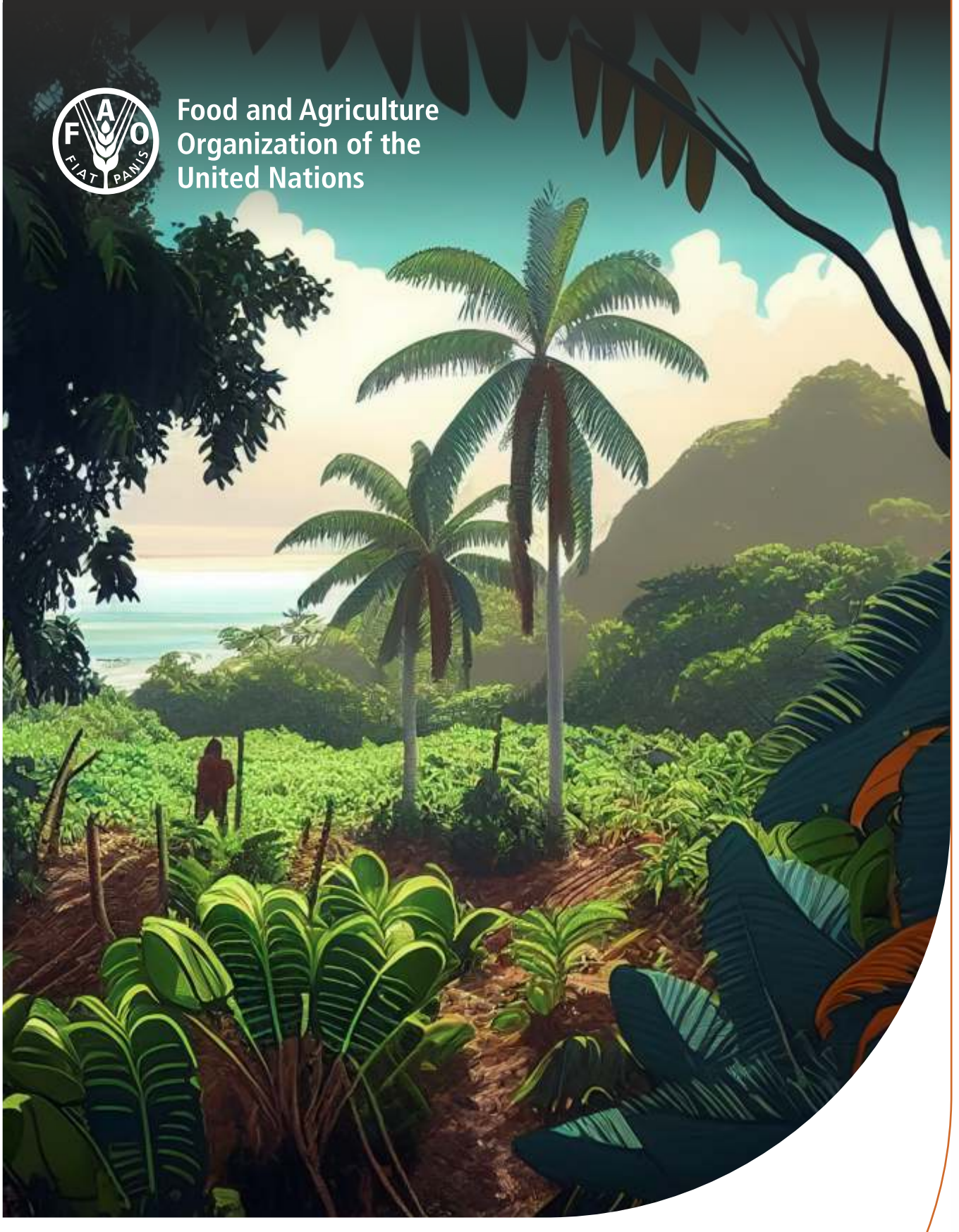
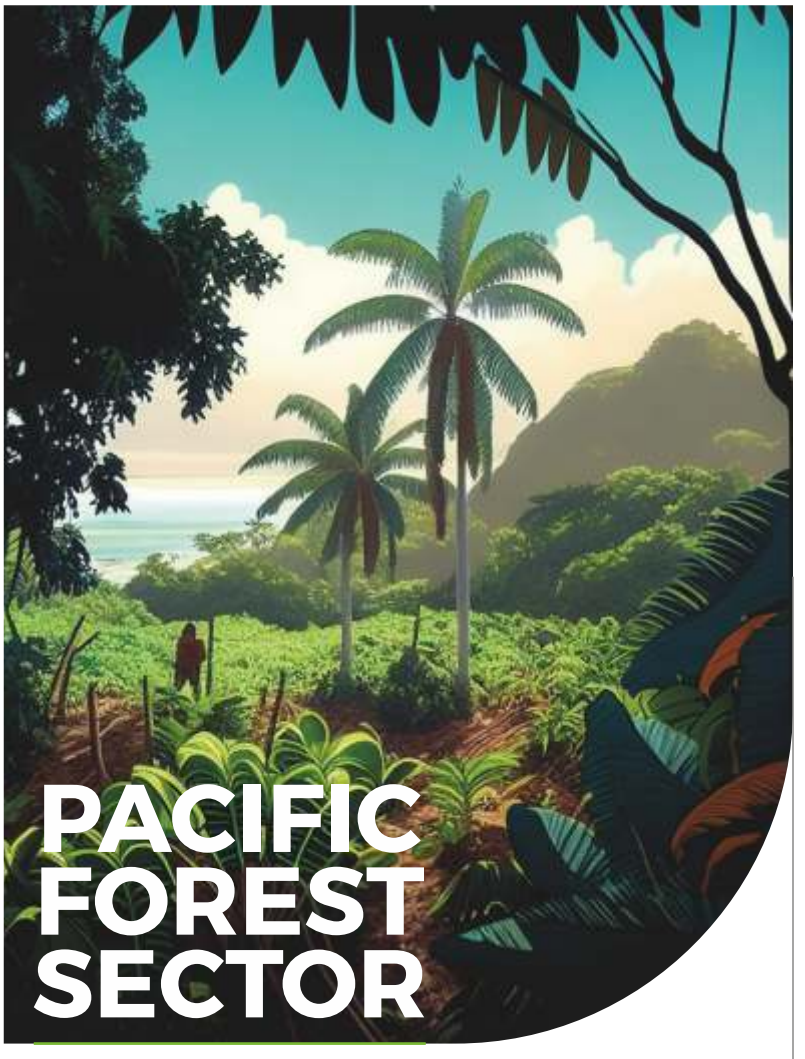


Food and Agriculture Organization of the United Nations

PACIFIC FOREST SECTOR OUTLOOK STUDY 2023



PACIFIC FOREST SECTOR

OUTLOOK STUDY 2023

Authors
C.T.S. Nair
Rao Matta
Raushan Kumar
Stephanie Lee
Lex Thomson

Food and Agriculture Organization of the United Nations (FAO)
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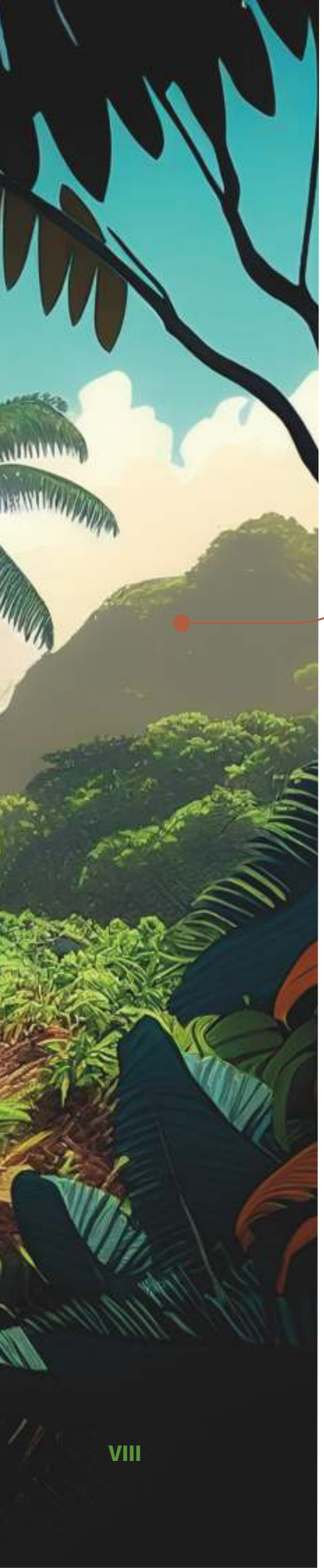


FOREWORD

It gives me immense pleasure to introduce the Pacific Forest Sector Outlook Study 2023. The report has been produced as a collaborative effort involving 14 FAO Pacific Member Nations, collectively referred to as the Pacific Small Island Developing States (SIDS) - Fiji, Papua New Guinea, Solomon Islands and Vanuatu (Melanesia); the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru and Palau (Micronesia); and the Cook Islands, Niue, Samoa, Tonga and Tuvalu (Polynesia).

The study synthesizes diverse sources of information, including national consultations, peer-reviewed thematic papers and country assessment reports. It highlights that, despite contributing a tiny fraction of global greenhouse-gas emissions, the Pacific SIDS are at the forefront of the negative impacts of climate change. Climate change has emerged as a super driver affecting all aspects of life in the subregion.

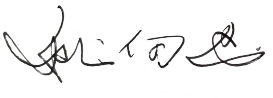
The study evaluates existing land uses involving trees, the drivers of change, forest value chains (that is, timber, woodfuel, non-wood forest products and ecosystem services), the economic significance of forestry and agroforestry, and the possibilities of forest-based bioeconomies in the Pacific SIDS. It describes scenarios for forestry in the subregion and puts forward potential priorities and strategies that countries may wish to pursue to support sustainable development in the forest sector.

The study comes at an appropriate moment, with countries aspiring to develop their economies and achieve the Sustainable Development Goals. Populations and economies in the subregion are growing and pressure on resources, including forests, is increasing. Climate change is already affecting forests, and its impacts are expected to increase in the future.

The study reports that, per-capita, forest cover in the Pacific SIDS is seven times the global average. At the same time, however, commercial logging in native forests is a major contributor to forest degradation and loss. It has created large tracts of secondary forests, adversely affecting the composition, structure and functions of natural forests and undermining long-term wood production. One of the suggestions in the report is that those countries now drawing down their natural capital to produce timber for global markets could increase their attention on the sustainability of wood production and thereby ensure a sustainable future for the sector.

The report's seven chapters constitute a wise evaluation of the role of forestry and agroforestry in the Pacific SIDS that will help in designing nationally appropriate and tailor-made policies in the face of rapid change. It provides a basis for evaluating and adjusting national priorities in the sector for the purpose of achieving higher-level objectives and transformational change in governance, innovation and investment for improved resource management. This report provides evidence and knowledge to guide policy and programme development for the forestry and land-use sector in the subregion to meet national development priorities.

I commend this information-rich report as a guide for decision-makers and other stakeholders in the Pacific subregion. FAO is fully committed to supporting members in developing their capacity and mobilizing resources to increase resilience and bring about positive change.



Xiangjun Yao

FAO Representative and Subregional Coordinator,
Subregional Office for the Pacific Islands

ACKNOWLEDGEMENTS

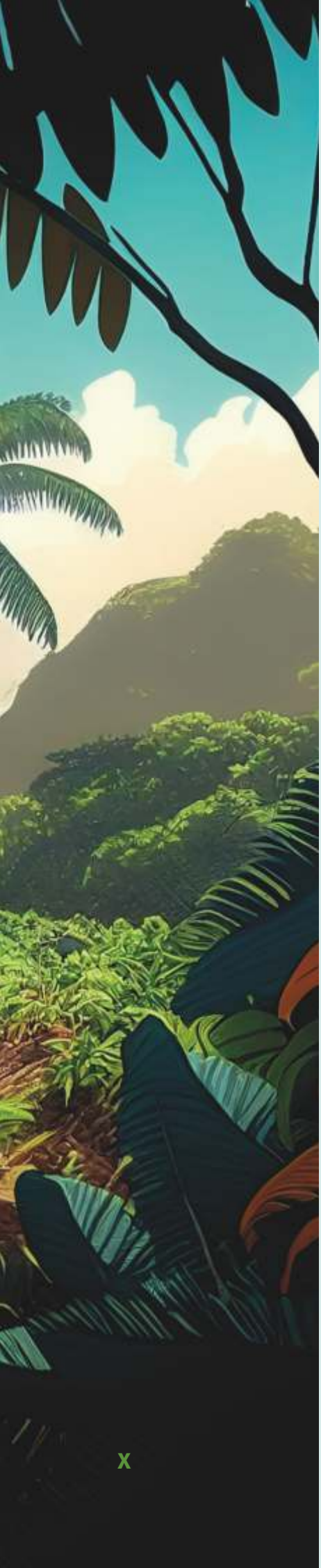
The Pacific Forest Sector Outlook Study was a collaborative effort involving the 14 Pacific Small Island Developing States that are members of the Asia-Pacific Forestry Commission and various organizations supporting forestry and sustainable development in the subregion. Considerable effort has been made to tap into the broad wealth of knowledge on the subregion, including by drawing on many previously undertaken studies and assessments.

Overall guidance and direction for the study was provided by an advisory committee consisting of the following experts and representatives of various countries and organizations: Keiran Andrusko, Claire Wallis and Katie Stokes (Australia); Sanjana Lal (Fiji); Eun Ho Choi (Republic of Korea); Tolusina Pouli (Samoa); Terence Titiulu (Solomon Islands); Gewa Gamoga (Papua New Guinea); Godfrey Bome (Vanuatu); Gan Kee Seng (Asia Pacific Association of Forestry Research Institutions); Luo Xi, Anna Finke and Zhang Shiyi (Asia-Pacific Network for Sustainable Forest Management and Rehabilitation); Vincent Gitz (Center for International Forestry Research); Jean-Christophe Claudon and Tetra Yanuariadi (International Tropical Timber Organization); Jalesi Mateboto (Pacific Community); Christine Fung (GIZ); and Patrick Durst. FAO colleagues who made extensive contributions in addition to their roles as members of the advisory committee were Safia Aggarwal, Christophe Besacier, Lyndall Bull, Angelica Jacome Daza, Thomas Hofer, Adam Gerrand, Mathilde Iweins and Xiangjun Yao.

A bottom-up approach, in which national focal points provided in-depth assessments ("country outlook papers") of the current and emerging situations for forests and trees in Fiji, Papua New Guinea, Samoa, Solomon Islands and Vanuatu in line with a previously agreed framework, enabled other professionals to participate in and contribute to online meetings and discussions.

The following six thematic studies carried out in collaboration with various partners provided further background material on which the subregional report draws significantly. These inputs were supplemented with information about other Pacific countries and territories derived from the following literature:

- "Increasing the resilience of people and landscapes in the Pacific Small Island Developing States: The role of forests and trees in the context of climate change" (Xi Luo, Patrick Durst, Anna Finke and Zhang Shiyi).
- "Emerging opportunities and challenges for Pacific Small Island Developing States in the production, processing and trade of forest products" (Chris Brown).
- "Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests" (Sairusi Bulai).
- "Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States" (Tony Bartlett).
- "Enhancing investments in sustainable land uses - What options for Pacific countries?" (Lucy Garett).
- "Opportunities and limitations for strengthening capacities for sustainable forest management in three Melanesian countries" (Tony Bartlett).



The outlook study was developed under the overall technical coordination of Rao Matta at the FAO Regional Office for Asia and the Pacific, Bangkok. The subregional report was written by C.T.S. Nair and edited by Alastair Sarre, with contributions from Chris Brown, Raushan Kumar, Stephanie Lee, Rao Matta and Lex Thomson. The country outlook papers were led by Lex Thomson with support from Keresoma Tevita at the FAO Subregional Office for the Pacific. Eriko Hibi, Thomas Hofer and Aru Mathias provided initial guidance on priority topics for in-depth study and on the overall approach.

Xiangjun Yao, Subregional Coordinator for the Pacific, Takayuki Hagiwara, Regional Programme Leader, FAO Regional Office for Asia and the Pacific, and Sheila Wertz, Senior Forestry Officer, provided overall supervision and strategic guidance.

In addition to various advisory committee members, the following people reviewed the subregional report and provided specific inputs during various stages of its development: Abe Hitofumi, Keiran Andrusko, Chris Brown, Sairusi Bulai, Lyndall Bull, Patrick Durst, Takayuki Hagiwara, Thomas Hofer, Raushan Kumar, Stephanie Lee, Digby Race, Katie Stokes, Lex Thompson, Chado Tshering, Claire Wallis and Sheila Wertz.

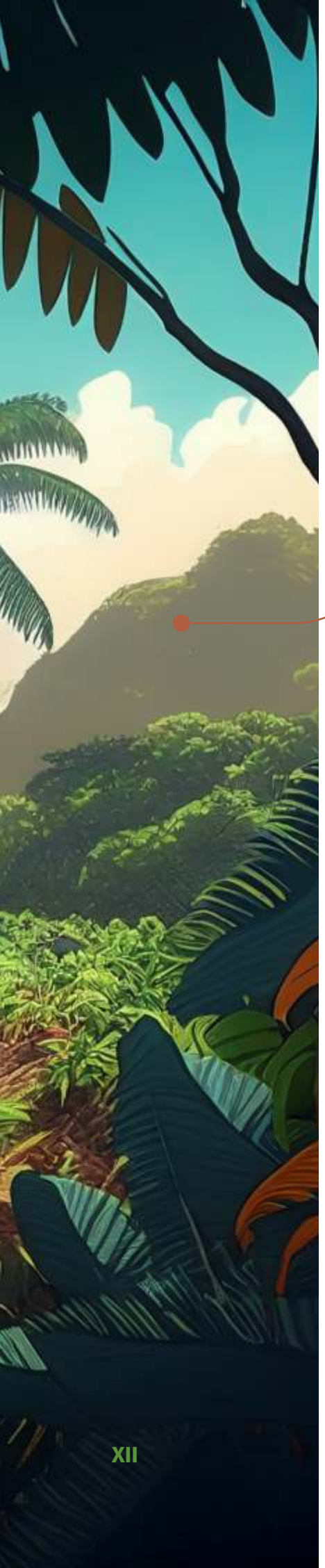
The Australian Government, the Australian Centre for International Agricultural Research ACIAR, the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), the International Climate Initiative IKI, the Advisory Committee on Sustainable Forest-based Industries (ACSFI), the FAO Office of SIDS, LDCs and LLDCs (OSL) and the Forest and Landscape Restoration Mechanism supported the development of the thematic studies, for which FAO extends its warm appreciation.

FAO thanks all contributors, especially those who participated in meetings, interviews, consultations, surveys, background papers and workshops.

Kallaya Meechantra and Gan Kee Seng supported the initiative in various ways, including by making arrangements for the meetings. Xpressions Print and Graphics Pvt Ltd. performed the design and layout.

ABBREVIATIONS AND ACRONYMS

CM	centimetre(s)
COVID-19	coronavirus disease 19
EEZ	economic exclusion zone
FAO	Food and Agriculture Organization of the United Nations
FDI	foreign direct investment
FJD	Fiji dollar(s)
FRA	Global Forest Resources Assessment
FRIMS	Forest Resource Information Management System (Papua New Guinea)
FRL	forest reference level
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
ha	hectare(s)
ICT	information and communication technology
ILG	incorporated land group (Papua New Guinea)
kg	kilogram(s)
km	kilometre(s)
m	metre(s)
mm	millimetre(s)
NWFP	non-wood forest product
ODA	official development assistance
PGK	Papua New Guinea kina
PPP	purchasing power parity
R&D	research and development
REDD+	reduced emissions from deforestation, forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
SABL	special agricultural business lease (Papua New Guinea)
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar(s)



EXECUTIVE SUMMARY

This outlook study focuses on 14 countries in the Pacific, collectively referred to as the Pacific Small Island Developing States (SIDS) - Fiji, Papua New Guinea, Solomon Islands and Vanuatu (Melanesia); the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru and Palau (Micronesia); and the Cook Islands, Niue, Samoa, Tonga and Tuvalu (Polynesia).

FAO prepared the study at the request of the Pacific Ministers of Agriculture and Forestry at a meeting held in Samoa in 2019. It analyses the outlook for forests and trees in the Pacific SIDS, including through future scenarios to indicate potential pathways of change and the options available for accomplishing the Sustainable Development Goals (SDGs). The study integrates information from country outlook papers, thematic studies and a wide range of published and unpublished information.

Overview of land use and forests

The Pacific SIDS have a land area of 51.7 million ha on about 3 400 islands of varying size. Differences in origin, size and elevation have created highly diverse biophysical conditions.

The total area under forests is estimated at 40.3 million ha. Melanesia accounts for 98.8 percent of the land area and 99.2 percent of all forests in the Pacific SIDS. Remoteness, fragmented distribution and small size are characteristic of most countries in the subregion, limiting the ability to take advantage of economies of scale.

The Pacific SIDS are among the world's most forested countries as a percentage of land area, with more than three-quarters (78 percent) of the land area under forests. The average forest area per capita among the 14 countries is 3.56 ha, which is nearly seven times the global average. There is considerable variation between countries, however.

Data on forest area and condition are poor in the Pacific SIDS. Nevertheless, it appears that deforestation is relatively low, at 0.06 percent in 2010- 2020. The large-scale expansion of oil palm and mining has led to significant forest reductions in some of the larger countries. Land use is relatively stable in most Micronesian and Polynesian countries and the scope for major changes in use is limited. Commercial logging is a major contributor to forest degradation; it has created large tracts of secondary forests and adversely affected the composition, structure and functions of natural forests and undermined long-term wood production.

Although the region has a long history of reforestation and afforestation, the pace of expansion of planted forests has been slow. Only Fiji has developed a large planted-forest estate, mainly of pine and mahogany. Nevertheless, plantation expansion has stagnated in recent years in Fiji, due largely to tenure uncertainties. Land tenure also appears to be a constraint on plantation development in Papua New Guinea and Solomon Islands, despite favourable growing conditions.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Agroforestry has a long history in the Pacific SIDS, with multiple forms adapted to differing biophysical and socio-economic contexts. Trees outside forests (mainly in agroforestry) have become the most important source of wood for most of the smaller Pacific SIDS. Several tree species are grown as integral components of agroforestry systems, of which coconut is the most ubiquitous.

Forest value chains: trends, potential and constraints

Forests provide diverse subsistence products in the Pacific SIDS, such as food, medicines, fuel, construction materials and cultural artifacts. They also provide essential services such as watershed protection, soil and biodiversity conservation, and spiritual and cultural services. Concerns about climate change have brought major shifts in the priorities of land and forest management, which is increasingly geared towards emissions reduction, carbon sequestration and environmental and socio-economic resilience.

Wood production is the starting point for several value chains, some local and others international. The Pacific SIDS produced about 14 million m^3 of roundwood in 2020, of which 57 percent was industrial and the remainder mainly woodfuel. Industrial roundwood production more than doubled between 2000 and 2020, due mainly to production in Papua New Guinea and Solomon Islands.

Native-forest logging is an important source of government revenue and employment in Solomon Islands, but there are concerns about its sustainability and legality. Most natural-forest logs produced in the Pacific SIDS are exported. Sawnwood and woodchips - most of which are also exported - are the two most important value-added products.

Countries focusing on primary production for global markets by drawing down their natural capital may soon face resource exhaustion. Restocking through the development of planted forests is not taking place at a scale that could ensure the sustainability of wood production, although Fiji obtains most of its wood supply from its pine and mahogany plantations.

The small size of domestic markets, the high cost of processing and the absence of conducive policy environments constrain investment in wood processing. Exceptions include high-value products from mahogany plantations in Fiji, balsa in Papua New Guinea and teak in Solomon Islands. Most high-value wood products - especially paper and paperboard - consumed in Pacific SIDS are imported, and dependence on imports for these is likely to remain high.

Woodfuel is the most important source of energy for cooking and heating, although reliable data on production and consumption are unavailable. Recent efforts to move up the biomass energy value chain include wood-pellet production and power generation in dendrothermal plants. Forests and farms produce many non-wood forest products catering to diverse needs for food, construction materials, medicines and cultural products; some have significant international demand.

Watershed protection is a crucial function of forests in the Pacific SIDS. The "Ridge to Reef" programme offers a holistic framework for the involvement of all stakeholders. Many challenges exist in the Pacific SIDS in monetizing forest-related carbon benefits through initiatives like REDD+ and the Green Climate Fund.

Drivers of forest change

Land use in the Pacific SIDS is shaped by drivers that operate locally, nationally, subregionally and globally. For most small-island economies, external factors tend to have overwhelming social, economic, environmental and political impacts.

Population growth, urbanization and a "youth bulge" are key demographic drivers. The population of the Pacific SIDS is expected to increase from 11.5 million people in 2020 to 13.6 million in 2030. Urbanization is likely to accelerate in some small-island countries, but most people in the larger countries will continue to live in rural areas. Both trends will exert pressure on lands and forests. The population of the Pacific SIDS is relatively young. Managing the subregion's youth bulge will require significant efforts to generate employment, which could affect land use.

Income growth in the Pacific SIDS has been relatively low in the last two decades, suggesting that the strategy in some countries of drawing down natural capital to boost economic development has not been fully effective. Low revenues have affected the ability of governments to invest in sustainable resource management. Those Pacific SIDS with significant stocks of natural resources have been compelled to draw down their natural capital, and those countries with few natural resources depend to at least some extent on external support.

The disruptive impact of the COVID-19 pandemic on global value chains, including tourism and the trade of forest products, has severely affected Pacific SIDS economies and increased dependence on land as a source of livelihoods. The vulnerability of global supply chains is encouraging reshoring and vertical integration in import-dependent countries and businesses, which could have negative impacts on Pacific SIDS with significant wood product trade.

Although the subregion emits just 0.03 percent of global GHG emissions, Pacific SIDS are at the forefront of the negative impacts of climate change. Climate change has emerged as a superdriver affecting all aspects of life, including land use. In addition to the direct impacts of climate change, multiple indirect impacts are undermining the ability of the Pacific SIDS to invest in sustainable resource management.

The Pacific SIDS are becoming the focus of competing geopolitical interests. This might

provide opportunities but is also fraught with challenges, especially if countries are caught in the crossfire of superpower rivalries.

Because of their vast economic exclusion zones, most small-island countries in the Pacific can be termed "large ocean states", with immense potential for tapping marine resources and developing sustainable "blue" economies. This would reduce economic pressure on land and open up opportunities for synergies between the blue and green economies.

Adapting to change: governance, technology and investment

Responses to the key change drivers described above centre largely on three interrelated areas: (1) governance; (2) innovation, especially the development and application of improved technologies; and (3) investment in improved resource management.

Reforming customary tenure to make land available for uses such as wood production, plantation establishment, infrastructure and mining has been a focus of land policies, legislation and institutional change in the Pacific. Efforts at such reform, however, are often perceived as a ploy for appropriating resources from communities.

In line with their divergent histories, considerable differences exist among countries in their policy and institutional development on land tenure. In Papua New Guinea, for example, the identification, demarcation and registration of customary land continues to be problematic because of conflicting claims. In Fiji, compulsory registration has helped address many issues related to customary land tenure, although problems still exist because of unequal access to land.

Most countries are striving - through policies, legislation and institutional arrangements - to strike a balance between safeguarding customary ownership and enabling the use of land and forests to meet national development goals. Progress is varied, however, and customary landownership reform remains a key challenge.

Countries that have created better institutional arrangements have been able to arrest deforestation and develop more sustainable systems of land management. Care must be taken to ensure that customary owners are able to reap the benefits of reforms and that their rights are safeguarded.

The dominant development paradigm has focused largely on reforming land tenure to increase the availability of land for private investors, governments and others. Ineffective reforms combined with other governance deficiencies, however, have created favourable conditions for the unsustainable and illegal exploitation of resources in resource-rich countries.

Changes in laws and institutional arrangements tend to lag behind policy reform, and wide gaps exist between policy intentions and what is accomplished on the ground. With many players seeking to maximize short-term profits, illegality has emerged as a major challenge in the forest sector, especially industrial-scale wood production in natural forests.

Innovation is a key to the sustainable management of land and forests in the Pacific SIDS, but the wide adoption of new technologies is challenging in most countries in the subregion. Overall, domestic innovation capacity is limited, leading to excessive dependence on technologies developed elsewhere and on external financial and technical support.

Forest management in the Pacific SIDS requires a shift towards green investment. In view of limitations in mobilizing investments domestically, most Pacific SIDS are highly dependent on foreign direct investment and official development assistance. Both have challenges, especially in ensuring that they are effective, efficient and help build sustainable systems. New funding avenues are opening up, including for climate-change mitigation and adaptation, with the potential to overcome certain deficiencies in traditional approaches. Accessing these will require governance improvements, including increased transparency, efficiency, effectiveness and equity.

Forest futures: scenarios for the Pacific Small Island Developing States

Multiple uncertainties and data limitations mean that conventional forecasting approaches have severe limitations, especially in the long term. Therefore, long-term outlooks necessarily involve scenario analysis to outline possible pathways of development. Scenario analysis provides an opportunity to assess various uncertainties and to articulate possible futures, considering the impacts of key drivers.

In the Pacific SIDS, major uncertainties stem from erratic economic performance - including due to disasters and global economic downturns - and a wide range of governance challenges. Here, three broad scenarios are identified: (1) "SDG world" (an aspirational scenario); (2) business as usual; and (3) "gloom and doom" (a disruptive scenario). Each scenario is applied to three groupings of Pacific SIDS: (I) Papua New Guinea; (2) the other Melanesian countries; and (3) Micronesia and Polynesia.

In the SDG-world scenario, concerted efforts to improve governance, and a more favourable global economic environment, enable more sustainable approaches to forests and forestry and the development of efficient and viable bioeconomies. The business-as-usual scenario involves a continuation of present trends, especially in governance and economic performance, with a mix of positive and negative developments. A decline in governance, and worsening economic conditions, give rise to the gloom-and-doom scenario.

Given the divergent situations among the three groupings of Pacific SIDS, the three scenarios

evolve differently in each, with differing implications for resource use and what needs to be done to prevent a shift to the gloom-and-doom scenario and to build an SDG world.

These scenarios, developed based on the interplay of economic performance and governance, could constitute a starting point for discussion on the future of forestry and agroforestry in the Pacific SIDS. Scenario development needs to be undertaken as a collective exercise involving all stakeholders, but this was not possible here given difficulties stemming from the COVID-19 pandemic. The scenarios could be refined and improved in each country as part of strategic planning processes that enable all stakeholders to understand the status of their country and sector, where they are heading, and what is needed to shift towards enabling achievement of aspirational goals.

The way forward: priorities and strategies

The Pacific SIDS must navigate highly complex domestic and global environments characterized by enormous uncertainties. Existential threats stemming from climate change loom large, and people's aspirations for a better life need to be met in the context of limited resources.

- Develop and operationalize adaptation plans for every major production system, including forestry.
- Improve the long-term sustainability of wood production in natural forests, including by strengthening field-level capacity for monitoring compliance with rules and ensuring transparent, just and equitable systems for income-sharing.
- Restore logged-over forests by developing appropriate institutional arrangements, building technical capacity through collaborative research and development, and creating a dedicated fund.
- Encourage intra-Pacific trade to help meet domestic timber demand.
- Carefully weigh the pros and cons of policies to promote downstream processing.
- Assess the scope for planted-forest development.
- Maximize the potential of agroforestry, including by supporting it with institutional arrangements such as tree-grower cooperatives and the adoption of information and communication technologies to increase access to knowledge and markets.
- Place more emphasis on high-value species and products, including non-wood forest products unique to the Pacific SIDS and products for which comparative advantages prevail.
- Maximize resilience by safeguarding ecosystem services, including through integrated approaches to land management.
- Take a long-term perspective on carbon and avoid overcommitting to selling carbon-related services while prices are low.
- Ensure institutional adaptability by adopting integrated frameworks and redirecting resources towards the people-resources interface.
- Develop hybrid institutional and governance models that combine the strengths of informal and informal systems.
- Strengthen strategic planning capacity, including by improving data and encouraging interdisciplinary research.
- Increase capacity in science and technology and the adoption of innovation, such as by developing a subregional forestry and agroforestry innovation centre to build on the existing wealth of indigenous knowledge.
- Build human capital for an SDG world, for example by creating a subregional Pacific human resources development centre to help develop the knowledge and practical skills required for forestry in coming decades.


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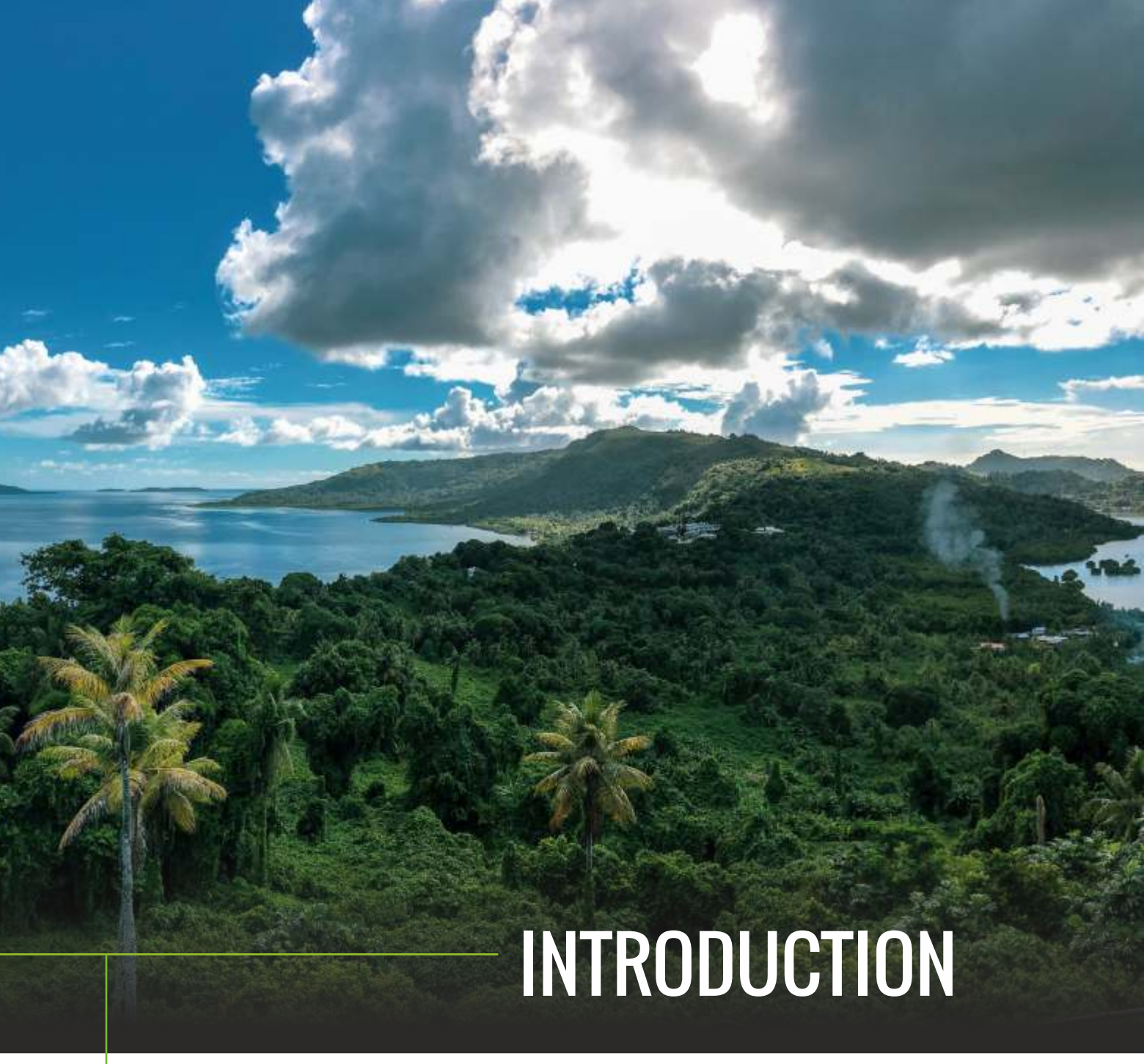


INTRODUCTION

Key points

- This study focuses on 14 countries in the Pacific, collectively referred to as the Pacific Small Island Developing States - Fiji, Papua New Guinea, Solomon Islands and Vanuatu (Melanesia); the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru and Palau (Micronesia); and the Cook Islands, Niue, Samoa, Tonga and Tuvalu (Polynesia).
- FAO prepared the study at the request of the Pacific Ministers of Agriculture and Forestry at a meeting held in Samoa in 2019. The study analyses the outlook for forests and trees in the Pacific Small Island Developing States, including through future scenarios, to indicate potential pathways of change and the options available for meeting the Sustainable Development Goals in the subregion.

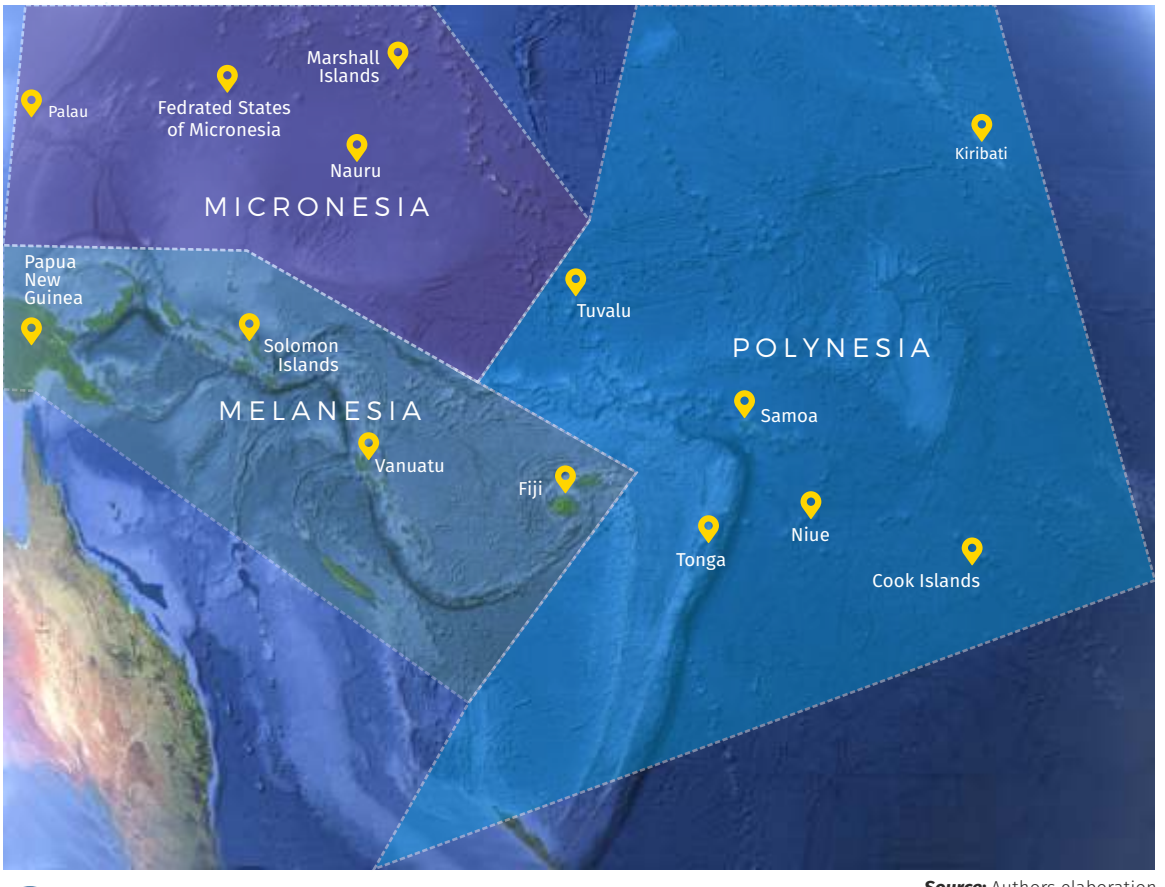
A rapidly changing world

This report focuses on 14 countries in the Pacific (Table 1, Figure 1). These countries, collectively referred to in this report as the Pacific Small Island Developing States (SIDS), are highly vulnerable to disasters as well as to economic disruption due to their remoteness from major markets (with associated high costs for imports and exports) and the generally small size of their economies. Climate change has emerged as an existential threat to many of the smaller countries.

Table 1. Countries covered by the Pacific Forest Sector Outlook Study

Group	Countries
Melanesia	Fiji, Papua New Guinea, Solomon Islands and Vanuatu
Micronesia	Federated States of Micronesia, Kiribati, Marshall Islands, Nauru and Palau
Polynesia	Cook Islands, Niue, Samoa, Tonga and Tuvalu

Figure 1. *The three Pacific zones encompassed in the outlook study - Melanesia, Micronesia and Polynesia*



Source: Authors elaboration

MELANESIA

MICRONESIA

POLYNESIA

Although the Pacific SIDS account for only about 0.35 percent of the world's land area and 1 percent of the forest area (Box 1), they host a diverse mosaic of land uses that are changing in response to larger changes taking place globally, nationally and locally. Climate change and its direct and indirect impacts have emerged as an overarching issue requiring major shifts in the management of land and other natural resources to increase resilience and reduce vulnerabilities. The COVID-19 pandemic has compounded the challenges facing the Pacific SIDS and continues to affect all Pacific SIDS, both directly and indirectly.

Box 1. The Pacific Small Island Developing States at a glance

Land area	51.8 million ha
Number of islands larger than 1 000 ha	156
Collective area of exclusive economic zones	20.8 million km^2
Estimated population (2020)	11.5 million people
Population density	21.8 persons per km^2
Most populous country	Papua New Guinea (8.9 million people)
Least populous country	Niue (2 000 people)
Gross domestic product (GDP) in 2020 (in purchasing power parity - PPP)	USD 52.6 billion
Per-capita GDP in 2020 (in PPP)	USD 4 580
Extent of forest cover	40.3 million ha
Land area under forest cover	77.8 percent

Note: Except where otherwise indicated, the numbers apply to the following 14 countries: the Cook Islands, Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Source: Authors elaboration

Outlook studies as key to strategic planning

Strategic planning - a key tool for improving food security and the sustainable use of land and other resources - requires a clear understanding of changes taking place at different spatial scales. In a highly interconnected world undergoing rapid changes, it is imperative that all sectors assess long-term changes, identify the options available, and mainstream this information in their strategic planning. Changing needs and aspirations require societies to reset their relationships with nature.

In light of the recommendation of the Asia Pacific Forestry Commission, FAO published the second Asia-Pacific Forest Sector Outlook Study in 2010 (FAO, 2010). In addition to the main regional report, FAO prepared five subregional reports, including one for the Pacific published in 2011 (FAO, 2011a). The latter publication focused on the state of forests and forestry in the Pacific, key drivers affecting the forest sector in the subregion, probable pathways of change, and options and priorities for increasing the contributions of forestry to socio-economic development and environmental sustainability.

These regional and subregional outlook studies provided a broad framework and direction for long-term planning, but developments after 2010 necessitated a revision, particularly in light of the 2030 Agenda for Sustainable Development and the 2015 Paris Agreement on climate change. Thus, in response to a recommendation of the 27th Session of the Asia-Pacific Forestry Commission in Colombo, Sri Lanka, in October 2017, FAO published the third Asia-Pacific Forest Sector Outlook Study in June 2019 (FAO, 2019). This provided an overview of how forests and forestry had evolved in the region since the 2010 outlook study, identified various drivers that were directly and indirectly affecting the forest sector, set out scenarios for 2030 and 2050, and proposed priorities and strategies for forestry to build a sustainable future.

Although the third Asia-Pacific Forest Sector Outlook Study addressed important issues relevant to the Pacific

Objectives and key issues

Almost all the Pacific SIDS have committed themselves to achieving the Sustainable Development Goals (SDGs). A key concern for most

countries is to increase resilience in the face of multiple disruptions, such as climate-change-related events, other disasters and the COVID-19 pandemic. The aim of the present study is to provide an in-depth analysis of the outlook for forests and trees in the Pacific SIDS, including the development of future scenarios to provide an indication of potential pathways of change and the options available for accomplishing the SDGs. Specifically, this report outlines

- the main trends for forests and trees in the larger landscape context of Pacific SIDS, including their vulnerability to economic and environmental changes;
- key drivers of change, particularly climate change, and development scenarios for exploring the situation that may emerge by 2030 and beyond, focusing on possible pathways of change and the vulnerabilities of countries; and
- options for interventions in forestry and related land uses to increase the resilience of people and landscapes, nationally and subregionally, including priorities and strategies appropriate to the diverse conditions in the subregion.

The outlook study in 2011 provided an indication of broad trends in the subregion, but there is a need to revisit these in the context of more recent developments. For example, extensive damage caused by cyclones, storm surges, floods and the COVID-19 pandemic have caused considerable disruption in Pacific SIDS. Most recently, the war in Ukraine has also caused changes in trade, geopolitics and economic development. Land and forest management must adapt to such changes. This study focuses on the current and future roles of forests and trees in accomplishing the SDGs. Specifically, the study addresses the following:

- the role of forests and trees in reducing vulnerabilities and increasing the resilience of livelihoods in the context of climate change and disasters;
- the state of the forest sector to 2030 and beyond and the potential to reduce deforestation and forest degradation as a means for enabling countries to accomplish the forest transition;
- the role of natural forests vis-à-vis planted forests in wood production and the potential for a major shift towards planted forests as a source of wood in those Pacific SIDS currently sourcing most of their wood from natural forests;
- the potential of wood exporters in the region to invest in value-adding and to enhance employment and income by moving up value chains;
- the role of agroforestry in the provision of multiple products and services, thereby enabling landowners to improve their livelihoods;
- scenarios for the production, processing and trade of key non-wood forest products (NWFPs) and their potential to improve rural livelihoods; and
- means by which forest-rich countries can respond to growing demand for global public goods, such as climate-change mitigation and biodiversity conservation while improving livelihoods, and how trade-offs can be managed.

Countries covered

The 2011 Pacific Forest Sector Outlook Study (FAO, 2011a) focused on the entire South Pacific, including Australia and New Zealand. Given the socio-economic differences among countries, however, and the more developed state of forestry in Australia and New Zealand and the differing nature of problems, the scope of this study is limited to the Pacific SIDS that are members of the Asia Pacific Forestry Commission, as listed in Table 1.

Although the Pacific SIDS have many characteristics in common and confront many similar problems, they differs in various ways - such as land area, population size and economic status - that affect the long-term outlook for forests and forestry. The conventional grouping of the Pacific SIDS into Melanesia, Micronesia and Polynesia (as shown in Table 1 and Figure 1) captures some of these differences, but there are certain inconsistencies that have a bearing on the long-term outlook for forestry. For example, Papua New Guinea accounts for 78 percent of the Pacific SIDS population, 88 percent of the land area and 89 percent of the forest area; at the other end of the spectrum, some countries have population sizes of a few thousand and land areas of fewer than 100 000 ha. To fully accommodate the divergent situations, this study uses the groupings shown in Table 2 in its scenarios.

Table 2. *Groupings of Pacific Small Island Developing States for the purposes of scenarios presented in this study*

Group	Countries	Remarks
I	**Papua New Guinea**	The largest country in terms of population (with a population of more than 8.9 million people), the largest economy, and the most forested country with considerable forest development potential
II	**Fiji, Solomon Islands and Vanuatu**	Medium-sized countries in terms of land area and population, comprising all Melanesia except Papua New Guinea
III	**Cook Islands, Federated States**	All the Micronesian and Polynesian countries of Micronesia, Kiribati, Marshall Islands, small-island and atoll ountries with population Nauru, Niue, Palau, Samoa, Tonga and Tuvalu sizes ranging from 2 000 (Niue) to 220 000 (Samoa) and small areas of forest. Many are low elevation atolls and relatively more urbanized; in view of the small forest area, the scope for conventional forestry is limited

Source: Authors' elaboration

Methodology

This study has been undertaken as a collaborative effort involving the Pacific SIDS and various organizations supporting sustainable development in the subregion. Considerable effort has been made to tap into the wealth of knowledge about the subregion, including by drawing on the many previously undertaken studies and assessments. Guidance and direction for the study was provided by an advisory committee consisting of experts and representatives of various organizations and countries. National focal points provided in-depth assessments ("country outlook papers") of the current and emerging situation for forests and trees in Fiji, Papua New Guinea, Samoa, Solomon Islands and Vanuatu, in line with a previously agreed framework. A bottom-up approach enabled several professionals to participate in and contribute to online meetings and discussions, particularly the following:

- First meeting of the advisory committee to endorse the overall approach and areas of focus (6 April 2021)
- First meeting of the country focal points (19 July 2021)
- Second meeting of the advisory committee (12 November 2021)
- Thematic workshop on climate-change scenarios and mitigation and adaptation strategies (1 December 2021)
- Thematic workshop on land tenure in the Pacific and its implications for sustainable land use and forest governance (2 December 2021)
- Outlook scenario planning meeting (1 March 2022).

These inputs were supplemented with information about other island countries and territories derived from the literature. The following thematic studies were also carried out in collaboration with various partners (listed in the acknowledgements) to provide necessary background material and on which this report draws significantly:

- *Increasing the resilience of people and landscapes in the Pacific Small Island Developing States: The role of forests and trees in the context of climate change* (Luo *et al.*, 2022)
- *Emerging opportunities and challenges for Pacific Small Island Developing States in the production, processing and trade of forest products* (Brown, 2022)
- *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests* (Bulai, 2022)
- *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States* (Bartlett, 2022)

- *Enhancing investments in sustainable land uses: What options for Pacific countries?* (in preparation).

