Integrated Ecosystem Management Plan for Navua catchment and Beqa lagoon

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Integrated Ecosystem Management Plan for Navua catchment and Beqa lagoon

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Executive Summary

Navua catchment and Beqa lagoon context

Located in the Central Division of Fiji, the Navua River and Beqa lagoon support high social, ecological and economic values. The river floodplains support subsistence farming and commercial agriculture, and the river and tributaries provide an important transport route to villages that are difficult to reach. The catchment includes the Upper Navua Gorge, which is a designated conservation area due to its high ecological significance and the forests containing traditional foods and medicines. The lagoon has been endorsed as a Particularly Sensitive Sea Area (PSSA) through the International Maritime Organization. An abundance of sea life including coral, fish, sharks and turtles resides in the lagoon. Local communities have deep cultural and spiritual connections to the lagoon, and many rely upon it as a traditional fishing ground for subsistence and commercial fishing. The river and lagoon support an extensive tourism industry including river tubing, white water rafting and the Namosi Eco Retreat within the catchment, as well as shark diving, surfing, scuba diving and snorkelling, with resorts located on and around Beqa Island.

The need for an Integrated Ecosystem Management Plan

Changes to the catchment, river and lagoon have reduced the adaptive capacity of the environment to rebound from natural hazards. Changes include decades of logging resulting in land degradation and changes to forest structure, which is likely resulting in excess sediment delivery to the river. Additionally, sand and gravel extraction from the channel is contributing to stream bed and bank instabilities and extensive erosion. This has a direct impact on infrastructure and houses located near rivers, as well as impacts to the lagoon due to excess sediment and nutrient delivery. Changes to the coastline such as removal of mangroves have reduced natural defences to coastal erosion. Overfishing and pollution are also major threats to the Beqa lagoon.

This Integrated Ecosystem Management Plan (IEMP) seeks to address the economic, social and environmental challenges of the Navua catchment and Beqa lagoon through halting the decline of biodiversity and strengthening the sustainable management of the coastal and marine ecosystems through an integrated ridge-to-reef management approach.

Drivers, Pressures/Threats, State and Benefits in the catchment and lagoon

The Driver-Pressure-State-Benefits-Response (DPSBR) framework has been used to guide development of the IEMP (Figure E1). Analysis using the framework found that the significant value provided by ecosystem services in the catchment were being impacted by a range of pressures and threats. Identification of strategies and actions focussed on the key threats impacting biodiversity, and therefore on protecting the benefits provided.

Figure E1. Drivers, Pressures/Threats, State and Benefits framework for the Navua catchment and Beqa lagoon

Strategies and actions

A set of five strategies and 13 underlying actions were identified in consultation with communities, and in response to the issues identified through the Driver-Pressure-State-Benefits-Response framework. The selection of strategies and actions also incorporated alignment with Integrated Village Development Plans (IVDPs); and ensuring Gender Equity, Disability and Social Inclusion (GEDSI).

Table E1 - Summary list of strategies and actions

Strategy	Actions	Threats mitigated	Benefits promoted	Contribution to IVDP goals
Strategy 1 – Reduce community level impacts on the environment	Action 1.1 Develop programme to improve solid waste management	Improper waste management; Water-borne disease	Fishing; Water supply; Recreation/tourism; Visual amenity	Improve governance (supporting goal); Build conservation and climate change resilience
	Action 1.2 Reduce the use of pollutants in agriculture	Nutrient pollution; Agriculture clearing for yaqona and other crops; Declining productivity of agricultural land	Fishing; Water supply; Recreation/tourism; Visual amenity	Improve community wellbeing; Promote economic empowerment; Build conservation and climate change resilience
Strategy 2 – Protect and rehabilitate the environment	Action 2.1 Develop and implement a reforestation programme for catchment protection	Unsustainable commercial forestry; Invasive species; Agriculture clearing for yaqona and other crops; Mining exploration; Large scale unsustainable farming/ agriculture	Hunting food; Seasonal fruits; Materials for cultural practices; Carbon sequestration; Water quality improvement; Recreation; Ecotourism; Visual amenity; Native and non-native habitat	Promote economic empowerment; Build conservation and climate change resilience
	Action 2.2 Improve sustainable forestry management	Unsustainable commercial forestry; Invasive species; Agriculture clearing for yaqona and other crops; Mining exploration; Large scale unsustainable farming/ agriculture	Hunting food; Seasonal fruits; Materials for cultural practices; Carbon sequestration; Water quality improvement; Recreation; Ecotourism; Visual amenity; Native and non-native habitat	Promote economic empowerment; Build conservation and climate change resilience

Strategy	Actions	Threats mitigated	Benefits promoted	Contribution to IVDP goals
	Action 2.3 Coral reef restoration and conservation	Loss of reef habitat; Crown-of-thorns starfish (COT)	Reef coastal protection; Recreation/tourism; Coral reef habitat	Promote economic empowerment; Build conservation and climate change resilience
	Action 2.4 Establish/protect/study Marine Protected Areas	Overfishing/poaching; Loss of reef habitat; Clearing of mangroves for development	Mangrove coastal protection; Carbon sequestration; Coastal protection from reefs; Recreation and tourism; Visual amenity; Mangrove nursery habitat; Coral reef habitat	Improve governance (supporting goal); Promote economic empowerment; Build conservation and climate change resilience
Strategy 3 – Promote opportunities for use of Nature-based solutions	Action 3.1 Develop and implement NbS for improving village water supplies and sewerage	Contamination of water sources	Enhanced public health; Improved water quality; Increased water supply resilience; Better and reliable infrastructure; Support for community well-being; Environmental sustainability	Improve community wellbeing; Build conservation and climate change resilience
	Action 3.2 Develop and implement NbS for strengthening riverbank, flood and coastal protection	Coastal erosion and flooding; Loss of reef habitat; Clearing of mangroves for development; Sedimentation; Nutrient pollution	Enhanced coastal resilience; Improved water quality; Biodiversity conservation; Economic stability; Community well-being	Improve community wellbeing; Promote economic empowerment; Build conservation and climate change resilience
	Action 3.3 Develop and implement NbS for improving transport and accessibility options (road resilience)	Coastal erosion and storm damage threats	Reduced infrastructure costs.; Reduced risk of flooding; Road users; Tourism industry	Improve community wellbeing; Promote economic empowerment; Build conservation and climate change resilience
Strategy 4 – Build ecosystems-	Action 4.1 Develop a responsible ecotourism strategy	Lack of alternative income sources	Provision of livelihood; Contribution to	Improve community wellbeing; Promote economic

Strategy	Actions	Threats mitigated	Benefits promoted	Contribution to IVDP goals
based livelihoods			intergenerational transfer of knowledge; Better aligns objectives of communities with ecosystem health	empowerment; Build conservation and climate change resilience
	Action 4.2 Improve livelihood opportunities from Non-Timber Forest Products (NTFP) (e.g. basket weaving)	Overexploitation of natural resources; Lack of alternative income sources	Reduced pressure on resources.; Poverty alleviation; Preserved indigenous knowledge and cultural heritage; Empowered local communities; Diversified income sources	Improve community wellbeing; Promote economic empowerment; Build conservation and climate change resilience;
Strategy 5 – Build capacity and knowledge sharing	Action 5.1 Build capacity on Climate Change	Climate change; Invasive species; Pest animal; Saltwater inundation; Erosion; Heavy rainfall; Droughts; Loss of reef habitat	Carbon sequestration; Mangrove coastal protection; Ecotourism; Flood mitigation	Improve community wellbeing; Build conservation and climate change resilience
	Activity 5.3 Monitor, evaluate and report through Report Cards	Lack of integration with community and stakeholders	Keeping all stakeholders aware of progress and maintaining the partnership	Improve governance (supporting goal); Build conservation and climate change resilience; Empower traditional leadership and Vanua (supporting goal)

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Acronyms

BIEM	By-catch and Integrated Ecosystem Management
BioRap	Biological rapid assessment
COT	Crown-of-thorns starfish
CSO	Civil Society Organisation
DPSBR	Driver-Pressure-State-Benefits-Response
EbA	Ecosystem-based Adaptation
ESRAM	Ecosystem and Socioeconomic Resilience Analysis and Mapping
ESVOA	Environmental and Socioeconomic Vulnerability and Opportunity Assessment
GEDSI	Gender Equality, Disability and Social Inclusion
GSI	Gender and Social Inclusion
IEMP	Integrated Ecosystem Management Plan
MPA	Marine Protected Area
NbS	Nature-based Solutions
NTF	Non-Timber Forest Products
PEUMP	Pacific-European Union Marine Partnership
PSSA	Particularly Sensitive Sea Area
SUMA	Special and/or Unique Marine Areas
SPC	The Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme

1 Introduction

1.1 Importance of Navua catchment and Beqa lagoon

The Navua River is located in the Central Division of Fiji, on the island of Viti Levu. The river and catchment support high social, ecological and economic values. For example, the floodplains support subsistence farming and commercial agriculture, and the river and tributaries provide an important transport route to villages that are difficult to reach.[1] The river also supports an extensive tourism industry including river tubing, white water rafting and the Namosi Eco Retreat. The catchment includes the Upper Navua Gorge, which is a designated conservation area due to its high ecological significance and the forests containing traditional foods and medicines.

The Navua River flows into the Beqa lagoon. The lagoon is a premier cultural and environmental asset that has been endorsed as a Particularly Sensitive Sea Area (PSSA) through the International Maritime Organization (IMO). An abundance of sea life including coral, fish, sharks and turtles, resides in the lagoon and underpins the lagoon's cultural and economic values. Local communities have deep cultural and spiritual connections to the lagoon, and many rely upon it as a traditional fishing ground for subsistence and commercial fishing. The lagoon supports a thriving tourism industry, including shark diving, surfing, scuba diving, snorkelling, and resorts located on the mainland and Beqa Island.

