Climate Change Management

Walter Leal Filho *Editor*

Managing Climate Change Adaptation in the Pacific Region

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Climate Change Management

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Climate Change Adaptation in the Agriculture and Land Use Sectors: A Review of Nationally Determined Contributions (NDCs) in Pacific Small Island Developing States (SIDS)

Krystal Crumpler and Martial Bernoux

Abstract Climate change is already altering the natural resource base upon which global food security and nutrition depend, with disproportionate impacts on rural and coastal communities in Small Island Developing States (SIDS) (IPCC in An IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate. IPCC, 2018). The agriculture and land use sectors (crops, livestock, forestry, fisheries and aquaculture) lie at the heart of the global response to climate change, with the unique capacity to protect ecosystem integrity and promote the livelihoods and resilience of the poor and vulnerable (FAO in State of food and agriculture: climate change, agriculture and food security. FAO, Rome, 2016a). The Food and Agriculture Organization (FAO) of the United Nations (UN) has developed a methodology (Crumpler et al. in Working paper no. 76, FAO, Rome, 2019) and analysis of the role of the agriculture and land use sectors in the climate change adaptation components set forth in the Nationally Determined Contributions (NDCs) of Pacific SIDS under the Paris Agreement (FAO in regional analysis of the Nationally Determined Contributions in the Pacific: gaps and opportunities in the agriculture and land use sectors. FAO, Rome, 2020). The analysis aims to provide a synthesis of the extent to which countries in the Pacific region include agriculture and land use in their adaptation components, as well as identify "gaps" and "opportunities" for enhancing adaptation ambitions by addressing the major climate-related impacts, hazards and vulnerabilities reported in ecosystems and social systems. Overall, around 90% of Pacific SIDS identify adaptation measures in ocean and coastal zone ecosystems and agroecosystems, with mangrove conservation and replanting and water storage and harvesting amongst the most frequently prioritized adaptation options. Adverse health, loss of productive infrastructure and assets, and food insecurity and malnutrition constitute the greatest climate-related risks in social systems reported. Over

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two-thirds of countries promote health information and services as a cross-cutting adaptation priority, and half prioritize resilient infrastructure. However, high adaptation policy coverage gaps emerge around climate-related losses in ecosystem service provision, particularly biological control, soil erosion control, moderation of extreme events and the maintenance of genetic diversity and abundance. In social systems, high policy coverage gaps are found around climate-related migration and displacement. The analysis aims to inform 2020 NDC revision processes, as well as guide country support and investment options in the region.

Keywords Climate change · Adaptation · Mitigation · Agriculture · Land use · Nationally determined contributions · NDC · Pacific · SIDS

Introduction

Climate change and variability are already altering the natural resource base on which food and agriculture systems rely, with disproportionately higher risk of adverse impacts on the world's most vulnerable and food insecure (IPCC 2014). Some of the worst impacts on sustainable development are expected to be felt among agricultural and coastal livelihoods in Small Island Developing States (SIDS), where both natural and human systems face hard limits to adaptation (IPCC 2018). The main climate- and ocean-related drivers of change in small islands include variations in air and ocean temperatures, ocean chemistry, rainfall patterns, wind strength and direction and sea levels; as well as climate extremes including tropical cyclones, drought and storm swell events (IPCC 2014). All pose cascading risks to ecosystems and people through an expected increase in the price of food, income and asset loss, foregone livelihood opportunities, adverse health impacts and population displacements (IPCC 2014). Overall, climate change disproportionately impacts the poor and vulnerable, due to higher levels of exposure to risk and lower coping capacities, with an additional 100 million people expected to fall into extreme poverty by 2030 (Hallegatte et al. 2016). At the household level, women and children may bear more of the burden of climate-related shocks and stresses on health, education and paid work, with intergenerational impacts on nutrition and poverty outcomes (FAO 2018).

Climate-related impacts on human systems and ecosystem services are already being observed in the Pacific (IPCC 2019a). It is expected that global warming will result in the irreversible loss of marine and coastal ecosystems and reduce the productivity of fisheries and aquaculture through shifts in distribution and abundance of species, with grave consequences on the income, livelihoods and food security and nutrition of marine resource-dependent communities in the region (Hanich et al. 2018; IPCC 2019a). The decline in warm water coral reefs is projected to greatly compromise the services they provide to communities, including food provision, coastal protection and tourism in small islands (IPCC 2019a). At the global scale, the biomass of marine animals across the food web is projected to decrease by up 15% and the maximum catch potential of fisheries by 24% under high emission

scenarios by the end of the 21st century (IPCC 2019a). Maximum catch potential was projected to decrease by up to 50% in the Pacific, with largest impacts in the western Pacific warm pool (Asch et al. 2018). When combined with increasing aridity and a decrease in freshwater availability, sea level rise will likely leave several atoll islands uninhabitable (IPCC 2018). The Pacific islands are confronted with the highest disaster risk globally in terms of per capita loss, and due to data gaps, is likely underestimated (Edmonds and Noy 2018). There is overall high confidence that a slower rate of climate-related ocean and land change associated with more ambitious mitigation action globally would provide greater adaptation opportunities (IPCC 2019b), with particular relevance to those communities and ecosystems in small islands in the Pacific where the biophysical limits to adaptation, characterized by high levels of exposure to current and future hazards, are compounded by financial, technological, institutional and other barriers.

The adoption of the Paris Agreement in 2015 constitutes a landmark achievement in the global response to climate change, when developed and developing countries alike committed to do their part in the transition to a low-emission and climate-resilient future. The Agreement seeks to limit global warming to below a 2 °C rise above pre-industrial levels and pursue efforts to stay within 1.5 °C, as well as sets a global goal on adaptation within the context of sustainable development. The Alliance of Small Island States (AOSIS), in particular, successfully advocated for the role of adaptation in the Paris Agreement as a key factor in the global response to climate change. Underpinning the Agreement are the (Intended) Nationally Determined Contributions, (I)NDCs, which for the purpose of this document are referred to as NDCs thereafter. NDCs represent the main national policy framework, under the United Nations Framework Convention on Climate Change (UNFCCC), by which Parties communicate their commitment to reducing national greenhouse gas emissions (GHG) and adapting to the impacts of climate change, based on national priorities, circumstances and capabilities (Article 4).

The success of the Paris Agreement rests upon the enhanced ambition of Parties to progressively revise and strengthen their respective mitigation and adaptation plans over time (Article 4.2). In 2023, and every five years thereafter, Parties will periodically take stock of the implementation of the Agreement to assess the collective progress towards achieving its purpose and long-term goals (Article 14). The outcome of the "Global Stocktake" will inform Parties in updating and enhancing, in a nationally determined manner, their actions and support in accordance with the relevant provisions of this Agreement, as well as in enhancing international cooperation for climate action. The tracking of NDC implementation will take place under the Enhanced Transparency Framework (Article 13), which provides a foundation for building mutual trust and confidence. The "Paris Rulebook" requires Parties to report reliable, transparent and comprehensive information on GHG emissions, climate actions and support, with built-in flexibility for developing countries under the principle of common but differentiated responsibilities and respective capabilities (Article 13).

The agriculture and land use sectors (crops, livestock, fisheries and aquaculture, and forestry) feature prominently in the NDCs, with up to 97 and 89% of developing

countries prioritizing climate change adaptation and mitigation, respectively, in one or more agricultural sub-sectors (FAO 2016b). The main objective of this paper is to provide a sector-specific synthesis of the climate change adaptation priorities set forth in the NDCs of countries in the Pacific and to identify opportunities for governments to strengthen adaptation ambitions, capture mitigation co-benefits and accelerate progress on the sustainable development agenda. Furthermore, a better understanding of national adaptation priorities, barriers to implementation and support needs in the agriculture and land use sectors can inform targeted programming and investments in the region. This analysis is directed at national policy makers and practitioners in the region with a stake in ensuring that future adaptation policies and programmes are clear, measurable, transparent and ambitious. It also aims to guide international development and civil society organizations, committed to providing the country support required for scaling up climate action in the agriculture and land use sectors and co-delivering on the 2030 Agenda for Sustainable Development and Sendai Framework for Disaster Risk Reduction.

