratory species. In 1996, humpback whales were listed as Vulnerable on the IUCN Red List. From 2008 to today, humpback whales have recovered to the status of Least Concern globally, although their Pacific subpopulation is still considered Endangered but increasing in size with high reproductive rates (Chero et al. 2020).

These gentle icons are a core component of tourism for some Pacific countries, such as Niue and Tonga. Several Pacific islands have declared whale sanctuaries, including American Samoa, Cook Islands, Fiji, French Polynesia, New Caledonia, Niue, Palau, Samoa, Tokelau, and Vanuatu. Repeated assessments of the proportion of each species that uses those sanctuaries (based on population size and proportion of a year spent in the sanctuary) and of management effectiveness (appropriate, enforced, and monitored) would strengthen our understanding of whales and their sustainable management.

With their large bodies and vast travel, whales store and move carbon across the planet (e.g. Lavery et al. 2010, SPREP 2017). In terms of carbon storage, the recovery of whale populations is akin to rebuilding forests. Although whales can be considered allies in the fight against climate change, whales are also affected by climate change, particularly through ocean warming and changes in their food supply. Many breeding sites currently used by humpback whales will be unsuitably warm by the end of the 21st Century (Derville et al. 2019).

Ocean acidification can alter sound transmission in the ocean (Reeder & Chiu 2010), although the impacts on cetaceans are not yet certain (Peng et al. 2015). Floating plastic debris is a direct threat to whales and other marine life, through entanglement or swallowing.

The humpback recovery has occurred primarily because of the decline in commercial whaling harvests, which used to be the single dominant threat. However, whales now face new threats. Many of today's threats to whales cross sanctuary boundaries. International cooperation is essential to ensure the continued health of Pacific whales.

MAKING THE PACIFIC SAFE FOR SHARKS

In 2009, the Republic of Palau established the world's first shark sanctuary to protect their biodiversity including great hammerheads, leopard sharks, oceanic whitetip sharks, and more than 130 other marine species. As of 2020, eight Pacific island countries and territories have designated their national waters as protected sanctuaries for all sharks and rays. The total area covers an estimated 17 million square kilometres consisting of the Exclusive Economic Zones (EEZs) of the Federated States of Micronesia, French Polynesia, Kiribati, New Caledonia, Palau, Republic of Marshall Islands and Samoa.

In some cases, such as in Kiribati, the regulations prohibit commercial shark fishing and trade but allow for local consumption (Manghubai et al. 2019b). In 2016, Guam and the Northern Mariana Islands established shark sanctuaries in their local waters (within three nautical miles from shore) prohibiting commercial fishing for sharks, the retention of sharks caught as bycatch, and the trade, possession, and sale of shark products. Both national nomination and regional cooperation are important to influence international management measures. Fiji successfully led a Pacific lobby to list the six species of mobulid rays on CMS Appendices in 2015.

Sharks and rays are totem species in some Pacific island cultures. In addition to their ecological importance, these unique animals have cultural and spiritual significance for the people of Oceania and the many tourists who come to appreciate their beauty.

PRESSURES AND OPPORTUNITIES

Migratory species in the Pacific islands face direct threats and indirect, chronic threats. The top threats to Pacific species include invasive species, climate change, and habitat loss. Direct harvesting, both over-harvesting and illegal harvesting of a variety of species, is a common threat to priority species in the Pacific.

For migratory species, habitat loss or consumptive use at sites of intermittent use, such as feeding or breeding locations, is a priority hazard placing Pacific biodiversity at risk. The Antipodean albatross (*Diomedea antipodensis*) is a good example of a migratory species at risk outside of its breeding jurisdiction, in New Zealand. Action where it is at risk is needed to prevent extinction. In this case, mitigation of fisheries bycatch throughout the southern Pacific Ocean would support Antipodean albatross populations (for example, Ochi et al. 2018).

Direct threats include bycatch hazards, fisheries harvests, or entanglement in active and discarded fishing gear or plastic debris. Invasive species can also directly kill Pacific migratory species, with the most notable losses from invasive rats eating seabird eggs and chicks. Among seabirds that only breed in the Pacific islands region, 30% are at risk (CR: 3; EN: 3; VU: 4; NT: 1; LC: 28) (IUCN 2020).

Indirect threats include habitat change or displacement due to human development (factors such as physical displacement, light, or sound pollution), invasive species, and climate change; disease, in some cases linked with climate change and tourism; and transboundary pollution, including persistent organic pollutants and heavy metals. Plastics are a growing threat to migratory species; see the Regional Indicator: Marine plastic pollution.

Migratory marine species, such as whales and dolphins, marine turtles, dugongs, seabirds, sharks, and rays, are key species within Pacific ecosystems, cultures, and economies but face many threats, the greatest due to fishing activities and climate change. Regional Marine Species Action Plans endorsed by SPREP Members were produced roughly every 5 years starting in 2003 for dugongs, marine turtles, whales and dolphins; the most recent editions covered 2012–2017. Existing action plans are being updated and new ones prepared for seabirds and for sharks and rays.

Due to their intermittent presence in multiple habitats under a range of governance, migratory species require more cooperation for management over a complex and dispersed area. For example, the Pacific islands are part of the West Pacific and East Asian/Australasian flyways, vast paths travelled between breeding and wintering grounds. Migratory seabirds face habitat change, invasive species pressures, and direct mortality both at sea and on land, complicating our understanding and management of their population status, pressures, and trends as compared to other birds.

In 2018, a Conservation Management Measure (CMM) was reviewed for seabirds by the Western and Central Pacific Fisheries Commission (WCPFC), building on the 2012 agreement to expand the area in the South Pacific where mitigation measures would be required with the intention of providing greater protection for seabirds, including the CR Antipodean albatross. Although most of the threatened seabirds in the Pacific that are listed on CMS are also found and studied in other countries such as Australia and New Zealand, seabird colonies in the tropical Pacific islands are not well understood. Most of the threatened Pacific seabirds are endemic or regionally endemic but not yet listed under CMS. Research is currently being conducted most notably in Fiji, French Polynesia, and New Caledonia; however, additional surveys are needed to better understand their status and threats.

Reptiles and especially marine turtles are critical species in the Pacific both culturally and in terms of decline. A region-wide assessment for marine turtles is underway (see Box 3.2 in Regional Indicator: Terrestrial wildlife use). In addition to biological indicators for the species, a comprehensive assessment could consider the economic value of marine turtles including their contributions to Pacific tourism; the social and cultural value of marine turtles including their traditional or aesthetic meaning; and the emerging threats to marine turtles from inside and outside of the Pacific region. Although the global population of leatherback turtles is listed as Vulnerable, this species is now Critically Endangered in the Pacific region (IUCN RedList). Trends in the East and West Pacific subpopulations are the primary drivers of the global decline in leatherback turtles (Wallace et al. 2013).

The vast size of the Pacific islands region is part of what makes Pacific migratory species so special, but this size also creates significant challenges for sustained, replicable monitoring of Pacific biodiversity.

REGIONAL RESPONSE RECOMMENDATIONS

Analysing gaps in policy areas that allow unfettered development to the detriment of priority migratory species and prioritising protection of priority migratory species throughout government systems are essential. Given the long lifespans of many priority migratory species, such as turtles which do not begin to breed until 25 years old or older, long-term sustainability of management efforts is essential for progress towards the Pacific goals for migratory species management. To ensure habitats remain available for priority species over such long timescales, multi-sectoral management will be critically important.

Countries are encouraged to:

- Confirm the suite of priority migratory species for Pacific region, considering cultural, economic, and traditional use. Countries can consider ratifying CMS and nominating migratory species to the CMS Appendices;
- Identify priority knowledge gaps and key sites (or Key Biodiversity Areas) for migratory species that are of particular importance for Pacific people, economies, and cultures;
- Protect essential habitats for biodiversity, beginning with an identification of the essential habitats for stages in migratory species' lifecycles;
- Measure *efforts* towards priority migratory species management, *contributions* of migratory species to national and regional economies, and *costs and contributions* from enforcement of management measures such as CITES fines, distinguishing between long-term national investments and short-term project funds;
- Ratify international and regional conventions or agreements, including the Convention on Migratory Species (CMS) and the Convention on International Trade in Endangered Species (CITES), that promote the protection of listed migratory species;
- Partner for management of priority migratory species, including essential partnerships between environmental managers and customs and biosecurity officials; and
- Develop legislation, policy, and regulations to protect biodiversity, mainstreaming biodiversity protection across all sectors of government.

INDICATOR IN ACTION **SDGs 6.6, 15.1, 15.6, 15.7, 15.c • Convention on Biological Diversity • Convention on Migratory Species • SAMOA Pathway (90, 94d) • Pacific Regional Environment Objective 2.3 • Pacific Islands Framework for Nature Conservation Objectives 4, 5**

FOR MORE INFORMATION

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

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THEME **Biodiversity**

INDICATOR **IUCN Red List summary**

DEFINITION	Number and types of species listed as threatened on the IUCN Red List and a summary of their threats
PURPOSE	Track the status of threatened species and understand the most important threats
DESIRED OUTCOME	Trend for species to be downgraded to lower threat levels or off the threatened species list

Status
Fair

Trend
Deteriorating

Data confidence
Medium


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PRESENT STATUS

Island biodiversity continues to be extremely vulnerable, and 47% of the known threatened Pacific species are declining towards extinction. Pacific island species have high levels of endemism combined with small land areas and therefore limited habitat. Habitat change, naiveté to predation by introduced animals, vulnerability to invasive species-driven changes, pollution, and climate change combine to influence the abundance and population structure of Pacific biodiversity.

The IUCN Red List of Threatened Species (Red List) is the global standard for the extinction risk status of animal, plant, and fungal species. Of the 11,158 listed species (IUCN 2020; Figure 22.1, Table 22.1) present in the Pacific island countries and territories included in this report:[1]

- 1,891 species (16.9%) are listed as threatened, falling in the categories of critically endangered, endangered, or vulnerable,
- 125 species (1.1%) are considered extinct or extinct in the wild,
- 7,671 species (68.7%) fall within the categories of lower risk, near threatened, or of least concern, and
- 1,471 species (13.2%) are data deficient and thus cannot be categorised accurately.

In 2013, 23% of the 5,797 listed Pacific species were identified as threatened (SPREP 2016). The change to 16.9% threatened in 2020 (Figures 22.1 and 22.2) does not necessarily mean that the status of individual species has improved; rather, the doubling in number of listed Pacific species might have balanced the number of threatened species with the number of listed species overall. More recent listings have a greater share of species at risk (see Table 22.2).

[1] American Samoa, Commonwealth of the Northern Mariana Islands, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Papua New Guinea, Palau, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna

Only 1% of listed species in the Pacific islands have an increasing trend in population abundance, matching the global average, and 47% of threatened species show population declines (Table 22.1). The population status of over half of the species present in the Pacific islands identified on the Red List is unknown. An unknown population trend is cause for concern because a lack of sightings, and therefore a lack of data on abundance over time, is common for species at risk, particularly Critically Endangered species.

Representation by taxonomic group or system is not even (Table 22.3): for example, the Fungi are significantly under-represented, and although 6,354 terrestrial and 4,740 marine species are listed, only 1,644 freshwater species are listed. The first systematic investigation of Pacific island freshwater ecosystems was conducted in 2009, at which time 44% of the studied water bodies were already stocked with nonindigenous fish species (Schabetsberger et al. 2009). Considering the pace of ecological change and the high extinction rate on islands, much biodiversity could be lost before we know it was there.

The share of known species represented on the Red List has improved substantially since 2008 for reptiles and fishes (Pippard 2008). Many other important groups, including insects and plants, remain poorly represented by comparison to the number of described species.

About 57% of the Pacific assessments were published within the last 5 years, but 15% of the Pacific listings are over 10 years out of date. These proportions are similar to the global share of 56% of assessments published within the last 5 years and 17% over 10 years old, with 40% of assessments for global species at risk in need of an update according to the IUCN. Of the 1,904 Pacific species categorised as extinct in the wild, critically endangered, endangered, and vulnerable, 43% of the listings need to be updated.

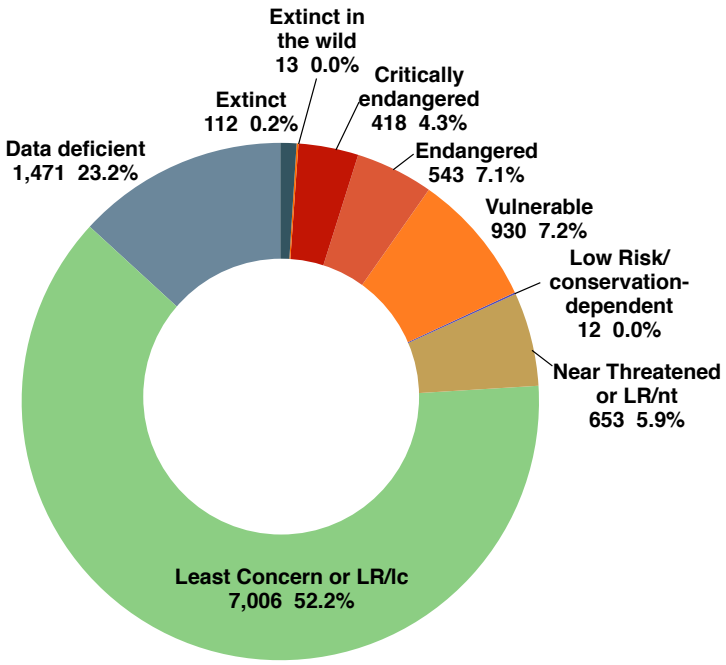

FIGURE 22.1: Number of species found within all IUCN Red List risk categories for all 22 Pacific island countries and territories combined, 2020. Source: IUCN (2020)

TABLE 22.1: Population trends of Pacific island species on the IUCN Red List, total and by selected risk category. Species defined as present in the 21 Pacific island countries and territories that are SPREP Members, in addition to Pitcairn island, were considered. Source: IUCN (2020)

POPULATION TREND %	UNKNOWN	STABLE	DECREASING	INCREASING
All listed species	62.2	20.9	16.0	0.9
Critically endangered species	53.6	1.9	43.5	1.0
Endangered species	38.3	2.0	58.9	0.7
Vulnerable species	51.7	5.2	41.8	1.3

TABLE 22.2: Red List assessments of species in Pacific island countries and territories published in 2010, 2015, and 2020. Although the number of assessments published in 2020 was substantially greater than the number published in 2010 or 2015, the share of those species that are at risk increased and the share of species with stable populations dropped. Source: IUCN (2020)

	2010	2015	2020
Number of assessments	**660**	**577**	**1314**
Share of species by threat status (%)			
Extinct	0.0	0.0	0.2
Extinct in the wild	0.0	0.0	0.0
Critically endangered	2.3	2.3	4.3
Endangered	4.8	1.9	7.1
Vulnerable	5.0	2.6	7.2
Low Risk/conservation-dependent	0.0	0.0	0.0
Near Threatened or LR/nt	4.2	2.3	5.9
Least Concern or LR/lc	77.3	82.8	52.2
Data deficient	6.4	8.1	23.2
Share of species by population trend (%)			
Unknown	62.0	76.8	70.2
Stable	23.6	16.6	14.6
Declining	14.4	6.2	15.0
Increasing	0.0	0.3	0.1

CRITICAL CONNECTIONS

For the Pacific islands, biodiversity loss threatens the cultures, traditions, well-being, and spiritual heritage of Pacific islanders. Accompanying aesthetic changes from biodiversity loss undermine tourism. These changes are under-monitored in comparison to the known impacts of biodiversity loss on the stable function of healthy ecosystems.

Shifts in and loss of biodiversity can both result in degradation of ecosystem services, such as availability of food, fresh water, and fuel sources. These changes in ecosystem services can affect health and wellbeing, livelihoods, income, local migration, and potential political conflict. Loss of biodiversity might reduce the opportunity for bioprospecting and the discovery of potential treatments for many diseases and health problems and might foster the spread of infectious diseases.

As the COVID-19 pandemic illustrated, our relationship with biodiversity has direct and indirect human health impacts. The conservation or unique Pacific species is fundamental to the Pacific way of life.

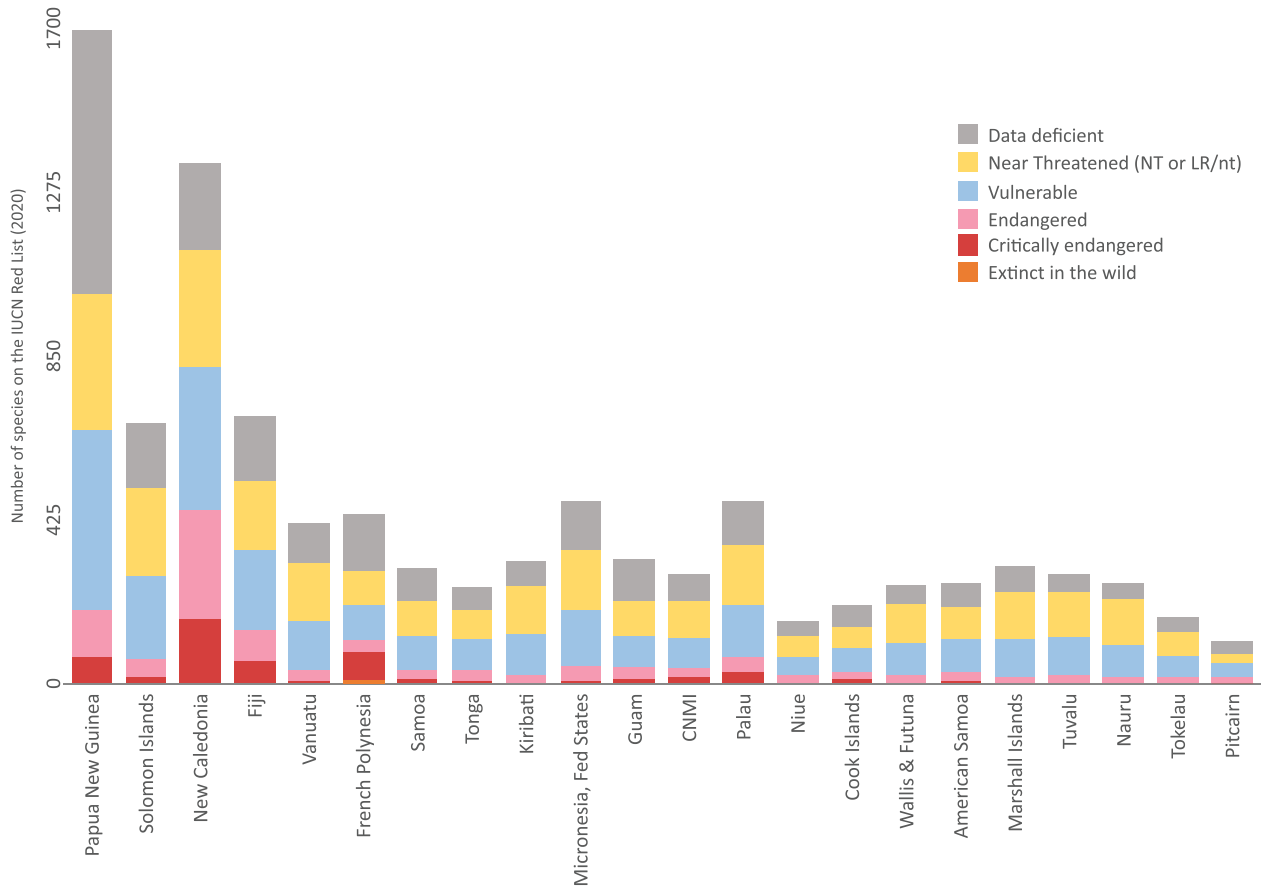

FIGURE 22.2: Number of species on the IUCN Red List at risk in Pacific island countries and territories, 2020. Countries are arranged by order of largest to smallest terrestrial area. Refer to Table 22.4 for data detail and land area. Numbers of species of Least Concern are excluded from this graph, provided in breakdown detail as Table 22.3. There is a general pattern of more species assessments on the Red List from countries with more land area and the highest biodiversity overall. CNMI: Commonwealth of the Northern Mariana Islands. Source: IUCN (2020)