This subregional outlook report was prepared by integrating information from the country outlook papers, thematic studies and a range of published and unpublished information. It has been subjected to internal and external peer reviews and revisions in light of these.

Conceptual and methodological issues

Most readers of outlook studies generally expect a picture of change presented in a set of numbers giving an indication of what might happen in specific years under the impacts of various drivers. In a typical outlook study on forestry, there is a strong temptation to forecast changes in key parameters such as the extent of forest cover, growing stock, the area of planted forests, the extent of protected areas, and the demand for and supply and trade of forest products. Although such forecasts can be helpful by offering a general picture of change, they have certain limitations. For example:

- Several factors that will shape the future - especially governance - cannot easily be quantified.
- In most Pacific SIDS, systems for the collection, reporting and analysis of forest data is relatively undeveloped.
- The strong presence of informal and subsistence sectors in forestry makes it challenging to obtain reliable data on forest-product production and consumption.
- In the main industrial roundwood producers in the Pacific SIDS, wood production is driven primarily by external demand, especially from Asian importers. Assessing changes in demand in such markets is resource-demanding and beyond the scope of this study.

Therefore, this outlook study focuses on the broad trajectories of change stemming from the impacts of various drivers and the crucial uncertainties that societies will need to address.

Key limitations

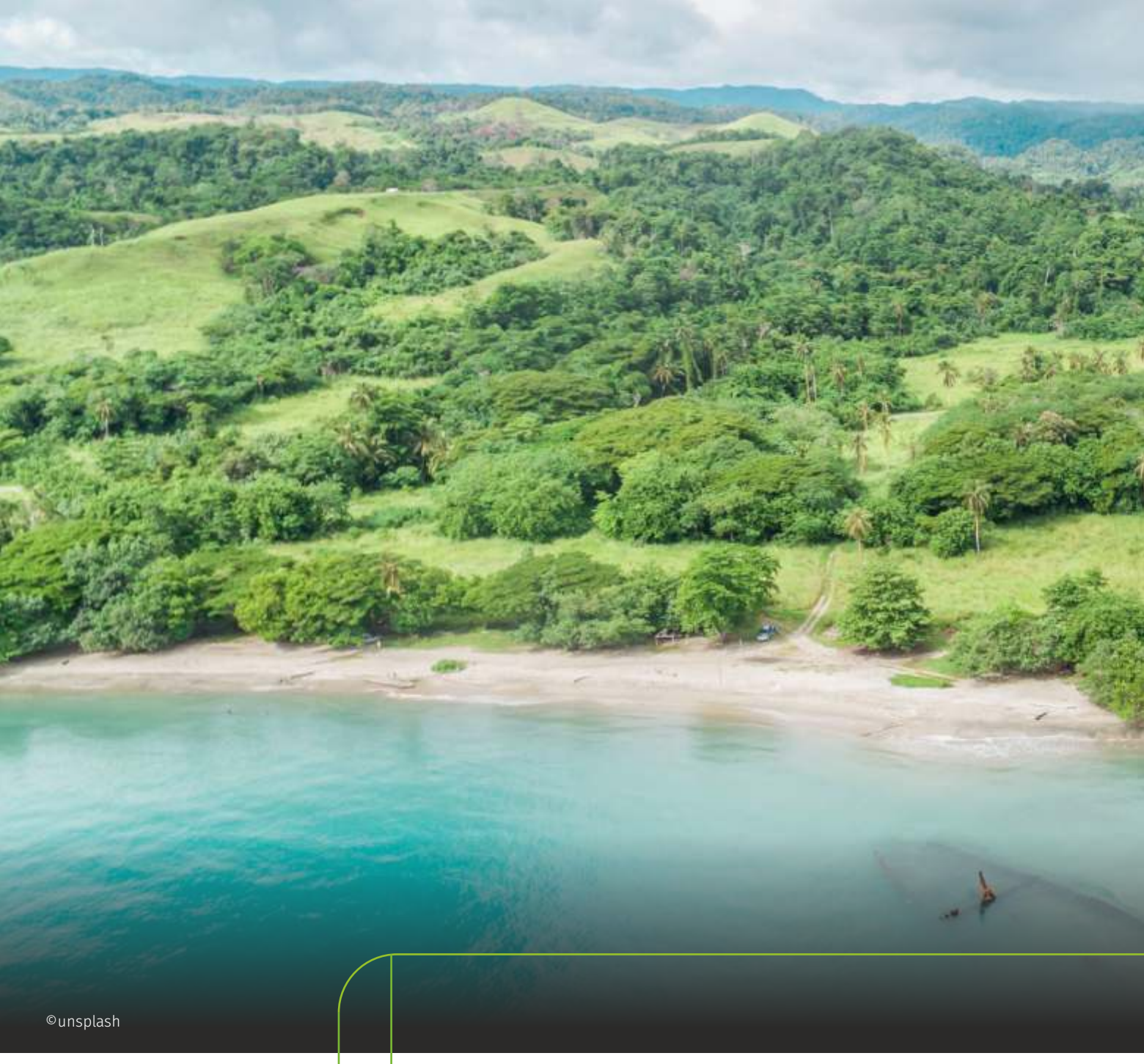
Outlook studies should be undertaken as collective exercises involving key stakeholders, especially in articulating scenarios, priorities and strategies. Scenario planning helps stakeholders envision alternative futures and encourages thinking on what needs to be done to achieve desirable futures, but they are prone to subjectivity if undertaken without the substantial involvement of stakeholders. Because of COVID-19-related disruptions, some key steps for developing this outlook study were skipped or diluted. Although online meetings and workshops were held to elicit the views of stakeholders, these are an inadequate substitute for in-person meetings that enable intense interactions and the development of consensus on crucial issues. It will be important in the future to have such in-depth discussions among stakeholders on pathways, priorities and strategies for forestry in the Pacific SIDS, building on the information and analysis contained in this report.

Structure of the report

Table 3. shows the seven chapters by which this report is organized.

***Table 3**. Structure of the report*

Chapter	Focal area	Main issues discussed
1	**Introduction**	Background, objectives, scope, approach and structure
2	**Current state of land use,**	Land use, forests and the management of forest and tree resources
3	**forests and forestry**	Goods and services provided by forests and trees, including the production of key products and the ecosystem services provided
4	**Drivers of change**	Demographic change, including population growth and distribution, income growth, structural economic changes, and the direct and indirect impacts of climate change
5	**Societal responses as drivers**	Changes in governance (including policies, legislation and institutions), technology, innovation and investment
6	**Scenarios and their implications**	Probable scenarios to 2030 and beyond and their implications and forests
7	**Priorities and strategies**	Priorities and strategies that may be pursued to enhance the contributions of forests and forestry to the Sustainable Development Goals, increasing resilience and reducing vulnerabilities



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02

Key points

- The Pacific SIDS have a land area of 51.7 million ha on about 3 400 islands of varying size. Differences in origin, size and elevation have created highly diverse biophysical conditions. The total area under forests estimated at 40.3 million ha, with Melanesia accounting for 98.8 percent of the land area and 99.2 percent of all forests in the Pacific SIDS.
- The Pacific SIDS are among the world's most forested countries as a percentage of land area, with more than three-quarters (78 percent) of the land area under forests. The average forest area per capita among the 14 countries is 3.56 ha, which is nearly seven times the global average. There is considerable variation between countries, however.

OVERVIEW OF LAND USE AND FORESTS

- Although data on forest area and condition are poor in the Pacific SIDS, it appears that deforestation is relatively low, estimated at 0.06 percent in 2010- 2020. The large-scale expansion of oil palm and mining has led to significant forest reductions in some of the larger countries. Land use is relatively stable in most Micronesian and Polynesian countries and the scope for major changes in use is limited. Forest degradation is widespread, with commercial logging a major contributor.
- The pace of expansion of planted forests in the subregion has been slow. Only Fiji has developed a large planted-forest estate, mainly of pine and mahogany, although plantation expansion has stagnated there in recent years, due largely to tenure uncertainties. Land tenure also appears to be a constraint on plantation development in Papua New Guinea and Solomon Islands, despite favourable growing conditions.
- Agroforestry has a long history in the Pacific SIDS, with multiple forms adapted to differing biophysical and socio-economic contexts. Trees outside forests (mainly in agroforestry) have become the most important source of wood for most of the smaller Pacific SIDS. Several tree species are grown as integral components of agroforestry systems, of which coconut is the most ubiquitous.

Collectively, the 14 Pacific SIDS that are the subject of this report have a land area of 51.7 million ha, which is about 0.4 percent of the world's land area. The pace of change in the subregion's landscapes and land use has accelerated in recent decades, particularly in the larger Melanesian countries. Forests and traditional subsistence farming, including agroforestry, dominated the landscapes for a long time and still do in many countries. Large-scale native-forest logging gathered momentum after about 1990, driven by surging global demand for tropical timber and decisions by governments to draw down their natural capital to mobilize resources for development. Plantation-scale agriculture - especially sugarcane and coconut - has had a long history in the Pacific, and in recent decades there has been a rapid expansion in the cultivation of oil palm, rubber, cocoa and coffee, even among smallholders, replacing traditional low-intensity mixed-cropping systems. Other land uses include mining, urban expansion and infrastructure development.

This chapter provides an overview of land use in the Pacific SIDS, focusing on how forests and forestry fit into the larger landscape framework, important changes in recent decades, and key trends in the production of goods and services. In addition to providing an overview of forest resources in the subregion, the chapter addresses:

- changes in land use, particularly deforestation and forest degradation;
- the management of native forests and planted forests; and
- the potential of and constraints to agroforestry

A complex and changing land-use mosaic

The Pacific SIDS comprise about 3 400 islands of varying size. Differences in origin, size and elevation have created very diverse biophysical conditions (Nunn *et al.*, 2016). Only 156 islands have a geographical area of more than 1 000 ha, which constrains the pursuit of large-scale activities. Remoteness, fragmented distribution and small size are characteristic features of most Pacific SIDS, which limit the ability to take advantage of economies of scale and hinder the commercial viability of certain uses.

Considerable variation exists in the land areas of the 14 Pacific SIDS and forest area (Table 4).

***Table 4**. Area of land, forest and other wooded land, Pacific Small Island Developing States, 2020*

Country	Forests	Other wooded land	Other land	Total land area
		(1 000 ha)		
Fiji	1 140	0	687	1 827
Papua New Guinea	35 856	0	9 430	45 286
Solomon Islands	2 523	22	254	2 799
Vanuatu	442	479	298	1 219
Melanesia	**39 961**	**501**	**10 669**	**51 131**
Federated States of Micronesia	64	0	6	70
Kiribati	1	26	54	81
Nauru	0	0	2	2
Marshall Islands	9	0	9	18
Palau	41	0	5	46
Micronesia	**115**	**26**	**76**	**217**
Cook Islands	16	0	8	24
Niue	19		7	26
Samoa	162	18	104	284
Tonga	9	4	59	72
Tuvalu	1	0	2	3
Polynesia	**207**	**22**	**180**	**409**
Pacific total	**40 283**	**549**	**10 925**	**51 757**

***Source:* FAO.** 2020. *Global Forest Resources Assessment 2020: Main report.* Rome. Available at https://doi.org/10.4060/ca9825en

Melanesia accounts for 98.8 percent of the land area and 99.2 percent of all forests in the Pacific SIDS. Papua New Guinea alone accounts for 87.5 percent of the land area and 89 percent of the forests in the Pacific SIDS. The extent of land and forests and how they are distributed among countries and islands have important implications for their current and future use.

The Pacific SIDS host a diverse mosaic of land uses that vary in their biophysical and socio-economic characteristics, with considerable differences between the larger and smaller islands. The highly diverse landforms of the larger islands contribute to their rich biodiversity and their cultural and linguistic diversity. The smaller islands and atolls are characterized by less-diverse landforms. Nevertheless, agroforestry is a dominant land use throughout the subregion, providing a wide range of products that supplement income generated by fishing, tourism and a host of tertiary-sector activities. The various land uses differ in their capacity to provide ecosystem services, such as stable water supply, coastal protection and various amenity values (Table 5).

Table 5. *Important land uses in the Pacific Small Island Developing States*

Land use/ vegetation	Structure	Functions	Potential transformation
Primary forest	Multistoried naturally regenerating forests with a preponderance of large trees	• A wide array of wood and non-wood products • Ecosystem services such as biodiversity conservation, carbon sequestration and coastal and watershed protection	• Unsustainable logging coupled with inadequate regeneration efforts have led to varying degrees of degradation • Areas close to population centres are most often converted into farms - shifting or permanent cultivation - or to forestry and horticultural plantation crops
Secondary forest	Multistoried forests whose structure and composition have been altered due to logging	• Production of goods and services much lower than in primary forests • Re-logging before fully regenerated a major problem, accentuating degradation	• There is a high likelihood of conversion to agriculture - shifting cultivation, agroforestry or plantations • If left undisturbed, secondary forests regain the original structure, composition and functions of primary forest
Shifting cultivation	Slash-and-burn cultivation with varying fallow periods	• A wide array of subsistence crops catering to the livelihoods of rural communities	• Abandoned shifting cultivation reverts to secondary forests and intensification results in transformation to permanent mixed-cropping systems or monocultures of cash crops
Permanent mixed farming – agroforestry	Multistoried farming system that mimics the original primary/ secondary forest to varying degrees, taking advantage of differing light, moisture and soil-nutrient regimes	• A mix of farm products from perennial trees and annual and seasonal crops • Source of multiple timber, woodfuel and non-wood forest products • Provides several ecosystem services, especially carbon sequestration, biodiversity conservation and watershed protection, albeit at a lower level than primary and secondary forest	• Mixed-cropping systems are relatively stable land uses in the Pacific that provide multiple products and services • A wide range of crop combinations is used, reflecting differences in biophysical, socio-economic, policy and institutional context
Plantation	Highly simplified production system, mostly of one species designed to produce timber, fruit, latex or other products	• Main emphasis is on commercial profitability, with a focus on high levels of production of one or a few products • Often designed to generate foreign exchange • Intense transformation of soil through the use of inputs such as fertilizers and pesticides	• The sustainability of plantations is dependent on commercial viability and the extent that changes in ecological condition affect productivity • Apart from the threat of pest and disease outbreaks, the commercial viability of plantations may be reduced by cyclonic storms

Land use/ vegetation	Structure	Functions	Potential transformation
Non-agricultural use	E.g. mining, urban development and infrastructure development, which can cause fundamental changes in topography, soil structure, drainage and other factors	• Land transformed such that it performs few or none of its original functions	• Substantial investment is required to rehabilitate abandoned minesites

Source: *Authors' own elaboration.*

Broad land-use trends relevant to forestry are discussed below

Forests in the Pacific

Diversity in ecological conditions has led to the existence of several forest types in the subregion, the most important being tropical lowland rainforests, montane rainforests, tropical dry forests, swamp forests and mangrove forests.

The existence of these forests is influenced by geology, which in turn determines soil characteristics. Continental islands such as New Guinea have diverse soils that include nutrient-rich volcanic and alluvial soils supporting the development of lowland tropical rainforests. At the other end of the spectrum, atolls have low-fertility shallow alkaline sandy soils that mainly support the growth of tropical dry forests. SPC (2011) provides a detailed account of forests in each of the Pacific SIDS, including key forest characteristics, a history of management, economic, social and ecological significance, trends in management, and key challenges.

Forest area and forest-cover change

Systematic assessment of forest resources in the Pacific is a recent phenomenon, driven largely by the need to comply with global commitments on sustainable forest management and more recently to demonstrate that Pacific Island countries are taking action to control deforestation and forest degradation. Notwithstanding various efforts, the availability of reliable data is a key challenge. The total area under forests in the 14 Pacific SIDS is estimated as 40.3 million ha, Most of it in the large Melanesian countries (FAO, 2020; Table 6), which is about 1 percent of the world's forest area.

Table 6. *Distribution of forests, Pacific Small Island Developing States, 2020*

Country	Forest area (1 000 ha)	Forest as percentage of total land area
Melanesia		
Fiji	1 140	62
Papua New Guinea	35 856	79
Solomon Islands	2 523	90
Vanuatu*	442	36
Total	**39 961**	**78**
Micronesia		
Federated States of Micronesia	64	91
Kiribati	1	1
Marshall Islands	9	50
Nauru	0	0
Palau	41	89
Total	**115**	**54**
Polynesia		
Cook Islands	16	67
Niue	19	73
Samoa	162	57
Tonga	9	12
Tuvalu	1	33
Total	**207**	**49**
Total, 14 countries	**40 283**	**78**

Note: ** See Box 4 for discussion of forest-area estimates in Vanuatu.*
Source: *FAO. 2020. Global Forest Resources Assessment 2020: Main report. Rome. Available at https://doi.org/10.4060/ca9825en*

The subregion is well-forested, with about 78 percent of land under forests; the Federated States of Micronesia, Palau, Papua New Guinea and Solomon Islands are all in the top ten countries worldwide for the proportion of land area under forests (FAO, 2020). At the other end of the spectrum, however, Nauru has no forest, a result of unregulated mining that has left behind a highly degraded landscape (Box 2). The four Melanesian countries - Fiji, Papua New Guinea, Solomon Islands and Vanuatu - account for 99.2 percent of forests in the subregion.

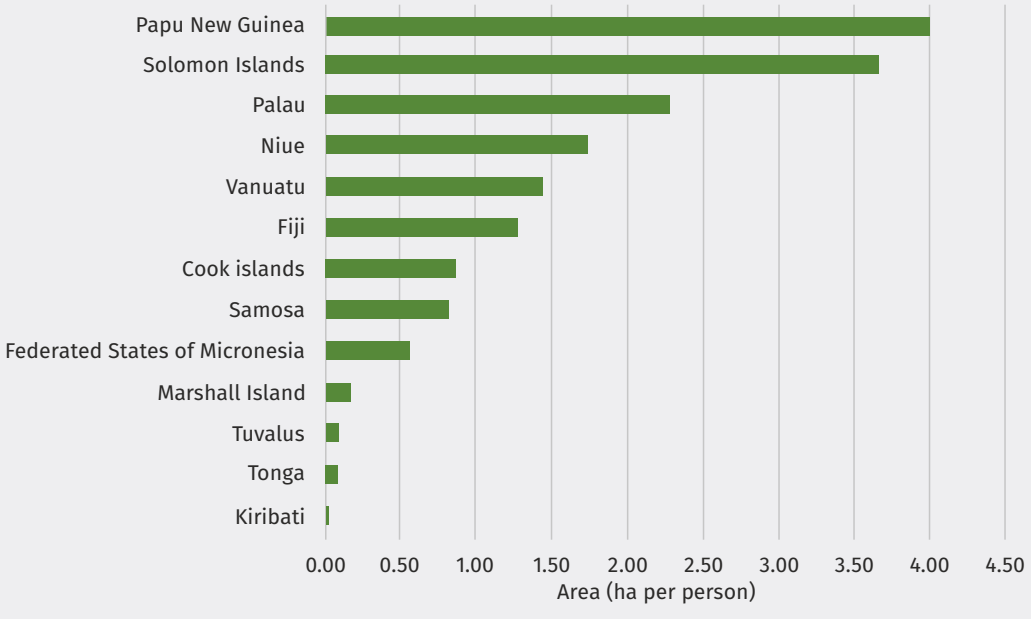
Box 2. Mining and deforestation: how Nauru lost its forest

Nauru is one of the world's smallest countries, with an area of just 2 100 ha. It is a small, raised limestone island reaching a height of 70 metres above sea level. Before the advent of phosphate mining, the island's central plateau was fully covered by native forests, and the traditional lifestyle relied almost entirely on land and its native forests and ocean resources. In the last 100 years, however, this central plateau - referred to as topside - has been totally excavated as a source of phosphate. The end result was a devastated landscape and a host of social, cultural and economic problems typical of a "resource curse". The existence of Nauru and the survival of its population depends on rehabilitating the landscape, a very costly venture being pursued through the Nauru Rehabilitation Corporation.

Sources: SPC. 2011. *Forests of the Pacific Islands: Foundation for a sustainable future*. A. Moorehead, ed. Secretariat of the Pacific Community (SPC). **Pollock, N.J. 2014.** Nauru phosphate history and the resource curse. *Journal of the Society of Oceanists*, 138/139: 107–120. https://doi.org/10.4000/jso.7055.

The per-capita forest area among the 14 countries is 3.56 ha per person, which is about 20 times higher than for the Asia-Pacific region as a whole and 6.8 times the global average. Nevertheless, there is considerable variation between countries in the subregion, ranging from 0.01 ha per capita in Kiribati to 4.01 ha per capita in Papua New Guinea (Figure 2) (Nauru is not included because it reported no forest area).

Figure 2. *Per-capita forest area, Pacific Small Island Developing States, 2020*



Sources: **FAO.** 2020. *Global Forest Resources Assessment 2020: Main report*. Rome. Available at https://doi.org/10.4060/ca9825en; **United Nations**. 2019. *World Population Prospects 2019: Data Booklet*. Statistical Papers - **United Nations** (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

A high per-capita forest area may not be economically advantageous unless there are opportunities for resource aggregation. Many of the Pacific SIDS are hindered in this by the small size of the total forest area, the fragmented distribution of forests among many small islands, and customary ownership. The scope for realizing economies of scale, which is crucial in the context of trade, is limited to a few countries, especially Fiji, Papua New Guinea and Solomon Islands. For most of the other Pacific SIDS, the emphasis must be on small-scale operations primarily to meet domestic demand and on the provision of ecosystem services.

Deforestation appears to be relatively low

Agricultural expansion, especially of shifting cultivation and plantation crops like oil palm, exacerbated by logging, has been a key factor in the reduction in forest area in the Pacific SIDS; for example, both logging and land conversion expanded rapidly from about 1990 in Papua New Guinea (Box 3) and Solomon Islands. Nevertheless, the assessment of deforestation and forest degradation is challenging, notwithstanding advancements in resource assessment technologies, due largely to the absence of an effective system of regular national inventories and the need to rely on extrapolations of outdated data. FAO's Global Forest Resources Assessment (FRA), which is prepared on the basis of national data, is currently the only source of comparable information on forest-area change. Table 7 provides an overview of changes in forest extent, as reported in the most recent (2020) iteration of the FRA (FAO, 2020).

Box 3. Deforestation and forest degradation in Papua New Guinea, 2000- 2015

An estimated 253 000 ha of forest in Papua New Guinea was converted to other land uses between 2000 and 2015. Of this, 60.7 percent was for shifting cultivation and 32 percent was for oil-palm cultivation. Other uses for which forests have been cleared are permanent crops (other than oil palm), cocoa (0.78 percent), coconut (0.77 percent) and settlements (0.52 percent). Nearly 79 percent of the clearance took place in low-altitude tropical rainforests on plains, fans and uplands and another 17 percent was in lower montane forests. In total, 81 200 ha was cleared for conversion to oil palm; overall, however, an area of 5.5 million ha has been allocated for this use under special agriculture business leases.

An assessment by the Papua New Guinea Forest Authority estimated the extent of forest degradation at about 2.37 million ha, nearly ten times the area of forest clearance for other uses. The main contributing factor to forest degradation was considered to be logging, which accounted for 2.18 million ha. The assessment pointed out that low-altitude rainforests in the plains, fans and uplands accounted for nearly 92 percent of the total degraded forest area.

Sources: Gamoga, G., Turia, R., Abe, H., Haraguchi, M. & Iuda, O. 2021. *The forest extent in 2015 and the drivers of forest change between 2000 and 2015 in Papua New Guinea: Deforestation and forest degradation in Papua New Guinea*. Case Studies in the Environment. Available at http://online.ucpress.edu/cse/article-pdf/5/1/1442018/482839/cse.2021.1442018.pdf
Papua New Guinea Forest Authority. 2021. *Papua New Guinea country outlook report*. Unpublished.

Table 7. *Change in forest area, Pacific Small Island Developing States, 1990- 2020*

Country	Forest area (1 000 ha)			
	1990	2000	2010	2020
Melanesia				
Fiji	940	1 006	1 073	1 140
Papua New Guinea	36 400	36 278	36 179	35 856
Solomon Islands	2 545	2 538	2 530	2 523
Vanuatu	442	442	442	442
Total	**40 327**	**40 264**	**40 224**	**39 961**
Micronesia				
Federated States of Micronesia	64	64	64	64
Kiribati	1	1	1	1
Marshall Islands	9	9	9	9
Nauru	n.d.	n.d.	n.d.	n.d.
Palau	38	40	41	41
Total	**112**	**114**	**115**	**115**

Country	Forest area (1 000 ha)			
	1990	2000	2010	2020
Polynesia				
Cook Islands	15	16	16	16
Niue	19	19	19	19

Note: n.d. = no data.
Source: FAO. 2020. *Global Forest Resources Assessment 2020: Main report*. Rome. Available at https://doi.org/10.4060/ca9825en

Box 4. *The need for more systematic assessment of land use and land-use change*

Systematic efforts to assess the extent of forests in the Pacific are of recent origin, driven mainly by the need to provide information for the Global Forest Resources Assessment and to make more precise estimates of deforestation and degradation and therefore changes in the carbon stocks, especially to assess reference-level carbon emissions. This work has provided more accurate estimates of forest cover than earlier approaches that often relied on extrapolating outdated assessments. For example, the Global Forest Resources Assessment has been reporting the forest area in Vanuatu at 442 000 ha since 1990. As part of the preparation of a REDD+ strategy for Vanuatu, however, a systematic assessment reported the extent of dense forests at 831 000 ha, which is 65 percent of the land area. This indicates the need for systems that enable regular monitoring and reporting on land use and land-use change in the Pacific Small Island Developing States.

Sources: **FAO.** 2020. *Global Forest Resources Assessment 2020: Main report.* Rome. Available at https://doi.org/10.4060/ca9825en
Vanuatu Department of Forests. 2021. *Vanuatu country outlook paper.* Prepared for FAO. Unpublished.

Notwithstanding data limitations (Box 4), most forest loss in the Pacific SIDS is occurring in Papua New Guinea, Samoa and Solomon Islands, with the forest area increasing in Fiji since 1990 and others showing no change (possibly due to a lack of data and the difficulties in capturing small changes). At the aggregate level, the deforestation rate is relatively low in the Pacific SIDS, at 0.06 percent in 2010- 2020, compared with South and Southeast Asia (- 0.31 percent) and the global average (- 0.12 percent) (Table 8).

Table 8. *Estimated annual rate of forest-area change, world and selected Pacific Small Island Developing States and subregions*

Country/subregion	% change		
	1990- 2000	2000- 2010	2010- 2020
Fiji	+0.01	+0.01	+0.01
Papua New Guinea	- 0.03	- 0.03	- 0.09
Samoa	- 0.26	- 0.29	- 0.25
Solomon Islands	- 0.03	- 0.03	- 0.03
Pacific SIDS	- 0.01	- 0.01	- 0.06
South and Southeast Asia	- 0.58	- 0.09	- 0.31
World	- 0.19	- 0.13	- 0.12

Source: FAO. 2020. *Global Forest Resources Assessment 2020: Main report*. Rome. Available at https://doi.org/10.4060/ca9825en

Box 5. The definition of forests

The 2020 Global Forest Resources Assessment (FAO, 2020) defines a forest as land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use. The definition includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and a tree height of 5 m. It also includes areas that are temporarily unstocked due to clearcutting as part of forest management practice or disasters and which are expected to be regenerated within five years. In exceptional cases, local conditions may justify the use of a longer timeframe. Rubber plantations are included in the definition but oil-palm plantations are not.

Most Pacific SIDS have adopted FAO's definition, with the following minor differences:

- In Papua New Guinea, forest is defined as land spanning more than 1 ha with trees higher than 3 m and a canopy cover of more than 10 percent.
- In Vanuatu, the forest area has been derived from a 1992 assessment based on three components - (1) land with a canopy over 20 m in height (205 307 ha); (2) low forests with tree heights ranging from 10 to 20 m (234 089 ha); and (3) mangroves with an area of 2 519 ha; thus, the total is 441 915 ha. Another category, thickets with a dense canopy 3- 8 m in height, covered an area of 433 941 ha. If this is included, the total estimated extent of forests in Vanuatu would be 875 856 ha.

Sources: **Gamoga, G., Turia, R., Abe, H., Haraguchi, M. & Iuda, O.** 2021. *The forest extent in 2015 and the drivers of forest change between 2000 and 2015 in Papua New Guinea: Deforestation and forest degradation in Papua New Guinea.* Case Studies in the Environment. Available at http://online.ucpress.edu/cse/article-pdf/5/1/1442018/482839/cse.2021.1442018.pdf
Papua New Guinea Forest Authority. 2021. *Papua New Guinea country outlook report*. Unpublished.

A fundamental issue for assessing deforestation is the criteria used to define forests. FAO's definition, which is generally applied in the Pacific SIDS, is based on canopy cover, the height of trees and the area of the land parcel that is forested (Box 5). To capture the diverse ecological conditions and to facilitate aggregation, global assessments use low cut-off points. For example, the cut-off point for canopy cover is 10 percent, which implies that the removal of trees will not be regarded as deforestation until the canopy cover declines below 10 percent.

There is a need, therefore, to also assess forest degradation, which affects the composition, structure and functions of forests. Two key indicators of forest degradation (but far from the only ones) are:

- change in the area under primary and secondary forests; and
- growing stock (or carbon stock) per unit area.
- In general, FRA 2020 (FAO, 2020) did not provide data for change in primary-forest area, especially for those countries with large areas of naturally regenerating forests.
- The state of regeneration of logged-over forests has generally received little attention. Although such forests may ultimately recover much of their former functionality and biodiversity if left undisturbed, a number of factors may contribute to their degradation. For example:
- Logging damage may be so severe that it changes the condition of soil, drainage and residual vegetation. The “high-grading” of the most valuable trees during harvesting may hamper the subsequent regeneration of those species and favour the growth of secondary and invasive species.
- Logged-over forests may be re-entered prematurely to extract the remaining timber, as has been reported in Solomon Islands (e.g. see Brown, 2022), further undermining the regeneration and recovery of the logged area.
- Logging increases the accessibility of forests and can facilitate conversion to other land uses, especially agriculture. This has been an important contributory factor to deforestation and degradation in the Pacific SIDS, especially in Melanesia.

Natural forests are the most important source of large-scale wood production in Papua New Guinea and Solomon Islands. They can be managed sustainably for the production of wood and other goods and services given adequate attention to technical and economic considerations. Notwithstanding the existence of codes of logging practice, however, current systems of logging are adversely affecting the composition, structure and functions of natural forests and undermining long-term wood production.

Plantation forestry in the Pacific

Forest plantation establishment has a long and often chequered history in the Pacific SIDS. Mahogany was introduced into Fiji from Central America in 1911 as an ornamental plant and its promising growth performance led to the establishment of small experimental trials shortly thereafter. Forest plantation trials commenced in Tonga in the 1940s, as did pine plantations in Bulolo, Papua New Guinea. FAO (2011a) reported the extent of forest plantations in the Pacific SIDS at 322 000 ha. The most recent assessment (FAO 2020) put it at 299 000 ha (Table 9), which is 0.7 percent of the forest area. Of the Pacific SIDS, only Fiji achieved a consistent increase in plantation area - about 4 000 ha annually - between 1990 and 2020; plantation expansion has stagnated in recent years in Fiji, however, due to uncertainty about tenure, especially the renewal of land leases. Land tenure also appears to be a constraint on plantation development in Papua New Guinea and Solomon Islands, despite favourable growing conditions

Table 9. *Extent of forest plantations and important species, selected Pacific Small Island Developing States, 2020*

Country	Area (1 000 ha)	Plantations as percentage of total forest area	Main plantation species	Annual change in area of planted forests (1 000 ha)
Fiji	207	18.2	*Pinus caribaea*, *Swietenia macrophylla*, *Santalum album*, *Tectona grandis*	4.0
Papua New Guinea	61	0.2	*Araucaria* spp., *Acacia mangium*, *Eucalyptus deglupta*, *Terminalia brassii*, *Ochroma pyramidale*, *Tectona grandis*	The reported plantation area has been unchanged since 1990
Solomon Islands	24	1.0	*Eucalyptus deglupta*, *Acacia mangium*, *Tectona grandis*	Plantation area declined from 41 000 ha in 1990 to 24 000 ha in 2020
Samoa	5	3.1	*Swietenia macrophylla*, *Tectona grandis*, *Eucalyptus urophylla*, *Eucalyptus teretecornis*	
Cook Islands	1	6.2	*Pinus caribaea* var. *Hondurensis*, *Acacia* spp., *Casuarina equisetifolia*	
Tonga	1	11.1	*Pinus caribaea*	
Total	**299**	**0.7**		

Source: FAO. 2020. *Global Forest Resources Assessment 2020: Main report*. Rome. Available at https://doi.org/10.4060/ca9825en

The estimate of planted-forest area in the Pacific SIDS based on FRA 2020 (FAO, 2020) is incomplete, with several countries not providing data on this parameter, although many have pursued plantation development. Vanuatu, for example, reported 3 000 ha in FRA 2000 (FAO, 2001) but has not provided estimates to subsequent FRAs. The country implemented the "local supply plantations" programme with the aim of enhancing village wood supplies, but funding constraints, inappropriate species selection and disease meant that only about 1 000 ha had been established by 1986, mainly of *Cordia alliodora*. A second plantation programme, "industrial forestry plantations", was initiated in 1982 to enhance the supply of wood for processing and export. Plantation establishment also fell far short of the area planned, with only 1 200 ha of industrial plantations established, mainly of *Pinus caribaea*. Tate (2013) estimated a total of 4 800 ha of forest plantations, as of 2006. In 2012, Vanuatu had about 1 120 ha of sandalwood plantations and another 233 ha of whitewood *(Endospermum medullosum)*. Tate (2013) noted that land availability and suitability were not an issue and that the national forest policy was clear in its desire to create frameworks to encourage plantation investment. In 2011, the Vanuatu Department of Forests set a target of establishing 20 000 ha of planted forests by 2020 in the form of large-scale plantations, community forest plantations and woodlots, but a stumbling block has been an absence of private-sector investors (Vanuatu Department of Forests, 2011).

Niue initiated a programme to establish a high-quality hardwood forest plantation estate, envisaging the eventual establishment of 4 000 ha of *Swietenia macrophylla* and *Toona australis* plantations over a 40-year period, with a view to creating a sustainable supply of logs for export. Approximately 300 ha of forest plantations had been established by 2000, but the programme was

halted, and Niue reported just 10 ha of mahogany plantations to FRA 2020 (FAO, 2020). No information was available on the fate of the remaining plantation area.

Palau reported no forest plantations to FRA 2020. However, around 2000, an FAO Forest Management Description for Palau (as reported in Brown, 2022) noted that:

"Small areas of forest plantations (around 250 hectares) have been established on both State and privately-owned lands. The principal species planted are Acacia spp., Swietenia macrophylla and Calophyllum inophyllum, which are grown with a view to timber production. Acacia auriculiformis is grown for timber production and for use in agroforestry".

Thus, there may still be a small area of forest plantations available for wood production in Palau.

Kiribati, Nauru and Tuvalu have undertaken various trials to establish forest plantations, but few details of area and species are available. The extent of any plantations in these countries is likely very small although possibly important at the local level.

In summary, only Fiji has been successful in developing a large planted-forest estate, mainly through Fiji Pine Limited and Fiji Hardwood Limited, thereby enabling a shift in wood production from natural forests to plantations. Papua New Guinea and Solomon Islands have considerable potential for forest plantation development, and examples exist in these countries of initiatives, including by the private sector. Success stories of plantation efforts include balsa plantations in East New Britain, Papua New Guinea (Box 6), and the Kolombangara teak plantations in Solomon Islands. Nevertheless, natural forests are still the mainstay of wood production in both countries. Most of the other Pacific SIDS have very small areas of plantations that are insufficient to meet domestic demand for wood and wood products. In addition to the inherent problems of the remoteness and fragmented nature of resources, limited human resource capacity and the small size of the plantation area undermine the economic viability of planted forests. In most of the small Pacific SIDS, agroforestry is likely to be the most feasible option for meeting domestic wood demand.

Box 6. Balsa wood industry in East New Britain, Papua New Guinea - a success story

Balsa (*Ochroma pyramidale*) is a fast-growing tree grown in Papua New Guinea on 5- 6-year rotations, mainly in East New Britain Province. It is estimated that there are more than 6 000 ha of balsa plantations in the country, with some 1 500 smallholder growers accounting for about 75 percent of production. Balsa production in East New Britain comprises about 9 percent of the world's processed balsa (making the region the second-largest producer behind Ecuador, which dominates production). In 2016, Papua New Guinea had two large corporate processors and eight small to medium-sized processors. Balsa is used as the lightweight core of composite panel products suitable for applications ranging from surfboards to wind-turbine blades, and it has long been used in the construction of model and real aeroplanes. Key markets for Papua New Guinea balsa wood include Australia, China, India and the United Kingdom of Great Britain and Northern Ireland.

Several factors have contributed to the success of the balsa plantations, the most important being:

- strong linkages between wood production and processing and the technical prerequisite for processing wood within 48 hours of harvesting;
- the rapid growth of the species, with short rotations providing very early returns;
- the need of farmers to cultivate a commercially viable crop in the context of the declining viability of traditional crops such as coconut and cocoa;
- the potential for integrating balsa wood production with other agricultural activities;
- science and technology inputs - especially in genetic improvement - provided by various international organizations, which have helped increase productivity;
- extension support provided by PNG Balsa Ltd and the Papua New Guinea Forest Authority;
- strong collaboration between industry, farmers, government agencies and research and development systems; and
- the gearing of production to a high-value niche market.

Sources: **Brown, C.** 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Jenkin, B., Minimulu, J. & Kanowski, P. 2019. Improving the smallholder balsa value chain in East New Britain province, Papua New Guinea. *Australian Forestry*, 82(sup1): 23–31. https://doi.org/10.1080/00049158.2018.1537541

Agroforestry in the Pacific

Agroforestry has a long history in the Pacific SIDS, with multiple forms adapted to differing biophysical and socio-economic contexts, including plantation - crop combinations, multipurpose trees, home gardens, alley cropping/hedgerow intercropping, taungya, sequential cropping systems, dispersed trees with understorey intercropping, silvopastoral systems, shelterbelts and windbreaks, live fences, and border plantings. Multispecies agroforestry has been a widely practised land use in the Pacific for centuries, supported by a wealth of traditional knowledge (Box 7). Most existing agroforestry systems are multifunctional, providing a wide range of products and ecosystem services. They mostly involve timber, fruit and nut trees intercropped with root crops and other food crops, as well as silvopastoral systems such as cattle under coconuts.

Box 7. Agroforestry in support of livelihoods in Vanuatu

Traditional knowledge and practices form the basis of the use of forests and trees in Vanuatu as sources of food, woodfuel, medicinal plants, housing materials and wood for canoes. *Ni*-Vanuatu have developed efficient traditional agroforestry systems, such as combinations of fruit and nut crops and root-crop farming on shallow soils in uplifted coral areas and on fertile volcanic, sandy loam and clay soils. The accumulated traditional knowledge includes the management of pests and diseases associated with various crops and practices for growing food in forests and agroforestry settings, creating unique systems of food crops, trees and forests to support livelihoods. Recently, there has been a shift in cropping systems, with greater emphasis on cash crops and livestock for meat production. Many rural smallholders are pursuing semi-commercial agriculture (for both domestic and international markets) in light of burgeoning cash needs for education, healthcare and other necessities.

Sources: Vanuatu Department of Forests. 2021. Vanuatu country outlook paper. Prepared for FAO. Unpublished.

Carodenuto, S., Schwarz, B., Nelson, A., Bome, G. & Andre, G. 2022. Practice-based knowledge for REDD+ in Vanuatu. *Society and Natural Resources*, 35(2):220–241. https://doi.org/10.1080/08941920.2021.2011996.

Trees outside forests (mainly from agroforestry) are the most important source of wood for most of the smaller Pacific SIDS. Such trees may have been planted originally to provide shelter from winds and salt spray but have become important sources of wood for construction and fuel. In Kiribati and Tuvalu, for example, *Casuarina equisetifolia* and *Calophyllum inophyllum* are both used widely for construction. Coconut - *Cocos nucifera* - is the predominant tree outside forests in almost all the Pacific SIDS; given that every part of the tree contributes to livelihood improvement, it is widely referred to as the "tree of life". No recent information is available on the area under coconut or the number of trees; Table 10 shows that the Pacific SIDS had an estimated 89 million coconut trees in 1997, an average of 8 trees per inhabitant (for the population in 2020). This resource, if maintained at optimum productivity, including through the timely replacement of senile trees, would be an important means of livelihood. Furniture based on coconut wood is a luxury item, and efforts are ongoing to develop biofuel from coconut biomass.

Table 10. *Estimated coconut resources, 12 Pacific Small Island Developing States*

Country	No. of coconut trees in 1997	Area under coconut in 1997 (ha)	Area under coconut in 2006 (ha)
Cook Islands	215 000	-	-
Fiji	10 806 000	64 000	60 000
Kiribati	3 494 000	-	25 000
Nauru	107 000	-	-
Niue	107 000	-	-
Palau	-	-	-
Papua New Guinea	42 473 000	260 000	-
Samoa	4 623 000	75 000	93 000
Solomon Islands	11 827 000	59 000	59 000
Tonga	1 344 000	-	-
Tuvalu	107 000	-	-
Vanuatu	13 924 000	96 000	96 000

Source: Compiled by Brown (2022) from various sources. Brown, C. 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

An impressive range of benefits can be attributed to multispecies agroforestry, including agricultural diversification; genetic conservation; carbon capture; catchment protection and rehabilitation; strengthening of agricultural infrastructure; increased self-sufficiency in timber and woodfuel; reduced need for food imports; poverty reduction; improvement in the nutritional status of people and associated health benefits; improved utilization of degraded and marginal cropping land; improved wildlife habitat; and landscape amenity. Although agroforestry is a more complex land use than monocultural timber plantations, it offers several benefits, including increased economic and environmental resilience. Agroforestry is generally not the responsibility of any individual government department, however, and new forms of governance may be needed to provide a more supportive framework for greater adoption (Harrison and Karim, eds, 2016).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Land use

Considerable differences exist in land uses and the state of forests and forestry among the various Pacific SIDS. Table 11 presents a categorization of the Pacific SIDS into three groupings based on these differences.

Table 11. *Three groupings of the Pacific Small Island Developing States, based on land uses and forests*

Grouping	Key characteristics
I – Papua New Guinea	• The largest country with the largest forest area • One of the world's most biodiversity-rich countries • Almost all land uses and forest types in the Pacific subregion occur in Papua New Guinea, and the land-use mosaic is changing rapidly • Contains a large area of primary forests, as well as extensive areas of secondary forests that require restoration • Has potential to emerge as a leader in forestry given its wealth of natural forests • Will continue to be a frontier for land-use change in the Pacific subregion given that it has the largest land area. Land use is limited by accessibility, but this will change should proposed investments in the national road network go ahead to increase connectivity and pave the way for major land-use change
II – Fiji, Solomon Islands and Vanuatu	• All have significant areas of forest and most have relative stability in land use • There is limited scope for large-scale land-use change, although some change will occur in response to changing markets • The environmental functions of forests, especially watershed protection, biodiversity conservation and amenity values, are crucial for resilience • Substantial efforts have been made to develop planted forests • The depletion of resources has led to the scaling down of logging in natural forests • Customary land ownership has evolved to accommodate emerging opportunities for new land uses • Several community-managed conservation areas provide valuable lessons for grassroots resource management • Agroforestry will remain the most important land use, providing a range of products and services
III – Micronesian and Polynesian countries	• Although the proportion of land under forests is generally very high, the forest area is small, and the fragmented distribution limits commercial potential • There is very limited scope for forests and forestry to provide global public goods at scale, but their role in the provision of locally important ecosystem services, especially the protection of watersheds and coastal areas, will remain crucial • The amenity values of forests is particularly important for economic diversification, especially the development of nature-based tourism • Agroforestry will be crucial for providing a range of livelihood-relevant goods and services

Source: Authors' own elaboration.

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Key points

- Forests provide diverse wood and non-wood products in the Pacific SIDS, such as foods, medicines, fuel, construction materials and cultural artifacts. They also provide essential services such as watershed protection, soil and biodiversity conservation, and spiritual and cultural services.
- Concerns about climate change have brought major shifts in the priorities of land and forest management, which is increasingly geared towards emissions reductions, carbon sequestration and environmental and socio-economic resilience. Challenges exist in the subregion in monetizing forest-related carbon benefits.

FOREST VALUE CHAINS: TRENDS, POTENTIAL AND CONSTRAINTS

- The Pacific SIDS produced about 14 million m^3 of roundwood in 2020, of which 57 percent was industrial and the remainder mainly woodfuel. Industrial roundwood production more than doubled between 2000 and 2020, due mainly to Papua New Guinea and Solomon Islands. Most natural-forest logs produced in the Pacific SIDS are exported. Sawnwood and woodchips are the two most important value-added products.
- Countries focusing on primary production for global markets by drawing down their natural capital may soon face resource exhaustion. Restocking through the development of planted forests is not taking place at a scale that could ensure the sustainability of wood production, although Fiji obtains most of its wood supply from its pine and mahogany plantations.
- The small size of domestic markets, the high cost of processing and the absence of conducive policy environments constrain investment in wood processing. Exceptions include high-value products from mahogany plantations in Fiji, balsa in Papua New Guinea and teak in Solomon Islands. Most high-value wood products consumed in Pacific SIDS are imported, and dependence on imports for these is likely to remain high.

Changes in forest value chains

Historically, forests have been the backbone of rural subsistence economies in the Pacific SIDS. Globally, growth in demand and the consequent expansion of trade have led to the development of new value chains for wood and non-wood forest products and more recently for forest ecosystem services, with the potential to bring about profound changes in the management of forests and trees (Box 8). Such changes will have direct and indirect impacts on the production, processing, trade and consumption of forest products and services in the Pacific SIDS. This chapter identifies broad trends in forest value chains with implications for the Pacific SIDS.

Box 8. Key changes in forest-product value chains

Advances in science, technology and innovation have led to the development of new processes and products, often at the expense of traditional processes and products. There has been a huge increase in the number of products in which wood is an important component.

The rapid growth of international trade, investment and technology transfer has led to the development of global value chains. In the forest sector, this may involve harvesting wood in one country, transporting it to another country (potentially in another continent) for processing, and selling the final products to consumers in a third country. Various components of a single product may be sourced from several countries, based largely on the competitive ability of the countries and their enterprises. Although global value chains have adversely affected local value chains, globalization also offers opportunities for local value chains via new (and potentially more valuable) markets for products and services.

Other changes in forest value chains include the following:

- With the objective of increasing domestic value capture, some countries have imposed log export bans and incentivized downstream processing, albeit often with limited impact.
- Dependence on natural forests for wood production is in decline; increasingly, planted forests are becoming the most important source of wood.
- Issues associated with the verification of legality and sustainability are affecting forest value chains, with market access increasingly dependent on demonstration that certain social and environmental stipulations are met.
- Increased understanding of the importance of forest ecosystem services has encouraged efforts to assess the value of these and to develop systems for rewarding providers and to adopt more informed approaches for determining trade-offs.
- Concerns about climate change are encouraging the pursuit of alternative approaches to development, including nature-based solutions and policy and market interventions that favour low-carbon-footprint products. Efforts to develop bioeconomies could have profound impacts on forest management and the production, processing and trade of forest products.

Source: Authors own elaboration.

Production, trade and consumption of wood and wood products

Wood and wood products play important roles in the economies of many of the Pacific SIDS. Table 12 indicates some broad trends in the production of important wood products and where the Pacific SIDS stand in relation to global and Asia-Pacific production.

Table 12. *Production of important wood products, globally, the Asia-Pacific region, and Pacific Small Island Developing States*

Product	World			Asia-Pacific region			Pacific Small Island Developing States		
	2000	2010	2020	2000	2010	2020	2000	2010	2020
Roundwood (million m^3)	3 485	3 587	3 912	1 080	1 144	1 159	9.29	12.85	14.03
Industrial roundwood (million m^3)	1 690	1 723	1 983	273	379	453	3.4	6.967	8.139
Woodfuel (million m^3)	1 795	1 864	1 928	808	764	706	5.89	5.88	5.89
Sawnwood (million m^3)	385	376	473	61	86	133	0.152	0.267	0.520
Woodchips (million m^3)	330	474	498	49.3	164	211	0.26	0.21	0.21
Veneers (million m^3)	8.19	12.8	16.5	3.33	6.93	7.79	0.02	0.09	0.12
Wood-based panels (million m^3)	178	284	368	46	152	213	0.018	0.024	0.075
Paper and paperboard (million tonnes)	324	392	401	95	170	198	0	0	0

Source: **FAO**. Undated. FAOSTAT [online]. Rome [Cited June - August 2021]. www.fao.org/faostat/en/ - data/FO

Wood production in the Pacific SIDS can be grouped into the following two broad categories:

1. large-scale, export-oriented logging undertaken by transnational logging companies based outside the Pacific SIDS; and
2. small-scale harvesting and processing catering mainly to domestic demand.

Fiji, Papua New Guinea and Solomon Islands are significant tropical timber producers, based mainly on planted forests in the case of Fiji and mainly on natural forests in the case of Papua New Guinea and Solomon Islands. For the latter two countries, taxes and royalties from natural-forest logging are important sources of income and foreign exchange for governments and customary landowners. Significant efforts are made in the two countries to record and report production and trade statistics but inaccuracies exist, depending on the extent to which production and trade are undocumented, underreported or concealed. Small-scale logging takes place in most Pacific SIDS but, being a highly dispersed activity, it is largely unaccounted for in national wood production statistics. Given such issues, the data on wood production, trade and consumption presented below should be regarded as indicative only of broad trends.