Methodology

The NDCs are the product of diverse national priorities, capacities and processes, meaning that they vary greatly in terms of style, format, scale and level of detail. A common framework was developed to facilitate the synthesis and analysis of the NDCs in the agriculture and land use sectors. The framework provides a structure for assessing the clarity, measurability, transparency and ambition of NDCs over time. Each NDC was analyzed in full within the bounds of this common framework. The framework was based on a stocktaking of 184 NDCs to quantify and qualify the types of climate change mitigation and adaptation contributions in the agriculture and land use sectors by means of a common set of categories and sub-categories. The full methodological notes are contained in Crumpler et al. (2019). In order to fill the information gap whereby some countries opted to make reference to existing national climate change plans and vulnerability analyses, a review of National Communications (NCs) and National Greenhouse Gas Inventories (NGHGIs) was carried out to supplement the information contained in the NDCs. This paper is based on the information reported in the most recently submitted NDCs, NCs and Technical Needs Assessments (TNA) of non-Annex I Parties in the Pacific to the UNFCCC as of 1 August 2019. Table 1 contains a list of the documents analyzed, which are all publicly available on the UNFCCC website (www.unfccc.int).

For this analysis, the Pacific refers to 14 independent countries, in three geographic areas in Oceania: Melanesia (Fiji, Papua New Guinea, Solomon Islands and Vanuatu), Micronesia (Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Palau) and Polynesia (Cook Islands, Niue, Samoa, Tonga and Tuvalu) (UNSD n.d.). All 14 countries are SIDS and four (Solomon Islands, Vanuatu, Kiribati and Tuvalu) are Least Developed Countries (LDC). The assignment of countries or areas

Table 1 Source of national data for analysis

Country name	NDC	NC	TNA
Fiji	2016	2014	
Papua New Guinea	2016	2014	
Solomon Islands	2016	2017	
Vanuatu	2016	2014	
Kiribati	2016	2013	
Marshall Islands	2016	2015	
Micronesia (federated states of)	2016	2015	
Nauru	2016	2014	
Palau	2016	2002	
Cook Islands	2016	2011	
Niue	2016	2014	2003
Samoa	2016	2010	
Tonga	2016	2012	
Tuvalu	2016	2015	

to specific groupings is for statistical convenience and does not imply any assumption regarding political or other affiliation of countries or territories by the authors.

A systematic analysis of the NDCs presents a number of methodological challenges, owing to their aggregate volume and heterogeneity in terms of content, scope and detail. Due to lack of a standard template for NDC formulation, and capacity constraints, not all information was necessarily made available, nor equal in level of detail. For instance, many countries decided to make reference to their existing national climate change adaptation policies rather than explicitly integrate them into their NDCs. For this reason, the information contained in the NDC is supplemented by information from other sources, including the NCs and TNAs. Nonetheless, the information is not always comparable in absolute terms, constituting a limitation to the methodology presented. It should also be noted that the adaptation policy coverage gap analysis serves as a broad review of the coverage of adaptation priority sectors and measures mentioned by each country in the documents analyzed and does not constitute an assessment of their strength, which could be further analyzed in terms of type (e.g. action, policy, project, programme or framework), scale, comprehensiveness and timeframe. The adaptation policy gap analysis, therefore, serves as an initial stocktaking of policy coverage and does not necessarily indicate policy effectiveness.

Results and Discussion

Climate-Related Hazards, Slow Onset Events and Impacts in Ecosystems

In order to contextualize the adaptation priorities of countries in the region as set forth in the NDCs, we reviewed the types of climate-related impacts, vulnerabilities and risks found in national reports, or NCs, using definitions adapted from the IPCC (2014) and/or EM-DAT (n.d.). Countries often include a description of observed and/or expected climate-related hazards, including hydro-meteorological, climatological and biological processes or phenomenon that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources, along with longer-term chemical, biological, and physical changes, leading to slow onset events. Countries also report climate-related impacts, vulnerability and risk in social systems that are observed or expected in the future, as well as non-climatic environmental, social, economic, cultural, political and institutional variables, or stressors, that can affect individual adaptive capacity to respond, as well as the level of exposure to climate change, creating new or exacerbating existing vulnerabilities to climate change.

All countries in the Pacific report the occurrence of storms amongst observed and/or projected climate-related hazards, followed by drought (93% of countries), floods (64%) and invasion by pests and non-native species in agriculture (29%), amongst others. Salt-water intrusion and water stress are reported most amongst observed and/or projected climate-related slow onset events in terrestrial and freshwater ecosystems (64%, respectively), while sea level rise and coastal erosion are reported most frequently amongst those in marine and coastal ecosystems (100 and 86%, respectively). Figure 1 illustrates the share of countries in the region that report observed and/or projected climate-related slow onset events, by type of risk.

Agro-ecosystems are considered the most vulnerable of ecosystems by all countries, followed by oceans and coastal zones (71%). In particular, marine fisheries and crops are considered the most vulnerable of agricultural sub-sectors to climate change (79 and 64%), followed by livestock (36%) and forestry (29%). Figure 2 illustrates the share of countries in the region that report observed and/or expected climate-related impacts in agro-ecosystems, by sub-sector/land use category.

Overall, genetic resources, primarily in agro-ecosystems, are reported most frequently amongst natural resource impacts (93% of countries), followed by land and soil resources in coastal zone ecosystems (86%) and water resources across all ecosystems (79%). While loss of primary production and productivity are most frequently reported amongst ecosystem service impacts (93% of countries), primarily in the marine fisheries and crops sub-sectors, followed by changes in water availability and quality across all ecosystems and coastal erosion (79%, respectively), as well as biodiversity loss, primarily in ocean and coastal zone ecosystems (57%), amongst

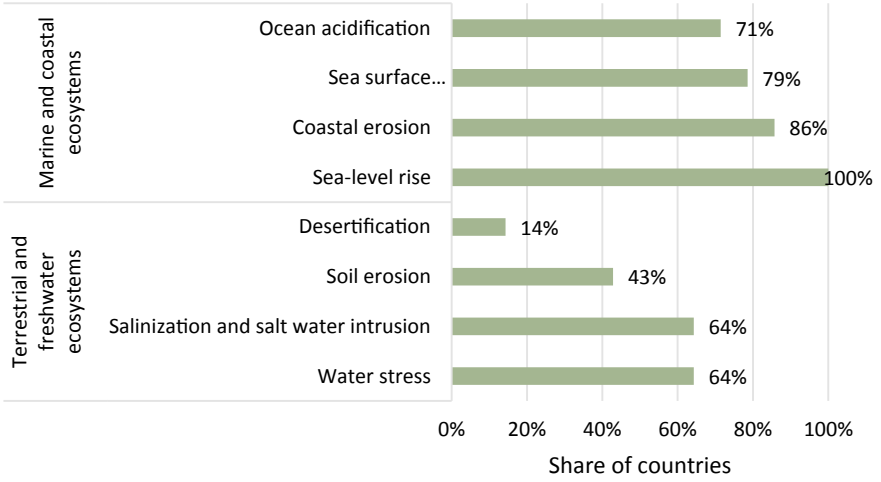

Fig. 1 Observed and/or projected climate-related slow onset events reported in the Pacific, by type (share of countries)