1.2 The need for an Integrated Ecosystem Management Plan

Changes to the catchment, river and lagoon have reduced the adaptive capacity of the environment to rebound from natural hazards. Changes include decades of logging resulting in land degradation and changes to forest structure[2], which is likely resulting in excess sediment delivery to the river. Additionally, sand and gravel extraction from the channel is contributing to stream bed and bank instabilities and extensive erosion. This has a direct impact on infrastructure and houses located near rivers, as well as impacts to the lagoon due to excess sediment and nutrient delivery. Changes to the coastline such as removal of mangroves have reduced natural defences to coastal erosion. Overfishing and pollution are also major threats to the Beqa lagoon.

Flooding and subsequent hillslope, floodplain, riverbank and coastal erosion is predicted to be exacerbated by climate change impacts. Climate change impacts are also leading to existential threats to marine life, coral reefs and mangrove systems, which cascade into social, cultural, environmental and economic decline. The impacts of this are typically felt disproportionately. Exclusion from humanitarian services and decision-making processes in natural resource planning makes women and people with disabilities amongst the most vulnerable groups in society. This reduces the adaptive capacity of these groups to respond to increasing threats from climate change.

This Integrated Ecosystem Management Plan (IEMP) seeks to address the economic, social and environmental challenges of the Navua catchment and Beqa lagoon through halting the decline of biodiversity and strengthening the sustainable management of the coastal and marine ecosystems through an integrated ridge-to-reef management approach. Specifically, the IEMP aims to address these challenges through identification of realistic activities to increase the natural adaptive capacity of coastal and catchment habitats whilst promoting human health and poverty reduction, supporting sustainable livelihoods and contributing to the delivery of Fiji's conservation priorities.

Development of this IEMP has been supported by the By-catch and Integrated Ecosystem Management (BIEM) Initiative of the Pacific-European Union Marine Partnership (PEUMP) programme funded by the European Union and the Government of Sweden (see Appendix A for description).

[1] Secretariat of the Pacific Community (SPC). 2012. Catalogue of Rivers for Pacific Islands.

[2] Tuinivanua, O. 1996. Improving Fiji's Rainforest Classification Using Digital Satellite Images, Paper reported in the GIS and Remote Sensing News, University of the South Pacific. (9601 (pgrsc.org)).

1.3 Approach to developing the Integrated Ecosystem Management Plan

The IEMP has been developed through a scientific and consultative process. This has included a range of assessments[3] as follows:

- Gender and Social Inclusion (GSI), human rights and poverty alleviation situational analysis – documented in the report titled *GSI, human rights and poverty alleviation situational analysis for the Navua catchment and Beqa lagoon.*
- Rapid Biodiversity Assessment – documented in the report titled *Biological rapid assessment (BioRap) for the Navua catchment and Beqa lagoon.*
- Ecosystem and Socioeconomic Resilience Mapping (ESRAM) – documented in the report titled *Ecosystem and Socioeconomic Resilience Mapping (ESRAM) for the Navua catchment and Beqa lagoon.*
- Ecosystem-based Adaptation options development and prioritisation – documented in the report titled *Ecosystem-based Adaptation options for the Navua catchment and Beqa lagoon.*
- Environmental and Socioeconomic Vulnerability and Opportunity Assessment (ESVOA) – documented in the report titled *Socioeconomic Vulnerability and Opportunity Assessment (ESVOA) for the Navua catchment and Beqa lagoon.*

In addition, stakeholder engagement planning and implementation has been undertaken to seek to ensure the plan is widely understood and accepted (Figure 1). This engagement has included:

- Informal consultations during the BioRaps.
- Consultations with 53 communities to inform the ESRAM and ESVOA.
- Consultation workshop on the underpinning scientific and socioeconomic assessments with approximately 45 participants from communities, government, private sector and NGOs operating in the catchment and/or lagoon.
- Six community consultation workshops on the draft IEMP.

Figure 1. Consultation with community members

[3] These reports are available on the SPREP Virtual Library at library.sprep.org

1.4 Aligning the Integrated Ecosystem Management Plan and Integrated Village Development Plans

To ensure alignment of the IEMP with existing development planning in the catchment and island, the IEMP has been informed by the review of 55 Integrated Village Development Plans. The review revealed a consistent set of five goals (noting one province presented slightly differently) and a consolidated set of 21 objectives of relevance to the Integrated Ecosystem Management Plan.

Combining with the consultations undertaken in developing the plan, and baseline information and data received, the goals and objectives have informed the development of the IEMP. The goals are:

1. Improve governance (supporting goal)
2. Improve community wellbeing
3. Promote economic empowerment
4. Build conservation and climate change resilience
5. Empower traditional leadership and Vanua (supporting goal)

1.5 The Driver-Pressure-State-Benefits-Response framework

The Driver-Pressure-State-Benefits-Response (DPSBR) framework (see Box 1) has been used to guide development of the IEMP. The DPSBR framework is adapted from frameworks commonly utilised in environmental and conservation planning to define cause and effect relationships between society and the environment. Adoption of this framework helps to ensure that IEMP is focussed on where it can have the greatest impact.

Box 1. Driver-Pressure-State-Benefits-Response framework

Driver – Drivers refer to the social, demographic, and economic developments which influence the human activities that have a direct impact on the environment. Key drivers to be considered in the plan are subsistence and commercial farming, tourism, mining, forestry, town development and prosperity, coastal protection, and fishing.

Pressures – Pressures represent the consequence of the driving force, which in turn affects the state of the environment. Key threats in the catchment include logging, forestry, mining, land clearing for farming, gravel extraction, animal pests, eutrophication, sedimentation, and overfishing.

State – State describes the physical, chemical and biological condition of the environment or observable temporal changes in the system.

Benefit – The environment provides benefits to communities through ecosystem services. The ecosystem services generally fall into different categories, specifically for the Navua catchment and Beqa lagoon:

- ***Provisioning***, such as rivers providing water supply, or healthy soils providing for food, or sustainable timber harvesting providing building materials.
- ***Regulating***, such as clean catchments reducing the need to treat drinking water, or coastal vegetation such as healthy mangroves protecting the Queens Road from coastal erosion.
- ***Cultural*** such as the natural habitat underpinning tourism sector activity or providing spiritual value to local communities.

Response – Response refers to actions taken to correct the problems of the previous stages, by adjusting the drivers, reducing the pressure on the system, bringing the system back to its initial state, and mitigating the impacts.

2 About Navua catchment and Beqa lagoon

2.1 Physical description

The Navua River originates on the eastern slopes of Mt Tuvutau and flows east for 60 km before making a sharp bend to the south and joining the main tributary, the Wainikoroiluva River. Following the turn, the Navua River flows south for approximately 30 km and discharges into Drakeilobi Bay within the Beqa lagoon. The catchment's highest point reaches 1,084 m above sea level and comprises five sub-catchments: Veinuqa, Wainimoli, Wainikoroiluva, Wainikovu, and the smallest, Volasa.

Upstream of the sharp bend, the Navua River has heavily incised into underlying mudstone resulting in a partly bedrock confined cobble and gravel bed channel with floodplain pockets sitting in a deep valley. Below the sharp bend the river cuts through hard volcano-clastic rock[4] before emerging into a partly bedrock confined cobble and gravel bed channel bounded by a steep valley underlain by volcanic rock (Figure 2). Approximately 11 km upstream of the outlet the river emerges onto a wide coastal floodplain.

Figure 2. Upstream reach of the Navua River showing native forest

The Navua River flows into the Beqa lagoon (**Error! Reference source not found.**), which is the largest enclosed lagoon in Fiji.[5] The lagoon covers 440 km^2 and is protected from ocean swells by a barrier reef and fringed by mangroves on the mainland.

The catchment and lagoon can be divided into four distinct biomes: native forest; terrestrial waterways; mixed-use native forest and agriculture; and coastal/marine (Figure 4). These biomes have been used to frame the assessments undertaken to develop this IEMP.

[4] Terry J. and Pain C. 2002. Geomorphological Evolution of the Navua River, Fiji, Physical Geography, Vol. 23, Issue 5, pp. 418 to 426

[5] Pacific Blue Foundation, ND

Figure 3. The Beqa lagoon from the upper catchment showing the upland rainforests, the floodplains and Beqa Island.