Industrial roundwood

The total industrial roundwood production in the Pacific SIDS in 2020 was reported at 8.14 million m^3 (Table 12), which was about 0.4 percent of the global production. Three countries - Fiji, Papua New Guinea and Solomon Islands - dominate roundwood production. There was a significant increase in industrial roundwood production in these countries in the decade from 2009, with Solomon Islands registering an increase of 145 percent. Although disaggregated information on the source of production - whether from natural forests or planted forests - is unavailable, most of the increase was sourced from natural forests.


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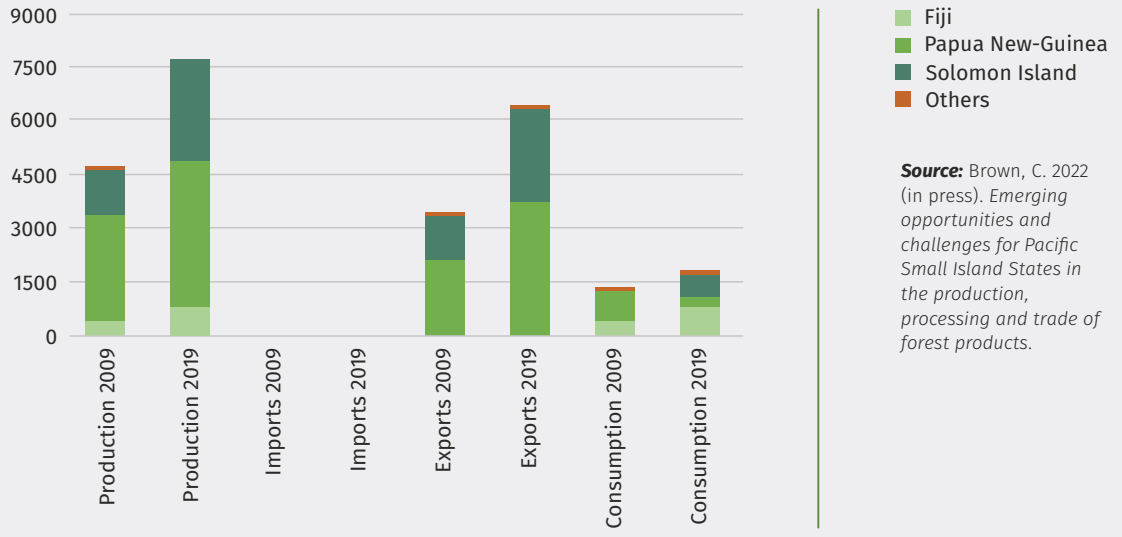
Figure 3. *Production, consumption and trade in industrial roundwood in Fiji, Papua New Guinea, Solomon Islands and other Pacific Small Island Developing States, 2009 and 2019*

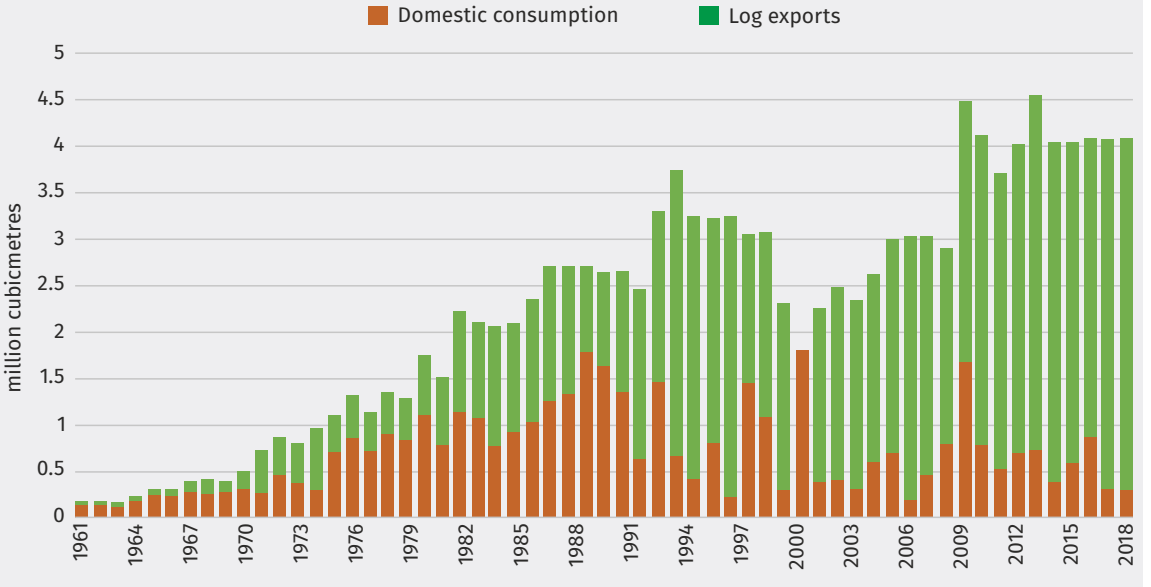


Source: Brown, C. 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Figure 3 shows broad trends in industrial wood production, trade and consumption in the subregion, as discussed below.

Three countries account for most of the industrial roundwood production. Fiji, Papua New Guinea, and Solomon Islands accounted for 99 percent of the production in 2009 and slightly more than this in 2019. Industrial roundwood production grew in Solomon Islands from 1.3 million m^3 in 2009 to 3.2 million m^3 in 2019, a compounded annual growth rate of 9.3 percent. Such rapid growth calls into question the sustainability of wood production, especially in view of the country's limited resource base. Papua New Guinea also registered a significant increase (Figure 4), from 2.90 million m^3 in 2009 to 4.07 million m^3, a compounded annual growth rate of 3.4 percent.

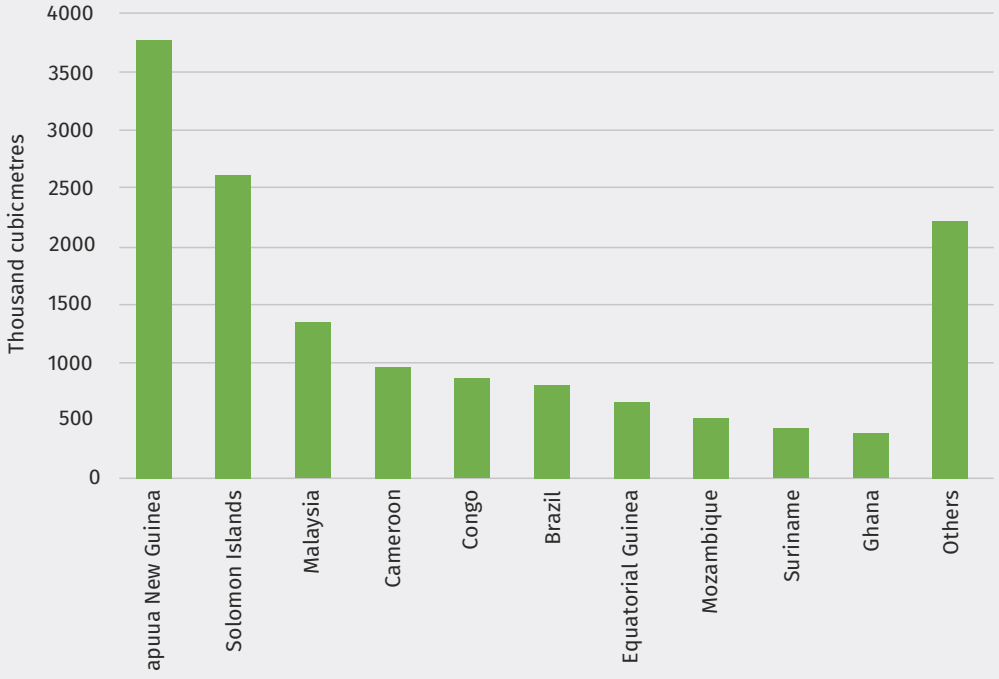
Figure 4. Production (domestic consumption + exports) of industrial roundwood, Papua New Guinea, 1961- 2019



Source: Brown, C. 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

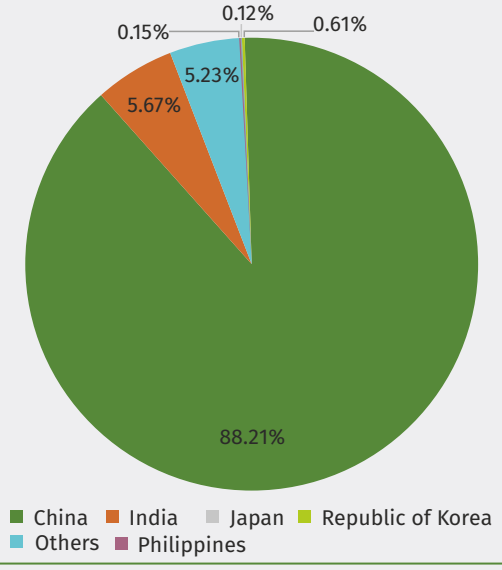
Industrial roundwood production is driven by export demand. Most industrial roundwood production in the Pacific SIDS is exported. Papua New Guinea and Solomon Islands are the world's largest exporters of non-coniferous tropical roundwood (Figure 5), accounting for about 44 percent of the global volume in 2019. Nevertheless, the overall share of the Pacific SIDS (almost entirely Papua New Guinea and Solomon Islands) in global industrial roundwood production is just 0.4 percent (about 1.6 percent of Asia-Pacific production), indicating their limited market leverage. The share of industrial roundwood production that is exported in the Pacific SIDS increased from 72 percent in 2009 to 78 percent in 2019. In Papua New Guinea, the share of exports increased from 72 percent in 2009 to 92 percent in 2019, an upward trend that has been evident since the 1990s (Figure 4). In Solomon Islands, the proportion of production exported declined from 98 percent in 2009 to 80 percent in 2019, although the volume exported almost doubled during the period.

Figure 5. *World's largest exporters of non-coniferous tropical industrial roundwood, 2019*



Source: FAO. Undated. FAOSTAT [online]. Rome [Cited June-August 2021]. www.fao.org/faostat/en/ - data/FO

Figure 6. *Exports of industrial roundwood from Papua New Guinea, by destination, 2017*

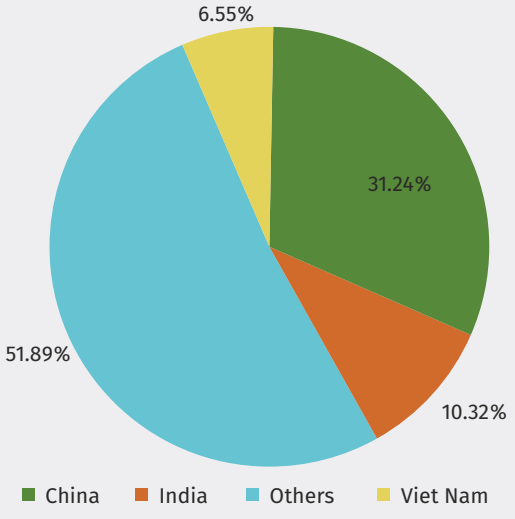


Source: *Brown, C. 2022 (in press). Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Asia, especially China, is the main export destination. Another feature of industrial roundwood exports from Papua New Guinea and Solomon Islands is the small number of destination countries, mostly in Asia and particularly China. In 2017, about 88 percent of industrial roundwood exports from Papua New Guinea went to China (Figure 6), and China was also the single-largest destination for industrial roundwood from Solomon Islands (albeit with a much lower share, at about 31 percent). India and Viet Nam are other important export destinations for industrial roundwood from Solomon Islands, and a high proportion of exports goes to "other" destinations (Figure 7). There is a strong link between industrial roundwood production in Papua New Guinea and Solomon Islands and surging demand in Asia, especially China, India and Viet Nam. Growth in exports to China has coincided with China's emergence as a major producer of sawnwood, wood panels and wooden furniture and a consequent surge in wood imports. China imported just 7.25 million m^3 of industrial

roundwood in 1990, which was about 8.8 percent of total global imports, but the volume had grown to 61.1 million m^3 by 2019, which was almost 44 percent of total global industrial roundwood imports (FAO, 2021). This suggests that the future of export-oriented industrial roundwood production in Papua New Guinea and Solomon Islands depends to a large extent on China, including whether it remains a global leader in the production of wood products. Given the larger economic and technological changes now taking place in China, the wood products sector could undergo shifts, which would have major direct and indirect impacts on tropical timber demand in the Pacific SIDS.

Figure 7. *Exports of industrial roundwood from Solomon Islands, by destination, 2017*



Source: **Brown,** C. 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Fiji is sourcing most of its industrial wood supply from planted forests. In contrast to the situation in Papua New Guinea and Solomon Islands, Fiji's industrial roundwood production is based on its planted-forest resources, especially Caribbean pine and mahogany, although some natural-forest harvesting does take place to cater for domestic demand. This is due largely to early efforts to develop forest plantations facilitated by appropriate institutional arrangements, including for leasing customary land and managing plantations. Wood production has also largely shifted from native forests to planted forests in Tonga, and there is a trend towards this in Samoa and Vanuatu.

Small islands rely on diverse sources of supply. Industrial roundwood production and consumption is negligible in the Pacific SIDS outside Fiji, Papua New Guinea and Solomon Islands because of the small resource base and low demand. The small quantity of wood required in most countries is obtained from homegardens and trees outside forests, small areas of native forests and forest plantations, and imports from mostly Fiji, Papua New Guinea, Solomon Islands, New Zealand and Southeast Asia. Coconut has become an important source of wood used locally and for producing globally traded high-quality furniture.

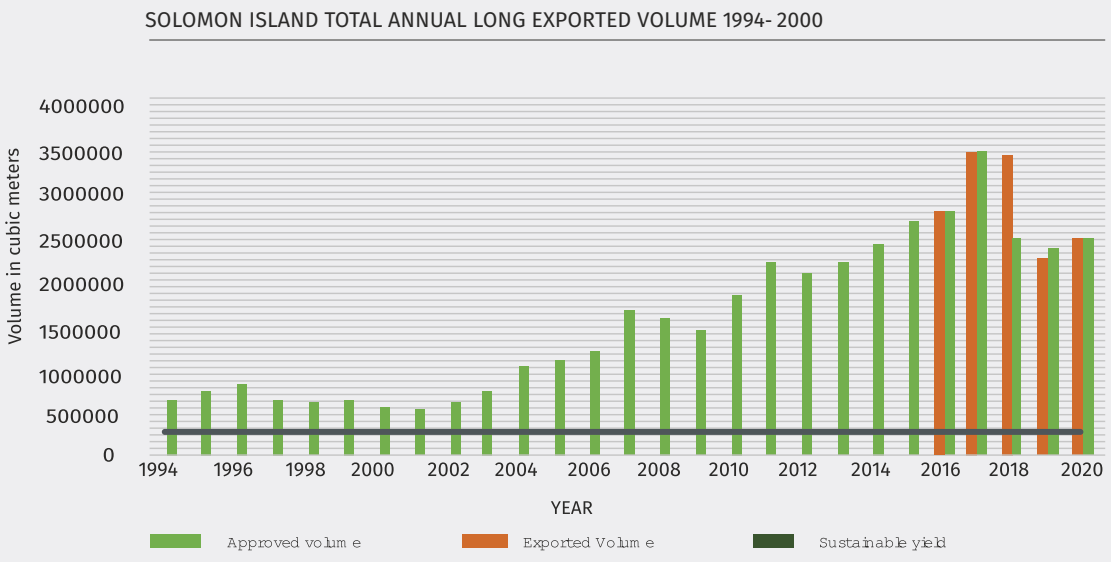
Two key issues confronting the subregion regarding industrial roundwood production are ensuring the long-term sustainability of production in natural forests and increasing the role of planted forests in wood supply. Data on the extent of production forests and logged-over forests suggest that Papua New Guinea will be able to rely on natural forests for industrial roundwood production for a couple more decades if the current level of production is maintained and various constraints related to accessibility are addressed. The situation in Solomon Islands is precarious, however, given that the current volume of industrial roundwood exports is estimated at about ten times the sustainable yield (Box 9). Solomon Islands may soon be faced with the exhaustion of its wood supply (Brown, 2022).

Box 9. Sustainability of wood production in natural forests in Solomon Islands

Logging accelerated sharply in the Solomon Islands after 2000 and especially in the decade to 2020. The volume of wood exports gives an indication of the scale of harvesting, which over the two decades was far above the estimated annual sustainable yield of 250 000 m^3. The approved harvest volume (and the volume exported) in 2017 was 14 times that of the sustainable yield; log exports were about ten times the estimated sustained yield in 2018- 2020 (Figure 8), indicating that the resource is being depleted rapidly. According to an estimate by the Solomon Islands Ministry of Forest Resources, about 30 million m^3 of wood was exported between 2008 and 2021. The Ministry estimates that the remaining area of forest available for logging (excluding slopes greater than 30 degrees) at 299 000 ha; given an average yield of exportable log of 31 m^3 per ha, the total volume of exportable timber is about 9.0 million m^3. At the current rate of removal/export, this volume will be extracted in 4- 5 years.

Source: Authors elaboration.

Figure 8. *Solomon Islands total annual log export volume, 1994- 2020*



Source: **Solomon Islands Ministry of Forestry and Research.** 2021. *Solomon Islands country outlook paper*. Prepared for FAO. Unpublished.

Sawnwood

Sawnwood is the most significant processed wood product produced in the Pacific SIDS, with Fiji and Papua New Guinea accounting for 88 percent of the estimated production volume of 398 000 m^3 in 2019. Both these countries experienced significant increases in sawnwood production between 2009 to 2019, from 90 000 m^3 to 130 000 m^3 in Fiji and from 81 000 m^3 to 220 000 m^3 in Papua New Guinea (Table 13). The upward trend continued in Papua New Guinea in 2020, with sawnwood production increasing to 340 000 m^3, indicating an increase in domestic processing capacity, possibly as an outcome of government policy.

Table 13. *Volume of sawnwood production, consumption and trade, 12 Pacific Small Island Developing States, 2009 and 2019*

Country	Volume (m^3)							
	2009				2019			
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption
Cook Islands	0	4 300	0	4 300	0	35	0	35
Fiji	90 000	2 186	14 630	77 556	130 000	11 002	12 889	128 113
Kiribati	0	2 195	0	2 195	0	1 863	0	1 863
Nauru	0	403	16	387	0	319	0	319
Niue	0	321	0	321	0	0	0	0
Palau	0	2 979	0	2 979	0	2 363	0	2 363
Papua New Guinea	81 000	501	33 266	48 235	220 000	15	111 957	108 058
Samoa	1 000	4 350	13	5 337	1 000	23 610	0	24 610
Solomon Islands	27 000	145	18 276	8 869	31 000	49	12 853	18 196
Tonga	2 009	5 173	19	7 163	2 009	50	131	1 928
Tuvalu	0	732	0	732	0	0	0	0
Vanuatu	14 000	5 314	286	19 028	14 000	53	29	14 024

Source: **Brown,** C. 2022 (in press). Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.

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Of particular interest are changes in the ratio of sawnwood production to domestic consumption, as follows:

- In Fiji, domestic consumption jumped by more than 54 000 m^3 between 2009 and 2019 and accounted for more than 98 percent of production in 2019. The volume of exports declined over the period and the volume of sawnwood imports increased. These trends reflect rapid growth in the Fiji economy, especially the construction sector.
- In Papua New Guinea, domestic consumption increased by nearly 60 000 m^3 between 2009 and 2019, reflecting increasing demand due to growth in population and income. The ratio of exports to production increased from 41 percent in 2009 to 51 percent in 2019. Papua New Guinea exported about 2.58 million m^3 of industrial roundwood in 2019, showing the potential to further expand sawnwood production, especially in light of a proposed log-export ban and policies designed to encourage domestic processing.
- Growth in sawnwood production was only marginal in Solomon Islands, increasing by about 4 000 m^3 between 2009 and 2019, a period in which industrial roundwood production and exports nearly doubled. The scope for first-level value-adding through investment in sawmilling is substantial, notwithstanding concerns about the sustainability of log production.

Other major consumers of sawnwood among the Pacific SIDS are Samoa, Tonga and Vanuatu; in these countries, most sawnwood production is consumed domestically. Given the relatively small forest and tree resource in these countries, the scope for significant expansion in the sawmilling industry is limited.

Woodchips

Of the Pacific SIDS, Fiji is the only significant producer (and exporter) of woodchips, derived mostly from the country's pine plantations. Since 2013, approximately two-thirds of Fiji's woodchip exports have gone to Japan, with the remainder going to China (except for a small quantity shipped to New Zealand). Fiji exported an estimated 313 000 m^3 of woodchips in 2019, although this declined to 225 000 m^3 in 2020 (FAO, undated), due mainly to disruptions stemming from the COVID-19 pandemic.

Given the current policy in Fiji's softwood plantations of harvesting only 40 percent of the area restocked in any year (Naiqamu, 2020), a substantial acceleration in woodchip production is unlikely in the period to 2030. With a significant proportion of long-fibre softwood chips traditionally used for newsprint production, and newsprint consumption likely to continue to diminish globally (having effectively halved since 2004; FAO, undated), markets for softwood chips are likely to continue experiencing significant disruption over the next decade. This may affect demand and prices for Fijian woodchips, although the impacts are likely to be softened by continued strong growth in the global production and consumption of packaging materials, fibreboard and similar products.

Prospects for the development of significant woodchip industries in other Pacific SIDS in the next decade are probably relatively slim and likely tied to the development of other wood-processing industries (e.g. sawmilling), which might produce significant volumes of wood residues that could be chipped and exported.

Wood-based panels

Wood-based panel production constitutes a very small segment of forest-product markets in the Pacific SIDS. A handful of mills in Fiji and Papua New Guinea are producing plywood and veneer. Table 14 shows general trends in the production, trade and consumption of plywood in the Pacific SIDS between 2009 and 2019.

Table 14. *Volume of production, consumption and trade of plywood, 12 Pacific Small Island Developing States, 2009 and 2019*

Country	Volume (m^3)							
	2009				2019			
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption
Cook Islands	0	1 300	0	1 300	0	1 177	0	1 177
Fiji	11 000	226	739	10 487	11 000	4 859	23	15 836
Kiribati	0	54	0	54	0	157	0	157
Nauru	0	17	0	17	0	17	0	17
Niue	0	33	0	33	0	47	0	47
Palau	0	984	0	984	0	471	0	471
Papua New Guinea	14 000	4 473	9 880	8 593	64 000	1 795	7 544	58 251
Samoa	0	144	4	140	0	1 427	0	1 427
Solomon Islands	0	346	0	346	0	1 142	0	1 142
Tonga	0	381	0	381	0	634	0	634
Tuvalu	0	67	0	67	0	43	0	43
Vanuatu	0	808	0	808	0	1 454	0	1 454
Total	**25 000**	**8 833**	**10 623**	**23 210**	**75 000**	**13 223**	**7 567**	**80 656**

Source: Brown, C. 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

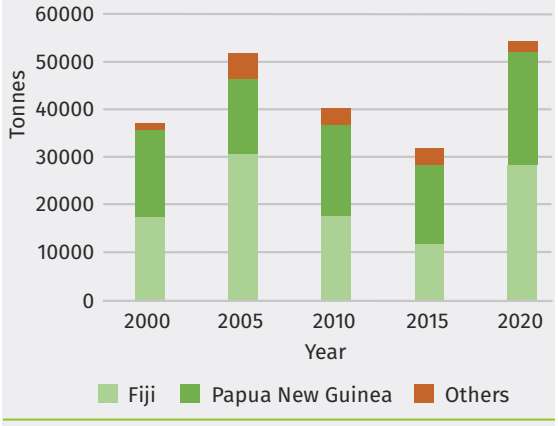
Plywood consumption in the subregion increased by 57 400 m^3 between 2009 and 2019, a compounded annual growth rate of more than 13 percent, with most of the increase occurring in Fiji and Papua New Guinea (the two largest economies). Consumption in Solomon Islands and Samoa also increased. The subregion has become a net importer, suggesting an overall uptick in demand driven by growth in populations and incomes. Fiji has been exploring the production of coco veneer using spindleless-lathe technology; there is considerable potential for the production of veneer based on small-diameter plantation timber using this technology (Brown, 2022). Given the size of its population and economy and the still considerable timber resource, Papua New Guinea has potential to expand production to meet demand both domestically and in other Pacific SIDS. Currently, however, no plans have been announced for the commissioning of such capacity; thus, this prospect is speculative and, even if it were to come to fruition, it would have little impact on production to the end of the present decade (Brown, 2022). In Fiji, the production of significant volumes of softwood chips suggests potential for the establishment of a fibreboard or particleboard facility, but no plans have been announced (Brown, 2022).

Paper and paperboard

There are no pulp or paper mills in the Pacific SIDS, although at least one facility[1] in Fiji manufactures cardboard and packaging, including for export. Thus, demand for paper and paperboard products in the subregion is met by imports, with net imports increasing from 37 400 tonnes in 2000 to 54 500 tonnes in 2020, a compounded annual growth rate of about 1.9 percent (Figure 9). Fiji and Papua New Guinea accounted for 95.5 percent of net paper and paperboard imports in 2020.

It is expected that demand for paper and paperboard products in the Pacific SIDS will mirror international trends, with demand for newsprint and fine papers declining in the face of electronic alternatives and demand for packaging and similar products increasing (Brown, 2022).

Figure 9. *Net imports of paper and paperboard, Fiji and Papua New Guinea and other Pacific Small Island Developing States, 2000- 2020*



Source: FAO. Undated. FAOSTAT [online]. Rome [Cited June- August 2021]. www.fao.org/faostat/en/- data/FO

[1]Golden Manufacturers.

There is little prospect for the development of pulp-and-paper processing capacity in Pacific SIDS to 2030 (Brown, 2022). Only Fiji and Papua New Guinea have the potential to establish sufficient wood resources to sustain a pulp-and-paper mill and no plans have been announced for such a development. Several factors will limit the ability to produce paper and paperboard in the subregion, the most important being the small size of local markets, which are fragmented, access to raw material, and a lack of the capital needed to build the facilities (Brown, 2022). Therefore, the Pacific SIDS will continue to rely on imports for the foreseeable future.

The annual per-capita consumption of paper and paperboard in 2020 ranged from 2.6 kg in Papua New Guinea to 32 kg in Fiji (FAO, undated). Total consumption in the subregion in 2020 was 54 500 tonnes, or about 4.7 kg per person (FAO, undated). At this per-capita rate of consumption, total paper and paperboard consumption will be about 85 000 tonnes in 2050 for a projected population of 18 million people in that year. Even if per-capita consumption was to increase threefold (to about 15 kg), which seems unlikely, total demand would be only about 270 000 tonnes. Given the highly fragmented nature of markets, achieving economically viable production of paper and paperboard remains challenging in the Pacific SIDS, especially because such viability is highly scale-dependent.

Moving up the value chain and investments in domestic processing

Box 10. Measures to encourage domestic wood processing in Papua New Guinea

Most investments in wood processing are made by the private sector and driven largely by assessments of financial viability. Nevertheless, governments often step in to incentivize such investments through measures designed to encourage domestic processing and discourage (or even outright ban) log exports. Papua New Guinea, for example, has been pursuing the idea of domestic processing while repeatedly pushing back the cut-off date for an export ban. Proposed measures for encouraging domestic processing in Papua New Guinea include the following:

- an increase in the log export development levy announced in the government's 2020 budget and a 20 percent increase in timber royalties proposed in April 2021;
- requirements for linking new forest concession allocations to downstream processing;
- an announcement in 2021 by the Internal Revenue Commission that 20 logging companies are being audited by the tax office for tax evasion. The Internal Revenue Commission linked the audit to the government's "Take Back PNG" agenda and downstream-processing policy; and
- government targets to increase exports of processed timber - through the Papua New Guinea Vision 2050, the Development Strategic Plan 2010- 2030 and the National Strategy for Responsible Sustainable Development for Papua New Guinea, the government has tasked the forest sector with increasing processed timber exports to 80 percent of all forestry exports by 2030.

Sources: **Brown, C.** 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Governments have employed various measures to encourage domestic processing, especially by banning log exports and levying higher export taxes (Brown, 2022; Box 10). Although such measures may have popular appeal, they should be based on in-depth assessments of the pros and cons of various interventions. In the context of the Pacific SIDS, the following aspects warrant particular attention:

- Although the assured availability of raw materials is neither a necessary nor sufficient condition for the development of a vibrant industrial sector, only the Melanesian countries - Fiji, Papua New Guinea, Solomon Islands and Vanuatu - have certain advantages regarding wood production capability. The availability of land for wood production in these countries is subject to restrictions attributable to customary

ownership. Solomon Islands, a relatively resource-rich country, may be on the verge of forest resource depletion, discouraging investment in wood processing.

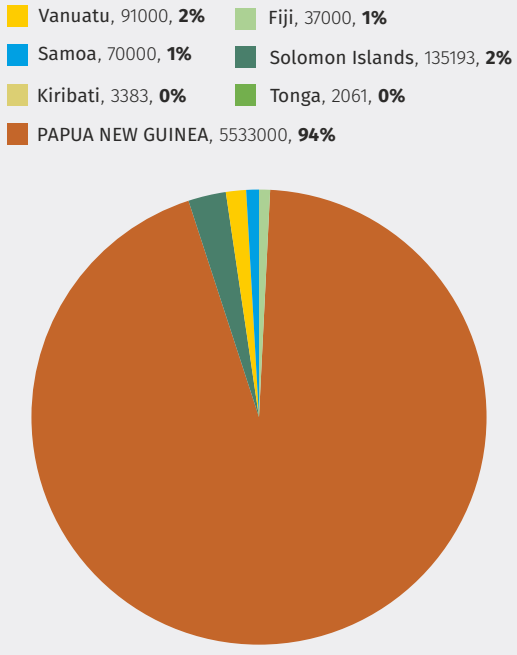
- Most other Pacific SIDS have very limited land areas, reducing their ability to produce significant sustainable wood supplies capable of sustaining wood-processing industries at an economically viable scale.
- Given their small populations and low incomes, domestic demand for wood products in the Pacific SIDS tends to be low, meaning that any significant industry will need to sell into highly competitive global markets.
- Overall, the investment environment in most Pacific SIDS is unfavourable, which is an important reason why the private sector has shown little interest in investing in wood processing. The risks associated with investment are perceived to be very high in most Pacific SIDS.
- Other problems included a lack of infrastructure, a low skills base, limited managerial capability and uncertain policy environments. Any uptick in domestic processing will largely depend on how such constraints are addressed.

It is worth noting that the neighbouring developed countries of Australia and New Zealand have also found it challenging to develop internationally competitive wood-processing industries to the levels targeted by their governments, despite significant advantages compared with the Pacific SIDS. Both countries continue to export large proportions of their roundwood harvests as unprocessed logs and woodchips (Brown, 2022).

Wood energy

Wood is an important source of energy in the Pacific SIDS, particularly in rural areas, where it is used extensively for cooking and heating and few alternative sources of energy are available. A wide array of biomass is used as fuel, including wood from primary and secondary forests, trees on farms, and coconut shells and husks. Most woodfuel is obtained from natural forests and the opportunity costs involved in their production and consumption in rural areas are generally minimal. Reliable data on woodfuel production and consumption are unavailable. FAOSTAT compiles estimates based on inputs provided by national correspondents but, where countries do not supply data, estimates are derived from linear regression models based on variables such as income, climate, forest cover, land area and percentage of population living in urban areas (Broadhead, Bahdon and Whiteman, 2001). Figure 10 indicates the extent of woodfuel production in the Pacific SIDS. Of the estimated woodfuel production of 5.89 million m^3 in the Pacific SIDS in 2019, 94 percent was in Papua New Guinea, reflecting that country's large population (of which more than 80 percent lives in rural areas with limited access to fuels other than biomass) (Figure 10). Although this provides a broad picture, the on-the-ground reality of woodfuel production and consumption may differ significantly, due primarily to factors not considered in the regression models. Available studies suggest that actual woodfuel consumption in the Pacific SIDS could be much higher than FAOSTAT estimates (Box 11).

Figure 10. *Share of woodfuel production, selected Pacific Small Island Developing States, 2019*



Source: FAO. Undated. FAOSTAT [online]. Rome [Cited June- August 2021]. www.fao.org/faostat/en/ - data/FO

A significant recent development in Fiji and Papua New Guinea is biomass-based electricity generation. In Papua New Guinea, the government's Climate Change and Development Authority signed a memorandum of understanding in July 2019 with PNG Biomass (a subsidiary of Oil Search Ltd, the country's largest oil and gas company) related to plans to construct a 30-megawatt biomass energy plant in the Markham Valley in Morobe Province. The Markham Valley project envisages the establishment of more than 16 000 ha of *Eucalyptus* and *Acacia* plantations to fuel the plant, and establishment of an 11-megawatt solar facility would constitute another strand of an integrated facility.

Box 11. Wood-energy consumption in Fiji and Papua New Guinea

In one of the earliest studies of woodfuel consumption in Fiji, Siwatibau (1981) estimated the annual per-capita woodfuel consumption at 350 kg (or 0.875 m^3). Several factors influence woodfuel use, the most important being the relative cost of alternatives, availability, accessibility and convenience; many of these have changed considerably in the last four decades. The Government of Fiji wanted to reduce the percentage of the population with primary reliance on woodfuel for cooking to 12.5 percent by 2020 and to zero by 2030 (ECA and SMEC New Zealand, 2013). If this 12.5 percent target was met in 2020 and the 1981 per-capita rate of woodfuel consumption was maintained, Fiji's woodfuel consumption for cooking alone in 2020 would have amounted to at least 98 000 m^3 (oven-dried volume), more than 2.5 times that estimated using FAOSTAT data (FAO, undated).

In Papua New Guinea, Nuberg, Mitir and Robinson (2017) estimated by extrapolation that 9.34 million m^3 of woodfuel is collected annually, significantly higher than the estimate based on FAOSTAT data of 5.5 million m^3 (FAO, undated).

These examples indicate the challenges in obtaining a realistic picture of woodfuel consumption. Given the need to reduce fossil-fuel consumption and rely more on renewables, including biomass, the earlier energy transition that helped countries reduce dependence on woodfuel is becoming less relevant and even potentially undesirable.

Source: **Brown, C.** 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*

Globally, dendrothermal power facilities have a chequered history. In the 1980s, for example, the Government of the Philippines planned to build more than 60 wood-fired electricity-generating plants to offset rising oil prices but had only limited success in the face of challenges such as those posed by developing or securing reliable and timely woodfuel supplies and operating the power-generating technology; perhaps the most important obstacle, however, was that, once grown, the feedstock wood proved too valuable to warrant simply burning it (P. Durst, personal communication, 26 August 2021). The development of electricity-generating plants such as Nabou Green Energy (Box 12) and the envisaged Markham Valley project may be superficially attractive to Pacific SIDS seeking greater self-sufficiency in energy production, but their ongoing operation is complex. The competitiveness of dendrothermal power generation was a key issue in the context of cheaper fossil-fuel-based power generation options. This could change, however, in light of climate-change-mitigation policies aimed at reducing greenhouse-gas (GHG) emissions, possible increases in fossil-fuel prices (as experienced recently due to supply-chain disruptions caused by the COVID-19 pandemic and conflicts) and the infeasibility of fossil-fuel-based power generation in many places.

Box 12. The Nabou Green Energy biomass plant

Nabou Green Energy Ltd opened a 12-megawatt biomass energy plant in Sigatoka, Fiji, in July 2017 to provide a renewable source of electricity. The plant is a partnership between the Fijian softwood company Tropik (Fiji) Ltd and a consortium of three companies from the Republic of Korea. It is planned to establish 5 000 ha of *Gliricidia sepium* plantations to provide feedstock for the plant. The plant will also use wood residues from sawmilling and logging, as well as biomass from the widely established African tulip tree (*Spathodea campanulata*) as part of the Government of Fiji's eradication programme for this invasive species. The plant also plans to export wood pellets to the Republic of Korea.

Source: **Nabou Green Energy Ltd.** Undated. *Home* [online]. Company website. [Cited August 2021]. HYPERLINK "http://ngel.com.fj/" http://ngel.com.fj

The manufacture of wood pellets, primarily for residential heating but also for power generation in the industrial sector, is a burgeoning industry globally; global wood-pellet production increased from about 2 million tonnes in 2000 to more than 55 million tonnes in 2018 (Jaganmohan, 2021). Pacific SIDS may approach electricity-generating facilities with caution, but the manufacture of wood pellets for domestic residential use or export could offer significant opportunities for some countries.

Wood will continue to be an important source of household energy for cooking (and heating, where required) in most Pacific SIDS through to 2030. There may be a moderate increase in the use of wood in biofuel plants, including for electricity generation and co-generation. The production of wood pellets for export may offer a means for increasing domestic wood processing in Fiji, Papua New Guinea and Vanuatu.

Non-wood forest products

NWFPs comprise a wide range of forest products that are key to rural livelihoods in most Pacific SIDS. Subsistence consumption and informal trade of NWFPs are widespread, but little information is available on their quantity and value, except in the case of certain commercialized products.

NWFPs comprise many forest-based plant and animal products - such as flowers, fruits, nuts, foliage, plant fibres, honey, extracted resins, gums and oils (obtained from canopy and sub-canopy tree species), vertebrate and invertebrate animal species, and fungi. The diversity of NWFPs produced in Pacific SIDS encompasses extractive oils, fungi, medicinal plants, foods, and various fibres, such as rattan and bamboo, bark and other plant materials used for utensils, cloths, decorative items and other handcrafts. NWFPs are an important food source and are used widely for ceremonial, cultural and medicinal purposes and as perfumes.

Although hundreds of NWFPs exist in the Pacific SIDS, only a handful - such as kava, ngali nut (Box 13), sandalwood (Box 14) and noni - are commercially important. Coconut and other plants grown in agroforestry systems, such as screw pine (*Pandanus tectorius*), breadfruit (*Artocarpus altilis*), papaya (*Carica papaya*) and citrus, are important foods. Mangrove forests also provide foods as well as construction materials while acting as vital nurseries for pelagic fish. Urbanization, emigration and the increased use of imported products have eroded the importance and cultural knowledge of many NWFPs. Nevertheless, efforts by civil-society organizations and community groups are ongoing to retain and recapture knowledge on the traditional uses of NWFPs, including in food preparation.

Box 13. Commercializing ngali nut in the Pacific

Ngali nut (galip nut in Papua New Guinea) obtained from *Canarium indicum* is a traditional non-wood forest product used widely in the Pacific, especially Melanesia, as part of traditional diets. Many farmers grow the trees as components of their agroforestry systems. The nut is edible, and the oil derived from it is an ingredient in bodycare products. Demand for ngali nut has soared with increasing urbanization and as the Pacific diaspora has grown. Efforts have been made to develop value chains, including processing and marketing, to link rural producers with urban markets. A project to build a public - private partnership to accelerate the development of the galip nut industry in Papua New Guinea's East New Britain Province identified the following challenges:

- demonstrating commercial potential to entrepreneurs and the feasibility and viability of ngali nut processing and marketing;
- scaling up supply, processing and marketing;
- inadequate infrastructure, including transport, storage and delivery; and
- overall deficiencies in the enabling environment for enterprise development that discourages private entrepreneurs from taking up activities perceived as risky.

A success story in marketing ngali nuts in Solomon Islands is that of Sol Agro, a local company that supports organic product development in rural communities. Sol Agro procures, processes and exports ngali nuts to Biomonde Noumea, a health-food retailer in New Caledonia. The company also exports to a cafe chain in Fiji. Ngali nut collectors are committed to certifying their production, as per the Pacific Organic Standards, through the Participatory Guarantee System under the guidance of the Pacific Organic and Ethical Trade Community.

Source: **Bartlett, T.** 2022 (in press). *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States.*
Organic Without Boundaries. Undated. Ngali nuts – from the forest floor to the food store [online]. [Cited 24 September 2022]. HYPERLINK "https://www.organicwithoutboundaries.bio/2020/03/03/ngali-nuts/" www.organicwithoutboundaries.bio/2020/03/03/ngali-nuts

A wide variety of NWFPs with commercial potential can be identified in the four Melanesian countries. For example:

- The Government of Fiji has initiated various policies, grants and programmes supporting the development of NWFPs, notably through community-based enterprises. A primary focus is on rural communities and their food supplies, including bush fruits and nuts. Several initiatives are supporting women-run processing enterprises to produce various products derived from mulberry trees and pandanus leaves. The government also monitors the production of sandalwood and bamboo - Fiji exported 3 200 kg of sandalwood in 2015.
- Papua New Guinea's report to FRA 2020 (Gamoga and Turia, 2020) identified a broad range of NWFP products, including eaglewood oil, *massoi* bark oil, sandalwood oil, rattan, bamboo, baskets and trays, medicinal plants and mushrooms. Rural communities in Papua New Guinea have traditionally relied heavily on NWFPs for their subsistence (for example, wild meat was once a primary source of protein). Increasing access to domestic and international markets is enabling rural communities to generate revenue from traditional medicinal plants and other NWFPs. Eaglewood, sandalwood and rattan are all traded internationally.
- Solomon Islands reported a variety of NWFPs to FRA 2020 (Ago and Vigalu, 2020), including foods, medicinal leaves, loya cane, spices (including cinnamon) and vitamins, orchids and other flowers, massage oils, handicrafts, utensils, dyes and resins. Several native species have been commercialized and are exported, such as ngali nut, *Morinda citrofolia* (Indian mulberry) and *Calamus hollrungii* (lawyer cane, a type of rattan).
- NWFPs in Vanuatu include coconut, tubers, fruits, breadfruit, nuts and wild meat. *Pandanus* fibres, grass and leaves are used for thatch. Small volumes of sandalwood are still harvested in the wild, and research efforts are focusing on the domestication of sandalwood for the development of plantation-based sources. Kava is another important NWFP in a number of Pacific SIDS (Box 15). The growing importance of kava in Vanuatu has led to the formulation of the National Kava Strategy 2016- 2025 as an integral component of the Vanuatu Agriculture Policy. A traditional drink widely used during social gatherings, kava has become one of Vanuatu's most important export crops, earning revenue of about USD 48 million in 2019 (Heaton, 2021).

Box 14. Sandalwood in the Pacific - a green growth industry?

Sandalwood is a high-value product with diverse uses, and it has been traded globally for centuries. Various species of sandalwood (*Santalum* spp.) indigenous to the Pacific supported an exploitative commercial market in the nineteenth century, with supplies virtually exhausted by 1865. Demand for sandalwood products has remained strong, however, with limited supplies driving high market prices. Thomson (2020) cited wholesale prices for *Santalam album* oil exceeding USD 2 000 per kg. Sandalwood is grown in plantations (often intensively managed), in small woodlots or as individual trees in mixed-cropping systems. Both *S. album* and *S. yasi* are cultivated in Pacific SIDS, especially Fiji, Tonga, Papua New Guinea and Vanuatu. There is natural hybridization between *S. album* and *S. yasi*. The essential oil distilled from sandalwood heartwood is an important ingredient in the production of perfumes, medicines, incense sticks and several health and beauty products, and the wood is used for carving and high-value artifacts. Annual exports of yasi sandalwood from Fiji and Tonga since 2000 is estimated at around 100 tonnes with a value of USD 5.0 million. The long-term outlook for growing sandalwood seems positive, and it has considerable potential to emerge as a "green growth industry" due to the following:

- Being an important ingredient in health- and beauty-care products, demand for sandalwood oil and related products is expected to grow as incomes increase.
- The diverse array of products from sandalwood reduces the risks associated with many high-value products.
- Consumer preference for natural products will ensure that sandalwood-derived products will continue to be in demand.
- Being a native species and grown in diverse systems, sandalwood has inherent management flexibility. It can be grown in a wide range of farming systems.
- Sandalwood cultivation, maintenance and harvesting can easily be learned and adopted.
- The high value- bulk ratio makes sandalwood attractive for small-scale cultivation, especially for smallholders, who are often far from markets.
- A wealth of knowledge already exists based on research carried out by various organizations.

The economic contribution of the sandalwood industry can be increased significantly through appropriate policy and technical interventions aimed at addressing issues in value chains. The global demand for sandalwood is expected to remain strong, making its production attractive to sandalwood growers in the Pacific SIDS, particularly in agroforestry systems.

Sources: **Thomson, L.A.J.** 2020. Looking ahead – global sandalwood production and markets in 2040 and implications for Pacific Island producers. *Australian Forestry,* 83(4): 245–254. https://doi/epub/10.1080/00049158.2020.1841441
Thomson, L.A.J., Bush, D. & Lesubula, L. 2020. Participatory value chain for yasi sandalwood (*Santalum album*) in Fiji. *Australian Forestry*, 83(4): 227–237. https://doi.org/10.1080/00049158.2020.1841442

Natural forests in the Cook Islands provide a range of foods and medicines, and several flowering species *(e.g. Gardenia taitensis)* are used in lei-making and exported to Hawaii in the United States of America and to several other countries. The Cook Islands also supports a conservation programme for the rare *vairakau Maori* (a traditional medicinal plant).

Box 15. A bright future for kava?

Kava (also known as *yoqona/yogona*) (*Piper methysticum*) is a sterile cultivar of a wild species of pepper (*P. wichmannii*) originating in Vanuatu. The roots produce psychoactive extracts, known as kavalactones. The discovery of kava's properties, and selective breeding of the plant to enhance its psychoactive properties, dates back about 3 000 years. Kava was traded eastwards to Fiji, Samoa, other Polynesian countries and Hawaii, and it has become well established in the cultures and ceremonies of Pacific SIDS. More recently, various interests, including beyond the Pacific SIDS, have sought to refine and standardize the commercial development of kava.

Kava has come to be used to relieve anxiety disorders and is considered a healthier alternative to alcohol. In 2020, the FAO/World Health Organization Codex Alimentarius Commission approved kava as a beverage in the Codex Alimentarius, prescribing standards for its production, processing and transport. There are indications that this will boost various kava value chains and open up markets for a wide array of products, and several producers and processors have already entered the market, although there are also concerns about appropriation by outsiders and the potential for a "kava bubble". Kava is a well-established drink among Pacific communities and production is expanding in Fiji, Tonga and Vanuatu. There is also increasing demand for dried root product among Pacific Islanders and wider communities abroad, including in Australia, New Zealand and the United States of America, where commercial kava bars have been established. Fiji Kava, an Australian Stock Exchange-listed producer of kava extracts, is exploring how kava might be incorporated into traditional Chinese medicine. A rapid expansion of kava cultivation has the potential to accelerate deforestation and an oversupply could result in a sharp decline in prices, as has happened in the case of many commercialized non-wood forest products. Also, there is concern that an increase in its popularity would result in its cultivation outside its natural distribution, undermining the ability of the Pacific SIDS to reap the full benefits of a plant considered a "gift from their ancestors".

Sources: **Pollock, N.J.** 2009. Sustainability of the kava trade. *The Contemporary Pacific*, 21(2). https://www.jstor.org/stable/23724852 **Heaton**, T. 2021. Kava: the Pacific's economic diamond is being coveted by competitors [online]. *Hawaii News*, 29 August 2021. [Cited 26 September 2022]. Available at HYPERLINK "https://www.civilbeat.org/2021/08/kava-the-pacifics-economic-diamond-is-being-coveted-by-competitors/" www.civilbeat.org/2021/08/kava-the-pacifics-economic-diamond-is-being-coveted-by-competitors

- In Niue, important NWFPs reported to FRA 2020 (Poihega, 2020) include sources such as coconut crabs, *Asplenium nidus* (a fern), lupe (Pacific pigeon), peka (flying fox) and various plants used for handicrafts, tapa cloth and medicinal purposes.
- NWFPs in Samoa are obtained from remnant natural forests, forest plantations and agroforestry systems. Food is an important class of NWFPs in Samoa - it includes honey, nuts and fruits. The leaves, bark and roots of several plants are used in traditional medicines and to manufacture tapa cloth. Two species of possible commercial significance are *Homolanthus nutans,* which shows potential in the treatment of human immunodeficiency virus/acquired immunodeficiency syndrome, and nonu *(Morinda citrifolia)*, which is used extensively as a herbal remedy and is exported from Samoa and other Pacific SIDS. The Government of Samoa is exploring benefit-sharing arrangements with multinational pharmaceutical companies for developing novel medicines from certain native plant species.
- In Tonga, NWFPs are mostly produced in forest plantations and agroforestry; they include a range of foods, medicinal plants and decorative and construction materials. Collaborative programmes focusing on the management of commercial species have been established, including for beach pandanus *((Pandanus tectorius)* kava/yaqona *(Piper methysticum)*, nonu (Morinda citrifolia) and sandalwood *(Santalum spp.)*.
- Forests in Palau produce nuts, fruit, fish, medicines and craft and weaving materials. Coconut is a key multiproduct species in Palau and most Pacific SIDS.

Three general phases can be identified in the development of NWFPs, as described below:

1. In a pre-commercialization phase, the vast majority of NWFPs are collected in the wild for subsistence purposes. In addition to providing supplementary nutrition, many NWFPs act as safety nets when other sources of food are in short supply. In agrarian societies in the Pacific, especially inland in Melanesian countries, the most important sources of animal protein for rural communities was often wild meat such as feral pigs and deer, wallabies, cuscus, cassowaries, hornbills and pigeons and foods from forest waterways (e.g. fish, shellfish and crustaceans). Various NWFPs have important cultural roles and histories, which are context-specific. When forests are intact and population densities low, consumption can be maintained at sustainable levels, supported by customary regulatory mechanisms to prevent overexploitation.