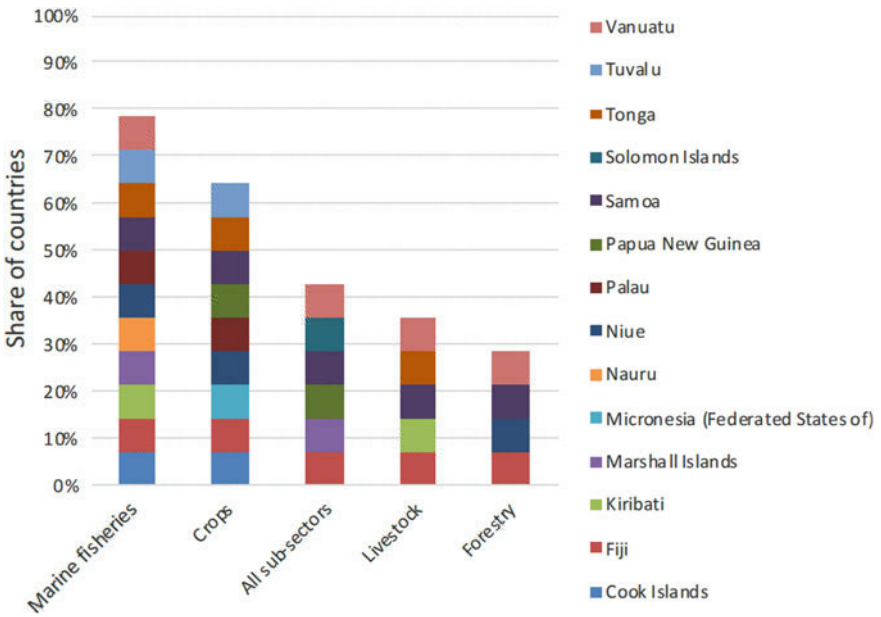

Fig. 2 Observed and/or projected climate-driven impacts in agro-ecosystems reported in the Pacific, by sub-sector/land use category (share of countries)

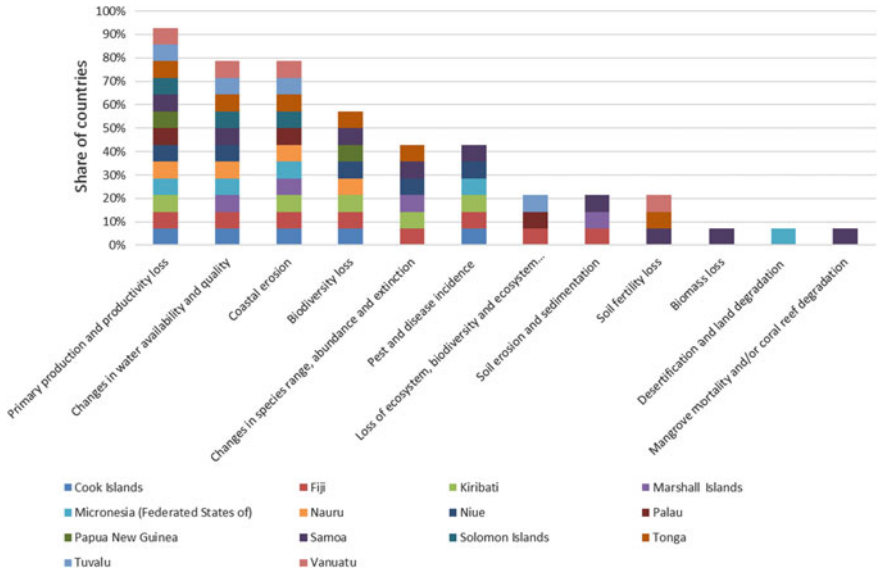

Fig. 3 Observed and/or projected climate-related impacts reported on ecosystem services in the Pacific, by type (share of countries)

others. Figure 3 illustrates the share of countries in the region that report observed and/or projected climate-related impacts in ecosystems, by ecosystem service impact category.

Climate-Related Impacts, Vulnerabilities and Risks in Social Systems

All countries in the region identify at least one observed and/or expected impact, vulnerability and risk induced by climate change in social systems. Overall, the majority of countries report health as social dimension at risk under climate change (93% of countries), followed by loss of productive infrastructure and assets, food insecurity and malnutrition and rural livelihoods and income loss (71% each), migration and displacement (57%) and gender and youth inequality (50%), amongst others. Figure 4 illustrates the share of countries in the region that report observed and/or expected climate-related impact, vulnerability and risk in social systems, by type.

Geography and topography are reported as the largest non-climatic stressors of vulnerability, followed by the economic dependence on agriculture and natural resources (79%), poverty and low levels of development (71%), undermining the adaptive capacity of people to respond to climatic shocks and stresses.

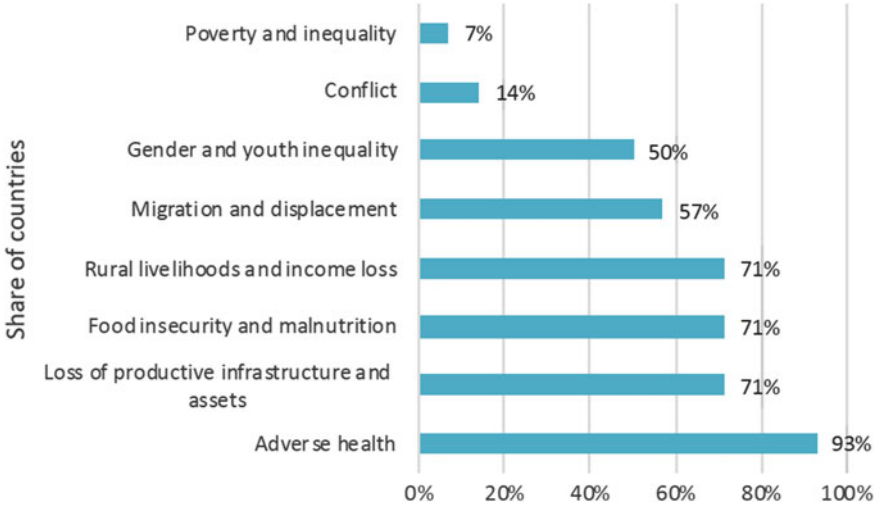

Fig. 4 Observed and/or projected climate-related impacts, vulnerabilities and risks reported in the Pacific, by type (share of countries)

Adaptation Components in Pacific NDCs

Including when a country makes reference to key adaptation plans in their ND, all countries in the Pacific communicated an adaptation component of which include the agriculture and land use sectors. The level of detail included in each country's adaptation component varies, as some countries detailed their adaptation visions, goals and measures, while other countries made reference to national adaptation and climate change plans. For the sake of this analysis, the agricultural adaptation component is differentiated in terms of ecosystems and social systems.

Amongst priority sectors and cross-sectoral priorities for adaptation, all countries identify water resources as a priority, followed by the agriculture sector in general (93% of countries) and oceans and coastal zones (86%), as well as fisheries and aquaculture, biodiversity and forestry (36%, respectively), amongst others. Figure 5 illustrates the types of ecosystem-related adaptation priority sectors and cross-sectoral priorities, by country.

Health represents the greatest cross-cutting adaptation priority in social systems amongst countries in the region (71% of countries), followed by Disaster Risk Reduction (DRR) (64%), food security and nutrition (57%), resilient infrastructure (50%) and gender equality (21%), amongst others. Figure 6 illustrates the types of cross-cutting adaptation priorities in social systems, by country.