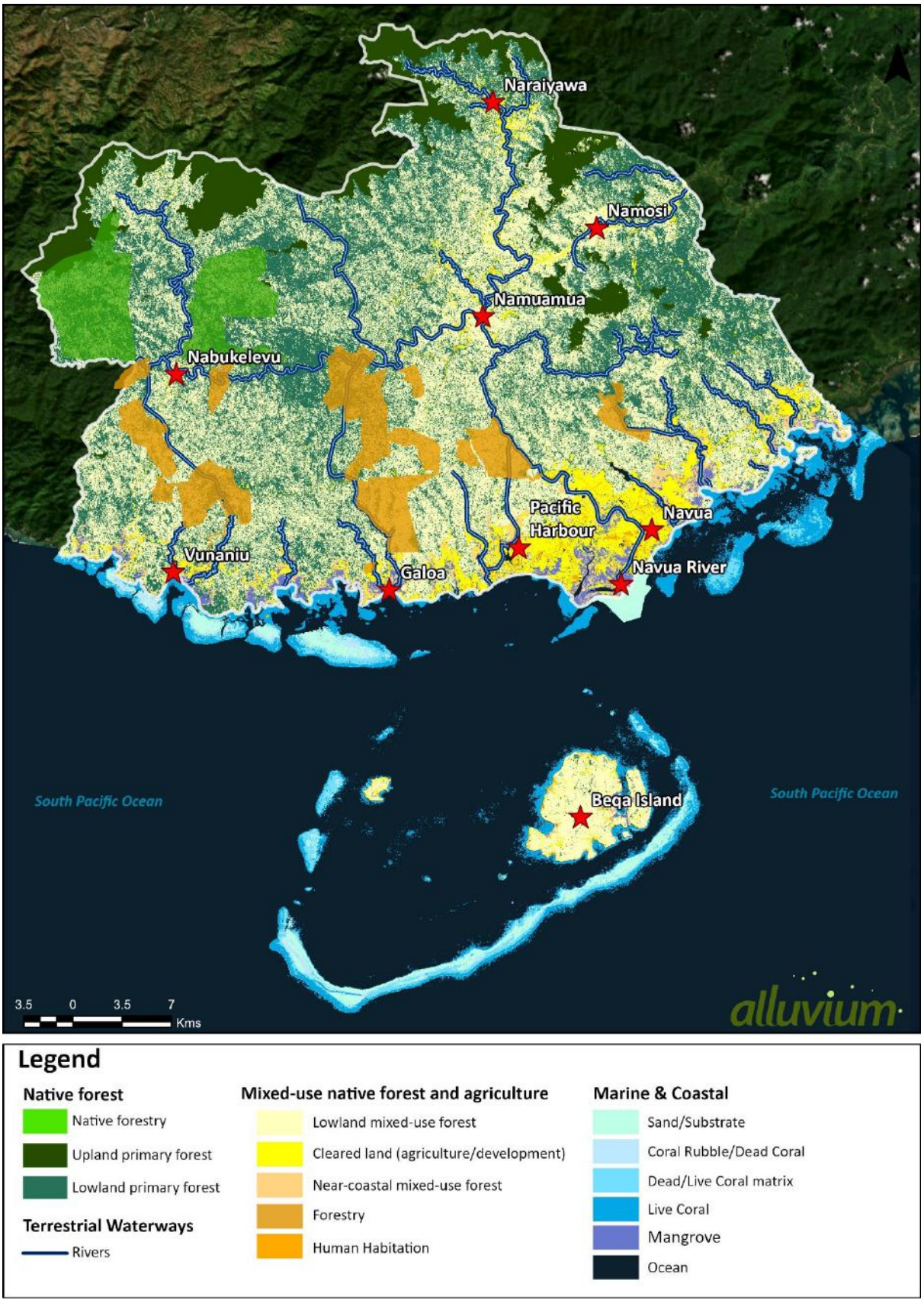

Figure 4. Navua catchment and Beqa lagoon biomes and underlying land use

2.2 Drivers

In the DPSBR framework, the **drivers** refer to the social, demographic and economic developments, which influence the human activities that have a direct impact on the environment.

Drivers for the Navua catchment and Beqa lagoon have been identified through literature review, field visits and consultations with communities and government agencies. The key drivers are subsistence and commercial farming, tourism, mining exploration, forestry, town development and prosperity, coastal protection, and fishing.

2.3 Pressures/Threats

In the DPSBR framework, the **pressures/threats** are the human activities resulting from the driving force, which in turn, affect the state of the environment.

Pressures on the ecosystems of the Navua catchment and Beqa lagoon have been identified through spatial analysis, field visits and consultations with communities and government agencies. A summary of the pressures/threats for each biome are presented in Table 1.

Climate change is likely to provide additional pressures with significant impacts on Fiji projected over future decades. These projections indicate increased temperatures, altered rainfall patterns, rising sea levels, and intensified tropical cyclones.[6]

Table 1. Summary of key pressures and threats by biome

Biome	Pressures/threats
Native forest	• Unsustainable commercial forestry operations: Commercial forestry operations result in significant areas of loss, significantly greater than losses for clearing by villagers in the interior. Furthermore, the mahogany naturally spreads beyond plantation areas, invading native forests and inhibits the native plant regeneration through allelopathic effects.[7] • Invasive species: Invasive species such as the African Tulip trees threaten biodiversity and hinder native forest recovery from other impacts. This is particularly an issue for native forest near cleared land as these areas can support more invasive weeds and pests. • Agriculture clearing for yaqona and other crops: Threatens native forest areas, largely driven by population growth (i.e. need more space for housing and agricultural production to meet demand), productivity decline of existing cultivated land. • Lack of alternative income sources: Even where communities acknowledge a need to protect native forest areas, a lack of alternative income sources can put pressure on landowners to agree to leases with forestry companies. • Mining exploration: Mine prospecting has resulted in land clearing for roads and drilling for sampling. These negative effects remain unchecked as prospecting licenses do not require an Environmental Impact Assessment. Should the prospecting activities result in larger scale extraction, there may be impacts on native forest areas (e.g. through clearing, altering regional scale hydrology).
Mixed-use native forest and agriculture	• Pest animals: Pests such as rats, mongoose and wild pigs threaten not only ecosystem through predation but also impacts on crops and livestock. • Saltwater inundation: Temporary flooding and regular tidal inundation (increasing due to sea level rise) can sterilise land for cropping, impact on local community housing and other infrastructure and have health impacts (e.g. inundation of septic pit areas). • Erosion: Results in loss of land available for other uses, impacts on buildings, other infrastructure, and access (e.g. road impacts). Can also be exacerbated by human activities (e.g. fast boats).

[6] Pacific Climate Change Monitor [PCCM]. 2021. Marra, J.J., Gooley, G., Johnson, M-V, Keener, V., Kruk, M.K., McGree, S., Potemra, J.T., and Warrick, O., 2021. Pacific Islands - Regional Climate Centre Network (PI-RCC) Report to the Pacific Islands Climate Service (PICS) Panel and Pacific Meteorological Council (PMC). April 18, 2022.

[7] Allelopathy is a biological phenomenon in which plants release chemicals into the environment that can affect the growth, survival, or reproduction of other plants. These chemicals, known as allelochemicals, can inhibit or promote growth depending on their nature and concentration.

	• Declining productivity of agricultural land: The allelopathic effects of mahogany inhibit the regrowth of other plants, while intensive farming impacts soil quality. • Kava dieback disease: reduces crop yields of yaqona impacting on income and availability for cultural practices. Communities sometimes relate Kava dieback disease to unhealthy soil, resulting in further clearing and degradation of forest to grow more crops. May also trigger switch to more expensive substitute products subsequently reducing cashflow required to maintain livelihoods. • Small black ant: A number of villages mentioned a specific ant that has been noticed in recent years. These ants tend to farm and protect sap-sucking insects like aphids and scale insects, which secrete honeydew that the ants consume. This relationship leads to higher populations of these pests, which damage crops by extracting essential nutrients.[8] This has reduced crop productivity, resulting in impacts to livelihoods. • Population growth: Increases demand for land for buildings and agriculture. • Land tenure restricting expansion of village boundaries: Limits available space for new buildings or farmland.
Terrestrial waterways	• Overfishing/poaching: Threatens aquatic biodiversity and ecosystem balance in waterways. Communities noted fewer and smaller aquatic species in many areas resulting in impacts to livelihoods. • Water-borne disease: Poor water quality and flooding are factors in the spread of water-borne disease (e.g. typhoid, leptospirosis) in local communities. • Inappropriate harvesting practices: Communities noted the use of chemical "fish bombs" used in some areas to achieve greater harvests. These "fish bombs" typically use chemicals such as chlorine, fertilisers, or duva root. These have had two major impacts including a decrease in reproduction rates by affecting larvae and eggs as well as affecting village water supplies (there are cases of villages having to empty out reservoirs due to contaminated water). Lack of awareness was suggested as a key factor driving this. • Heavy rainfall: Results in poor water quality, particularly increased incidence of water-borne disease, and sediment in water supplies. • Allelopathic effects from mahogany plantations: Chemicals released by mahogany trees contaminate waterways, harming aquatic life and ecosystem health. This also reduces the size and quantity of aquatic species available for communities to harvest for subsistence and income. • Livestock along riverbanks: Contribute to water pollution and water-borne disease through destabilising riverbank sediment and greater levels of manure near the water supply. • Population growth: Increases pressure on water supply and aquatic species used for subsistence and income. • Wastewater and other polluted discharge: Wastewater and runoff from villages and seepage from septic can return directly and indirectly to waterways, impacting on both ecological functions and human health. • Infrastructure maintenance requirements: Impose challenges for managing and preserving waterway ecosystems. • Droughts: Exacerbate water scarcity and stress on aquatic habitats. • Sedimentation: Caused by forestry and farming practices upstream, leading to flooding and restricted waterway access. • Impact of gravel extraction from rivers: Gravel extraction from rivers, while sometimes providing a source of income, can lead to habitat destruction, increased sedimentation, and altered water flow, adversely affecting aquatic ecosystems and species.
Marine and coastal areas	• Overfishing/poaching: Threatens marine biodiversity and disrupts ecosystem balance. Communities noted fewer and smaller aquatic species in many areas resulting in impacts to livelihoods. • Loss of reef habitat: Endangers marine species and disrupts coastal ecosystem dynamics, reducing the nursery habitat ecosystem services provided. • Clearing of mangroves: Leads to habitat destruction and coastal ecosystem fragmentation, reducing the nursery habitat ecosystem services provided.

[8] For further discussion of the ants and associated bugs and insects see Thaman R. 2018. The 2016 Fiji Ant-Mealybug Bioinvasion.