2. Rapid growth in demand for NWFPs, and consequent commercialization, can result in intensive exploitation and ultimately, in many cases, in resource depletion. This was the case, for example, for sandalwood in the nineteenth century, which led to the near total depletion of sandalwood stocks (or limited its availability to inaccessible areas). Continued demand and decline in supply from the wild leads to domestication, largely through two approaches - (1) the cultivation of important NWFPs as components of mixed-farming systems, especially agroforestry; and (2) intensively managed monocropping. Considerable variation exists in the scale and intensity of cultivation, depending on the changing demand for products, the socio-economic status of households, and the policy and institutional framework.
3. As demand for certain NWFPs increases, the emphasis shifts to intensively managed cultivation, often as monocrop systems such as rubber, oil palm, coffee and cocoa, catering primarily to international markets. A major challenge in this phase of development is the cyclic nature of demand, leading to booms and busts that cause considerable instability in product prices and thus income for producers.

More systematic effort is required to properly document the traditional uses of NWFPs, improve knowledge on production and processing, develop appropriate technologies for sustainable production and processing, and create policy environments conducive to enterprise development. Until the major challenges in knowledge and enterprise development are addressed, the vast potential of biodiversity and traditional knowledge is likely to be underused, with the potential for declines in both the resources and the traditional knowledge associated with them.

Ecosystem services

Forests and trees in the Pacific SIDS provide a wide range of ecosystem services, recognition of which is increasing. The most notable are:

- climate-change mitigation and adaptation;
- biodiversity conservation;
- protection of watersheds and stabilization of water supply;
- coastal-zone protection, including of marine reefs; and
- amenity values.

Almost all land uses provide ecosystem services to varying degrees, depending on aspects such as topography, slope, vegetation, species composition, biomass, carbon stock and human interactions. Land-use change is the most important factor affecting ecosystem services. Studies exist of various ecosystem services in the Pacific SIDS, although these are mostly descriptive and quantitative assessments are more constrained (e.g. MACBIO, undated).

The provision of ecosystem services can be ensured through broad-based measures such as zoning, in which areas designated as protection forests provide multiple ecosystem services, and interventions focused on specific ecosystem services, such as carbon sequestration and storage, biodiversity conservation and watershed protection. Given the small size of many islands in the Pacific and the strong dependence of coastal ecosystems on upland management, "ridge to reef" approaches are needed to maintain and improve all ecosystem processes vital to people and environment.

Box 16. Environmental protection in the constitution of Papua New Guinea

The preamble of Papua New Guinea's constitution identifies the following five national goals:

1. Integral human development
2. Equality and participation
3. National sovereignty and self-reliance
4. Natural resources and environment
5. Papua New Guinean ways.

The constitution's preamble describes the following directives for goal 4 ("natural resources and environment"):

- wise use to be made of our natural resources and the environment in and on the land or seabed, in the sea, under the land, and in the air, in the interests of our development and in trust for future generations;
- the conservation and replenishment, for the benefit of ourselves and posterity, of the environment and its sacred, scenic, and historical qualities; and
- all necessary steps to be taken to give adequate protection to our valued birds, animals, fish, insects, plants, and trees.

Source: Papua New Guinea. Undated. *Constitution of the Independent State of Papua New Guinea*. Available at HYPERLINK "http://www.parliament.gov.pg/images/misc/PNG-CONSTITUTION.pdf" www.parliament.gov.pg/images/misc/PNG-CONSTITUTION.pdf

All Pacific SIDS have explicit policies and legislation on environmental protection. For example, the conservation of natural resources and environment for the collective benefit of all and their replenishment for the benefit of future generations is one of five goals in Papua New Guinea's constitution (Box 16). The principal legislation in that country dealing with forestry (the Forestry Act, 1991), however, is almost entirely focused on timber extraction, although other laws, such as the Environment Planning Act (1978) (which mandates environmental impact assessments for all development projects), the National Parks Act (1982), the Conservation Areas Act (1978) and the Fauna (Protection and Control) Act (1966) have provisions dealing with various ecosystem services, especially biodiversity conservation (FAO, 2004). Similar policies and laws exist in most other Pacific SIDS, but there is considerable variation in implementation. Many initiatives to safeguard ecosystem services have been driven by international organizations, including bilateral and multilateral agencies and international civil-society organizations in collaboration with national non-governmental organizations; some of these with direct impacts on forests and forestry are outlined below.

Climate-change mitigation and adaptation

The 2015 Paris Agreement on climate change underscored the importance of arresting deforestation, reducing degradation, improving carbon stock management and enhancing carbon sequestration. Before then, the Kyoto Protocol stipulated the capping of emissions by industrialized countries and permitted emissions trading by industries to accomplish the emission reductions. The European Union Emission Trading Scheme and other trading arrangements provided a boost to carbon trading through both regulated and voluntary markets.

Afforestation and reforestation were eligible for certified emission reductions under the Kyoto Protocol's Clean Development Mechanism, but the conservation of existing forests was not. The issue of incentivizing forest conservation was taken up in the United Nations Framework Convention on Climate Change (UNFCCC) by the Coalition of Rainforest Nations (which included Papua New Guinea), leading to the development of REDD and later REDD+. REDD+ is a results-based payment mechanism developed by Parties to the UNFCCC designed to compensate developing countries that demonstrate slowed or reversed forest loss or degradation. It is implemented in three stages: (1) readiness; (2) demonstration activities; and (3) full implementation leading to results-based payments. From REDD+ readiness to full implementation, countries are required to complete five components: 1) a national REDD+ strategy; 2) a forest reference level (FRL); 3) a national forest monitoring system; 4) a safeguards information system; and 5) a measurement, reporting and verification system of results-based actions.

REDD+ is seen as a financing tool for developing countries, and REDD+ programmes are expected to reduce emissions, support economic development and improve forest governance and tenure rights (Maraseni *et al.*, 2020). Internationally, REDD+ is mentioned in the nationally determined contributions of 56 countries, which represent two-thirds of annual natural forest loss in non-Annex 1 countries (Hein *et al.*, 2018). In the Pacific SIDS, the four Melanesian countries - Fiji, Papua New Guinea, Solomon Islands and Vanuatu - are pursuing REDD+, with bilateral and multilateral donor support (Fiji, Papua New Guinea and Vanuatu are supported by the Forest Carbon Partnership Fund and Solomon Islands by the Global Environment Facility - GEF - and the United Nations Development Programme). A regional REDD+ project by GIZ *(Deutsche Gesellschaft für Internationale Zusammenarbeit)* and the Pacific Community, "Forest conservation in Pacific Island countries", has been implemented in Fiji, Papua New Guinea, Solomon Islands and Vanuatu since 2011 in two phases. The project has been assisting the four participating countries to implement their previously designed REDD+ strategies and reducing, measuring and accurately reporting forest-sector GHG emissions in accordance with international standards to the UNFCCC. It has also supported local demonstration projects to show how additional benefits can be achieved through sustainable forest management and restoration, such as sustainable livelihoods and an increase in the resilience of both forests and people to climate change (GIZ, 2020; Pacific Community, 2021).

All four countries are moving towards a stage whereby they will be able to obtain results-based payments for reduced emissions relative to their FRLs (Box 17).

Box 17. REDD+ progress in the participating countries in the Pacific

- Fiji began its REDD+ process in 2009 and received funding for readiness activities in 2015. The activities are now being implemented, and the country's national REDD+ strategy, forest reference level, national forest monitoring system and safeguards information system were expected to be completed by June 2020. Fiji and the Forest Carbon Partnership Facility signed the Emission Reductions Program Agreement in January 2021, the aim of which is to reduce greenhouse-gas emissions by 2.5 million tonnes in five years by reducing forest loss by 9 500 ha, supporting afforestation and reforestation, and promoting plantation management and agroforestry in riparian zones. This should lead to results-based payments of at least USD 12.5 .
- Papua New Guinea has been a pioneer in REDD+. It assessed the drivers of change and developed its national REDD+ strategy and the four elements of the Warsaw Framework in the readiness phase in 2011- 2017, leading to the beginning of the demonstration phase. There have been instances of REDD+ carbon-credit transactions in voluntary markets.
- Solomon Islands joined the UN-REDD Programme in 2010 and is now in the readiness phase. The country's National REDD+ Readiness Roadmap 2014- 2020 was endorsed in 2015, and a project, "Integrating global environment commitments in investment and development decision making", has supported implementation of the roadmap .
- Vanuatu is pursuing low-carbon development and the diversification of its economy. The aim of the country's REDD+ programme is to reduce emissions cost-efficiently, address the key drivers of deforestation and forest degradation, promote sustainable economic growth, and mitigate climate change in a socially and environmentally appropriate way . As of 2020, Vanuatu had finished its REDD+ readiness package and developed the first draft of a national REDD+ strategy.
- Samoa is developing its forest reference level and national forest monitoring system in 2022, with technical assistance from FAO.

Source: **REDD Fiji.** 2021. *Fiji's Emission Reductions Program to build resilient communities* [online]. [Cited 16 August 2021]. http://fijireddplus.org/1004-2
World Bank. 2021a. *State and Trends of Carbon Pricing in 2021*. Washington, DC. Available at https://openknowledge.worldbank.org/handle/10986/35620

REDD+ must confront various challenges if it is to accomplish its objectives of reducing deforestation and forest degradation. Although it was conceived as a results-based payment system, few REDD+ programmes have reached that stage and most are publicly funded. The limited policy and institutional capacity of most countries experiencing high rates of deforestation and forest degradation imply prolonged readiness phases to build the necessary capacity, especially at the field level. Uncertainty of tenure, especially in Papua New Guinea, is a complicating factor, and carbon ownership is contentious. In the meantime, taking advantage of weak governance and ambiguities in the carbon trading system, some private players have entered the field through voluntary carbon markets, buying REDD+ carbon credits from local communities. Fraudulent practices of carbon trading in voluntary markets could undermine the credibility of the system (Gavara-Nanu, 2020). There is also a larger question about the effectiveness of REDD+ in bringing about significant emissions reductions and the potential for misuse as a "greenwashing" tool if regulatory mechanisms are weak. Nevertheless, REDD+ has the potential to help improve forest governance in the Pacific SIDS.

In summary, forests in the Pacific can play an important role in reducing GHG emissions, including through REDD+. Ensuring that landowners and countries benefit from this service requires addressing a host of technical and governance challenges in both supply and demand.

Biodiversity conservation

The Pacific SIDS host two of the 36 identified global biodiversity hotspots - East Melanesian Islands and Polynesia - Micronesia. They are home to over 6 000 endemic vascular plant species, 52 endemic mammals, 312 endemic native birds, 84 endemic reptiles and 48 endemic amphibians (Aalbersberg *et al.*, 2012; Atherton *et al.*, 2007). Native ecosystems and species have developed resilience over thousands of years to the Pacific's natural hazards and climate variations (Burslem, Whitmore and Brown, 2000; Keppel *et al.*, 2014). For example, native tree species such as *Agathis macrophylla, Alphitonia zizyphoides, Bischofia javanica, Casuarina equisetifolia, Endospermum* spp. and *Terminalia richii* have demonstrated resistance to wind and cyclones (Thomson, Thaman and Fink, 2016). Mangroves in the Acanthaceae family recover quickly from cyclones because of their ability to

resprout by coppicing; Bruguiera gymnorrhiza, on the other hand, failed to regenerate naturally in Viti Levu Bay, Fiji, after cyclone damage (Cameron *et al.*, 2021).

The direct and indirect benefits of the rich biodiversity in the Pacific SIDS are well documented; they span generations and have local, national and global dimensions. Forests constitute the most important repository of terrestrial biodiversity at the genetic, species and ecosystem levels and are closely linked to the cultural and linguistic diversity of the Pacific SIDS. The biodiversity pool is being eroded, however, due to forest clearance for agriculture, mining, urban expansion and infrastructure and by activities such as logging, hunting and plant collection. Increasingly, climate change and associated disasters loom as major threats to biodiversity.

All Pacific SIDS are signatories to the Convention on Biological Diversity and have taken steps to conserve biodiversity with the involvement of stakeholders, especially customary landowners. Rural life in the Pacific is closely intertwined with nature, and biodiversity conservation is part of people's day-to-day activities. Several community-level initiatives are underway in the Pacific SIDS aimed at protecting biodiversity. Collectively, the Pacific SIDS have about 609 protected areas covering 316 million ha, of which the vast majority comprises marine areas (Table 15). Terrestrial protected areas cover 2 033 600 ha, of which 85 percent is in Papua New Guinea.

Table 15. *Extent of protected areas in the Pacific Small Island Developing States, by grouping*

Group	No. of protected areas	Terrestrial protected area (ha)	Marine protected area (ha)	Total (ha)
I - Papua New Guinea	57	1 724 800	334 400	2 059 200
II - Other Melanesian countries	273	214 300	1 388 600	1 602 900
III - Micronesian and Polynesian countries	267	94 600	312 567 000	312 661 600
Total	**597**	**2 033 700**	**314 290 000**	**316 323 700**

Source: SPREP. Undated. Home [online] | PIPAP. In: *Pacific Islands Protected Area Portal* (PIPAP). Secretariat of the Pacific Regional Environment Programme (SPREP). [Cited 6 September 2022]. https://pipap.sprep.org

Terrestrial protected areas account for about 4 percent of the land area of the Pacific SIDS. In Papua New Guinea, the largest country in the subregion and the richest in biodiversity, 3.69 percent of the land area is designated as protected areas. In contrast, some small-island states have set aside most of their terrestrial and marine areas as protected areas. In Palau, for example, about 44 percent of the land area and 100 percent of the marine area are designated as protected areas. In the Cook Islands, about 25 percent of the terrestrial area and 100 percent of the marine area is so designated. In some of these countries, biodiversity conservation is seen as a key to increasing their status as preferred tourist destinations.

The conventional approach to biodiversity conservation through the establishment of protected areas is facing challenges, including the following:

- The concept of protected areas, as defined by national and international conservation organizations, is somewhat alien to most people. In traditional societies, conservation is integral to the culture and people's livelihoods, and large areas of forest are protected, even without official designation as protected areas.
- In accordance with global norms, the creation of protected areas requires the consent of customary owners. This is challenging given the predominance of customary tenure.
- Most problems related to biodiversity conservation in the Pacific SIDS stem from:
- large-scale projects, such as those associated with mining, logging, agriculture (including oil-palm plantations), infrastructure development and urbanization;
- climate-change-related factors, such as increased fire, drought, flooding and long-term changes affecting the survival of species and ecosystems; and
- invasive species.

Most large-scale land-based projects are driven by external investment. On the other hand, land clearance for subsistence cultivation, especially in the low-population-density Melanesian countries, seldom has lasting impacts on biodiversity. Mixed-cropping systems featuring a high proportion of trees and herbs also help conserve agrobiodiversity. This would suggest the need for better science-based decision-making, especially an effective system for environmental impact assessments of large projects involving land clearance (e.g. special agricultural business leases - SABLs - in Papua New Guinea), infrastructure development (e.g. the proposed national road network, also in Papua New Guinea, which will cut through biodiversity-rich areas), and urban development (especially in the smaller atoll countries).

Ultimately, the extent to which biodiversity is conserved will depend on how stakeholders perceive the opportunity costs. A significant share of the benefits of biodiversity conservation will be reaped by future generations, and this is ingrained in the thinking of Indigenous and other rural communities in the Pacific SIDS. Many other stakeholders, such as among governments and private investors, also recognize the multiple values of biodiversity but may put more priority on boosting present incomes, which is likely to mean the continued loss of biodiversity.

Watershed protection

Water has emerged as a key concern in the Pacific SIDS in the management of lands and forests. On many islands, freshwater is in short supply and is often limited to shallow lenses prone to depletion and contamination. Watershed protection is a key service of forests, and considerable attention is being given to enhancing water yield and reducing contamination. In addition to fulfilling ecological functions, water is a key component of socio-economic development and is needed to support all main economic activities. The commodification of a natural product like water is alien to Pacific cultures; nevertheless, Fiji's flourishing mineral-water industry is now the country's top export-

income-earning industry (earning USD 102 million in 2020), although it is unclear how much of this is being retained in the Fijian economy (Nguyen, 2021).

Initiatives are underway to protect watersheds - especially those that supply water to urban centres - with the aim of stabilizing stream flows and maintaining water quality. Because most land and forests are under customary ownership, these initiatives require community involvement.

Mangroves and coastal-zone protection

Mangroves fulfil multiple functions in the Pacific SIDS. Efforts in recent decades have increased understanding of the extent, structure, species composition and functions of mangroves, and numerous studies have been made on their regional and national status (UNEP, 2006). The total extent of mangroves in the 14 Pacific SIDS included here is estimated at 504 000 ha, with Papua New Guinea accounting for 74 percent and Solomon Islands and Fiji (combined) another 21 percent; the remainder are mainly in the Federated States of Micronesia, Palau, Tonga and Vanuatu. Papua New Guinea's mangroves are highly diverse, featuring 33 mangrove plant species and two hybrids. Diversity declines towards the east, and Samoa host only three native mangrove plant species.

Mangrove management typically involves a range of trade-offs between competing uses in the Pacific SIDS. This is further compounded by two factors:

1. Coastal areas are also the most populated regions, and mangroves are subject to intense pressures, including those posed by urban development, waste disposal and water pollution. Land reclamation and urban infrastructure development often involve large-scale mangrove clearance.
2. Climate-change-related sea-level rise poses a major threat to mangroves. For example, UNEP (2006) estimated that the extent of mangroves would decline by about 13 percent by 2100, based on sea-level-rise projections by the Intergovernmental Panel on Climate Change.

Amenity values - improving urban landscapes and supporting tourism

Tourism, which is highly dependent on a pristine environment, has emerged as the most important economic activity in most Pacific SIDS. This is especially the case for the smaller island countries, which have only limited potential for traditional extractive sectors like logging and mining and for agriculture. Tourism receipts exceed 20 percent of gross domestic product (GDP) in the Cook Islands, Fiji, Niue, Samoa and Vanuatu; two-thirds of GDP in the Cook Islands is derived from tourism (Pacific Private Sector Development Initiative, 2021; Asian Development Bank, 2022). The growth of tourism has helped reduce direct pressure on land. Although most tourism in the Pacific SIDS is centred on the coastal and marine environments, green assets also play an important role. The link between sustainable land management, especially watersheds, and the health of coastal ecosystems is well recognized.

Several Pacific SIDS are already highly urbanized and others are in the process of becoming so, and towns are the epicentres of most economic activities, including tourism. The attractiveness of Pacific SIDS as tourism destinations depends to a large extent on a clean and healthy urban environment (Kiddle *et al.*, 2017), but much of the urbanization taking place is unplanned, undermining systematic efforts to create urban green spaces. Although interest in urban forestry is increasing, urban development tends to focus on urgent challenges such as the growth of squatter settlements, the absence of basic amenities, and waste management. "Re-naturing urbanization" (ESCAP, 2018) requires an integrated approach, as outlined in the Economic and Social Commission for Asia and the Pacific's regional policy guide (ESCAP, 2019).

The economic significance of forests and forestry

Notwithstanding the considerable efforts being made to develop methodologies to assess the total economic value of forests, many challenges persist in measuring the sector's contributions and in incorporating these in national income accounts. Several products, especially from agroforestry, are not accounted for in forestry; moreover, much of forestry output is produced and traded in the informal domain. Keeping in mind such limitations, this section provides an overview of general trends in the economic contribution of forests and forestry in the Pacific SIDS, based on data compiled by FAO (2014).

Contribution of forestry to national income

The gross contribution of forestry (which includes wood production and wood processing) to GDP grew in the Pacific SIDS (and in Oceania as a whole and globally) between 1990 and 2011, albeit at a slower pace than the overall economy (Table 16).

Table 16. *Contribution of wood production and wood processing to gross domestic product, selected Pacific Small Island Developing States, Oceania and globally, 1990- 2011*

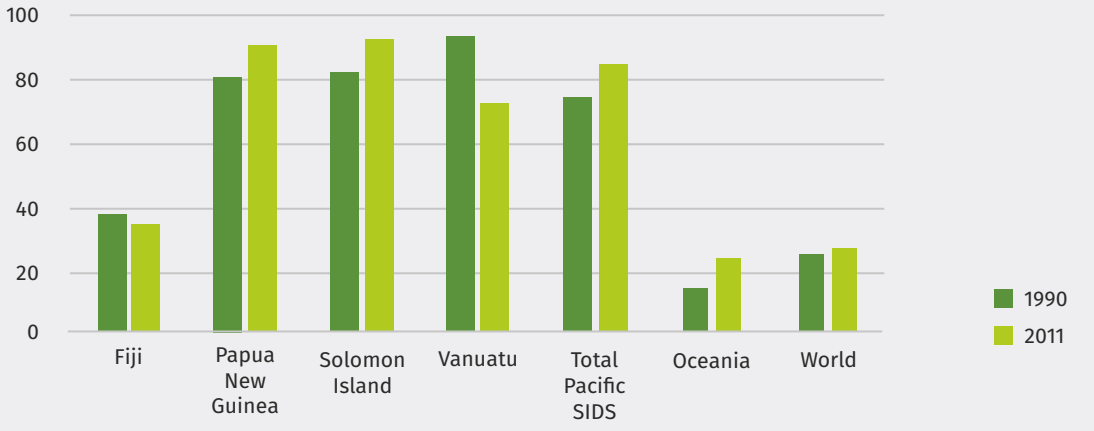
Country	Year				
	1990	1995	2000	2005	2011
	(USD million, 2011 values)				
Selected Pacific Small Island Developing States					
Fiji	50 (2.2)	63 (2.3)	88 (2.9)	71(2.2)	62 (2.0)
Papua New Guinea	167 (3.3)	239 (3.1)	238 (3.1)	104 (1.2)	358 (2.8)
Samoa	27 (7.1)	12 (3.0)	8 (1.6)	6 (0.3)	2 (0.3)
Solomon Islands	18 (6.9)	47 (11.3)	37 (9.3)	57 (8.7)	99 (11.5)
Tonga	2 (0.7)	2 (0.6)	2 (0.5)	2 (0.4)	3 (0.7)
Vanuatu	16 (3.6)	13 (2.3)	21 (3.9)	12 (1.6)	11 (1.6)
Total	280	376	394	252	535
Oceania	10 541 (1.3)	13 004 (1.3)	12 368 (1.7)	14 177 (1.4)	11 140 (1.1)
World	547 615 (1.4)	580 116 (1.4)	590 746 (1.2)	577 752 (1.0)	605 953 (0.9)

Note: Figures in parentheses are the percent share of gross domestic product held by forestry gross value added.
Source: FAO. 2014. *Contribution of the forestry sector to national economies, 1990- 2011,* by A. Lebedys & Y. Li. Forest Finance Working Paper FSFM/ACC/09. Rome.

Gross value-added in the forest sector in six Pacific SIDS grew from USD 280 million in 1990 to USD 535 million in 2011. This is a compounded annual growth rate of 3.1 percent, which is much higher than that for Oceania (0.26 percent) and the world (0.48 percent). In 2011, three countries - Fiji, Papua New Guinea and Solomon Islands - accounted for most (97 percent) of the gross value-added in the six Pacific SIDS shown in Table 16 (with Papua New Guinea accounting for 67 percent). Other important observations based on available data include the following:

- The share of forestry value-added in GDP declined between 1990 and 2011, from 3.3 percent to 2.8 percent in Papua New Guinea and from 2.2 percent to 2.0 percent in Fiji, largely because of faster growth in other economic sectors.
- In Solomon Islands, the contribution of the forest sector increased in both relative and absolute terms between 1990 and 2011. The value-added of the forest sector increased from USD 18 million to USD 99 million in absolute terms, and the sector's share in GDP rose from 6.9 percent to 11.5 percent. This shows the economic importance of the forest sector in Solomon Islands but also has negative implications - much of the increase was due to an increase in logging, which likely had negative environmental impacts and may have exceeded the sustainable yield.
- Most of the forest sector's gross value-added is attributable to wood production (mainly logging); the share of wood processing, including pulp and paper and furniture production, is very low in the Pacific SIDS. In the key tropical timber-producing countries of Papua New Guinea and Solomon Islands, for example, wood production comprises more than 80 percent of the gross value-added in the forest sector and the share of wood processing is correspondingly low (Figure 11). The share of wood production in value-added increased in both countries between 1990 and 2011 but declined in Fiji and Vanuatu. As discussed elsewhere, reversing the decline in gross value-added from wood processing will be important for increasing the share of the forest sector without drawing down the wood stock by logging above sustainable yields.

Figure 11. *Change in the share of wood production in total forestry value-added, Fiji, Papua New Guinea, Solomon Islands, Vanuatu, Pacific Small Island Developing States, Oceania and world, 1990 and 2011*



Note: "Total Pacific SIDS" is for Fiji, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu only because no data were available for the other countries.

Source: FAO. 2014. *Contribution of the forestry sector to national economies, 1990- 2011*, by A. Lebedys & Y. Li. Forest Finance Working Paper FSFM/ACC/09. Rome.

In assessing the role of forestry in income generation it is imperative to consider indirect contributions. Some efforts have been made to capture this recently: FAO (2022) estimated the total contribution of the income-generation effect of forestry (direct, indirect and induced) at about 2.3 times that of the direct income-generation impact alone. Thus, the direct income impact of forestry globally was USD 663 billion in 2015 and the total income attributable to the sector was USD 1 533 billion. This estimate of forestry's overall economic contribution is of interest in the Pacific SIDS. The multiplier effect of the income-generation effect of forestry and logging is much lower than for other forest subsectors (FAO, 2022). Given that most of the forest-sector value-added in the Pacific SIDS comes from that subsector, the total income is likely to be lower than it would be if the processing sectors were better developed.

Employment in forestry

Assessing the contribution of forestry to employment faces a similar problem to that of assessing gross value-added - a considerable share of it is in the informal domain. As for gross value-added, too, employment in agroforestry is not captured and accounted for as forestry. FAO (2014) provided a broad indication of trends in forestry employment (for those Pacific SIDS for which data were available), as follows:

- The growth in forestry employment was very low between 1990 and 2011, with the number of people employed in forestry increasing from 19 000 full-time equivalent to 25 000 over the period. The compounded annual growth rate was 1.3 percent, which was much lower than those for population, GDP and the gross value-added attributable to forestry. This does not consider employment in the informal segment of the forest/agroforestry sector, however.
- In most countries, forestry employment declined as a proportion of the total labour force between 1990 and 2011. Even in forest-rich Papua New Guinea, the sector's share in total employment declined from 0.7 percent to 0.4 percent over the period. Only Solomon Islands bucked the trend, with forestry's share in employment increasing from 2.1 percent in 1990 to 3.9 percent in 2011.
- Given the dominance of logging and industrial roundwood exports, most forest-related employment was generated in wood production, especially logging. The fact that employment did not increase even in this subsector, despite a significant increase in the scale of logging, suggests that many activities were carried out in the informal domain through subcontracting and that technological changes reduced the requirement for labour. The decline in the share of forestry in employment reflects a global trend - the share of the forest sector in employment worldwide declined from 0.7 percent in 1990 to 0.4 percent in 2011.

Policies that justify logging in natural forests as a means for generating rural employment require scrutiny. Employment in the informal domain is seldom an adequate substitute for formal jobs, given the often dangerous and low-paid working conditions. Technological developments have contributed to a reduction in labour requirements in all sectors, including forestry, although new jobs are emerging in the services sector. Efforts are needed in the Pacific SIDS to build the human resources required for both traditional forest industries and emerging opportunities, especially in the services sector linked to forests. A lack of such effort would affect the employability of citizens and could necessitate the use of expatriate workers, thus undermining the employment objective of any expansion of forestry activities.

Forest-based bioeconomies in the Pacific

Concerns about the adverse impacts of climate change has led to a rethink about the global economic system, which has been based largely on the exploitation of non-renewable resources. Increasingly, the feasibility of circular bioeconomies is being debated that would focus on the production and use of bio-based materials to substitute fossil-based energy, feed, fibre and other manufactured goods. "Bioeconomy" can be defined as "the production, utilization, conservation and regeneration of biological resources, including related knowledge, science, technology and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy" (FAO, 2022). Forestry has considerable potential as a means for developing bioeconomies, and many products exist and more are under development (Verkerk *et al.*, 2022). Scenario analysis on the development of a bioeconomy provides useful insights into the opportunities and challenges involved in transitioning to a renewable resource-based bioeconomy. Most of the Pacific SIDS have been and even now are traditional bioeconomies, with a heavy reliance on forests. This has been enabled by, among other things, low population densities, low levels of consumption and limited access to non-renewable resources. The key question is whether the Pacific SIDS will be able to leapfrog from traditional low-technology subsistence bioeconomies to modern bioeconomies that produce a wide range of products and services, thus avoiding the conventional path to a fossil-resource-based economy, which most countries in the subregion are still pursuing.

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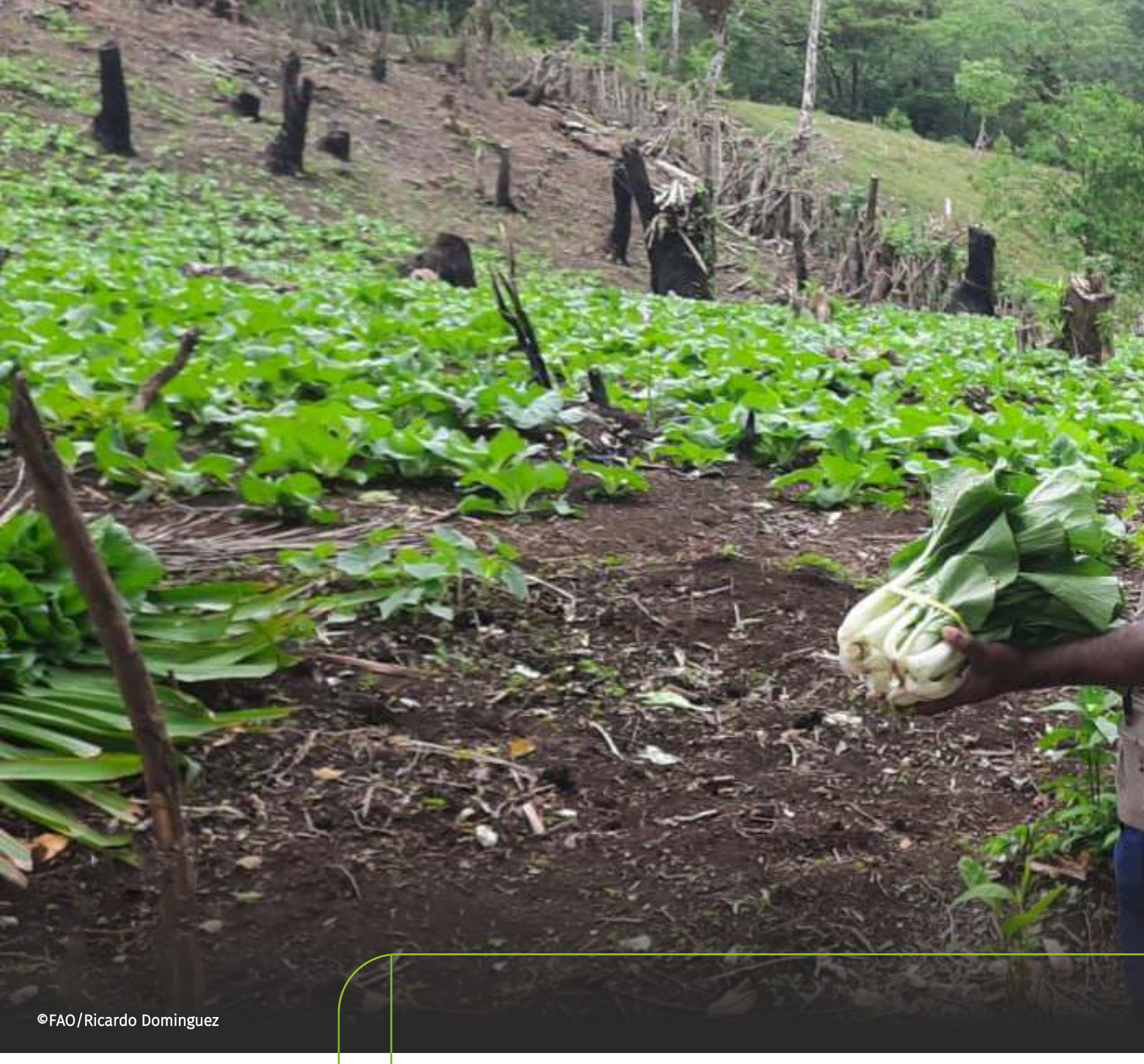

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04

Key points

- Population growth, urbanization and a “youth bulge” are key demographic drivers in the Pacific SIDS. The population of the Pacific SIDS is expected to increase from 11.5 million people in 2020 to 13.6 million in 2030. Urbanization is likely to accelerate in some small-island countries, but most people in the larger countries will continue living in rural areas.
- Income growth in the Pacific SIDS has been relatively low in the last two decades, affecting the ability of governments to invest in sustainable resource management. Those Pacific SIDS with significant stocks of natural resources have been compelled to draw down their natural capital, and those countries with few natural resources depend to at least some extent on external support.

DRIVERS OF FOREST CHANGE

- The disruptive impact of the COVID-19 pandemic on global value chains has severely affected Pacific SIDS economies and increased dependence on land for livelihoods. Global supply-chain vulnerability is encouraging reshoring and vertical integration in import-dependent countries and businesses, which could have negative impacts on Pacific SIDS with significant wood products trade.
- Although the subregion emits just 0.03 percent of global GHG emissions, Pacific SIDS are at the forefront of the negative impacts of climate change. Climate change has emerged as a superdriver affecting all aspects of life, including land use. Multiple direct and indirect impacts are undermining the ability of the Pacific SIDS to invest in sustainable resource management.
- The Pacific SIDS are becoming the focus of competing geopolitical interests. This might provide opportunities but is also fraught with challenges, especially if a new “cold war” emerges and countries are caught in the crossfire of superpower rivalries. Because of their vast economic exclusion zones, most small-island countries in the Pacific can be termed “large ocean states”, with immense potential for tapping marine resources and developing sustainable “blue” economies.

The state of forests and forestry outlined in previous chapters is an outcome of the collective impact of various drivers, and the future will be shaped by how these evolve in coming years. Most discussions on land-use change, including deforestation and forest degradation, tend to focus on proximal drivers such as the expansion of subsistence and commercially driven cultivation, investment in infrastructure, urban development (which often has a cascading impact on land use) and growing demand for products and services. Underlying these proximal drivers are more fundamental drivers, such as changes in the size and spatial distribution of populations and economic changes that determine the extent to which lands and forests contribute to income and consumption. Although changes in demand for products such as food, fibre and energy have received considerable attention in the past, environmental issues such as climate change, biodiversity loss and water scarcity are increasingly important concerns. Climate change has become a "superdriver", affecting all people and environments, and the way in which societies collectively respond to it will be the key determinant of land use in the future.

Understanding the impact of drivers on resource use is challenging given their complex interactions, including multiple feedback loops. The drivers and their outcomes operate and manifest at various spatial levels - local, national, regional and global. In closed societies, resource-use change is driven primarily by local drivers. In an era of rapid globalization and the integration of local, national and global economies, global developments tend to overwhelm local drivers. This is particularly the case for small-island countries: small ripples at the global level can manifest as "tsunamis" locally. Recent developments such as growth in global demand for products and services, changing geopolitics in the Indo-Pacific, the disruptive impact of the COVID-19 pandemic, and the war in Ukraine clearly indicate how global drivers can affect the Pacific SIDS (ESCAP, 2022). Of particular interest are global efforts (or lack of effort) to address climate change, which could have far-reaching impacts on land use, including forestry, in the Pacific SIDS.

This chapter provides an overview of how changes in populations, economies and the environment are affecting lands and forests and how drivers of change might evolve in coming decades.

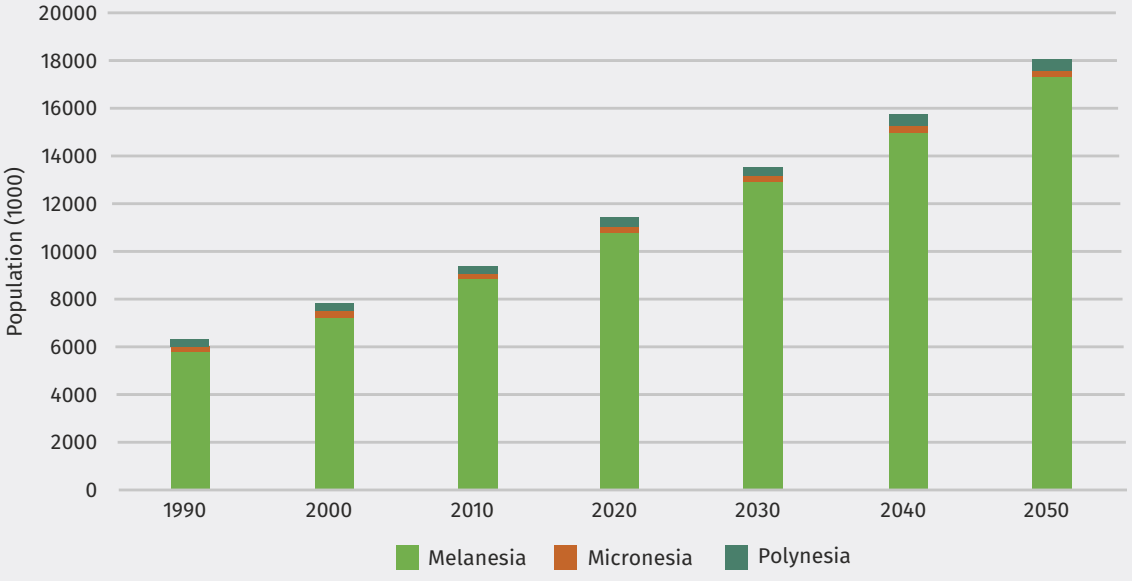
Demographic changes

The Pacific SIDS are undergoing rapid changes in population size, structure and spatial distribution. A direct effect of population growth is increased demand for food, fibre and energy, which leads to the expansion of agriculture (often through forest clearance) and the intensification of agricultural production through the application of new technologies. Demographic drivers operate in conjunction with other factors, too: for example, external demand for products and services can have overwhelming impacts on natural resources. Below, an overview is presented of demographic changes occurring in the Pacific SIDS and their implications for land use.

Populations in the Pacific countries will continue to increase

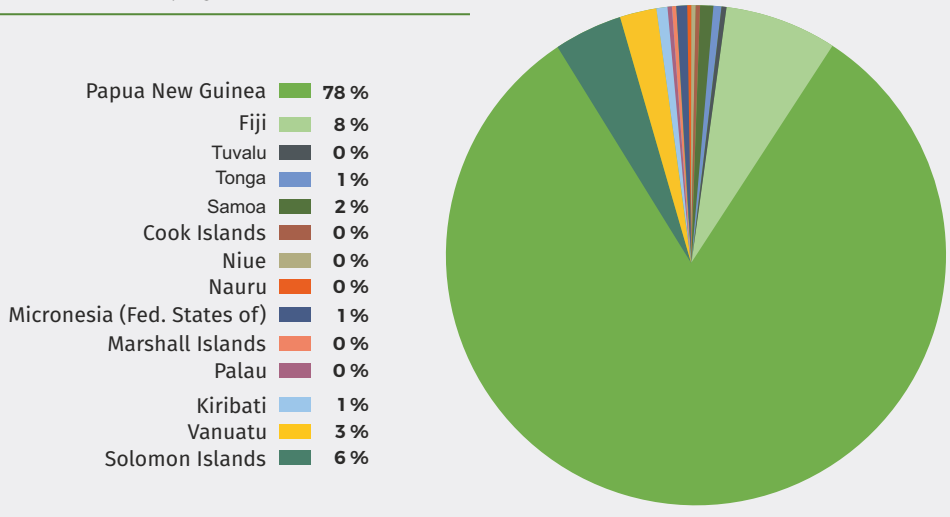
The population in the 14 Pacific SIDS combined was 6.33 million people in 1990, which was about 0.1 percent of the world population. This had grown to about 11.5 million in 2020 (United Nations, 2019), a compounded annual growth rate of 2.0 percent. The world population grew from 5.33 billion people to 7.79 billion people over the same period. The population in the Pacific SIDS is projected to increase to 13.65 million people by 2030 and to 17.98 million by 2050 (United Nations, 2019; Figure 12).

Figure 12. *Actual and projected population, Pacific Small Island Developing States, 1990- 2050*



Source: United Nations. 2019. *World Population Prospects 2019: Data Booklet.* Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

Figure 13. *Share of the subregional population held by 14 Pacific Small Island Developing States, 2020*



Source: United Nations. 2019. *World Population Prospects 2019: Data Booklet.* Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

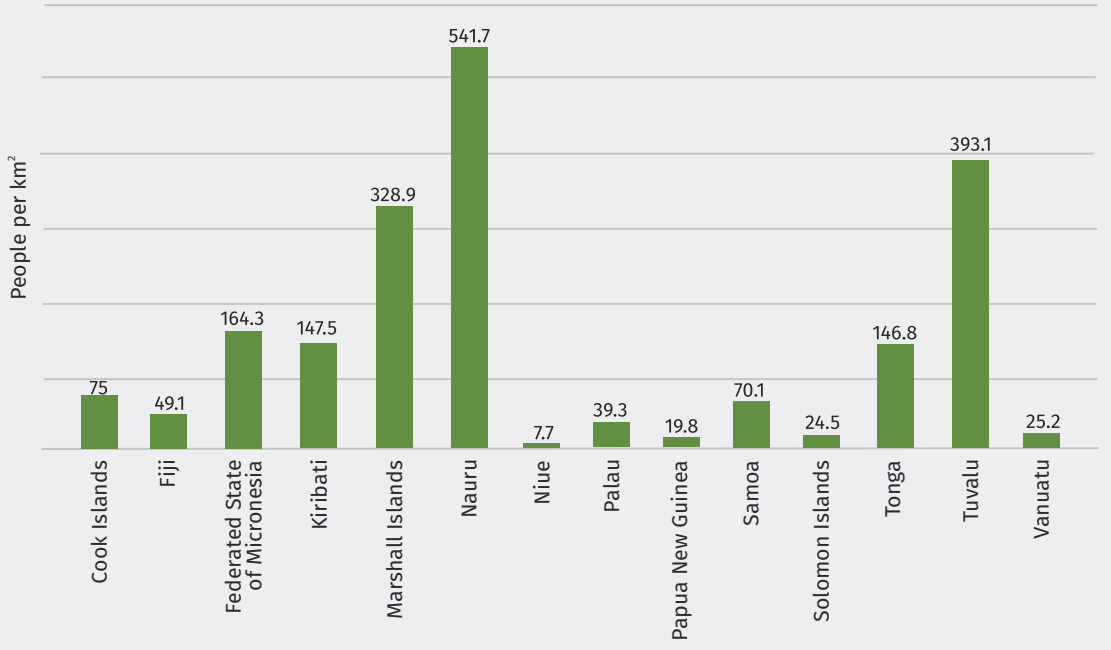
The Melanesian countries of Fiji, Papua New Guinea, Solomon Islands and Vanuatu account for most of the population in the Pacific SIDS (Figure 13); the share is expected to increase from 94 percent in 2020 to 95 percent in 2050. Population size in 2020 varied from just 2 000 people in Niue to 8.95 million people in Papua New Guinea; most countries in Micronesia and Polynesia have populations of fewer than 200 000 people. There is also a considerable range in Melanesia: the population of Fiji, the subregion's second-most populated country, is one-tenth that of Papua New Guinea. This uneven distribution will persist, resulting in differing demands on natural resources.

Population size has important implications for land use and forests. For example:

- Demand for food, fibre, energy and other products is highly dependent on population size, any increase in which would require changes in land use or increased productivity. In the absence of other opportunities to generate income, land remains the most important source of livelihood.
- A large population with adequate income generates demand for products and services. A smaller population distributed across many islands affects the viability of wood production and processing because of a lack of economies of scale.

Although increases in population size is an important driver, population density is also an important determinant of impacts on natural resources. There is wide variation in population density among the 14 Pacific SIDS (Figure 14).

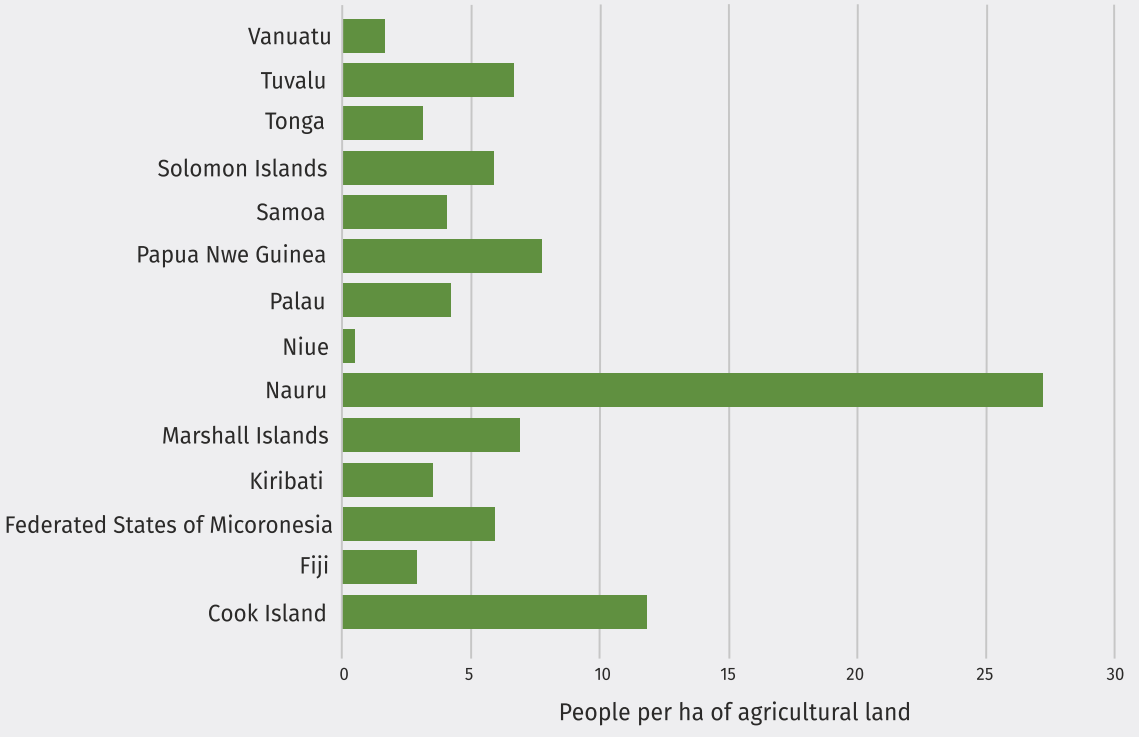
Figure 14. *Population density, Pacific Small Island Developing States, 2020*



Sources: FAO. 2020. *Global Forest Resources Assessment 2020: Main report.* Rome. Available at https://doi.org/10.4060/ca9825en; **United Nations**. 2019. *World Population Prospects 2019: Data Booklet.* Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

With a population density of fewer than 20 people per km^2, Papua New Guinea - which accounts for 78 percent of the region's land area - is the least densely populated country in the subregion; in contrast, Nauru, the subregion's most densely populated country, has more than 540 people per km^2. Combined with land area, population density gives an indication of the potential and limitations of land use and capacity. Although domestic demand for products and services affect how land and forests are used, external demand may have a greater impact. The large, low-population-density, low-income countries in the Pacific are particularly prone to intense demand pressure arising from rapidly growing, densely populated countries in Asia, which is both an opportunity (if sustainability and legality issues are addressed) and a risk (if governance systems are ineffective) for forests.

Figure 15. *Population density of agricultural land, Pacific Small Island Developing States, 2020*



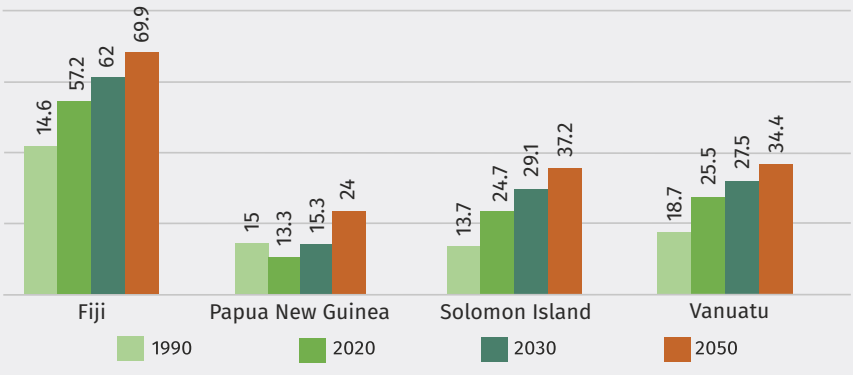
Sources: FAO. Undated. FAOSTAT [online]. Rome [Cited June-August 2021]. www.fao.org/faostat/en/- data/FO; **United Nations.** 2019. *World Population Prospects 2019: Data Booklet*. Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en.

Several Pacific SIDS have uninhabited islands, which means that the effective population density is higher than that derived simply from land area and population. For example, the overall population density of Kiribati is about 148 people per km², whereas the urbanized South Tarawa, which hosts nearly half the population, has a density of 3 600 persons per km². The limited availability of arable land is an important challenge, given that many Pacific SIDS possess large areas of rugged terrain and cultivation is restricted to narrow strips along rivers and coastal belts. In some smaller Pacific SIDS, population density per unit area of agricultural land is extremely high (Figure 15). Even in Papua New Guinea, a low-population-density country, population density on agricultural land is relatively high, at about 7.8 people per ha.

Those countries with very high ratios of population to agricultural land area and population to forest area tend to be highly dependent on forests, including for agricultural expansion. For example, the Cook Islands has an overall population density of just 75 persons per km² but supports 12 people per ha of agricultural land, placing enormous pressure on land, including forests. The vast exclusive economic zones (EEZs) of most Pacific SIDS are a major asset that can enable them to overcome the limitations imposed by low land availability.

