



Advancing Climate Resilience, Biodiversity Conservation, and Human Well-Being Through Nature- Based Solutions in Aquaculture

Lessons from Fiji

IISD REPORT



© 2026 International Institute for Sustainable Development
Published by the International Institute for Sustainable Development
This publication is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is a globally recognized think tank with more than 30 years of experience working to solve today's greatest sustainable development challenges. We combine deep expertise across critical policy areas with a collaborative approach to research, advice, and hands-on support that delivers real-world results. Headquartered in Winnipeg, Manitoba, we are a diverse team of over 300 experts working from offices in Canada and Switzerland as well as other locations around the world.

IISD's headquarters in Winnipeg are situated on Treaty 1 Territory—the ancestral lands of the Anishinaabe (Ojibwe), Ininiw (Cree), Anisininew (Ojibwe Cree), Dene, and Dakota Nations, and the homeland of the Red River Métis Nation.

IISD is a registered charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Province of Manitoba and project funding from governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

iisd.org

Advancing Climate Resilience, Biodiversity Conservation, and Human Well-Being Through Nature-Based Solutions in Aquaculture: Lessons from Fiji

September 2026

Written by Veronica Lo on behalf of AQUA-Pearl partners

Photo: Melonie Ryan/Acronym Design

Acknowledgements

The author gratefully acknowledges the contributions of AQUA-Pearl partners and collaborators—The Pacific Community, J. Hunter Pearls, Wildlife Conservation Society, and the Fiji Ministry of Fisheries and Forests. Many thanks to Chinthaka Hewivitharane, Kevin Ellard, Boripat Lebel, Alec Crawford, Neomai Ravitu, Rosi Batibasaga, Joelle Albert, and Justin Hunter for their review and input. This work was carried out with the aid of funding from the Government of Canada's International Climate Finance Initiative and the International Development Research Centre (IDRC), Ottawa, Canada. The views expressed herein do not necessarily represent those of IDRC or its Board of Governors.



Key Points

- Nature-based solutions (NbS) in aquaculture enhance climate resilience, human well-being, and biodiversity; restore ocean and coastal ecosystem functions; and support the diversification of the aquaculture sector.
- Multiple policy objectives can be met through the implementation of NbS in aquaculture, but this requires enhanced collaboration across different ministries and sectors.
- In Fiji, plans and policies relevant to inclusive NbS in aquaculture need stronger alignment with and integration of climate resilience and biodiversity conservation objectives, which requires strong inter-agency coordination, ongoing stakeholder engagement, and greater political will.
- Countries aspiring to adopt NbS in aquaculture will need to implement key actions to address the challenges of climate change, financial barriers, market access, and customary land and sea tenure systems, as well as to support public-private partnerships.



Table of Contents

1.0 Introduction	1
1.1 Challenges for Fisheries in a Changing World.....	1
1.2 The Role of Nature-Based Solutions	1
2.0 NbS in the Aquaculture Sector.....	3
2.1 Aquaculture: A rapidly expanding sector	3
2.2 A Need for Sustainable and Equitable Models of Aquaculture	3
2.3 Nature-Based Solutions	4
2.4 Extending the NbS Concept to Aquaculture	5
2.5 Examples of NbS in Aquaculture.....	7
3.0 Integrating Climate Resilience and Biodiversity Into Inclusive Aquaculture Practice and Policy in Fiji	9
3.1 Climate Change.....	10
3.2 Tenure Systems.....	10
3.3 Market Access	10
3.4 Capacity.....	11
3.5 Policy Environment for NbS in Aquaculture in Fiji.....	11
4.0 Integrating Climate Resilience, Biodiversity Conservation, and Human Well-Being Into NbS in Aquaculture: Key recommended actions.....	16
5.0 Summary.....	19
References	20
Appendix A. Policies and Plans Relevant to Nature-Based Solutions in Aquaculture in Fiji.....	26



List of Figures

Figure 1. What are NbS in aquaculture?	6
Figure 2. Core enabling requirements to align biodiversity, climate, fisheries, and development policies in support of NbS in aquaculture	15

List of Tables

Table 1. Frameworks related to NbS in aquaculture	7
Table 2. Policies and plans relevant to NbS in aquaculture in Fiji	11

List of Boxes

Box 1. AQUA-Pearl.....	2
------------------------	---



1.0 Introduction

1.1 Challenges for Fisheries in a Changing World

The deepening climate change and biodiversity loss crises, combined with unsustainable fishing and aquaculture practices, pose significant challenges for meeting global food and marine livelihoods needs. Warming oceans, rising acidity levels, coral bleaching, invasive species, overfishing, and pollution are among the drivers of negative change pushing many aquatic ecosystems to the brink while also undermining the livelihoods, food security, and the well-being of millions who depend on them.

Almost nowhere are fish more culturally and economically important than in the Pacific Islands. Across the region, household fish consumption is 3–5 times higher than the global average (Johnson & Wabnitz, 2025). As in many other parts of the world, increasing population pressures, resource demands, and pollution are exacerbating climate impacts and environmental degradation in this region (Johnson & Wabnitz, 2025). In Fiji, aquatic foods are a vital source of protein, vitamins, and minerals. However, a deficit in fish protein is projected by 2050 based on current climate projections, fisheries catch trends, and average consumption levels (Pacific Community, 2025c). New, sustainable, and equitable approaches to fishing and aquaculture are urgently needed for maintaining food and nutritional security and enhancing inclusive livelihoods.

1.2 The Role of Nature-Based Solutions

Within this context, there is a growing policy imperative for implementing nature-based solutions (NbS), given evidence of their increased economic efficiency and ability to deliver multiple societal benefits (Chausson et al., 2024; Lo et al., 2022). Yet, work remains on scaling up NbS and integrating the concept across sectors, including fisheries and aquaculture (the latter meaning the cultivation of aquatic animals or culturing of seaweeds). NbS in aquaculture is closely related to sustainable aquaculture, but a key difference is that NbS in aquaculture explicitly aims for net benefits for nature alongside improvement of human well-being. NbS in aquaculture can bring multiple benefits to Pacific communities and can help achieve several policy objectives, including those on climate adaptation, food and nutritional security, livelihoods, and ecosystem functioning.

This technical brief discusses the challenges and opportunities for policy-makers in integrating national adaptation, biodiversity, and well-being priorities into the plans and policies governing Fiji's aquaculture sector. It draws on work conducted by the International Institute for Sustainable Development (IISD), the Wildlife Conservation Society Fiji, J. Hunter Pearls, and the Pacific Community on community-led pearl oyster aquaculture through the AQUA-Pearl project (see Box 1). Key actions are recommended for government partners, stakeholders, and other actors aspiring to achieve sustainable, climate-resilient growth in the fisheries and aquaculture sector.



Box 1. AQUA-Pearl

The AQUA-Pearl project scales up gender-responsive and inclusive NbS incorporated into aquaculture systems in Fiji through the development of community-led edible pearl oyster farms (IISD, n.d.).

AQUA-Pearl addresses the intertwined critical challenges of climate change, biodiversity loss, and food and livelihood insecurity by

- developing gender-responsive, climate-adaptive aquaculture initiatives based on assessing climate and gender vulnerabilities, risks, and opportunities;
- integrating community values and preferences into aquaculture initiatives;
- identifying entry points for aligning fisheries and aquacultural development plans with national adaptation, biodiversity conservation, gender, and development priorities;
- establishing a partnership with the private sector to provide technical expertise; and
- fostering knowledge-sharing and capacity-building on NbS within aquaculture systems among civil, national, and local authorities from Fiji and other Pacific Island states.

AQUA-Pearl is implemented by IISD in partnership with J. Hunter Pearls and the Wildlife Conservation Society Fiji, and in cooperation with the Pacific Community and Fiji's Ministries of Fisheries and Forests, Environment, and Health. Outcomes include the establishment of two community-led pearl farms in Vanua Levu governed as a gender-responsive co-operative, with measurable increases in fish and seaweed along the oyster lines. A national quality assurance program for shellfish is being established, aligned to international standards and best practices, while supporting sustainable livelihoods and market linkages.

The project builds on a previously piloted community-led oyster aquaculture project and is part of the Nature-based Climate Solutions in Aquacultural Food Systems in Asia-Pacific initiative (AQUADAPT). This 4-year initiative aims to drive research action toward inclusive, NbS in aquaculture and a better understanding of how such solutions can contribute to climate change adaptation, biodiversity conservation, and food security in Southeast Asia and the Pacific region. AQUADAPT is carried out with the aid of funding from the Government of Canada's International Climate Finance Initiative and the International Development Research Centre, Ottawa, Canada (International Development Research Centre, n.d.).



2.0 NbS in the Aquaculture Sector

2.1 Aquaculture: A rapidly expanding sector

Aquaculture has grown significantly since the late 1980s. Statistics from the Food and Agriculture Organization of the United Nations' (FAO's) *The State of World Fisheries and Aquaculture 2024* reveal the following (FAO, 2024):

- Aquaculture production surpassed capture fisheries for the first time in 2022, with production of aquatic animals amounting to 94 million tonnes (or 51% of the total combined fisheries and aquaculture production). An additional 36.5 million tonnes of algae was produced in 2022.
- The fisheries and aquaculture sector supports 62 million livelihoods globally, mostly in artisanal and small-scale operations, with at least 36%—more than 22 million people—engaged in aquaculture.
- The growth of aquaculture is variable across regions and countries. Ten countries dominate aquaculture production, with China, Indonesia, India, Vietnam, Bangladesh, the Philippines, Republic of Korea, Norway, Egypt, and Chile representing approximately 90% of the industry, whereas low-income countries in Asia and Africa make up only a small share of total global aquaculture production. While globally insignificant, the sector is still important at the local level for livelihoods and food.