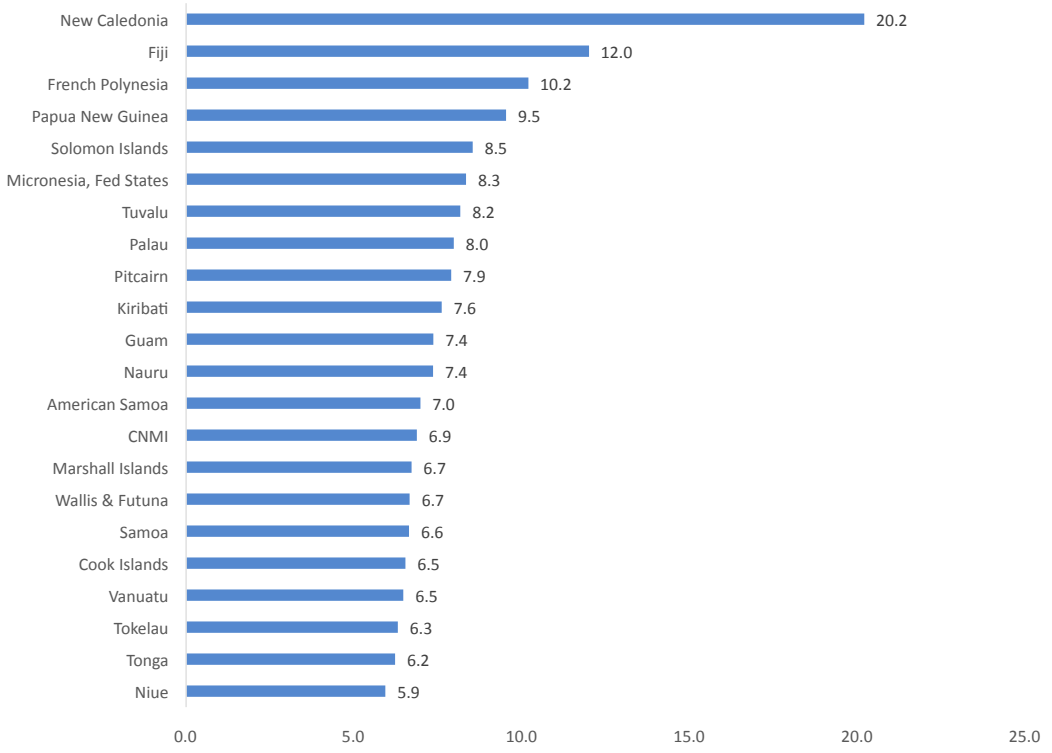

FIGURE 22.3: Species at risk as a share of all species on the IUCN Red List, by Pacific island country or territory (%), 2020. Species in the categories Extinct in the Wild, Critically Endangered, Endangered, and Vulnerable were considered at risk. Note that the identification of species at risk relies on data-driven assessments, thereby the share of species at risk could be underestimated for understudied islands. CNMI: Commonwealth of the Northern Mariana Islands. Source: IUCN (2020)

TABLE 22.3: Number of Red Listed species in selected taxonomic groups in the Pacific island countries and territories.
These groups range from taxonomic Kingdom to Order and are not comprehensive of all Pacific species. Mammalia is subdivided by system into terrestrial or marine; the New Zealand fur seal (*Arctocephalus forsteri*) and leopard seal (*Hydrurga leptonyx*) are included in both systems and are both considered of Least Concern. It is important to note that the number of described species far exceeds the number on the Red List for some groups. Significant gaps in representation remain for fungi, plants, insects (not shown) and more (Pippard 2008); for example, only 10 species of fungi have been assessed and listed, all since 2013. Source: IUCN (2020)

NUMBER OF SPECIES	FUNGI	PLANTAE (PLANTS)	CORALS (CNIDARIA)	AMPHIBIA	AVES (BIRDS)	MAMMALIA	MAMMALIA	REPTILIA	TESTUDINES (INCL. TURTLES)
Taxonomic rank	Kingdom	Kingdom	Phylum	Class	Class	Class. terrestrial	Class. marine	Class	Order
Total	**10**	**3,368**	**599**	**284**	**1,262**	**320**	**35**	**468**	**17**
Extinct	0	12	0	0	29	4	0	1	0
Extinct in the wild	0	1	0	0	1	0	0	0	0
Critically endangered	1	236	0	1	32	16	0	20	1
Endangered	6	315	8	0	41	33	2	38	4
Vulnerable	0	462	163	11	90	23	5	32	6
Lower risk: Conservation dependent	0	8	0	0	0	0	0	0	0
Near Threatened (NT or LR/nt)	1	254	154	2	121	17	3	21	2
Least Concern (LC or LR/LC)	1	1,722	224	153	935	187	19	285	4
Data deficient	1	358	50	117	13	40	6	71	0

TABLE 22.4: Number of species on the IUCN Red List by Pacific island country or territory and share of those at risk, 2020.
Countries are arranged by order of largest to smallest terrestrial area. There is a general pattern of more species assessments on the Red List from countries with more land area. CNMI: Commonwealth of the Northern Mariana Islands. Source: IUCN (2020)

	LAND AREA (KM^2)	EXTINCT	EXTINCT IN THE WILD	CRITICALLY ENDANGERED	ENDANGERED	VULNERABLE	LOWER RISK: CONSERVATION DEPENDENT	NEAR THREATENED (NT OR LR/NT)	LEAST CONCERN (LC OR LR/LC)	DATA DEFICIENT	TOTAL	SPECIES AT RISK (%)
Papua New Guinea	462,840	1	0	65	123	468	3	355	5032	831	6878	9.5
Solomon Islands	28,896	2	0	14	46	218	3	227	2572	172	3254	8.5
New Caledonia	18,575	9	0	168	283	372	10	299	2700	230	4071	20.2
Fiji	18,274	2	0	58	78	208	3	182	2166	167	2864	12.0
Vanuatu	12,189	1	0	4	30	125	4	152	2033	107	2456	6.5
French Polynesia	4000	65	11	69	37	88	2	88	1503	146	2009	10.2
Samoa	2831	2	0	7	27	86	3	90	1509	82	1806	6.6
Tonga	747	2	0	6	25	83	3	74	1574	63	1830	6.2
Kiribati	726	1	0	1	20	107	3	122	1360	66	1680	7.6
FSM	702	2	0	6	34	150	3	153	1801	128	2277	8.3
Guam	549	5	1	10	32	80	3	94	1336	108	1669	7.4
CNMI	464	2	0	11	25	81	3	95	1411	73	1701	6.9
Palau	459	1	0	28	40	133	4	153	2048	112	2519	8.0
Niue	260	0	0	2	18	48	0	58	982	37	1145	5.9
Cook Islands	236	16	0	9	19	60	1	55	1130	56	1346	6.5
Wallis & Futuna	200	0	0	3	17	84	0	99	1305	53	1561	6.7
American Samoa	199	1	0	5	25	84	3	87	1366	61	1632	7.0
Marshall Islands	181	0	0	1	15	100	3	125	1417	65	1726	6.7
Tuvalu	26	0	0	2	18	99	3	118	1167	49	1456	8.2
Nauru	20	0	0	2	12	87	0	117	1113	41	1372	7.4
Tokelau	12	0	0	2	14	55	2	59	956	37	1125	6.3
Pitcairn	5	0	1	2	14	38	1	26	584	30	696	7.9

PRESSURES AND OPPORTUNITIES

Our knowledge of Pacific species is growing. Research effort is related to the number of species assessments on the IUCN Red List and to the share of species with identified population trends. For some taxonomic groups, such as plants, fungi, and insects, the number of described species from Pacific islands is likely still a small fraction of the true number of species present.

We have enough information to know that human-caused pressures are contributing to or driving Pacific species decline.

Invasive species remain the most commonly identified threat to Pacific wildlife (listed as a threat for 1,641 species), followed by climate change and severe weather (1,622 species). Although some threats are global and/or transboundary, Pacific people can directly influence some of the top threats to Pacific species, such as unsustainable harvest, entanglement in plastics and fishing debris, and local habitat loss.

Measures of the status of and threats to IUCN Red List Species in Pacific islands are limited by a lack of research and available data (IPBES 2018). Although baseline knowledge of Pacific island species would be ideal for making informed decisions to better protect biodiversity and manage natural resources, collecting data for the majority of species is costly and requires a high level of expertise for identification.

In a 2018 assessment, the lowest extinction risk of endemic species within the Asia-Pacific region occurred in Oceania (22% threatened; the highest risks were found in South Asia with 46% of species threatened and Northeast Asia with 36% threatened), even though Oceania had the largest numbers of species actually extinct (IPBES 2018). More than half of all recent extinctions have occurred on islands, and islands are home to over one third of all species facing extinction in the near future (IPBES 2018). Invasive animals have been identified as a driver in 86% of island plant and vertebrate extinctions (see Regional Indicators: Invasive species). These findings demonstrate that local management actions can alter the course of biodiversity loss.

In addition to single-species assessments, a new Red List of Ecosystems has been proposed as a global standard. All ecosystems around the world are to be assessed by 2025. There have been no assessments for the Pacific to date.

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REGIONAL RESPONSE RECOMMENDATIONS

Although 13% of the listed Pacific species lack sufficient data to identify their conservation status, our understanding of the threats to Pacific species is enough to demand greater action. For some taxonomic groups, many more Pacific species might exist and might be described than are presently on the IUCN Red List (Pippard 2008). A complete analysis of representation will require national and regional analyses. Even without more data, species-driven action with a focus on healthy native habitats can benefit multiple species simultaneously.

Countries can benefit from a whole system approach with investment in management actions, such as the prevention, control, and eradication of invasive species, to conserve biodiversity. To progress towards the desired outcomes, Pacific islanders can:

- Identify priorities for biodiversity protection, assessment, and monitoring, in consultation, to identify the areas and kinds of species that require most urgent action;
- Create a regional species inventory identifying priority species and priority threats to those species;
- Support local researchers and knowledge keepers, including training in taxonomy and biodiversity assessments for the next generation of Pacific island experts (see Box i.2);
- Mitigate threats to Pacific biodiversity, with key attention to climate change, invasive species and disease, and habitat loss, while equipping communities and sectors to live alongside, conserve, and enrich Pacific biodiversity;
- Implement and monitor action plans for species-driven conservation, ensuring a balance between assessment and action in the spending on environmental management;
- Plan for species conservation, including preparedness such as disaster risk reduction and biosecurity; and
- Partner for environmental management across sectors that rely on biodiversity or impact biodiversity and natural spaces and look for synergistic benefits.

Globally, biodiversity is declining. Action to reverse the decline is essential across the world, and the world benefits from practical examples of positive relationships between people and nature. Pacific leadership can capitalise on our existing island life and connections to nature to support strong, sustainable relationships with our unique biodiversity.

INDICATOR IN ACTION SDGs 6.6, 15.1, 15.5, 15.7, 15.c • Convention on Biological Diversity • SAMOA Pathway • Pacific Regional Environment Objective 2.3 • Pacific Islands Framework for Nature Conservation Objective 4

FOR MORE INFORMATION

IPBES (2018) The IPBES regional assessment report on biodiversity and ecosystem services for Asia and the Pacific. Karki M, Senaratna Sellamuttu S, Okayasu S, Suzuki W (eds) Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IUCN (2020) The IUCN Red List of Threatened Species. Version 2020-1. https://www.iucnredlist.org (accessed October 2020)

IUCN Red List of Ecosystems: https://iucnrle.org/about-rle/rle/

For assessments, see https://iucnrle.org/assessments/

Pippard H (2008) The Pacific islands: an analysis of the status of species as listed on the 2008 IUCN Red List of Threatened Species. International Union for the Conservation of Nature.

Schabetsberger R, Drozdowski G, Rott E, Lenzenweger R and others (2009) Losing the Bounty? Investigating species richness in isolated freshwater ecosystems of Oceania. Pacific Science 63:153–179. DOI: 10.2984/049.063.0201

SPREP (2016) State of conservation in Oceania: regional report. Apia: Secretariat of the Pacific Environment Programme.

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HOW DO WE MEASURE PREPAREDNESS?

Long timescales, uncertainties, and the multi-faceted nature of climate change adaptation makes monitoring progress in this field inherently challenging; there is no simple way to determine how well prepared we are for current and future climate change impacts. This contrasts with climate change mitigation, for which greenhouse gas emissions can be considered a universal indicator, and there are clear guidelines for preparing and analysing greenhouse gas inventories. The result is that national State of Environment (SOE) reports have tended not to provide a clear picture of progress in climate change adaptation. Encouragingly, some countries, notably Samoa (2013), Cook Islands (2016), Republic of the Marshall Islands (2016), and Federated States of Micronesia (2018), have begun to develop their own adaptation indicators for their SOE reports; however, at present, there is no regional set of indicators for adaptation and preparedness.

The lack of a consistent methodology for assessing adaptation and preparedness is perhaps surprising given that, in the 2018 Boe Declaration on Regional Security, Pacific Leaders reaffirmed that "*climate change remains the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Pacific*". Developing a simple set of preparedness indicators could help to fill this void, enhance future SOEs, and support countries in their national and international climate change reporting requirements.

The indicators outlined in Table 4.1 have been developed by the IMPACT Project through a detailed review of existing climate change adaptation indicators (including those developed for the SDGs and Sendai Framework for Disaster Risk Reduction) and climate change adaptation monitoring frameworks/scoreboards (such as the Tracking Adaptation and Measuring Development Framework currently being applied in Fiji as well as the EU Adaptation Preparedness scoreboard). Following this review, a shortlist of indicator categories and indicators were developed and refined in collaboration with SPREP's Climate Change and Resilience (CCR) and Environmental Monitoring and Governance (EMG) teams. In doing so, alignment with the *Framework for Resilient Development in the Pacific* was considered in addition to ensuring that the indicators were relevant, measurable, objective, and realistic (that is, could be assessed as a desk-based exercise using information that is publicly available online in a realistic amount of time).

APPLICATION OF THE INDICATORS

The indicators have been compiled into a scorecard format with each assessed against "No", "Partial", or "Yes" criteria, developed to be as objective and unambiguous as possible to allow the practitioner to impartially determine a robust answer. In addition, progress towards each indicator can be described in more detail in a brief narrative section. An example of these assessment criteria can be seen in the table below; please note that the assessment criteria for the remaining indicators have been defined and are ready for use, although not shown here.

Example of an indicator assessment

INDICATOR	'NO'	'PARTIAL'	'YES'
Indicator 5.1 (M&E)	No M&E framework or system for adaptation in place at national level	An M&E framework or system for adaptation being developed at national level but not yet completed or being implemented	An M&E framework or system for adaptation in place at national level

Once the indicator scorecard has been completed, it can be verified by the country, for example using a telephone interview with the Climate Change Focal Point or other suitably qualified individuals. The country scores can then be combined to give an overall picture of the regional trends and areas for improvement, while allowing for the national situation to be described if so desired.

This scorecard approach will be piloted in 14 Pacific island countries in 2020 and will provide a means of more comprehensively understanding climate adaptation and preparedness in future SOEs.

Ella Strachan and Patrick Pringle led the development of this scorecard and summary. For more information about the pilot application in 2020, please contact SPREP filomenan@sprep.org

TABLE 4.1: Assessing national preparedness using standard indicators and criteria.

DRAFT INDICATORS FOR THE PACIFIC CLIMATE CHANGE PREPAREDNESS SCORECARD		NO	PARTIAL	YES
Adaptation Planning				
1.1	An up-to-date national adaptation plan (NAP; or Joint National Action Plan including an implementation plan) has been published and is being implemented.			
1.2	Adaptation action is coordinated at a sectoral level evidenced by sector adaptation plans or mainstreaming of adaptation into sector plans and policies.			
1.3	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).			
1.4	A systematic prioritisation of adaptation activities (such as a Country Programme or project pipeline) has been undertaken with indicative costs and potential funders identified, endorsed by the relevant authority.			
1.5	Actions to address climate change adaptation are supported by a national level authoritative financial entity (such as a Ministry of Finance) which is able to facilitate access to international climate finance.[1]			
Addressing Impacts and Vulnerabilities (including Early Warning Systems)				
2.1	Observation systems are in place to monitor climate change, extreme climate events, and their impacts with data publicly available (Regional indicator).			
2.2	Up-to-date scenarios and climate projections are used to inform national adaptation planning.			
2.3	A consistent approach to vulnerability assessments is used at an island level with a standardised methodology.			
2.4	The region has a comprehensive multi-hazard monitoring and forecasting system, with analyses of risks involved that are effectively communicated to countries.			
2.5	There is a clear process in the country for the activation of emergency plans to prepare and respond to hazards and warnings, including the dissemination of timely warnings.			
Mainstreaming Climate Change Adaptation				
3.1	Climate change adaptation considerations are included in the country's Environmental Impact Assessment legislation (or in the developments approval document/consent licenses/approval conditions).			
3.2	National Development Plans (national strategic plans, national sustainable development plans, frameworks, or similar) consider the impacts of climate change.			
Monitoring and Evaluation				
4.1	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).			
Information Knowledge Management and Brokerage				
5.1	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 has been made available in accessible formats.			

[1] International climate finance is defined here as the financial mechanisms of the UNFCCC (i.e. Global Environment Facility [GEF], the Green Climate Fund, and the Adaptation Fund)

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SECTION

Climate resilience through environmental management

Conducting forest research as part of a carbon credit programme, PNG. © Cory Wright, UN REDD Programme

Pacific islands are experiencing the most immediate effects of climate change, despite historically low contributions to global greenhouse gas emissions (IPCC 2019). Pacific islands now face expected annual losses of 0.3% to 6% of GDP or more directly due to natural disasters, such as flooding and cyclone damage, with increasing risks under climate change (IPCC 2019). Damages due to some disasters have exceeded the annual GDP (Lee et al. 2018).

The selected regional environment indicators relate to Pacific commitments to manage their greenhouse gas emissions and to climate finance for mitigation and adaptation.

Climate change mitigation is action to reduce greenhouse gas emissions and to enhance carbon sinks. Mitigation is part of efforts to reduce the risks from climate change and extreme events.

Climate change adaptation is adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. Adaptation refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. Adaptation to climate change can take several forms:

- **Soft**: development of policies and frameworks.
- **Hard (or grey)**: infrastructure specifically designed to protect communities and structures, often involving engineered “hard” solutions.
- **Green/blue**: managing and conserving natural systems that provide services that are essential for reducing the impacts of natural disasters caused by climate change.
- **Amalgam**: a cross between soft, hard and ‘green/blue’ solutions or an integration of natural solutions, ecosystem-based adaptation (EbA), and infrastructure, making natural and man-made systems work together to ensure resilience and reduce human vulnerability.

Pacific people are engaging with innovative solutions to combat the ecosystem effects of climate change, to harness ecosystem services for increased resilience, and to ensure that adaptation measures are aligned with long-term ecosystem health. Adaptation is already happening and at present is conducted in multiple sectors and for multiple purposes. For example, the establishment of terrestrial and marine protected areas (see Regional Indicators: Protection of Pacific Spaces) is an adaptation step.