Urbanization

Figure 16.
Actual and projected urban population as a proportion of total population, Fiji, Papua New Guinea, Solomon Islands and Vanuatu, 1990- 2050



Source: United Nations. 2019. *World Population Prospects 2019: Data Booklet*. Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

The nature of urbanization differs among the Pacific SIDS. In some countries, the small size of islands limits the extent of arable land and increases dependence on marine resources; this tends to favour high concentrations of people along narrow coastal belts. Other urbanization trends include the following:

- The relatively large Melanesian countries are the least urbanized - overall, about 80 percent of the population still lives in rural areas. Fiji is the most urbanized, at 57 percent in 2020, and Papua New Guinea is the least urbanized, at about 13.3 percent. Urbanization is expected to continue increasing - in Fiji, for example, 70 percent of the population is expected to be living in urban areas by 2050. Solomon Islands is projected to urbanize rapidly, from 24.7 percent in 2020 to 37.2 percent in 2050 (Figure 16).
- A large increase - of 2.52 million people - in the number of people living in urban areas is projected in Papua New Guinea by 2050, which is a much higher number than the total population increase in all the other Pacific SIDS combined.
- Except for the Federated States of Micronesia, *Samoa and Tonga, all Micronesian and Polynesian countries are already highly urbanized - with the proportion of urban population exceeding 75 percent in the Cook Islands, the Marshall Islands, Nauru and Palau (Nauru is 100 percent urbanized).*

Urbanization in the Pacific SIDS poses several challenges, especially because of climate change and the associated increased risk of disasters.

Most urbanization is occurring through the expansion of informal squatter settlements, often referred to as "urban villages" (Asian Development Bank, 2016). Such settlements are often established in areas unsuitable for long-term human habitation, such as low-lying flood-prone areas, peri-urban waste-disposal sites, peri-urban edgelands, mangroves, and other land prone to flooding. Other challenges include high unemployment, a lack of access to safe and adequate housing, degraded environmental conditions, and high crime rates (ACFID, 2019). Most people in the Pacific SIDS who have moved to urban areas continue to rely on land and forests for a wide range of subsistence products, such as food, biofuels and medicines. This puts enormous pressure on forests adjoining urban settlements. Urban development and greening efforts will need to navigate complex governance challenges, especially those stemming from overlapping and conflicting customary and formal institutional arrangements, the high vulnerability of urban areas to disasters, and the continued dependence of urban people on the subsistence use of various forest products.

Most people in the Pacific live close to the coast

Except for Papua New Guinea, most of the population in the Pacific SIDS lives close to the coast (Andrew *et al.*, 2019) (Table 17), due partly to geography (especially the small size of islands) and terrain. In some countries, it is physically impossible to be more than a few kilometres from the coast. Fisheries, trade and tourism are the main livelihoods of people in such situations.

Table 17. *Distribution of population in relation to distance from coast, Melanesia, Micronesia and Polynesia*

	Proportion of total population living:		
	Within 1 km of the coast	Within 5 km of the coast	Within 10 km of the coast
Melanesia, excluding Papua New Guinea	47	85	94
Papua New Guinea	8	21	30
Fiji	27	76	91
Solomon Islands	65	91	98
Vanuatu	64	94	99
Micronesia	72	99	100
Polynesia	74	99	100

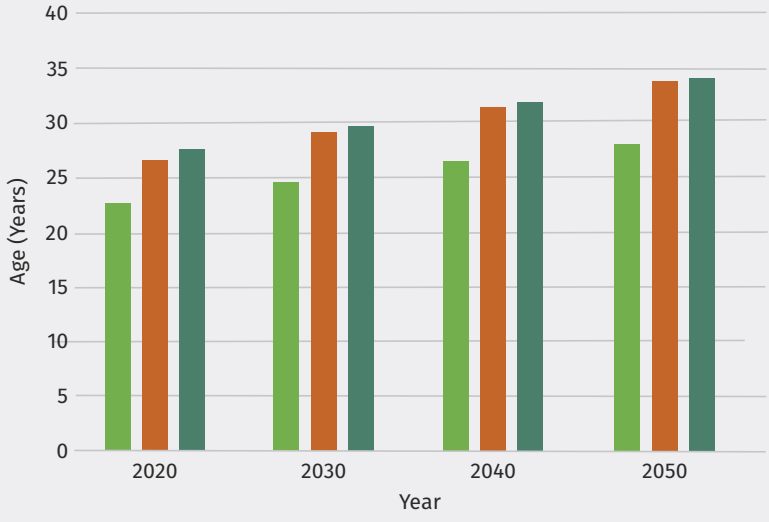
Source: **Andrew, N.L, Bright, P., de la Rua, L., Teoh, S.J. & Wickers, M.** 2019. Coastal proximity of populations in 22 Pacific Island countries and territories. PLoS ONE, 14(9): e0223249. https://doi.org/10.1371/journql.pone.0223249

In several countries in Micronesia and Polynesia, 100 percent of the population lives within 1 km of the coast, and only in Papua New Guinea does a minority (30 percent) of people live within 10 km (Andrew *et al.*, 2019). This has important implications for land use and exposure to climate-change-related risks, especially sea-level rise and saline-water intrusion on freshwater supplies. Papua New Guinea will need to invest significantly in infrastructure to increase the access of people living inland to markets, education, healthcare and other essential services. For other countries, the challenge will be to improve the quality of infrastructure to withstand disasters.

Implications of the youth bulge

The Pacific SIDS have a high proportion of young people, often referred to as a youth bulge (Wilson, 2020). The median age in the Pacific SIDS varies from 19.9 years in Solomon Islands to 27.9 years in Fiji, showing that at least 50 percent of the population is still very young (United Nations, 2019). Figure 17 shows that the median age will increase (from a low base) in the three groupings of Melanesia, Micronesia and Polynesia between 2020 and 2050. The median age in 2020 was 22.8 years in Melanesia, 26.8 years in Micronesia and 27.6 years in Polynesia. The median age in Papua New Guinea was only 22.4 years; of the people aged 20- 24 years, an estimated 23 percent of the potential youth labour force was unemployed (reflecting only the formal sector and those actively seeking work).

Figure 17. *Actual and projected median age of the population, Melanesia, Micronesia and Polynesia, 2020- 2050*



Source: *United Nations. 2019. World Population Prospects 2019: Data Booklet.* Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. https://doi.org/10.18356/3e9d869f-en

A high proportion of young people can be a "demographic dividend" if the young can engage in productive, remunerative economic activities and the unemployment rate is low. A large number of unemployed young adults, however, can be a liability that increases the risk of social unrest and associated violence. Low employment rates, weak governance, fiscal pressures and high dependency on official development assistance (ODA) makes the Pacific SIDS - especially the Melanesian countries - vulnerable to the negative consequences of the youth bulge (Wilson, 2020). For forestry, the implications of a high proportion of young people include:

- a need to provide remunerative and attractive jobs in forestry and agroforestry, including the processing of wood and other products; and
- meeting increased demand for wood products arising from higher demand for housing and other necessities.

Migration, remittances and land use

Pacific SIDS are both a source of and destination for migrants, with the larger countries accommodating migrants from within the subregion, especially from smaller, high population-density countries. Disparities in economic and social conditions between the Pacific SIDS and neighbouring developed countries have been a main driver of international migration (FAO, 2011b). Among the Pacific SIDS, the diasporas of the Cook Islands, Fiji, Niue, Samoa and Tonga are especially numerous. The migrant population living abroad as a proportion of the total population in 2019 was 50.6 percent in Tonga, 46.2 percent in Samoa and 21.5 percent in Fiji (International Organization for Migration, 2021). Migration from the Pacific SIDS stems from economic and environmental factors, as follows:

- In many Pacific SIDS, employment is precarious, partly because of the youth bulge coupled with the slow growth of economies, causing young people to migrate in search of better job prospects. The seasonal labour migration schemes of other countries, such as New Zealand's Recognised Seasonal Employer scheme in 2007 and Australia's Seasonal Worker Programme in 2012, which aimed to meet the labour needs of those countries' horticulture and viticulture industries, have offered

opportunities for temporary migration. The United States of America has been another important destination for migrants from Pacific SIDS, especially Tonga. Australia and New Zealand are the main destinations for labour migrants from Pacific SIDS, but the United States of America and Japan are also becoming attractive (International Organization for Migration, 2019).

- Climate-related problems such as sea-level rise, flooding and increasingly intense storms and storm surges, coupled with other disasters such as earthquakes, are also triggering migration. This might be within a country from smaller, remote islands with limited facilities to larger islands. In Tonga in the 1960s, for example, disasters and other factors prompted migration from the smaller outer islands to Tongatapu, especially the capital, Nuku'alofa (FAO, 2011b). The vulnerability to climate change and the likelihood of associated migration, displacement and relocation vary among the Pacific SIDS. In Kiribati and Tuvalu, half the population already lives in overcrowded urban areas on atolls comprising narrow strips of coral, with a high vulnerability to sea-level rise, saltwater intrusion and drought. A number of governments are considering the planned relocation of groups and communities. Kiribati, for example, has promoted the "Migration with Dignity" policy; in 2014, the country purchased 2 200 ha of land from Fiji as a long-term adaptation measure.[2] The aim of the Migration with Dignity policy is to facilitate permanent and temporary labour migration on a voluntary basis as a way of coping with climate change. The Government of Fiji is in the process of relocating people from several vulnerable coastal villages (International Organization for Migration, 2019).
- The impact of migration on land use varies depending on the context, who is migrating, whether it is temporary or permanent, and a range of economic factors. Potential impacts of migration include the following:
- Few studies have been undertaken on the effect of migration for economic reasons on land use in the Pacific SIDS, but experience elsewhere suggests that it can reduce forest degradation and deforestation and increase restoration efforts, with remittances helping improve the livelihoods of people staying behind and lessening their dependence on scarce local resources. Remittances by migrants are a major source of income for families in Pacific SIDS, as well as an important source of foreign exchange (Box 18).
- Climate-change-related migration, especially within a country or the subregion, is bound to affect land use, mostly likely by causing land clearance to accommodate the immigrants. There is an urgent need to plan such immigration with a view to minimizing the negative social and environmental impacts.

Box 18. Remittances an important source of income

Remittances are funds transferred by migrant workers to their home countries to support their families, relatives and friends. Globally, remittances increased from USD 121.8 billion in 2000 to USD 646.2 billion in 2020; in the Pacific Small Island Developing States (SIDS), they increased from USD 106.1 million to USD 835.1 million over the same period. Remittances are now a major source of national income and foreign exchange for several Pacific SIDS. For example, the value of remittances to Tonga was USD 194 million in 2020, about 37.7 percent of that country's gross domestic product (GDP); for Fiji, the value was USD 312 million (7.2 percent of GDP). Other countries with sizeable remittances in 2020 were Samoa (USD 150 million, 18.7 percent of the GDP), Vanuatu (USD 76 million, 8.8 percent of GDP) and the Marshall Islands (USD 31.0 million, 31 percent of GDP). The value of remittances is much higher than that of foreign direct investment in the Pacific SIDS. Although there was concern that the COVID-19 pandemic might adversely affect remittances, there has been no significant decline, possibly stemming from improved transaction records because of the increased use of digital platforms for fund transfers.

By increasing the food security of recipients in destination countries, remittances can reduce dependence on land (and therefore deforestation and forest degradation). They are also invested in productive activities and to develop capacity, thus helping increase income in the longer term. No in-depth study has been carried out on the impact of remittances on land use and forests in the Pacific SIDS, however.

Sources: International Organization for Migration. 2020. *Rapid assessment of the socioeconomic impact of COVID 19 on labour mobility in the Pacific region*. Fiji.

[2] There is now a proposal to develop this land as a commercial farm to meet the needs of Kiribati, with technical assistance from China.

Migration and the growth of remittances are changing the socio-economic situation in many rural areas in developing countries. The movement of labour, corresponding changes in relative wages due to migration, and remittance inflows are affecting agricultural production, the relative competitiveness of agriculture, and social safety nets (FAO, 2011b). Over time, such factors could reduce labour availability in forestry and there may be a need to introduce productivity-enhancing technologies. Migration and remittances are also affecting traditional institutions, including customary land ownership, with those local people educated and exposed to other systems of ownership potentially increasingly driven by personal ambition and more likely to push for changes in traditional institutions.

Although increased migration provides new and possibly more remunerative employment opportunities and may be a positive development from the perspectives of emigrants and their families, it could have certain long-term negative impacts. Most migrants tend to be young, healthy and well-qualified, and their emigration can reduce productivity in their countries of origin, including in agriculture and forestry. Emigration can also push up wages in the origin countries (because of labour shortages), reducing the economic viability of agriculture and allied activities - although it could also speed up the adoption of productivity-enhancing technologies.

If past trends persist, migration will continue to be a strong factor in land use, especially given that many developed countries in the Asia-Pacific region have rapidly aging populations and may turn increasingly to immigration to boost productivity. In addition to Australia, New Zealand and the United States of America, other countries that may increase intakes of skilled and semi-skilled labour include Japan and the Republic of Korea.

Human-capital development crucial

The capacity of Pacific SIDS to take advantage of emerging opportunities will depend largely on the development of human capital, which to date has been highly varied (Box 19). Countries with greater human capital will be in a much better position to take advantage of emerging opportunities, including employment in other countries.

Box 19. Measuring human capital development through the Human Capital Index

Investing in human capital, especially through a focus on education and health, is crucial for achieving the Sustainable Development Goals. The World Bank has developed the Human Capital Index (HCI) to measure and compare human-capital development between countries. The following six indicators are used to determine the HCI: (1) the probability of survival to age 5; (2) expected years of schooling; (3) harmonized test scores; (4) learning-adjusted years of schooling; (5) adult survival rate; and (6) the proportion of children under 5 not stunted. The highest HCI achieved globally (among 174 countries) in 2020 was by Singapore, which scored 0.88, and the Central African Republic has the lowest score, at 0.29. Table 18 shows the HCI for the Pacific countries.

Table 18. *Human-capital development scores, 11 Pacific Small Island Developing States, 2020*

Country	Human Capital Index score
Samoa	0.55
Tonga	0.53
Fiji; Federated States of Micronesia; Nauru	0.51
Kiribati	0.49
Tuvalu; Vanuatu	0.45
Papua New Guinea	0.43
Marshall Islands; Solomon Islands	0.42

Source: World Bank. 2021b. *The Human Capital Index 2020 Update: The human capital in the time of COVID-19.* Washington, DC.

Economic change

The measurement of economic change can be problematic given difficulties in capturing the multiple dimensions of change using a limited number of parameters. The most commonly used parameters for such measurement include the size of an economy (most often measured as GDP); per-capita income; the rate of growth of income over time; how income is distributed within a country; the extent of poverty; and changes in the share of GDP among sectors. This section provides an overview of key economic drivers that may shape land use and forestry in the Pacific SIDS in coming years.

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How are forests affected by changes in income?

Changes in national income measured in terms of GDP and per-capita income affect demand for various products and services, including those provided by forests. The quantity and quality of forest products and services demanded by consumers change in response to changes in income. Forests and trees also generate income for those involved in various value chains, such as forest owners, logging companies, processing enterprises, shipping companies, wholesalers, retailers and governments. When forest owners - individuals, groups or governments - have limited options for income, they may feel pressure to increase harvesting. It is important, therefore, to consider the role of forests and forestry in changing incomes and how changes in income may affect forests and forestry.

Two forms of production systems can be identified in the Pacific SIDS:

1. a predominantly subsistence form that is largely in the informal domain and thus inadequately captured in national income statistics; and
2. a formal, more market-driven form, catering to national and global markets. Since these value chains are longer, most - if not all - transactions are measurable and eventually captured by and reflected in national income statistics.

Growth of Pacific economies has been slow

Table 19 gives an overview of the economic situation in the Pacific, compared with that of East Asia and globally.

Table 19. *Economic measures for 12 Pacific Small Island Developing States, East Asia and globally, 2000 and 2020*

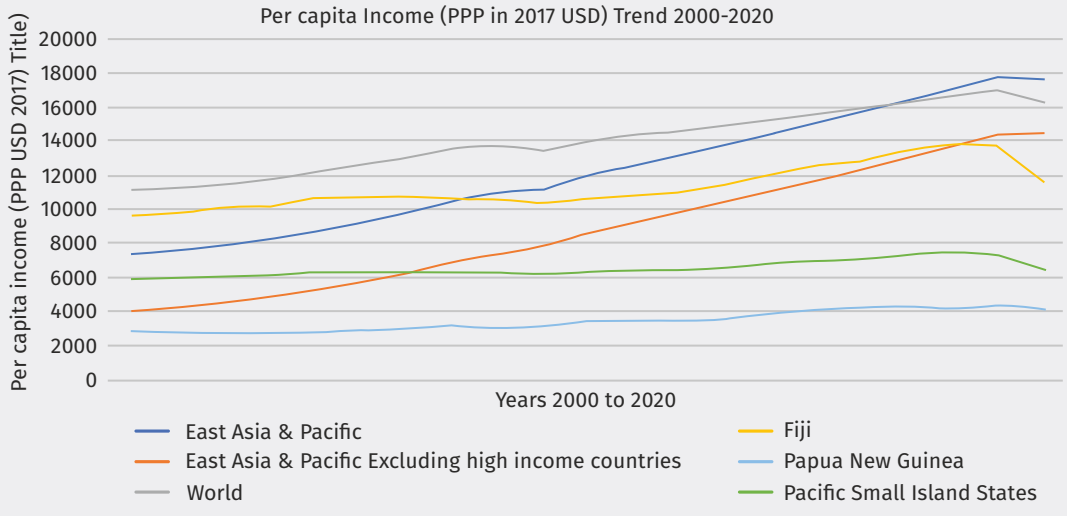
	Gross domestic product (GDP), purchasing power parity (PPP) (2017 constant) (USD billion)		Per capita GDP, PPP (USD)		Growth rate (compounded annual)	
	2000	2020	2000	2020	GDP	Per-capita income
12 Pacific Small Island Developing States*	28.4	52.6	3 637	4 580	3.1	1.2
East Asia (excluding developed economies)	7 315	30 593	4 027	14 471	7.4	6.6
World	68 114	126 319	11 140	16 270	3.1	1.9

Note: * No data were available for the Cook Islands and Niue.
Source: World Bank. 2022. *Global Economic Prospects. Washington*, DC. Doi: 10.1596/978-1-4648-1843-1

Key economic characteristics of the Pacific SIDS are summarized below:

- As per World Bank classifications, the Pacific SIDS are in either the lower-middle (with per-capita income of USD 1 046-USD 4 095) or upper-middle (USD 4 096-USD 12 695) income groups. In 2020, the GDP of the Pacific SIDS was USD 52.6 billion, which was 0.04 percent of world GDP in that year and 0.17 percent of the GDP of East Asia and the Pacific (excluding high-income countries).
- GDP of the Pacific SIDS in 2020 ranged from USD 53.6 million (Tuvalu) to USD 36.4 billion (Papua New Guinea). Papua New Guinea and Fiji (the subregion's two largest economies) accounted for 89 percent of the subregion's GDP.

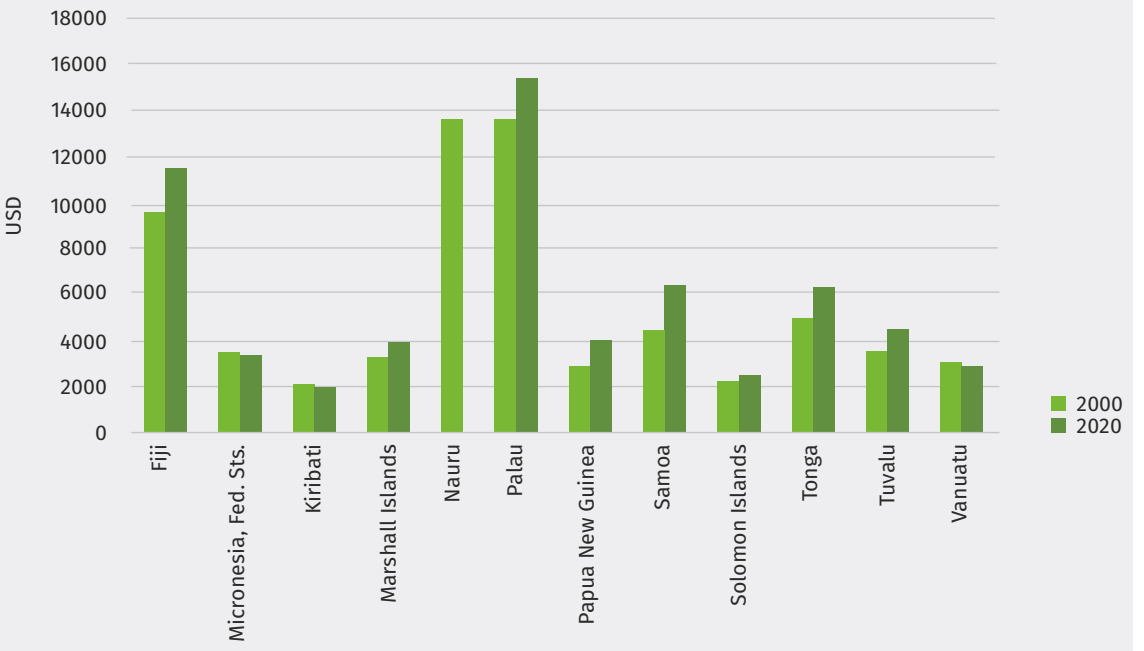
Figure 18. *Per-capita income, purchasing power parity (2017 United States dollars), various countries and groupings, 2000- 2020*



Source: **World Bank**. Undated[a]. Aid effectiveness [online] | Data. [Cited 24 September 2022]. https://data.worldbank.org/topic/aid-effectiveness?locations=TV-FJ-S2-XL

- Although, collectively, the Pacific SIDS registered a compounded annual growth rate of 3.1 percent in GDP (purchasing power parity - PPP - at 2017 prices) between 2000 and 2020, per-capita income grew much more slowly, at a compounded annual growth rate of 1.2 percent. In contrast, per-capita income in East Asia and the Pacific (excluding high-income countries) combined grew at an annual rate of 6.6 percent over the period; globally, per-capita income grew by 1.9 percent (Figure 18). Fiji's per-capita income increased from USD 9 576 in 2000 to USD 13 684 in 2019 and then nose-dived to USD 11 527 in 2020, due almost entirely to the collapse of the tourism sector due to the COVID-19 pandemic. In Papua New Guinea, per-capita income grew at a modest 1.8 percent in 2000-2020; the growth rate was only 0.5 percent in Solomon Islands over the same period (Figure 19).
- The rapid growth in income outside the Pacific SIDS implies an increase in global demand for products and services. Large markets and high incomes in Asia put considerable pressure on the resources of the larger countries in the Pacific, especially timber, minerals and marine products. Yet it seems that the resource-rich Pacific SIDS benefited little from the favourable regional and global economic situation.
- Continuation of the trend of slow growth in per-capita income would likely mean that domestic demand, including for wood and other forest products, will remain sluggish and some export-oriented sectors, such as forestry, will continue to rely on external markets. Wood production in the major exporting countries of Fiji, Papua New Guinea and Solomon Islands is highly dependent on demand in Asian markets, especially China. Any economic slowdown in Asia would likely affect wood demand in the Pacific. The small size of the Pacific economies suggests that domestic markets will be unable to absorb slack in global demand.

Figure 19. *Per-capita gross domestic product, purchasing power parity, 12 Pacific Small Island Developing States, 2000 and 2020*



Note: Data were unavailable for the Cook Islands and Niue.

Source: **World Bank**. Undated[a]. Aid effectiveness [online] | Data. [Cited 24 September 2022]. https://data.worldbank.org/topic/aid-effectiveness?locations=TV-FJ-S2-XL

The economic situation of the Pacific SIDS has become more challenging due to the direct and indirect impacts of the pandemic. The direct impacts have been less pronounced, with several Pacific SIDS remaining infection-free, but GDP has declined in almost all countries. Border closures and lockdowns have had significant impacts on the travel and trade sectors, especially tourism and commodity exports (Box 20). No systematic assessment has been carried out on the impact of the economic contraction on land use and forests, but anecdotal evidence and experience elsewhere suggest that people have needed to rely more on rural lands, including forests, for their livelihoods, with potential negative impacts on forests.

The outlook for income growth

The economic outlook for the Pacific SIDS is largely dependent on global and regional developments, some of which are difficult to predict. The COVID-19 pandemic has had a devastating impact on the global economy as well as the Pacific SIDS, many of which are yet to fully recover. Hope for a rapid economic recovery globally received a severe blow with the start of the war in Ukraine, which, for example, has caused rises in food and fuel prices. More locally, the Pacific SIDS need to confront challenges posed by climate change, which is likely to have major economic (and other) impacts.

Box 20. The impact of the COVID-19 pandemic on the economies of Pacific Small Island Developing States

Although several Pacific SIDS were able to prevent COVID-19 from reaching their shores, border closures and lockdowns have affected most sectors, with the manufacturing and services sectors suffering most. The subregion's economy contracted by 5.8 percent between 2019 and 2020, with the resumption of economic growth likely to be slow, depending on factors such as vaccination rates and the establishment of travel bubbles to facilitate international tourism. Other economic impacts of the pandemic include the following:

- Fiji's economy contracted by 19 percent in 2020, due mainly to declines in tourism and manufacturing. Visitor arrivals plunged by 84 percent, reaching their lowest level since 1970. Earnings from tourism, which accounted for 34 percent of GDP and 26.3 percent of employment in 2019, fell by 85 percent in 2020.
- Export-focused activities in Papua New Guinea were severely affected by the pandemic, reducing GDP by 3.3 percent in 2020. This decline was due mainly to falls in mining and petroleum extraction, which accounted for almost one-fourth of GDP.
- The economy of Solomon Islands contracted by 4.5 percent in 2020, with log exports declining by 12.5 percent and fish catch by 40 percent.
- The Vanuatu economy contracted by 9.8 percent in 2020 due to the combined impact of the pandemic and Tropical Cyclone Harold. Travel restrictions caused the number of air travellers to drop by 82 percent and the number of cruise ship arrivals to fall by 60 percent. Tropical Cyclone Harold had a devastating impact on agriculture, and construction was also down.
- Palau, one of the most tourism-dependent economies, registered a 11.2 percent decline in GDP in 2020. The Cook Islands, Niue and Tonga also had significant declines in tourism.
- Samoa's GDP declined by 3.2 percent in 2020 due to a decline in tourism and a drastic slow-down in commerce and manufacturing. A further contraction in GDP of 9.2 percent is expected in 2021.
- It is too early to quantify the total impact of the COVID-19 pandemic, which is still ongoing.

Sources: Asian Development Bank. 2021. Asian Development Outlook 2021: Financing a green and inclusive recovery. Manila.

Table 20 summarizes recent World Bank forecasts of GDP, with modest economic growth projected in most selected Pacific SIDS to 2023.

Table 20. *Actual and projected change in gross domestic product, world, East Asia and 12 Pacific Small Island Developing States, 2019- 2024*

	2019	2020	2021	2022	2023	2024
				(%)		
World	2.6	- 3.3	5.7	2.9	3.0	3.0
East Asia and the Pacific	5.8	1.2	7.2	4.4	5.2	5.2
East Asia excluding China	4.8	- 3.7	2.6	4.8	5.4	5.4
12 Pacific Small Island Developing States	4.4	- 5.3	- 0.2	3.7	3.6	3.1
Fiji	- 0.4	- 15.7	- 4.1	6.3	7.7	5.6
Papua New Guinea	5.9	- 3.5	1.0	4.0	2.7	2.5
Samoa	4.4	- 2.6	- 8.1	-0.3	2.5	3.8
Solomon Islands	1.2	- 4.3	0.1	-2.9	5.3	3.8
Vanuatu	3.9	- 6.8	1.2	2.0	4.1	3.7

Note: Data were unavailable for the Cook Islands and Niue.
Source: World Bank. 2022. *Global Economic Prospects*. Washington, DC. Doi: 10.1596/978-1-4648-1843-1

Low growth rates combined with high public and private debt would significantly affect the ability of countries to save and invest in sustainable resource management. In such circumstances, countries that are highly dependent on resource extraction will be more likely to pursue business-as-usual approaches that draw down natural capital.

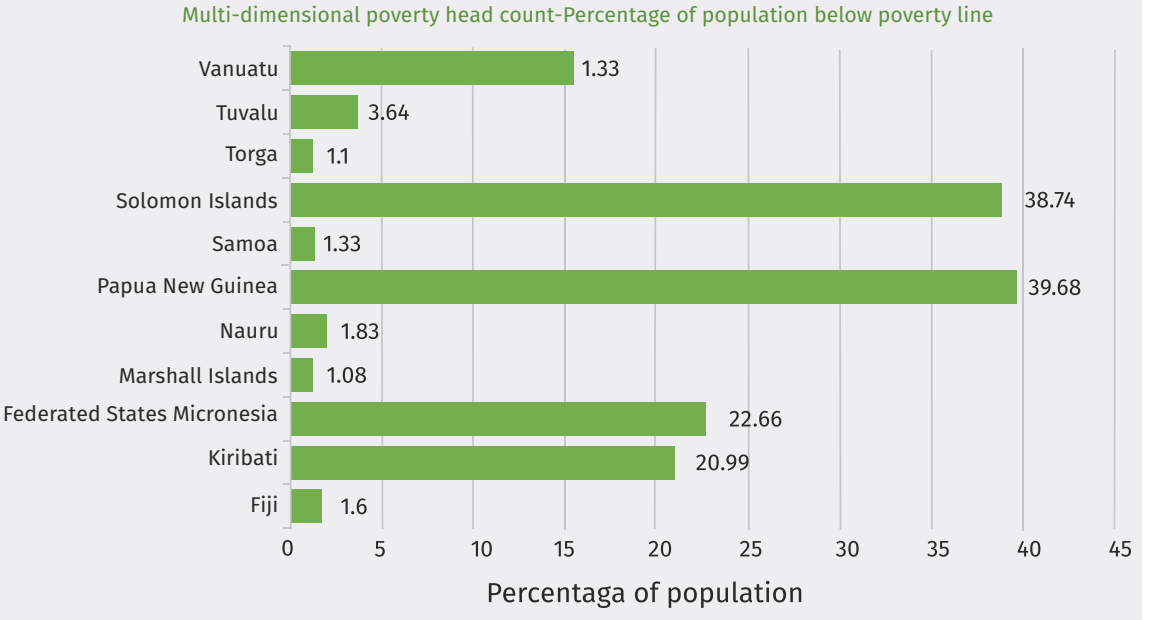
Persistence of poverty and implications for land use

Notwithstanding the limitations of existing methodologies for measuring poverty, poverty appears to be high in the Pacific SIDS, including in the resource-rich countries of Papua New Guinea, Solomon Islands and Vanuatu (Figure 20).

Large proportions of the populations of countries with high levels of poverty live in rural areas; therefore, improved land use, including forestry, will be a key to poverty-reduction strategies and achieving SDG 1 ("no poverty"). This implies the following for the forest sector:

- Pressure to increase the availability of land for cultivation - including shifting cultivation and mixed cropping - will continue, with impacts on forest area.
- Employment generation will be a key concern for all sectors, and forestry can play an important role in generating remunerative, attractive jobs.
- A capacity to tap the potential of new sources of income such as payments for ecosystem services and ensure that communities fully benefit from initiatives like REDD+.

Figure 20. Percentage of population below the poverty line, selected Pacific Small Island Developing States



Note: Pertains to 2019 or the most recent year for which information is available.

Source: World Bank. Undated[b]. Poverty and Inequality Platform [online]. [Cited 20 October 2022]. https://pip.worldbank.org/home

Almost all initial assessments suggest a worsening of poverty due to the COVID-19 pandemic. Although the virus has had relatively minimal direct impact on people's health in the Pacific SIDS, the economic impacts have been significant, with indications of a significant increase in poverty (Asian Development Bank, 2020) likely to have concomitant impacts on land use. The persistence of extreme poverty in the most forest-rich countries in the Pacific SIDS raises fundamental questions about how and for whom and what forests are being managed.

Structural changes in economies

Most discussions on structural economic transformations envisage the development of manufacturing sectors that add value to raw materials produced mainly by agriculture and forestry and sell the value-added products at much higher prices. Structural change envisages a significant increase in the share of the manufacturing sector and in due course this will also pave the way for the growth of a vibrant services sector. For several reasons, however, such a transition is not taking place and, instead, the growth of a low-value-adding services sector is being observed. Table 21 shows change in the share of value-added in the three segments of the economy - agriculture, industry and services - in selected Pacific SIDS between 2000 and 2019.

Table 21. *Change in the share of value-added, agriculture, industry and services, selected Pacific Small Island Developing States, 2000 and 2019*

Country	2000			2019 (or as indicated)		
	Agriculture	Industry	Services	Agriculture	Industry	Services
Fiji	16.5	21.6	61.9	14.6	19.1	66.3
Kiribati	20.0	12.2	67.8	28.3	10.9	60.8
Papua New Guinea	35.2	40.7	24.1	17.9	38.6	43.5
Samoa	16.7	26.8	56.6	10.1	15.8	74.1
Solomon Islands	N/A	N/A	N/A	33.2	17.4	49.3*
Tonga	22.4	20.7	56.9	23.4	18.0	58.6
Vanuatu	25.4	12.2	62.3	21.2	10.1	59.8**

Note: Totals may not sum to 100 due to rounding. * 2017; ** 2018.
Source: **World Bank.** Undated[a]. Aid effectiveness [online] | Data. [Cited 24 September 2022]. https://data.worldbank.org/topic/aid-effectiveness?locations=TV-FJ-S2-XL

Several studies (e.g. Bolesta, 2020) have indicated the inapplicability of a conventional structural transition in most small-island countries. Overall, the share of agriculture and forestry has declined in most of the Pacific SIDS. The services sector tends to dominate, and much of the employment available in urbanizing centres appears to involve low wages. Given this, and challenges in resource mobilization, most governments in the Pacific SIDS depend for income on extractive sectors like logging, mining and fossil fuels (in the resource-rich countries), donor assistance (from bilateral and multilateral agencies), and foreign direct investment (FDI). Considerable potential exists for taking advantage of the vast EEZs of the Pacific SIDS, but the capacity to manage marine resources is low because of human-resource and financial constraints and a host of governance challenges.

Impact of developments in other sectors

Chapter 2 described how the expansion of subsistence cultivation and mining has led to deforestation. Population growth in the Pacific SIDS, especially Melanesia, requires an increase in food production, which, in turn, entails the further expansion of agriculture or an increase in productivity. Although subsistence farming is still an important cause of deforestation, recent large-scale deforestation has been due largely to the expansion of commercial crops like oil palm, rubber, cocoa and coffee. Key developments with direct and indirect impacts on forests and forestry, especially in Papua New Guinea and Solomon Islands, are described below.

Expansion of oil-palm cultivation. In Papua New Guinea, the area under SABLs reached 5.6 million ha in 2011, or about 12 percent of the land area. The outcry arising from the impacts of these leases, however, caused the government to impose a moratorium on the issuance of further SABLs. Many SABLs were designed to enable logging under the pretext of establishing oil-palm plantations, thus serving as a means for circumventing the log export ban that is applicable to logging undertaken as per the National Forestry Development Guidelines (Nelson *et al.*, 2014). The large-scale expansion of oil palm in Papua New Guinea in the future cannot be ruled out given growing global demand for palm oil, including as a biofuel (Qaim *et al.*, 2020), although pressure from consumers could compel producers to pursue deforestation-neutral strategies for increasing palm-oil production.

Infrastructure development. Infrastructure development, especially the expansion of road networks, is likely to be a major driver of land-use change, including deforestation. Road density and rural road access vary considerably in the Pacific SIDS. For most small-island countries, where the majority of the population is concentrated in the coastal belt, road access is not a major issue. This is not so, however, in Papua New Guinea and Solomon Islands, where rural areas have very low road densities. In Papua New Guinea, 87 percent of the population lives in rural areas and only 11.7 percent has access (within 2 km) to all-season roads (Asian Development Bank, 2020); overall, the country's road density is just 2 km per 100 km^2. Given the huge demand for better road access, Papua New Guinea has embarked on an ambitious programme to expand its national road network, although concerns have been expressed about its social and environmental implications (Alangir *et al.*, 2019).

Exclusive economic zones and the development of a blue economy. Most Pacific SIDS have vast EEZs, such that their status could be viewed less as "small-island states" and more as "large ocean states" (Chan, 2018). The total land area of the 14 Pacific SIDS is about 0.5270 million km^2, but their combined EEZs cover about 20.8 million km^2 (about 40 times as large). Because of the wide distribution of islands, some of the very small Micronesian and Polynesian countries have huge EEZs compared with their land areas (Bergin, Brewster and Bachhawat, 2019). The EEZ of the Marshall Islands,

for example, is 11 700 times the land area, and Tuvalu's EEZ is more than 29 000 times the land area. The ocean is seen as a new frontier for socio-economic development, with potential to enable countries to overcome the constraints imposed by land scarcity. Thus, there has been considerable discussion about the potential to develop "blue economies", a concept articulated by the Pacific SIDS in conjunction with the "green economy" during the Rio+20 conference in 2012. The key subregional Pacific Island Forum and Pacific Island Development Forum have helped elaborate the concept and build its political acceptability (Louey, 2022). Marine resources such as fisheries, minerals, biopharmaceuticals and energy have the potential to boost economic growth and create jobs (World Bank and UNDESA, 2017), thus reducing pressure on land. Although conceptually attractive, making the blue economy a reality is challenging, as per the following:

- There is considerable divergence in interpretations of "blue economy" between that of Pacific Islander people, who consider the ocean as integral to their life and culture and focus on resource stewardship that builds on customary rules and regulations and traditional knowledge, and business interests, which tend to focus on economic exploitation (Louey, 2022).
- Translating *de jure* control into *de facto* control over an EEZ to sustainably use the resources within it requires significant investment to improve governance and to develop and deploy appropriate technologies. Most countries lack the resources themselves and will require external capital, technology and entrepreneurship, which raises governance issues. The changing geopolitical environment in the subregion is adding to the complexity.

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Meaningful development of a blue economy will have transformative impacts on land use, including forests, in the Pacific SIDS, especially by reducing people's economic dependence on land. There will be a need to recognize connections between the green and blue economies - such as the extent to which the ecosystem services provided by sustainable land and forest management improves the marine environment and thus helps sustain the blue economy.

Globalization and the changing geopolitical environment

Land use in the Pacific SIDS, including forestry, has been affected by globalization, which has increased the transboundary flow of investments, goods, services, people and knowledge. The globalization process has accelerated since 1990 due to factors such as multilateral and bilateral trade and investment agreements, the rapid growth of information and communication technologies (ICTs) and the growth in containerized shipping, all of which gained momentum at the end of the Cold War. The rapid growth of logging, mining, plantation development and tourism in the Pacific SIDS has been driven primarily by external investments, which is an outcome of globalization, as is the outflow of migrant workers from the Pacific SIDS and the consequent inflow of remittances. Globalization has enabled the development of value chains in which the production of goods (and their components) and services occurs where they are most profitable. Efficiency, profitability and just-in-time production became the driving forces of these global value chains. Most of the formal forestry activities in the Pacific SIDS, especially logging, plantation development and the production of non-wood forest products, expanded as a result of globalization.

Nevertheless, there are signs that globalization is losing steam; The Economist (2019a) dubbed this "slobalization". Globalization has also led to discontent (Stiglitz, 2002) due to (among other things) increasing GHG emissions, widening inequality, and the appropriation of resources from indigenous communities. The 2008 global financial crisis highlighted many of these negative impacts of globalization and drew attention to the vulnerability of the global economy. All the key indicators of globalization (e.g. trade in goods and services as a percentage of GDP, multinational profits, FDI as a percentage of GDP, and stock of cross-border bank loans) stagnated in the years following the global financial crisis (The Economist, 2019b). The escalation of trade tariffs between the United States of America and China, which started in mid-2018, was another important moment for the deceleration of globalization, as was the COVID-19 pandemic. Many countries and industries are now focusing on the security and resilience of supply chains, moving away from the efficiency- and profitability-focused approach they previously followed. The disruption of energy and food supplies due to the war in Ukraineis another major setback for globalization. All these factors ultimately have impacts on land use in the Pacific SIDS; nevertheless, it is challenging to visualize how globalization might play out in the future and how this will affect land use and forestry in the Pacific. Recent trends suggest that the nature of globalization might change substantially in the next couple of decades.

The evolving geopolitical environment in the Indo-Pacific region adds to uncertainty about the future of globalization in the Pacific (Baruah, 2022). Contesting interests vying to increase their strategic influence could affect investment, trade and security. Small global and regional ripples have the potential to manifest as major changes in the Pacific SIDS. Certainly, competing geopolitical interests have brought increased attention on the Pacific SIDS. The competition to gain strategic control could boost investment, with diverse consequences. It could take the socio-economic development of the subregion in new directions, provided the Pacific SIDS ensure they are not caught in the crossfire of superpower rivalry and suffer significant collateral damage, as happened in the Second World War.

Climate change: the all-pervasive superdriver

Although the Pacific SIDS contribute 0.03 percent of global GHG emissions (Luo *et al.*, 2022), they are at the forefront of the devastating impacts of climate change. Projected sea-level rise poses an existential threat to countries in the subregion - particularly low-elevation coral islands - with the potential to inundate densely populated coastal areas and increase salinity, affecting agriculture and freshwater supplies. Climate change will also exacerbate weather-related disasters: for example, projected more intense cyclones and storm surges would affect almost all human pursuits, including land use (Luo *et al.*, 2022). Being an all-encompassing driver - a "superdriver" - affecting all sectors, climate change will have profound direct and indirect impacts on forestry. This section draws on the thematic paper for this outlook study prepared by Luo *et al.* (2022) to provide an overview of the state of knowledge on climate change in the Pacific SIDS, its direct and indirect impacts on forests and forestry, and the responses of countries in the subregion.

Globally, it has been successively warmer at the Earth's surface in each of the last three decades and warmer than any preceding decade since 1850. From 1800, the combined land and ocean temperature has increased at an average rate of 0.08 °C per decade (NOAA, 2021). In the Pacific SIDS, there is clear evidence of subregional air

temperature increases stemming from anthropogenic climate change, with the decadal average air temperature increasing at a rate of 0.18 °C in the period 1961-2011 (Whan *et al.*, 2014). The rate of sea-level rise has accelerated since 1870; the current average is about 3.5 mm per year (Chen *et al.*, 2017), which is faster than the global average.

Direct impacts on forests and forestry

A major challenge in assessing (and projecting) the impacts of climate change on forests in the Pacific SIDS is the absence of systematic studies in the subregion. All forest ecosystems - and changes within them - are a product of complex interactions among diverse biophysical and socio-economic factors. Biophysical factors influencing the structure, composition and functions of forest ecosystems include ambient temperature, moisture availability, soil nutrient status, drainage and slope. Some of the changes manifest in the short term, but many others - more fundamental in nature - have longer time horizons. In addition to long-term changes affecting the structure, composition, distribution and functions of forests, climate-change-related events such as cyclones, coastal inundation, landslides, fire and drought will cause direct and indirect changes in forests. Climate-change-related risks are likely to have a chilling effect on investment in forestry and forest industries.

Temperature increase and forests. An increase in air temperature raises the vapour pressure deficit and evaporation, limiting photosynthetic activity and potentially leading to an overall reduction in growth (Doughty and Goulden, 2009). General predictions have limitations, however, because each species responds differently and has different temperature thresholds. Nevertheless, it can be concluded that a sustained increase in temperature will have major effects on vegetation.

Forests and precipitation. Precipitation is projected to increase overall near the equator, but specific rainfall patterns are region- and location-specific due to differing geomorphologies. On large islands, for example, moist surface air is forced upwards and can lead to higher local rainfall rates, causing large differences both between islands and within them. Generally, seasons themselves are expected to become more extreme, with wet seasons becoming wetter and dry seasons drier.

Sea-level rise and forests. Sea levels are projected to continue rising in the Pacific by more than the global average, which by 2100 could be between 40 cm in low-emissions scenarios and 70 cm under shared socio-economic pathway 5-8.5; higher estimates cannot be excluded due to feedback loops stemming from the melting of ice sheets (IPCC, 2021). Sea-level rise predictions under even low-emissions scenarios would threaten many low-lying atolls, in some cases submerging them - and their forests - entirely (Mimura, 1999). In Solomon Islands, swamp forests with commercial timber are threatened with submersion. Few species can be expected to survive prolonged inundation, especially in coastal areas. Sea-level rise and king tides result in saltwater intrusion and the contamination of freshwater "lenses", which often constitute the only source of clean water in atolls.

Habitat shifts. Increasing temperatures may shift the distribution of forests, with many species - especially those in montane rainforests and cloud forests - highly sensitive to changes in temperature. In the long term, species that are sensitive to higher temperatures could be eliminated in certain habitats and those capable of withstanding higher temperature regimes could expand their ranges. Nevertheless, the nature of temperature-change-driven vegetation shifts is largely unknown, and more work is required to better understand the impacts of projected climate change on forest ecosystem dynamics.

Invasive species. Invasive species can adversely affect indigenous vegetation by gaining dominance over, suppressing and even eliminating local species because of their ability to quickly adapt to the changing biophysical environment (Mainka and Howard, 2010). Most invasive species grow well, reproduce quickly and disperse widely through wind and water. Therefore, they occupy and spread rapidly, particularly in disturbed areas, poorly managed agricultural lands, and damaged or stressed forests. Climate change is anticipated to create more favourable conditions for the spread of invasive species in the Pacific (Taylor, McGregor and Dawson, ed., 2016).

Disasters. Climate change will lead to an overall increase in extreme weather events, especially tropical cyclones, storm surges and drought, in turn causing increases in flooding, fire and windthrow, with diverse and likely negative impacts on forests. These can affect forest assets both directly - such as by damaging natural forests and plantations and forest infrastructure like roads and buildings - and indirectly by affecting other sectors of the economy, thus undermining the capacity to manage resources sustainably.

Table 22. *Annual average economic loss due to disasters, 14 Pacific Small Island Developing States*

Country	Annual average loss (USD million)	% gross domestic product
Cook Islands	4.9	2.0
Federated States of Micronesia	8.3	2.9
Fiji	79.1	3.0
Kiribati	0.3	0.2
Marshall Islands	3.1	2.0
Niue	0.9	5.8
Palau	2.7	1.6
Papua New Guinea	85.0	0.9
Samoa	9.9	1.7
Solomon Islands	20.5	3.0
Tonga	15.5	4.3
Tuvalu	0.2	0.8
Vanuatu	47.9	6.6
Total	**278.3**	

Source: World Bank. 2013. *Acting on climate change & disaster risk for the Pacific.* Available at www.worldbank.org/content/dam/Worldbank/document/EAP/Pacific Islands/climate-change-pacific.pdf

Many Pacific SIDS are highly vulnerable to disasters, which can have major economic impacts (Table 22). The average annual loss due to disasters is equivalent to 6.6 percent of GDP in Vanuatu and 3 percent in Fiji (World Bank, 2013). Based on 204 natural disasters that occurred in 12 Pacific SIDS in the period 1980- 2016, Lee, Zhang and Nguyen (2018) estimated that, on average:

- The probability of a disaster occurring somewhere in the subregion in any given year is 34 percent.
- A disaster in the subregion results in damage equivalent to 14 percent of GDP and affects 11 percent of the population.

The impacts of various types of disasters on forests and forestry in the Pacific SIDS are summarized below.

Tropical cyclones and associated flash-flooding pose a threat to forests, especially during El Niño-Southern Oscillation events. According to Masson-Delmotte *et al.* (2021), the proportion of major tropical cyclones has increased in the last four decades, and the proportion of intense tropical cyclones, as well as their peak wind speeds, are projected to increase due to climate change. Thus, although storms may not increase in frequency in the Pacific SIDS, they are likely to be more intense.

The increased intensity of recent storms has weakened some forests, with the likelihood of more serious damage increasing with each subsequent extreme weather event. The immediate threat to forests from cyclones and storm surges mostly derives from the strong winds, which can break tree stems, especially those of trees growing in fragmented or degraded natural forests (Laurance and Curran, 2008), isolated trees, trees growing at the edges of stands, and trees planted in monocultures. Trees with high height-to-diameter ratios are particularly vulnerable to strong winds. Box 21 illustrates the damage that cyclones can cause to forest assets.

Box 21. Impact of tropical cyclones on forests and other forestry assets

The Pacific subregion recorded 26 tropical cyclones between 2010 and 2015, including 14 categorized as severe: the subregion experienced five category 5 cyclones between 2016 and 2020. The estimated value of damage from Tropical Cyclone Winston in 2016 to Fiji's forest sector exceeded FJD 1.1 million. Assets damaged included forest nurseries, sawmills (static and portable) and a solar kiln. Damage to trees included mature trees in plantations and native forests, with significant damage to pine, teak and mahogany in the Western Division. Significant damage was also caused to teak in Ra, mahogany in Ba and pine plantations in the Central, Eastern and Northern divisions (Esler, 2016). The Fiji Pine group of companies reported that 500 ha of pine plantation was severely damaged by Cyclone Winston .