- Crown-of-thorns starfish (COT): Destroys coral reefs, affecting marine biodiversity and ecosystem health.
- Coastal erosion: Endangers coastal habitats and key transportation infrastructure along the coast (Figure 5).
- Sedimentation: Exacerbates flooding and hampers waterway access, driven by upstream forestry and farming practices. Sediment loads are also effectively burying coral reefs in some locations.
- Nutrient pollution: Impacts marine ecosystems and contributes to COT growth, and oxygen depletion.
- Waste management challenges: Increased access to cold storage and processed food is resulting in more litter generation, polluting marine and coastal environments and impacting visual amenity and marine life.
- Improper waste management reduces the effectiveness of Marine Protected Areas along with coastal environments encompassing Navua River.

Figure 5. Erosion threatening transportation corridor near Galoa (May 2023)

2.4 State

In the DPSBR framework, the **state** describes the condition of the environment or observable temporal changes in the system.

A biological rapid assessment (BioRap) was undertaken to understand the state of the ecosystems within the Navua catchment and Beqa lagoon. The BioRap assessment, documented in detail in the BioRap report, was designed to provide an understanding of the functional diversity of the ecosystems within the catchment and determine the impact of different threats on biodiversity.

Figure 6. Orchid found in the Navua catchment

In the terrestrial biomes, the dominant land use cover (per area) is lowland mixed-use forest (part of the mixed-use native forest and agriculture biome). This was followed by lowland primary forest (native forest biome). Combined, these two land use types provide the largest habitat and contain the majority of the flora and fauna in the catchment. This combined area is also where the greatest impact of forestry, mining exploration and agriculture occurs. As a result, this area represents both the largest ecosystem service provided by the catchment and the area with the largest (by size) risk to biodiversity.

The terrestrial biomes also include significant levels of the critical upland rainforest (montane), mangrove forests and coastal forests, all of which are threatened by a combination of clearing for agriculture, urban and industrial development and tourism (e.g. resort development).

Figure 7. *Polyura camponitis* butterfly found in the Navua catchment, endemic to Fiji.

Navua catchment is home to a high number of unique and endemic native forest biodiversity, including the endangered Navua palm (*Heterospathe phillipsii*), which is endemic to the catchment, and the endangered sago palm (*Metroxylon vitiense*), which is endemic to Fiji. The Critically Endangered conifer, *Acmopyle sahniana,* (drautabua[9]) is known to be within Navua catchment[10] but was not observed in this BioRap. Further detail on the state of the terrestrial biomes is provided in Table 2.

In terms of marine and coastal biomes, in the Beqa lagoon, critical coastal habitats like coral reefs, mangrove forests and seagrass meadows abound but are impacted by flood runoff and land clearing along the coastal fringe. There are approximately 1,241 ha of native mangrove forests. Two areas within the study area are listed as Inshore Special and/or Unique Marine Areas (SUMA): the Beqa barrier reef and lagoon (including associated mangroves) and the Serua mangroves and (coastal) passages (Sykes et al 2018[11]). There are extensive estuarine and coastal mangroves and coastal vegetation in the bays, particularly near Galoa-Namatakula, Nadiri-Malomalo, Namaqumaqua and Komave villages. Further detail on the state of the marine and coastal biome is provided in Table 2.

Figure 8. Example of the marine life in the Beqa lagoon

[9] Keppel G. & Thomas N. 2023. *Acmopyle sahniana*. The IUCN Red List of Threatened Species 2023: e.T31052A99514723. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T31052A99514723.en. Accessed on 13 August 2024.

[10] Tuiwawa M., Pene S. and Tuiwawa S. 2013. A rapid biodiversity assessment and archaeological survey of the Fiji REDD+ Pilot Site: Emalu Forest, Viti Levu. Institute of Applied Sciences, USP.

[11] Sykes H., Le Grand J., Davey K., Kirmani S.N., Mangubhai S., Yakub N., Wendt H., Gauna M. and Fernandes L. 2018. Biophysically special, unique marine areas of Fiji. MACBIO (GIZ, IUCN, SPREP), Wildlife Conservation Society and Fiji's Protected Area Committee (PAC); Suva.

Table 2. Findings of the BioRap

Biome	Condition	Observable impacts of threats and pressures
Native forest and land	• 67 flora species were observed on Beqa Island, seven of which are endemic to Fiji and 17 introduced. • Avian survey resulted in 38 species, including 15 endemics. Common species included the Fiji bush warbler (*Cettia ruficapilla*), giant forest honeyeater (*Gymnomyza viridis*, Vulnerable), wattled honeyeater (*Foulehaio carunculate*), Polynesian triller (*Lalage maculosa*), Fiji white eye (*Zosterops explorator*), and masked shining parrot (*Prosopeia personata,* Vulnerable). • Threatened bird species encountered were the pink-billed parrotfinch (*Erythrura kleinschmidti*, Vulnerable), black-faced shrikebill (*Clytorhynchus nigrogularis*, near threatened), and friendly ground dove (*Gallicolumba stairi*, Vulnerable). • The most common native species encountered was the endemic Fijian snake-eyed skink (*Cryptoblepherus eximius*) which was numerous along the beaches of Beqa Island. • Seven herpetological species were observed in the Nabukelevu area; four are native (two endemic) and three introduced (one invasive). • Insect surveys revealed a rich diversity of insects, particularly beetles, with notable findings of rare and endemic species, such as the *Polyura camphonitis* butterfly and Nesobasis damselflies. Additionally, the presence of Cerambycidae (long-horned beetles) further emphasises the integrity of the forest ecosystem. This is because long-horned beetles spend up to 12 years in larval stage in rotting wood and their presence is indicative of its support for forest ecological functioning.[12, 13] • The unique Matalima Cave in Serua Province sits in a slightly disturbed forest and hosts the Endangered Fijian blossom bat (*Notopteris macdonaldi*) and white-rumped swiftlets (*Aerodramus spodiopygius*).	• Plots without logging history exhibited greater flora species diversity and larger trees, while disturbed plots showed reduced numbers and sizes due to past logging activities. • Logging activity in the Nabukelevu lands has opened up pathways for the introduction of invasive animals and plants that are known to have an impact on native species. • Logging activities pose threats to habitat and bird populations by removing large trees with hollows. Some rare species were absent from the BioRap, for example *Charmosyna amabilis* (Critically Endangered; IUCN Red List) and *Trichocichla rufa* (Endangered; IUCN Red List). Conversely, sightings of the Vulnerable pink-billed parrotfinch (*Erythrura kleinschmidti*) are encouraging. • The intact forest systems of the area exhibited higher insect diversity compared to logged sites, emphasising the importance of forest conservation.

[12] Waqa-Sakiti H. 2016. Taxonomy, Host Selection, Biogeography and Species Distribution Modelling of the Fijian Long-horned beetles (Coleoptera: Cerambycidae). PhD Thesis, University of the South Pacific, Suva, Fiji.

[13] Waqa-Sakiti H., Hodge S. and Winder L. 2018. Distribution of long-horned beetles (Cerambycidae: Coleoptera) within the Fijian Archipelago. The South Pacific Journal of Natural and Applied Sciences, 36 (1): 1-8.

Biome	Condition	Observable impacts of threats and pressures

Mixed-use native forest and agriculture	• Mixed-use low-land forests have higher disturbance levels than primary forests.
	• Mixed-use land may consist of intercropping trees with the dominant staple food crops in home gardens and around villages in upland and alluvial lowland areas and river terraces and consist of a mix of native, non-native and invasive species. Because of this close interface between human activities and native forest, the condition of these areas is dependent on management practices and land uses.
	• Agroforestry or mixed-species agriculture in the catchment is declining and being replaced by intensive single-species agriculture.
	• Intensive cropping degrades soil and can lead to other disturbances like erosion and increases in pest activities (e.g., aphids and their ant protectors). Whereas diverse cropping can increase invertebrate diversity which lowers the chances of pests becoming a problem. Practices like shorter fallow periods and reduced mulching practices can reduce soil health and increase erosion.
	• Fallow period may be decreasing due to increased demand for food and higher availability of short turnaround crops such as cassava.[14]
		• The BioRap found that disturbed areas have typically lower levels of species richness and abundance of flora and fauna species. Weed species invade from human settlements into mixed-used native and primary native forests (84 species of introduced plants have been recorded in the catchment, including 17 on Beqa Island; BioRap 2024).
		• Pests and diseases threatened native wildlife and agricultural assets. For example:
		  ○ Mongoose and feral cats have decimated the native ground herpetofauna including the banded iguana (*Brachylophus bulabula*), which descend to the ground to lay their eggs. Mongoose have also been associated with the decline in forest fowl on Beqa Island.
		  ○ Small black ants that farm and protect sap-sucking insects like aphids and scale insects, which secrete honeydew that the ants consume. This relationship leads to higher populations of these pests, which damage crops by extracting essential nutrients. This has reduced crop productivity, resulting in impacts to livelihoods.
		  ○ Diseases in crops reduce yields and affect

[14] Harrison S. and Karim MS. (Eds). 2016. Promoting sustainable agriculture and agroforestry to replace unproductive land use in Fiji and Vanuatu. Australian Centre for International Agricultural Research: Canberra, ACT