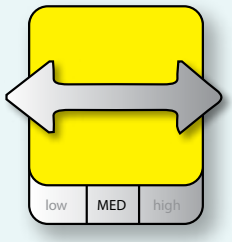
The Global Commission on Adaptation (GCA) argued for nature- and ecosystem-based measures for climate change adaptation, setting out eight Action Tracks in its 2019 report. At the global level down to national levels, data disaggregation of general adaptation and ecosystem-based adaptation funding or efforts is often inconsistent or absent. A complete identification of all existing EbA actions would require an extensive consultative process.

The goal of EbA is to increase resilience and decrease the vulnerability of both people and natural systems. EbA definitions vary, and EbA approaches can be thought of as a policy mix that address a blend of using ecosystems to help humans adapt and protecting ecosystems to facilitate the survival of species and ecosystem services (Scarano 2017). Donatti et al. (2020) identified a range of adaptation outcomes that can be achieved using EbA and propose a set of seven indicators to assess and monitor EbA efforts.

THEME **Atmosphere and Climate**

INDICATOR **Climate Adaptation and Mitigation Funding**

DEFINITION	Total funds received for climate adaptation and mitigation projects
PURPOSE	Indicates capacity for implementing climate change adaptation and mitigation
DESIRED OUTCOME	Climate change projects are adequately financed



Status
Fair

Trend
Stable or improving

Data confidence
Medium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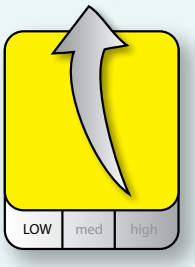
THEME **Atmosphere and Climate**

INDICATOR **Funding for ecosystem-based adaptation**

DEFINITION	Total funds received to implement ecosystem-based approaches to climate adaptation
PURPOSE	Indicates capacity for implementing ecosystem-based approaches to climate change adaptation
DESIRED OUTCOME	Positive trend in funds received for ecosystem-based approaches to adaption to ensure that PICTs are more able to respond to climate change



Status
Fair

Trend
Improving

Data confidence
Low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PRESENT STATUS

Climate change is a growing component of regional and national development projects in the Pacific islands.

In addition to general climate finance, the Pacific region selected a funding indicator that specifies ecosystem-based approaches to climate adaptation: it is important to note that not all adaptation is ecosystem-based, and not all ecosystem-based approaches to management are directly applied toward climate change adaptation.

Each Pacific island country is directing a portion of national budgets toward ecosystem-based adaptation projects, supported by donor funding, although these investments are not always quantified separately from other development or environment-related efforts. Clear identification and reporting of these funds will provide the essential information for this indicator.

Other funding comes into the Pacific islands region for climate change work through bilateral partnerships and project-based mechanisms. Here, we focus on funding provided through the Green Climate Fund (GCF) and the Adaptation Fund and Special Climate Change Fund (SCCF) through the Global Environment Facility (GEF).

Since 2015, there has been growth in the number of entities accredited to access GCF funds, including SPREP (2015), Micronesia Conservation Trust (2017), and The Pacific Community (2019). Approximately USD 306 million in GCF grants has been committed to the Pacific islands region since 2015, with additional support through loans and national commitments to climate resilience (Table 23.A).

GEF grant funding for climate change for Pacific island countries alone increased to a peak of USD 54.1 million over 11 projects in the fifth replenishment cycle (2010–2014), decreasing to USD 39.6 million over 14 projects in the sixth cycle (2014–2018) [Figure 23.1].[1] Pacific islands were also included in a growing number of regional and global projects. From 2011 to 2012, Adaptation Fund grants of USD 26.2 million total were provided to four countries in four projects. Since 2015, Adaptation Fund grants of USD 21.6 million total were provided to seven countries. In 2012, USD 14.8 million was provided to the Pacific islands region through the Pacific Islands Adaptation to Climate Change project (PACC) under the SCCF.

Loan financing is also increasing. The total climate finance received in the Pacific islands region as loans through multilateral development banks reached USD 366 million in 2019, up from USD 169 million in 2015 (World Bank 2020).

[1] UNFCCC Climate Finance database; see https://unfccc.int/climatefinance/gef/gef_data (accessed September 2020)


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Quantifying the funding directed toward specifically ecosystem-based approaches to adaption is more complex.

As a partial summary of known EbA efforts, SPREP prepared an overview of EbA projects in the Pacific Region (Table 23.B). Some of the 17 identified projects are specifically designed for EbA, such as the Pacific Ecosystem-Based Adaptation to Climate Change (PEBACC) project active in three countries (Fiji, Solomon Islands, and Vanuatu), whereas others have EbA as supportive components. EbA efforts are underway in all Pacific island countries, to varying degrees.

Pacific commitments to sustainable development and the increasing global attention to ecosystem-based solutions (albeit from a low starting point, estimated at less than 2% in 2017; Buchner et al. 2017) lead us to consider the status of these indicators as *fair* and the trends as *improving* or *stable to improving*. However, information must be collected and assessed to track these indicators and their results into the future. Data are more readily available for general climate adaptation and mitigation funding, but data regarding funds directed to EbA approaches are limited or difficult to access.

CRITICAL CONNECTIONS

Community resilience and ecosystem resilience are intertwined.

Nature is an ally in trapping and storing carbon. Destruction of nature worsens climate change and lowers Pacific resilience. In addition to the carbon stores in forests and well-managed soils, carbon storage in coastal and marine ecosystems, called 'blue carbon', is important for the islands. The ocean is the largest carbon sink. Given that Pacific island countries govern 20% of the ocean that is within national boundaries, Pacific leadership in ocean management is essential for our healthy planet.

The funds required for present and future adaptation are generally considered to be lower in the case of healthy environments providing ecosystem services. Spending on environmental management in general can support resilience.

Waste management is part of a holistic approach to a healthy atmosphere, from reduced consumption (SDG12) requiring less energy/carbon in production and transport to less methane-emitting food waste going to landfills, to less energy/carbon required to manage waste residues.

Simultaneously, greenhouse gas emissions and climate change impact Pacific nature. These effects are emerging in multiplicative, often unpredictable combinations with the impacts of over-extraction, pollution, and other environmental stresses.

Some species will move to different areas as the changing climate changes their habitats. These range shifts can bring humans and other species together in new ways, with potential benefits and potential harm. For example, some species might invade new territories or have problematic population increases, like harmful algal blooms. Opportunities for crops and fisheries might shift, increasing livelihood opportunities in one area at the expense of another. Diseases can spread, among wild species and humans.

To take advantage of these connections, effective national adaptation plans build in ways to receive and respond to scientific and indigenous and local knowledge alongside technology transfer and international cooperation. Multi-sectoral approaches are important: tourism, energy, waste, land-use/development, climate/environment, transport, energy and other sectors all need to partner with communities to address the causes and impacts of GHG emissions.

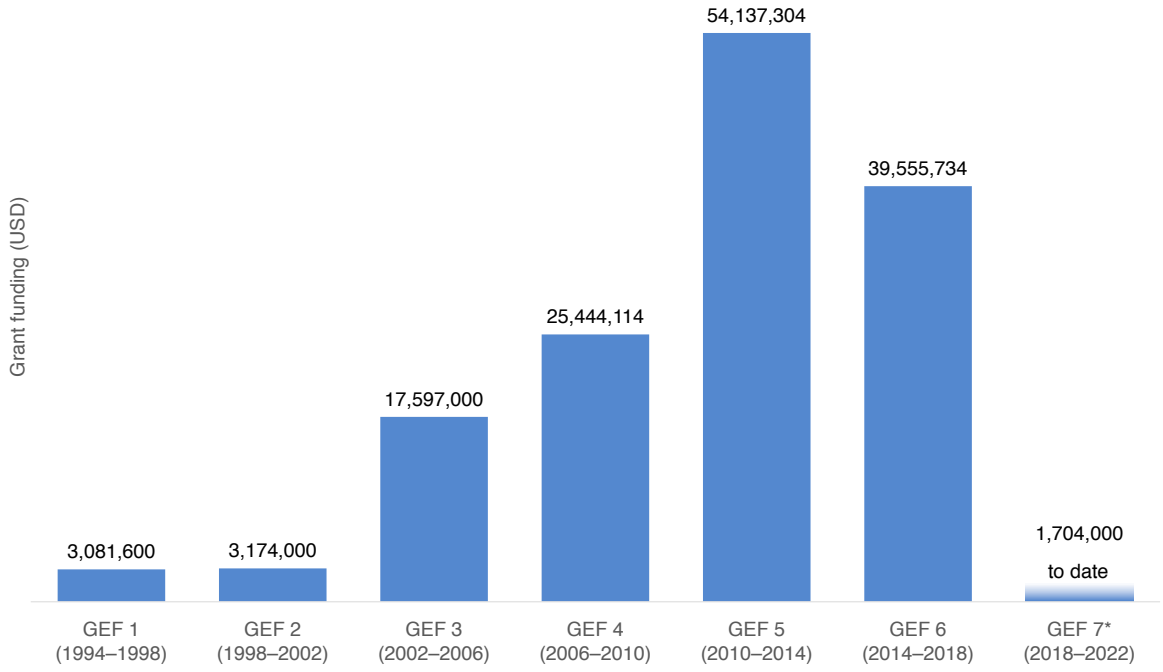


FIGURE 23.1: Global Environment Facility (GEF) grant funding for climate change response in the Pacific island countries, by replenishment cycle. Grant funding represents projects identified as climate change or climate change alongside another focal area, considering only projects exclusively for Pacific islands. Pacific countries were also included in regional (outside of the Pacific islands) and global projects; data not shown here. GEF7 funds are incomplete. Source: UNFCCC Climate Finance database (accessed September 2020); see https://unfccc.int/climatefinance/gef/gef_data

PRESSURES AND OPPORTUNITIES

The global response to climate change requires urgent action with committed support. Globally, the annual costs of adaptation could range from USD 140 billion to USD 300 billion by 2030 and from USD 280 billion to USD 500 billion by 2050 (UNEP, 2018).

Funding mechanisms are increasingly recognising the value of ecosystem-based approaches, assisted by national Environmental Impact Assessments and response for any potential development measure.

Pacific leaders have actively engaged with the GCF, and 52 of the GCF's 124 active projects as of April 2020 are in the Pacific, although many of these are small-scale readiness projects. Ten GCF Adaptation projects are active in the Pacific, as of September 2020 (Table 23.A). Not all of the GCF-funded adaptation projects use ecosystem-based approaches or are ecosystem-friendly.

The government of Germany's International Climate Initiative (IKI) adaptation theme emphasizes EbA instruments. Pacific island countries are included in six of the 125 active IKI projects in the South and Southeast Asia & Pacific region (as of March 2020).

In January 2020, UN Environment Programme and the International Union for Conservation of Nature launched the Global Fund for Ecosystem-based Adaptation (2020–2024) to provide targeted and rapid support mechanisms through seed capital for innovative approaches to ecosystem-based adaptation. The first proposals to this multi-year, € 20 million fund were to be assessed beginning in June 2020.

In 2018, the Global Environment Facility and the GCF launched an initiative to harmonize climate finance flows to strengthen efficient, effective programming in their climate-related support.

The selected adaptation options require funding to create and to implement over an appropriate period of time (GIZ 2018). In addition to partnering with major funding institutions and private donors, countries can also institute financial schemes that can support sustainable financing for EbA or environmental management, such as:

- green or blue bonds, which can be linked to tourism, fisheries, and other industries;
- a system of levies or fines that engage potential users or polluters to maintain critical natural systems that provide essential ecosystem services;
- payment for ecosystem services;
- insurance mechanisms that support conservation of ecosystems and ecosystem services.

Pacific islands are also investing in renewable energy technology. The energy sector is one of the dominant drivers of climate change, globally, and the energy sector alone contributed 40% to nearly 80% of estimated national carbon emissions as reported in Pacific NDCs (see below). Mitigating emissions from this sector by reducing energy demands or reducing the reliance on fossil fuels for energy production is essential for most countries to meet their climate targets (see Regional Indicator: Renewable Energy). Over USD 2 billion was committed to the Pacific energy sector in development assistance from 2011 to 2018, with a strong focus on sustainable energy production.[1]

Energy and transport far outweigh other sectors in terms of the adaptation finance loans received from multilateral development banks in 2019 in the East Asia and Pacific region, with USD 543 million directed toward energy, transport, and other built infrastructure compared to USD 265 million on water and wastewater systems, the next-largest category (World Bank 2020, their Table 15). The same is true for mitigation finance.

Ecosystem-based management suits the Pacific context where most of the land is traditionally owned, requiring a participatory approach engaging local communities (Nalau et al. 2018). Ecosystem-based management is holistic, achieving a range of economic, social, and environmental outcomes in a single project. Cost-benefit analysis can also assist in showing the overall benefits of EbA.

EbA can address capacity constraints by employing adaptive management techniques, using scientific knowledge in combination with traditional and local knowledge, and promoting coordination across agencies and between national and local levels. Many ecosystem-based solutions are easily accessible, which increases their likelihood of use and effectiveness.

Ecosystem conservation, restoration, and protection can enhance resilience. The conservation of native island forests, especially mangroves along shorelines, and associated ecosystems is a key natural adaptation strategy and mitigation measure (Daigneault et al. 2016). Lagoon and freshwater quality benefit from sustainable, ecosystem-based approaches and can be threatened by 'grey' or hardscaping measures, such as seawalls. For example, seawalls support lower biodiversity than natural shorelines (Lai et al. 2018).

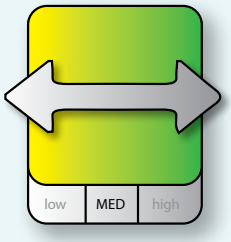
Incorporating ecosystem-based management and adaptation into disaster risk management and the design of disaster responses should lead to more environmentally, socially, and economically appropriate portfolios of disaster risk management and adaptation options.

[1] Lowy Institute Pacific Aid Map: https://pacificaidmap.lowyinstitute.org/database

THEME **Atmosphere and Climate**

INDICATOR **Trend in greenhouse gas emissions**

DEFINITION	Trend of nationally determined contribution
PURPOSE	Greenhouse gas emissions are the primary cause of global warming. Countries have committed to reduce GHG emissions in ratifying UNFCCC and the Paris Agreement.
DESIRED OUTCOME	Negative trend in GHG emissions



Status
Fair to good

Trend
Stable

Data confidence
Medium


Dead forest on disappearing island, Solomon Islands © Stuart Chape

PRESENT STATUS

A nationally determined contribution (NDC) outlines a country's post-2020 plan to reduce national greenhouse gas (GHG) emissions and voluntarily to show how it will adapt to the impacts of climate change. NDCs are a requirement of the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). Each Pacific island country reports their National Communication to the UNFCCC and NDC to the Paris Agreement (see Regional Indicator: MEA reporting requirements). In 2016, Papua New Guinea was the first country in the world to formally submit its NDC. RMI was the first to submit an updated and upwardly revised NDC in 2019, and all Pacific island countries are expected to complete this process in 2020.

This regional indicator is defined according to the NDC. The primary focus of much climate action is carbon dioxide (CO_2) emissions, but the larger goal is to decrease all direct and indirect greenhouse gas emissions including, among others: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases including hydrofluorocarbons (HFCs).

Pacific island countries are managing and reducing the release of HFCs (see Regional Indicator: Ozone depleting substances). Nitrous oxide from unsustainable livestock management and unsustainable agricultural soil practices is of relatively low concern in the Pacific islands, with few countries having dense, feedlot-style livestock. Globally, human-caused release of excess nitrous oxide has been increasing, at a faster rate since 2009, primarily due to nitrogen fertilizers (Thompson et al. 2019).

Methane is of greater concern, particularly as a large amount of food and green waste enters landfills (see Table 5 of the *Cleaner Pacific 2025*, SPREP 2016). Globally, the anthropogenic outputs of methane are increasing, driven by agriculture and the fossil fuel industry which each account for nearly a quarter of methane emissions (Schiermeier 2020 and references therein). In the Pacific, the primary sources of excess methane are sewage and domesticated animal waste, such as piggeries, as well as food and green waste in landfills or other treatments.

The Pacific island countries accounted for less than 0.2% of the world total anthropogenic carbon emissions in 2016, the most recent year with complete data (WRI 2020).[2] Broadly speaking, emissions have remained roughly stable for most Pacific countries in the past decade (Figure 23.2). National emissions measurement and reporting has been improving.

The Pacific island countries are committed to strengthening their NDC targets and to strengthening national mitigation and adaptation efforts using national action plans.

PRESSURES AND OPPORTUNITIES

Net greenhouse gas emissions are closely linked to development decisions and societal affluence as well as to the presence and health of natural ecosystems. Pacific ecosystems, particularly forests and soil systems under wetlands like mangroves and seagrass beds, capture and store carbon while providing other essential ecosystem services. With governance over 20% of the ocean within national exclusive economic zones, Pacific island countries have a great opportunity to monitor and support ocean carbon uptake.

Conversely, the destruction of natural ecosystems can release stored carbon and prevent the capture and storage of carbon from natural processes. The primary sectors considered by most countries in national greenhouse gas accounting are the energy, waste, and agriculture (livestock) sectors. From the perspective of releasing greenhouse gases or losing natural sinks of greenhouse gases, the sector managing land use and development can also be an important partner in the effort to maintain greenhouse gas-sequestering ecosystems. Globally, the energy sector is the

[2] World Resources Institute's CAIT Climate Data Explorer, Climate Watch; see https://www.climatewatchdata.org/

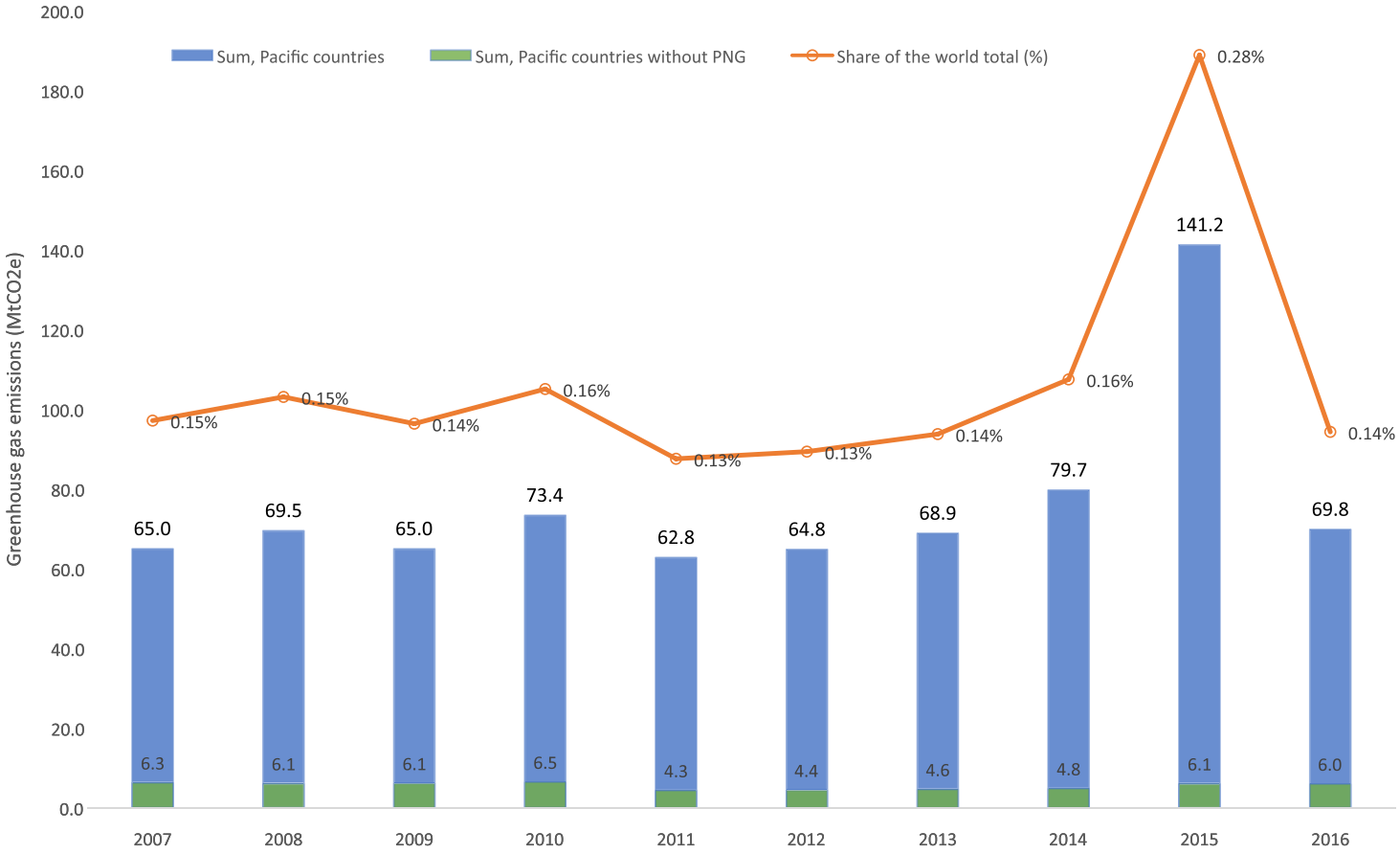


FIGURE 23.2: Total greenhouse gas emissions from the 14 Pacific island countries, as a regional sum and share of the global total, from 2007 to 2016. Data are presented for the sum of all Pacific island countries with and without Papua New Guinea (PNG). The spike in 2015 is related to a spike in emissions from land use change and forestry in PNG. $MtCO_2e$: million tonnes of carbon dioxide equivalent. Source: Climate Data Explorer, World Resources Institute (accessed August 2020)

largest contributor to greenhouse gas emissions but land-use change is ranked second, causing 23% of greenhouse gas emissions (IPCC 2019).