Source: **Bartlett, T.** 2022 (in press). *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States.*
Nasokia, W. 2016. *500 hectares of pine plantation in Ra undergoing harvest* [online]. *Fiji Sun* [Cited 20 February 2022]. https://fijisun.com.fj/2016/06/20/500-hectares-of-pine-plantation-in-ra-undergoing-harvest

Flash-flooding caused by cyclones and other storms can lead to soil erosion and landslides on unprotected steep slopes, especially where these have previously been degraded (e.g. by unsustainable logging practices) or cleared of natural vegetation (Wenger *et al.*, 2018). Erosion and landslides are already a common problem for many people in highlands that have been either historically or recently deforested. In the Eastern Highlands of Papua New Guinea, for example, people are now reforesting because reduced forest cover is leading to frequent landslides.

Prolonged drought poses a major threat to forests. Despite a projected increase in rainfall overall under climate-change scenarios in the southwest Pacific, ecological drought and El Niño-induced droughts are also likely. Only a few studies have analysed climate-change-induced drought effects on islands; nevertheless, drought-induced mortality in semi-arid and mesic forests suggests that no forest type in any climatic zone is invulnerable, even if the environment is generally not water-limited (Allen *et al.*, 2010). Overall, drought is considered a vital triggering event that weakens tree vitality and makes trees susceptible to indirect climate-change impacts, such as pest attack. Drought can also lead to more frequent and severe fires as litter and woody debris lose moisture and become more flammable.

Directly connecting fire to climate change in the tropics is difficult because climatic and weather thresholds for fire occurrence have only partially been established and climate models continue to struggle with the already naturally variable weather patterns caused by El Niño and La Niña events (Vecchi and Wittenberg, 2010). Specific research correlating fire occurrence with climate change is still sparse for most of the Pacific SIDS, although there is evidence for some islands in the Pacific, such as Hawai'i, that the area subject to fire increased between 1904 and 2011 (Trauernicht *et al.*, 2015). Other studies have shown a correlation between fire and climate change and suggest that fire probability will continue to increase due to global warming (Trauernicht, 2019).

Overall, higher temperatures and prolonged droughts will further dry out forests and decrease tree vitality. Although less pronounced in the tropics due to faster cycling, dry litter provides an ideal starter for forest fire, increasing the fire hazard. At higher risk are the dry, often leeward areas of islands, with the risk increasing during El Niño (Trauernicht, 2015) or La Niña events, depending on the weather patterns of specific islands.

Indirect impacts of climate change

Climate change is threatening the food security and health of many people in the Pacific SIDS. The impacts are mostly in terms of disruptions to local food production, including through the loss of arable land, the loss of crops to extreme weather, and variable crop production due to unfavourable climatic conditions.

Vulnerability to disasters that are intensified by climate change, such as drought, frost, inundation and tropical cyclones, is a key factor constraining agricultural development in the Pacific SIDS (Rosegrant *et al.*, 2015). For example, up to 80 percent of Vanuatu's food production was lost to Tropical Cyclone Pam in 2015 (Cvitanovic *et al.*, 2016). An estimated 770 000 people suffered from hunger in 2016 due to El Niño-induced drought and frost in Papua New Guinea in 2015 (Bourke, Allen and Lowe, 2016). Prolonged wet weather can lead to the in-ground rotting of tubers such as sweet potato (Queensland Department of Agriculture and Fisheries, 2016), which is a key source of calories in Papua New Guinea and Solomon Islands.

In addition to disasters, gradual changes in, for example, temperature, precipitation and sea-level rise affect agriculture through (for example) changed rainfall, increased groundwater salinization and the spread of disease.

About 70 percent of agricultural systems in the Pacific Islands subregion are rain-fed, and variations in rainfall therefore make crop production highly variable. Most good agricultural land in Fiji, Papua New Guinea, Solomon Islands and Vanuatu is located near rivers and coastal plains and is therefore exposed to flooding, saltwater inundation and intrusion (Nunn, 2012). These countries have many islands that are also large (i.e. larger than 30 km^2) and high (above 88 m above sea level), with comparatively large populations who largely derive their subsistence from the land on which they reside.

Many tree species, which are a main source of income in many Pacific communities, are being affected by sea-level rise. For example, the pandanus fruit is commonly preserved in Kiribati for later consumption, especially during drought, but coastal erosion stemming from sea-level rise has led to the loss of pandanus trees, thereby endangering food security for many (Government of Kiribati, 2007). In Tuvalu, traditional swamp taro pit gardens are being destroyed by groundwater salinization because of sea-level rise (Wairiu, Lal and Iese, 2012). Residents of the Carteret Islands, a low-lying atoll in Papua New Guinea, reported that inundation had destroyed food gardens and coconut groves and that continuous overwash from storm surges and increasing salinization are making it difficult to grow breadfruit, banana and coconut on the remaining land (Connell, 2016).

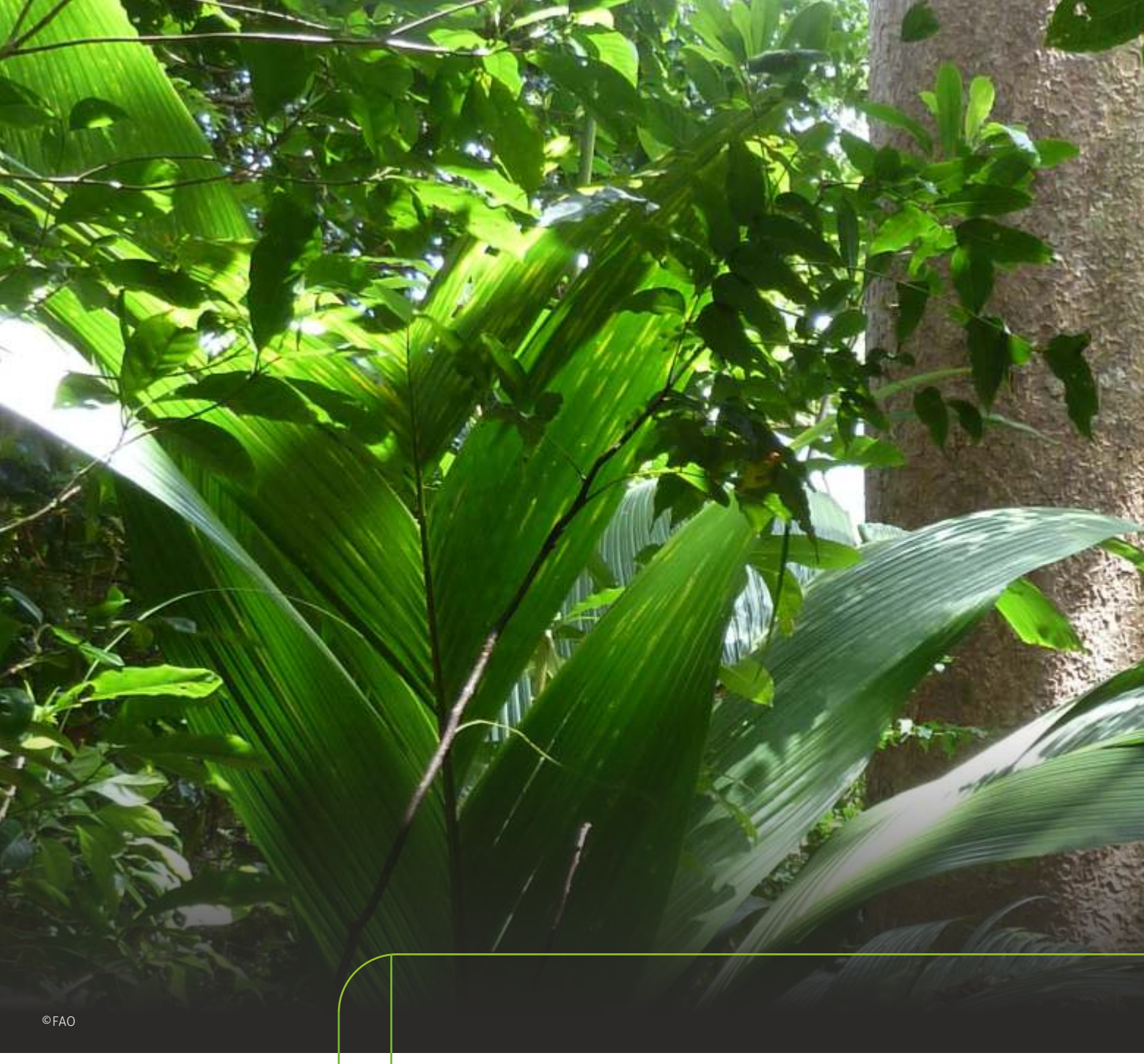
Disruptions to food production and economies may intensify in the Pacific SIDS in the future, given projections for more intense tropical cyclones and for precipitation variations of up to 14 percent of normal rainfall by 2090 (Wairiu, Lal and Iese, 2012). Moreover, thermal and water stress due to shifts in rainfall patterns and increases in pests, weeds, soil-fertility losses and erosion due to increased climatic variability will reduce the yields of crops such as sweet potato, taro and coffee (Wairiu, Lal and Iese, 2012).

Climate change is likely to have a devastating impact on water security in the Pacific SIDS. The bulk of groundwater is found as freshwater lenses under the surface of predominantly permeable limestone islands. Sea-level rise will result in a decrease in freshwater in the Pacific SIDS if freshwater lenses become saline due to contamination from below or inundation from above. In Fiji, saline soils caused by saltwater inundation have forced farmers in the village of Nataleira to stop planting rice in lowland areas (Kumar, ed., 2020). People facing drinking-water shortages in droughts must make do with diminishing water supplies, import water, or move elsewhere.

Impact of climate-change responses on forestry

Several countries and blocs have pledged to accomplish climate-change neutrality. For example, the European Union has set a target of achieving net-zero greenhouse-gas emissions by 2050, and China and India have committed to climate neutrality by 2060 and 2070, respectively. Limiting GHG concentrations to those set out in the Paris Agreement will require major changes in the mix of goods and services produced, how and where they are produced, and where they are consumed. Major changes are expected in the characteristics of global value chains (World Bank, 2022), including the production and trade of forest products. An integral part of the European Union's "green transition" is the Carbon Border Adjustment Mechanism, the aim of which is to reduce imports of carbon-intensive products. How such development might affect forest-product value chains in the Pacific SIDS requires further study. Wood and wood products have low-carbon footprints, and demand for them may surge as the production, trade and consumption of high-carbon-footprint products scale down.

Climate change, and global efforts to counter it, will inevitably have major direct and indirect impacts on food supply in the Pacific and implications for land use, including the potential expansion of agricultural area at the expense of forests. The challenge is to increase the capacity for climate-smart land uses that increase resilience and reduce vulnerabilities, requiring improvements in governance and the appropriate deployment of science and technology, as discussed in the next chapter.



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Key points

- Reforming customary tenure to make land available for uses such as wood production, plantation establishment, infrastructure and mining has been a focus of land policies, legislation and institutional change in the Pacific. Efforts at such reform, however, are often perceived as a ploy for appropriating resources from communities.
- Most countries are striving - through policies, legislation and institutional arrangements - to strike a balance between safeguarding customary ownership and enabling the use of land and forests to meet national development goals. Progress is varied, however, and customary landownership reform remains a key challenge. Countries effective institutional

05

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arrangements have been able to arrest deforestation and develop more sustainable systems of land management.

- In resource-rich countries, ineffective reforms combined with other governance deficiencies have created favourable conditions for the unsustainable and illegal exploitation of resources. Changes in laws and institutional arrangements tend to lag behind policy reform, and wide gaps exist between policy intentions and what is accomplished on the ground. Illegality has emerged as a major challenge in the forest sector.
- Innovation is a key to the sustainable management of land and forests in the Pacific SIDS, but the wide adoption of new technologies is challenging in most countries. Overall, domestic innovation capacity is limited, leading to excessive dependence on technologies developed elsewhere and on external financial and technical support.
- Forest management in the Pacific SIDS requires a shift towards green investment. New funding avenues are opening up, including for climate-change mitigation and adaptation, with the potential to overcome certain deficiencies in traditional approaches. Accessing these will require governance improvements, including increased transparency, efficiency, effectiveness and equity.

Responses to the key drivers of change described in the previous chapter centre on three interrelated areas: (1) governance; (2) innovation, especially the development and application of improved technologies; and (3) investment in improved resource management. This chapter provides an overview of the state of forest and land governance, innovation and investment, with a focus on:

- the general landscape of forest governance and how it is adapting to change;
- policy, legal and institutional developments that help improve forest governance and enhance legality and sustainability;
- challenges in governance, including corruption and illegal trade;
- the state of innovation in forestry and agroforestry, including how knowledge is developed, disseminated and applied; and
- trends in investment in land and forest management and the challenges of mobilizing resources to achieve sustainability.

The governance landscape

General trends

Good governance is central to the ability of a society to adapt to change and to manage land and other natural resources sustainably. Forest governance is a component of larger governance systems, and it is affected by changes in policies, legislation and institutional arrangements in other sectors. Substantial resources have been invested in the Pacific SIDS to improve forest governance - including reforms of policies, revisions to legislation and improvements in institutional arrangements - to help in coping with changing circumstances and meeting social aspirations. Globally, broad trends in forest governance include the following:

- **Changes in forest tenure**. In almost all countries worldwide, the ownership and control of resources are contested. Forest ownership has been in flux and is changing in response to wider social changes. For example, forests largely in public (government) ownership have been privatized or handed over to local communities through various arrangements. In some cases, policies of government takeovers of forests from Indigenous communities have been reversed to undo historical injustices. Many countries are attempting to strike a balance between the centralized and decentralized management of land and other resources, adhering to the principle of subsidiarity. Tenure change forms a key element of governance reform, bringing in new players, priorities and management approaches.
- **Forest governance influenced by developments at different spatial levels.** For a long time, the fate of forests was largely determined by local priorities. The emergence of nation states and the need to meet larger national objectives led to the formulation of new policies, laws and institutional arrangements. Similarly, global governance systems have been established to address transboundary problems such as climate change and biodiversity loss. The emergence of various levels of governance, globalization and a wide range of "wicked" problems has increased the complexity of rule-making.
- **Changes in forest management objectives.** Resource management objectives have changed over time. Historically, most local communities have deployed low-intensity forest management regimes that rely largely on natural processes and produce multiple products and services relevant to subsistence needs. Responding to national and global demand has brought major changes in forest management to favour the large-scale production of one or a few products and services. This has often significantly altered forest composition, structure and functions, with monocultural plantations of non-native species an extreme example of this. More recently, the negative impacts of such approaches have encouraged a shift in favour of multifunctional management aimed at striking a balance between economic, social and environmental objectives.

Customary landownership: foundation of the "Pacific way of life"

Customary ownership was once the norm in most countries worldwide but, for various reasons, today most forest globally is publicly or privately owned. Most Pacific SIDS have bucked this trend, however, with customary ownership upheld and constitutionally guaranteed. It forms the backbone of the "Pacific way of life", creating unique governance opportunities as well as challenges. Customary land tenure is fundamental to the social, spiritual, economic and political life of the Pacific SIDS, and any proposals for reform - which invariably are viewed with suspicion by customary landowners - must be mindful of the risks they could present to the social fabric of these countries (Fingleton, 2008).

In customary landownership (Box 22), land is under the collective ownership of groups in the form of extended families, clans or tribes. Unlike individual ownership, customary ownership relates to the concept of custodianship, meaning that the group bears a responsibility and duty to maintain land for the current and future generations. The post-independence constitutions of almost all Pacific SIDS have strived to strengthen the protection of customary tenure (Bulai, 2022). Fiji, for example, has changed its constitution three times since independence in 1970 (most recently in 2013), mainly in response to political upheavals caused

by fears that the Indigenous population would lose their land rights. Customary landownership provisions have recently been strengthened in the constitutions of Papua New Guinea (2016), Samoa (2020) and Vanuatu (2014). Tonga is an exception, with all land now owned by the crown (Box 23).

Box 22. Customary tenure

Customary land tenure is a system used in many rural communities to express and order land ownership, possession and access and to regulate land use and transfer. Unlike introduced landholding regimes, the norms of customary tenure derive from and are sustained by a community rather than by the state or state law (statutory land tenure). Although the rules followed by a particular local community are known as customary law, they are rarely binding beyond that community. Customary land tenure is as much a social system as a legal code, which confers enormous resilience, continuity and flexibility. The extent to which national laws support customary land rights, and the norms in operation to sustain this, are of immense importance to modern customary landholders.

Customary land tenure operates most expansively in agrarian economies - that is, societies where most of the population is dependent on, and most of the gross domestic product is derived from, land-based production and use, not off-farm industry and urban employment. Common characteristics of customary ownership include:

- community-based jurisdiction over landholding;
- acknowledgement within the customary sector that each community owns and controls a discrete area (and may access others by arrangement and which themselves become customary rights of access);
- collective ownership or possession and control over naturally communal resources such as forests, rangelands and marshlands; and
- a tendency for the size of customary territories or domains to be adjusted periodically so they remain at the scale at which community-based control can be effective.

Source: Alden Wily, L. 2011. *Customary land tenure in the modern world, rights and resources in crisis: Reviewing the fate of customary tenure in Africa.* Brief 1 of 5. Washington, DC, Rights and Resources Initiative. Available at https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/7713/customary%20land%20tenure%20in%20the%20modern%20world.pdf?sequence=1

Important features of rights to customary land in the Pacific SIDS include the following (Bulai, 2022):

- Most customary land is owned jointly.
- People other than the owners may have subsidiary or secondary rights (less than rights of ownership) in customary land.
- Families within a clan have rights to cultivate land earmarked for the family, and customary ownership guarantees such access.
- The rights of people to customary land are derived from and determined by rules of custom of the area in which the land is located, which are expounded by chiefs and elders but which are normally not written down or officially recorded.
- No outsider can own the land, although leasing is allowed.

Table 23 gives an indication of the extent of customary ownership of land in selected Pacific countries.

Table 23. *Proportion of land under customary ownership, selected Pacific Small Island Developing States*

Country	Percentage of land under customary ownership	Remarks
Fiji	87	The remaining 13 percent comprises state land (5 percent) and freehold land (8 percent)
Kiribati		
Marshall Islands	100	
Niue	95	The remaining 5 percent is crown land, of which 1 percent is government land and the remaining held under lease in perpetuity
Papua New Guinea	97	Most customary land is unregistered and undemarcated
Samoa	80	The remainder comprises public land (12 percent) and freehold land (8 percent)
Solomon Islands	87	Most customary land is unregistered
Tonga	0	See Box 23 for an explanation of landownership in Tonga
Tuvalu	75	The remaining 25 percent is under government ownership
Vanuatu	100	The 1980 constitution abolished all freehold (alienated) land, returning it to customary ownership

Note: Information on ownership was unavailable for the Cook Islands, the Federated States of Micronesia, Kiribati and Palau. In the case of the Marshall Islands, the entire extent of forests - 9 400 ha - is stated as under private ownership, presumably customary ownership.

Sources: Bulai, S. 2022 (in press). *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests*; FAO. 2020. Global Forest Resources Assessment 2020: Main report. Rome. Available at https://doi.org/10.4060/ca9825en

Box 23. Tonga's century-old land reform

Tonga implemented a major change in land tenure in 1875 through a constitutional decree that replaced customary land ownership and put all the land under the following three categories of ownership: (1) the crown/monarch; (2) nobles; and (3) government. Termination of customary ownership was intended to consolidate the power of the king and undermine the power base of traditional communities and clan chiefs. In due course, however, most chiefs have become nobles and control large estates (bereft of traditional community responsibilities and owing allegiance to the king only), resulting in highly skewed land ownership. Commoners may lease land from nobles and the government. Although each adult man is entitled to a tax allotment of 8.25 acres (3.34 ha) for cultivation (*api tukuhau*) and a town allotment (*api kolo*) for the construction of residential buildings, many are unable to obtain land for cultivation, exacerbated by population growth, a shortage of cultivable land and a concentration of land in the hands of a few. Inequitable access to land is a potential source of conflict in Tongan society.

Source: **Kennedy, K.H.** 2012. Why land tenure reform is the key to political stability in Tonga. *Pacific Rim Law & Policy Journal,* 21(2): 327–362. Available at https://digitalcommons.law.uw.edu/wilj/vol21/iss2/4

Several studies exist on the characteristics of customary ownership in the Pacific SIDS (e.g. Trebilcock, 1983; Bulai, 2022) and how it operates on the ground. Broad features include the following:

- Various categories of rights to land exist that are typically held at different levels.
- In many cases, the largest social units, such as tribes, hold no land rights, and those rights they do hold are few and of limited significance.
- There are common rights to hunting territories and common defence obligations at the level of the clan, parish or community.
- Bush-fallow rotations of gardens of component subgroups are often contained within the lands of such groups.
- Group land rights tend to be focused on the level of subclans and lineages (typically matrilineal or patrilineal) or hamlets and villages (with membership numbering from a few dozen people to a few hundred), where decisions on the allocation of land other than by inheritance are mostly frequently made.
- Rights to intensive use (e.g. gardening) are usually held at a lower level, typically households, at least one member of which (usually the household lead) is either a member of the landowning group or has a relationship with someone who is a member.
- Rights of extensive use (e.g. livestock grazing) are often held in common at the subclan level.
- The main principles on which landowning groups are formed are descent, locality (or residence) and participation in common activities such as gardening and defence.

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Table 24 presents the results of a strengths, weaknesses, opportunities and threats analysis of customary ownership of land and forests for five Pacific SIDS. One of the most positive aspects of customary ownership is that it guarantees access to land for community members and acts as a *de jure* barrier to resource appropriation by outsiders - although this has not always been the case in practice, especially in the context of more subtle ways of land - and resource-grabbing.

Table 24. *Strengths, weaknesses, opportunities and threats, customary ownership of land and forests, Fiji, Papua New Guinea, Samoa, Solomon Islands and Vanuatu*

Strengths	Weaknesses
• Ensures equitable access to land and other resources for all members of the clan/group • Locally developed rules and regulations pass from one generation to the next and consequently the cost of ensuring compliances is low • Enables the effective use of diverse resources sustainably • Able to meet local demand for products and services effectively • Well adapted to the needs of subsistence economies • Provides stability and a sense of belonging to members of customary landowning groups • Helps fulfil multiple objectives - economic, social, cultural, environmental and spiritual • Centrality of collective ownership ensures that use of land and other resources adheres to natural processes • Strong sense of intergenerational equity	• Conformity with group/clan decisions undermines individual initiatives • Generally closed societies with limited interaction with other groups and people, which also paves the way for inter-clan conflicts • Achieving consensus in decision-making can take a very long time, exacerbated by the increasing number of group members residing outside their villages • Very slow pace of innovation and development • Group ownership can be misused and manipulated by outside interests • Limited ability to take a broader national and global perspective given that customary organizations are designed mainly to accomplish limited clan, group and family objectives • The strong attachment to land and fear of losing control results in negative perceptions about discussions on tenure reform. This often results in rejection of even demarcation and registration of land under customary tenure
Opportunities	**Threats**
• Provides considerable scope for integrated resource management at the local level • New tools and technologies are enabling access to information by customary institutions, helping overcome some traditional problems • Increasingly, society is recognizing the importance of customary institutions and consequently increasing acceptance • Potential to build a highly decentralized, locally rooted green economy • Increased international and national recognition of indigenous rights is helping safeguard customary ownership of resources • Markets are emerging for products and services produced by indigenous groups • The rapid growth of ecotourism is focusing attention on indigenous ways of life	• Exposure to the outside world could undermine customary practices, especially as younger generations become more educated • Population growth is increasing pressure on land, undermining customary rules and regulations • The increased availability of goods and services from outside undermines traditional knowledge and use of resources, affecting the viability of customary ownership • Market-driven policies and legislation are undermining customary rules and regulations • The perceptions of younger people are changing, resulting in rejection of traditional social arrangements and hierarchies • It is difficult to absorb and integrate developments in science and technology • Conservatism leads to the rejection of new knowledge and skills and to blind adherence to customary practices, even when these have outlived their usefulness • Pressure is increasing on resources and appropriation of customary land and other resources by others

Source: **Bulai**, S. 2022 (in press). *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.*

Land-leasing arrangements

Reforming customary tenure to make land available for uses such as wood production, plantation establishment, infrastructure and mining has been a focus of land policies, legislation and institutional change in the Pacific. It has involved the identification, demarcation and registration of land to show land boundaries and owners, including the members of landowning groups. Colonial governments instituted the compulsory registration of customary land in Fiji, Kiribati and Tuvalu, but land registration has been a protracted and unfinished business elsewhere. Stability in landownership requires a legal and institutional framework that enables efficient and transparent land transactions, as provided by customary ownership and other policies and laws.

In Fiji, the efforts of the colonial government to complete the land registration process, and the establishment of the *iTaukei* Land Trust Board (formerly the Native Land Trust Board) (Box 24), helped provide a robust framework for the leasing of customary land.

Box 24. Fiji's *iTaukei* Lands Act and *iTaukei* Land Board

The Fijian Chiefs voluntarily ceded Fiji to Great Britain in 1874, and the country was then a British colony until independence in 1970. The process of land registration commenced in the colonial period, and all registered customary lands were brought under the purview of the 1905 Native Lands Act (later renamed the *iTaukei* Lands Act). Under the Act, all native lands "shall be held by native Fijians according to native custom as evidenced by usage and tradition". The Act established the Native Lands Commission to register customary lands, with the *mataqali* (clan) the recognized land-owning unit. The *iTaukei* Land Trust Board was vested with control of customary land "for the benefit of all the *iTaukei* owners". The Board's functions and structure have been modified over time to accommodate the changing needs of landowners and government, especially to make the Board more representative and participatory. The Board deals with land-leasing for a wide range of purposes, such as agriculture, forestry, industrial development, tourism, water and mineral development, education, and commercial activities. The early registration of land ownership, as well as the legal and institutional arrangements made, have gone a long way towards overcoming the issues associated with customary ownership. Some of the pioneering initiatives in planting pines and mahogany on native lands would have been almost impossible in the absence of the *iTaukei* Land Trust Board and the well-established leasing process.

Source: **Bulai, S.** 2022 (in press). *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.*
Fingleton, J. 2008. *Pacific land tenures: New ideas for reform.* FAO Legal Papers Online#73. FAO.

Papua New Guinea and Solomon Islands are well behind Fiji in addressing the challenges associated with customary ownership. Disputes have stalled the identification of owners and the boundary demarcation of lands belonging to different groups, clans, tribes and families. This is often accentuated by deficiencies in the nodal agencies. In Papua New Guinea, where the heterogeneity of society and the large number of clans and linguistic groups makes addressing challenges presented by customary landownership, incorporated land groups (ILGs) can be formed under the provisions of the Land Incorporation Act, 1974 (Box 25).

Box 25. Incorporated land groups in Papua New Guinea

It has proved challenging in Papua New Guinea to demarcate and register customary land, and there is a lack of clarity on who has rights to given areas. Efforts to register land have been unsuccessful, with many landowners suspicious of the registration process. The absence of records of land ownership has created uncertainties, caused conflict and prevented the use of land for development. There have been several attempts since 1952 to institute customary land registration and demarcation, but early efforts were mostly unsuccessful. The 1973 Commission of Enquiry into Land Matters recommended that, for the purpose of registration of titles in customary land, landowning groups should be incorporated with a constitution defining their membership, powers and decision-making processes. The introduction of the Land Incorporation Act (1974) enabled customary landowners to form incorporated groups "to allow them to hold, manage and deal with land in their customary names". Incorporated land groups (ILGs) give legal recognition for a clan to do business, make decisions on land and land use and receive benefits from those who use the land. Today, there are some 25 000 ILGs in the country, many established without due process, such as obtaining the consent of constituent members. A 2009 amendment of the Act was designed to make ILG formation more stringent, but a legacy still exists of a very large number of ILGs established with a lack of transparency. The ILG system has been misused for resource extraction, and there are several instances of illegal practices carried out under the cover of ILGs in logging, mining and SABLs. Some ILGs have been formed to act as fronts for logging and other activities and thereby appropriate income that should have gone to customary owners. There are also concerns about the sustainability of ILGs.

Source: Bulai, S. 2022 (in press). Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.
Act Now. 2019. A critique of incorporated land groups in Papua New Guinea. Available at https://actnowpng.org/sites/default/files/publications/ILG%20Paper%20June%202019.pdf
Karigawa, L., Babarinde, J.A. & Holis, S.S. 2016. Sustainability of land groups in Papua New Guinea. Land, 5(14). HYPERLINK "doi:10.3390/land502001" Doi:10.3390/land502001

Village land trusts are an institutional innovation in Vanuatu to manage the alienated land that was reverted to customary ownership. Difficulties in identifying the customary owners of such land means that they are now to be managed for the collective benefits of the community. This is the origin of the concept of village land trusts, which draws on the experience of Fiji's *iTaukei* Land Trust Board. Village land trusts are run by boards of directors, supported and guided by village customary institutions, including the village chief and his council and representatives of families in the village. Village land trusts have provided some protection against the loss of village land, but experience suggests that safeguards are needed to compel trusts to act only in the long-term best interests of the village (Bulai, 2022).

Forest governance policies, laws and institutional arrangements

Table 25. *Forestry production systems in the Pacific Small Island Developing States*

Production system	Key characteristics
Traditional community management of land and forests for subsistence use	• Multiple products and services produced in low-intensity management systems • Primarily for local consumption, although some products may be sold or bartered • Customary institutions
Timber production in natural forests for export	• Prohibition (*tapu*) the main means for preventing excessive resource use • Focused entirely on industrial roundwood production • Primarily catering to external markets for logs, sawnwood and panels • Income generation a key objective of governments and local communities • In the absence of domestic capacity to undertake large-scale operations, timber extraction from natural forests is dominated by foreign-owned logging companies, which often wield enormous economic, organizational and political influence, overshadowing the regulatory ability of government forestry agencies and local communities
Plantations of indigenous and introduced species	• Industrial wood production for export as roundwood, sawnwood, wood chips and panel products; production of non-wood forest products • Revenue generation the main objective; other objectives include employment and income for local communities • Often taken up as part of restoration efforts on degraded lands • Key players are public-sector forestry agencies, private-sector actors, local community organizations and smallholders
Community management of conservation areas	• Benefits include biodiversity conservation, watershed protection, the provision of amenity values (e.g. ecotourism) and income and employment for local communities • Communities and community-based institutions. • Supported by government agencies, bilateral and multilateral agencies and civil-society organizations, raising issues about long-term sustainability
Forest conservation for reducing greenhouse-gas emissions	• Global public good with potential to generate income through results-based payments • Co-benefits such as biodiversity conservation, in some cases • Stakeholders include governments, bilateral and multilateral agencies, local communities, buyers of carbon credits, and carbon trading intermediaries - complex transactions
Agroforestry systems	• Mixed-farming systems with varying proportions of trees and other crops • Primarily smallholders • Provides a range of goods and services, such as food, biofuel, building material and cash income • Dynamic and sustainable land-use systems capable of responding to the needs of landowners and increasing resilience

Source: Authors' own elaboration.

As shown in Table 25, the Pacific SIDS host diverse forest production systems. Almost all countries have developed policies, laws, regulations and institutional arrangements to improve the management of forests and trees; these are being refined and adapted as experience is gained (Bulai, 2022). Thus, in the Pacific SIDS (and elsewhere):

- Timber-centric governance and its associated policy and institutional frameworks are giving way, albeit slowly, to policies and laws that recognize the multiple functions of forests and which pay increased attention to the provision of ecosystem services, including those related to climate-change mitigation and adaptation.
- There is clear recognition of the need for local participation in managing forests and trees and sharing the benefits thereof. This is essential in the Pacific SIDS given the dominance of customary ownership and the dependence of communities on forests for the provision of many goods and services.
- Traditional sectoral approaches to land management are giving way to more integrated approaches. At the farm level, more attention is being paid to the integration of trees and agriculture; more broadly, landscape approaches that optimize complementarities among land uses are gaining traction. Such

integration is well-recognized in the Pacific SIDS, where agroforestry systems are entrenched and there are strong economic and ecological linkages between land uses.

- The growth of export-oriented wood production and the potential of payments for globally valuable ecosystem services (especially carbon sequestration) have increased the importance of global value chains. This, in turn, has brought more attention to forest governance and the verification of legality and sustainability.

Traditional community-based land and forest management. Well-established community governance in the Pacific SIDS successfully managed issues arising in predominantly subsistence economies; it included checks and balances that curtailed resource overexploitation (Box 26). The growing integration of local, national and global economies and attendant opportunities to use resources to meet individual ambitions have weakened customary governance systems, however, and most countries are confronting challenges in this transition. The effectiveness of customary governance arrangements has eroded and systems designed to accomplish national and global objectives are still evolving. The emergence of parallel informal (and illegal) governance systems has undermined the functioning of traditional community-managed arrangements. The problem is particularly acute in situations where ownership claims are unsettled, such as in many places in Papua New Guinea. Forest-based extractive sectors that yield high returns in the short term and where operations are conducted in remote areas require a strong focus on legality if sustainability is to be achieved.

Box 26. Traditional forest management in the Pacific - the use of *tapu* as a conservation tool

Forests and trees have long had a central role in the lives of Pacific peoples. Wood is used as a source of energy and a building material and to produce bowls, utensils, weapons and canoes. A wide array of foods and medicines is obtained from forests and trees. Even when land is cleared, useful forest plants are retained and nurtured, resulting in the development of highly productive agroforestry systems. Spiritually and culturally important places and things are afforded protection through traditional prohibitions, often referred to as *tapu* (prohibition). *Tapu* provides a cultural, social, economic and spiritual framework for natural resource conservation. Many relate to resources in decline, thus enabling recovery.

Source: **Bartlett, T.** 2022 (in press). *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States.*
Whitmore, N., Lamaris, J., Takendu, W., Charles, D., Chuwek, T., Mohe, B., Kanau, L. & Pe-eu, S. 2016. The context and potential sustainability of traditional terrestrial periodic *tambu* areas: insights from Manus Island, Papua New Guinea. *Pacific Conservation Biology*, 22(2): 151–158.

Timber production in natural forests for export. Natural forests are important sources of wood supply in the forest-rich Melanesian countries. Growth in demand globally and the potential to generate income for governments and landowners led to a rapid expansion of natural-forest logging. Papua New Guinea and Solomon Islands are among the world's top producers and exporters of tropical timber. Timber extraction also takes place in other Pacific SIDS, mostly for domestic markets and on a relatively small scale by domestic enterprises. In Papua New Guinea and Solomon Islands, natural-forest logging is a major source of government income and foreign exchange and also generates employment and income for local communities. Communities in forested areas with limited options for income may generally be welcoming of logging as a way of escaping "opportunity poverty", but their expectations are often unmet. Moreover, unsustainable logging creates substantial externalities with often significant negative effects on local communities.

Logging natural forests to generate revenue remains a priority in the forest-rich Pacific SIDS, although other objectives are also pursued. The limited domestic capacity to undertake large-scale logging means that the logging sector is dominated by foreign-owned companies. Rapid growth in tropical timber demand in Asia in the 1990s led to a logging boom in Papua New Guinea and Solomon Islands, to some extent coinciding with a decline in log exports in Southeast Asia, especially Indonesia and Malaysia. The convergence of objectives among the three key groups of players - governments, logging companies and some landowners - to maximize income led to logging practices that paid little attention to sustainability. Box 27, describing the situation in Papua New Guinea, illustrates the risk of unethical practices, too, including failure to obtain prior approval from landowners, non-compliance with environmental regulations, bribery, and human-rights violations. Attempts to regulate the logging industry in Solomon Islands have also faced resistance (Box 28).

Box 27. Sustainable forest management in Papua New Guinea - a distant dream?

Before 1991, the emphasis of forest management in Papua New Guinea was to log natural forests, almost all of which are under customary ownership, primarily through timber rights purchase agreements (TRPs) and local forest areas (LFAs). Under TRPs, the Department of Forests would obtain the right to extract timber from customary landowners and give this right to logging companies; LFAs were direct transactions between customary landowners and logging companies. The Department of Forests was the primary institution responsible for forestry, which generated revenue by levying taxes and royalties. As revealed by the Barnett Commission of Inquiry in 1989 (Barnett, 1989), the system was riddled with corruption, illegality and human-rights violations perpetrated by powerful foreign-owned logging companies. The Barnett Inquiry passed a damning judgement on the conduct of the logging industry and the state of forest management, with Justice Barnett characterizing foreign-owned logging companies as acting like robber barons "roaming the country-side, bribing politicians and leaders, creating social disharmony and ignoring laws to gain access to rip out and export the last remnants of the provinces' valuable timber".

In response to the Barnett Inquiry, Papua New Guinea implemented a major overhaul of forest governance, culminating in the formulation of the Forest Act (1991) and the creation of the Papua New Guinea Forest Authority and the National Forest Service. TRPs and LFAs were replaced by forest management agreements (FMAs) with the intention of encouraging sustainability and legality. A detailed process involving 32 steps was put in place for the development of FMAs. The Forest Act provided checks and balances to minimize corruption and mismanagement, including limiting the discretionary powers of ministers and higher-level officials, and the National Forest Board and provincial forest management committees were created to provide checks and balances in decision-making. The expectation was that this would enable the implementation of sustainable forest management in a transparent manner with the full involvement of customary landowners, but many problems persist. For example:

- Most of the timber still comes from TRP and LFA logging concessions - in 2020, FMAs accounted for 0.49 million m^3 of logs exported, which was about 17 percent of total log exports. TRPs and LFAs accounted for about 1.56 million m^3, which was 54 percent of the total. Forest Clearance Authority (FCA) areas (mainly land cleared for agriculture under special agricultural business leases) produced another 0.56 million m^3 (19 percent). Of the 137 operational logging projects in August 2021, 14 were FMAs, 53 were TRPs, 17 were LFAs and 53 were FCAs.
- Of the 137 operators, 95 were foreign-owned and 42 were under national ownership but *de facto* operated by foreign-owned logging companies.
- Logging companies continued to operate with impunity, and there have been reports of violations of human rights, including the use of violence to subdue local communities.
- The Forest Authority has limited human and financial resources to enforce regulations and implement sustainable forest management. Local functionaries are often dependent on logging companies for transport and accommodation, resulting in conflicts of interest and increasing opportunities for rent-seeking behaviour.

Source: **Gamoga, G., Turia, R., Abe, H., Haraguchi, M. & Iuda, O.** 2021. *The forest extent in 2015 and the drivers of forest change between 2000 and 2015 in Papua New Guinea:* Deforestation and forest degradation in Papua New Guinea. Case Studies in the Environment. Available at http://online.ucpress.edu/cse/article-pdf/5/1/1442018/482839/cse.2021.1442018.pdf
Global Witness. 2018a. *A major liability: Illegal logging in Papua New Guinea threatens China's timber sector and global reputation.* London. Available at HYPERLINK "https://www.globalwitness.org/en/campaigns/forests/major-liability-illegal-logging-papua-new-guinea-threatens-chinas-timber-sector-and-global-reputation/" www.globalwitness.org/en/campaigns/forests/major-liability-illegal-logging-papua-new-guinea-threatens-chinas-timber-sector-and-global-reputation
Lawson, S. 2014. **Illegal logging in Papua New Guinea.** EER PP 2014/4. London, Chatham House. Available at HYPERLINK "https://www.chathamhouse.org/sites/default/files/home/chatham/public_html/sites/default/files/20140400LoggingPapuaNewGuineaLawson.pdf"
www.chathamhouse.org/sites/default/files/home/chatham/public_html/sites/default/files/20140400LoggingPapuaNewGuineaLawson.pdf
Overseas Development Institute. 2007. *What can be learnt from the past: A history of the forestry sector in Papua New Guinea.* London. Available at https://pngforests.files.wordpress.com/2013/05/a-history-of-the-forestry-sector-in-png.pdf
PNGi Forests. Undated. Forests Portal. In: *PNGi / Forests.* [Cited 20 October 2022]. https://pngiforests.org/

Box 28. Forest governance in Solomon Islands

Logging in Solomon Islands is regulated by the pre-independence Forest Resources and Timber Utilization Act (1969). This Act prescribes the process to be followed in accessing timber on customary land and the steps for developing agreements between landowners and logging companies, with the Department of Forests functioning as an intermediary to ensure compliance with legal and technical issues. This policy and legal framework was retained on independence, but amendments to rules and regulations were made over time with the effect of weakening regulatory provisions and enabling unscrupulous logging companies to deal directly with landowners, thereby paving the way for uncontrolled exploitation.

The Solomon Islands National Development Strategy 2016- 2035 sets out the actions needed to rectify the situation. These include the adoption of a holistic approach to the forest management; the sustainable management of logging in remaining forests; reforestation; and a review of the Forestry Act. The 2020 National Forest Policy articulates a clear vision for forestry development and outlines ten guiding principles and seven strategies to be pursued and specific goals, objectives and expected results. The policy is a major improvement because it addresses the key elements needed for sustainable forest management. Various rules and regulations, including the Forest Resources and Timber Utilization Act (1986) and the Code of Logging Practice (2002), are under review.

Source: **Baines, G.** 2015. *Solomon Islands is unprepared to manage a mineral-based economy.* State, Society, Governance in Melanesia Discussion Paper 2015/6. Australian National University Press.
Bartlett, T. 2022 (in press). *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States.*
Bulai, S. 2022 (in press). *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.*
Global Witness. 2018b. *Paradise lost: How China can help Solomon Islands protect its forests.* October. London. Available at HYPERLINK "https://www.globalwitness.org/en/campaigns/forests/paradise-lost/" www.globalwitness.org/en/campaigns/forests/paradise-lost

Curtailing illegality has been a priority for forest-sector reforms in Papua New Guinea and Solomon Islands. For example, measures initiated in Papua New Guinea to improve the governance framework include an elaborate procedure for natural-forest logging covering every stage from drawing up a forest management agreement with landowners to a logging code and the process for exporting timber. The country has also developed a timber legality standard to provides a clear definition of what constitutes legal timber sourced in Papua New Guinea. Efforts are underway towards the assessment of the legality standard requirements using FSC and PEFC standards and certification infrastructure/services.

Vanuatu also has potential for export-oriented log production, although the annual allowable cut is much lower than in Papua New Guinea and Solomon Islands. Log exports have been banned since 1993 and only processed wood (mainly sawnwood) is exported. Because the volume involved is small and harvestable forests do not exist as contiguous blocks, the cost of production tends to be high, reducing profit margins. Landowner opposition to logging by foreign companies has helped prevent large-scale logging in Vanuatu. Vanuatu's economy is also more diversified and the government does not rely on income from log exports.

Although Fiji has a sizeable area of natural forest, it has developed a plantation-based forest industry and is not reliant on logging in natural forests. Nevertheless, landowners do undertake small-scale logging of natural forests to meet domestic demand; this has the potential to be damaging given low monitoring capacity.

How wide is the policy formulation-implementation divide? Overall, most Pacific SIDS with natural-forest logging have rules, regulations and procedures designed to minimize illegality and encourage sustainability, such as codes of logging practice, systems of transport permits, rules relating to the distribution of income, and log-export procedures. The main challenge, however, is bridging the divide between what is stipulated in policies and actual implementation. With limited financial and human resources, especially at the field level ("ground zero"), the capacity to implement legality and sustainability safeguards is limited, and many countries are unable to meet the high initial transaction costs to improve governance arrangements at the field level.

Illegality is not just a problem on the supply side; to tackle it effectively, there is a need to also address demand. Several importing countries have tightened import regulations to prevent the entry of illegal timber (e.g. the 2008 amendment to the Lacey Act in the United States of America and the European Union's Timber Regulation, put in place in 2013), compelling log suppliers to respond to certain due-diligence requirements of importers. For example, to comply with regulations under the Australian Illegal Logging Prohibition Act (2012), Papua New Guinea has developed a country-specific guideline to inform Australian importers about what constitutes legal timber. China, which accounts for most of the exports from Papua New Guinea and Solomon Islands, revised its forest law in 2019 to impose a ban on "purchasing, processing, or transporting timber that is known from illegal sources" and prescribing penalties for violations (articles 65 and 78). This revision, which came into force on 1 July 2020, has the potential to address some of the issues affecting the logging industry in Papua New Guinea and Solomon Islands.

Forest certification is a tool designed to eliminate illegality from supply chains and ensure sustainability and social and environmental benefits. Little progress has been made to date, however, in the certification of natural forests in the Pacific SIDS, with existing certification in the subregion limited to plantations. For example, the plantations of Fiji Pine received certification from the Forest Stewardship Council in 2013, and efforts are underway to certify the mahogany plantations of the Fiji Hardwood Corporation to distinguish the timber produced in those plantations from illegal and unsustainable sources. The Fiji Hardwood Corporation aims to use certification to increase market access and revenue. The plantations of Kolombangara Forest Products are the only certified forests in Solomon Islands. Solomon Islands has developed a legality standard for processed wood (exported to AUS and NZ) and is proposing to use a private 3rd party certification body to check compliance (group certification by SITPEA association).

Governance of planted forests. The establishment and management of plantations raises different governance issues than those associated with natural forests. Most large-scale plantations in the Pacific are in Fiji, Papua New Guinea and Solomon Islands, with varying institutional arrangements and associated governance issues. Generally, they comprise public-sector plantations managed by forest departments or agencies established exclusively for the purpose; industry-managed plantations; and community/smallholder plantations. There are also collaborative efforts, such as cooperatives and partnership between landowners and companies.

Fiji's public-sector model involves plantation development on lands under customary ownership through the government-owned companies Fiji Pine (Box 29) and the Fiji Hardwood Corporation. Overall, these two companies have succeeded in developing and managing viable plantation-based industries on land leased through the *iTaukei* Land Trust Board, albeit with challenges such as low stocking levels stemming mainly from inadequate investment in new planting and management.

Box 29. Fiji Pine Ltd - evolution of governance arrangements

Fiji's Ministry of Agriculture, Fisheries and Forests initiated the Fiji Pine Scheme in 1971 by planting *Pinus caribaea* in unused and degraded land leased from customary landowners through the Native Land Trust Board. The initial success of these plantations encouraged further expansion and the establishment of a statutory body, the Fiji Pine Commission (FPC) (replacing the Fiji Pine Scheme), in the Fiji Pine Commission Act (1976). The main objective of the FPC was to establish and develop an industry based on growing, harvesting, processing and marketing *Pinus caribaea*. The FPC entered into partnerships with landowners to produce industrial wood and established a fully-owned subsidiary company, Tropic Wood Industries, in 1987. In 1991, the FPC was incorporated as Fiji Pine, which took over all the assets, liabilities and obligations of the FPC. As part of the corporatization process, the government established the Fiji Pine Trust, which included customary landowners as board members. Among the measures taken by the Fiji Pine Trust are the following:

- Fiji Pine entered into an agreement with the Fiji Pine Trust to handle all Fiji Pine's affairs with landowners.
- The Fiji Pine Trust created forest-based trusts in the six main plantation areas to handle social development projects, including education, supported by Fiji Pine.
- Forest-based companies were set up at each forest station to engage in business activities with Forest Pine, such as silvicultural operations and logging.
- Since 2000, Fiji Pine has developed arrangements for contact with *mataqalis* to provide landowners with a direct communication channel with the company.
- The system for the disbursement of dividends and other payments to landowners was changed so that a substantial share goes directly to *mataqali* members or is used for projects requested by a majority of *mataqali* members.

Fiji Pine faces several challenges stemming largely from past neglect of the plantations. There was little new planting and maintenance during the 1990s and early 2000s, such that the actual stocked area reported in 2017 was only 23 867 ha, although on paper the company had an area of 84 000 ha under management. Fiji Pine has made a significant effort since 2011 to re-stock its planted-forest estate, but a significant gap remains in age-class structure due to the low rates of planting in the period 1995- 2011. The company has a policy of logging only 40 percent of the area replanted in any year, which will likely lead to a reduction in pine roundwood production in the period to 2030.

Source: **Brown, C.** 2022 (in press). *Emerging opportunities and challenges for Pacific Small Island States in the production, processing and trade of forest products.*
Bulai, S. 2022 (in press). *Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.*

Innovative institutional arrangements in Papua New Guinea in the form of cooperatives have produced seedlings, and smallholders in the country's East New Britain province have invested in balsa plantations with the support of balsawood processing units. Similarly, smallholders in Solomon Islands are supported by Kolombangara Plantations and other large plantation companies in marketing their teakwood. Most forestry departments have extension services to provide technical support to landowners engaging in afforestation and reforestation. Governance challenges associated with plantation management relate largely to access to knowledge, inputs and markets. The availability of high-quality planting material is another significant challenge. Uncertainties around customary tenure tend to deter private investment.

Community-based conservation initiatives. Several examples exist of initiatives to improve land management by communities operating within the framework of customary ownership. Many have incorporated key principles of good governance, including participation, equity, transparency, accountability, efficiency and effectiveness. Notable examples that demonstrate the potential and challenges of governance systems for underpinning community participation include:

- the Drawa Block community-based sustainable forest management project on Vanua Levu, Fiji;
- the Sovi Basin Conservation Area, Fiji, managed by the National Trust of Fiji with the involvement of local communities;
- integrated land management in the Adelbert Mountain Range, Madang Province, Papua New Guinea;
- the Loru forestry project on Santo, Vanuatu, aimed at protecting the Loru coastal rainforest, one of the last stands of lowland rainforests on the island;
- the Tetepare Community Conservation Area, Solomon Islands, designed to protect terrestrial and marine ecosystems in an integrated manner under the control of the Tetepare Descendants Association (Box 30); and
- the Bauro Highlands Conservation Area on Makira, Solomon Islands.

Box 30. Community conservation area management by the Tetepare Descendants Association, Solomon Islands

Tetepare Island is an uninhabited biodiversity-rich coral island in Western Province, Solomon Islands, with a land area of 120 km^2. Faced with the possibility of significant damage by logging companies, the communities who legally own the island came together and constituted it - and the adjoining marine ecosystems - as a community conservation area in 2001. The area is managed by the Tetepare Descendants Association (TDA), which was formed in 2003. The goal is to protect and conserve the island for the benefit of descendants of members of the TDA. Since its formation, the TDA has transformed from a local landowner association into a world-class community-based conservation organization responsible for one of the largest integrated land and marine conservation initiatives in the South Pacific. The area is divided into zones, with management prescriptions for each zone.