While aquaculture production is growing, capture fisheries are facing increasing pressures, including coastal development, pollution, fisheries mismanagement, and climate change impacts (for example, extreme weather events, ocean warming, acidification, and sea level rise). Thus, there is a strong imperative to scale up and intensify aquaculture in response to decreased fisheries yields and in pursuit of economic development, particularly in developing countries, while keeping in mind the socio-economic, nutritional, and food security risks associated with aquaculture expansion (FAO, 2024; Sumaila et al., 2022).

2.2 A Need for Sustainable and Equitable Models of Aquaculture

The dominant form of aquaculture is “fed” aquaculture—an example is finfish, which requires fishmeal inputs, typically produced from smaller pelagic and juvenile fish such as anchovies and sardines. However, these forage fish are important for marine food chains, as well as the nutrition and livelihoods of developing coastal nations (Cashion et al., 2017). Non-fed aquaculture, such as rearing oysters or seaweed, can be more sustainable, as no external feed is required. Such non-fed species can contribute to ecosystem services such as water filtration and carbon sequestration, thus having higher potential than finfish for addressing climate change, biodiversity loss, and food insecurity (Wong et al., 2024). Unfortunately, the global share of non-fed aquaculture is decreasing in favour of fed aquaculture: it currently represents less than a third of total aquaculture production (~27%) in 2022, compared to ~40% in 2000 (FAO, 2024).



Beyond overfishing forage fish for fishmeal, intensive commercial aquaculture can result in the degradation of ecosystems and habitats. In coastal zones, the extensive clearing of mangrove forests for shrimp farming is a primary driver of habitat loss and a decline in biodiversity declines, as well as pollution and persistent soil and water salinization (Aslan et al., 2021; de Lacerda et al., 2021, Sanpatamit et al., 2020; Tran et al., 2025). Aquaculture of finfish in net pens, such as salmon, can spread diseases to wild populations when unnaturally high stocking densities of farmed fish lead to an amplification of pathogens (Bass et al., 2024, Krkosek et al., 2024). Waste and effluent from the farms containing antibiotics and lice treatment chemicals also pollute the surrounding environment (Adenaya et al., 2023, Avendaño-Herrera et al., 2023). Mass die-offs can also result from a combination of factors related to feed, disease, management, or environmental factors such as temperature and dissolved oxygen concentration (Sajid et al. 2024).

Adding to the environmental challenges, the human impact of intensive aquaculture has also resulted in socio-economic impacts. Inequalities, a lack of decent work, and human rights violations have been associated with certain intensive aquaculture practices. A lack of social safety nets, slave labour, child labour, sexual abuse, and human trafficking have been documented (Brugere et al., 2024), in addition to gender inequalities (Mangubhai & Lawless, 2021; Mangubhai et al., 2023).

2.3 Nature-Based Solutions

While there is large potential for the intensification of aquaculture, more sustainable models are needed that provide equitable benefits to and participation of communities and respect the rights of Indigenous Peoples and local communities.

NbS are increasingly being promoted as an integrated solution to the climate and biodiversity crises. This follows decades of policy advocacy and implementation experience on closely related practices such as ecosystem-based adaptation (EbA), ecological restoration, community-based adaptation, climate-smart agriculture, and others (Lo et al., 2016). Parties to the UN Convention on Biological Diversity (CBD) had adopted the term “ecosystem-based adaptation” in 2009 and subsequent guidelines on their effective design and implementation in 2018 (CBD, 2019). A year later, the framing for the umbrella term “nature-based solutions,” which encompasses EbA, was developed by the International Union for Conservation of Nature (Cohen-Shacham et al., 2019). The United Nations Environment Assembly formally adopted a definition in 2022:

Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits. (United Nations Environment Assembly, 2022)

In tandem, the role of Indigenous values, cultures, and worldviews in stewarding nature is increasingly being acknowledged as central to addressing the challenges of biodiversity loss and climate change impacts (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2024).



While NbS have largely been promoted as “solutions” to support climate mitigation, climate adaptation (EbA), disaster risk reduction, and restoration of degraded land (e.g., forest landscape restoration), there remains a gap in integrating conservation and restoration of nature across economic sectors, including fisheries and aquaculture (Castelleri et al., 2021; Martin et al., 2025).

2.4 Extending the NbS Concept to Aquaculture

In recent years, several definitions for sustainable approaches to aquaculture have been proposed (Table 1). Pre-dating NbS, fisheries scientists and stakeholders had been discussing and testing various interpretations of an “ecosystem-based approach” to fisheries. As with NbS, vigorous debate occurred with different framings and principles proposed for an ecosystem-based approach to fisheries. With discussions on NbS picking up pace within multilateral environmental negotiations, there is a parallel movement toward extending the concept of NbS to the aquaculture sector to integrate elements of enhancing human well-being, biodiversity, and ecosystem functioning, all while addressing food insecurity (Harohau et al. 2025, Le Gouvello et al. 2022).

Extending the NbS concept to aquaculture, NbS in aquaculture refers to aquaculture practices and management approaches that protect, conserve, restore, and sustainably use and manage natural or modified freshwater and marine ecosystems while enhancing human well-being, climate resilience, biodiversity, and ecosystem services (Figure 1). NbS in aquaculture

- contribute to human well-being through income generation, inclusive participation in aquaculture, and access to nutritious aquatic food products;
- support increased biodiversity and ecosystem functioning by enhancing water quality, providing habitats, and sequestering carbon (such as via non-fed bivalve or seaweed farming); and
- enhance climate resilience of communities by providing alternative livelihoods or income streams, providing food sources in the face of declining fish yields, and facilitating practices that support climate adaptation. For example, farms and processing facilities can be selectively sited in naturally sheltered bays with less exposure to storms and cyclones; the lines supporting bivalves or seaweeds can be suspended deeper in the water column to shelter from storm action or adjusted to reach optimal temperatures and salinity for growth; and baskets or lines can also be translocated to avoid the risk of contamination from excess runoff from rainfall or seasonal flooding events.

NbS in aquaculture is closely related to sustainable aquaculture, but a key difference is that NbS in aquaculture explicitly aims for net benefits to nature alongside improvement of human well-being. Sustainable aquaculture practices such as using renewable energy to reduce carbon footprints or containing/treating pollution are complementary approaches, but net-positive ecosystem benefits (compared to pre-intervention levels) are not a primary objective.

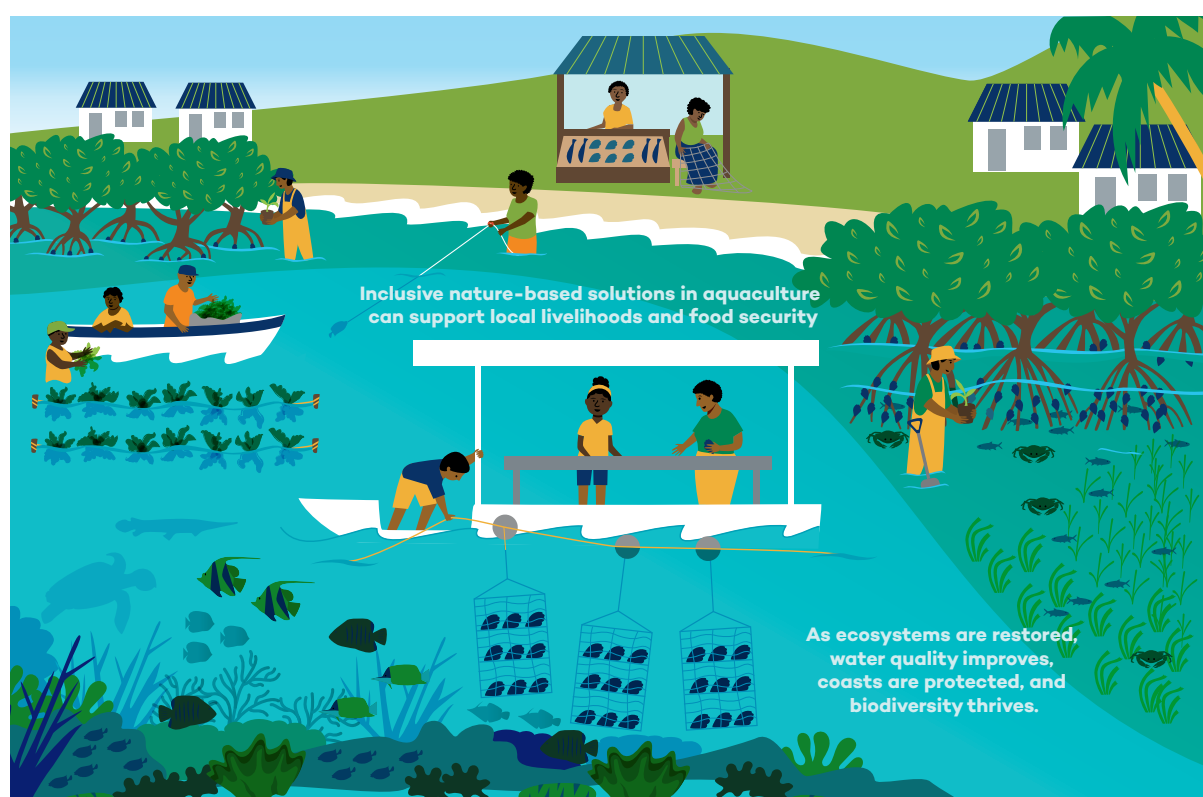
Other closely related concepts are regenerative and restorative aquaculture (Table 1). Regenerative aquaculture actively restores and improves marine and coastal ecosystems



while producing seafood and supporting livelihoods (Mizuta et al., 2023). Unlike conventional aquaculture, which focuses mainly on production, regenerative aquaculture aims to ensure that farming activities leave the ecosystem healthier than when they began. Restorative aquaculture is designed specifically to restore degraded aquatic ecosystems while producing seafood or marine products, supporting active ecological recovery (The Nature Conservancy, 2021).