Transport, forestry, fisheries, and other priority sectors in the Pacific are important sources or opportunities for reductions of greenhouse gas emissions. Pacific efforts to transition to renewable energy are important for reducing emissions (see above). Most Pacific countries are seeking to incorporate data from more sectors in their updated NDC.

GHG emissions from shipping are a priority for import-dependent Pacific islands. In 2018, the International Maritime Organisation adopted an initial strategy on the reduction of GHG emissions from ships. International shipping produced about 2% of global anthropogenic CO_2 emissions in 2012 and those emissions could grow by 50% to 250% by 2050 without action (IMO 2018). Global fishing-related vessel emissions increased by 17% from 2013 to 2015, although outranked by international shipping which accounted for about 87% of total CO_2 emissions from ships (ICCT 2017).

The COVID-19 pandemic brought into sharp focus our relationship with nature, the impacts of disturbed ecosystems, and our resilience. There is a fragile but growing push to ensure that post-pandemic recovery plans, at national to global levels, retain and grow commitments to sustainable, resilient actions. In July 2020, the UNFCCC Secretariat and the Global Commission on Adaptation released a *Call to Action for a Climate-Resilient Recovery from COVID-19*. At the peak of shutdowns, emissions did drop, but scientists have shown that the pandemic changes alone will have a negligible impact on climate change; instead, shifts in the energy sector and green recovery efforts could reduce future warming (Forster et al. 2020).

In their NDCs, Pacific island countries are seeking to actively reduce their future emissions as total values, despite their negligible contribution to global emissions. Using the classic model of societal impact on the environment as Impact = function of (Population, Affluence, and Technology), researchers have argued that managing resources and pollution more effectively lower impact and are preferable to attempting to alter population, consumption, and technology changes piecemeal (Alcott 2010). By setting emissions targets, Pacific leaders seek a low-carbon future regardless of population growth and development. Achieving these targets will require holistic management that treats people and nature as allies.

REGIONAL ACTION IS UNDERWAY

Pacific Nationally Determined Contributions Hub (NDC Hub) was launched in 2017 and officially opened in 2020. The Pacific NDC hub is tasked to build upon existing partnerships and mechanisms to facilitate NDC implementation roadmaps, NDC investment plans, and core monitoring to assess progress towards NDCs. For more information and to read each country's INDC, see https://www.pacificclimatechange.net/project/regional-pacific-ndc-hub

To date, seven Pacific island countries (Federated States of Micronesia, Fiji, Nauru, Papua New Guinea, Republic of the Marshall Islands, Tonga, and Vanuatu) are also members of the global NDC Partnership. Support to countries to prepare national assessments and implement NDCs is available through multiple mechanisms, including the NDC Support Facility managed by the World Bank Group. Collaboration and support are considered essential to meet Pacific goals for climate resilience, including ecosystem-based adaptation (see above).

As of 2019, the existing NDCs around the world were insufficient to attain global climate targets and instead would lead to an approximately 10% increase in emissions by 2030 relative to 2016 levels (UNDP & UNFCCC 2019). In September 2019, Pacific island countries announced their intentions to enhance their national goals in their revised NDC commitments (post-2020). Fiji, Marshall Islands, Vanuatu and others pledged net-zero emissions by 2050 (*Uniting Behind the Science to Step up Ambition by 2020*). Papua New Guinea set out a target of carbon neutrality by 2050 in its NDC (2016).

National capacity to assess and monitor emissions is a focal area for Pacific research. Tokelau completed its first inventory of GHG in 2018, covering the period 1990 to 2017.[3] See Figure 23.3 and Table 23.1 for emissions data.

Actions in the energy sector are a primary focus for Pacific countries. In its NDC, Fiji is pursuing an economy-wide indicative reduction of 10% carbon dioxide emissions from energy efficiency improvements. Collectively, these measures will reduce the Fijian energy sector's total carbon dioxide emissions by around 30% by 2030. The government of Kiribati has committed to reducing the country's GHG emissions by 48.8% and fossil fuel consumption by 45% in South Tarawa and 60% on Kiritimati Island by 2025, in the *Kiribati Integrated Energy Roadmap 2016 to 2025* (World Bank 2019).

REGIONAL RESPONSE RECOMMENDATIONS

All UNFCCC Parties are requested to submit the next round of NDCs (new or updated) by 2020 and every five years thereafter (for example, by 2025 and 2030), regardless of their respective implementation time frames. Starting in 2023 and then every five years, all parties will take stock of the implementation of the Paris Agreement to assess the collective progress towards achieving the purpose of the Agreement and its long-term goals. Pacific reporting will feed into this global process.

To advance and monitor progress towards their climate goals, while achieving international visibility, Pacific countries should:

- continue to measure and monitor national emissions over time, building national capacity to assess all relevant greenhouse gases in the prioritised sectors and to pursue analyses of ecosystem carbon balances;
- conserve and restore carbon-capturing ecosystems, with particular attention to forests and wetlands, such as seagrasses, mangroves, and salt marshes;
- strengthen waste management measures to reduce methane emissions;
- plan for low-carbon development;
- strengthen mitigation measures, such as building on efforts to transition to renewable energy and restoring carbon-storing ecosystems; and
- partner for sustainable financing systems to support low-carbon development.

In the face of continued greenhouse gas emissions and climate change, the effort and funding required to mitigate and adapt to changing conditions grows. Part of ensuring that available funds are 'adequate' for sustainable, resilient islands is taking a harmonized management approach to control the future requirements for adaptation and mitigation efforts (see 'Climate preparedness'). To monitor progress towards the selected regional indicators, countries should:

- identify funding directed toward climate change and specifically toward EbA, tracking national and project funds and distinguishing grants versus loans;
- measure total spending on adaptation and environmental management, including EbA, to allow for cost comparison and assessment of management actions;
- plan for ecosystem-based approaches, ideally using fair and participatory planning; and
- partner for sustainable financing systems.

[3] Source: Tokelau's national presentation at the Pacific Islands Renewable Energy Statistics Workshop, Nadi, Fiji, 22–24 October 2019

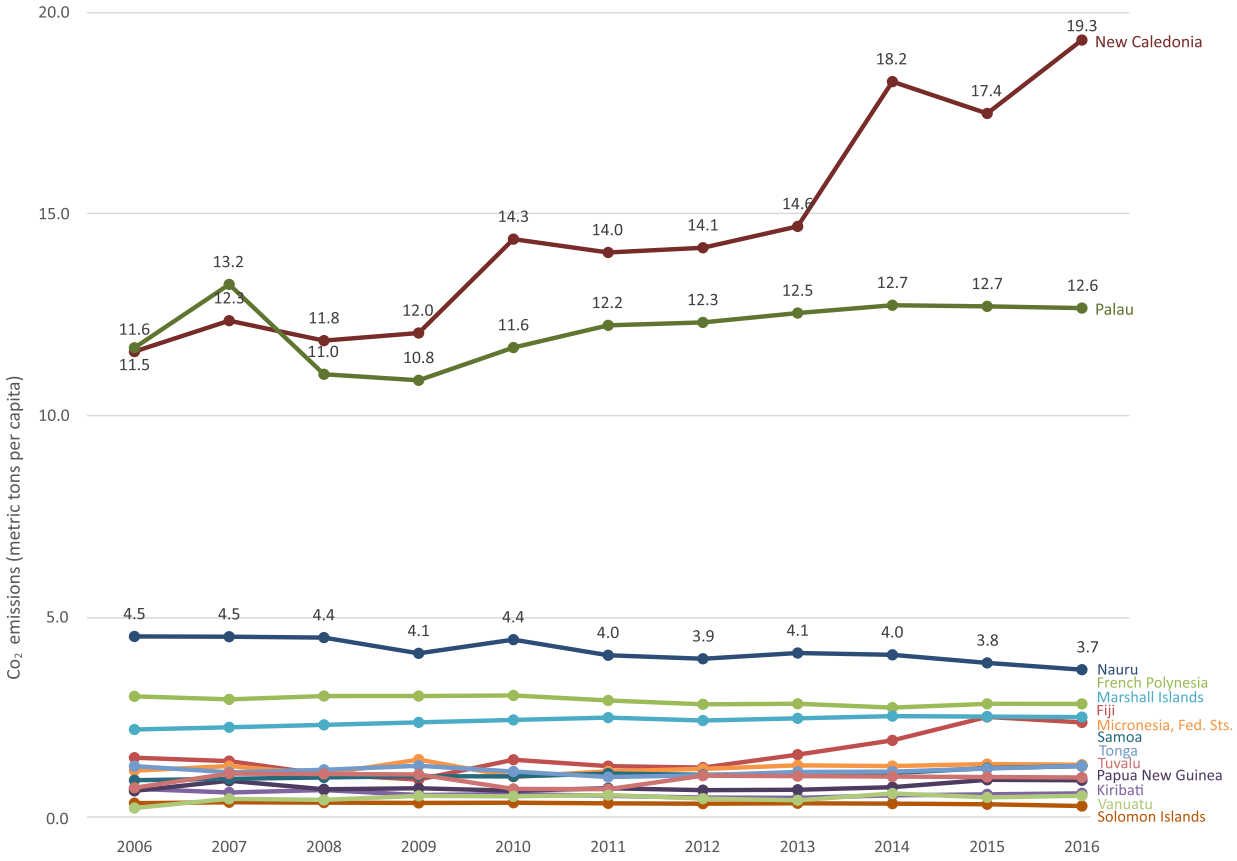


FIGURE 23.3: Pacific carbon dioxide emissions relative to population (metric tons of emitted CO_2 per capita), 2006–2016. Note that the methodology used for the carbon emissions reported by the World Bank differs slightly from the CAIT, and therefore the values might differ slightly from the CAIT data although the trends and relationships among the countries and territories remain the same. Population and population density differs strongly across the region, with Papua New Guinea accounting for 78% of the regional population among Pacific island countries (72% of the regional population combining countries and territories); see Table i.1 for country characteristics. Data are not available for American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. Source: World Bank's World Development Indicators, August 2020

TABLE 23.1: Pacific greenhouse gas emissions in the most recent year with complete data for all emission types. Values are presented in thousand metric tons of CO_2 equivalent. Source: World Bank's World Development Indicators, August 2020

	CO_2 EMISSIONS (KT)		METHANE EMISSIONS	NITROUS OXIDE EMISSIONS	OTHER GREENHOUSE GAS EMISSIONS, HFC, PFC AND SF6	TOTAL GREENHOUSE GAS EMISSIONS
	2012	2016	2012	2012	2012	2012
American Samoa	–	–	13.1	23.7	7.11 x 10-15	58.8
Fiji	1059.8	2046.2	714.6	343.8	-97.0	2258.2
French Polynesia	751.7	770.1	99.1	37.4	–	–
Guam	–	–	71.5	1.7	-8.44 x 10-15	85.9
Kiribati	51.3	66.0	16.3	4.0	–	–
Marshall Islands (RMI)	135.7	143.0	7.9	0.1	–	–
Micronesia, Fed. States	124.7	143.0	30.4	11.1	–	–
Nauru	40.3	47.7	3.2	0.2	–	–
New Caledonia	3656.0	5328.2	214.7	98.2	–	–
Northern Mariana Islands	–	–	12.4	0.1	–	12.5
Palau	216.4	223.7	1.4	0.0	–	–
Papua New Guinea	5078.8	7535.7	2142.9	1234.1	805.7	11087.5
Samoa	198.0	245.7	132.9	40.3	54.8	356.1
Solomon Islands	183.4	168.7	1449.2	2656.0	228.5	4591.5
Tonga	106.3	128.3	61.4	22.2	–	–
Tuvalu	11.0	11.0	3.4	1.3	2.89 x 10-15	5.2
Vanuatu	113.7	146.7	254.2	108.7	-20.5	446.2

INDICATOR IN ACTION

SDG 9.4.1, 11.b, 13.1, 13.2, 13.b, 14.2, 14.3 • UNFCCC Paris Agreement • Convention on Biological Diversity • MARPOL Annex VI (shipping) • SAMOA Pathway • Framework for Resilient Development in the Pacific • Noumea Convention • Pacific Regional Environment Objectives 1.1, 1.4 • Pacific Islands Framework for Nature Conservation Objectives 2, 5, 6

FOR MORE INFORMATION

Networks: Friends of Ecosystem-based Adaptation (FEBA), supported by IUCN; The Global Adaptation Network, supported by UNEP.

For more about the Pacific NDC Hub, see Project Brief: Establishment of a Regional Pacific NDC Hub

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org

TABLE 23.A: PACIFIC ISLANDS PROJECTS UNDER THE GREEN CLIMATE FUND

GCF funding noted; in many projects, additional co-financing has been committed.

	PROJECT	YEAR APPROVED	COUNTRY	PROJECT TITLE	GRANT FUNDING (TOTAL PROJECT FUNDING)
Adaptation	FP008	2015	Fiji	Fiji Urban Water Supply and Wastewater Management Project	USD 31 million grant (USD 405.1 million total)
	FP 015	2016	Tuvalu	Tuvalu Coastal Adaptation Project	USD 36 million grant (USD 38.9 million total)
	FP035	2016	Vanuatu	Climate Information Services for Resilient Development in Vanuatu	USD 18.1 million grant (USD 21.8 million total)
	FP036	2016	Pacific islands (Cook Islands, RMI, FSM, Nauru, PNG, Samoa, Tonga)	Pacific Islands Renewable Energy Investment Program	USD 17 million grant (USD 26 million total)
	FP037	2016	Samoa	Integrated Flood Management to Enhance Climate Resilience of the Vaisigano River Catchment in Samoa	USD 57.7 million grant (USD 65.7 million total)
	FP044	2017	Solomon Islands	Tina River Hydropower Development Project	USD 16 million grant, USD 70 million loan from GCF (USD 234 million total)
	FP066	2018	Republic of the Marshall Islands	Pacific Resilience Project Phase II for the Republic of the Marshall Islands	USD 25 million grant (USD 44.1 million total)
	FP090	2018	Tonga	Tonga Renewable Energy Project under the Pacific Islands Renewable Energy Investment Program	USD 29.9 million grant (USD 53.2 million total)
	FP112	2019	Republic of the Marshall Islands	Addressing climate vulnerability in the water sector (ACWA) in the Marshall Islands	USD 18.6 million grant (USD 24.7 million total)
Mitigation	SAP016	2020	Fiji	Fiji Agrophotovoltaic Project in Ovalau	USD 1.1 million grant (USD 10 million total)
Cross-cutting	FP091	2018	Kiribati	South Tarawa Water Supply Project	USD 28.6 million grant (USD 58.1 million total)
	FP052	2017	Nauru	Sustainable and Climate Resilient Connectivity for Nauru	USD 26.9 million grant (USD 65.2 million total)

Source: Green Climate Fund project list (accessed September 2020)

TABLE 23.B: OVERVIEW OF ECOSYSTEM-BASED ADAPTATION (EBA) PROJECTS IN THE PACIFIC REGION

Criteria for projects included here:

- Project end date must not be before 2015.
- Total project value must be greater than USD 1 million.
- EbA is a significant focus of the project (as specified by being included in the title, summary text, major activities, or budget lines).
- Estimated value of the EbA component is greater than USD 250,000 (where estimation is possible).
- 'Participating countries' should only be those where EbA activities occur(ed). For example, if Kiribati was part of a USD 5 million project with a strong EbA focus but in the case of Kiribati all project activities were for hard infrastructure, then Kiribati is not be listed here.

Efforts are summarized by project or investment (Table 23.B.1) and by country (Table 23.B.2).

This table is intended as an overview of major known projects, as of March 2020. This information is not to be considered comprehensive of all EbA efforts in the Pacific region. For more information, please contact sprep@sprep.org with attention to Herman Timmermans, Filomena Nelson, and Espen Ronneberg.

TABLE 23.B.1: Overview of Pacific ecosystem-based adaptation efforts by project/investment.