Biome	Condition	Observable impacts of threats and pressures
		livelihoods (for example kava dieback disease). • Sea level rise can inhibit cropping and pasture whilst expanding mangrove and near-shore forests. • Natural disasters like fire and flooding can affect productivity of agricultural land.
Terrestrial waterways	• Terrestrial waterway condition was not directly observed during the BioRap, however, observations and community consultations gave indications of terrestrial waterway condition. • Waterway condition in the more elevated, upper catchment areas is generally good with intact riparian (streambank) vegetation and clear water. • Waterways downstream of mining exploration and forestry roads have a higher degree of sedimentation from erosion after rainfall. Sedimentation accumulates in the larger tributaries and the Navua River so water quality is typically poorer in those waterways. • The waterways on the coastal flood plain of the catchment are in poorer condition with extensive bank erosion that has resulted from clearing of streambank vegetation to be used for agriculture and forestry. This effect is exacerbated after heavier rainfall and storm events with most of the waterways in the lower catchment experiencing a very high level of sedimentation which impacts water quality and eventually flows out into the lagoon. • Water quality in the main tributaries in the upper catchment and in lower catchment waterways is also impacted by a high level of nutrients from sewage overflows and run off from urban and cleared areas on the coastal plain. • The main Navua River is in relatively good condition in the upper catchment, however water quality gets poorer downstream as impacts accumulate. The river is highly sedimented after floods. It is also highly impacted by gravel extraction just downstream of the gorge. The Navua estuary is in moderate condition, although many of the vegetation communities on the banks of the estuary have	• Gravel extraction in the reach of the Navua River adjacent to the village of Nakavu. Gravel extraction in that reach has destabilised the riverbed, impacted on riverine habitats and increased sediment in non-flood times. • Erosion in the majority of waterways on the coastal floodplain that have been cleared for agriculture show signs of erosion and sedimentation. Where vegetation is present, much of it is non-native (e.g. bamboo, African tulip and mahogany). • The Qaraniqio River that runs through Pacific Harbour has been heavily modified with adjacent development (e.g. golf course and housing estate) and dredging for the harbour. Water quality is often poor due to the malfunctioning sewage treatment plant that discharges into the river. • The Navua River regularly floods, which delivers a very high amount of sedimentation downstream and out into the Beqa lagoon. • Many of the villages reported occasional contamination of their water supply from either poor quality from upstream or sewage contamination. The Ministry of Health records the outbreaks of leptospirosis and

Biome	Condition	Observable impacts of threats and pressures
	been removed or modified, which causes erosion and reduces the connectivity for marine species like fish that need access to estuarine habitats to complete their life cycles.	typhoid which are common in villages throughout the Navua catchment.
Marine and coastal areas	• Species richness and fish abundance was typically low in mangroves compared with the reef-based habitats, with the most diverse and abundant mangrove forest being at the mouth of the Navua River. Thirty-five fish species were recorded in the mangrove forests in and around the Beqa lagoon. • The character of the immediate foreshore along the coastal frontage of the Navua delta, and the entire Navua–Pacific Harbour foreshore is that of sloping sandbanks, with algal overgrowths and seagrass beds. Because of the high-water turbidity these are often heavily sedimented, but even sedimented seagrass beds remain an important feeding habitat for invertebrates, juvenile fish, and the endangered green turtle, *Chelonia mydas*. A total of 217 fish species were recorded at the near shore coral reef sites. • Outside the Shark Reef Marine Reserve (SRMR) and Lawaki Marine Protected Area (MPA), all fish recorded in surveys in the current and previous studies were small and not species typically targeted by commercial fishers. Few larger predators were seen in the 2023 survey. No trevallies or other larger predators were seen on deeper outer reef walls during previous surveys. A total of 176 species of fish were recorded at the offshore reef sites.	• **Inshore reefs:** Fish species richness and abundance (including harvested fish) were highest at sites outside the flood plume and further from the river mouth. This indicates the impact of the Navua River discharge on the fish community structure of the nearshore reefs of the Beqa lagoon. • **Near coastal foreshores**: tend to be heavily silted by terrestrial sediments deposited by turbid river water. • **Patch reefs** (1 km to 2 km from shore): are also regularly affected by sedimentation during times of heavy rainfall, but tidal currents and wave motion displace the sediments much of the time. • High degree of fishing pressure from local and other subsistence and small-scale commercial fishers. The most highly sought after harvested fish (e.g. groupers, sweetlips and trevally) were rarely recorded in any of the surveys over the past 10 years. Only within the relative protection of the SRMR in 2019 was there any record of larger numbers of goatfish and snappers. • Many of the reefs had fewer fish than are normally seen in Fiji, even in regularly fished areas so there is a very strong indication of overfishing. The long-term impacts of fishing have significantly modified fish communities throughout the Beqa lagoon. This has resulted in a reduction in the

Biome	Condition	Observable impacts of threats and pressures
		numbers of higher order predators (e.g. sharks and piscivores) that are present on both the inshore and offshore reefs. This truncated food web is common throughout heavily fished regions, where the higher order or larger consumers are fished out first, before the focus moves to lower order species. This has been shown to have significant impacts on the functioning of the reef system, particularly impacting algal herbivory. However, there is a large amount of shark tourism in the region with sharks fed on a regular basis. This may have a significant effect on the fish community and the sharks in the region due to the availability of scavenging opportunities available.

Figure 9. Left photo] Valley dominated by endemic and endangered sago palm (Metroxylon vitiense), north-east of Pacific Harbour. [Right photo] View on the opposite side of ridge with scattered sago palm (white arrows), cleared land and invasive forestry mahogany

2.5 Benefits

In the DPSBR framework, the **benefits** are the social and economic value of retaining the biodiversity and ecological function of the catchment.

For the Navua catchment and Beqa lagoon, the benefits of protection of the environment were valued through an ecosystem services framework. Information on ecosystem services was primarily identified through community consultations. Figure 10 provides a summary of the ecosystem services identified. These benefits are outlined in more detail in the accompanying ESRAM report.

Using benefit transfer approaches including indexing to 2023 Fiji dollars, the ecosystem service of all biomes in the area have been estimated to provide a value of approximately $6.98 billion per annum, with over $2.1 billion of this value attributed to mangrove ecosystems and an additional $2.4 billion to near-coastal forests. The estimated values for marine ecosystem services within the catchment area suggest that over 20,200 hectares of marine area provide an estimated $18.2 billion, with almost $14 billion of this value attributed to over 11,500 hectares of live coral. These values offer insights into the economic trade-offs associated with development that could compromise the realisation of ecosystem services, such as the losses associated with mangrove clearing.

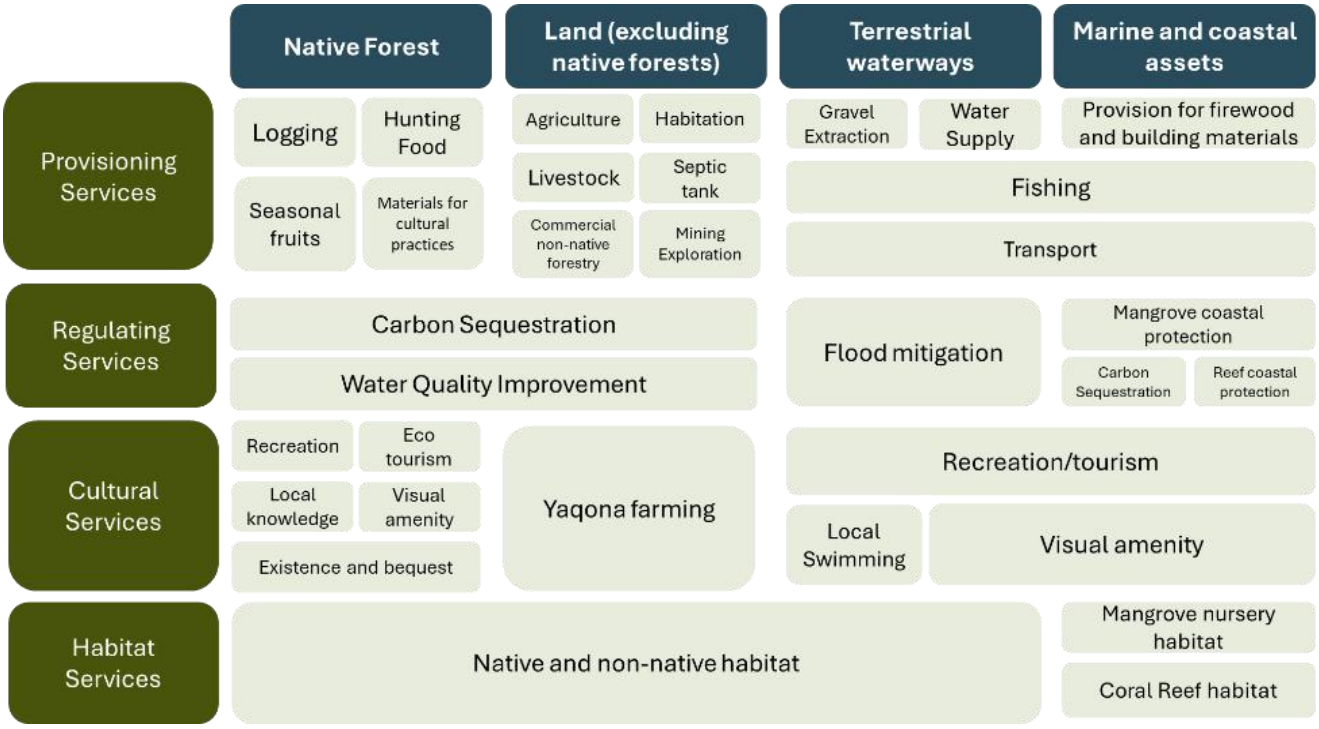

Figure 10. Ecosystem services of the Navua catchment and Beqa lagoon

3 Recommended strategies and actions

Recommended strategies and actions are described in this section, with a summary list presented in Table 3. Further information regarding the development and prioritisation of strategies and actions is provided in the accompanying documents (BioRap, ESRAM, EbA Options and ESVOA).