Meeting climate adaptation, biodiversity conservation, and human well-being goals will require a diverse portfolio of aquaculture approaches, including nature-based, regenerative, restorative, and sustainable approaches.

Figure 1. What are NbS in aquaculture?



Source: Author on behalf of AQUA-Pearl partners.

Note: NbS in aquaculture are aquaculture practices and management approaches that protect, conserve, restore, and sustainably use and manage natural or modified freshwater and marine ecosystems, while enhancing human well-being, climate resilience, biodiversity, and ecosystem services.



Table 1. Frameworks related to NbS in aquaculture

Concept	Definition
Frameworks related to NbS in aquaculture (IDRC, 2023)	Aquaculture practices that protect, conserve, restore, and sustainably manage natural or modified ecosystems, including freshwater and marine ecosystems, and that contribute to enhancing human well-being, climate resilience, biodiversity benefits, and ecosystem services.
Ecosystem approaches to aquaculture (FAO, 2021)	A strategy for the integration of the aquaculture within the wider ecosystem such that it promotes the sustainable development, equity, and resilience of interlinked social–ecological systems.
Regenerative aquaculture (Mizuta et al., 2023)	Commercial or subsistence aquaculture performed with a focus on social, economic, and ecological responsibility and stability, with minimal external input and impact to the environment.
Restorative aquaculture (The Nature Conservancy, 2021)	Restorative aquaculture occurs when commercial or subsistence aquaculture actively restores degraded ecosystems, providing direct ecological benefits to the environment, with the potential to generate net-positive environmental outcomes.
Blue Transformation (FAO, 2022)	Aimed at maximizing the opportunities presented by aquatic food systems to enhance food security, improve nutrition, eradicate poverty, and support the achievement of the 2030 Agenda for Sustainable Development.
Ecosystem-based fisheries management (Staples et al., 2014)	Considers both the impacts of the environment on fisheries health and productivity and the impacts that fishing has on all aspects of the marine ecosystem. Often used interchangeably with an ecosystem approach to fisheries management.
Ecosystem approach (CBD, 2000)	A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way.

Source: Author's compilation based on the listed references.

2.5 Examples of NbS in Aquaculture

2.5.1 Integrated Rice-Fish Farming Systems

Practised for millennia, integrated rice farming systems support the culture of aquatic animals like fish and shrimp with rice farming. The rice provides shade and food sources, while the fish consume pests and weeds, reducing the need for fish feed and chemical fertilizers. Fish waste fertilizes the rice crop, resulting in higher rice yields and reduced chemical fertilizer use. Such integrated farming systems enable the growing of rice, fish, vegetables, and potentially livestock, while helping farmers strengthen their resilience to climate change with strengthened food security and livelihood opportunities (Sean et al., 2025).



2.5.2 Living Fish Houses

Originating in southern Thailand, traditional fish shelters (known as “sung/sunk” or “living fish houses”) enhance fish population growth by protecting juvenile fish, restoring habitat, and promoting the health of aquatic food webs. Communities use their local Traditional Knowledge to build the fish houses by planting mangrove species within wooden enclosures, taking advantage of their complex branching systems to protect spawning and nursery grounds (Ngamsnae, 2026). As living trees, the mangroves have outlasted the temporary bamboo structures that were used as fish shelters in the past and require less maintenance and fewer repairs, resulting in measurably higher biodiversity and financial returns (Research World Thailand, n.d.). It is considered a form of aquaculture as environmental conditions are controlled to enhance fish growth, regulate harvests, and improve yields, with seedling survival for fish houses supported with bamboo anchors, mud, and PVC pipe shields (Ngamsnae, 2026).

2.5.3 Non-Fed Aquaculture

Extractive aquaculture species—including seaweeds and filter-feeding bivalves such as mussels, oysters, and clams—derive their nutrients directly from the surrounding environment and do not require external feed inputs, which reduces pressure on wild fish stocks and conversion of land for terrestrial sources of feed. Moreover, bivalves and seaweed cultivation provide habitat for fish and invertebrates, supporting net increases in biodiversity (Theuerkauf et al., 2021). Netting to protect bivalves from predators also provides refugia for smaller juvenile fish, and aquaculture gear provides settlement substrate that enhances habitat complexity while serving as physical protection from waves and currents, in turn reducing physiological stress on farmed organisms (Theuerkauf et al., 2021). Oyster protection netting has had variable success in excluding predators on oyster farms in Fiji and has been found to incidentally increase favourable forms of biodiversity that can be harvested by communities, such as fish and sea grapes (Dehm et al., 2025). Overall, seaweeds and bivalves score high on their potential to deliver food, climate, and biodiversity outcomes, but market development and valuation are lacking (Naylor et al., 2021), and bivalves in particular are underrepresented in global production (Wong et al., 2026).

While not an aquaculture practice, **traditional fishing closures are an effective fisheries management tool** that conserves fish stocks, enhances natural recruitment, and supports the sustainable management of wild fisheries. For example, *Lubuk Larangan*, also known as “forbidden deep pools,” is a type of local fish resource management system in Indonesia that utilizes customary laws to sustainably manage fishing and prevent pollution. Fishing is restricted in certain locations for a period of 8–12 months to replenish fish stocks (Matondang, 2023). Communities perceive *Lubuk Larangan* as effective in promoting fish conservation while enhancing ecosystem health through environmental protection and pollution management (Tumanggor et al., 2025). Temporal community-led protected areas have also resulted in increased income and perceptions of increased fish yields (Pornpinatepong et al., 2025), contributing to community resilience by diversifying income and food sources in the face of climate change and other pressures on fisheries. An analogous example is *tabu* areas in Fiji, which are seasonal fishing closures located in traditionally managed *qoliqoli* customary fishing grounds (Jupiter et al., 2010).



3.0 Integrating Climate Resilience and Biodiversity Into Inclusive Aquaculture Practice and Policy in Fiji

Fiji's culture and economy are closely tied to its ocean and coastal resources. Fijian communities depend on fisheries for subsistence and livelihoods, but marine resources are declining due to a combination of urban and coastal development, unsustainable resource extraction, poor waste management, climate change, and natural disasters (Government of the Republic of Fiji, 2017). Combined with population growth, these pressures on fisheries are causing their decline.

To counter these declines, aquaculture is seen as a means of contributing to climate resilience by addressing food and nutritional security, local livelihoods, and conservation and restoration of ecosystems (by farming ecosystem-enhancing, filter-feeding species such as clams and sea cucumbers). Access to export markets, currently dominated by shrimp, seaweed, and pearls, and value addition such as the production of local handicrafts, are seen as cornerstones of economic growth in the aquaculture sector (SPC, 2025b). Indigenous Knowledge is also emphasized and has helped to guide site selection for sustainable capture-based aquaculture, such as traditionally managed milkfish collection sites (Garcia Gomez et al., 2025)

Fiji's Ministry of Fisheries and its partners have a long history of experimenting with and implementing aquaculture initiatives for economic development and livelihoods support. Since the 1970s, farms covering 16 species of native shrimp, pearl, and seaweed have been established in Fiji. Community-led initiatives include the Pearl and Mangrove Oyster Research and Development Programme, brackish and freshwater aquaculture programs, and seaweed (Government of the Republic of Fiji, 2024).

The government is planning an ambitious domestic expansion of aquaculture operations through its Fiji Aquaculture Development Plan 2024–2028. The plan aims to rapidly increase the value of aquaculture production by more than 10 times by 2028 (currently ~USD 5 million/year), while reducing the value of imported seafood by 70% (Fiji Ministry of Fisheries and Forestry, 2024). The plan's objectives include revenue generation, import reduction, and brand recognition, particularly related to sustainability. Community livelihoods and gender equality are emphasized, with the goal of forming cooperatives for different commodities. While climate resilience is not a specific objective, climate adaptation and disaster risk response are integrated into the plan through standard operating procedures that set out coordination tools at national, divisional, and district levels and that bring together several disaster risk reduction frameworks and the National Adaptation Plan (NAP). However, several challenges will need to be overcome to achieve climate, food, and environmental resilience through aquaculture expansion in Fiji, including climate change, land and resource tenure, limited market access, and capacity gaps.



3.1 Climate Change

As a Pacific Island state with a population highly dependent on ocean resources, Fiji is among the countries most vulnerable to climate change. Projections for climate change include increased air and sea surface temperatures, sea level rise, and a decrease in ocean pH¹ (Pacific Community, 2025a). Fiji is also expected to be impacted by more intense, but less frequent, tropical cyclones, marine heat waves, and increased La Niña and El Niño extremes (Pacific Community, 2025a). Ocean warming is also creating favourable conditions for the proliferation of harmful algae and pathogens (Holbrook et al., 2022), while thermal stress, environmental degradation, and other pressures are resulting in coral bleaching (Samperiz et al., 2025).

Two major cyclones have affected Fiji's aquaculture sector in the past decade, compounded by challenges in accessing markets during the global COVID-19 pandemic in 2021–2022. Such extreme weather events increase risks to farming operations, facilities, and infrastructure (Garcia Gomez et al., 2025). Other climate impacts create both opportunities and challenges—for example, increased rainfall is projected to expand suitable areas for inland freshwater aquaculture, whereas sea level rise will favour expanded production zones for mariculture (Garcia Gomez et al., 2025). Despite expected decreases in coastal and oceanic fisheries yields due to climate change, aquaculture production is relatively less impacted and is expected to increase (Garcia Gomez et al. 2025).