PROJECT NAME	FUNDER	VALUE	START YEAR	END YEAR	PARTICIPATING COUNTRIES	KEY EBA ACTIVITIES (SUCH AS MANGROVE RESTORATION, REEF RESTORATION, IMPROVED FOREST MANAGEMENT, TRAINING, ETC.)
Pacific Adaptation to Climate Change (PACC) Project	Global Environment Facility (GEF)/ UNDP/Australia	GEF USD 13.2 million AusAID USD 7.6 million	2009	2015	Fiji, Marshall Islands, Micronesia, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu, and Tokelau	Riparian rehabilitation, mangrove planting, flood control using vegetation, rainwater harvesting for food security, agricultural rehabilitation, composting toilets
Coping with Climate Change in the Pacific Region [CCCPIR] Project	Deutsche Gesellschaft fur Internationale Zussamenarbeit GmbH [GIZ]	€19.2 million	2009	2015	Federated States of Micronesia, Kiribati Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu	Addressing climate change affects across key economic sectors such as agriculture, forestry, fisheries and tourism
GCCA: PSIS (Pacific Small Island States) Project	EU/SPC	€500,000 per country	2012	2015	Tonga	Designing, building and monitoring the success of 'hard' and 'soft' engineering measures working in combination along two coastal stretches including beach replenishment and coastal mangrove planting
Adapting to Climate Change and Sustainable Energy (ACSE) Project	EU/GIZ	€550,000	2016	2018	Tonga	Trialing of 'Hard' and 'Soft' coastal protection measures in 6 villages in Western Tongatapu, including mangrove rehabilitation
PacSIDS Ridge to Reef (R2R) Project	GEF/UNDP	USD 83 million	2014	2017	Cook Islands, FSM, Fiji, Kiribati, Nauru, Niue, Palau, Tonga, Papua New Guinea, Republic of the Marshall Islands, Solomon Islands, Samoa, Tonga, Tuvalu, Vanuatu	Maintain and enhance Pacific Island countries' ecosystem goods and services through integrated approaches to land, water, forest, biodiversity and coastal resource management that contribute to poverty reduction, sustainable livelihoods and climate resilience
Climate Resilience Sector Project (CRSP)	Asian Development Bank (ADB)	USD 19.25 million	2014	2018	Tonga	Component 4 of the project is 'Ecosystem resilience and climate-resilient infrastructure investments developed through mangrove rehabilitation, establishing communal Special Management Areas (Coastal fisheries)
Pacific Ecosystem-based Adaptation to Climate Change (PEBACC)	German Federal Ministry of Housing, Nature Conservation and Nuclear Safety (BMU)	€5 million	2015	2020	Governments of Fiji, Vanuatu and Solomon Islands. Various donor, civil society, technical and community organisations.	Ecosystem and Socio-Economic Resilience Analysis and Mapping (ESRAM) conceptual approach. EbA demonstration projects – reforestation, agroforestry, community-conservation areas
EU-funded Intra-ACP GCCA+ Pacific Adaptation to Climate Change and Resilience Building (PACRES)	EU	€12 million shared among partners (SPREP, PIFS, SPC and USP) (EbA investment up to €1 million)	2018	2023	Papua New Guinea, Samoa, Solomon Islands, Vanuatu for EbA activities. All 15 Pacific-ACP countries participating in PACRES.	Mangrove restoration and rehabilitation, riparian zone restoration, watershed restoration, agroforestry, urban greening and climate ready cropping
By-catch and Integrated Ecosystem Management Initiative – KRA5 of the Pacific-European Union Marine Programme	EU and Swedish Government	€6.2 million	2020	2022	Governments of Fiji and Vanuatu. Various civil society, technical and community organisations	Integrated ecosystem management plans for selected coastal areas and associated watersheds. BIORAP and participatory planning using the Ecosystem and Socio-Economic Resilience Analysis and Mapping (ESRAM) conceptual approach

PROJECT NAME	FUNDER	VALUE	START YEAR	END YEAR	PARTICIPATING COUNTRIES	KEY EBA ACTIVITIES (SUCH AS MANGROVE RESTORATION, REEF RESTORATION, IMPROVED FOREST MANAGEMENT, TRAINING, ETC.)
Blue Carbon Ecosystems	German Federal Ministry of Housing, Nature Conservation and Nuclear Safety (BMU) with GIZ and SPC as partners	€9 million	2020	2023	Fiji, Vanuatu, Solomon Islands, PNG	Assessment, valuation, conservation and management of mangrove and seagrass ecosystems in Melanesia
Restoration of ecosystem services and adaptation to climate change (RESCCUE)	French Development Agency (AFD) and the French Global Environment Facility (FFEM)	€13 million	2015	2018	Fiji, French Polynesia, New Caledonia and Vanuatu	Strengthening integrated coastal management, ecological restoration and erosion control, community conservation areas (terrestrial and marine)
Strengthening Coastal and Marine Resources Management in the Coral Triangle of the Pacific (Phase 2)	GEF/ADB	USD 15 million	2011	2018	Papua New Guinea, Solomon Islands, Timor-Leste	Output (ii): coastal communities experienced in applying best practices in ecosystem-based management and climate change adaptation
Tuvalu Coastal Adaptation Project (TCAP)	GCF	USD 36 million	2018	2024	Tuvalu	Hard engineering is the focus of the project, however there is also emphasis on ecosystem-based adaptation for coastal protection where appropriate. E.g. coastal revegetation, ridge and dune restoration, coral transplantation or seagrass plantation
Readiness for El Nino project	EU/SPC	€4.5 million	2017	2020	Marshall Islands	Improve soil management practices, establish nurseries, expand the use of drought resistant crop varieties
Mangrove Rehabilitation for Sustainably Managed Healthy Forests (MARSH)	USAID	USD 7.5 million	2012	2017	Papua New Guinea	Mangrove Vulnerability Assessment, mangrove rehabilitation and restoration and mangrove management
Kiribati: Enhancing national food security in the context of global climate change	GEF/LDCF	USD 11.5 million	2015	2020	Kiribati	Coral reef restoration, coastal revegetation to prevent erosion and protect reefs from siltation, improving land and lagoon resources management planning
Enhancing adaptive capacity of communities to climate change related floods in the North Coast and Islands Region of Papua New Guinea	The Adaptation Fund	USD 5 million	2012	2016	Papua New Guinea	Integrated riverbank protection measures to prevent inland flooding, mangrove restoration and conservation to protect against coastal flooding

TABLE 23.B.2: Overview of Pacific ecosystem-based adaptation efforts by country.

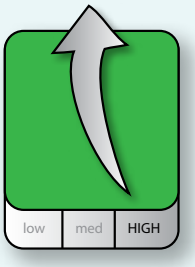
Notes: For acronyms, see Table 23.B.1. EbA-related projects should only be listed where they (a) meet the criteria for Table 23.1 and (b) involve the implementation of EbA activities in the listed country. Y: yes.

COUNTRY	EBA PROJECTS CURRENTLY ACTIVE? (Y/N)	NUMBER OF EBA PROJECTS SINCE 2015	EBA-RELATED PROJECTS (LIST)	KEY EBA ACTIVITIES IMPLEMENTED (E.G. MANGROVE RESTORATION, REEF RESTORATION, IMPROVED FOREST MANAGEMENT, TRAINING, ETC.)
Cook Islands	Y	1	R2R	
Federated States of Micronesia	Y	2	CCCPIR, R2R	CCCPIR: Community fisheries management plans and community FAD construction/training R2R: Integrated ecosystems management plans, management and rehabilitation of critical ecosystems (watershed restoration), sustainable land management
Fiji	Y	5	PACC, PEBACC, Blue Carbon Ecosystems, RESCCUE, R2R	Riparian restoration in Rewa river for flood control RESCCUE: Integrated coastal management plan in Kadavu and Ra, ecological restoration and erosion control, community conservation areas (terrestrial and marine)
Kiribati	Y	3	CCCPIR, R2R, Food Security	
Republic of the Marshall Islands	Y	4	PACC, CCCPIR, R2R, Readiness for El Niño	
Nauru	Y	3	PACC, CCCPIR, R2R	
Niue	Y	2	PACC, R2R	PACC: Rainwater harvesting (hard measure) also for irrigation for food security
Palau	Y	3	PACC, CCCPIR, R2R	Mangrove replanting and flood control through vegetation – secured taro plantations and reintroduced mudcrabs
Papua New Guinea	Y	7	PACC, CCCPRI, R2R, MARSH, Enhancing Adaptive Capacity…to Floods, Strengthening Coastal and Marine Resource Management, PACRES	Agriculture diversification for food security. Mangrove rehabilitation and climate-ready cropping
Samoa	Y	3	PACC, R2R, PACRES	Watershed restoration, agroforestry and climate-ready cropping
Solomon Islands	Y	7	PACC, CCCPIR, PACRES, PEBACC, Blue Carbon Ecosystems, R2R, Strengthening Coastal and Marine Resource Management	Mangrove and riparian zone restoration and urban greening
Tonga	Y	6	PACC, CCCPIR, GCCA:PSIS, ACSE, R2R, CRSP	Mangrove replanting
Tokelau	Y	1	PACC	
Tuvalu	Y	3	PACC, TCAP, CCCPIR	Composting toilets for water conservation and producing compost for food security Hard and soft coastal protection. Soft including dune restoration, coastal revegetation, reef restoration
Vanuatu	Y	8	PACRES, PACC, CCCPIR, R2R, PEBACC, By-catch and Integrated Ecosystem Management Initiative, RESCCUE, Blue Carbon Ecosystems	Mangrove and riparian zone restoration and watershed restoration

THEME **Atmosphere and Climate**

INDICATOR **Ozone Depleting Substances (ODS)**

DEFINITION	Trend in consumption of ozone depleting substances (ODS)
PURPOSE	Tracks countries progress to phasing out ODS. Ozone depleting substances destroy the earth's ozone which protects the earth from UV radiation
DESIRED OUTCOME	Negative trend in ODS consumption



Status
Good

Trend
Improving

Data confidence
High

Actions by households and individuals were essential to meeting global ozone goals. Participants of the 2 Million Tree Planting Campaign, Samoa. © Roland Setu

CRITICAL CONNECTIONS

Taking action on ozone-depleting substances has benefits for Pacific people, species, ecosystem services, and climate.

Ozone-depleting substances, like many other hazardous wastes, move long distances and have transboundary impacts. Spatially protected areas cannot, alone, protect species and ecosystems from such transboundary pollution impacts.

Refrigeration and air conditioning were major users of CFCs. Under the Montreal Protocol, CFCs were completely phased out, first replaced by HCFCs and then HFCs. The Kigali Amendment is now stimulating a further shift towards low global warming HFCs or alternative coolants, such as hydrocarbons or ammonia. This shift to new coolants has also allowed manufacturers and users to switch to refrigeration and air conditioning systems with more efficient energy use, reducing our reliance on fossil fuels and thereby increasing our energy independence.

The ozone story illustrates the success that can be obtained through committed, coordinated action that links production, consumption, waste management, and environmental management for a cleaner, healthier world for both people and nature.

PRESENT STATUS

Ozone depleting substances (ODS) are considered hazardous wastes due to the impacts of ozone destruction on people, ecosystems, and species. For more about other hazardous wastes, please see Regional Indicator: Hazardous waste.

The Vienna Convention for the Protection of the Ozone Layer was adopted in 1985, followed by the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987. These multilateral environment agreements (MEAs) are the first international environmental treaties to be universally endorsed by 198 nations. Now, 16 September is World Ozone Day, marking these unique agreements that have protected our planet and ourselves.

All Pacific island countries are parties to the Montreal Protocol, with annual reporting and triennial meetings. For more about Pacific reporting to multilateral environment agreements, see Regional Indicator: MEA reporting requirements.

Since 2015, all reporting Pacific island countries (13) with the exception of Nauru have maintained their consumption of controlled ODS below the agreed limits. No data are available for Niue. Clear data records are maintained at the Ozone Secretariat's Data Centre; see: https://ozone.unep.org/countries

The present status of this indicator is *good* with *improving* trends among countries. The availability and clarity of the data provide *high* confidence.

While addressing ozone depletion, a new problem was created: some replacements for ODS, known as hydrofluorocarbons (HFCs), have proven to be powerful greenhouse gases. Some HFCs are more than a thousand times more potent than carbon dioxide in contributing to climate change. To continue protecting the ozone layer while also mitigating greenhouse gas emissions, the parties to the Montreal Protocol agreed in 2016 to amend the Protocol to include control measures to reduce HFCs (the Kigali Amendment). A successful HFC phasedown is expected to avoid up to 0.4 degree Celsius of global temperature rise by 2100, while continuing to protect the ozone layer.

Eleven Pacific island countries have acceded to or ratified the Kigali Amendment (see Table 2.1). To date, only Palau and Vanuatu have established HFC licensing systems. In 2019, Pacific island countries exported 354,611 tonnes of recovered, recycled, or reclaimed HFCs (UN Environment Ozone Secretariat 2020).

WHAT IS THE OZONE LAYER?

The ozone layer is a region of high ozone concentration in the stratosphere, 15 to 35 kilometres above Earth's surface. The ozone layer acts as an invisible shield and protects us from harmful ultraviolet (UV) radiation from the sun. In particular, the ozone layer protects us from the UV radiation, known as UV-B, which causes sunburn. Long-term exposure to high levels of UV-B threatens human health and damages most animals, plants, and microbes, so the ozone layer protects all life on Earth. Protection of the ozone layer even protects our food security. Plants need sunlight to grow, so they cannot avoid exposure to UVB, but too much UVB can also harm plants. By taking action to avoid and safely manage existing ODS, we protect ourselves and the environment on which we depend. Because of the Montreal Protocol and national actions to stop producing, consuming, and releasing ODS, we have avoided a world in which severe ozone holes would have occurred every year over the Arctic and Antarctic. For more, see https://ozone.unep.org/ozone-and-you

PRESSURES AND OPPORTUNITIES

According to the Ozone Secretariat, in the mid-1970s, scientists realised that the ozone layer was threatened by the accumulation of gases containing halogens (chlorine and bromine) in the atmosphere. Manmade chemicals containing halogens were determined to be the main cause of ozone loss. These chemicals are collectively known as ozone-depleting substances (ODS).

The most important ODS were chlorofluorocarbons (CFCs), which at one time were widely used in air conditioners, refrigerators, and aerosol cans. Other chemicals, such as hydrochlorofluorocarbons (HCFCs), halons, and methyl bromide, also deplete the ozone layer.

Other gases containing nitrogen and hydrogen are also in the stratosphere and participate in reaction cycles that destroy ozone converting it back into oxygen. These reactions decrease the amount of ozone in the stratosphere. When undisturbed, the balance between the natural processes of ozone production and destruction maintains a consistent ozone concentration in the stratosphere.

Older materials and equipment, particularly refrigeration and cooling units, can still contain ODS, HCFCs, or CFCs. Only Fiji and Tuvalu are on the list of parties not wishing to receive products & equipment relying on Annex A & B Substances (Dec.X/9). In 2020, Vanuatu joined the list of parties which formally do not want to receive products and equipment containing or relying on hydrochlorofluorocarbons (HCFCs) *(Decision XXVII/8)*.

No treatment facilities for the neutralisation and safe disposal of ODS exist in the Pacific island countries. For disposal, ODS and HFCs would need to be collected, safely stored, and transported internationally to a treatment centre. The permitting and cost of this process has been a significant barrier, despite its small value (USD thousands or less) in the context of international efforts.

The process of ODS management illustrates the resources and time needed for even agreed-upon change. In case of the Montreal Protocol, where reporting is driving decision-making and action and under which significant progress has been made since 1987, several countries, including Cook Islands, Kiribati, Nauru, Niue, and Tonga, were parties to the Montreal Amendment to the Protocol but only recently established import and export licensing systems for ozone-depleting substances and therefore achieved compliance with Article 4B of the Protocol, with financial assistance approved for all of them through the Multilateral Fund.

Continued effort to identify and avoid the import and consumption of ODS will help us keep our global ozone layer intact.

REGIONAL RESPONSE RECOMMENDATIONS

The regionally adopted *Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025* and its 2020 mid-term review (SPREP, forthcoming) set out national and regional recommendations, including for countries to:

- Separate ODS and other hazardous wastes from the general waste stream and recyclable materials;
- Develop regular, consistent monitoring and reporting at regional and national levels for hazardous waste management activities, waste generation, and the receiving environment;
- Develop and update national and regional inventories of hazardous substances and hazardous waste;
- Implement national measures to restrict and regulate importation, handling, storage, and sales of ODS-containing equipment and hazardous substances;
- Construct national secure storage facilities for chemicals and hazardous waste management, with environmentally sound operation;
- Support regional and national training and capacity development for management of priority hazardous wastes, such as ODS, including compliance monitoring, enforcement, and prosecution; and
- Partner for informed and effective hazardous waste management, including partnerships with customs officials and local industry.

INDICATOR IN ACTION SDGs 12.4, 12.5, 12.7 as well as 3.9, 11.6, 14.1 • Montreal Protocol • SAMOA Pathway • Pacific Regional Environment Objectives 3.1, 3.4 • Pacific Islands Framework for Nature Conservation Objectives 3, 5

FOR MORE INFORMATION

In addition to national focal points, the Secretariat of the Pacific Regional Environment Programme is coordinating regional efforts for hazardous waste management and hosts a Hazardous Waste Management Advisor. Contact sprep@sprep.org for assistance with hazardous waste management.

SPREP (forthcoming) Mid-term review report: Cleaner Pacific 2025 Pacific Regional Waste and Pollution Management Strategy 2016–2025. Bradley M (author). Apia, Samoa: Secretariat of the Pacific Regional Environment Programme.

SPREP (2016) *Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025*. Apia, Samoa: Secretariat of the Pacific Regional Environment Programme.

SPREP PROE

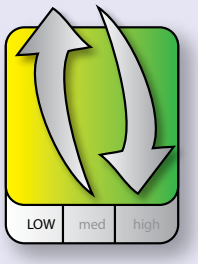
The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org

INDICATOR Renewable Energy

DEFINITION	Trend in percentage production of energy from renewable sources
PURPOSE	Energy generation is a major source of GHG emissions. Pacific island countries also have limited capacity for oil and gas storage and are therefore highly vulnerable to fluctuations in fossil fuel price and availability
DESIRED OUTCOME	Positive trend in energy production from renewable sources



Status
Fair to good

Trend
Mixed

Data confidence
Low

Electric Vehicles for Sustainable Transport, Samoa. © Roland Setu

PRESENT STATUS

Here, we focus on the production of *electricity* from renewable sources. As such, we focus on a statistic distinct from SDG 7.2.1 "Renewable energy share in the total final energy consumption". Data for this Pacific regional indicator are relevant for SDG 7.b.1 "Installed renewable energy-generating capacity in developing countries (in watts per capita)".

Renewable energy (RE) is gaining more regional attention and the number of installed renewable systems for electricity supply (directly by national utilities or through independent power producers) has increased in several Pacific island countries and territories. For example, Asian Development Bank (ADB) projects on RE technology continue to 2021 with efforts in 13 Pacific island countries and at the regional level (ADB 2019).

The share of renewables in the total energy demand is not routinely reported (Johnstone 2019). Data are available regarding the planned and installed generation capacity. However, the share of total electricity production that comes from renewables is not regularly reported. Here, we collate data from national presentations at the Pacific Islands Renewable Energy Statistics Workshop[1] and national energy sector plans (Table 27.1). A substantial increase in renewable electricity production is projected from committed project funds; the last summary of projected shares of electricity generation upon the completion of existing projects was prepared in 2016 (MFAT 2016).

Based on assessments from at least 2015 to the latest available year, we consider the present status to be *fair to good* with *mixed* trends among countries. The availability and clarity of the data provide *low* confidence; the absence of data has been identified as one of the challenges for informed decision making, effective energy planning, and tracking of renewable energy deployment in the region.[1]

That said, efforts are underway to improve reporting and, with sustained support for long-term monitoring, data confidence will grow quickly.

Pacific leaders have set RE targets, focusing on the share of domestic electricity production using renewable resources (Table 27.1). In 2012, Tokelau was the first country in the world to achieve 100% of its electricity generation from solar systems, with 45 kW solar plants on all three atolls, reducing diesel imports by 80% (Government of Tokelau 2016). The actual supply is now about 90% with supply difficulties under cloudy conditions or with battery failures.

Electricity is only a portion of the total energy demand in the region. In 2017, modern renewables (which excludes traditional uses of wood biomass burning) supplied 12.3% of the total final energy consumption in the Pacific region (Asia-Pacific Energy Portal). (When including biomass burning, the share of renewables was 13.8%.) The trend in renewables as a share of total final energy consumption is stable: although renewable electricity generation capacity is increasing, overall, the demand for energy is also growing.

The countries with the greatest shares of renewables in energy consumption are Kiribati, Solomon Islands, and Papua New Guinea (PNG). In 2014, 63% of the national energy *supply* for Kiribati came from imported petroleum products; endogenous renewable energy sources (mainly bioenergy, then solar) accounted for the remaining 37% (Taibi et al. 2017). In 2017, RE accounted for 48% of PNG's total primary energy supply; recent values are lower than the nearly 70% pre-2000 share of renewables in total final energy consumption as PNG's demand has increased.[2] Fiji, Samoa, and PNG, all with hydropower systems in place for decades, show this declining trend as demand surpasses existing hydropower supply.