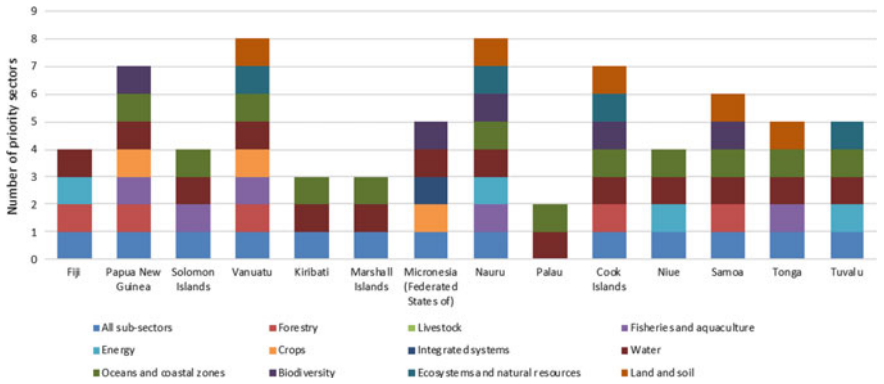

Fig. 5 Adaptation priority sectors and cross-sectoral priorities in ecosystems in the NDCs of Pacific countries

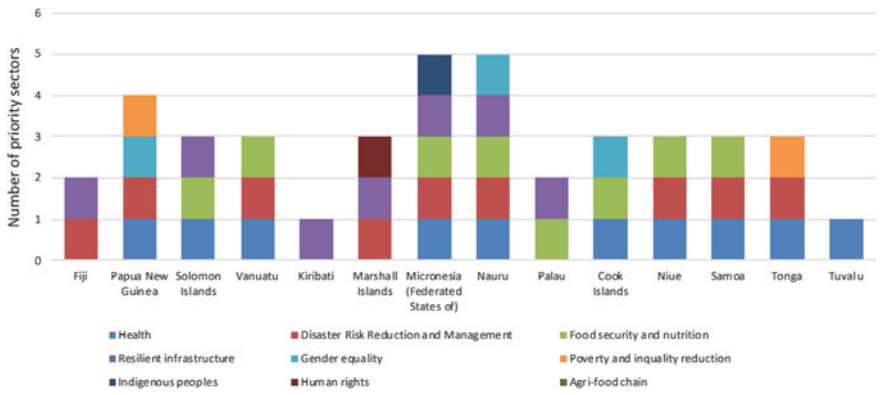

Fig. 6 Cross-cutting adaptation priorities in social systems in the NDCs of Pacific countries

Adaptation Measures in Ecosystems

In addition to prioritized sectors or cross-cutting priorities for adaptation, countries often include a set of policies or measures as part of their adaptation strategy. Overall, the majority of countries include at least one or more adaptation policy or measure in oceans and coastal zones, followed by agro-ecosystems and ecosystems in general.

Ninety-three percent of countries include at least one adaptation policy or measure in ocean and coastal zone ecosystems, of which the majority promote mangrove conservation and replanting (57% of countries), followed by coastal zone management (43%), biodiversity and ecosystem management (21%), flood management and land/soil management, restoration and rehabilitation (14%, respectively), amongst other measures. Figure 7 illustrates the share of countries in the region with one or

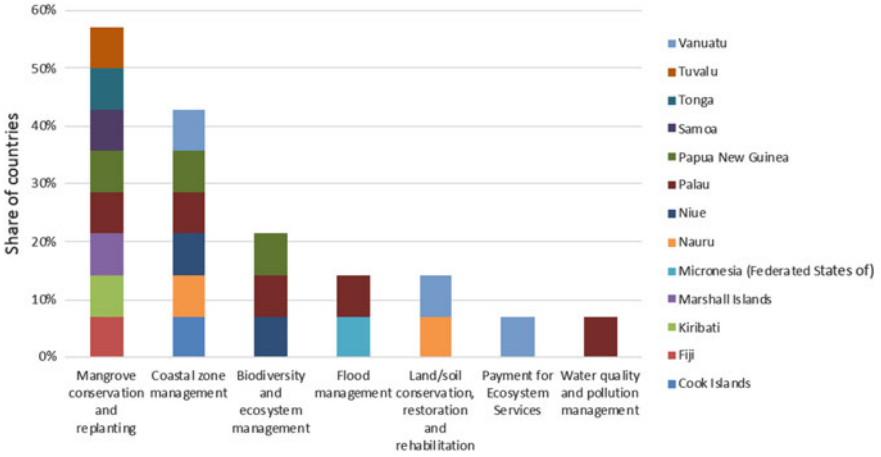

Fig. 7 Adaptation policies and measures in ocean and coastal zone ecosystems in the NDCs of Pacific countries, by type (share of countries)

more (to avoid bias of representation) adaptation policy or measure in ocean and coastal zone ecosystems, by management activity.

Eighty-six percent of countries include at least one adaptation policy or measure in agro-ecosystems. The majority of those countries promote adaptation in marine fisheries and aquaculture (71% of countries), followed by crops and agriculture in general (64%, respectively), forestry (57%), livestock (50%), freshwater aquaculture (14%) and integrated systems (7%). Figure 8 illustrates the share of countries in the

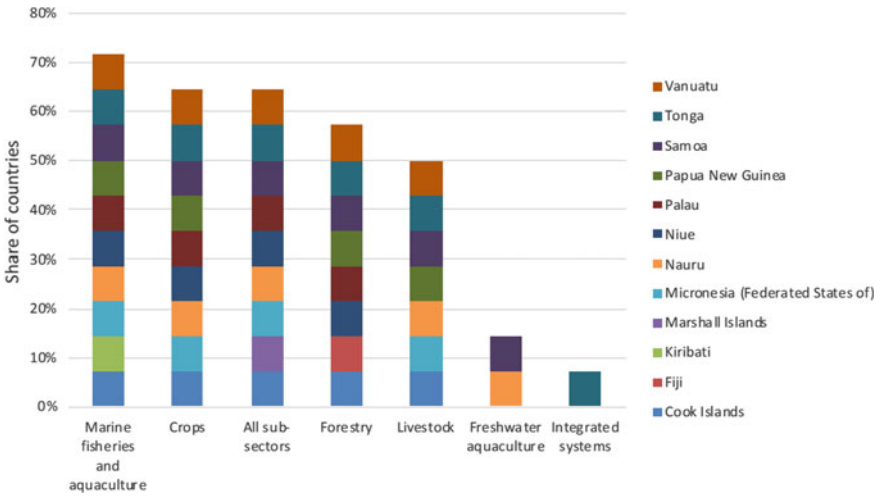

Fig. 8 Adaptation policies and measures in agro-ecosystems in the NDCs of Pacific countries, by sub-sector (share of countries)

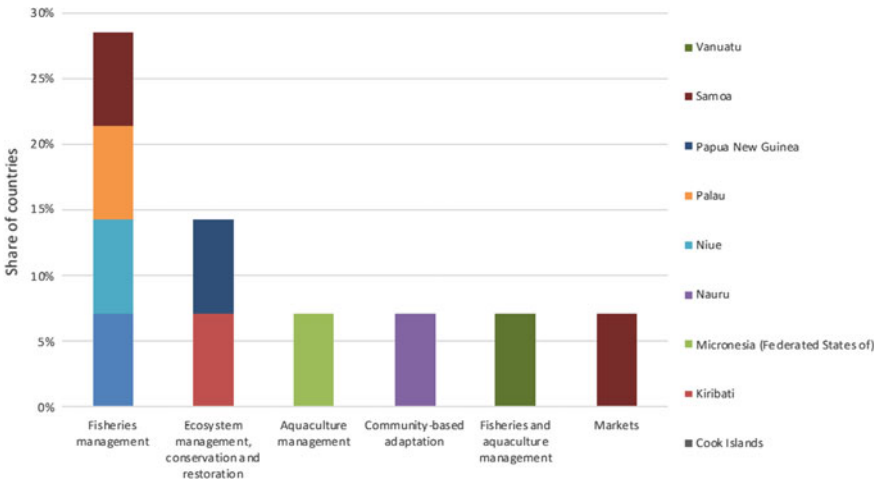

Fig. 9 Adaptation policies and measures in marine fisheries and aquaculture in the NDCs of Pacific countries, by type (share of countries)

region with one or more (to avoid bias of representation) adaptation policy or measure in agro-ecosystems, by sub-sector.

Seventy-one percent of countries include at least one adaptation policy or measure in marine fisheries and aquaculture. The majority of those countries promote fisheries management (29% of countries), followed by ecosystem management, conservation and restoration (14%), and equal shares of aquaculture management, community-based adaptation, market-based measures and fisheries and aquaculture management in general (7% each). Figure 9 illustrates the share of countries in the region with one or more (to avoid bias of representation) adaptation policy or measure in marine fisheries and aquaculture, by management activity.