3.2 Tenure Systems

Fiji has a unique land and sea tenure system, with approximately 91% is owned by Indigenous iTaukei (under the iTaukei Land Trust Board), who have customary rights to hunt, fish, or forage. Customary landowners also have the right, under the Fisheries Act, to fish and collect shellfish without a permit within designated registered fishing areas (*mataqali* fishing areas) (Department of Environment, 2020). At the same time, the state has ownership of the foreshore and nearshore waters, blending formal ownership and customary access, which can lead to a lack of clarity in implementing aquaculture activities. Expanding aquaculture, including NbS in aquaculture, requires mapping out feasible areas that do not infringe on customary rights and strengthening capacity for community members to manage the traditional *qoliqoli* fishing grounds that can encompass aquaculture activities. Clarity of tenure would also support applications for government subsidies for sustainable aquaculture activities and support access to insurance.

3.3 Market Access

A lack of investment in market analyses and surveys accompanies aquaculture expansion plans. For example, the Fiji Aquaculture Development Plan outlines the scaling up of community-led black-lip pearl oyster farms with ambitious targets for local and export markets but has not yet begun formal market analyses to establish what domestic and

¹ By 2050, based on medium and high greenhouse gas emissions scenarios, relative to 1995–2014 baseline (Pacific Community (SPC) 2025).



international markets could look like. There is no established export market for bivalves yet, in part due to a lack of quality assurance standards, although some progress has been made for seaweeds.

3.4 Capacity

There are various capacity needs to scale up NbS in aquaculture in Fiji. Financial capacity is needed because aquaculture lacks investment, including in equipment, food safety laboratory testing facilities, cold chain storage, and hatcheries. Technical capacity and training are also required. Robust monitoring and evaluation systems that capture the multiple benefits of NbS in aquaculture need to be developed and implemented, including for biodiversity, climate resilience, human well-being, and nutrition.

3.5 Policy Environment for NbS in Aquaculture in Fiji

To explore the enabling policy environment for implementing NbS in aquaculture, various plans, strategies, and policies were analyzed in relation to climate resilience, biodiversity conservation, and elements of human well-being, including food security, people, and livelihoods (Table 2, Appendix A). Ocean-related climate and biodiversity frameworks were prioritized in this non-exhaustive review, but other relevant legislation and plans include the Rural Development Framework, National Gender Policy, Fisheries Act, Forest Act, and National Development Plan 2017–2036. Details within each framework are outlined in Appendix A.

Table 2. Policies and plans relevant to NbS in aquaculture in Fiji

Theme	Policy instrument
Climate resilience	• Fiji's Third Nationally Determined Contribution (NDC 3.0) (Government of the Republic of Fiji, 2025a) • National Adaptation Plan (Fiji Ministry of Economy Climate Change and International Cooperation Division, 2018)
Biodiversity	• Fiji National Biodiversity Strategy and Action Plan 2026–2030 (Government of the Republic of Fiji, 2025b)
Fisheries sector	• Ministry of Fisheries Strategic Development Plan 2019–2029 (Ministry of Fisheries, Fiji, 2024b) • Ministry of Fisheries National Fisheries Policy 2024–2028 (Ministry of Fisheries, Fiji, 2024a) • Fiji Aquaculture Development Plan 2024–2028 (Fiji Ministry of Fisheries and Forests, 2024) • Pacific Regional Aquaculture Strategy (Pacific Community, 2025b)
Development	• National Ocean Policy 2020–2030 (Government of the Republic of Fiji, 2020) • Fiji National Development Plan (20252029) (Government of the Republic of Fiji, 2024)

Source: Author's non-exhaustive compilation based on cited policies and plans.



3.5.1 Climate Resilience

Fiji's commitments under Article 4.11 of the Paris Agreement are detailed in its NDC, which was updated in 2020 and 2025.

- **Alignment:** The latest revision aligns adaptation priorities with the global goal on adaptation, Fiji's National Biodiversity Strategy and Action Plan (NBSAP), and commitments under the CBD.
- **Sectoral integration:** A primary adaptation priority is the promotion of climate-smart agriculture, agroforestry, sustainable fisheries, and aquaculture. An associated indicator calls for ensuring resilience in the forestry and fisheries sectors through watershed management, sustainable aquaculture, and coastal protection (Government of the Republic of Fiji, 2025a).
- **Gaps:** The role of NbS in aquaculture in reducing carbon emissions should be acknowledged. For example, extractive aquaculture, like seaweed and shellfish farming, can help reduce the carbon footprint of aquaculture and have the potential to act as carbon sinks (Yang et al., 2026).

Fiji's NAP (Fiji Ministry of Economy, Climate Change and International Cooperation Division, 2018) establishes an enabling environment to scale up NbS in aquaculture through the core objectives of integrating climate resilience across sectors, providing equal and sustainable access to health and well-being services, and implementing inclusive, equitable, and locally driven NbS.

- **Adaptation in aquaculture:** The NAP proposes upgrading existing aquaculture facilities, strengthening community-based fisheries management, promoting sustainable fisheries and non-extractive cultured fisheries management, and launching insurance schemes for small-scale fisheries and aquaculture. Such climate adaptation measures would support the resilience of the sector.
- **Opportunities:** The NAP is currently being revised to include a monitoring and evaluation framework (Government of the Republic of Fiji, 2020). Multiple sectors are represented on the NAP Steering Committee, presenting an opportunity to prioritize adaptation actions and align the updated NAP with relevant policies and plans (Table 1), particularly under fisheries, aquaculture, and biodiversity.

3.5.2 Biodiversity

Fiji's NBSAP 2026–2030 outlines its plans to implement its commitments under the CBD, aiming to align national actions with the Kunming–Montreal Global Biodiversity Framework (KMGBF), strengthen ecosystem resilience to climate change, and support sustainable livelihoods (Government of the Republic of Fiji 2025b).

- **National Target 10:** This target focuses on enhancing biodiversity and sustainability across the agriculture, aquaculture, fisheries, and forestry sectors. It mandates the sustainable management of these sectors through increasing the use biodiversity-friendly practices, such as sustainable intensification and agroecological approaches.



- **Indicator gaps:** The proposed indicators mirror CBD headline indicators but focus heavily on agriculture and forestry, omitting explicit mentions of aquaculture. National indicators, currently limited to applying sectoral sustainable certification standards and guidelines for industry and small-scale producers, should reflect the indicators outlined in the NAP and the Ministry of Fisheries guiding policy frameworks—the National Fisheries Policy and the Strategic Development Plan (described below).
- **Strategic actions:** Sub-activity 10.1A mandates a rapid analysis of sectoral strategic plans to improve tracking alignment. However, the NBSAP must still be updated to reflect Fiji’s unique fisheries context and the opportunities for NbS in aquaculture to support biodiversity conservation.

3.5.3 Fisheries Sector

The fisheries sector in Fiji comprises the sub-sectors of offshore fisheries, inshore coastal fisheries, freshwater fisheries, and aquaculture (Government of the Republic of Fiji, 2024).

The Strategic Development Plan (2024–2028) outlines strategic priorities and targets for fisheries, aquaculture, research, and quality. It promotes economically viable local aquatic foods to enhance nutritional value intake for coastal and inland communities. It calls for the development of a robust biosecurity protocol to protect biodiversity when introducing species for aquaculture. However, it places less emphasis on climate resilience and biodiversity conservation measures.

The National Fisheries Policy (2024–2028) establishes policy directions and activities for sustainable management, including institutional arrangements, legislative frameworks, and resource requirements. As the monitoring and evaluation framework is currently being developed to track implementation progress, it should be aligned with targets laid out in Fiji’s updated NAP, NDC 3.0, and NBSAP.

The Fiji Aquaculture Development Plan (2024–2028) focuses on expanding aquaculture production for sustainable livelihoods. Key initiatives include a model farm approach (building on the AQUA-Pearl project) to develop a black-lip pearl oyster national cooperative with a revolving fund for investing in materials or equipment. The plan references contingency plans for disaster response, such as insurance schemes for extreme events. Standard operating procedures outline climate change adaptation and disaster response tools at divisional, district, and national levels that include preparedness checklists, early warning messages, coordination structures, response plan templates, and contact lists. Crucially, it notes the need to integrate climate adaptation into the upcoming revision of the Fiji National Disaster Management Plan. A forthcoming Aquaculture Act will include a bill to implement this plan.

The Pacific Regional Aquaculture Strategy was adopted in 2025 by the regional fisheries ministries. The strategy addresses regional needs for sustainable aquaculture development in Pacific Island countries and territories. It focuses on climate resilience, livelihoods development, equity and inclusion, and strengthened biosecurity protocols to accompany aquaculture expansion, protecting the Pacific from the introduction of aquatic pests and diseases. Bridging the gap between this regional policy and national and sub-national



implementation will require tailoring objectives to specific local contexts and meeting training and capacity needs.

3.5.4 Development

Fiji's **National Ocean Policy** (2020–2030) is an overarching policy bridging national ocean-related plans and frameworks. It recognizes the role of healthy coastal and ocean ecosystems in sequestering carbon and calls for their protection. There are few explicit references to sustainable and nature-based solutions in aquaculture. In its next iteration, the policy should integrate climate adaptation and disaster risk reduction measures and coordination mechanisms that are described in the Fiji Aquaculture Development Plan.

The **Fiji National Development Plan 2025–2029 and Vision 2050** outlines Fiji's development priorities of gender balance, community empowerment, addressing climate change, upholding moral and ethical values, good governance, and commitment to political stability. It references diversified market pathways for aquaculture products, providing a supportive legislative framework to facilitate iTaukei fishery business ownership and establishing cold-storage facilities in designated sites. The National Development Plan beyond 2029 should also cross-reference the NDC 3.0's priority adaptation actions for aquaculture (including upgrading aquaculture facilities, promoting non-extractive cultured fisheries management, and insurance schemes for small-scale fisheries and aquaculture).