[1] Pacific Islands Renewable Energy Statistics Workshop, Nadi, Fiji, 22–24 October 2019. See: http://prdrse4all.spc.int/node/4/content/pacific-islands-renewable-energy-statistics-workshop-nadi-fiji-22-24-october-2019

[2] APEC Energy Database, Primary Energy Supply Table; see https://www.egeda.ewg.apec.org/egeda/database/php/newprimary2/primary.php

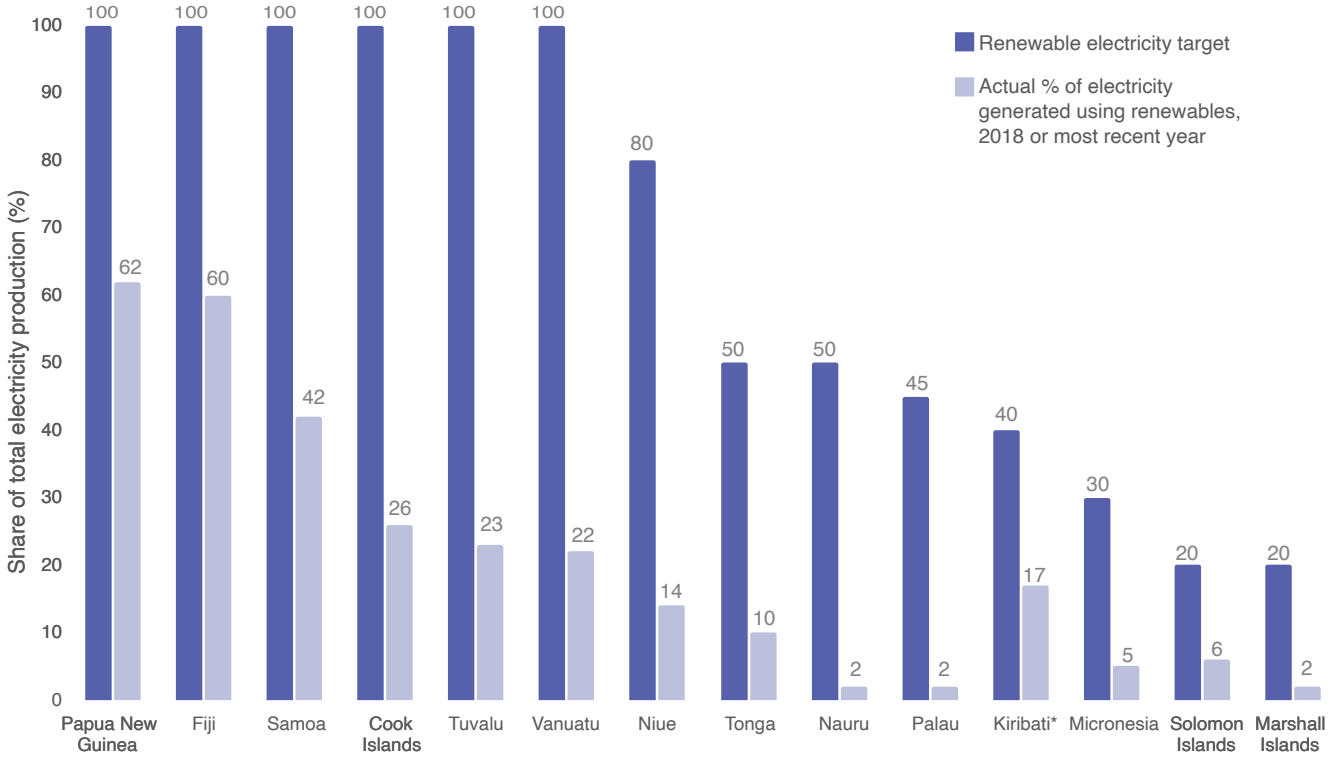


FIGURE 27.1: Target and actual share of renewable energy in electricity production in Pacific island countries. Kiribati's data are for solar only for South Tarawa only. Micronesia: Federated States of Micronesia. Sources: see Table 27.1

WHAT ARE THE RENEWABLE ENERGY OPTIONS FOR PACIFIC ISLANDS?

Solar energy capture has high potential throughout the region and is a focal point for many international projects. Solar is the most common method for micro- and small-scale renewable energy applications, including off-grid applications. In some countries, solar is already commonly used for a portion of household energy uses, such as water heaters.

Hydroelectricity is only available in Fiji, French Polynesia, New Caledonia, PNG, Samoa, Solomon Islands, and Vanuatu.

To date, wind energy is used in Fiji, Federated States of Micronesia (Yap state), New Caledonia, Samoa, Tonga, and Vanuatu. Wind energy can be used for micro- to large-scale applications but most focus on large-scale, grid-connected systems.

Biogas can take advantage of existing waste products, such as piggery effluents or copra residues. Biogas efforts have largely been project-based and face challenges of start-up costs and maintenance. For example, as of October 2019, only 22 of the 49 digesters of Tuvalu's ACSE Biogas Project were working.[1]

Marine energy (tidal, ocean, wave, ocean thermal energy conversion, or salinity gradient) is largely at the development stage around the world. With few constricted harbours and small tidal ranges, the islands are largely unsuited to tidal energy. A 1 MW ocean thermal energy conversion plant is under development in Kiribati, to be completed in 2020.

Biomass (primarily wood) is used on many islands for traditional cooking, excluding atolls. Fiji, PNG, and Solomon Islands also use biomass for electricity production, with Fiji using sugarcane bagasse during the crushing season as well biomass from the timber mill. Solomon Islands and PNG rely heavily on waste biomass from their palm oil industries.

For all technologies and for all countries, the maintenance and modification or innovation of renewable energy technologies remains a challenge. Tropical conditions create a unique set of hazards to sustained production, and geographic remoteness complicates the timely servicing and repair of replaceable components. True energy independence will rely on trained personnel with the skills, time, and resources to develop energy systems.

CRITICAL CONNECTIONS

Renewable energy production assists in the fight against climate change and can increase Pacific resilience. That said, the infrastructure of renewable energy systems is also vulnerable to extreme events. Flooding is a particular concern. With the region's vulnerability to natural disasters, RE systems must be resilient.

As with any land-use change or hardscape development, the installation of renewable energy systems bears risks for local biodiversity and ecosystems. The practice of clearing forest or native landscapes to install RE infrastructure, for example, is to be discouraged. All RE systems are subject to environmental impact assessment, like any other construction.

As part of a system of energy supply and infrastructure throughout the region, RE can support education, communication, and environmental management based on research and data management.

TABLE 27.1: Electricity access, renewable energy targets, status upon completion of active projects, and existing share of renewables in total electricity production in Pacific island countries and territories. Data were unavailable for American Samoa, Commonwealth of the Northern Mariana Islands, and Guam. Note that Tokelau achieved 100% solar power in 2012.

COUNTRY	ELECTRICITY ACCESS, 2017 [ACCESS TARGET] (% OF POPULATION)	RENEWABLE ENERGY TARGET (% OF TOTAL ELECTRICITY PRODUCTION, UNLESS SPECIFIED)	SHARE OF RENEWABLES IN TOTAL ELECTRICITY GENERATION, 2018	SHARE OF RENEWABLES IN ELECTRICITY CAPACITY, 2019
Cook Islands	100%	100% by 2020	26%	28%
Fiji	96% [100% by 2020]	100% by 2036	60%	59%
Kiribati	98.6%	45% reduction of fossil-fuel energy generation by 2025	17%	30%
Marshall Islands	94.8% [95% by 2020]	20% by 2020, 100% by 2050	~2% from government-owned RE; a project underway to reach 9%	5%
Micronesia, Fed. States of	80.8% Access varies significantly among the 4 states: Kosrae 98%, Pohnpei 87%, Yap 67%, Chuuk 26%	30% by 2020	5%	9%
Nauru	99.6%	50% by 2020	2%	5%
Niue	100%	80% by 2025	14%	31%
Palau	100%	45% by 2025	2%	4%
Papua New Guinea	54.4% [70% by 2030]		62%	32%
Samoa	96.8%	100% by 2017	42%	47%
Solomon Islands	62.9% [100% urban and 35% rural by 2020]	20% by 2020	6%	5%
Tokelau	–	100% by 2020	~90%	–
Tonga	98% [100% by 2020]	50% by 2020 (70% by 2030)	10%	30%
Tuvalu	100%	100% by 2020	23%	42%
Vanuatu	62.8% [100% by 2030]	100% by 2030	22%	30%
French territories: French Polynesia (FP), New Caledonia (NC), Wallis & Futuna	100% (FP, NC)	Reductions in diesel use	FP: 29% NC: 12%	FP: 29% NC: 18%

Sources: Access, 2018 generation, and 2019 capacity from International Renewable Energy Agency (IRENA) Statistical Profiles, September 2020 with the following exceptions: Marshall Islands generation data pers. comm. Ben Wakefield, Deputy Director, National Energy Office; Tokelau generation data from Government of Tokelau (2016). Targets based on national energy policies, NDCs, and Asian Development Bank *Pacific Energy Update 2019*. Additional information about existing status available from country presentations at the Pacific Islands Renewable Energy Statistics Workshop, Nadi, Fiji, 22–24 October 2019 as well as: Kiribati data from Kiribati Integrated Energy Roadmap 2017–2025; Nauru data from Wyder (2018) Review of the Nauru Energy Road Map 2014–2020; Niue data from Niue Solar Installations 2016 from PRDRSE4ALL database; Samoa data from EPC 36th Annual Report 2017–2018; Vanuatu data from Vanuatu Utilities Regulatory Authority (2018) Electricity Fact Sheet 2012–2017.

PRESSURES & OPPORTUNITIES

The costs for renewable power generation have continued to decline, with most renewable electricity-generating options, particularly wind and solar, less expensive than fossil fuel options (IRENA 2019; PRIF 2019). That said, up-front investment can still be a barrier. Energy is typically a separate budget from environmental management although the transition to renewable energy (RE) is mutually beneficial; see Regional Indicator: Environment Ministry budget allocation.

According to the ADB (2019), "the uptake of renewables is restricted by lack of finance and private sector participation, capacity barriers, poor sector regulation, and the limited ability of local grids to absorb new sources of renewable power" in the Pacific islands region.

Consistent, sustainable data reporting remains a challenge. Countries identified lack of capacity for data analysis and data management. Given the lack of global standardization in the presentation of RE statistics (for example, as share of electricity production, share of domestic energy production, or share of total final energy supply), managing RE statistics is challenging.

The Review of the *Framework for Action on Energy Security in the Pacific* (FAESP: 2010–2020) gives an overview of the data situation: 'In 2011, a set of quantitative and qualitative indicators was developed to provide a simple and reliable means to measure changes or achievements in energy security for the PICTs. They were chosen as a workable compromise between comprehensiveness and the effort required to acquire data. In 2012, SPC published a set of 14 Country Energy Security Indicator Profiles (2009 data or closest available year) and had planned annual updates, which were stymied due to lack of sufficient data from the countries. […] Access to accurate, consistent and up-to-date energy data remains a serious issue, with the need for improved data highlighted at numerous meetings of the region's energy ministers in the past decade, including 2019. In their 2019 resolution, energy ministers "noted the data management challenges of the Pacific Islands and call on the World Bank to urgently appraise and treat the SPC data funding proposal as a matter of priority"' (Johnstone 2019). The FAESP indicators cover all RE for electricity, which includes estimates for small grids and off-grid supply where available; however, the data supply is unreliable.

In 2014, the Pacific Ministers of Energy and Transport endorsed the establishment of a regional centre of excellence, the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), under the umbrella of the FAESP. PCREEE was inaugurated in April 2017.[3] To support efficient coordination of efforts, project investments are streamlined through the Pacific Renewable Energy Investment Facility, with current operation extending through 2021.

Solar farm, Samoa. © Roland Setu

The Pacific Solar Challenge was launched in late 2019 by the Pacific Islands Development Forum (PIDF) in partnership with Solar Head of State as a regional initiative hosting nationally focused competitions for youth to design community outreach materials.

The energy sector alone contributed 40% to nearly 80% of estimated national carbon emissions as reported in Pacific NDCs (see Regional Indicator: Trend in greenhouse gas emissions). Transitioning to RE mitigates carbon emissions. Imported diesel is the dominant source of electricity generated in the Pacific islands, bulking out their imported fossil fuels. For example, prior to the 2018 completion of the Tafitoala-Fausaga and Faleata hydropower plants, diesel for electricity production accounted for 20% of Samoa's annual petroleum imports and 50% of the country's total installed electrical capacity (Bird & Mataita 2019). This reliance on fossil fuels increases greenhouse gas emissions.

Domestic energy production provides independence. Due to the high cost of long-distance fuel shipping and the heavy reliance on fossil fuels, Pacific islands could save substantially through the transition to RE. For example, fuel imports represent nearly 13% of the GDP of the Federated States of Micronesia.[1] The global average expenditure on energy is 8% of GDP (Institute for Energy Research 2010) and spending on energy research and development (R&D) was about 0.04% of the GDP of the major economies in 2018 (IEA 2019). At present, the Pacific islands do not report national investment in energy R&D as a share of GDP.

[3] See: https://sustainabledevelopment.un.org/partnership/?p=7498

REGIONAL RESPONSE RECOMMENDATIONS

The regular use of a clearly defined metric will help identify status and trends in renewable energy systems. Learning alliances within the region can facilitate the sustained reporting of RE indicators, during the planned rapid transition to renewables.

Using the *Framework for Action on Energy Security in the Pacific* (FAESP: 2010–2020) and other regional frameworks, countries can:

- Standardise reporting based on the same data for SDG 7, national energy plans/roadmaps, Pacific NDC Hub requirements, and other MEAs or frameworks;
- Measure investment in renewable energy systems, distinguishing national and project funds;
- Plan for energy system resilience and independence, including preparedness such as disaster risk reduction and biosecurity as well as pollution levies;
- Partner to advance the transition to renewables, focusing on private sector partnerships; and
- Partner for RE data management, resourcing, and capacity building, including South-South partnerships.

INDICATOR IN ACTION SDGs 7.1, 7.2, 7.a, 7.b • SAMOA Pathway • Noumea Convention • Montreal Protocol • Regional Environment Objectives 1.1, 1.3, 1.5 • Pacific Islands Framework for Nature Conservation Objective 2

FOR MORE INFORMATION

Pacific Regional Data Repository for Sustainable Energy for All: http://prdrse4all.spc.int/list/data

Asia Pacific Energy Portal: https://asiapacificenergy.org/

Pacific Power Association; https://www.ppa.org.fj/publications/ Note that PPA data are only for the main grids of each utility.

IRENA Renewable Energy statistics: https://www.irena.org/Statistics

ADB Pacific Energy Update series: https://www.adb.org/publications/series/pacific-energy-update

For Papua New Guinea, APEC Energy Database: https://www.egeda.ewg.apec.org/egeda/database_info/index.html

PRISM: https://prism.spc.int/ link to country statistics websites

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
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National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal.
pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

THEME **Built Environment**

INDICATOR **Per capita generation of municipal solid waste**

DEFINITION	Annual per capita generation of municipal solid waste
PURPOSE	Accurate measurement of per capita waste generation for better waste management
DESIRED OUTCOME	Stabilisation and subsequent negative trend in household waste generated

Status
Fair

Trend
Improving

Data confidence
Medium


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PRESENT STATUS

The regionally endorsed *Cleaner Pacific 2025* strategy set a target for the performance indicator *Per capita generation of municipal solid waste* of 1.3 kilograms or less per person per day by 2020.

The Pacific countries and territories have estimated waste production below this target, with the exception of the Commonwealth of the Northern Mariana Islands, French Polynesia, Guam, Palau, Tonga, and Vanuatu (Fig. 28.1). However, 16 countries and territories have estimated waste generation rates near or above the global average of 0.74 kilograms per day (Kaza et al. 2018), with far fewer resources to safely manage and dispose of this waste.

Between 2016 and 2019, the Pacific region reduced the (average) municipal solid waste generation per capita with an average of 1.2 kg produced per person per day (SPREP, forthcoming).

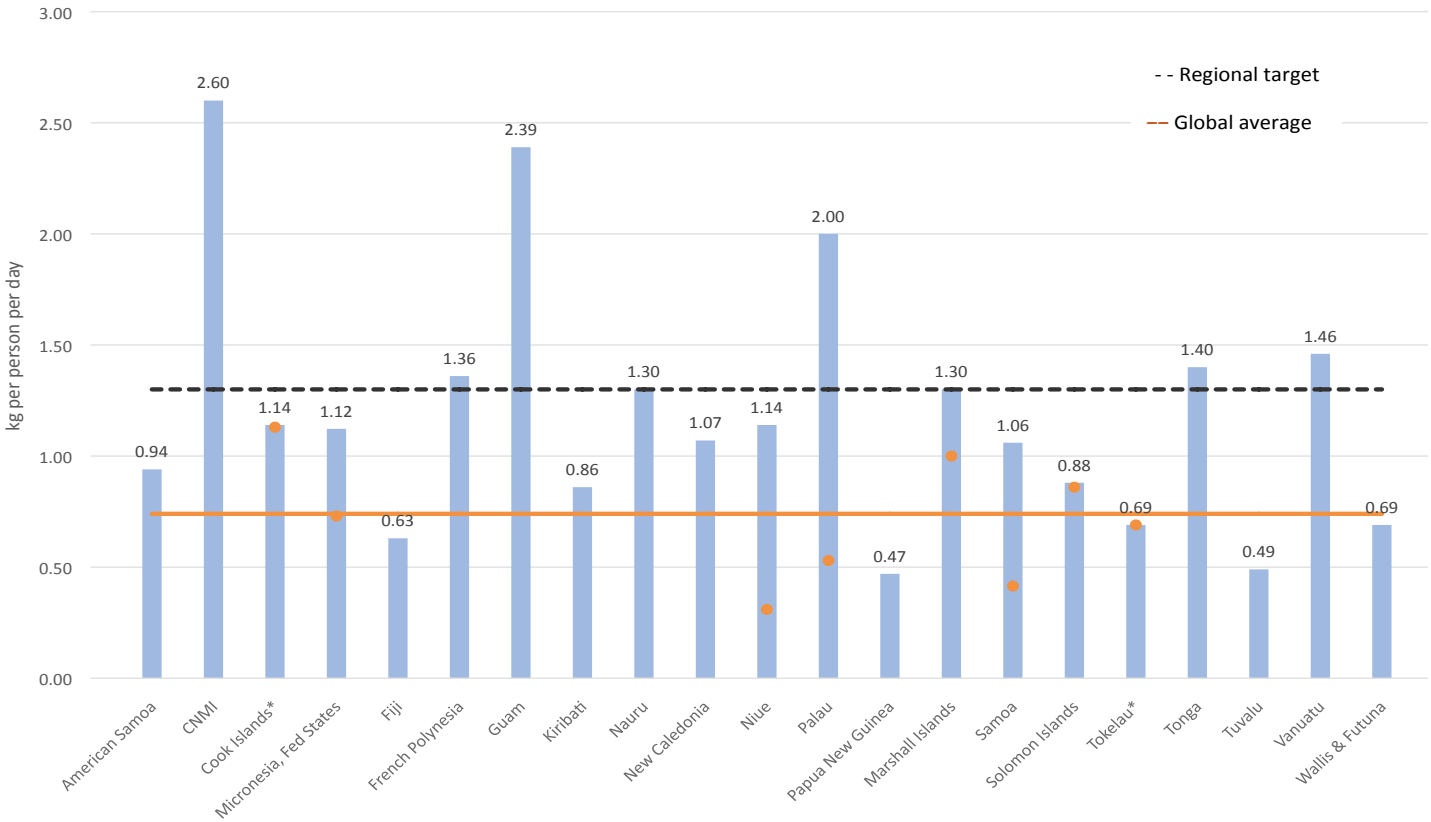

FIGURE 28.1: Municipal waste generation per person in the Pacific islands, 2019 or most recent year. Municipal solid waste includes household, commercial and institutional waste. Sources: (columns) SPREP (forthcoming), (dots) national State of Environment reports or estimates based on income status using Kaza et al. (2018) values for upper-middle income countries (Tokelau) or an averaged value of upper-middle and high-income status (Cook Islands). Dashed line: regional target; solid line: global average (0.74 kg per person per day)

THEME **Built Environment**

INDICATOR **Waste generation and capture**

DEFINITION	% of total household waste captured by authorised provider
PURPOSE	Measures the percentage of total household waste collected (either for disposal or recycling) in waste facilities
DESIRED OUTCOME	Positive trend in percentage of household waste captured

Status
Fair to poor

Trend
Unknown

Data confidence
Low


© Roland Setu

PRESENT STATUS

Between 2016 and 2019, the Pacific region increased the (average) national waste collection coverage, in other words the availability of waste-collection services to their population (SPREP 2020). Where information on waste capture rate was not available for any of the Pacific island countries and territories in 2014, data for seven of the 21 countries and territories was available in 2020 (Table 29.1).