Table 3. Summary list of strategies and actions

Programme	Actions
Strategy 1 – Reduce community level impacts on the environment	Action 1.1 Develop programme to improve solid waste management
	Action 1.2 Reduce the use of pollutants in agriculture
Strategy 2 – Protect and rehabilitate the environment	Action 2.1 Develop and implement a reforestation programme for catchment protection
	Action 2.2 Improve sustainable forestry management
	Action 2.3 Coral reef restoration and conservation
	Action 2.4 Establish/protect/study Marine Protected Areas
Strategy 3 – Promote opportunities for use of Nature-based solutions	Action 3.1 Develop and implement NbS for improving village water supplies and sewerage
	Action 3.2 Develop and implement NbS for strengthening riverbank, flood and coastal protection
	Action 3.3 Develop and implement NbS for improving transport and accessibility options (road resilience)
Strategy 4 – Build ecosystems-based livelihoods	Action 4.1 Develop a responsible ecotourism strategy
	Action 4.2 Improve livelihood opportunities from Non-Timber Forest Products (NTFP) (e.g. basket weaving)
Strategy 5 – Build capacity and knowledge sharing	Action 5.1 Build capacity on Climate Change
	Activity 5.3 Monitor, evaluate and report through Report Cards

3.1 GEDSI considerations

Gender Equality, Disability and Social Inclusion (GEDSI) has been a core consideration in development of the IEMP. Consultation undertaken to develop the plan has been GEDSI aware, ensuring inputs from a diverse range of views. GEDSI considerations are also integrated through the IEMP strategies and actions, including:

- **Enabling inclusive participation** – Ensuring that activities are accessible to people with disabilities through appropriate infrastructure other accommodations will enhance their participation and engagement. For example, in establishing pilot sites, it is important to consider active participation in project designs, land area for establishment of project, types of diverse crops utilised, and inclusion in decision making space for women, youth, persons with disability (men, women and youth), women and men in all their diversities. Also, many proposed actions include training, and it is critical that all training is planned and delivered to be inclusive.

- **Inclusive training** – Training facilitators can ensure inclusivity by employing GEDSI-integrated questions in training needs assessments, accessibility of information, accessible training venues, dates and times of facilitation, facilitation material suiting the forms of disability present (font, sign language, translation to local dialect, etc) and designing breakout sessions that aim to limit reinforcement of gender norms.
- **Focus Group Discussions within Communities:** Youth groups, village subcommittee and religious groups within communities can support awareness raising sessions (door-to-door talanoa sessions and communal outreach events) that limit reinforcement of gender norms, favouritism and clan dynamics. For example, men, women, youth and persons with disability married into the local community have limited power and privilege to speak on land use directly, however through focus group discussions they are able to contribute.
- **Decision making and land tenure ownership** is generally dominated by males, hence reinforcing traditional landownership and governance structures can favour men. GEDSI-oriented participatory mapping of access and control over resources can help ensure input to decisions relating to native reforestation of harvested forestry areas, revegetation of long-term fallow areas and protection of existing native forest and natural assets.
- **Cultural norms** – Cultural norms and discrimination may limit the involvement of women, youth, and PWD in monitoring and conservation initiatives, highlighting the need for targeted support to empower these groups. Furthermore, it is important to provide platforms for all community members because traditional ecological knowledge is gendered. Knowledge held by women and men differs depending on their gendered roles and their access and use of natural resources and environmental spaces.
- **Participatory approaches** – Participatory approaches to planning and activities that actively engage diverse community members will strengthen the effectiveness and inclusivity of the IEMP implementation.
- **Platforms for sharing benefits** – Creating platforms to share the social and economic benefits (e.g. employment, community development) helps promote social equity, justice and dignity for all community members.
- **Engaging youth and religious teachers** – Engaging youth and religious teachers in conservation advocacy within local communities through environmental education and hands-on activities promotes environmental stewardship, skill development, and knowledge transfer from elders, ensuring sustainability.

Strategy 1 – Reduce community level impacts on the environment

The reduction of community-level impacts on the environment is crucial for maintaining the ecological integrity and sustainability of the Navua catchment and Beqa lagoon. This strategy focuses on minimising the detrimental effects of human activities, particularly in waste management and agricultural practices, to safeguard natural resources and enhance community well-being. Taking a ridge to reef approach, the strategy aims to protect both terrestrial and aquatic ecosystems, promote sustainable development, and improve the quality of life for residents through cleaner and healthier environments.

Action 1.1 Develop programme to improve solid waste management

Action description

Effective waste management involves addressing challenges such as overflowing rubbish pits, inadequate collection systems, and unsafe burning practices. These issues result in litter that negatively impacts visual amenity, aquatic species, and human health, particularly where open containers create breeding grounds for dengue mosquitoes.

Improving waste management in the Navua catchment requires implementing more frequent rubbish collection, recycling, and proper waste disposal systems. Behaviour change, though typically a significant barrier, has been addressed in these communities through previous programmes. While rubbish sorting is already happening in some villages, waste is often just being burned or buried. Upgrading from unsafe burning practices to incinerators and improving rubbish collection systems will be critical steps to achieving improved solid waste management.

It is recommended that a catchment-wide programme for waste management is considered as it will enable securing funding that leverages economies of scale.

This action can be applied in all biomes in the catchment and Beqa Island in which villages are located and will benefit all the biomes through reduction in solid waste.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Strengthening local capacity for waste management by establishing village bylaws and providing training and guidance for villages.
- Promoting household and communal composting through awareness raising and practical training sessions.
- Improving management of recycling of waste including i) community training for the segregation of waste; ii) investment for a glass breaking machine in key villages, the product from which can be used in concrete production; iii) establishing a recycling service across the catchment to help remove recyclable materials including whitegoods; iv) collaborating with recycle companies for collection purpose of recyclable items; and v) providing sorting bags for the 3R (reduce, reuse, and recycle).
- On Beqa Island, assistance is required for transporting tin out of the community to Navua jetty as limited space is available for accumulated rubbish.
- Improve options for sewage waste disposal including establishing v-drains to manage wastewater within the community and installing waste management systems in villages that don't have them.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Improper waste management • Water-borne disease	• Fishing • Water supply • Recreation/tourism • Visual amenity	• Improve governance (supporting goal) • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of Environment and Climate Change
- NGOs
- Ministry of Health and Medical Services
- Private sector utilising waste resources (e.g. https://wasterecyclers.com.fj/)

Action 1.2 Reduce the use of pollutants in agriculture

Action description

Promotion of agricultural production systems, which require or allow for lower application rates of various potential pollutants (e.g. pesticides, herbicides, fertilisers) should be pursued to reduce the impact of these pollutants on downstream ecosystems and communities.

Approaches could include:

- Crop diversification (i.e. cultivating multiple crops on a farm through crop rotations or intercropping)
- Conservation tillage (i.e. establishing crops in the leftover waste of a previous crop, which provides mulch that protects topsoil and allows natural decomposition thereby increasing the organic matter of the soil)
- Agroforestry (i.e. combining trees or shrubs with agricultural land use such as crops or pastures to create integrated and sustainable land-use systems)
- Non-chemical-based invasive species management.

The promotion of these more sustainable agricultural production systems should be through training, piloting and financial support of farmers to adopt the new systems.

This action can be applied within the mixed-use native forest and agriculture biome and will benefit all the biomes through reduction in pollutants impacting ecosystem health. Promotion of these approaches should be focused on areas where they will have the greatest impacts, particularly where agricultural production borders on waterways.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Establishing pilot sites for crop diversification, agroforestry, conservation tillage and non-chemical invasive species management and creating events to promote the success as well as learnings gained from the pilots. Learnings from the pilot sites can be shared with Teitei Taveuni, Tutu Rural Training Centre and Pacific Farmers Organization as well as Navua Women's Group and Waibau Women's Group.
- Ensuring proper use of chemicals for both crops and pests through development of training and guidance materials for villages.
- Village-led restricting or prohibiting farming near communal water sources to reduce risk of chemicals entering the water supply.
- Undertaking a study on organic weed killer from locally sourced plants on Beqa Island (vaivai).

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Nutrient pollution • Agriculture clearing for yaqona and other crops • Declining productivity of agricultural land	• Fishing • Water supply • Recreation/tourism • Visual amenity	• Improve community wellbeing • Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of Agriculture and Waterways
- Commercial agriculture operations
- Pacific Farmers Organization
- Teitei Taveuni, Tutu Rural Training Centre

- Navua Women's Group
- Waibau Women's Group
- Fiji Hotel and Tourism Association
- Duavata Collective

Strategy 2 – Protect and rehabilitate the environment

Protecting and rehabilitating the terrestrial, coastal and marine environments is central to the ridge to reef approach. By protecting and rehabilitating important ecosystems such as native forest and coral reef, we can ensure that they continue to provide the ecosystem services on which communities in the catchment and lagoon rely. This IEMP proposes a focus on: 1) rehabilitation of forested areas; 2) sustainable forestry management; 3) coral reef restoration and conservation; and 4) marine protected areas.

Action 2.1 Develop and implement a reforestation and protection programme

Action description

Reforestation is the restoration of previously forested land back to forest. Reforestation is often used on heavily managed lands like those that have been used for commercial forestry, mining or fallowed agricultural land. Reforestation of an area like the Navua catchment should consider the type and diversity of species present to ensure that the forest will grow to provide similar ecological, economic and cultural services as a native mature forest. Vegetation protection is focussed on maintaining the condition of the relatively undisturbed habitats of the Navua catchment.

Reforestation and revegetation options were identified as high priority actions as they offer considerable environmental, economic and social benefits, as well as relative ease of implementation. The cost of implementation depends on the selection of native species and their purpose (food, medicinal, regulating services or cultural services). All require ongoing monitoring and maintenance and come at a land/opportunity cost.