3.5.5 Policy Coherence for NbS in Aquaculture in Fiji

Fiji's climate, biodiversity, fisheries, and ocean frameworks collectively provide an enabling environment for adopting NbS in aquaculture. Together, these policy instruments bridge climate resilience, food security, nature conservation, and livelihoods. This intersection demands a multisectoral and multistakeholder approach to scaling up NbS in aquaculture.

However, more clarity is needed on the relationship between the different policies and plans and their interdependencies. While livelihoods are central to most frameworks, there is an uneven focus on climate resilience and biodiversity conservation and a critical need to strengthen linkages between ocean-related policies. For example, while the National Development Plan focuses heavily on economic development, there are weaker linkages to the Fisheries Strategic Plan and NAP. Resolving these discrepancies requires a dedicated coordination mechanism to ensure cross-policy coherence and support.

3.5.6 Alignment Gaps and Sectoral Opportunities

The capacity for NbS in aquaculture to simultaneously address climate resilience, biodiversity conservation, and human well-being must be more strongly reflected in upcoming policy revisions. Current national frameworks need to consolidate these priority adaptation and conservation actions rather than leaving them fragmented.

- **National Ocean Policy 2020–2030:** While fisheries and aquaculture feature prominently, references to aquaculture are limited and typically mentioned from the perspective of using sustainable aquaculture practices, such as minimizing emissions

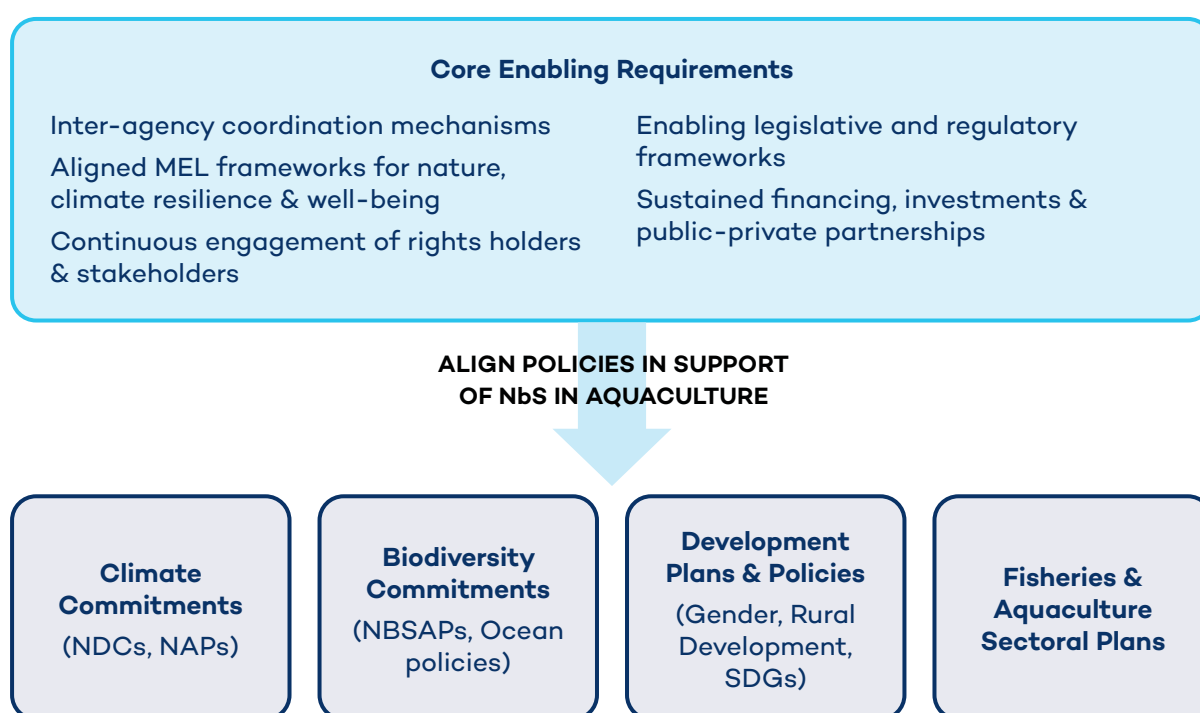


from aquaculture and promoting commercial seaweed and algae farming as an alternative to fuels, feedstock for agriculture and aquaculture, and plastic alternatives. The policy lacks a broader focus on ecosystem-level benefits from NbS in aquaculture.

- **Fisheries sectoral plans:** The Strategic Development Plan, National Fisheries Policy, and Aquaculture Development Plan should explicitly connect aquaculture to nature conservation. A primary step is integrating monitoring systems to track net biodiversity gain across various aquaculture initiatives.
- **NBSAP:** While closely aligned with the KMGBF, the unique fisheries context in Fiji and contributions of NbS in aquaculture to biodiversity conservation are largely missing, yet have large potential for supporting implementation of Target 10.

Implementing NbS in aquaculture has high potential for delivering on multiple policy objectives for climate, biodiversity, and human well-being. Harmonizing these goals across national plans and policies, particularly as they are periodically updated, requires active inter-agency coordination, continual stakeholder engagement, and sustained political commitment.

Figure 2. Core enabling requirements to align biodiversity, climate, fisheries, and development policies in support of NbS in aquaculture



Source: Author.



4.0 Integrating Climate Resilience, Biodiversity Conservation, and Human Well-Being Into NbS in Aquaculture: Key recommended actions

Fiji illustrates the challenges of implementing NbS in aquaculture and how implementation can be supported by aligning policies and plans on climate, biodiversity, oceans, and development. Learning from Fiji, the following key actions are recommended for governments and supporting actors facing similar conditions (high vulnerability to climate change, high dependence on marine resources) to integrate climate resilience, biodiversity conservation, and human well-being into the aquaculture sector.

Policy Alignment and Institutional Arrangements

- Embed NbS in aquaculture across sectoral plans and policies in climate and nature commitments (such as through NBSAPs, NAPs, and NDCs), and in strategies for food security, poverty alleviation, and economic development. This will be particularly relevant when these policy frameworks are renewed or updated.
- Align monitoring, evaluation, and learning frameworks for aquaculture programming with specific indicators on nature, climate resilience, and community well-being (including livelihoods and nutrition), and ensure alignment with relevant targets and commitments, including Target 10 under the KMGBF.
- Enhance inter-agency coordination by assigning designated focal points across ministries to collaborate on the review; update and advance aquaculture regulatory processes and legislative frameworks (such as through an inter-agency steering committee); and engage stakeholders in advisory councils to provide guidance on policies, plans, implementation, and research that advance NbS in aquaculture.
- Ensure climate change adaptation actions, mechanisms, and tools are integrated into disaster risk response plans, and vice versa.
- Provide enabling legislative and regulatory frameworks for investments that clarify tenure and customary access, support private sector engagement, and cover gaps that may exist (such as for health, biosecurity, zoning, or other topics relevant to aquaculture).

Climate Adaptation and Resilience

- Identify areas less susceptible to climate and disaster risk for aquaculture expansion, based on formal climate risk assessments, with careful site selection in more naturally sheltered areas.
- Promote the adoption of modular, non-fed aquaculture systems, such as for seaweeds and oysters, which will facilitate physical adjustments for optimal wave sheltering,



temperature, and salinity in cases of climate extremes, and support food product diversification as the infrastructure attracts marine life.

- Increase support for research and monitoring of pathogens that have the potential to expand their ranges with climate change and affect aquaculture production and human health, in connection with national quality assurance programs and environmental monitoring.
- Invest in climate-resilient critical infrastructure, such as building infrastructure (e.g., hatcheries and cold-storage facilities) in sheltered areas. Climate-resilient hatcheries will also be important for the larval/juvenile stages of species development.
- Develop integrated climate adaptation and disaster preparedness response and recovery plans and delineate coordination mechanisms within fisheries and aquaculture sectoral plans.

Access to Finance

- Incentivize public–private partnerships by promoting equitable cost-sharing of risks and benefits of NbS in aquaculture innovations.
- Support innovative insurance schemes for small to medium-sized aquaculture actors, such as parametric insurance under the Pacific Insurance and Climate Adaptation Programme.
- Develop partnerships with bilateral cooperation and regional agencies to invest in research and technical support.
- Mobilize domestic resources for NbS, such as ministerial budgets and dedicated funds for climate action, disaster risk management, or rural support.
- Support communities in accessing community, entrepreneurship, or cooperative funds, and incentivize NbS in aquaculture with subsidies.

Tenure and Customary Access

- Develop gender-responsive governance models for aquaculture initiatives that enable ownership and equitable sharing of labour, costs, and benefits in a manner sensitive to Indigenous Pacific cultures and traditions.
- Map customary ownership and rights when scoping for potential aquaculture sites with transparent engagement that upholds human rights, alongside the undertaking of Free, Prior, and Informed Consent processes.
- Strengthen and provide capacity for community members to manage traditional fishing grounds, protected areas, or Indigenous conserved areas.

Market Access

- Conduct research to understand market preferences for NbS in aquaculture products, understand market access opportunities and barriers, and identify value-addition opportunities along the aquaculture value chain.
- Invest in climate-resilient storage, transport logistics, hatcheries, and equipment, as well as associated training needs to enable local market expansion.



- Strengthen export testing standards by supporting research and testing methodologies for pollutants and pathogens, aligning with national biosecurity protocols.