As of 2020, 74% of the population received waste-collection services and 46% of the generated waste was captured. In addition, the (average) national recycling rate across the region increased to 60% of the recyclable material, which will reduce the share of waste entering landfills or incineration facilities. There is still loss of material from landfills, particularly in countries with limited soil and equipment for rapid burial of wastes. Wind and water movements, particularly during extreme events, can redistribute previously collected waste.

Lower waste-generation rates would have the effect of increasing the share of total waste captured without any additional effort for waste capture.

CRITICAL CONNECTIONS

Reducing waste at the household, community, and national level provides cross-cutting benefits to people and nature.

Reduced and 'smarter' packaging makes for more efficient transport of goods with greater value to consumers. Tropical conditions place challenges on standard packaging, but in many cases traditional uses of tropical resources make beautiful substitutes.

Our waste can pollute our water, from streams and drinking water sources to our lagoons and ocean.

Excess packaging, waste production and certain modes of waste management contribute to greenhouse gas emissions and the health of the protective ozone layer. For example, burning plastic releases persistent organic pollutants (POPs) that cause direct and indirect risks to human health through the release of carcinogens (cancer-causing chemicals). Other Pacific priorities include mercury, heavy metals, and the as yet unknown impacts of plastics.

Inadequate management of wastes and activities that contribute to pollution threaten the health of Pacific communities and degrade natural ecosystems, reducing their resilience to climate change impacts. The economic development of many Pacific islands is also adversely affected from the impacts of poor waste and pollution management because their economic bases (tourism, fishing, and agriculture) are heavily reliant on healthy environments.

When people see how their wastes affect Pacific biodiversity and ecosystems that they value, they can create a socio-cultural shift toward lower waste production and better waste management.

TABLE 29.1: Waste collection coverage and capture rate in Pacific island countries and territories, 2020. ND: no data available. Source: SPREP (forthcoming).

	WASTE COLLECTION COVERAGE (% OF POPULATION)	WASTE CAPTURE RATE (AMOUNT COLLECTED / AMOUNT GENERATED) (%)
American Samoa	ND	ND
CNMI	ND	ND
Cook Islands	ND	ND
Micronesia, Fed States	29*	18
Fiji[u]	100[u]	ND
French Polynesia	ND	ND
Guam	100*	ND
Kiribati	ND	76
Nauru	ND	ND
New Caledonia[u]	75	ND
Niue	100	ND
Palau[u]	100	24[a]
Papua New Guinea[u]	67*	55[b]
Marshall Islands[u]	91	56[c]
Samoa	61	ND
Solomon Islands[u]	51	41[d]
Tokelau	99	ND
Tonga	ND	ND
Tuvalu	80	ND
Vanuatu	50[e], 100[u]	50[f]
Wallis & Futuna	ND	ND

[u] Urban only

* Waste collection coverage: Federated States of Micronesia's national value is the unweighted average of the state values. Fiji's estimate for waste collection coverage is for Suva only. In Guam, 100% collection coverage is assumed, with the Guam Solid Waste Authority providing curb-side collection services plus residential transfer stations for those who do not pay for curb-side collection. Papua New Guinea's estimate for waste collection coverage is for Port Moresby only.

[a] Palau's waste capture rate is for Koror and Babeldaob only

[b] Calculated as the average of waste capture rate values across 5 areas in PNG – NCDC 66.8%, Alotau ULLG 65.3%, Goroka ULLG 45.3%, Kokopo-Vunamami ULLG 49.1%, Lae ULLG 49.4%. All data are from 2018 J-PRISM II waste flow surveys.

[c] 2017 estimate based on an average of the capture rates for Majuro (50.8%) and Ebeye (60.8%)

[d] Mid-point of waste capture rate range, 37–45%, based on comparative data from JICA and APWC

[e] Luganville only.

[f] Mid-point of waste capture rate range, 30–70%, based on comparative data from JICA and APWC

PRESSURES & OPPORTUNITIES

Pacific leaders adopted the *Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025*. The mid-term review of CP2025 progress (SPREP, forthcoming) indicated:

Some progress was made towards achieving all four strategic goals in CP2025 (1. prevent and minimise generation of wastes and pollution; 2. recover resources from wastes and pollution; 3. improve life-cycle management of residuals; and 4. improve monitoring of the receiving environment).

Only 7 of 20 performance indicators exceeded or met their 2020 targets. Between 2016 and 2019, the Pacific region achieved: reduced (average) municipal solid waste generation per capita, an increased number of container deposit programmes, an increased number of Extended Producer Responsibility programmes for used oil, increased number of national chemicals and pollution inventories, increased (average) national waste collection coverage, an increased (average) waste recycling rate, and an increased number of national environmental monitoring programmes.

Given that 44% of Pacific household waste is organic material (food and yard waste) that could be recaptured into healthy soil through composting and that another 43% is potentially recyclable material, there are great opportunities for waste reduction and successful management (see *Cleaner Pacific 2025*). Safe waste management has a direct impact on human health not only through the reduced spread of pollutants but also through reductions of disease-carrying pest populations (such as mosquitoes) that thrive in poorly managed dump sites. See Regional Indicators: Fresh water quality, Lagoon water quality, and Access to and quality of sewage treatment.

Distance to recycling facilities and markets is a significant barrier to Pacific recycling, due to high transport fees. On-island facilities could increase the rate of re-use of recyclable materials, which can be as simple and elegant as artisanal paper from recycled fibres, crushed glass for urban roadways, or reclaimed plastic pellets for production of new items. There are signs of growth in initiatives to support recycling in the region, such as the public-private Moana Taka Partnership[1] and consideration of a regional recycling network. SPREP is planning to propose a Regional Recycling Association during the 2021 Clean Pacific Roundtable. There are ongoing initiatives to identify recycling hubs in the Pacific as part of establishing a regional recycling network through the Pacific Regional Infrastructure Facility although little progress has been made beyond a scoping study.

[1] The Moana Taka partnership, initiated in 2017 between the China Navigation Company and SPREP, takes advantage of empty cargo containers on return voyages to remove recyclable materials. Such containers are common because Pacific islands rely on imports while exporting comparatively little. The cost of shipping is the greatest barrier to local recycling collection companies.

The Pacific commitments to renewable energy production (see Regional Indicator: Renewable energy), combined with the growing use of modern technologies, create an electronic waste recycling and waste management challenge. The rare earth elements used in many modern technologies and the potential danger of disposal of certain components, such as batteries, make recycling, landfill diversion, and landfill management critical issues of the 4th Industrial Revolution. More subtly, demand for these materials also creates pressure for mining, including seabed mining.

Disaster waste management is increasingly essential for changing Pacific islands. Low-lying islands with limited land have reduced capacity to bury waste, and unprotected wastes can be easily scattered by wind and water. Severe and frequent extreme events are becoming common throughout the Pacific islands region. Disaster waste management is essential in facilitating humanitarian responses and recovery efforts post-disaster. Priority actions include clearing access roads, reducing exposure to toxic wastes, re-using construction debris to rebuild, and not overloading the capacity of disposal facilities, among others.

Reducing per capita waste generation provides financial benefits and greater safety for people and ecosystems, even during disasters. Safe management of the excess wastes produced following a disaster is a long-term planning priority for Pacific islands.

Pacific leaders have introduced several waste-reducing policies and legislation to curb the import, production, and uncontrolled release of waste. Plastics are one focal material, and Pacific communities like those around the world are using the management of plastics to advance waste reduction (see Table 12.2).

REGIONAL RESPONSE RECOMMENDATIONS

Cleaner Pacific 2025 sets out national and regional recommendations. Building on these recommendations, countries can:

- maintain participation in the biennial, regional Clean Pacific Roundtable to coordinate and facilitate waste management and pollution-control dialogue and networking in the region;
- strengthen national and regional cooperation and coordination on waste and pollution management activities, including improved coordination with:
- the private sector to enhance resource recovery efforts;
- agricultural entities to promote better utilisation and recycling of organic waste;
- disaster risk reduction entities to reduce risks associated with landfills and waste disposal sites;
- climate change entities to promote GHG emission reductions through low-emission recycling technologies and waste treatment as well as organic waste diversion from dumps and landfills; and
- conservation groups to promote improved ecological monitoring around waste, chemical, and pollutant facilities;
- cooperate to ensure timely monitoring of the *Pacific Regional Waste and Pollution Management Strategy 2016–2025*; and
- build awareness of the importance of improving waste and pollution management with politicians, decision-makers, and communities. Informed politicians and decision-makers are more likely to prioritise funding for waste and pollution management, and an informed populace is more likely to support relevant initiatives.
- When measuring national spending on waste management, countries should include the cost of landfill space, to quantify benefits from waste-reduction measures, in addition to national and project funds toward waste management programmes.

INDICATOR IN ACTION

SDGs 3.9, 11.6.1, 12.4 • Basel (Art. 4 obligations 2c); Rotterdam; Stockholm (BSR) Conventions • SAMOA Pathway Outcome 71(a) • Noumea Convention • Pacific Regional Environment Objectives 3.1, 3.2, 3.3, 3.4 • Pacific Islands Framework for Nature Conservation Objectives 2, 5

FOR MORE INFORMATION

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator.
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For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

INDICATOR **Hazardous waste**

DEFINITION	Quantity of generated hazardous wastes processed/treated (including export)
PURPOSE	Treatment and safe storage of hazardous waste mitigates the risk to humans and nature. Hazardous materials can have direct and indirect, chronic or acute impacts
DESIRED OUTCOME	Full treatment/processing of all hazardous waste generated

Status
Poor

Trend
Deteriorating

Data confidence
Low

Nauru landfill car dump © Stuart Chape

PRESENT STATUS

Here, hazardous waste is defined according to the Basel and Waigani Conventions, with categories listed in Basel Convention Annex I, Annex II and characteristics in Annex III. These include wastes that are explosive, flammable or prone to spontaneous combustion, poisonous or toxic, and infectious, among other characteristics.

Among these, the *Cleaner Pacific 2025* strategy (SPREP 2016, hereafter *CP2025*) focuses on healthcare waste, electronic waste (e-waste), used oil, asbestos, used lead-acid batteries, persistent organic pollutants (POPs), mercury, and ozone-depleting substances as priority waste streams in the Pacific islands region (see Regional Indicator: Ozone-depleting substances).

The present report is the first use of this indicator for the Pacific islands region. Data used to assess this indicator could be the quantity of hazardous waste accepted at landfills/open dumps or at treatment facilities like incinerators. There are few if any dedicated hazardous waste treatment facilities other than incinerators in the region. In the case of highly hazardous chemicals, these chemicals could be generated, stored, and exported, and quantifying each step will be important to assess progress towards this indicator.

At present, there is no regional collation of hazardous wastes or of hazardous waste data. National State of Environment reports indicate that the amount of hazardous material has increased in countries that have conducted assessments. Consumption of the goods that produce hazardous waste is increasing. Without waste segregation, many hazardous materials are entering the general waste stream and sent to landfills or entering the environment.

At present, the quantity of generated hazardous waste that is processed or treated is considered *poor* with a *deteriorating* trend due to increased consumption of goods that produce hazardous waste, lack of waste segregation, and lack of treatment or storage facilities. Data gaps persist. The status of relevant policies and strategies in Pacific island countries and territories as of 2016 is summarised in Table 4 of *CP2025*.

CRITICAL CONNECTIONS

Hazardous waste is a threat to Pacific people, ecosystems, and species. Hazardous waste is most obviously linked to human health and the health of waterways but can also have far-reaching effects for species and ecosystem services in the Pacific islands and around the world.

Remediation of contaminated sites and management of hazardous waste has benefits for Pacific people, ecosystems, and species. Building national capacity for remediation requires support but has positive effects within and beyond the region, particularly for hazardous wastes with long dispersal, such as heavy metals. Such remediation can blend with the focus on priority sites for protection, including invasive species management.

The trend toward renewable energy and electrification reduces greenhouse gas emissions and improves air quality but also increases the potential management need for battery waste, including new battery types such as lithium.

Burning plastics at standard temperatures can prevent their release into the ocean but also releases POPs, invisible but cancer-causing. High-temperature incineration of any waste is a concern if incinerators are poorly maintained or operated. POPs, like many other hazardous wastes, have transboundary impacts, blunting the effectiveness of protected areas.

The COVID-19 pandemic has shed light on an existing problem: the urgent need for effective processing of healthcare waste. Natural disasters such as cyclones, floods, and tsunamis can also generate large quantities of solid and liquid wastes, which can pose risks to public health through direct or vector-induced exposure to uncollected hazardous waste. Waterways, agricultural areas, and communities are at risk of contamination. A strong disaster management plan accounts for ways to protect people from hazardous materials during and after the disaster event.

Partnerships among sectors using and receiving the impacts from hazardous materials, such as agriculture and watershed managers, can increase the effectiveness of monitoring and management of hazardous wastes. Everyone can be involved in reducing waste, from households to businesses all the way up to international policy.

Endogenous capacity for management, training, and research into the impacts of hazardous materials can help Pacific islands direct their own development pathways. Safe management of some hazardous wastes, such as the pesticides used for some invasive species management, is part of existing nature conservation efforts.

HOW MUCH HAZARDOUS WASTE IS IN THE PACIFIC ISLANDS REGION?

Plastics are increasingly common throughout the region. With common backyard burning, landfill fires, or incineration at inadequate temperatures, burning plastics release persistent organic pollutants that affect air quality and health throughout the Pacific islands.

According to a regional baseline assessment of healthcare waste in 14 Pacific island countries completed during the PacWaste Project, the indicative average hazardous healthcare waste generation rate is approximately 0.8 kg per occupied bed (ENVIRON Australia 2014 in *CP2025*). Under the COVID-19 pandemic conditions, we can anticipate that the production of infectious hazardous waste has increased, although the waste has not yet been quantified for the region. With the COVID-19 pandemic, healthcare waste has another dimension as a component of household waste with the use of disposable gloves or masks in non-clinical settings, potentially carrying infectious residues for a restricted amount of time.

Household residues of pharmaceutical products are not yet measured in the Pacific islands region nor are they fully considered in this management area. Like some other hazardous wastes, pharmaceutical residues can enter water systems through household drains, with potential downstream impacts; please see Regional Indicators: Freshwater quality and Lagoon water quality.

Asbestos waste is a hazardous waste stream with no economic value. Minimising public exposure to asbestos fibres will entail urgent and environmentally appropriate disposal of stockpiles and stabilisation of asbestos in occupied buildings, where appropriate, prior to its eventual removal and disposal (*CP2025*).

Based on a regional assessment of 13 Pacific island countries completed as part of the PacWaste Project, more than 285,784 square metres and 267 cubic metres of asbestos-containing materials (ACM) were estimated to be distributed across the Pacific in stockpiles, abandoned infrastructure, and occupied buildings as of 2016. Of the total amount, 87 per cent were considered high risk with significant potential for release of asbestos fibres if disturbed and posing a significant health risk to occupants of affected buildings. The high-risk ACM in Nauru accounted for 74 per cent of the total regional ACM.

Other hazardous wastes, from chemicals to used oil and batteries, and more, are not fully quantified across the Pacific islands region. In the first phases of implementation of the *Cleaner Pacific 2025* strategy, ten of the 21 Pacific island countries and territories completed assessments of varying geographic scope and data coverage targeting solid waste, but not hazardous wastes (SPREP, forthcoming).

PRESSURES AND OPPORTUNITIES

At present, there are no commercial hazardous waste collection services in the Pacific islands region. There is a lack of hazardous waste treatment facilities and a lack of retail take-back systems or periodic drop-off services provided by local authorities. These limitations increase the burden of hazardous waste collection and treatment and increase the likelihood of uncontrolled disposal of hazardous materials that can harm Pacific people and environments.

There is enacted legislation throughout the region for hazardous waste management. However, the implementation of policies, strategies, and plans is often a weak point with progress limited or unreported. Hazardous waste should be included in national disaster waste management plans, many of which need to be strengthened across the Pacific islands region.

As of 2020, no progress had been made towards *CP2025* activity 5.14: 'Implement measures to restrict and regulate importation, handling, storage, and sales of chemicals and hazardous substances' (SPREP, forthcoming). Activity gaps include the construction of national secure storage facilities for chemicals and hazardous waste management. The management of hazardous waste, including development of inventories, requires further effort across the region. Tonga has shown political initiative and set a target of having a national hazardous waste management plan by 2019 but such a plan has not yet been finalised.

Many wastes require treatment or disposal outside of the country or region. The Moana Taka Partnership is exploring options for a regional insurance arrangement for the transboundary movement of hazardous waste, under the Waigani and Basel Conventions (SPREP, forthcoming).

Maintenance of incinerators has been a technical challenge to the safe treatment of hazardous waste, particularly healthcare waste. Improperly functioning incinerators can actually increase the unintentional release of persistent organic pollutants and other hazardous materials if the wastes are burned incompletely or at an insufficient temperature.

Globally, e-waste is the fastest-growing waste stream. E-waste may contain a range of hazardous substances including heavy metals (such as mercury, cadmium, and lead), flame retardants, and other substances, which may pose significant environmental and human health risks if released to soil, water, and air through inappropriate practices such as burning and dumping. Baseline e-waste assessments in nine Pacific island countries were completed in 2013 and 2014 (Leney 2013, 2014 in *CP2025*) and support was provided to nine countries under the PacWaste Project between 2013 and 2017.

Mercury can travel long distances, making international cooperation essential to reduce the global and local impacts of mercury pollution. The Minamata Convention on Mercury entered into force in 2017 to protect human health and the environment from the adverse effects of mercury. To date, six Pacific island countries are Party to the Minamata Convention. Samoa and Papua New Guinea have completed their Minamata initial assessments, and another eight Pacific island countries are undertaking initial assessments to be completed by 2021 supported by SPREP and UNEP. For more about Pacific reporting to multilateral environment agreements, see Regional Indicator: MEA reporting requirements. There is a lack of data on mercury emissions in Pacific island countries and territories. However, in 2010, the average emission of mercury to air from all of Oceania (including Australia, New Zealand) was estimated at 22.3 tonnes or 1.1 per cent of the global emissions (UNEP 2013 in *CP2025*). Pacific islanders already have relatively high body loads of mercury, potentially linked with tuna consumption (Bell 2017).