The reefs and other marine areas are also zoned: some are fully protected and others are closed in certain seasons, thus providing livelihood options for stakeholders and users while ensuring sustainability and conservation. The TDA trains and employs local managers, who monitor the island's marine, freshwater and terrestrial resources in line with plans developed by the community.

Tetepare is an excellent example of a whole-of-island integrated management approach that could be considered by other Pacific SIDS. The TDA received the Equator Prize in 2012 for its conservation management: it has been able to mobilize technical and financial support from various international organizations and has become a model for community conservation efforts in Solomon Islands and other Pacific SIDS. The TDA has been effective in integrating conservation and livelihoods, enabling landowners to resist more lucrative but environmentally destructive options. There are doubts about the replicability of this model, however, especially where land ownership is contested, community members have diverse objectives, and access to knowledge and financial resources is limited.

Source: Bulai, S. 2022 (in press). Forest governance in the context of customary land ownership in Pacific Small Island Developing States: Crafting enabling policies, legislation and institutions to support customary landowners in managing their own forests.
UNDP. 2013. Tetepare Descendant's Association, Solomon Islands. Equator Initiative Case Study Series. New York, USA, United Nations Development Programme (UNDP). Available at HYPERLINK "https://www.equatorinitiative.org/wp-content/uploads/2017/05/case_1370356629.pdf" www.equatorinitiative.org/wp-content/uploads/2017/05/case_1370356629.pdf

These examples indicate that sustainable resource management within the framework of customary ownership is feasible and a viable alternative to large-scale centralized interventions involving governments and logging companies. Bulai (2022) derived the following lessons from several community initiatives:

- Although relevant government agencies and other local stakeholders have been supportive, most of the work thus far has not been government-led but, rather, initiated by the landowners themselves, with direct technical and funding assistance mostly from international non-governmental organizations.
- Long-term external support to improve institutional capacity helps strengthen landowner project management capabilities.
- Adequate time is needed for pre-project landowner consultation to ensure sufficient buy-in before implementation begins. In the case of the Sovi Basin, an initial five-year conservation lease was issued to allow for consultations and planning before the 99-year lease was finalized. Similarly for the Drawa Block, more than ten years of work with landowners facilitated a change from timber harvesting to forest conservation.
- Strong landowner leadership was a main factor of success in Tetepare by ensuring that rules are followed for the benefit of all members. Tetepare has an effective governance structure that ensures a clear division of responsibility between the board and management.
- Leasing a project area is an effective mechanism for locking in long-term support, including access to trust funds, such as in the Sovi Basin, and voluntary carbon markets, such as in Drawa and Loru. There is a need to identify a more suitable and realistic valuation methodology for areas of interest to determine appropriate annual lease rental payments to landowners. Current modest land rentals paid to *mataqali* landowners of forest reserves in Fiji suggest the need to find a more appropriate basis for valuation. Flexibility in lease conditions is also necessary to enable adaptation to the needs of future generations, especially for longer-term (e.g. 99-year) leases.
- Land management should integrate the formal and informal institutional structures that exist locally and nationally and seek synergies between Western and customary systems. This requires long-term external support to allow systems to properly develop and mature.
- National forestry agencies have an important facilitating role to play in providing technical and management support and creating favourable conditions for community initiatives to flourish.

Governance of the provision of global public goods. Pacific forests provide important carbon sequestration services. REDD+ has emerged as a means for curtailing emissions from deforestation and degradation by incentivizing landowners to protect forests and refrain from forest clearance with payments for measurable and sustainable reductions in deforestation and degradation. As described in Chapter 3, the four Melanesian countries - Fiji, Papua New Guinea, Solomon Islands and Vanuatu - have all included REDD+ as a key component of their mitigation efforts and have prepared national REDD+ strategies with financial and technical support from bilateral and multilateral agencies.

All four Melanesian countries have completed the REDD+ readiness phase and are at different stages of the demonstration phase. The fact that, after more than a decade, few countries globally have reached full implementation, thereby enabling them to tap into results-based payments, shows the challenges involved in operationalizing REDD+. There are reports of REDD+ credit transactions in Papua New Guinea in the voluntary carbon market, but there are concerns that these are being made without creating the necessary legal and institutional framework. Questions remain on whether carbon prices paid to landowners are adequate to disincentivize deforestation and degradation and whether project-based approaches accomplish genuine long-term emissions reductions at the jurisdictional level.

There are also governance issues on the demand side, especially relating to the functioning of carbon markets at the global level. These include the functioning of voluntary markets (European Union Institute, 2021) and the price of carbon that will lead to effective emissions reductions. Other issues relating to voluntary and compliance markets include the following:

- Demand for carbon credits is driven primarily by companies required to curtail their emissions or that voluntarily opt to pursue net-zero emission objectives by buying credits. Such companies want to minimize costs and seek low-priced carbon credits.
- Jurisdictional entities like governments and project-based credit providers in supplier countries tend to use carbon markets to generate income and seldom pass on the benefits to those responsible for generating credits (e.g. by avoiding deforestation). More clarity is needed on who owns forest carbon and on ensuring that results-based payments are sufficiently high to avoid GHG-emitting land uses and land-use change.
- Linking the buyers and sellers of carbon credits is a web of intermediaries such as exchanges, brokers and financiers using often opaque instruments and transaction processes. There is concern that less-informed suppliers can be "taken for a ride" by opportunistic carbon traders, who may take advantage of the undeveloped state of carbon markets and the inadequate information available on how carbon markets function.
- Even if governance issues at various levels are addressed, the question remains as to whether the carbon price will ensure a shift towards low-emission trajectories. Despite strong growth in carbon markets, carbon prices remain well below the level considered necessary to bring about significant decarbonization (World Bank, 2021a). For example, the volume of carbon transacted in forestry and land use in 2020 was 47 million tonnes of carbon dioxide equivalent at a price of just USD 5.59 per tonne. The average price of REDD+ credits in 2020 was just USD 3.79 per tonne (World Bank, 2021a). The High-Level Commission on Carbon Prices (2017) concluded that the explicit carbon price level consistent with achieving the temperature target in the Paris Agreement was at least USD 40- 80 per tonne of carbon dioxide equivalent by 2020 and USD 50- 100 per tonne by 2030, "provided a supportive policy environment is in place". Thus, carbon prices need to increase manyfold if the world is to accomplish the climate-change mitigation target specified in the Paris Agreement.

Even if all supply-side governance issues can be resolved through an effective REDD+ readiness effort, it may still be insufficient because of a need to significantly improve governance along the entire carbon value chain. It is important to ensure that landowners do not end up selling carbon credits at very low prices used primarily for greenwashing, benefiting neither the landowners nor the global public.

Detail is still lacking on how international carbon-credit transfers will be implemented to avoid some of the challenges that arose in implementing the Clean Development Mechanism under the Kyoto Protocol. Building an effective, equitable and efficient global carbon trading system will take time and considerable resources. Ongoing efforts to provide an oversight mechanism to voluntary carbon markets and thereby enhance their integrity could help curb speculative transactions and carbon trade scams. In any case, the Pacific SIDS will need to avoid selling their carbon credits at low prices in a market that is yet to mature and stabilize and later incurring higher costs in fulfilling their mitigation commitments under their nationally determined contributions.

Technology and innovation

Innovations in forestry, including the processing of wood and other products, can be grouped as follows:

- practices that have mainly evolved locally based on traditional knowledge and the experiences of communities;
- technologies that have been developed or introduced by public institutions, including research and development (R&D) institutions, often with support from bilateral and multilateral agencies and civil-society organizations, focusing on the needs of end users such as public-sector agencies, farmers, communities and small private enterprises; and

- technologies and processes introduced by private industries, especially in the fields of harvesting, plantation development and the processing of wood and other products.

Irrespective of who takes the lead in enhancing knowledge, what really matters is the systematic application of the technologies and innovations to optimize their contributions to socio-economic development and environmental well-being.

Roshetko *et al.* (2022) carried out a detailed review of developments in innovation as a follow-up to the Asia Pacific Forest Sector Outlook Study III (FAO, 2019). They listed the following important outcomes of science and technology development:

- **improved understanding of ecosystems and ecosystem processes,** enabling fine-tuned interventions, including the development and application of precision forestry;
- **enhanced capability to gather information on resources** - such as forest area, stocks of wood and carbon, forest structure and composition and the status of flora and fauna species - to monitor change and initiate timely action to deal with (for example) pests and diseases, fire, and flooding and other climatic events;
- **improved ICTs**, which especially offer hope of improving governance by enabling greater transparency, accountability and efficiency;
- **the domestication of species and the development of new cropping systems** - in the Pacific, an example is the shift in sandalwood production technology from exploiting trees in the wild to domestication and cultivation in various cropping systems;
- **productivity improvement technologies**, especially those that increase the production of wood and other products through genetic improvement and improved land management;
- **changes in logging and transportation technologies,** with considerable effort directed towards reducing the adverse impacts of logging; and
- **processing technologies**, with increasing emphasis on reduce the ecological footprint of processing, increasing recycling, and creating new engineered products suitable for diverse uses, including structural purposes.

Innovation efforts remain weak and underdeveloped in the Pacific SIDS

There has been considerable effort in the Pacific SIDS to increase capacity in science and technology and to develop and apply innovations in forestry, but this has proved challenging. Most countries are in transitions from largely subsistence economies, and inevitably the state of R&D and innovation reflects the larger socio-economic situation. Overall, the resources allocated to science, technology and innovation development are very low (Box 31 describes the situation in Papua New Guinea). UNIDO (2016) listed the following obstacles to the development of innovation systems in Pacific SIDS: inadequate local demand for new products and processes; a shortage of skilled workers; the remoteness and small size of economies and consequent high costs of operations; a high concentration of market power and product specialization in resource-based goods, especially extractive products like timber and minerals; a lack of knowledge about innovation opportunities; the weak links between the private sector, governments and universities; large government inefficiencies; and a "brain drain" in which qualified and skilled people tend to emigrate.

Box 31. The state of research and development in Papua New Guinea

Overall, the Pacific Small Island Developing States allocate very limited resources for research and development (R&D). Data availability is limited, with the database of science and technology indicators maintained by the United Nations Educational, Scientific and Cultural Organization (UNESCO) containing data only for Papua New Guinea (the latest being for 2016). The UNESCO Institute for Statistics (undated) reported that, in 2016, the total number of R&D personnel (full-time equivalent) in the entire R&D sector, including agriculture and forestry, in Papua New Guinea was 592.6 (about 71.6 per million people). In comparison, New Zealand had 7 656 R&D personnel per million people in 2017, and Viet Nam had 876 per million. Another indicator is gross expenditure on research and development (GERD) as a proportion of gross domestic product (GDP). The GERD/GDP ratio in 2016 was 0.03 percent in Papua New Guinea, compared with the overall global average of 1.69 percent. The GERD per capita was USD 0.70 (in PPP at 2005 price) in Papua New Guinea and USD 221.3 worldwide. Papua New Guinea is the largest and most populous country and has the largest economy among the Pacific SIDS, and its situation provides an indication of the overall underdeveloped state of R&D in the Pacific Small Island Developing States.

Source: UNESCO Institute for Statistics. Undated. UIS Statistics [online]. United Nations Educational, Scientific and Cultural Organization (UNESCO) [Cited 27 December 2021]. http://data.uis.unesco.org/Index.aspx

Current state of technology

Globally a plethora of technologies relevant to forestry has been developed for a wide range of purposes, but its application depends on factors such as the financial cost; the existence of conditions appropriate for technological adaptation and application, including infrastructure (for example laboratories and other infrastructure); the availability of qualified skilled human resources; and demand for such technologies. While some technologies are easily accessible, others require substantial upfront investment.

Conventional R&D models tend to be economically unviable in most Pacific SIDS because of the small human resource base and limitations in realizing economies of scale. Therefore, they need to follow strategies for innovation appropriate to their socio-economic situations and human resources. Although Fiji and Papua New Guinea have dedicated forestry research systems, to a considerable extent these rely on project-related bilateral and multilateral support and the introduction of technologies by domestic and foreign investors.

Some bilateral and multilateral organizations also provide focused R&D support aimed at developing new knowledge, technologies, practices and skills. For example, the Australian Centre for International Agricultural Research has played a crucial role in supporting the development of science, technology and innovation in the Pacific SIDS, including that related to forests and forestry (Bartlett, 2022). The support it provided has helped overcome some of the major problems confronting national R&D systems and significantly strengthened national research capacity, although there are concerns about long-term sustainability. Building up an ecosystem for innovation requires long-term investments in human capital, including through higher education, an area that requires urgent attention.

Table 26 provides an indication of the important forestry activities and innovation areas in the Pacific SIDS. Various areas of technology and innovation important for the forest sector are discussed below.

Table 26. *Potential innovation areas, by forest activity, Pacific Small Island Developing States*

Activitiesm	Main innovation areas
Overall governance of the forest sector	• Assessment of resources, including changes over time • Monitoring factors that affect forest health and vitality - e.g. pests and diseases, fire, cyclone damage and flooding • Information and communication technologies
Logging, regeneration and management of natural forests	• Technologies, tools and machinery involved in logging, yarding and transport, including reduced-impact logging • Portable sawmilling technology • Monitoring logging operations, tracking product movements, and ensuring that taxes and other fees are paid before logs are exported • Regenerating logged-over forests
Wood production in planted forests and woodlots	• Improved techniques for site - species matching • Production of planting material, including genetic improvement • Site management practices to improve productivity • Efficient harvesting and transportation technologies
Restoration/rehabilitation of degraded forests	• Development of appropriate restoration/rehabilitation technologies, especially on difficult sites
Production, processing and marketing of non-wood forest products	• Cultivation, management and harvesting of non-wood forest products • Development of new products and processes
Agroforestry systems	• Development of agroforestry models appropriate for various socio-economic and environmental contexts • Interactions of crops and their impacts on productivity over time • Processing and marketing of products from agroforestry systems
Wood and wood products	• Production of sawnwood, panel products, pulp and paper and furniture, including technologies that enhance recovery and reduce wastage • Engineered wood and similar products • Improved technologies for wood-energy production

Activitiesm	Main innovation areas
Ecosystem services, such as carbon sequestration and storage, biodiversity conservation and amenity	• Monitoring changes in carbon stocks • Green technologies that enhance the flow of ecosystem services and reduce carbon footprints

Note: This table has been compiled based on the preceding analysis and associated thematic papers as a possible basis for discussion. It is not intended to be prescriptive.

Technologies relating to resource assessment. Challenges in applying technologies for resource assessment in the Pacific SIDS include:

- accessing the technologies and the products thereof (e.g. satellite imagery), some of which are expensive;
- the infrastructure required to use the technology; and
- developing the human resources needed to use the technology.

There has been a spurt in the adoption of resource assessment and monitoring technologies in the Pacific in the last decade, largely because of initiatives like the UN-REDD Programme. Assessing changes in land use and carbon stock is key to the development of REDD+, and remote sensing is one of the quickest approaches. With technical and financial support from international partners, Fiji and Papua New Guinea have used geospatial technologies to assess their forest resources, thus enhancing capabilities for complying with international reporting requirements. Specifically, support to improve resource assessments has included:

- access to remotely sensed data, especially satellite imagery and other materials;
- the provision of relevant technologies, including setting up facilities for spatial data analysis (e.g. a remote-sensing laboratory has been established in Vanuatu's Department of Forests);
- capacity building through the training of national staff;
- the development of methodologies and guidelines for resource assessment; and
- access to expertise through the deployment of specialists in various aspects of resource assessment, such as interpretation of remotely sensed data and conducting forest inventories.

These efforts have helped improve access to innovations such as lidar. Geospatial technologies are advancing rapidly and could become cheaper, but most Pacific SIDS will find it challenging to keep pace. One-time external support is helpful, but it is imperative that each country develops a clear strategy for adopting technologies capable of helping to cost-effectively achieve objectives. Especially in the case of resource assessment technologies, there is a strong case for putting in place a regional institutional mechanism.

Information and communication technologies. There has been a rapid uptake in ICTs in the Pacific SIDS, with profound social, economic and cultural impacts (Box 32). Governance, including forest governance, is particularly affected by ICTs, which are helping overcome barriers presented by remoteness. Connectivity has improved significantly in the last decade, with the wide availability of mobile phones especially enabling people to communicate more easily over large distances. The potential for the wider use of ICTs to improve governance is vast.

Box 32. Digital trends in the Pacific Small Island Developing States

There has been significant growth in digital connectivity in the Pacific SIDS in the last decade, and this is having a major impact on all sectors, including forestry. Isolation is vanishing rapidly, with the digital revolution bringing about fundamental changes and enabling close interactions between people separated by distance. Many countries are already reaping the benefits of investments in submarine optical cables and satellite connections. Per-capita active mobile broadband subscriptions in 2019 were much higher in Fiji, Tonga and Vanuatu than in the Asia-Pacific region overall and the world, and so was the proportion of individuals using the internet (ITU, 2021). E-government is also expanding, taking advantage of the growth of information and communication technologies (Australian Strategic Policy Institute, 2020). For example, Fiji's *iTaukei* Land Trust Board, which is responsible for the provision of native land-leasing services, has developed the Tenant app, which provides access to leasing financials and statements, tenant information, lease payments, lease details and lease cases and provides notifications and messaging (*iTaukei* Land Trust Board, undated). It has been a major step towards increasing transparency and efficiency in the management of leases under the Board. Given the high proportion of young people in the Pacific SIDS, the pace of uptake of advancements in information and communication technologies is expected to accelerate in coming years, bringing about fundamental changes in governance.

Source: UNESCO Institute for Statistics. Undated. UIS Statistics [online]. United Nations Educational, Scientific and Cultural Organization (UNESCO) [Cited 27 December 2021]. http://data.uis.unesco.org/Index.aspx

Several efforts are underway to strengthen management information systems, especially to integrate information from different spatial and temporal scales. For example, the Papua New Guinea Forest Authority is developing the Forest Resource Information Management System (FRIMS) with technical support from the Japan International Cooperation Agency. FRIMS is a system for estimating forest area using a forest base map (which includes vegetation and topographical information); estimating commercial timber volumes and carbon stock using logging history; and projecting land-use change using time-series data. The Papua New Guinea Forest Authority can update forest resource information and geospatial data in the FRIMS using field survey data with global positioning systems, logging plans submitted by logging companies, satellite imagery and other inputs (PNGFA and JICA, 2019). Such information systems have tremendous potential for improving forest governance, and most countries are making efforts to improve their capacity to integrate diverse information and thereby provide holistic perspectives essential for long-term strategic planning.

Logging, regeneration and management of natural forests. A wide range of technologies is deployed in forest harvesting, ranging from labour-intensive traditional technologies - mainly involving hand-held tools - to highly capital-intensive heavy machinery, the latter introduced in some Pacific SIDS to facilitate large-scale logging. The economic, social and environmental implications of these technologies are well-known, and most countries have attempted to reduce the negative impacts by prescribing logging codes and requiring environmental impact assessments as a condition for the approval of logging plans. The logging codes are elaborate, prescribing (for example) do's and don'ts, areas that should not be logged, allowable road densities, road and skid track widths, measures to be adopted to prevent soil erosion and ensure the safety of workers, weather restrictions for logging, and the decommissioning of roads and skid trails. Efforts have been made to introduce reduced-impact logging. Nevertheless, most countries face challenges in ensuring compliance with logging codes because of inadequate capacity to monitor and enforce their provisions.

The sustainability of logging depends on post-logging management, especially the regeneration of logged-over areas to ensure the survival and growth of commercially important species. The general neglect of this in forest management in the Pacific SIDS can be attributed to the following:

- Undefined land ownership acts as a major disincentive to long-term investments in forest management. In Papua New Guinea, for example, even when an area is covered by a forest management agreement there is no guarantee it will be available for management, with landowners able to use it instead for agriculture.
- Logging companies and governments tend to favour revenue maximization by drawing down available wood stock, and wood supply in the distant future is not a major concern. Re-entry logging before forests have had sufficient time to recover is a major challenge in Solomon Islands (Katovai *et al.*, 2021).
- On the whole, limited efforts have been made to develop appropriate restoration techniques in logged-over areas, such as assisted natural regeneration (Katovai *et al.*, 2015).

The restoration of logged-over areas tends mostly to be left to natural processes - assisted regeneration is demanding on human and financial resources and well beyond the means of most countries. If restoration is attempted at all, much of the emphasis is on those practices that are already known, often involving exotic species (e.g. the establishment of mahogany plantations in logged-over natural forests in Fiji, and teak plantations in Solomon Islands).

Research and development efforts in support of planted forest development. The role of planted forests in wood production is limited in the Pacific with the exception of Fiji and to a lesser extent Papua New Guinea and Solomon Islands. Most R&D in the subregion has focused on plantation development, especially the selection of species suitable for differing site conditions, tree improvement practices, planting, and the maintenance of plantations. The most notable work is in Fiji, especially for Caribbean pine and mahogany, mainly by the Forestry Department's Silviculture Research Division (Box 33). Significant work has also been done on teak in Solomon Islands, especially by Kolombangara Forest Products, which, in addition to managing plantations under its ownership, provides landowners with technical and marketing support. The main areas for innovation in teak management are productivity enhancement using improved germplasm and improved planting and maintenance practices - especially thinning.

A core issue in improving the productivity of plantations and natural forests is the need for trial plots to assess the performance of different species under differing site conditions and treatments. A network of long-term sample plots is a key R&D investment in forestry, but this seems to have received inadequate attention in the Pacific SIDS. Moreover, disputes over land ownership, a lack of resources, a lack of regular measurement, and the inadequate maintenance of records have affected the limited number of existing field trials. Often, the absence of continuity of effort has led to the destruction of provenance trials, resulting in the loss of crucial information on productivity and sources of good-quality seeds.

Fire management technologies. Forest fire, exacerbated by climate change, has become a major source of emissions and needs urgent attention globally if the forest sector is to be carbon-neutral. Many Pacific SIDS have experienced an increased incidence of damaging wildfires in the last two decades but are generally poorly equipped to suppress them or limit the damage. Tropical rainforests in general and many of the exotic tree species planted in the Pacific SIDS are poorly adapted to fire. Most of the planted forests are very susceptible to damage by wildfire, which can result in the total loss of commercial value. The increasing risk to forests from wildfires in drier zones is likely to be a significant constraint on the goal of enhancing the role of planted forests in the Pacific SIDS. Fiji is developing a national forest fire management strategy and has received support for this from an Australian non-governmental organization, Foresters Without Borders (Bartlett, 2022). Although many aspects of fire management are known, there is a need to develop technologies and practices that address the specific context of the Pacific SIDS (Trauernicht *et al.*, 2018) encompassing prevention, suppression and the restoration of fire-affected areas.

Box 33. Fiji's Silviculture Research Division

The Silviculture Research Division, which is part of Fiji's Forestry Department, undertakes research relevant to the sustainable management of Fiji's native and plantation forests. It played a key role in developing the country's commercially viable pine plantation estate and the world's largest high-quality big-leaf mahogany plantation estate. Plantation forestry and sustainable natural forest management, including mangrove forests, are the Division's two main areas of research. In plantation forestry, it is paying particular attention to tree improvement, forest health, seed technology and nursery practice. Recent research efforts have focused on forest genetic resources, forest health surveys and the development of smallholder plantings of Fiji's native sandalwood. The Division also undertakes operational functions, such as seed collection and seedling production for reforestation programmes.

Improvement is needed in research analysis and publication, and research objectives need review to ensure they incorporate current issues. A review of the Silviculture Research Division identified the following three needs for it to better undertake its research and development mission (Thomson, Doran and Tauraga, 2019):

1. progressively increase resources, both in the Division's recurrent budget allocations and through collaborative research projects;
2. upskill the staff, including through further tertiary training, short courses and attachments with appropriate forest research agencies in the Asia-Pacific region and co-opting expert volunteers; and
3. recruit additional professional staff in the areas of tree improvement, plantation silviculture, agroforestry systems, sustainable native forest management, forest restoration, tree seed, and forest health (pathology).

An independent review in 2019 (Thompson 2019) recommended several measures to strengthen silvicultural research, including to reorganize the Division into three clusters:(1) plantations and agroforestry; (2) native forests; and (3) genetic resources and propagation.

Source: **Bartlett, T.** 2022 (in press). *Nurturing innovation and resilience in land-use practices and technologies in forestry and agroforestry in Pacific Small Island Developing States.*

Agroforestry technologies. The Pacific SIDS host many agroforestry systems producing diverse products for subsistence and trade. Given its diversity of structure, composition and products, agroforestry is probably one of the most resilient land uses, and it is a mainstay of livelihood security in the subregion. It has mostly evolved locally, enriched by the introduction of indigenous and exotic species and adaptions to varying socio-economic and cultural settings. Most research has been invested in a few commercially valuable species, such as coffee, cocoa, coconut and rubber (the commercial viability of which has waxed and waned), and enhancing their productivity in agroforestry systems. Efforts to understand the dynamics and innovations of agroforestry have been limited. Most innovations have been specific to products or species and focused on incorporating high-value tree species in farming systems to boost farmer incomes. Early emphasis was on high-value species, including improving planting material, and later efforts have focused on value-adding and marketing, which have proved challenging for several reasons. Often, innovations, although technically sound, have failed because of a failure to consider larger socio-economic and

cultural factors. This continues to be a major challenge, and it shows the importance of a holistic approach to innovation that integrates biophysical and human dimensions given the nature of land ownership, the complexity of mixed cropping, and socio-economic and cultural diversity.

To summarize, the science and technology capability in the forest sector in Pacific SIDS is underdeveloped. Only two countries - Fiji and Papua New Guinea - have institutions dedicated to forest research, although both are underfunded and understaffed. Challenges facing forest innovation in the Pacific SIDS are (Bartlett, 2022):

- a lack of political support for forest research in countries;
- inadequate or outdated research facilities;
- an absence of funding stability;
- a lack of secure land tenure for long-term field trials;
- inadequate library and information services;
- limited interaction between researchers and potential users of research results;
- a lack of research extension programmes and mechanisms for transferring research knowledge, technologies and findings to users;
- low levels of academic qualifications and specific training in forest research disciplines;
- limited interactions with other related research organizations within countries; and
- limited coordination of research efforts among Pacific SIDS.

There is considerable dependence on external bodies to undertake research and a reliance on the introduction of technology and practices from elsewhere. There is an urgent need to develop an R&D strategy focused on integrated land use in the specific ecological and socio-economic context of the Pacific SIDS.

Investment in sustainable forest management

Resource scarcity has compelled the drawing down of natural capital (disinvestment) in the Pacific SIDS to meet consumption needs and to build up physical and human capital (investment). This section focuses on how Pacific SIDS are addressing the challenge of balancing investment and disinvestment.

The Pacific SIDS are highly vulnerable to climate change and must invest to reduce this vulnerability and increase resilience, including through sustainable land management. Multiple players are involved in land management - local communities, corporate investors (especially mining companies, large agricultural enterprises and logging companies), governments, bilateral and multilateral agencies, and civil-society organizations. Their perceptions about land and forests and how their consumption and investment decisions affect sustainability and the ecological footprint differ considerably. Increasing the resilience of landscapes and people requires major shifts from "brown" to "green" investments. Broadly, investments can be categorized as those originating from within the country, based largely on domestic savings, and those deriving externally (Table 27).

Table 27. *Key players and sources of investment funds, Pacific Small Island Developing States*

Sources of funds	Key players
Domestic	Local communities Domestic private sector Governments
External	Private sector Bilateral and multilateral agencies Civil-society organizations

Source: Authors' own elaboration.

Key issues around enhancing investments by the various players are discussed below.

Domestic investments

The capacity to mobilize domestic investment funds in the Pacific SIDS is limited due to the following:

- **A predominance of subsistence production and low investible surplus.** Although there has been an expansion of commercial crops, most farming is subsistence-oriented, which generates few investible surpluses. Although land productivity is inherently high in the Pacific, factors such as customary tenure, limited access to inputs and markets, access to credit, small-scale production and the high risk of disasters limit the ability to generate and invest surpluses in agricultural development and increase production. These factors also affect the ability of governments to mobilize resources through taxation. A significant proportion of farming and related activities are in the informal domain, further constraining resource mobilization. More positively, subsistence production maintains a certain inherent balance between investment and disinvestment where populations are low.
- **Most governments find it difficult to balance budgets.** Although the tax-to-GDP ratios in the Pacific SIDS are comparable with those in other countries in the Asia-Pacific, most of it comes from taxes on goods and services, and individual and corporate income tax rates are relatively low (there is no tax on individual and corporate incomes in Vanuatu) (OECD, 2021a). Even with intensive tax collection efforts, there are limits to what can be collected given the

generally low levels of income. Most governments need to find trade-offs between the marginal cost of collection and what can be collected, and they need to ensure that tax regimes don't discourage economic activities. The cost of governance, including the provision of public services such as education, healthcare, building and maintaining essential infrastructure, tends to be high in the Pacific SIDS because of geographical factors, especially the dispersed nature of populations. Frequent disasters add to the demand on public funds for rescue, relief and rebuilding. In several Pacific SIDS, the annual average economic loss due to disasters is more than 2 percent of GDP (see Table 22 in Chapter 4); it is more than 6 percent of GDP in Vanuatu. Precarious budgets and debt burdens limit the ability of governments to mobilize domestic resources. Inevitably, this means drawing down natural capital and a dependence on external financing.

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- **Revenue leakages, illegal transactions, and capital flight.** A few Pacific SIDS well-endowed with natural resources are under pressure to draw down their natural capital. Logging and mining are major sources of income for some Melanesian countries, and so are fishing licences in several countries in the subregion. Illegal transactions - mainly transfer pricing - results in a considerable loss of income and capital flight from these countries: for example, Global Financial Integrity (2021) estimated the value gap due to trade-related illicit financial flows at about 18 percent of the total value of trade; the average annual value gap in 2009-2018 was estimated at about USD 1.131 billion for Papua New Guinea and USD 343 million for Fiji. The narrow export base, centred on a small number of products, enhances volatility (UNDP, 2017) which became particularly pronounced in the context of pandemic-related supply-chain disruptions.

External support

Traditional external funding comes primarily in two forms: ODA, channelled through bilateral and multilateral agencies including those through dedicated facilities, and FDI (investment by the international private sector). The funds of philanthropic and religious institutions sometimes play important roles, although their overall share of external funding is relatively low. Most countries are dependent on external support - both ODA and FDI. The implications of investment from these two sources are discussed below.

Official development assistance. ODA is a major source of financial support in most Pacific SIDS; some, especially the smaller ones, are highly dependent on it (Dornan and Pryke, 2017). For example, Tuvalu received ODA of USD 3 130 per capita in 2019, which was 55.8 percent of the gross national income. At the other end of the spectrum, Papua New Guinea received ODA of USD 76 per capita, which was 2.8 percent of the gross national income (World Bank, undated[a]). ODA in the Pacific SIDS amounted to USD 424 per capita in 2019, compared with USD 54 per capita for the least-developed countries globally and USD 47 per capita for sub-Saharan Africa (World Bank, undated[a]). To some extent, this reflects the high cost of operations catering to the needs of small populations scattered over vast areas and the consequent diseconomies of small-scale operations. The situation for ODA may be summarized as follows:

- ODA comes mainly from bilateral and multilateral organizations and financial institutions and goes directly to recipient countries, institutions and projects. Several bilateral and multilateral programmes are directed at specific countries or groups of countries focusing on land use, including forestry and agroforestry. They address issues such as policy development, the formulation of rules and regulations, and capacity building (Box 34). Often, projects and programmes are funded jointly by bilateral and multilateral institutions, with development banks catering to the loan component and bilateral institutions providing grants to cover technical assistance components.
- Climate finance refers to "local, national and transnational financing drawn from public, private and alternative sources of financing that seeks to support mitigation and adaptation actions that will address climate change" (United Nations Climate Change, undated). Financial resources - loans and grants - to developing countries are provided mainly through the GEF, established in 2001, and the Green Climate Fund, established in 2010. Two funds managed by the GEF - the Special Climate Change Fund and the Least Developed Countries Fund - have also been established, and there is also the Adaptation Fund, established in 2001 under the Kyoto Protocol. Figure 21 provides an indication of the commitment of climate finance made to the Pacific SIDS in the period 2014- 2019. Several bilateral and multilateral adaptation and mitigation projects are underway in the Pacific SIDS.

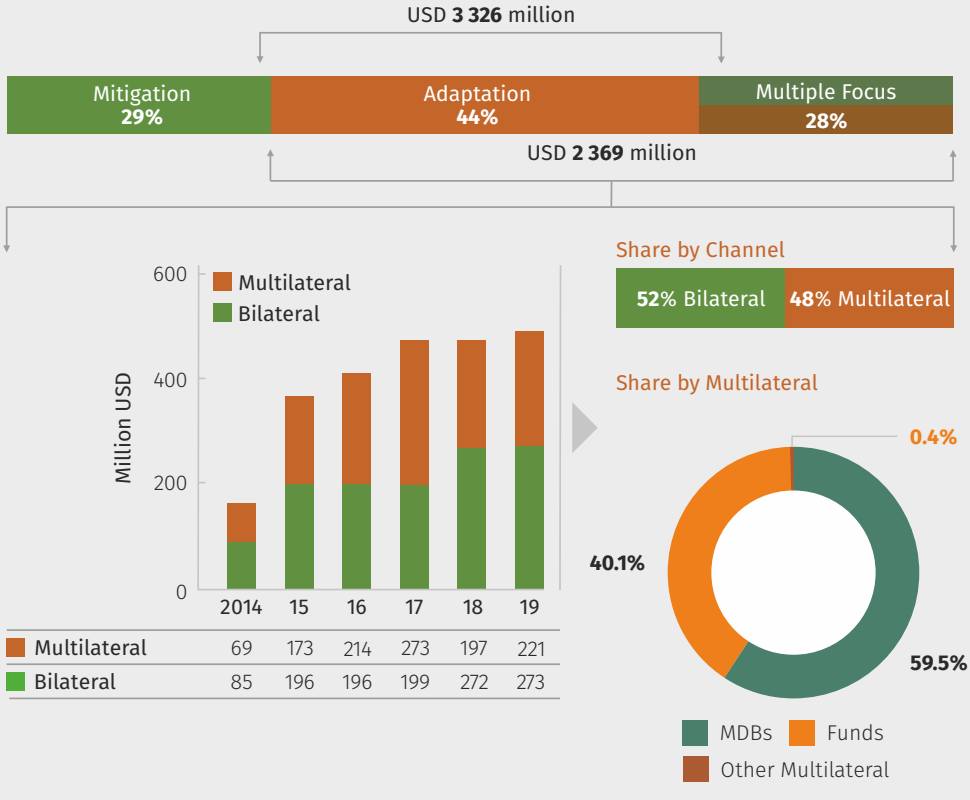
Box 34. Examples of bilateral and multilateral assistance to Pacific Small Island Developing States in forestry, agroforestry and environmental protection

- Official development assistance through the Japan International Cooperation Agency is financing a project in the Solomon Islands, "Capacity development for sustainable forest resource management in Solomon Islands (2017-2022)". The aim of the project is to build capacity in the Ministry of Forest Resources to develop policies that support sustainable forest management. It includes support for community and resource owners to develop alternative livelihoods and boost sustainable timber production in plantations.
- The Global Environment Facility (GEF) is financing several forest conservation and sustainable management efforts in the subregion. In Samoa, for example, GEF-7 is financing the USD 3.5 million project, "Enhancing integrated sustainable management to safeguard Samoa's natural resources". The aim is to equip and empower local communities to safeguard Samoa's indigenous species, natural ecosystems and food production systems from invasive alien species and unsustainable land-use practices.
- The GEF is also financing the Pacific Ridge to Reef programme in 14 countries, at a value of USD 90 million. The aim is to improve the management of high-priority water catchments to conserve biodiversity and ecosystem services, sequester carbon, improve climate resilience and sustain livelihoods.

The European Investment Bank is financing projects in the subregion in both the public and private sectors (European Investment Bank, 2019). For example, it is contributing USD 75 million to a USD 405 million investment programme by Fiji's Water Authority to reinforce water systems following the impacts of Tropical Cyclone Winston in 2016. Other contributors to the programme are the Fijian Government, the Green Climate Fund and the Asian Development Bank.

Source: Authors elaboration

Figure 21. *Commitment of climate finance made to the Pacific Small Island Developing States, 2014- 2019*



Source: **International Monetary Fund.** 2021. *Unlocking access to climate finance for Pacific Island countries.* Asia-Pacific Fiscal Affairs Department DP/2021/020.

An assessment of trends in ODA to 2019 indicates the many challenges involved in mobilizing resources for climate action. Concerns in the context of climate finance include the following:

- Climate-change finance is supposed to be additional to regular ODA, but many donors have reduced their general contribution to ODA and shifted it to climate finance.
- There are major gaps between commitments and actual delivery (OECD, 2021b), compounded by a lack of capacity to use what is provided.
- A large component of ODA comprises loans and non-concessional finance. For example, Oxfam (2020) found that 80 percent of all reported public climate finance is provided mostly as loans and other non-grant instruments; moreover, about half these loans are non-concessional and offered on ungenerous terms requiring higher repayments.
- Accessing bilateral and multilateral assistance continues to be challenging for most Pacific SIDS because of their limited capacity to prepare fundable proposals (International Monetary Fund, 2021). Changing donor perceptions and priorities add to the problem, and most Pacific SIDS have limited human resource capacity to develop proposals, meaning they must use expensive external experts, whose limited understanding of on-the-ground realities affects the quality of project proposals.
- The changing geopolitical environment has the potential to bring about major changes in resource flows in the subregion, with key players pumping in more funds and other resources to enhance their strategic security interests. However, such investments often fail to consider the real development needs of the Pacific SIDS, and there are concerns they could become debt traps.

Foreign direct investment. FDI, which is primarily private-sector-driven, plays a key role in overall economic development; for example, there is a close link between the rapid economic growth of some countries in the Asia-Pacific region and the volume of FDI. Globally, the net inflow of FDI increased from USD 239.4 billion in 1990 to USD 1.64 trillion in 2019. It peaked at 3.13 trillion in 2007 but declined sharply due to the global financial crisis in 2008. The net inflow of FDI in the Pacific SIDS increased from USD 156.6 million in 1990 to USD 746.2 million in 2019, which is relatively high as a proportion of the GDP. Globally, FDI accounted for about 1.9 percent of the global GDP in 2019, but it was about 2.2 percent of GDP in the Pacific SIDS (World Bank, undated[c]).

The future role of FDI in forestry and the forest industry in the Pacific SIDS will be determined by various factors, including the following:

- FDI in forestry has focused on extractive activities, especially logging, which generates early returns on investment. On the whole, FDI in logging has a poor track record because of the tendency to ignore environmental and social aspects. This is linked to land tenure in the Pacific SIDS, which gives rise to considerable risks and uncertainties for outside investors.
- Returns on investments in the Pacific SIDS tend to be lower than those obtainable elsewhere. Generally, a 10 percent increase in the ratio of FDI to GDP is associated with an increase in GDP growth of about 2 percent, but in the Pacific SIDS the average increase is 0.1- 0.4 percent (Feeny, Iamsiraraj and McGillivray, 2014). Most FDI is concentrated in areas that generate quick returns and minimal risk, such as natural-forest logging.
- Economic uncertainties - stemming from national policies and the changing geopolitical environment - remain a major deterrent to long-term investment in the Pacific SIDS, along with challenges such as small and fragmented markets and the high cost of transportation.
- Climate-change-related events such as tropical cyclones, forest fire, flooding and coastal inundation also increase investment risks. Future Forests Fiji - a private investment in plantation development - went into liquidation partly because of the extensive damage caused by Tropical Cyclone Winston.

Alternative financing modalities

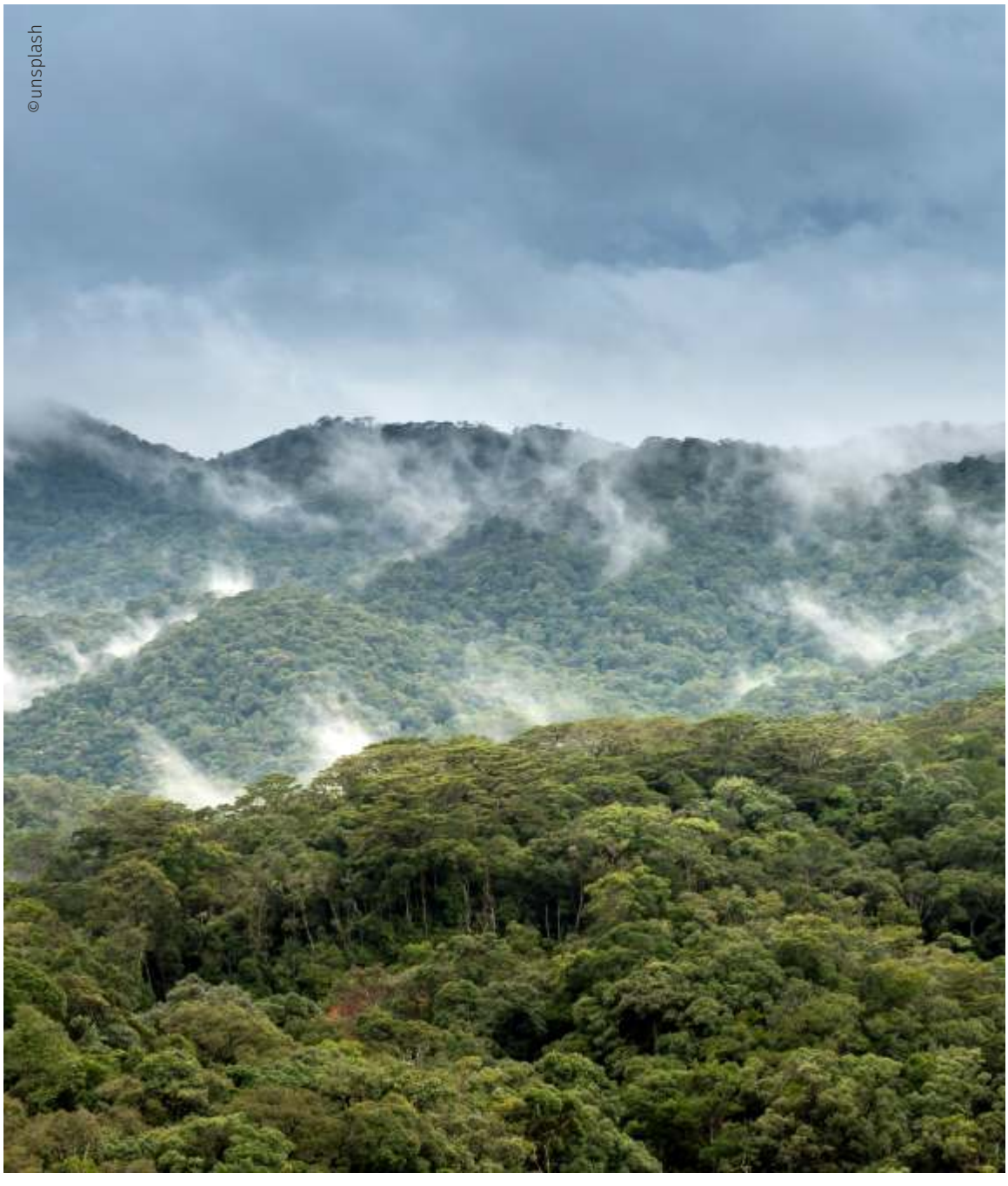
Most conventional approaches to financing sustainable land management focus on large projects, but the scope for these is limited in the Pacific SIDS because the small population is dispersed in many islands. Moreover, the technical capacity required to implement large projects is often lacking. There is a need for alternative approaches to funding forest conservation and climate-change mitigation and adaptation projects. Options include:

- blended finance to enable the pooling of resources from diverse sources;
- debt-for-nature swaps, under which external debt is written off partially or fully and a corresponding amount is earmarked for strengthening conservation efforts;
- payments for ecosystem services like carbon sequestration, watershed protection and the provision of amenity values, such as Palau's "pristine paradise fee" (Box 35); and
- crowd funding of conservation efforts, including climate-change adaptation and mitigation.

Box 35. Palau's fee for maintaining paradise

Palau levies tourists to help fund conservation and ensure that tourism assets and scenic values are conserved effectively. Palau introduced a "green" fee in November 2009 as a departure tax of USD 35 per traveller. In January 2018 this was changed to the "pristine paradise environmental fee", which is charged on arrival at a rate of USD 100 per person (aged 13 years and above). Visitors are not issued a visa until they sign a pledge promising to respect the environment and culture of Palau. The fee helps offset the impacts of tourism on the environment and ensure its sustainability. Part of the fee goes to the Fisheries Protection Trust Fund to support the conservation of the Palau National Marine Sanctuary, which covers 80 percent of Palau's economic exclusion zone. In slightly more than a year, the fee had raised USD 9.0 million for environmental protection.

Source: **Srinivasan, P.** 2019. Palau's visitor fee helps fund environmental protection, but could it be driving away tourists? In: *ABC Pacific*. [Cited 21 October 2022]. HYPERLINK "https://www.abc.net.au/pacific/programs/pacificbeat/industry-pushback-on-palaus-fee-for-environmental-protection/11743290" www.abc.net.au/pacific/programs/pacificbeat/industry-pushback-on-palaus-fee-for-environmental-protection/11743290



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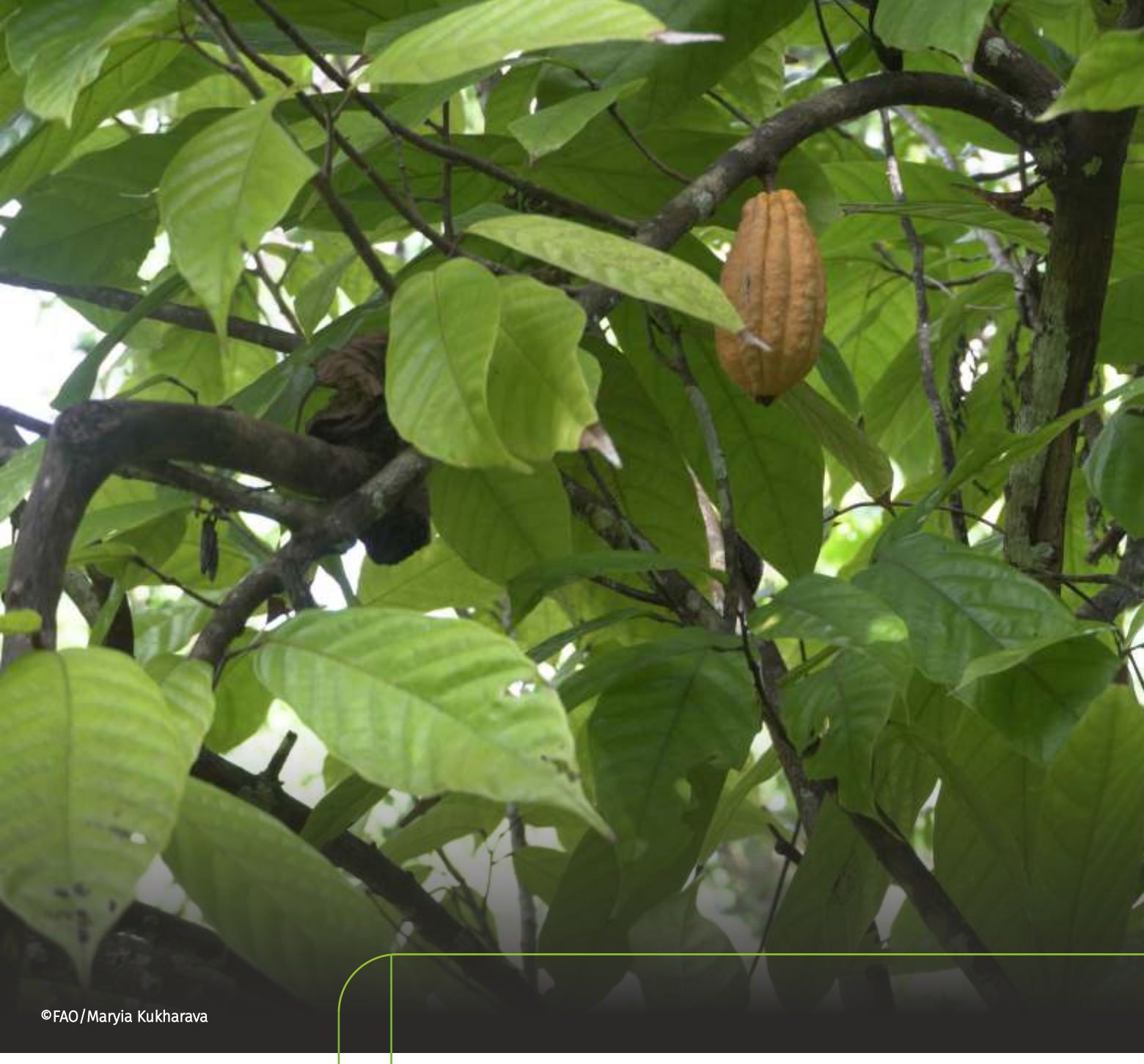

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06

Key points

- Scenario analysis provides an opportunity to assess uncertainties and articulate possible futures, considering the impacts of key drivers. In the Pacific SIDS, major uncertainties stem from erratic economic performance - including due to disasters and global economic downturns - and a wide range of governance challenges.
- Here, three broad scenarios are identified: (1) “SDG world” (an aspirational scenario); (2) business as usual; and (3) “gloom and doom” (a disruptive scenario). Each scenario is applied to three groupings of Pacific SIDS: (I) Papua New Guinea; (2) the other Melanesian countries; and (3) Micronesia and Polynesia.