Capacities and Skills

- Build awareness and implement training programs for line agencies on approaches to sustainable, restorative, and NbS in aquaculture.
- Support training programs for personnel to develop surveillance and implement laboratory testing to ensure food safety, supporting NbS in aquaculture in addition to other food development sectors.
- Support training programs for farm workers and food handlers on safe seafood handling in compliance with health legislation and industry best standards.
- Develop capacities to implement robust monitoring, evaluation, and learning programs that capture the multiple benefits of NbS in aquaculture, along with centralized and transparent data management.

Political Will

- Identify opportunities to strengthen capacity, promote leadership, and champion NbS in aquaculture within line agencies.
- Enforce existing legislation that addresses threats to the integrity of marine and coastal ecosystems, such as illegal dumping and resource extraction.



5.0 Summary

Climate change impacts, pollution, and overfishing around the globe threaten fisheries and marine ecosystems and demand innovative and transformative approaches to secure food and ensure good nutrition. NbS in aquaculture is a promising approach with the key objectives of climate resilience, net benefits to nature, and human well-being. In Fiji, an enabling policy environment supports the implementation of NbS in aquaculture approaches that have the potential to deliver on climate and food resilience, nature conservation, and inclusive livelihoods, including community-led models that emphasize gender equality. However, Fiji also reveals that national plans and policies need better alignment on climate and biodiversity, which can be achieved via inter-agency coordination mechanisms, robust monitoring and evaluating frameworks aligned with climate and biodiversity commitments, continual rights holder and stakeholder engagement, enabling legislative and regulatory frameworks, and sustained financing, investments, and public-private partnerships.

Learning from the Pacific context, countries with a similar context that are aspiring to adopt NbS in aquaculture need to implement key actions to address the challenges of climate change, inadequate financial support, limited market access, and customary land and sea tenure systems, and to support public-private partnerships. Doing so will provide the enabling conditions for NbS in aquaculture to deliver on multiple policy objectives.



References

- Adenaya, A., Berger, M., Brinkhoff, T., Ribas-Ribas, M., & Wurl, O. (2023). Usage of antibiotics in aquaculture and the impact on coastal waters. *Marine Pollution Bulletin*, 188, Article 114645. <https://doi.org/10.1016/j.marpolbul.2023.114645>
- Aslan, A., Rahman, A. F., Robeson, S. M., & Iman, M. (2021). Land-use dynamics associated with mangrove deforestation for aquaculture and the subsequent abandonment of ponds. *Science of The Total Environment*, 791, Article 148320. <https://doi.org/10.1016/j.scitotenv.2021.148320>
- Avendaño-Herrera, R., Mancilla, M., & Miranda, C. D. (2023). Use of antimicrobials in Chilean salmon farming: Facts, myths and perspectives. *Reviews in Aquaculture*, 15(1), 89–111. <https://doi.org/10.1111/raq.12702>
- Bass, A. L., DiCicco, E., Kaukinen, K. H., Li, S., Johnson, R., Powell, J., Isaac, V., Dedeluk, N. B., Bateman, A. W., & Miller, K. M. (2024). Infectious agent release and Pacific salmon exposure at Atlantic salmon farms revealed by environmental DNA. *Scientific Reports*, 14, Article 31488. <https://doi.org/10.1038/s41598-024-83250-5>
- Brugere, C., Bansal, T., Kruijssen, F., & Williams, M. (2023). Humanizing aquaculture development: Putting social and human concerns at the center of future aquaculture development. *Journal of the World Aquaculture Society*, 54(2), 482–526. <https://doi.org/10.1111/jwas.12959>
- Cashion, T., Le Manach, F., Zeller, D., & Pauly, D. (2017). Most fish destined for fishmeal production are food-grade fish. *Fish and Fisheries*, 18(5), 837–844. <https://doi.org/10.1111/faf.12209>
- Castellari, S., Zandersen, M., Davis, M., Veerkamp, C., Förster, J., Marttunen, M., Mysiak, J., Vandewalle, M., Medri, S., & Picatoste, J. R. (2021). *Nature-based solutions in Europe: Policy, knowledge and practice for climate change adaptation and disaster risk reduction* (EEA Report No. 1/2021). European Environment Agency. <https://op.europa.eu/en/publication-detail/-/publication/da65d478-a24d-11eb-b85c-01aa75ed71a1/language-en>
- Chausson, A., Smith, A., Reger, R. Z.-Z., O’Callaghan, B., Mori Clement, Y., Zapata, F., & Seddon, N. (2024). Harnessing nature-based solutions for economic recovery: A systematic review. *PLOS Climate*, 3(10), Article e0000281. <https://doi.org/10.1371/journal.pclm.0000281>
- Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., Maginnis, S., Maynard, S., Nelson, C. R., Renaud, F. G., Welling, R., & Walters, G. (2019). Core principles for successfully implementing and upscaling nature-based solutions. *Environmental Science and Policy*, 98, 20–29. <https://doi.org/10.1016/j.envsci.2019.04.014>
- Convention on Biological Diversity. (n.d.). *CBD Clearing House Mechanism: National targets*. <https://ort.cbd.int/national-targets>



- Convention on Biological Diversity. (2019). *Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information* (Technical Series No. 93). <https://www.cbd.int/doc/publications/cbd-ts-93-en.pdf>
- Convention on Biological Diversity. (2000). *Decision V/6: Ecosystem Approach*. Fifth Meeting of the Conference of the Parties, Nairobi, 15–26 May 2000 (UNEP/CBD/COP/5/23). <https://www.cbd.int/doc/meetings/esa/ecosys-01/other/ecosys-01-dec-cop-05-06-en.pdf>
- Dehm, J., Kaure, T., Tunaka, E., Vanukon, S., Hunter, R., Hunter, J., Pickering, T., & Hewavitharane, C. (2025). Assessing growth, survival, and predator management in juvenile black-lip pearl oyster (*Pinctada margaritifera*) farming: Insights from Savusavu Bay, Fiji. *Aquaculture International*, 33, Article 170. <https://doi.org/10.1007/s10499-025-01852-w>
- de Lacerda, L. D., Ward, R. D., Godoy, M. D. P., Meireles, A. J. de A., Borges, R., & Ferreira, A. C. (2021). 20-years cumulative impact from shrimp farming on mangroves of Northeast Brazil. *Frontiers in Forests and Global Change*, 4, Article 653096. <https://doi.org/10.3389/ffgc.2021.653096>
- Department of Environment, Government of Fiji. (2020). *National biodiversity strategy and action plan 2020–2025*. Government of Fiji. <https://library.sprep.org/content/national-biodiversity-strategy-and-action-plan-fiji-2020-2025>
- Fiji Ministry of Economy Climate Change and International Cooperation Division. (2018). *Republic of Fiji national adaptation plan: A pathway towards climate resilience*. <https://fijiclimatchangeportal.gov.fj/ppss/republic-of-fiji-national-adaptation-plan-a-pathway-towards-climate-resilience/>
- Fiji Ministry of Fisheries and Forestry. (2024). *Fiji aquaculture development plan 2024–2028*. Government of the Republic of Fiji. https://www.spc.int/CoastalFisheries/CFM/Document/Get/ef1f1b2f-768d-4510-95a9-da0069974c00/FJ_Aquaculture%20Development%20Plan%202024-2028.pdf
- Food and Agriculture Organization of the United Nations. (2022). *Blue transformation – Roadmap 2022–2030: A vision for FAO’s work on aquatic food systems*. <https://doi.org/10.4060/cc0459en>
- Food and Agriculture Organization of the United Nations. (2024). *The state of world fisheries and aquaculture 2024: Blue transformation in action*. <https://doi.org/10.4060/cd0683en>
- Garcia Gomez, R., Whitford, J., Teitelbaum, A., Hewavitharane, C., Kinch, J. P., & Pickering, T. (2025). Implications of climate change for aquaculture in the Pacific Islands region. In J. E. Johnson & C. C. C. Wabnitz (Eds.), *Climate change implications for fisheries and aquaculture in the Pacific Islands region* (ch. 6). Pacific Community. <https://www.spc.int/digitallibrary/get/5b4nt>
- Government of the Republic of Fiji. (2020). *Monitoring and evaluation framework for Fiji’s national adaptation plan process*. Ministry of Economy’s Climate Change and International Cooperation Division. <https://napglobalnetwork.org/resource/monitoring-and-evaluation-framework-fiji-nap-process/>