Sixty-four percent of countries include at least one adaptation policy or measure in the crops sub-sector. The majority of those countries promote plant management (30% of countries), followed by water management and general crop management (22 and 18%, respectively), nutrient and on-farm soil management and pest and disease management (11% each), amongst others. Figure 10 illustrates the share of countries with one or more (to avoid bias of representation) adaptation policy or measure in the crops sub-sector, by management activity.

Fifty-seven percent of countries include at least one adaptation policy or measure in the forestry sub-sector. The majority of those countries promote afforestation/reforestation (36% of countries), followed by reducing deforestation and forest conservation (29%), reducing degradation and sustainable forest management (21%) and water management (7%), amongst others. Figure 11 illustrates the share of countries with one or more (to avoid bias of representation) adaptation policy or measure in the forestry sub-sector, by management activity.

Fifty percent of countries include at least one adaptation policy or measure in the livestock sub-sector. The majority of those countries promote animal breeding and

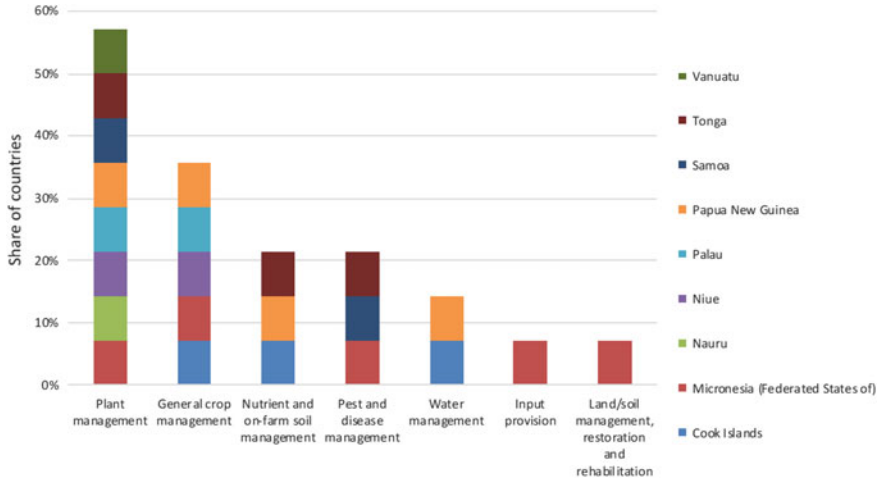

Fig. 10 Adaptation policies and measures in the crops sub-sector in the NDCs of Pacific countries, by type (share of countries)

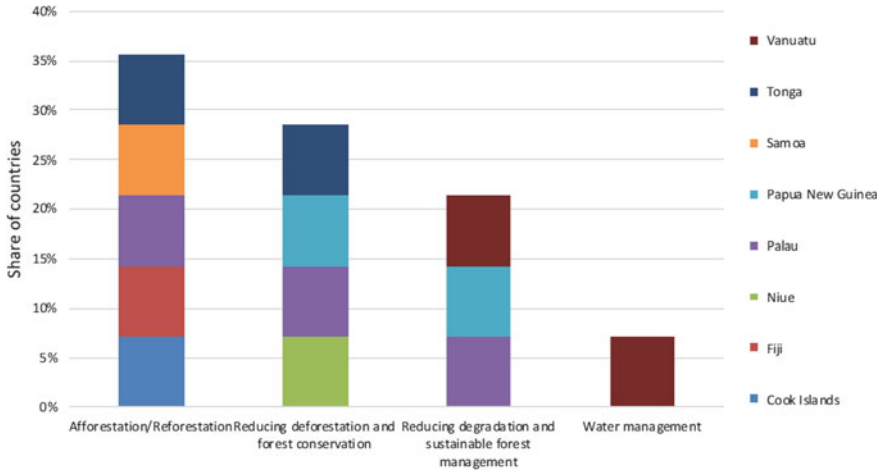

Fig. 11 Adaptation policies and measures in the forestry sub-sector in the NDCs of Pacific countries, by type (share of countries)

husbandry (20% of countries), followed by water and general livestock management (14% each), and manure and grassland management (7% each). Figure 12 illustrates the share of countries with one or more (to avoid bias of representation) adaptation policy or measure in the livestock sub-sector, by management activity.

Only two countries (Nauru and Samoa, 14% of countries) identify at least one adaptation policy or measure in freshwater aquaculture, while only one country

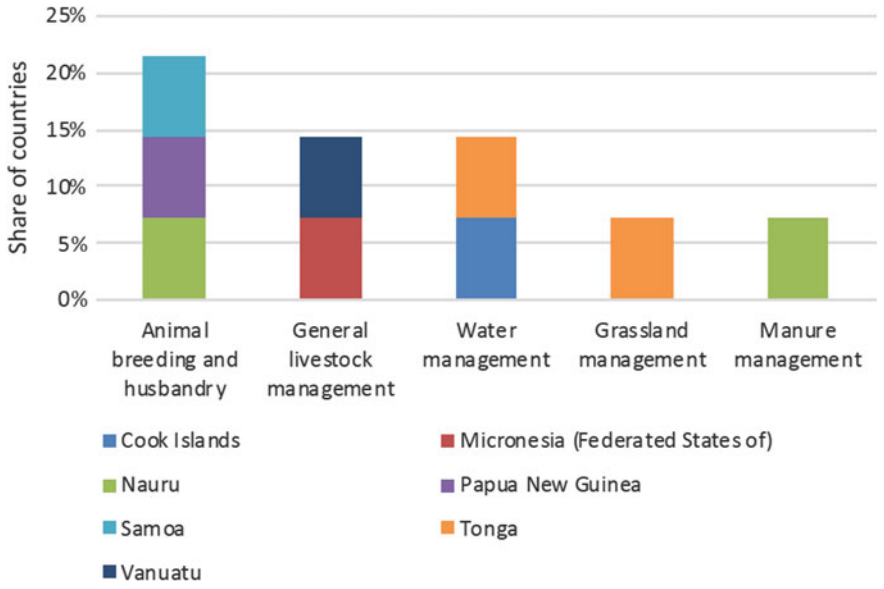

Fig. 12 Adaptation policies and measures in the livestock sub-sector in the NDCs of Pacific countries, by type (share of countries)

(Tonga, 7%) includes an adaptation policy or measure in integrated systems, namely agroforestry.

Natural resource use and management options are integrated within each of the approaches to adaptation identified above due to their cross-cutting nature. From a natural resource perspective, 86% of countries identify water resource use and management amongst adaption options. The majority of those countries promote water storage and harvesting (57% of countries), followed by integrated watershed management and sustainable use and management (29% each), availability and access, quality and pollution management and efficiency and use (21% each), amongst others. Figure 13 illustrates the share of countries with one or more (to avoid bias of representation) water-related adaptation policy or measure across all ecosystems, by resource use and management option.

Seventy-one percent of countries identify ecosystem and genetic resource use and management amongst adaption options. The majority of those countries promote pest and disease management (43% of countries), followed by the protection, conservation and restoration of biodiversity and ecosystems in general (36 and 29%, respectively) and payment for ecosystem services (7%). Figure 14 illustrates the share of countries with one or more (to avoid bias of representation) ecosystem and genetic resources-related adaptation policy or measure across all ecosystems, by resource use and management option.