Potential sources of mercury include artisanal and small-scale gold mining, batteries, paints, electrical and electronic equipment, thermometers, blood-pressure gauges, fluorescent and energy-saving lamps, pesticides, fungicides, medicines, and cosmetics. The mercury contained in these products is mobilised if the waste is burnt without proper controls (thus releasing mercury into the air) or sent to dumps and improperly managed landfills where the mercury can leach into soil and water (UNEP 2013 in *CP2025*). It is not clear if all the Pacific islands currently segregate discarded medical devices containing mercury.

In 2016, training, technical advice, and support were delivered to Fiji, Kiribati, PNG, RMI, Solomon Islands, and Tuvalu as well as to New Caledonia and Wallis et Futuna, to support collaboration under the Waigani and Basel Conventions and achieve smooth and efficient transboundary movement of hazardous waste. Training in solid and hazardous waste management including landfill management and waste management techniques was delivered by Griffith University and Fiji National University in 2016 through the GEFPAS UPOPs project (SPREP, forthcoming).

The PacWaste Plus project is designing hazardous waste management activities for implementation in 2021. The GEF ISLANDS project, beginning in 2021, is also targeting hazardous wastes. SPREP is actively working with five countries to update their national implementation plans for the Stockholm Convention on POPs.

Ship wrecks, Honiara, Solomon Islands © Stuart Chape

REGIONAL RESPONSE RECOMMENDATIONS

The regionally adopted *Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025* and its 2020 mid-term review (SPREP, forthcoming) set out national and regional recommendations, including for countries to:

- Separate hazardous wastes from the general waste stream and recyclable materials;
- Develop regular, consistent monitoring and reporting at regional and national levels for hazardous waste management activities, waste generation, and the receiving environment;
- Develop and update national and regional inventories of hazardous substances and hazardous waste;
- Implement national measures to restrict and regulate importation, handling, storage, and sales of chemicals and hazardous substances;
- Construct national secure storage facilities for chemicals and hazardous waste management, with environmentally sound operation;
- Support regional and national training and capacity development for management of priority hazardous wastes (e.g. ozone-depleting substances, mercury, used oil, biosecurity waste, and disaster waste management, including compliance monitoring, enforcement, and prosecution);
- Develop waste management equipment and maintenance capacity within Pacific island countries and territories;
- Improve national waste management infrastructure and services, incorporating sustainable financing measures; and
- Partner for informed and effective hazardous waste management, including partnerships with customs officials and local industry.

INDICATOR IN ACTION SDGs 3.9, 6.3, 12.4 • BRS Conventions • Minamata Convention • Waigani Convention • SAMOA Pathway • Regional Environment Objectives 3.1, 3.2, 3.3, 3.4 • Pacific Islands Framework for Nature Conservation Objective 5

FOR MORE INFORMATION

This indicator was developed with the assistance of Joshua Sam, Hazardous Waste Management Advisor at the Secretariat of the Pacific Regional Environment Programme. Contact sprep@sprep.org for assistance with hazardous waste management.

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SPREP PROE

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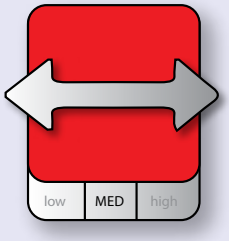
pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal.
pipap.sprep.org

THEME **Built Environment**

INDICATOR **Access to and quality of sewage treatment**

DEFINITION	% of households connected to central sewerage system
PURPOSE	Tracks progress in managing sewage in a way that minimises the risk of water contamination. Untreated sewage and leaking septic systems are a major source of ground and surface water contamination
DESIRED OUTCOME	Positive trend in % of households connected to central sewerage system



Status
Poor

Trend
Stable

Data confidence
Medium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PRESENT STATUS

The Pacific islands region is the least urbanised region in the world, and for the region's vast rural populations sanitation is primarily managed at the household, village, or island level. Central sewerage systems are generally only available in urban centres and therefore less relevant for the majority of Pacific people. According to Anderson et al. (2019 and references therein), the share of Pacific people living in urban settings varies widely from 13% to 100% by country but on average over 81% of the population lives in rural areas, with reduced access to water, sanitation, and hygiene (WASH) services, and the "economic losses associated with the lack of WASH services represent 1.6% of the region's GDP".

Sewage treatment is an environmental issue as well as a human health issue. Ecosystems can help support safe sewage treatment for healthy people, and ecosystems can suffer from poor sewage treatment and disposal.

The 2030 Agenda for Sustainable Development includes a goal (SDG 6) and targets for universal access to safe and affordable drinking-water, adequate and equitable sanitation and hygiene for all, ending open defecation, and reducing the discharge of untreated wastewater to the environment. SDG 6 is widely recognised as an enabling goal, critical to the achievement of many other SDGs. Data provided by Pacific island countries through the WHO/UNICEF Joint Monitoring Programme (JMP[1]) estimates that approximately 70% of Pacific islanders live without access to basic sanitation, the highest proportion of any JMP subregion, and that approximately 1.3 million Pacific islanders rely on the bush or the beach for their toilet.

[1] World Health Organization & United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP): https://washdata.org/

CRITICAL CONNECTIONS

Safe and efficient sewage management provides cross-cutting benefits to people and nature.

Our waste can pollute our water, from our streams and drinking water sources to our lagoons and ocean. Water resource management and sanitation infrastructure are intertwined, especially in islands with a short interface between sanitation and freshwater drinking water supply.

Managing wastewater helps Pacific islands manage their impact on their own water resources. In this effort, nature is on our side. Pacific ecosystems, particularly native forests and wetlands, provide clean fresh water. In contrast, Pacific waterways and fisheries change and, in some cases, suffer due to the excess nutrients and pollutants from wastewater.

The resilience of Pacific wastewater infrastructure to the impacts of climate change and extreme events is a priority. Conversely, safe wastewater management is a component of increasing the resilience of Pacific ecosystems through the protective benefits of reduced pollution and healthier Pacific people.

Used water, both 'grey' and 'black' wastewater, can contain plastics, pharmaceutical residues, heavy metals, and potential endocrine-disrupting chemicals that affect humans and wildlife. The level of impacts of these 'secondary residues' in the Pacific region is unknown.

Tourism relies on clean, healthy environments but places an extra wastewater burden on Pacific islands, especially in fragile nearshore environments. In cases like Muri Lagoon in the Cook Islands, mitigation of wastewater impacts became a national priority to save the lagoon, associated reef fisheries, and tourism.

Sewage management supports the health and dignity of Pacific people, equipping them to live in greater harmony with nature.

TABLE 31.1: Share of the Pacific islands population (%) served by sanitation facility types and sewage treatment, 2017

	SEWER	SEPTIC TANK	IMPROVED LATRINE AND OTHER	SEWAGE TREATED
Total	8.3	14.2	11.7	4.2
Urban	28.3	39.8	11.9	14.5
Rural	2.3	6.5	11.0	1.1

Note that the facility type sewer refers to sewer connections only and does not consider the level of treatment. Of the sewage that was collected and treated, about 88% was treated to primary standards and 65% to secondary standards as of 2013 (the most recent year with data).

Source: JMP washdata.org for households (May 2020); for more information, see *Cleaner Pacific 2025*

Complete and/or recent data are not available for all Pacific island countries and territories (Table 31.1; see Table 13 in SPREP 2016). The Pacific Water and Wastewater Association (PWWA) benchmarking process provides the most accurate and comprehensive regional summary of connections to centralised sewerage systems, with 17 of PWWA's utility members regularly reporting on sewerage system coverage in countries' larger urban areas. The JMP also reports national and regional data on access to various sanitation services, including connections to centralised services.

When considering this indicator, it is important to note that the share of households connected to a central sewerage system does not consider the quality of treatment nor the appropriateness of disposal of the collected wastewater and sewage sludge. For three major considerations—the risk to human health, the level of nutrients entering the environment, and the management of non-biodegradable wastes such as plastics—the level of treatment and the nature of disposal or reuse of wastewater has significant bearing. Untreated waste bears the greatest risk. Open defecation is practiced widely within the Pacific region, particularly in remote rural communities and atolls with limited freshwater sources. Disease vectors, including those linked to streams, groundwater, and coastal waters, mean that the proportion of people affected by the practice of open defecation is far greater than the share of people actively practicing open defecation.

The regionally endorsed *Cleaner Pacific 2025* strategy (SPREP 2016) did not set a target for wastewater treatment but called for a regional assessment by 2020. Regional strategic frameworks regarding wastewater management are more than ten years old and in need of an update. Wastewater management remains a relatively minor consideration in development support to the region, with only a small number of active projects containing wastewater-management components. In many cases, efforts to support human health and water security (including the protection of potable groundwater) are the primary drivers for better sewage management.

In November 2019, the Pacific Community (SPC) convened a Pacific High-Level Dialogue on Water and Sanitation that identified that more needs to be done to improve the rate, reach, and effectiveness of action to meet the region's commitment to safe and resilient water and sanitation for all by 2030. The Dialogue produced a Call to Action that called on Pacific island governments and partners to commit to prioritise water and sanitation investments and take a range of urgent actions to address the region's persistently low levels of access to safe water and sanitation facilities.

COHERENT REPORTING WITH SDG 6.3

The proportion of households connected to a central sewerage system is only relevant to a relatively small part of the Pacific population and therefore represents only part of the wastewater management picture in the Pacific (SPC 2019). Assessing the fate of all human wastewater, including in rural areas without centralised treatment infrastructure, is arguably more meaningful for the health of Pacific people and environments.

SDG target 6.3 aims to improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing wastewater recycling and safe reuse globally. In supporting this target, SDG indicator 6.3.1 tracks the proportion of wastewater flows from households, services, and industrial premises that is safely treated. SDG 6.3.1 is one of the 132 Headline Indicators selected by the Pacific SDG Taskforce as part of the Pacific Roadmap for Sustainable Development. The indicator refers to the percentage of discharge that is treated in compliance with national or local standards, either for level of treatment, quality of effluent, or impact on receiving waters.

The Pacific is just making a start in reporting on this important indicator, with data for only three countries represented in the latest JMP report (with estimates from Palau, Tuvalu, and Samoa that approximately half of all wastewater is safely treated), and more is needed to support countries to collect and compile the data needed to track progress and inform decision making and investment.

For future State of Environment and Conservation reporting, Pacific countries could consider which of these wastewater indicators best supports their information needs: the Pacific Headline Indicator of SDG 6.3.1 or the present regional indicator of the share of households connected to a central sewage system.

For more information, see https://www.sdg6monitoring.org/ The global custodians of SDG 6.3.1 are WHO, UN Habitat, and UNSD. UN Water has prepared a guidance note with methodology for SDG 6.3.1; see https://www.unwater.org/publications/progress-on-wastewater-treatment-631/

PRESSURES AND OPPORTUNITIES

Although sanitation statistics are often managed within the health sector, we focus here on the environment and ecosystem relationships with the management of sewage wastewater, which includes human wastes and non-biodegradable sanitation by-products such as plastic in personal care products and plastic-based hygiene products.

Inadequate management of wastes and activities that contribute to pollution threaten the health of Pacific communities and degrade natural ecosystems, reducing their resilience to climate change. The economic development of many Pacific island countries can also be adversely affected by the impacts of poor waste and pollution management because their economic bases (tourism, fishing, and agriculture) are heavily reliant on healthy environments and because the geological conditions in many islands make freshwater sources vulnerable to pollution.

From an environmental management perspective, there is a desire to assess the receiving environments such as the water quality in areas surrounding wastewater release, treatment, or disposal sites. However, the first step in many locations will be to collect and treat human waste at all, coordinating among the diverse sectors in charge which vary from health to urban planning divisions. A simple, consistently applied standard for the wastewater itself would have flow-on benefits for the receiving environment.

In practical terms, regulating the distance of wastewater sites from streams, drinking groundwater, or coastlines can be a first step in protecting Pacific people and ecosystems. The required distances might vary among areas depending on the local soil and volume of output.

With its high nutrient levels and the potential for high concentration due to centralised collection, wastewater has profound impacts on Pacific environments. Many of the secondary impacts of sewage on Pacific species and ecosystems are unknown, particularly with regard to new pollutants such as microplastics and pharmaceuticals. Wastewater treatment does not target pharmaceutical pollutants or microplastics, which can build up in sewage sludge and in receiving environments (Murdoch 2015, Ferreira et al. 2020). The levels of pharmaceutical pollution and potential impacts remain nearly unknown in Pacific islands. For information about identifying and monitoring contamination of freshwater and nearshore waters with wastewater, see Regional Indicator: Freshwater quality and Regional Indicator: Lagoon water quality.

Releasing untreated sewage into waterways or directly to the ocean can harm reefs and associated fisheries (for an example from Papua New Guinea, see Ford et al. 2017). Land-based pollution dominates, although shipping, fisheries vessel, and cruise vessel traffic in the region also brings a sewage burden addressed under the MARPOL Convention's Annex IV.

Sanitation and sewage management must consider all members of society, including the needs of women and girls and the significant role that they play in the management of water, sanitation, and hygiene. Safe and shame-free disposal of single-use hygiene products, such as menstrual products, disposable nappies/diapers, and wipes, is an essential component of sanitation management and the prevention of plastic pollution. Access to sustainable hygiene options combined with support for appropriate disposal according to product type can reduce the maintenance and repair costs of waste-treatment facilities, protect Pacific environments, and maintain the health and dignity of Pacific women, girls, and young children.

Access to sanitary systems and location of sewage treatment must consider the needs of growing Pacific societies and the environment. Rapid urbanisation is putting pressure on governments and utilities to keep up with sanitation needs. People in informal urban settlements are often at greatest risk from unmanaged sewage and simultaneously of causing harm to local environments.

INVESTING IN WASTEWATER MANAGEMENT FOR RESILIENCE

Connection to a centralised sewerage system rarely if ever eliminates the impact of wastewater pollution and in some cases can intensify impacts on the environment. In recognition of these risks, SDG 6.3 also refers to illegal or uncontrolled dumping of wastewater, including uncontrolled discharges and overflows from centralised sewerage systems. In recent years, uncontrolled sewage discharges have impacted coastal waters across the Pacific.

Across the region, the relatively high rainfall intensities experienced in many of our urban centres contribute to frequent and often significant overflows of untreated effluent from centralised sewerage systems to urban streams and coastal waters. In 2015, a broken pipe saw millions of litres of untreated sewage enter Suva's Samabula River and render large areas of the city's coastal waters unsuitable for fishing or swimming for several weeks.

To minimise the risk of future discharges, Fiji is undertaking an Urban Water Supply and Wastewater Management Project designed to augment vital urban infrastructure and services in the Greater Suva Area by increasing water-supply capacity by 26% and wastewater-treatment capacity by 164%. As part of the project, a new 40 mega-litre treatment plant will be constructed in Viria, Rewa by 2025. Blended funding provided by the Asian Development Bank, European Investment Bank, the Green Climate Fund, and local sources made this project possible.

In 2020, sewage wastewater was shown to contribute to microplastic loads in sediments near Suva (Ferreira et al. 2020). Continued support is needed to manage emerging impacts of human wastewater.

Source: Government of Fiji 2019–2020 Budget Estimate, Green Climate Fund Project FP008

Disaster waste management is increasingly essential for changing Pacific islands. Low-lying islands with limited land have reduced capacity to store waste, including untreated sewage. The limited and fragile nature of freshwater resources on many Pacific islands also increases vulnerability to sewage contamination. Reducing the potable water requirements for sewage treatment and reducing the hazards from poorly managed sewage provides financial benefits and greater safety for people and ecosystems, even during disasters.

For central sewerage systems and septic tanks in both urban and rural areas, the safe disposal of the resulting sludge is a priority that can have environmental and economic impacts or benefits depending on how the sludge is managed. Although data on sludge management are limited in the Pacific region, composting and sustainable reuse is not widespread, and in many cases, sludge is either not appropriately collected or is disposed of in a manner that impacts fresh and/or coastal waters. Greater support is required for national agencies to better monitor and report on the management of sludge wastes.

Systematic support for Pacific island countries and territories to manage wastewater would benefit Pacific people and environments. Safe sewage management affects health of people and wildlife not only through the reduced spread of pollutants but also through reductions of disease vectors and enabling conditions.

In 2016, the estimated infrastructure cost to achieve universal adequate sanitation was USD 80 million per year, representing 0.33% of the combined GDP of the Pacific region (WHO 2016).

Pacific leaders have introduced several waste-reducing policies and legislation to curb the import, production, and uncontrolled release of waste (see Regional indicator: Household waste capture rate). Present in personal care products, plastics including microbeads can be part of the sewage waste stream, and Pacific islands are engaging with plastic and microplastic management (see Regional Indicator: Marine plastic pollution).

REGIONAL RESPONSE RECOMMENDATIONS

Cleaner Pacific 2025 sets out national and regional recommendations for waste management. Building on these recommendations to address the specific challenges to wastewater management, Pacific islands should:

build comprehensive regional understanding of the status of liquid waste management and receiving water quality in the Pacific region, including a regional collation of existing national wastewater treatment standards;

- implement integrated, cost-effective, technically appropriate, and culturally acceptable practices and technologies that minimise and manage wastewater pollution from various sources (such as domestic sewage, industrial sewage, animal waste, and sludge or landfill leachate);
- develop climate-resilient wastewater infrastructure, particularly that which can cope with the expected increase in frequency and severity of tropical cyclones and associated flooding and landslides;
- develop effective monitoring programmes, including data-sharing among the many sectors involved and the use of monitoring results to inform appropriate interventions;
- develop institutional and human capacity to implement pollution-reduction programmes and monitoring programmes, including support for communities for evidence-based decision-making;
- adopt national policies that reduce pollution from land-based sources;
- raise awareness of the importance of reducing and managing pollution; and
- strengthen partnerships to ensure timely monitoring and progress towards SDG 6.3.1 and the *Pacific Regional Waste and Pollution Management Strategy 2016–2025*.

SANITATION SOLUTIONS APPROPRIATE TO THE PACIFIC

Communities across the Pacific have demonstrated that locally appropriate sanitation solutions can contribute significantly to water savings and to the reduction of pollution impacts on drinking water supply. The implementation of "eco-sanitation", or composting toilets, in atoll nations such as Tuvalu and Kiribati has demonstrated significant reductions in sewage pollution to groundwater and coastal waters, reduction in the use of fresh water for toilet flushing, and the generation of valuable organic matter on islands devoid of agriculturally productive soils.

Work supported by SPC has demonstrated that households that adopt this innovative waterless solution can eliminate their sewage load to groundwater and reduce their use of fresh water by approximately 30%—equivalent to approximately eight to ten 10,000 litre rainwater tanks per household per year.

Although challenges remain in the wider adoption and acceptance of this approach across the Pacific, the social and design lessons learnt through the application of eco-sanitation in atoll countries such as Tuvalu has enabled the technology to become an important component of atoll nations' responses to climate change. Through its on-ground experience, Tuvalu is now a source of regional expertise on eco-sanitation and in the Pacific way has been active in sharing its findings with other atoll countries struggling with the pollution impacts and water demand associated with flush toilets.

Source: The Pacific Community (SPC)

New septic tank models built locally to replace aging spetic systems in Niue. © P Skelton

INDICATOR IN ACTION

SDGs 6.3.1, 6.2, 6.3, 6.a, 3.9, 12.4 • Basel (Art. 4 obligations 2c) • MARPOL Annex IV • SAMOA Pathway Outcome 58d, 64-65 • Noumea Convention (article 7) • Framework for Resilient Development in the Pacific • Pacific Regional Environment Objectives 2.1, 3.1, 3.2, 3.4 • Pacific Islands Framework for Nature Conservation Objectives 2 & 5

FOR MORE INFORMATION

This indicator was developed with the assistance of the Pacific Community (SPC). For more information about the SPC Water and Sanitation Programme, please see https://gem.spc.int/key-work/DCRP

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