- Government of the Republic of Fiji. (2024). *Fiji national development plan 2025–2029 and vision 2050*. <https://faolex.fao.org/docs/pdf/fj232617.pdf>
- Government of the Republic of Fiji. (2025a). *Fiji's third nationally determined contribution 2025–2035 (NDC 3.0)*. Department of Climate Change, Ministry of Environment and Climate Change. <https://fijiclimatchangeportal.gov.fj/tag/ndc-3-0/>
- Government of the Republic of Fiji. (2025b). *National biodiversity strategy and action plan 2026–2030*. Ministry of Environment and Climate Change. [https://ort.cbd.int/database/299468](https://ort.cbd.int/database/299468?documentID=299468)
- Harohau, D., Allison, E. H., & Teoh, S. J. (2025). *Nature-based solutions to aquaculture: A way forward for aquaculture development in Pacific Island countries*. Pacific Community. <https://digitalarchive.worldfishcenter.org/items/31010844-2a97-4990-a5e7-b0c5d2798304>
- Holbrook, N. J., Hernaman, V., Koshiba, S., Lako, J., Kajtar, J. B., Amosa, P., & Singh, A. (2022). Impacts of marine heatwaves on tropical western and central Pacific Island nations and their communities. *Global and Planetary Change*, 208, Article 103680. <https://doi.org/10.1016/j.gloplacha.2021.103680>
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2024). *Summary for policymakers of the thematic assessment report on the underlying causes of biodiversity loss and the determinants of transformative change and options for achieving the 2050 vision for biodiversity* (K. O'Brien, L. Garibaldi, A. Agrawal, E. Bennett, O. Biggs, R. Calderón Contreras, E. Carr, N. Frantzeskaki, H. Gosnell, J. Gurung, S. Lambertucci, J. Leventon, C. Liao, V. Reyes García, L. Shannon, S. Villasante, F. Wickson, Y. Zinngrebe, & L. Perianin, Eds.). IPBES Secretariat. <https://doi.org/10.5281/zenodo.11382230>
- International Development Research Centre. (n.d.). *Nature-based Climate Solutions in Aquaculture Food Systems in Asia-Pacific (AQUADAPT)*. <https://idrc-crdi.ca/en/initiative/aquadapt>
- International Development Research Centre. (2024). *Sowing a future of sustainable food through aquaculture*. <https://idrc-crdi.ca/en/research-in-action/sowing-future-sustainable-food-through-aquaculture>
- International Institute for Sustainable Development. (n.d.). *AQUA-Pearl*. <https://www.iisd.org/projects/aqua-pearl>
- Johnson, J. E., & Wabnitz, C. C. C. (Eds.). (2025). *Climate change implications for fisheries and aquaculture in the Pacific Islands region*. Pacific Community. <https://www.spc.int/digitallibrary/get/aj7sx>
- Jupiter, S. D., Egli, D. P., Jenkins, A. P., Yakub, N., Hartley, F., Cakacaka, A., Tui, T., Moy, W., Naisilisili, W., Dulunaqio, S., Qauqau, I., & Prasad, S. (2010). *Effectiveness of marine protected networks in traditional fishing grounds of Vanua Levu, Fiji, for sustainable management of inshore fisheries* (Technical Report No. 03/10). Wildlife Conservation Society-Fiji and Wetlands International-Oceania. https://library.sprep.org/sites/default/files/115_1.pdf



- Krkošek, M., Bateman, A. W., Bass, A. L., Bugg, W. S., Connors, B. M., Deeg, C. M., DiCicco, E., Godwin, S., Grimm, J., Krichel, L., Mordecai, G., Morton, A., Peacock, S., Shea, D., Riddell, B., & Miller, K. M. (2024). Pathogens from salmon aquaculture in relation to conservation of wild Pacific salmon in Canada. *Science Advances*, 10(9), Article eadn7118. <https://doi.org/10.1126/sciadv.adn7118>
- Le Gouvello, R., Brugere, C., & Simard, F. (2022). *Aquaculture and nature-based solutions: Identifying synergies between sustainable development of coastal communities, aquaculture, and marine and coastal conservation*. International Union for Conservation of Nature. <https://portals.iucn.org/library/node/49887>
- Lo, V. (2016). *Synthesis report on experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction* (Technical Series No. 85). Secretariat of the Convention on Biological Diversity. <https://www.cbd.int/doc/publications/cbd-ts-85-en.pdf>
- Lo, V. Qi, J., & Jang, N. (2022, June 6). *Seeking clarity on nature-based climate solutions for adaptation*. International Institute for Sustainable Development. <https://www.iisd.org/publications/brief/seeking-clarity-nature-based-climate-solutions-adaptation>
- Mangubhai, S., Barclay, K. M., Lawless, S., & Makhoul, N. (2023). Gender-based violence: Relevance for fisheries practitioners. *Fish and Fisheries*, 24(4), 582–594. <https://doi.org/10.1111/faf.12747>
- Mangubhai, S., & Lawless, S. (2021). Exploring gender inclusion in small-scale fisheries management and development in Melanesia. *Marine Policy*, 123, Article 104287. <https://doi.org/10.1016/j.marpol.2020.104287>
- Martin, J. C., Scolobig, A., Linnerooth-Bayer, J., Irshaid, J., Aguilera Rodriguez, J. J., Fresolone-Caparrós, A., & Oen, A. (2025). The nature-based solution implementation gap: A review of nature-based solution governance barriers and enablers. *Journal of Environmental Management*, 388, Article 126007. <https://doi.org/10.1016/j.jenvman.2025.126007>
- Matondang, S. A. (2023). Sustainability effort of traditional “Lubuk Larangan” forbidden deep pool stream. *WSEAS Transactions on Environment and Development*, 17. <https://doi.org/10.37394/232015.2021.17.14>
- Mizuta, D. D., Froehlich, H. E., & Wilson, J. R. (2023). The changing role and definitions of aquaculture for environmental purposes. *Reviews in Aquaculture*, 15(1), 130–141. <https://doi.org/10.1111/raq.12706>
- Ministry of Fisheries, Fiji. (2024a). *National fisheries policy 2024–2028*. Government of the Republic of Fiji. <https://faolex.fao.org/docs/pdf/fij235926.pdf>
- Ministry of Fisheries, Fiji. (2024b). *Strategic development plan 2019–2029*. Government of the Republic of Fiji. <https://faolex.fao.org/docs/pdf/fij219830.pdf>
- Naylor, R. L., Hardy, R. W., Buschmann, A. H., Bush, S. R., Cao, L., Linger, D. H., Little, D. C., Lubchenco, J., Shumway, S. E., & Troell, M. (2021). A 20-year retrospective review of global aquaculture. *Nature*, 591, 551–563. <https://doi.org/10.1038/s41586-021-03308-6>



- Ngamsnae, P. (2026). *Live fish house: Integrating local knowledge and nature-based solutions*. AQUADAPT. <https://aquadapt.org/2026/02/05/live-fish-house/>
- Pacific Community. (2025a). Fiji summary. In J. E. Johnson & C. C. C. Wabnitz (Eds.), *Climate change implications for fisheries and aquaculture in the Pacific Islands region*. <https://www.spc.int/updates/blog/dynamic-story/2025/11/climate-change-implications-for-fisheries-and-aquaculture-Pacific>
- Pacific Community. (2025b). *Pacific regional aquaculture strategy*. <https://spccfpstore1.blob.core.windows.net/digitalibrary-docs/files/2f/2f76606406f1e3507de0d6120d837640.pdf>
- Pacific Community. (2025c). *Promoting nature-based solutions in the Pacific: Key insights and recommendations 2025*. <https://pacificnbs.sprep.org/sites/default/files/2026-03/Promoting%20Nature-based%20Solutions%20in%20the%20Pacific-%20Key%20Insights%20and%20Recommendations%202025.pdf>
- Pornpinatepong, K., Chongwilaikasaem, S., Treewanchai, S., Kiripat, S., Jirakiattikul, S., Saelim, P., & Jaitang, C. (2025). Impact of temporal community-led marine protected areas on fishery income in southern Thailand. *Ocean & Coastal Management*, 264, Article 107618. <https://doi.org/10.1016/j.ocecoaman.2025.107618>
- Republic of Fiji. (2021). *National ocean plan 2020–2030*. https://fijiclimatechangeportal.gov.fj/wp-content/uploads/2021/01/Fiji_NationalOceansPolicy_2020.pdf
- Research World Thailand. (n.d.). Home. <https://www.researchworldthailand.com/>
- Sajid, Z., Gamperl, A. K., Parrish, C. C., Colombo, S. MN., Santander, J., Mather, C. Neis, B., HOLEMEN, I. M., Filgueira, R., McKenzie, C. H., SOUTO Cavalli, L., Jeebhay, M., Gao, W., López Gómez, M. A., Ochs, C., Lehnert, S., Couturier, C., Knott, C., ... & Singh, G. G. (2024). An aquaculture risk model to understand the causes and consequences of Atlantic salmon mass mortality events: A review. *Reviews in Aquaculture*, 16(4), 1674–1695. <https://doi.org/10.1111/raq.12917>
- Sampantamit, T., Ho, L., Lachat, C., Sutummawong, N., Sorgeloos, P., & Goethals, P. (2020). Aquaculture production and its environmental sustainability in Thailand: Challenges and potential solutions. *Sustainability*, 12(5), Article 2010. <https://doi.org/10.3390/su12052010>
- Samperiz, A., Sosdian, S., Hendy, E., Johnson, K., John, E. H., Jupiter, S., & Albert, S. (2025). Coastal seawater turbidity and thermal stress control growth of reef-building *Porites* spp. corals in Fiji. *Scientific Reports*, 15, Article 17172. <https://doi.org/10.1038/s41598-025-02283-6>
- Sean, V., Kosal, M., Akester, M. J., & Wardell, D. (2025). *Rice-field pond systems for food and resilient livelihoods*. WorldFish. <https://worldfishcenter.org/blog/rice-field-pond-systems-food-and-resilient-livelihoods>
- Stacy, N., & Govan, H. (2021). *Module 8: Livelihoods*. In K. Barclay, S. Mangubhai, B. Leduc, C. Donato-Hunt, N. Makhoul, J. Kinch, & J. Kalsuak (Eds.), *Pacific handbook for gender equity and social inclusion in coastal fisheries and aquaculture* (2nd ed.). Pacific Community. <https://www.spc.int/resource-centre/publications/pacific-gender-equity-and-social-inclusion-in-coastal-fisheries-and>