Fifty-seven percent of countries with an adaptation component identify land resource use and management amongst adaption options. The majority of those

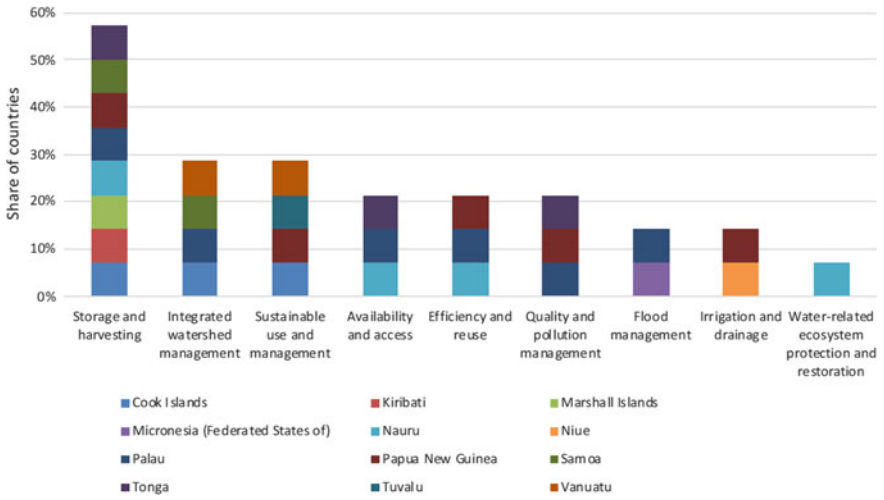

Fig. 13 Water-related adaptation policies and measures in the in the NDCs of Pacific countries, by type (share of countries)

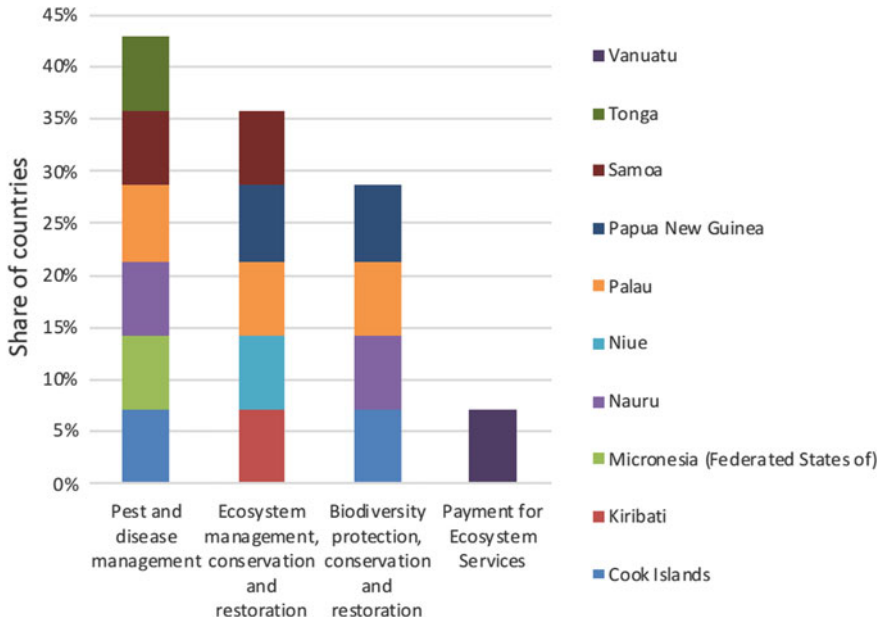

Fig. 14 Ecosystem and genetic resources-related adaptation policies and measures in the in the NDCs of Pacific countries, by type (share of countries)

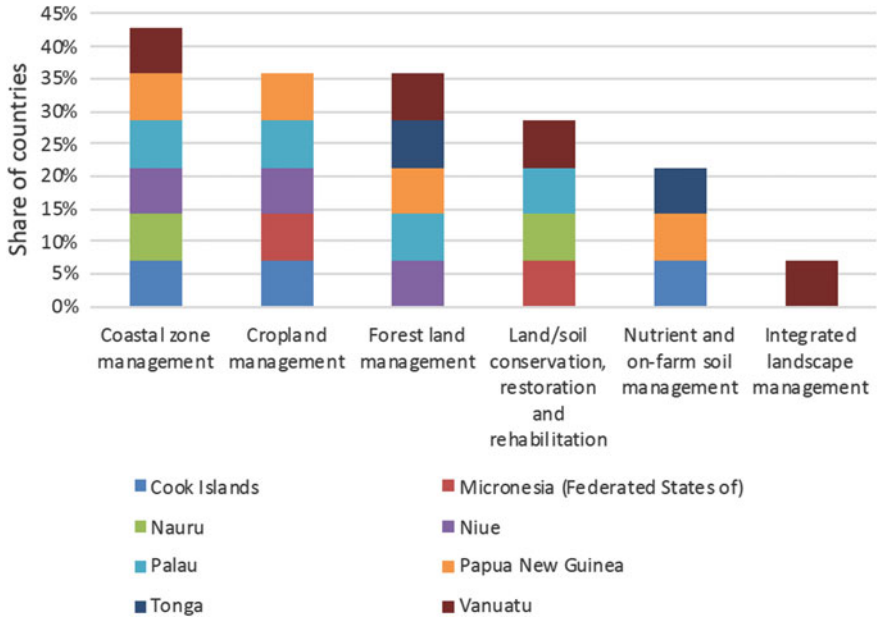

Fig. 15 Land-related adaptation policies and measures in the in the NDCs of Pacific countries, by type (share of countries)

countries promote coastal zone management (45% of countries), followed by forest and cropland management (36% each), land/soil conservation, restoration and rehabilitation (29%) and nutrient and on-farm soil management (21%), amongst others. Figure 15 illustrates the share of countries with one or more (to avoid bias of representation) land-related adaptation policy or measure across all ecosystems, by resource use and management option.

Adaptation Measures in Social Systems

For the sake of this analysis, adaptation measures in social systems are differentiated along three main pillars: socio-economics and well-being; knowledge and capacity; and institutions and governance. All countries in the Pacific identify at least one adaptation measure in social systems, primarily around the institutions and governance and socio-economics and well-being pillars (93% of countries each), followed by the knowledge and capacity pillar (86%).

Ninety-three percent of countries in the Pacific include at least one adaptation policy or measure related to institutions and governance. The majority of those countries

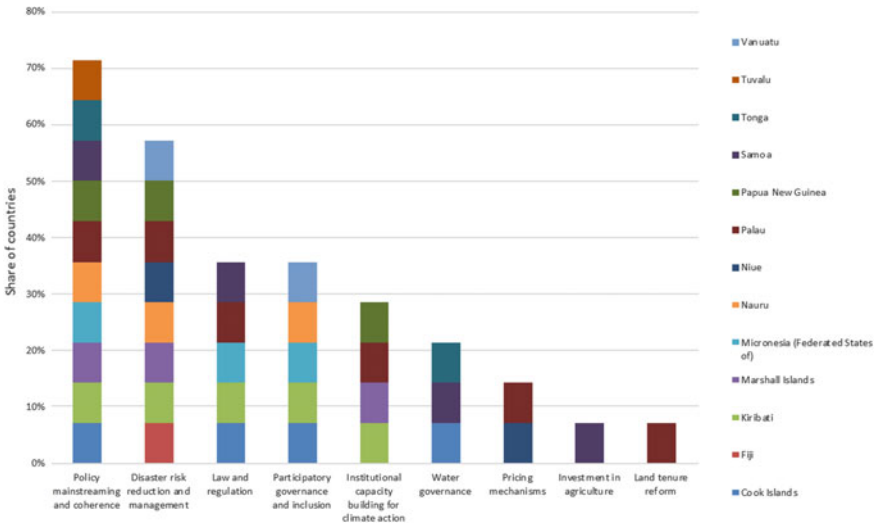

Fig. 16 Institutions and governance-related adaptation policies and measures in the NDCs of Pacific countries, by type (share of countries)

promote policy mainstreaming and coherence (71% of countries with policy or measure), followed by DRR and management (57%), participatory governance and inclusion (36%) and law and regulation reform (36%), and institutional capacity building for climate action (29%), amongst others. Figure 16 illustrates the share of countries with one or more (to avoid bias of representation) institutions and governance-related adaptation policy or measure, by intervention option.

Ninety-three countries in the Pacific include at least one adaptation policy or measure related to socio-economics and well-being. The majority of those countries promote health information and services (71% of countries), followed by resilient infrastructure (50%), social protection (29%), food security and nutrition, safe and responsible migration (21%) and resilience and adaptive capacity building (21%) and credit and insurance services and farmer cooperatives and services (14% each), amongst others. Figure 17 illustrates the share of countries with one or more (to avoid bias of representation) socio-economics and well-being-related adaptation policy or measure, by intervention option.