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- In the SDG-world scenario, concerted efforts to improve governance, and a more favourable global economic environment, enable more sustainable approaches to forests and forestry and the development of efficient and viable bioeconomies. The business-as-usual scenario involves a continuation of present trends, especially in governance and economic performance, with a mix of positive and negative developments. A further decline in governance, and worsening economic conditions, give rise to the gloom-and-doom scenario.
- The three scenarios evolve differently in each grouping, with differing implications for resource use and what needs to be done to build an SDG world.
- Scenario development needs to be undertaken as a collective exercise involving all stakeholders, but this was not possible here given difficulties stemming from the COVID-19 pandemic. Therefore, the scenarios could be improved in each country as part of strategic planning processes that enable all stakeholders to understand the status of their country and sector and what is needed to shift towards the achievement of aspirational goals.

From drivers to scenarios

Visualizing how the future might unfold is crucial for strategic planning designed to achieve a more desirable state and to avoid pathways that may lead to undesirable outcomes. Often, long-term strategic planning centres on a preferred narrative and fails to consider real-world uncertainties. Given the high level of uncertainty, however, it is imperative to consider alternative futures, their implications for societies and what needs to be done to achieve desirable outcomes and avoid undesirable ones.

Forecasting future developments is integral to long-term planning, with methodologies for doing so varying in terms of their scope, rigour, data requirements and reliability. Simple predictive models are used to model changes over short-term horizons and complexities are excluded through *ceteris paribus* assumptions. However, multiple uncertainties over long periods cannot be handled through such forecasting models; therefore, scenario analysis (Box 36) is employed to provide an understanding of how the future is likely to evolve. This chapter outlines various scenarios that may emerge in the Pacific SIDS and what they might mean for people, forests and forestry in the subregion.

Box 36. What is scenario analysis?

A scenario is a presentation of a possible future situation in a narrative form. In the short term, there is a degree of certainty about the impacts of various factors, and the cause - effect relationship can be analysed with relative ease. Using known relationships between variables, forecasts can be made of how a situation might develop in the future. Uncertainties increase over longer time horizons and certainties diminish, making conventional forecasting models unreliable. Scenario analysis is used in such situations to provide an indication of future possibilities. By integrating quantitative and qualitative information, scenario analysis can suggest possible pathways for the future and the key characteristics and consequences of these.

Source: Authors elaboration

Background

Although scenario analysis originated in the context of military strategies, it is used by industry and governments in developing strategic plans and analyses on a wide array of issues - such as foreign policy, sectoral futures, trade and infrastructure development - where the high level of uncertainty limits the use of conventional forecasting techniques. The Intergovernmental Panel on Climate Change uses scenario analyses to provide an indication of the situations that may emerge due to temperature increases

("representative concentration pathways") and the outcomes of various levels of intervention ("shared socio-economic pathways") (IPCC, 2021). The scenarios generated provide a basis for discussion on where a society might be at a given point of time, what pathways are possible, how they might affect the society and its various segments, and what needs to be done for course-correction to avoid negative outcomes and strengthen positive outcomes.

Several countries, including in the Pacific subregion (Box 37), have undertaken scenario analysis as part of efforts to articulate long-term visions of socio-economic development.

Box 37. Scenario analysis in Papua New Guinea

Papua New Guinea's National Strategic Planning Task Force used scenario analysis in the preparation of Papua New Guinea Vision 2050. Given various uncertainties, the Task Force identified four scenarios. The base case reflected a business-as-usual situation in which natural resources would be used to attain an annual growth rate of gross domestic product (GDP) of 4.5 percent. An annual population growth rate of 2.5 percent meant that, in real terms, GDP growth would be 2.0 percent in the base-case scenario; by 2020, in this scenario, GDP would have increased to PGK 15.1 billion. Scenario 2 (base case + land reform) assumed that land reforms would bring 3 percent of customary land into the formal domain, thus increasing GDP to PGK 18.5 billion by 2020. The third scenario assumed that the positive impacts of a liquified natural gas (LNG) project (base case + LNG project) would increase GDP to PGK 20.1 billion by 2020. The fourth scenario combined the first three scenarios (the cumulative scenario), in which GDP would increase to PGK 23.5 billion by 2020.

In its scenario analysis in Papua New Guinea, the Lowy Institute developed a matrix of key variables in the domains of politics, society, economics, infrastructure, security and geopolitics and identified a hierarchy of key variables (largely in the political, social and economic sectors) and the degree of their impact. Three scenarios were identified: (1) gradual improvement; (2) muddling through; and (3) accelerated decline. Outlining the many challenges, the analysis concluded that Papua New Guinea will continue in the "muddle through" scenario and that predicting what might happen will continue to be challenging.

Source: **Government of Papua New Guinea.** 2009. *Papua New Guinea Vision 2050*, prepared by the National Strategic Plan Task Force. Available at https://actnowpng.org/sites/default/files/png%20version%202050.pdf
Pryke, J. 2017. *Future scenarios for Papua New Guinea.* Lowy Institute. Available at https://interactives.lowyinstitute.org/archive/png-in-2017/downloads/Pryke_Scenarios.pdf

Scenario development should be a collective process that considers and discusses diverse views to ensure broad consensus. This helps minimize the subjectivity of narrow individual perceptions and also encourages wider understanding of the big picture of societal change.

Scenario analysis in forest-sector outlooks

Previous forest-sector outlook studies in the Asia-Pacific region have used scenario analysis to provide an idea of what might happen to forests and forestry at the regional, subregional and national levels. For example, Asia-Pacific Forest Sector Outlook Study III (FAO, 2019) identified the following three scenarios:

1. "Business-as-usual", which assumes that major drivers of change - demographic factors, economic growth, environmental and governance factors and technological innovation - will continue to develop in line with historical trends. Although countries might make progress in addressing certain challenges, there will be no significant change in the direction of these trends.
2. "Aspirational", which envisions the accomplishment of objectives outlined in international initiatives such as the SDGs, the Paris Agreement on climate change, the Bonn Challenge and the Global Forest Goals.
3. "Disruptive", in which several negative events such as economic crises, wars and environmental disasters lead to declines in human well-being. Countries may be unable to cope up with the occurrence of these events, with significant negative impacts on forests.

Scenario analysis undertaken as part of Asia-Pacific Forest Sector Outlook Study II (FAO, 2010; FAO, 2011a) proposed three scenarios for Australasia, Melanesia, and Micronesia and Polynesia (Table 28).

Table 28. *Scenarios for the Pacific, as articulated in Asia-Pacific Forest Sector Outlook Study II*

Subregions	Scenarios		
Australasia	Business as usual	Severe and protracted recession	Green economy
Melanesia	Business as usual	Industrial forestry	Green economy
Micronesia and Polynesia	Business as usual	Severe and protracted economic recession	Rapid economic recovery and growth

Source: **FAO**. 2011a. *Pacific Forests and Forestry to 2020*. Sub-regional report of the Second Asia-Pacific Forestry Sector Outlook Study. RAP Publication 2011/01. Bangkok.

In the scenarios articulated in FAO (2011a), business as usual represented a continuation of the prevailing situation with a mix of positive and negative factors; the "protracted recession" scenario envisaged an inability to recover from the 2008 global financial crisis, particularly in Australasia and Micronesia and Polynesia; and, in the "green economy" scenario, initiatives to reduce GHG emissions and conserve biodiversity would assist an economic transition.

Overall, in the last decade, most Pacific SIDS could be said to have moved in line with the business-as-usual scenario, reflecting an overall slow process of change: although some efforts have been made to address challenges, progress has largely been stymied. To a large extent, this reflects the slow pace of change in governance because changes in policies, legislation and institutional arrangements and their actual implementation are time-consuming and invariably contested. FAO (2011a) noted the divergence of scenarios between country groups in the Pacific in light of their stage of development. Australia and New Zealand, in Australasia, are developed economies with well-established and stable governance systems, and their business-as-usual scenario differed considerably from those of Melanesian and Polynesian and Micronesian countries.

Scenarios for the Pacific Small Island Developing States

Approach to defining scenarios

Land use, including the state of forests and forestry, is dependent on how various drivers shape the society - nature relationship. Drivers of changes vary in their level of certainty and degree of impact (Table 29).

Table 29. *Drivers shaping scenarios in the Pacific Small Island Developing States*

Driver	Subdriver	Degree of uncertainty	Impact	Remarks
Demographic change	Population growth	Low	Medium	Overall, there is good understanding of how key demographic variables will change in coming decades and hence uncertainty is low
	Urbanization Age structure Human-capital development	Low Low Medium	Medium Medium High	Human-capital development is dependent on investment in education and health and thus linked to economic growth
Economic change	Growth in income at the national and global levels	High	High	Most countries face considerable economic volatility given their relatively small size and vulnerability to climate-change-related events
	Structural economic changes	Medium	High	Although the share of agriculture and associated activities has declined, growth in the manufacturing sector has been sluggish; there is high dependence on extractive sectors - logging and mining - and tourism
	Distribution of income	High	Medium	Highly dependent on the state of governance

Driver	Subdriver	Degree of uncertainty	Impact	Remarks
	Globalization/ localization trends	Medium to high	Medium	Globalization has been a key driver of change in recent decades, bringing about fundamental changes to local, national and global economies. Strong antiglobalization sentiments have emerged favouring localization and near-shoring. A strengthening of this trend will have multiple impacts on all sectors and activities that are part of global value chains
Climate change	Rising sea levels	Low	High	Climate-change-related events will affect economic growth
	Disasters	Low to medium	High	
	Ecosystem change	Medium	High	
	Societal responses to climate change	High	High	Although there is reasonable understanding of the impacts of climate change, considerable uncertainty exists about how societies will respond. Strong vested interests are undermining urgent action, and this could severely affect the potential for achieving the Paris Agreement targets
Governance	Ability to curtail illegality and corruption	Medium	High	Primarily depends on the legal framework, including the ability to ensure compliance
	Reform of customary tenure	High	High	Adapting customary tenure to changing circumstances remains a major challenge
	Conflict management	High	High	
	Policies, rules and institutions at various levels	High	High	In a highly globalized society, it is imperative to consider governance at the global level, including the ability of global institutions to provide a level playing field
	Vibrancy, efficacy and effectiveness of institutions	High	High	This encompasses all types of institutions, such as public forestry agencies, the private sector, community institutions, civil-society organizations, financial institutions and research and development organizations
Technology and innovation	Ability to deploy new technologies and processes	Medium	Medium	Most communities have a wealth of traditional technologies, but the ability to develop, refine and adopt new technologies tends to be slow and dependent on external assistance
Investment	Quantitative and qualitative improvement in investment	High	High	High level of uncertainty stems from governance, economic growth and risks associated with climate change
Geopolitical developments	The Pacific subregion becoming a focal area for superpower rivalry	High	High	Collective action on issues such as climate-change mitigation and adaptation could be a casualty. National priorities and strategies could be distorted, paving the way for unsustainable resource use

Source: Authors' own elaboration.

Two broad groups of drivers likely to have overwhelming impacts on the future of the Pacific SIDS are economic performance and governance. These are linked to other drivers, as discussed below.

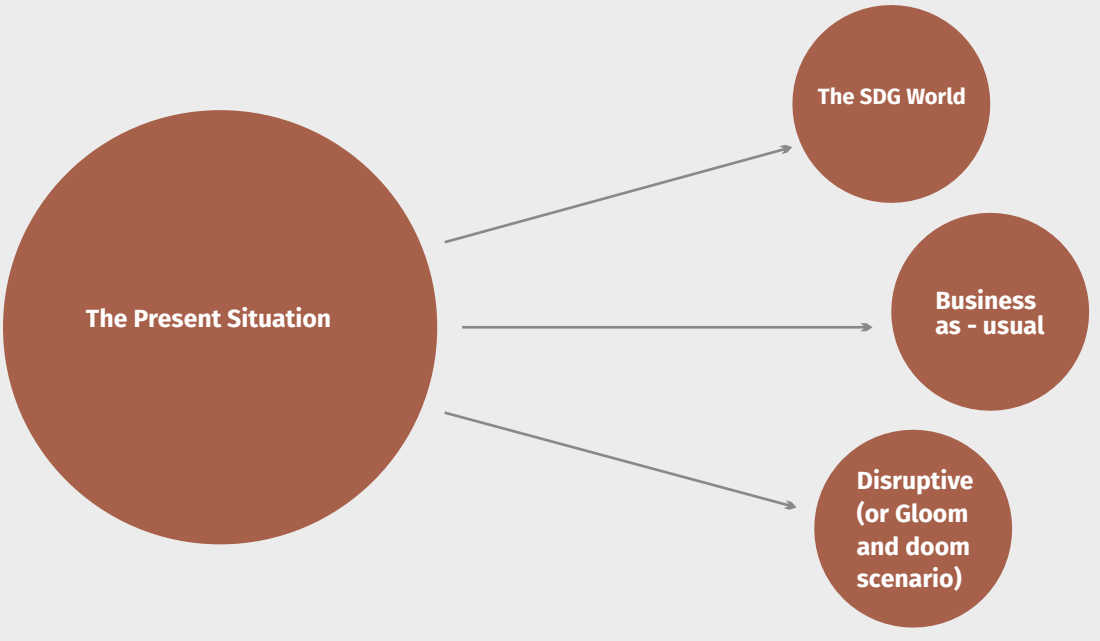
Economic performance. Several factors - global, national and local - could affect economic performance in coming years. Changes in the global economic situation could have major impacts on the economies of small-island countries in the Pacific, particularly on segments of the economy such as tourism that are most integrated with the global economy. Economic growth will also determine the rate of investment. The impacts of many other drivers - such as climate change and global pandemics - could drastically slow economic growth and even take income growth to negative territory. Growth in income also captures some of the impacts of population growth, with high population growth translated into low per-capita growth in income.

Governance. Governance affects all aspects of life, including economic performance, the distribution of wealth and income, social harmony, sustainability, and social resilience. The ability to improve governance and adapt it to the changing needs of society is challenging, however. The governance architecture at the global, national and local levels is characterized by a plethora of policies, rules, regulations and institutional arrangements. The efficiency and effectiveness of institutions vary considerably, giving rise to differing scenarios with very different impacts on society and nature. In the Pacific SIDS, customary ownership has received considerable attention and yet remains highly discussed and debated, often to the extent to which the demarcation of customary land and the identification of owners are contested. Several economic, social and environmental issues fall squarely in the domain of governance improvement. Governance has a direct bearing on reducing conflicts and improving harmony, without which economic growth is difficult.

Scenarios

Figure 22 and Table 30 show three scenarios based on combinations of economic performance and governance. In scenario 1, "SDG world", countries make steady improvements; in scenario 2, "business as usual", progress is much slower, and improvements in some areas may be undermined by deteriorating conditions in other areas; and, in scenario 3, "gloom and doom", conditions deteriorate in a wide range of areas. Each of these scenarios has distinct general characteristics and implications for land use, including forestry.

Figure 22. *Three possible scenarios for future development, Pacific Small Island Developing States*



Source: Authors' own elaboration.

Table 30. *Characteristics of three possible scenarios and implications for land use and forestry, Pacific Small Island Developing States*

Scenarios	General characteristics	Implications for land use and forestry
(1) SDG world	• A clear vision and mission are formulated through effective democratic processes • Priorities are clearly defined and agreed on • Sustainability, equity and justice are mainstreamed into all sectors and activities • A robust governance framework ensures efficiency, effectiveness, transparency, participation and equity • Well-developed institutions and people have trust in institutions, especially to prevent conflicts and resolve them if they do develop • Coherence exists between initiatives at the local, national and global levels • Institutions at different levels are responsive and efficient • Systematic efforts are underway to eliminate poverty • Social harmony and resilience are ensured through robust democratic institutions, with no one left behind • Considerable attention is paid to improving human capital, especially through investments in education, healthcare and skills development	• Integrated land-use approaches ensure synergies in policies and plans • Forestry institutions are well-developed and responsive, enable effective participation and provide flexibility and adaptability • A balanced mix of policy and market interventions provides a level playing field for local communities and small and medium-sized enterprises, enabling them to participate effectively in land management and enhancing their economic, social, environmental and cultural gains • The combination of modern science and technology and traditional knowledge helps produce a wide range of products and services • Critical ecosystems and processes are conserved and improved, taking advantage of traditional land stewardship experience • The resilience of people and ecosystems to disasters is enhanced • Land use plays a key role in reducing carbon footprints by reducing emissions and enhancing sequestration • Systems for the valuation of ecosystems and processes become integral to economic planning processes • There is widespread use of "green" technologies in the management of land and forests, including timber harvesting
(2) Business as usual	• There is broad consensus on long-term visions for countries and societies but disagreement on how to accomplish the vision • Economic growth fluctuates and is affected by disasters, pandemics and other disruptive events • The external environment, including trade, investments and geopolitics, is mixed • Governments face several limitations in mobilizing resources • Some progress is made in reforming policies and laws, but implementation lags behind because of institutional inadequacies. The pace of institutional change is slow • Persistent conflicts and divergences exist between the formal and informal economies	• The importance of integrated land use is well recognized, but weak synergies between policies and laws result in inconsistencies and conflicting actions • Institutional reform does not keep pace with changing needs. Consequently, many institutions relevant to land use work in silos, reducing efficiency and effectiveness • Many good initiatives are unable to be sustained because of resource constraints • The need to respond to crises – for example disasters – derails agreed plans • Powerful informal groups benefiting from the status quo undermine reform • Large tracts of forests are seen as a key resource to be extracted for generating employment and income • Limited opportunities for employment in the industrial and services sectors perpetuates a dependence on agriculture and continued deforestation • Conflicts in natural resource use intensify and those gaining from these are less willing to change the governance system

	General characteristics	Implications for land use and forestry
(3) gloom and doom	• No collective vision exists and societies are fragmented, with each group focusing on its own narrow interests • Conflicts over the use of natural resources are common • Many leaders are unable to take a broader perspective, focusing instead on maintaining the support of narrow segments of society, paving the way for pervasive corruption • Policies are inward-looking and fail to take advantage of opportunities presented by globalization • Low economic growth makes good governance unsustainable • The increasing intensity of disasters undermines economic progress. Often, countries lurch from one crisis to the next • There is a high dependence on external funding, which is unsustainable • Policy and market failures persist	• Pervasive land-use conflicts make building consensus on critical issues extremely difficult • An unfavourable investment climate discourages long-term investments, and the focus is on drawing down natural capital • Institutions, including in forestry, are unable to perform satisfactorily • Illegality is widespread, and governments lack the means to reduce corruption • There are many opportunistic investors, whose main interest is short-term profit maximization • Severe environmental problems exist, including deforestation, land degradation, biodiversity loss and declines in water quality • The external environment is extremely unfavourable, affecting trade, investment and technology transfer. The worsening geopolitical situation undermines harmony and international collaboration

Source: Authors' own elaboration.

The processes involved in the scenarios are highly dynamic and could change depending on the impacts of various drivers. For example, the SDG-world scenario could suffer setbacks should major changes occur in the external environment, such as a war that encourages countries to pursue inward-looking policies; for example, the war in Ukraine has led to a rethinking among some countries on priorities for public expenditure, with defence getting higher outlays (The Economist, 2022), diminishing the resources available for other sectors. Collective global action on challenges like climate change would likely be a casualty of a major conflict. Disruptions to supply chains are encouraging countries to question the globalization route to development, negatively affecting cross-border investment, technology transfer and trade flows.

Several countries, including in the Pacific, rely on natural-resource extraction (e.g. logging and mining) for economic growth, and a quest for faster growth encourages the more rapid depletion of natural capital. This pathway tends to be unsustainable in the long term and the benefits short-lived. Often, a considerable proportion of income from resource booms is spent on import-driven consumption; when resources are depleted, the situation reverts to a low-income state.

Scenarios, by country group

The 14 Pacific SIDS have several characteristics in common, but differences also exist in the pathways they might follow towards socio-economic development. How the three scenarios might unfold in a given country depends largely on the initial conditions in that country; ideally, therefore, scenarios should be developed for each. In view of data and time constraints, this is infeasible here, and an attempt is made to provide a disaggregated assessment by adopting the grouping indicated in Table 2 (Chapter 1).

Another important issue in describing scenarios is the time horizon. Asia-Pacific Forest Sector Outlook Study III (FAO, 2019) adopted 2030 as the time horizon for a detailed assessment and 2050 to give a longer-term perspective. Specifying a precise horizon is less important (and meaningful) for scenario analysis that relies on qualitative information than it is for modelling-based forecasting approaches based on time-dependent variables. Here, it was decided to use the relatively short time horizon of 2030 to make it consistent with the timeframe for accomplishing most of the SDGs. How the three scenarios could unfold is discussed below for the three groupings of Pacific SIDS.

Group I: Papua New Guinea

Papua New Guinea stands out among the Pacific SIDS for its relatively large land area and population. Both these confer several potential advantages, but the country's ability to realize its potential is limited by:

- the fragmented distribution of the population and its ethnic and linguistic diversity, potentially limiting the ability to realize economies of scale; and

- the remoteness of many communities, requiring substantial investments in infrastructure to tap natural capital.

Table 31 indicates the key characteristics of the scenarios for Papua New Guinea and their implications for land use, especially forestry.

Table 31. *Implications of the three scenarios for Papua New Guinea*

Scenarios	General characteristics	Implications for land use and forestry
(1) SDG world	• Economic growth rates are moderate to high due to a more favourable global situation • The government strengthens customary tenure through a transparent process of land registration that clearly identifies actual owners • A robust system for the management of customary land is in place, with an emphasis on community-managed enterprises • Income leakages are plugged through improved governance, and government and landholders receive higher incomes • Investment in sustainable resource management increases, especially at the field level • Government creates a favourable ecosystem for the development of forest enterprises • Key elements for transforming the traditional bioeconomy into a modern bioeconomy are in place, taking advantage of developments in science and technology • Society's ability to withstand shocks improves considerably	• The area of forest under sustainable management increases continuously • Field-level capacity to manage forests sustainably and run community enterprises improves continuously • Key stakeholders realize the heritage value of biodiversity and put in place a system of community-based conservation to ensure it becomes an important source of income • Landowner income is enhanced through a transparent system of carbon trading • A national programme on forest and landscape restoration helps restore large areas of degraded forest land • As new income opportunities emerge, government and landowners become less dependent on logging and each community develops a locally appropriate and sustainable portfolio of income from diverse sources (with an emphasis on ecosystem services) • There is a continuous increase in the area of certified forest, and Papua New Guinea becomes a leader in the production of ethically produced goods and services • Forests and forestry become the foundation of a modern bioeconomy • Society is more resilient to internal and external shocks
(2) Business as usual	• Economic growth is low • Structural changes in the economy are slow, and dependence on agriculture and other land uses for employment and income persists • Population growth is high but, in the absence of a substantial increase in investment in human capital, the country fails to take advantage of the demographic dividend • Unemployment is high, especially among youth • Customary tenure reform faces various roadblocks, perpetuating disputes over land ownership and uncertainty about land and forest use • Efforts to reform policies and laws face two problems – a lack of coherence between policies and inadequate capacity, especially at the field level • Global demand for agricultural and forest products remains high • The government's intention to enhance value-adding is reflected in policies to phase out log export bans, but stand-alone policies remain ineffective	• An unsatisfactory budget situation limits the ability of government to make substantial investments in improving land and forest management • Government continues to pursue large-scale logging to generate revenue, notwithstanding concerns about revenue leakage through illegal practices • Uncertain tenure coupled with resource constraints results in the neglect of post-harvest forest management, leading to degradation • Large areas of forests are unregenerated, resulting in their structural, compositional and functional decline • Log export bans are circumvented through various means • Growth in global demand for agricultural products such as palm oil results in continued deforestation • The extractive sectors continue to boom but the country is not on track to accomplish the Sustainable Development Goals • Resilience is low and dependence on external support for overcoming shocks is high

Scenarios	General characteristics	Implications for land use and forestry
(3) Gloom and doom	• Society becomes more fragmented, and a failure to address longstanding issues related to customary ownership makes the situation worse • The situation is unfavourable globally and regionally due to conflicts, pandemics and other disruptions, drastically curtailing trade opportunities • Collective global action on crucial issues is undermined by geopolitical tensions • Weakening global efforts to reduce greenhouse-gas emissions worsens climate change, with society locked into a vicious cycle of worsening climate change, declining incomes and declining ability to pursue climate-change mitigation and adaptation • Declining income severely undermines the ability of government to provide services, and public trust in institutions erodes • Most stakeholders are focused on short-term benefits and fail to consider how these might affect others and future generations • Illegal practices are rampant, leading to rapid declines in natural capital • Worsening poverty reduces social resilience	• Forest governance weakens, and illegality is widespread • Illegal timber extraction, and a severe weakening of the system of checks and balances, lead to rapid resource depletion • Unsettled land ownership disputes discourage investment in the restoration of degraded land • Conflicting policies pursued by different ministries and departments undermine the pursuit of integrated approaches • Landgrabbing leads to the deprivation of traditional rights to land and forests • High investment risks discourage long-term investments, and the few investors operating in such an environment focus on quick returns through logging, mining and other extractive activities • Science and technology capacity is very low, and investments in research and development declines • Achieving almost all the Sustainable Development Goals seems out of reach

Source: Authors' own elaboration.

Group II: Other Melanesian Small Island Developing States

Group 2, which consists of the other three Melanesian countries, is in a relatively better position than Papua New Guinea, with some having made advances in their institutional arrangements for managing customary land. Fiji and Vanuatu have also diversified their economic base and reduced dependence on extractive sectors. Overall, a better governance framework exists, although implementation faces various challenges. Several successful community initiatives in natural resource management points to the potential for more of these. Table 32 outlines the implications for land use and forestry of the three scenarios.

Table 32. *Implications of the three scenarios for Fiji, Solomon Islands and Vanuatu*

Scenarios	General characteristics	Implications for land use and forestry
(1) SDG world	• Strong domestic commitments exist to the various Sustainable Development Goals (SDGs) • ·Countries make strong efforts to accomplish the SDGs, building on internal strengths and taking advantage of a favourable external environment • ·There is a significant expansion of community initiatives, drawing on the lessons of community-based resource management • Developments in information and communication technologies percolate to all levels, enhancing ease of access to information, transparency and accountability	• Democratically functioning community-level institutions take lead roles in natural resource management • Policies and legal frameworks focus on providing a level playing ground for all stakeholders • Effective mechanisms for dispute resolution are in place • The benefits of forestry and other natural-resource management are distributed equitably • Systems of payments for ecosystem services are streamlined, and all countries establish effective mechanisms for overseeing carbon trade and ensuring that resource owners get a fair share of the benefits

Scenarios	General characteristics	Implications for land use and forestry
(2) Business as usual	• Economies are relatively more diversified and poverty is relatively low (except in Solomon Islands) • Relatively well-developed policy and institutional frameworks are capable of addressing emerging problems • Growing economic diversification reduces pressure on land, except in the context of major economic downturns • The strategic location of the countries leads to a changing geopolitical environment	• Land use becomes more streamlined and institutions for managing land are better developed • There is substantial community engagement and several successful instances of community natural resource management • Large-scale native-forest logging is discontinued except in Solomon Islands, and most natural forests are set aside for the provision of ecosystem services • Many communities take advantage of payments for ecosystem services, although imperfections in the systems persist • An increasing share of wood comes from planted forests managed by public-sector entities (in the case of Fiji) and private-sector and agroforestry areas • There is increased emphasis on the production of high-value wood (e.g. mahogany and teak) and non-wood forest products (e.g. sandalwood, kava and ngali nuts) • Value-adding still focuses on low-end products and the potential for producing high-end products remains unrealized
Gloom and doom	• Policies are ineffective and governance is poor • A weakening of democratic institutions undermines transparency, accountability and the equitable distribution of benefits • The external environment is unfavourable, leading to a failure to pursue collective global action to address climate change, biodiversity loss, food insecurity and other challenges. Narrow national interests prevent the pursuit of effective collaborative efforts	• Land and forest use is unsustainable • Weak governance results in unbridled exploitation of forests and other resources, with negative economic, social and environmental impacts • Illegality becomes widespread, and most of the benefits of natural-resource exploitation accrue to only a few • Investments for achieving sustainability decline drastically • The ability of societies to deal with various vulnerabilities diminishes drastically

Source: Authors' own elaboration.

Group III: Micronesian and Polynesian Small Island Developing States

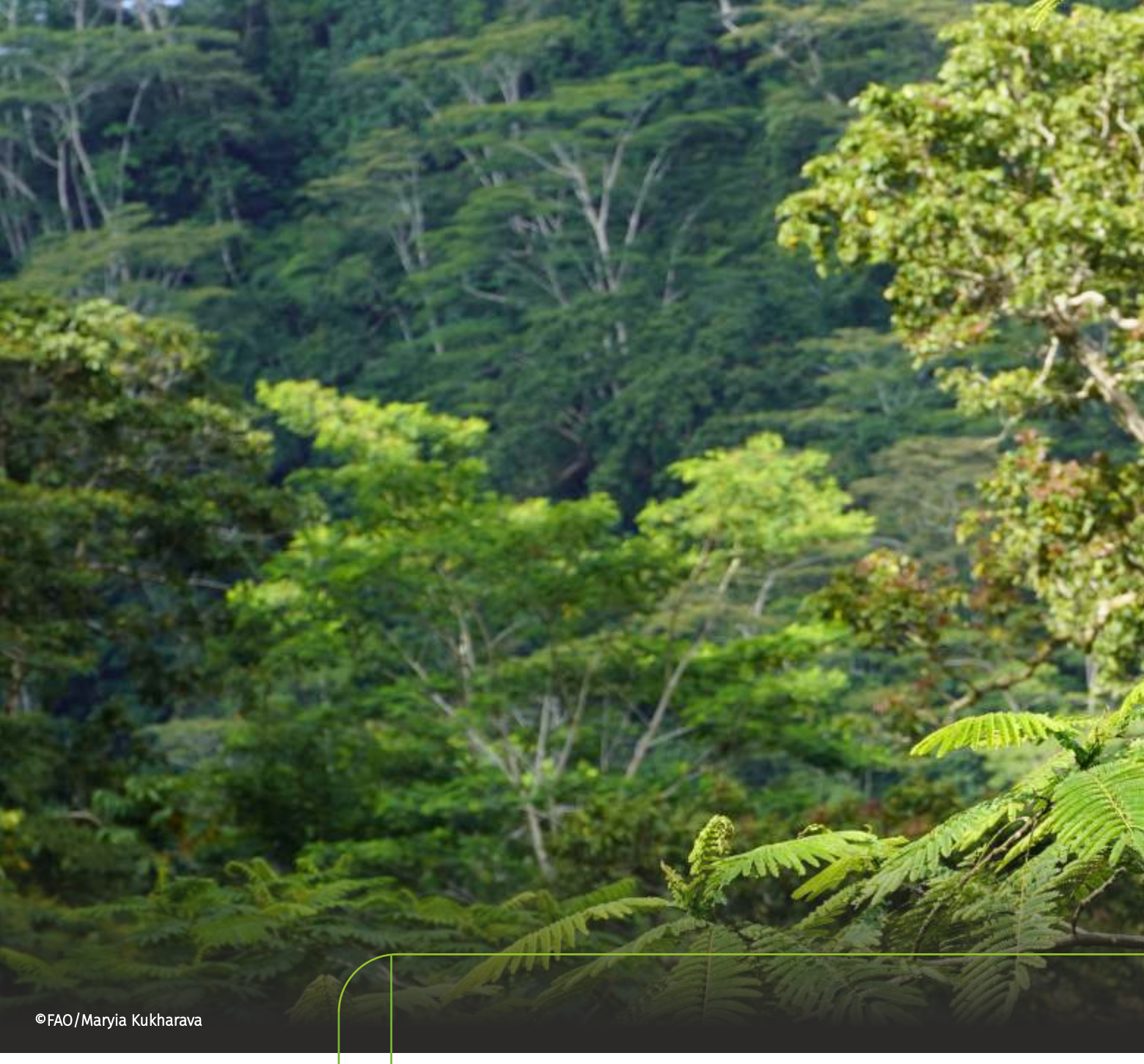
Table 33 indicates how the three scenarios might affect land use and forestry in the Micronesian and Polynesian countries.

Table 33. *Implications of the three scenarios for Micronesian and Polynesian countries*

Scenarios	General characteristics	Implications for land use and forestry
(1) SDG world	• A highly favourable global economic and political environment promotes collective action, especially to address climate change, biodiversity loss and poverty • The national governance system benefits from a favourable external environment • Access increases to investment funds, technologies and markets	• External support for various adaptation measures increases significantly • Community involvement in integrated resource management deepens, especially to protect vital ecosystems such as upland forests and mangroves • The development of a "blue" economy reduces pressure on land, and surpluses are directed towards improving land management to increase the flow of ecosystem services

Scenarios	General characteristics	Implications for land use and forestry
(2) Business as usual	• Most countries face severe constraints in the availability of land and forest resources • Increased vulnerability to climate-change-related events such as sea-level rise, tropical cyclones and drought significantly affects economies and livelihoods • The availability of water is a major constraint • There is a high level of dependence on external support such as official development assistance and remittances	• Most countries develop appropriate policies but severe resource constraints undermine implementation • Environmental protection - especially of watersheds and coastal ecosystems - is a priority, but institutional and financial constraints affect the pace of efforts • There is no scope for a sectoral approach, and integrated approaches are unavoidable • There is no scope for wood production for global markets, except for some high-value products • Governments and landowners are unable to generate much income from the production of wood and the provision of ecosystem services
(3) Gloom and doom	• The global commitment to the Sustainable Development Goals is extremely weak • Most countries focus on their own narrow short-term interests and fail to develop collaborative approaches for dealing with major challenges • The willingness to support developing countries to address various challenges is limited • Governance systems at the national level become inefficient, unaccountable and opaque	• Frequent disasters, global economic downturns and inward-looking policies result in drastic reductions in income • Key economic sectors such as tourism are affected by the negative external environment • The ability of societies to manage land and other resources sustainably is severely compromised • Crucial ecosystem functions, especially upland watershed conservation and coastal-zone protection, are negatively affected • Disasters and upland degradation undermine livelihoods and lead to greater outmigration

Source: Authors' own elaboration.



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07

Key points

- The Pacific SIDS must navigate highly complex domestic and global environments characterized by enormous uncertainties. Existential threats stemming from climate change loom large, and people's aspirations for a better life must be met with limited resources.
- A range of potential forestry and other land-use interventions are proposed here that could help countries adapt to climate change and flourish. These interventions can be placed in the following three main categories:

THE WAY FORWARD: PRIORITIES AND STRATEGIES

1. Forest production systems - developing and operationalizing adaptation plans; improving the long-term sustainability of wood production in natural forests; restoring logged-over forests; assessing the scope for planted-forest development; maximizing the potential of agroforestry; placing more emphasis on high-value species and products; and maximizing resilience by safeguarding ecosystem services.
2. Trade and processing - encouraging intra-Pacific trade to help meet domestic timber demand; weighing the pros and cons of policies to promote downstream processing; and taking a long-term perspective on carbon to avoid overcommitting to selling carbon-related services while prices are low.
3. Governance - ensuring institutional adaptability; developing hybrid institutional and governance models that combine the strengths of informal and informal systems; strengthening strategic planning capacity; increasing capacity in science and technology and the adoption of innovation; and building human capital, for example by creating a subregional Pacific human resources development centre to help develop the knowledge and practical skills required for forestry in coming decades.

The three scenarios outlined in the previous chapter provide an indication of the opportunities and challenges facing the Pacific SIDS in their endeavours to manage their lands and forests sustainably and accomplish socio-economic development. Weaknesses in governance, innovation and the capacity to attract investment in critical areas undermine the potential for achieving an "SDG world", with most countries more likely to tread along a business-as-usual path. Particular attention needs to be paid to improving governance: a failure to do so, and an associated lack of investment, could lead towards the "gloom and doom" scenario.

This chapter outlines some of the priorities and strategies that the Pacific SIDS may wish to pursue to enable a shift towards the SDG-world scenario and away from the unacceptable gloom-and-doom scenario, building on intervention areas identified in previous outlook studies (e.g. FAO, 2010; FAO, 2011a; FAO, 2019).

Priority areas

Given differences in biophysical and socio-economic settings and the divergent development pathways, priority areas for forestry and agroforestry will differ considerably among the Pacific SIDS. Table 34 sets out possible priority areas for the three groupings (as defined in Table 2).

Table 34. *Possible priority areas for forestry and agroforestry, Pacific Small Island Developing States*

	Priority area
I. Papua New Guinea	• Be a leader in high-quality, sustainably produced tropical timber and timber products in natural forests and plantations • Expand and intensively manage planted forests to cater to growing regional and global wood demand • Be a key player in the provision of global public goods, especially carbon storage and the conservation of biological, cultural and linguistic diversity • Develop forests and agroforests as major sources of income, producing a wide range of livelihood products and services
II. Other Melanesian countries	• Improve the integration of forestry with other land uses through landscape approaches • Scale down dependence on natural forests for wood production and enhance wood production from planted forests involving smallholders, community groups and private-sector investors • Ensure the continued provision of ecosystem services, including for ecotourism, especially watershed protection, amenity values and improved coastal-zone management • Produce high-value non-wood forest products and their downstream processing
III. Micronesia and Polynesia	• Fully integrate forests and forestry with other land uses and add value to other important economic activities, such as tourism • Set aside natural forests primarily for their multiple ecosystem services, especially watershed values • Improve the management of mangroves and coastal forests for coastal-zone protection and the production of wood and non-wood forest products • Encourage community/smallholder-managed woodlots for meeting domestic demand for wood and wood products • Encourage mixed-cropping systems, especially agroforestry - including coconut trees – to cater for wood demand and the production of high-value niche products

Note: This table presents possible priorities based on the preceding analysis and is provided as a basis for discussion. It is not intended to be prescriptive.

Source: Authors' own elaboration.

Key interventions

Develop and operationalize adaptation plans for all forest production systems

In a climate-change-affected world, the focus of most countries will be on adaptation, and this is especially the case in the Pacific SIDS, which are already facing multiple climate-change-related challenges. Particular attention could be given to:

- Reducing the economic and environmental risks associated with the various forest production systems - industrial roundwood production in natural forests, wood production in planted forests, the production of non-wood forest products, the management of forests for the provision of ecosystem services, and the multiple-use management of agroforestry systems. There is a need to systematically consider these risks and pursue appropriate action to minimize them and increase the resilience of the various production systems.
- Phasing out production systems that are most vulnerable to climate change, replacing them with more resilient systems.

Every economic sector and segment, including forestry, will need to develop and operationalize adaptation plans in the next few years.

Improve the long-term sustainability of wood production in natural forests

Large-scale logging in natural forests emerged as a hallmark of forestry in Papua New Guinea and Solomon Islands, but the sustainability of this approach is a key concern for both countries. The current level of wood production in natural forests in Solomon Islands is unsustainable, and the country will need to develop a transition plan to ensure a balanced approach to wood production involving reducing dependence on natural forests and increasing production in planted forests, community forests and agroforests, building on its diverse experience.

Industrial roundwood production in natural forests is seen as a low-risk investment by logging companies and as a source of income by governments and landowners. It often fails to consider various externalities, however, including social and environmental damage. Papua New Guinea has an elaborate process for the allocation of concessions, but the field-level implementation of this and monitoring compliance are far from satisfactory, due largely to the limited resources deployed. On the demand side, importers are increasingly required to factor in legality and sustainability considerations in procuring wood. Possible interventions include:

- significantly strengthening field-level capacity for monitoring compliance with rules and regulations, including codes of logging practice;
- developing and implementing effective certification systems to provide importers with assurance that the products they buy fully comply with social and environmental obligations;
- developing (in importer countries) appropriate legality frameworks to curtail imports of illegal timber;
- strengthening traceability and chain-of-custody systems, especially taking advantage of technological innovations;
- curtailing fraudulent practices - for example transfer pricing through subsidiary companies - that result in revenue leakage;
- developing transparent, just and equitable systems for income-sharing between landowners and other stakeholders; and
- for banks and other financial institutions, in extending credit to forest industries, ensuring that recipients comply with environmental, social and financial regulations and do not indulge in fraudulent practices.

Restore logged-over forests

- Forest degradation due to logging has been identified as the most carbon-emitting activity in Papua New Guinea, and the situation is unlikely to be different in the other major tropical timber producer, Solomon Islands. Restoration will be crucial for rebuilding carbon stocks and achieving sustainable wood production and the provision of ecosystem services. In countries with large areas of degraded forests, potential interventions include:
- developing appropriate institutional arrangements to undertake restoration;
- building technical capacity for restoration through collaborative R&D efforts; and
- creating a dedicated fund for the restoration of degraded forests and mobilizing finance from diverse sources.

Encourage intra-Pacific trade to help meet domestic timber demand

Small-scale logging is widespread in most Pacific SIDS, and it plays an important role in meeting domestic demand and providing income and employment for local communities. Domestic demand for timber, especially for construction, is expected to increase in coming decades, with timber becoming preferred over high carbon-footprint alternatives as a construction material. Demand in wood-deficit Pacific SIDS could be met through increased intra-Pacific SIDS trade.

Carefully weigh the pros and cons of policies to promote downstream processing

Downstream processing and value-adding is on the agenda of log-exporting countries in the Pacific as a means for increasing domestic employment and income and helping them emerge as exporters of manufactured products rather than raw materials. Some governments are willing to incentivize domestic processing with log export bans and tax incentives. The pros and cons of such approaches need careful assessment given that some superficially attractive options could be costly in the long term yet fail to generate the envisaged benefits. Industry-specific incentives often have limited impacts, especially when the overall ecosystem for development of the manufacturing sector remains unfavourable.

Assess the scope for planted-forest development

Although some Pacific SIDS have long histories in the development of planted forests, the pace of new plantation establishment has slowed considerably in the last decade. Customary tenure, the increasing risk of climate-change-related extreme events, and a host of economic factors may be disincentivizing plantation investments, although there is scope to grow high-value species as integral components of mixed-farming systems. Although the technical aspects of growing trees are well understood, several economic issues, such as fragmented markets and a lack of infrastructure, need to be addressed to increase the attractiveness of tree-growing for farmers and other landowners. Efforts to encourage plantation development should consider the overall situation, including the "last mile" connectivity with end users.

Maximize the potential of agroforestry

Mixed-farming systems predominate in most Pacific SIDS, and they play key roles in the livelihoods of households while increasing resilience. A wide array of agroforestry practices has evolved to suit specific socio-economic and ecological contexts. Especially for the smaller Pacific SIDS with limited land, agroforestry is probably the most important option for producing wood and other forest products to meet local demand. Practices have evolved locally based on farmer innovation, and continued adaptation may be expected as circumstances change. Agroforestry can be supported by institutional arrangements - for example tree-grower cooperatives - that enable landowners to address new challenges. ICTs have the potential to increase access to knowledge on technology and markets.

Place more emphasis on high-value species and products

In deciding what to produce, the Pacific SIDS could focus on species and products with high value in regional and global markets. The limited extent of land in most countries suggests they will struggle to compete in certain markets with countries where land is less of a constraint, but examples exist where Pacific SIDS have comparative advantages. Fiji has developed one of the world's largest mahogany plantations, and it could focus on enhancing its competitive advantage by investing in productivity improvements, value-adding and the development of new products. Sandalwood is another high-value species with a long history of production in the Pacific SIDS. Papua New Guinea has developed a flourishing balsa industry involving both company- and farmer-managed plantations. Several NWFPs are unique to the Pacific SIDS, and the subregion's rich biodiversity suggests potential for the discovery, development and marketing of many new products.

Maximize resilience by safeguarding ecosystem services

All the Pacific SIDS should work to safeguard the ecosystem services provided by forests, wetlands and coastal ecosystems because they enhance productivity both directly and indirectly and maintain water quality and quantity, among other benefits. Several initiatives - such as the Ridge to Reef programme - are adopting integrated approaches to land management. Many studies have shown the important role of mangroves in protecting coastal communities from cyclones, storm surges and coastal inundation and supporting local livelihoods, and they also help protect the marine environment - a key source of livelihood for local communities.

Take a long-term perspective on carbon

Much has been said about new opportunities stemming from the provision of ecosystem services and the potential to generate income for landowners based on their efforts to conserve forests, reverse degradation and manage forests sustainably. Substantial groundwork has been done to create conditions that enable landowners and managers to benefit from results-based payments for carbon services, and several initiatives are underway in the Pacific. In making long-term trading commitments, however, caution should be exercised for the following reasons:

- Carbon markets are in the early stages of development and will take time to mature and ensure integrity. They have exhibited extreme fluidity in their early years and may be dominated by profit-seekers, especially

intermediaries, with little interest in genuine emission reductions or ensuring that landowners obtain reasonable returns for their forest conservation efforts.

- With the global community preparing to achieve meaningful emission reductions, carbon prices are bound to go up. Making long-term commitments to sell carbon at the currently prevailing low prices could mean a significant loss of future income for resource owners.
- Rapid socio-economic development in the Pacific SIDS will involve growth in the industrial and services sectors, which will likely entail increases in GHG emissions. It is possible that many of the carbon credits generated by forestry in the Pacific SIDS will be needed to fulfil nationally determined contributions and meet the goal of carbon neutrality.

Pacific SIDS could develop a long-term perspective on GHG emissions management, with the carbon trade likely to undergo major changes in coming decades as prices go up and governance improves. Countries should avoid making long-term commitments on their carbon assets. Due consideration should be given to developing effective systems of carbon governance, such as national carbon banks.

Ensure institutional adaptability

Almost all Pacific SIDS have reformed policies on land and forests while keeping the framework of customary ownership intact, and many laws and rules have been created to regulate the management and use of forest resources. Such reforms, however, have not been accompanied by concomitant changes in institutional arrangements and, in many cases, institutional rigidities and limitations undermine the efficacy of well-intentioned policies and laws. Often, there is overlap and duplication of effort in decision-making, and the capacity to implement policies and legislation on the ground falls far short of what is required. There is a strong case for an objective assessment of the functions and structures of existing institutions. There is scope for integrated frameworks, especially in policy-making and planning, and the redirecting of resources towards the people- resources interface. The delivery of services such as technical advice and marketing support to landowners and other stakeholders, and the building of local-level institutions for collective action, warrant greater attention.

Institutional change should encompass other players, too, such as international agencies, civil-society organizations, R&D institutions, corporate players and financial institutions. The systems and procedures for obtaining finance tend to be complex, time-consuming and opaque. Pacific SIDS with limited human resources find it difficult to navigate the process of accessing funds, often compelling them to use outside experts, which is costly. Financial institutions, especially banks, need more stringent mechanisms for scrutinizing lending to ensure that funds are not used for illegal activities and that borrowers comply fully with social, cultural and environmental requirements. Care is needed to avoid the fragmentation of technical and financial support and to strengthen cohesion and collaboration as the geopolitical situation in the Pacific becomes more complex.

Develop hybrid institutional and governance models

Informal economies and their associated institutions play important roles in the management of natural resources in the Pacific SIDS. Customary landownership, which ensures access to land, enables communities to thrive, even in difficult times. Informal economies, with their networks of arrangements, act as safety nets when formal systems are under stress, such as occurred during the COVID-19 pandemic. Many development interventions, however, have focused on building formal economies and discouraging informal ones.

Realizing the potential of informal systems requires an understanding of how these have developed and performed and what needs to be done to take advantage of their strengths and overcome their weaknesses. More systematic work is required in this area so that hybrid approaches combining the strengths of informal and formal systems can be developed that enable the adaptive management of land and forest resources.

Strengthen strategic planning capacity

The lack of strategic planning capacity in support of sustainable land and forest management is a key challenge in the Pacific SIDS. Many land-use interventions are opportunistic, focusing on short-term benefits and often influenced by outside interests. The absence of in-country capacity to undertake strategic planning has led to an overreliance on external expertise, which tends to be costly. Pacific SIDS could:

- increase their strategic planning capacity in the forest sector with a view to fully considering long-term needs;
- invest in improving the data needed for effective strategic planning, such as on the state of forest resources, forest production, the trade in and consumption of forest products, forest product value chains, and markets for ecosystem services; and
- encourage and support interdisciplinary research, with a greater focus on socio-economic aspects.

Increase capacity in science and technology and the adoption of innovation

Moving away from business as usual and building sustainable societies in the Pacific SIDS will require substantial uptake of new technologies and innovations, especially those that address inherent constraints. There is an urgent need to strengthen innovation capabilities, which will require a significant increase in funding and human resources. A strong case can be made for a subregional "forestry and agroforestry innovation centre", particularly to support countries facing constraints in the development and adoption of innovation. Among other things, such a centre could help improve innovation strategies, facilitate learning among institutions and countries, and encourage local innovation for adaptive management, building on the existing wealth of indigenous knowledge.

Build human capital for an SDG world

A major challenge for forestry in the Pacific SIDS is the lack of human resource capacity, especially at the professional level. Many countries find it difficult to prepare fundable project proposals without external expertise. Given likely technological developments in the future, employment opportunities in many traditional activities are likely to shrink and new areas emerge. There will be a need to provide green jobs and to ensure these are sufficiently remunerative to meet the aspirations of the burgeoning youth demographic. New opportunities are emerging as demand increases for forest ecosystem services, but taking advantage of these will require significant efforts to build human capital in forestry and allied land uses. The creation of a subregional forestry human resources development centre would help develop the knowledge and practical skills required for forestry in coming decades.

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Subregional Office for the Pacific Islands
SIDS Street, Tuana'imato
APIA, Samoa
SAP-SRC@fao.org

Food and Agriculture Organization of the United Nations
Apia, Samoa

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