- Staples, D., Brainard, R., Capezzuoli, S., Funge-Smith, S., Grose, C., Heenan, A., Hermes, R., Maurin, P., Moews, M., O'Brien, C., & Pomeroy, R. (2014). *Essential EAFM: Ecosystem approach to fisheries management training course, Volume 1 – For trainees* (RAP Publication 2014/13). FAO Regional Office for Asia and the Pacific.
- Sumaila, U. R., Pierruci, A., Oyinlola, M. A., Cannas, R., Froese, R., Glaser, S., Jacquet, J., Kaiser, B. A., Issifu, I., Micheli, F., Naylor, R., & Pauly, D. (2022). Aquaculture over-optimism? *Frontiers in Marine Science*, 9, Article 984354. <https://doi.org/10.3389/fmars.2022.984354>
- Tansakul, V. (2024). *Nature-based solutions in aquaculture practices for sustainability*. AQUADAPT. <https://aquadapt.org/2024/12/09/nature-aquaculture-sustainability/>
- The Nature Conservancy. (2021). *Global principles of restorative aquaculture*. https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_PrinciplesofRestorativeAquaculture.pdf
- Theuerkauf, S. J., Barrett, L. T., Alleway, H. K., Costa-Pierce, B. A., St. Gelais, A., & Jones, R. C. (2021). Habitat value of bivalve shellfish and seaweed aquaculture for fish and invertebrates: Pathways, synthesis and next steps. *Reviews in Aquaculture*, 14(1), 54–72. <https://doi.org/10.1111/raq.12584>
- Tran, T., Duong, D. V., Le, T. D., et al. (2025). Promoting sustainable shrimp farming: Balancing environmental goals, awareness, and socio-cultural factors in the Mekong Delta aquaculture. *Aquaculture International*, 33, Article 119. <https://doi.org/10.1007/s10499-024-01802-y>
- Tumanggor, R., Sumiarsi, E., & Prianto, E. (2025). Existing condition of Lubuk Larangan management as a form of local wisdom in Padang Sawah Village, Kampar Kiri Subdistrict, Kampar Regency, Riau Province. *Jurnal Perikanan dan Kelautan*, 30(3), 297–304. <https://doi.org/10.31258/jpk.30.3.297-304>
- United Nations Environment Assembly. (2022, March 7). *Nature-based solutions for supporting sustainable development: Resolution adopted by the United Nations Environment Assembly on 2 March 2022* (UNEP/EA.5/Res.5). United Nations Environment Programme. <https://digitallibrary.un.org/record/3999268?ln=en&v=pdf#files>
- Wong, A., Frommel, A. Y., Sumaila, U. R., & Cheung, W. W. L. (2024). A traits-based approach to assess aquaculture's contributions to food, climate change, and biodiversity goals. *npj Ocean Sustainability*, 3, Article 30. <https://doi.org/10.1038/s44183-024-00065-7>
- Wong, A., Frommel, A. Y., Sumaila, U. R., & Cheung, W. W. L. (2026). Shifting trends in aquaculture's biological potential to address food, climate and biodiversity challenges. *Fish and Fisheries*, 27(3), 740–753. <https://doi.org/10.1111/faf.70081>
- Yang, H., Zhang, Q., Diao, H., & Xia, S. (2026). A critical review of greenhouse gas emissions from global aquaculture: Sources, drivers, and mitigation pathways. *Aquaculture*, 623, Article 744114. <https://doi.org/10.1016/j.aquaculture.2026.744114>



Appendix A. Policies and Plans Relevant to Nature-Based Solutions in Aquaculture in Fiji

	Areas of thematic analysis			
	Climate resilience	Food security	Nature	People and livelihoods
<i>National Biodiversity Strategy and Action Plan 2026–2030</i> (Government of the Republic of Fiji, 2025b)	Principle 9: Ecosystem-based adaptation (EbA) and eco-Disaster Risk Reduction Focal Area 5: Enabling Environment and Mainstreaming Strategic action to ensure climate change adaptation is mainstreamed into biodiversity conservation.	Focal Area 6: Sustainable Use and Development Integrate biodiversity conservation and sustainable use and management into the production and manufacturing downstream processing and value addition for agriculture, fisheries, forestry, tourism, mining, other land-uses and transport industries.	Principle 3: Biodiversity Mainstreaming and Ownership Emphasizes reciprocal biodiversity-development mainstreaming, and cross-sector coordination, strengthening links and action between sectors that affect and/or benefit from biodiversity—e.g., tourism, agriculture, forestry, mining, and fisheries.	Principle: Community Participation and Ownership Emphasizes traditional rights over natural resources, Indigenous intellectual property rights; community decision-making ensuring gender inclusivity, active involvement, and participation of local communities.



	Areas of thematic analysis			
	Climate resilience	Food security	Nature	People and livelihoods
Third Nationally Determined Contribution (NDC 3.0) (Government of the Republic of Fiji, 2025a)	Adaptation Target A8: To prioritize nature-based solutions that directly mitigate the impacts of flooding and cyclones, ensuring all high-priority, high-impact interventions are implemented by 2035.	Adaptation Target A1: To promote climate-smart agriculture practices that protect food security and adaptive capacity of vulnerable groups through an integrated approach to the management of Fiji's croplands, livestock, sugar production, forests, and fisheries across rural and peri-urban communities.	Adaptation Target A12: To designate 30% of Fiji's internal waters, archipelagic waters, territorial seas, contiguous zone, and exclusive economic zone as marine protected areas by 2030.	Adaptation Target A6: To contribute to Fiji's national objective to reduce poverty in all forms by 2030 through targeted adaptation measures that empower vulnerable groups and contribute to enhanced social protection.
National Adaptation Plan 2021 (Fiji Ministry of Economy, Climate Change and International Cooperation Division, 2018)	Objective 3.1: To integrate the consideration of climate change projections, articulation of risk reduction responsibilities, and formulation of resilience building objectives across all sector plans and strategies.	Objective 3.3: To secure equal and sustainable access to the produce, products, resources, and services that support human health and well-being.	Objective 3.2: To increase ecosystem protection, natural resource redundancy, and environmental resilience through nature-based solutions.	Objective 3.4: To implement climate change adaptation solutions which are inclusive, equitable, and locally driven.
	Objective 3.5: To integrate climate adaptation and disaster risk management priorities.			



	Areas of thematic analysis			
	Climate resilience	Food security	Nature	People and livelihoods
Strategic Development Plan 2024–2028 (Ministry of Fisheries, n.d.)	Cross references Pacific Climate Change Strategy.	Aquaculture Strategy within the Fisheries Strategy: To promote and enable the development of economically viable local aquatic foods to enhance nutritional value intake for coastal and inland communities.	Strategic priority under the Aquaculture Strategy: Develop robust biosecurity framework.	2020 aims: To have Fijian farmers producing and supply 1. 1,000 tonnes of tilapia 2. 1,000 tonnes shrimps 3. two new species of cultured products to both local and export markets
Aquaculture Development Plan 2024–2028 (Fiji Ministry of Fisheries and Forestry, 2024)	Emphasizes the need for contingency plans such as insurance cover to protect aquaculture, who were affected during COVID-19 and Cyclone Winstone.	Focus of the plan is for production for local markets and export, and for supporting livelihoods.	Linked to regulatory compliance and ensuring environmental protection and food safety, referencing the Biosecurity Act, Environment Management Act, and others.	Documenting gendered labour patterns, addressing gender in aquaculture governance, and empowering women at subsistence and semi-subsistence levels to move toward commercialization, are essential. References <i>Pacific Handbook for Gender Equity and Social Inclusion in Coastal Fisheries and Aquaculture</i> , Module 8: Livelihoods (Stacy & Govan, 2021).



	Areas of thematic analysis			
	Climate resilience	Food security	Nature	People and livelihoods
National Ocean Policy 2020–2030 (Republic of Fiji, 2021)	Goal 2: Sustainability Recognizes that diverse and productive ecosystems are vital to maintaining rates of sequestration of carbon in the marine environment, which help build climate resilience through carbon sinks and reservoirs.	Food security referenced throughout	Goal 2: Sustainability Protect, restore, and improve ocean ecosystems, and enhance climate resilience and biodiversity so benefits can be equitably shared through the sustainable management of 100% of Fiji's ocean within the national jurisdiction.	Goal 4: People Promote a people-centred approach to ocean management by sharing benefits in an equitable and inclusive way that respects rights, traditions, and culture. Goal 5: Development Establish a solid foundation for sustainable development, which includes facilitating ocean-based opportunities and innovations to ensure healthy ecosystems and secure economic livelihoods.
Pacific Regional Aquaculture Strategy (Pacific Community, 2025a)	Objective: To assess the resilience of aquaculture to climate change and natural disasters and develop preparedness and mitigating measures.	Objective: Identify and develop options to improve income and food security from aquaculture by expanding domestic, regional, and global market access.	Objective: To ensure that aquatic biosecurity measures keep pace with aquaculture development to protect farms and the environment from aquatic pests and diseases.	Social inclusion objective: To ensure social inclusion and equity issues are addressed along with aquaculture development.



	Areas of thematic analysis			
	Climate resilience	Food security	Nature	People and livelihoods
National Development Plan 2025–2029 and Vision 2050 (Government of the Republic of Fiji, 2024)	The plan sets out several strategies, including climate change adaptation and mitigation measures such as integration of climate change projections and disaster risk reduction across all sector plans, increasing ecosystem protection and natural resource redundancy and the migration to renewable energy sources.	Aquaculture strategy: Develop diversified market pathways for aquaculture products, including exploration of domestic and foreign markets, to enhance market access and profitability.	Fisheries strategy: Invest in research on the culture of highly valued marine species to support biodiversity conservation and sustainable aquaculture practices.	Fisheries policy: Provide supportive legislative framework to facilitate iTaukei fishery business ownership. Establish cold-storage facilities in designated sites.
			Enhance marine-managed areas to protect critical habitats and ecosystems, fostering sustainable fisheries and biodiversity conservation.	Fisheries strategy: Promote women and youth participation in fisheries activities through targeted capacity-building initiatives and inclusive policies.

©2026 International Institute for Sustainable Development
Published by the International Institute for Sustainable Development

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4



iisd.org