Eighty-six countries in the Pacific include at least one adaptation policy or measure related to knowledge and capacity. The majority of those countries promote hazard and vulnerability mapping (57% of countries), followed by awareness raising and education (50%) and early warning systems and climate information services (50%), research and development (R&D) (36%) and traditional knowledge (36%,), extension services for climate action (29%) and early warning systems (29%), amongst others. Figure 18 illustrates the share of countries with one or more (to avoid bias of representation) knowledge and capacity-related adaptation policy or measure, by intervention option.

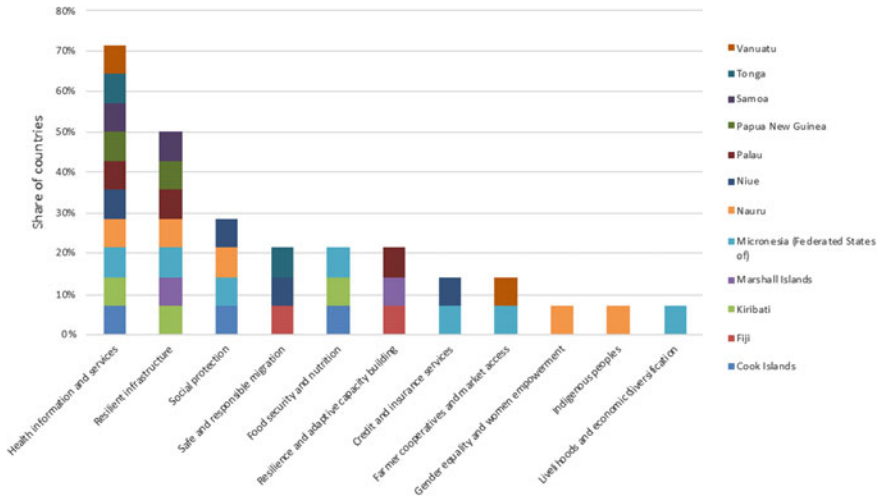

Fig. 17 Socio-economics and well-being related adaptation policies and measures in the NDCs of Pacific countries, by type (share of countries)

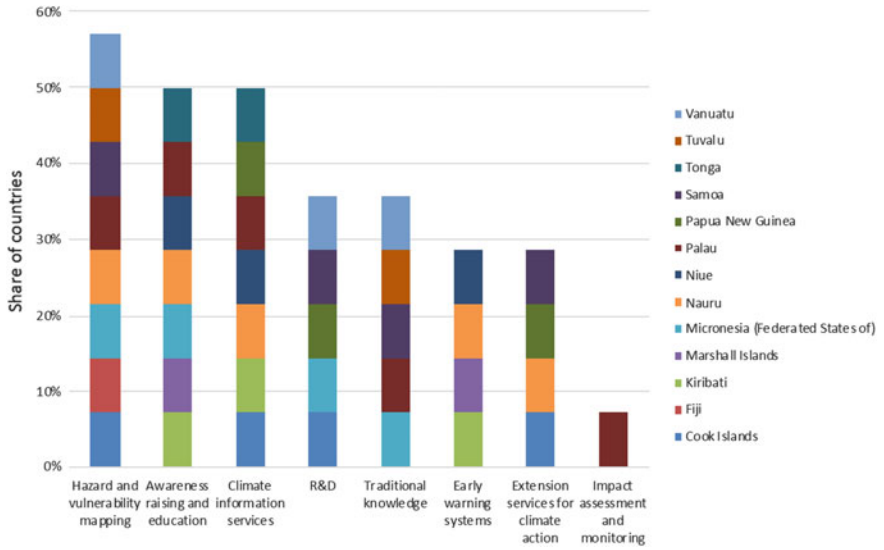

Fig. 18 Knowledge and capacity related adaptation policies and measures in the NDCs of Pacific countries, by type (share of countries)

Adaptation Gap and Opportunity Analysis

This section compares the major climate-related hazards, impacts, vulnerabilities and risks in ecosystems and social systems presented in the previous section against the adaptation measures found in the NDCs at either the ecosystem service level (for ecosystems) or social dimension (for social systems). The analysis aims to identify policy coverage gaps and, therefore, opportunities for enhancing adaptation options in the next round of NDCs.

"Policy coverage" refers to when at least one adaptation measure in a country's NDC aims to reduce vulnerability and/or increase adaptive capacity in relation to a given climate-related hazard, impact, vulnerability or risk reported, or "hotspot." The analysis is based on the methodological matrix and assessment framework that can be found in Crumpler et al. (2019). "Policy coverage" is quantified at the regional level as the share of countries with at least one adaptation policy or measure that addresses a given hotspot. A "policy coverage gap" refers to when there is an absence of at least one adaptation policy or measure that addresses a particular vulnerability hotspot. A policy coverage gap is the difference between the share of countries with a vulnerability hotspot and the share of countries with policy coverage. It should be noted that the analysis serves as a broad review of the coverage of adaptation priority sectors and measures mentioned in the NDC and not an assessment of their strength, which should be further assessed in terms of type (e.g. action, policy, project, programme or framework), scale, comprehensiveness and timeframe. The analysis, therefore, serves as an initial stocktaking of policy coverage and does not necessarily indicate policy effectiveness. Table 2 illustrates the range of policy coverage gaps and associated score.

In ecosystems, high to very high adaptation policy coverage gaps are found around climate-related losses in biological control services and ecosystem services regulating the moderation of extreme events, soil erosion and the maintenance of genetic diversity and abundance. Moderate gaps are observed in the relation to observed or projected losses in the provision of crops and fisheries, as well as ecosystem services supporting nutrient cycling and soil formation, and control against the increased invasion of pests and non-native species in agriculture. Table 3 illustrates the adaptation policy coverage gaps found around climate-related ecosystem hotspots, ordered from highest to lowest gap.

In social systems, high adaptation policy coverage gaps are found around climate-related migration and displacement. Moderate policy gaps are found in relation to

Table 2 Adaptation policy coverage gap scoring of NDC

Score	Policy coverage gap range (%)
Very high	61–100
High	31–60
Moderate	10–30
Low	0–9

Table 3 Ecosystem-related adaptation policy coverage gaps in Pacific NDCs

Climate-related ecosystem hotspot	Number of countries with hotspot (%)	Adaptation policy coverage gap
Reduced biological control services	21	Very high
Reduced moderation of extreme events services	29	High
Soil erosion	36	High
Reduced genetic diversity and abundance	43	High
Losses in fisheries provision	71	Moderate
Increased invasion by pests and non-native species in agriculture	29	Moderate
Reduced nutrient cycling and soil formation	71	Moderate
Losses in crops provision	57	Moderate

Table 4 Social system-related adaptation policy coverage gaps in Pacific NDCs

Climate-related social system hotspot	Number of countries with hotspot (%)	Policy gap
Migration and displacement	57	High
Gender and youth inequality	50	Moderate
Loss of productive infrastructure and assets	64	Moderate

observed or projected gender and youth inequality and loss of productive infrastructure. Table 4 illustrates the adaptation policy coverage gaps found around climate-related social system hotspots, ordered from highest to lowest gap.