There are several reforestation and protection options and potential locations identified in the Navua catchment (Table 4). Drawing on these locations as a basis, participatory approaches through access and control mapping and time-use surveys by resource owners (women, youth, persons with disability (men, women and youth), women and men in all their diversities) should be undertaken to confirm locations selected for reforestation efforts to maximise positive and inclusive impacts (based on enhancing ecosystem services).

This action can be applied within the mixed-use native forest and agriculture biome and will primarily benefit the native forest biome.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Establish community-based nurseries (including mangrove nurseries) to provide seedlings for reforestation (for example on Beqa Island, communities (Naceva, Lalati, Dakuni, Dakuibeqa, Raviravi, Rukua and Nawaisomo) have planted 250 native trees and fruit-bearing trees, while a separate community (Dakuibeqa) has successfully set up a nursery for 200 mangrove seedlings).
- Establish local forest reserves to support restoration efforts.
- Deliver awareness sessions on invasive species management.
- Establish village-led programmes to protect and rehabilitate water catchment areas.

Table 4. Reforestation and protection programme option and indicative locations

Option	Description	Location/s
Native reforestation of harvested forestry areas	Multi-species (native) reforestation of cleared land to promote biodiversity, reduce soil erosion, and enhance ecosystem resilience. Project could link to the Fiji 30 million trees programme and initiate native species nurseries or enhance existing nursery operations (e.g. focussed on traditional plant species – Gasau, Dawa, Ivi, Moli), providing opportunities for community development and capacity building. Historical practices of maintaining reserves for regeneration of land and	Highland communities and other harvested areas (e.g. upstream and downstream of Latianara and Korovisilou communities, land around Korovisilou Creek). Presented in Figure 11 as 'Potential Reforestation Area'.

Option	Description	Location/s
	food security as part of forestry leases could be reinstated.	
Revegetation of long-term fallow areas	Revegetation of cleared areas to support biodiversity and enhance ecosystem resilience. Natural recovery of these areas usually has a weedy stage before secondary forest, so this represents an opportunity to establish forests and reduce weed spread. Furthermore, this could be integrated with ecotourism and community groups for economic diversification and the support of livelihoods.	Long-term fallow agricultural land and suitable buffer zones. Villages and farming areas, prioritising those closer to Navua River and other major tributaries. These areas correspond to cleared land and mixed lowland forest in Figure 11.
Protection of existing native forest and natural assets	Forming a network of protected areas across the Navua catchment. Areas for protection should be selected as representative of the highest value habitat for each habitat type in order to protect the full range of biodiversity across the catchment.	Locations labelled as 'Potential Protected Areas' and numbered in Figure 11. The Potential Protected Area locations are designed to link to existing protected areas including: i) Southern Viti Highlands Important Bird Area (IBA), FJ10[15] (the red-throated lorikeet (*Charmosyna amabilis*), long-legged warbler (*Trichocichla rufa*) and pink-billed parrotfinch (*Erythrura kleinschmidti*) are the trigger species for this IBA[16]); and ii) Ramsar site, Upper Navua Conservation Area.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Unsustainable commercial forestry • Invasive species • Agriculture clearing for yaqona and other crops • Mining exploration • Large scale unsustainable farming/ agriculture	• Hunting food • Seasonal fruits • Materials for cultural practices • Carbon sequestration • Water quality improvement • Recreation • Ecotourism • Visual amenity • Native and non-native habitat	• Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- iTaukei Land Trust Board (TLTB)

[15] Masibalavu V. & Dutson G. 2006. Important Bird Areas in Fiji: conserving Fiji's natural heritage. Suva, Fiji: BirdLife International Pacific Partnership Secretariat.

[16] Tuamoto T. 2015. A guide to monitoring important bird areas in Fiji. Tuverea Tuamoto, Miliana Ravuso, Mark O'Brien. Suva, Fiji: BirdLife International Pacific Secretariat.

- Ministry of iTaukei Affairs Cultural Heritage and Arts – Natural Resource Owners Committee (NROC)
- Department of Forestry
- Fiji Hardwood Corporation Limited
- Civil society (Conservation International, Pacific Blue Foundation, Nature Fiji Maraqeti-Viti)
- Fiji Environmental Law Association
- Village sub-committees on natural resources

Box 2. Community case study on reforestation using ecotourism

Consultations with the Serua Province communities identified a keen interest in ecotourism opportunities and the wide-ranging benefits they provide the community beyond the income received from the tourism venture. One example was from a community who are planning on partnering with ecotourism operators to promote reforestation. This is a good example of the additional benefits that ecotourism ventures can bring to a community.

Figure B1: Ecotourism for reforestation (© Mamanuca Environment Society)

Figure 11. Reforestation with native plants can improve the resilience of cleared land

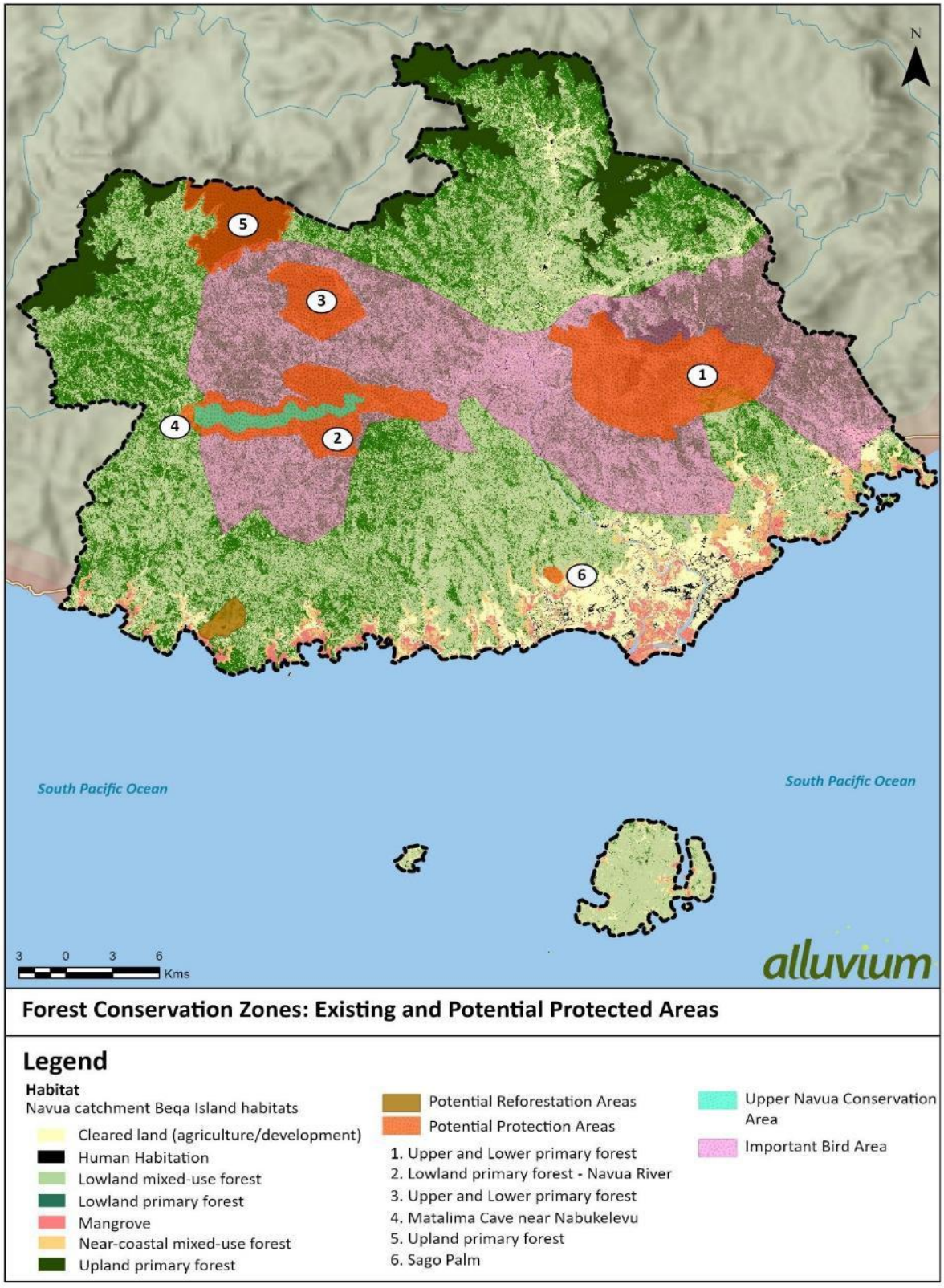

Figure 12. Indicative locations for reforestation and protection

Notes: 1) Eastern side of the catchment, south of Namosi has a large track of relatively undisturbed Primary Upland and Lowland Rainforest; 2) Extension of Upper Navua Conservation Area, including primary forest around Navua River; 3) Primary upland and lowland forest in the upper catchment, north of Navua River; 4) Matalima Caves which house Fijian blossom bats (*Notopteris macdonaldi*) and white-rumped swiftlets (*Aerodramus spodiopygius*); 5) Upland primary forest, including unique montane forest in the north of the catchment; 6) Sago palm (*Metroxylon vitiense*) population in a valley, north-east of Pacific Harbour.

Action 2.2 Improve sustainable forestry management

Action description

Forestry management within the study area presents a complex interplay between the economic benefits derived from commercial forestry, predominantly non-native mahogany, and the environmental impacts on ecosystem services. Environmental threats from forestry include the dominance of mahogany over native species (facilitated by the easy spread of its seeds) and environmental degradation from leakage of sap or other substances into soil and waterways. In addition, once harvested, some areas of former forest area have not been properly managed (including no reforestation) resulting in erosion, weed infestation and losses of ecosystem services.