Mitigation and Sustainable Development Co-benefits of Adaptation in the Pacific

Mitigation and adaptation in agriculture are closely interlinked through a web of feedbacks, synergies, and tradeoffs. Sustainable food and agriculture systems carry the greatest potential for generating synergies across climate change mitigation and adaptation efforts, as well as significant socio-economic and environmental co-benefits (FAO 2016a). In the Pacific, around 40% of countries explicitly reference the mitigation co-benefits of adaptation in their NDCs. Adaptation measures in ocean and

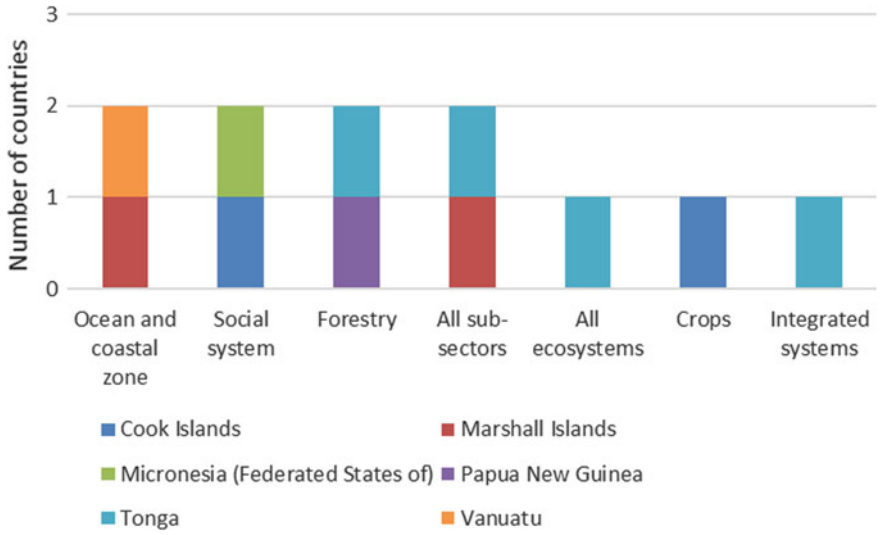

Fig. 19 Number of Pacific countries with explicit reference to the co-benefits of adaptation by land use/sub-sector in the NDCs

coastal zones, social systems and forestry are expected to generate the most mitigation co-benefits amongst adaptation measures in the agriculture and land use sectors, followed by crops and integrated systems. Out of those adaptation measures in ocean and coastal zones, mangrove conservation and replanting and land/soil conservation generate mitigation co-benefits. For instance, the Marshall Islands reference the capacity of mangroves to act as carbon sinks as well as protect water resources and human health. Out of those adaptation measures in social systems, disease management and awareness raising generate the majority of mitigation co-benefits. For instance, Micronesia stresses the benefits associated with raising awareness for the need for adaptation and mitigation, including shifting to renewable energy sources, reduced air pollution, consumption of local and more nutritious food and improved human health. Out of adaptation measures in forestry, reducing deforestation and sustainable forest management generate the majority of mitigation co-benefits. Figure 19 illustrates the number of countries with at least one adaptation measure with mitigation co-benefits explicitly referenced, by land use/sub-sector.

Barriers to Implementation and Support Needs

Article 9, 10 and 11 of the Paris Agreement reiterate the obligations of developed countries to support developing country efforts to build clean, climate-resilient futures through the provision of finance, technology and capacity-building support for climate change mitigation and adaptation. This section discusses the different

types of support needs communicated by countries in the Pacific, as well as the barriers facing these nations to effectively put in place technologies and policies to achieve their climate goals and targets. Information from the NDCs was supplemented by a comprehensive review of country NCs and the TNAs to identify all support needs and potential barriers to implementation.

Overall, the majority of countries identify lack of technical capacities and human skills, economic and financial constraints and lack of proper institutions and organizations as the three main barriers to technology transfer and dissemination for climate action in the Pacific. Figure 20 illustrates the share of countries with barriers to climate action in the agriculture and land use sectors reported, by type.

Access to additional financial resources, capacity-building and technology transfer is the preamble to achieving many of the ambitious climate goals and targets. All countries in the region communicate either full or partial conditionality of NDC implementation to external financial support, but not all quantify the respective conditional and unconditional shares. Eighty six percent of countries communicate that NDC implementation is partly conditional to international financial support, while two countries (Samoa and Vanuatu) make their NDC totally conditional to it.

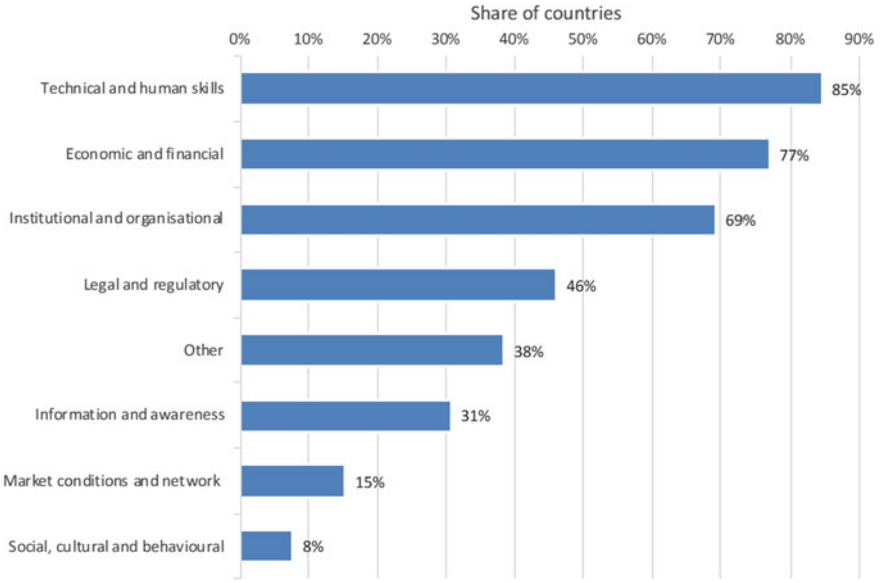

Fig. 20 Barriers to climate action in the agriculture and land use sectors reported in the Pacific, by barrier type (share of countries)

Conclusion

The incidence of climate-related hazards and natural disasters are on the rise in the Pacific (EM-DAT n.d.), threatening food security and nutrition through a cascading chain of impacts transferred from agroecosystems, along food value chains, to natural resource-dependent livelihoods (FAO 2018). Sea level rise, coastal erosion, water stress and storms are reported by the majority of countries in the Pacific as climate-related extremes and slow onset events, exacerbating the vulnerability of communities and households to other compounding social, economic and environmental stressors. The increasing intensity and frequency of climate extreme and variability is expected to result in the loss of productive infrastructure and assets, greater levels of food insecurity and malnutrition, negative impacts on incomes and rural livelihoods, wider gaps in gender and youth equality and increasing trends in migration and displacement, as reported by the majority of countries in the region. With some 486 million people still undernourished in Asia and the Pacific, and progress stagnated in all sub-regions, the increasing severity and incidence of weather extremes and climate-related disasters threaten to seriously burden food security and nutrition in the region, as well as challenge progress on poverty alleviation (FAO 2018).

Indeed, the agriculture and land use sectors feature prominently in the adaptation component found in the NDCs of countries in the Pacific. Around 90% of countries include adaptation polices or measures in ocean and coastal zones and in agro-ecosystems, particularly in the marine fisheries and crops sub-sectors. Almost all countries in the region also recognize the role of adaptation of institutions and governance, including measures promoting climate change policy mainstreaming and coherence, disaster risk reduction and management and health information and services. The opportunity to leverage mitigation and sustainable development co-benefits of adaptation in the agriculture and land use sectors is explicitly referenced by 40% of countries in the region. In particular, mangrove planting and conservation is associated with natural sinks for emission removals, while climate change awareness raising is associated with human health benefits.

However, high to very high adaptation policy coverage gaps are still found around climate-related losses in biological control services and ecosystem services regulating the moderation of extreme events, soil erosion and the maintenance of genetic diversity and abundance. In social systems, moderate to high adaptation policy coverage gaps are found in relation to climate-induced migration and displacement, gender and youth inequality and losses in productive infrastructure and assets.

By highlighting the gaps in the coverage of adaptation policies in the agriculture and land use sectors, as well as illustrating opportunities for enhancing adaptation ambitions in the next round of NDCs, this analysis can serve as an important roadmap for informing country programming and directing future investments in support of low-emission and climate-resilient agriculture and food systems in the region. Evidence suggests that an integrated approach to disaster risk reduction and management and climate change adaptation that promotes anticipatory, absorptive, adaptive and