Adoption of a sustainable forestry management approach through multi-species reforestation in areas being logged would limit many of the ecosystem threats from forestry, whilst aligning with initiatives such as the Fiji Government's 30 million trees programme. Broad adoption of sustainable forestry management could be instrumental in restoring the ecological balance by reintroducing native species and reducing the dominance of mahogany, while allowing the economic benefits of forestry to continue. The locations selected for reforestation efforts should be strategic to maximise positive impacts (based on enhancing ecosystem services).

Transitioning from monoculture to multiple species plantations not only enhances biodiversity but also provides employment opportunities in the region. For example, native forestry species can contribute to agroforestry practices by providing native fruits and bush foods.

Community capacity building will be crucial for the success of sustainable forestry management, and developing comprehensive guidelines, from nursery operations to planting, would empower local communities to actively participate in sustainable forestry practices. Establishing native species nurseries or enhancing existing operations can be a vital component of this effort and is linked to Action 2.1 (forest rehabilitation).

Important strategies are already in place under the current Fiji Forest Harvesting Code of Practice[17] such as incorporating buffer zones around protection forests, catchment areas and reserves and avoiding excessive canopy openings by retaining one out of four eligible adjoining trees for shelter and seed production. Additionally, some forestry operating companies are in the process of becoming FSC certified.[18] These positive developments can be further strengthened by creating legislative backing to enforce implementation[19] and ensuring adequate resources are available for all mitigation measures.

This action can be applied within the mixed-use native forest and agriculture biome and will benefit all the biomes through improved catchment health.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Increasing community awareness of and stewardship over forestry management through i) providing communities with awareness on logging agreements and contracts; and ii) enhancing landowner knowledge on importance for sustainable management of buffer zones around cleared areas using native trees and traditional forestry management (vasili, damu and vasa).
- Establishing community agroforestry using drala and koka based cropping systems.

[17] Republic of Fiji, Fiji Forest Harvesting Code of Practice, 2013, Ministry of Fisheries and Forests, Suva.

[18] FSC certification confirms that the forest is being managed in a way that preserves biological diversity and benefits the lives of local people and workers, while ensuring it sustains economic viability.

[19] Klassen, Arthur W. 2012. Reduced Impact Logging and Fiji's National Harvest Code of Practice. Report prepared on behalf of SPC/GIZ Regional Project "Climate Protection through Forest Conservation in Pacific Island Countries" SPC Narere Compound, Beaumont Rd, SUVA, Fiji

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Unsustainable commercial forestry • Invasive species • Agriculture clearing for yaqona and other crops • Mining exploration • Large scale unsustainable farming/ agriculture	• Hunting food • Seasonal fruits • Materials for cultural practices • Carbon sequestration • Water quality improvement • Recreation • Ecotourism • Visual amenity • Native and non-native habitat	• Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Fiji Hardwood Corporation – Mahogany plantations
- Mineral Resources Department
- Department of Forestry – harvesting of native trees and sago palm
- BirdLife International
- NatureFiji

Action 2.3 Coral reef restoration and conservation

Action description

Coral reef restoration is becoming popular across the Pacific in an attempt to restore and protect the ecological function of coral reef ecosystems. While reef restoration can be costly, coral reefs in Beqa lagoon are facing existential threats like global warming and ocean acidification. To provide resilience for the lagoon's coral assemblages, active restoration in suitable locations across the lagoon would protect the diversity of corals in the lagoon, as well as providing critical habitat for other organisms like macroalgae, fish and macroinvertebrates.

Reef restoration is undertaken for a variety of reasons including ecological (e.g. restoring reef structure and function) and socioeconomic (e.g. supporting coral reef tourism industry, sustaining local fisheries) goals. Further, reef restoration efforts are increasingly seeking to restore coral reef ecosystem function, resilience, and adaptation to local and global threats. Once threats are abated and populations of reef fishes and other associated species are stable, reef ecosystems have the capacity to self-generate, which lowers ongoing investment in restoration projects.

Prioritisation of locations that would support coral reef restoration at a lagoon-wide scale will be an important first step. Conserving and restoring coastal habitats depends on sound science and a clear investment plan that outlines the specific locations that require restoration. A clear prioritisation of locations across the Beqa lagoon for coral restoration would enable various levels of government and community operating within the lagoon to better manage these habitats at a scale that would lead to a demonstrable improvement in the current condition of coastal habitats and protect against future threats. A lagoon-wide prioritisation would be a powerful decision making tool to lay out the suite of on-ground actions required and would provide opportunity for NGOs and communities to attract larger and longer-term funding to implement the plan.

Once a set of locations is prioritised, before restoration activities, proximate threats need to be addressed and removed. Following this, coral reef restoration includes a wide range of activities from growing and planting nursery grown corals onto reefs, ensuring habitat is suitable for coral growth, harvesting naturally produced eggs and sperm to create millions of new genetic individuals, and building reef resilience to climate change and other threats.

Coral reef restoration needs to promote participation of diverse community members, including women, youth, persons with disability (men, women and youth), women and men in all their diversities by fostering inclusive spaces and amplifying diverse voices in decision making. For instance, in planning for coral restoration a

participatory map could be developed that visually represents different needs, barriers and vulnerabilities of women, youth, persons with disability (men, women and youth), women and men in all their diversities. Women's involvement in coral conservation can contribute to community health, economic empowerment, and the preservation of traditional knowledge, providing livelihood opportunities in ecotourism and sustainable resource management.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Reducing harvesting of marine species by establishing tabu areas around villages for coral reef protection.
- Establishing village-based coral nurseries. These could be linked with resorts and other ecotourism ventures to help support activities.
- Raising awareness and providing training for communities on the importance of vegetation buffer zones around waterways and coastal areas to protect against downstream coral impacts.
- Strengthening village bylaws of penalising illegal dumping of waste out at sea.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Loss of reef habitat • Crown-of-thorns starfish (COT)	• Reef coastal protection • Recreation/tourism • Coral reef habitat	• Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of iTaukei Affairs
- Department of Heritage and Arts
- Fiji Hotel and Tourism Association
- Tourism Fiji
- Duavata Collective
- Women in Business Council (FCEF/WEBC)
- Ministry of Environment and Climate Change
- Ministry of Fisheries and Forestry
- Fiji Locally Marine Managed Area
- Pacific Blue Foundation
- Fiji Hotel and Tourism Association
- Private Sector partners that are not part of the Duavata Collective (resorts, tour companies, etc.)
- Women in Fisheries (establishing alternative livelihoods that encompasses youth and minority groups)
- Other environmental NGOs

Action 2.4 Establish and maintain Marine Protected Areas

Action description

A Marine Protected Area (MPA) is a defined region designated and managed for the long-term conservation of marine resources, ecosystem services or cultural heritage. They are typically areas where extraction of marine resources like fish, invertebrates and marine plants is limited or prohibited. MPAs are designated for a range of reasons. This can include the protection of an ecologically representative cross section of a region's biodiversity which can enhance the connection of critical habitats for species to use during different life stages. Alternatively, MPAs at a local scale can provide an area that enables species to breed and support populations in adjacent areas.

For the Beqa lagoon, the aim would be to establish a network of MPAs across the lagoon to protect sustainability of the livelihoods and food sources of local communities as well as protect the biodiversity of the coral reefs, mangroves and seagrass. Ideally, a network of MPAs would be developed to connect critical habitats (see **Error! R eference source not found.** for proposed MPA areas). The MPA network should also be linked to community level protected areas, called tabu areas, where a community has agreed not to fish certain stretches of river or ocean.

It will be critical to support enforcement of MPAs through the appointment and training of fish wardens tasked with preventing illegal fishing. This is particularly important as stakeholders highlighted existing MPA protection efforts are impacted by a lack of resources such as boats and enforcement capabilities of wardens.

MPAs can disrupt livelihoods by restricting access to traditional fishing grounds, leading to economic loss and food insecurity. While MPAs can create economic opportunities (e.g. ecotourism, sustainable fishing), unequal power dynamics may result in marginalised groups being excluded from these benefits. Involving these groups in MPA management can help mitigate these impacts. In addition, transparent governance and equitable resource-sharing are critical for inclusive implementation of MPAs.

This action can be applied within, and will primarily benefit, the marine and coastal biome.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Support MPAs through providing villages with support for enforcement and ensuring governance of the MPA is clear (e.g. everyone is aware of key roles, access, and ownership of MPAs when established).
- Establish training and capacity building programmes for village-based fish wardens.
- Villages and communities to be included in decision making for any fishing licence requests.
- Invest in equipment for fish wardens to be able to effectively undertake their duties (e.g. boats).

Justification for the action

Threats mitigated 	Benefits promoted 	Contribution to IVDP goals 
• Overfishing/poaching • Loss of reef habitat • Clearing of mangroves for development	• Mangrove coastal protection • Carbon sequestration • Coastal protection from reefs • Recreation and tourism • Visual amenity • Mangrove nursery habitat • Coral reef habitat	• Improve governance (supporting goal) • Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of Environment and Climate Change
- Ministry of Fisheries
- Fiji Locally Marine Managed Areas
- Pacific Blue Foundation
- Duavata Collective (sustainable tourism)
- Fiji Hotel and Tourism Association
- Tourism Fiji
- Private Sector partners that are not part of the Duavata Collective (Business, etc)
- Women in Fisheries (establishing alternative livelihoods that encompasses youth and minority groups)
- Other environmental NGOs

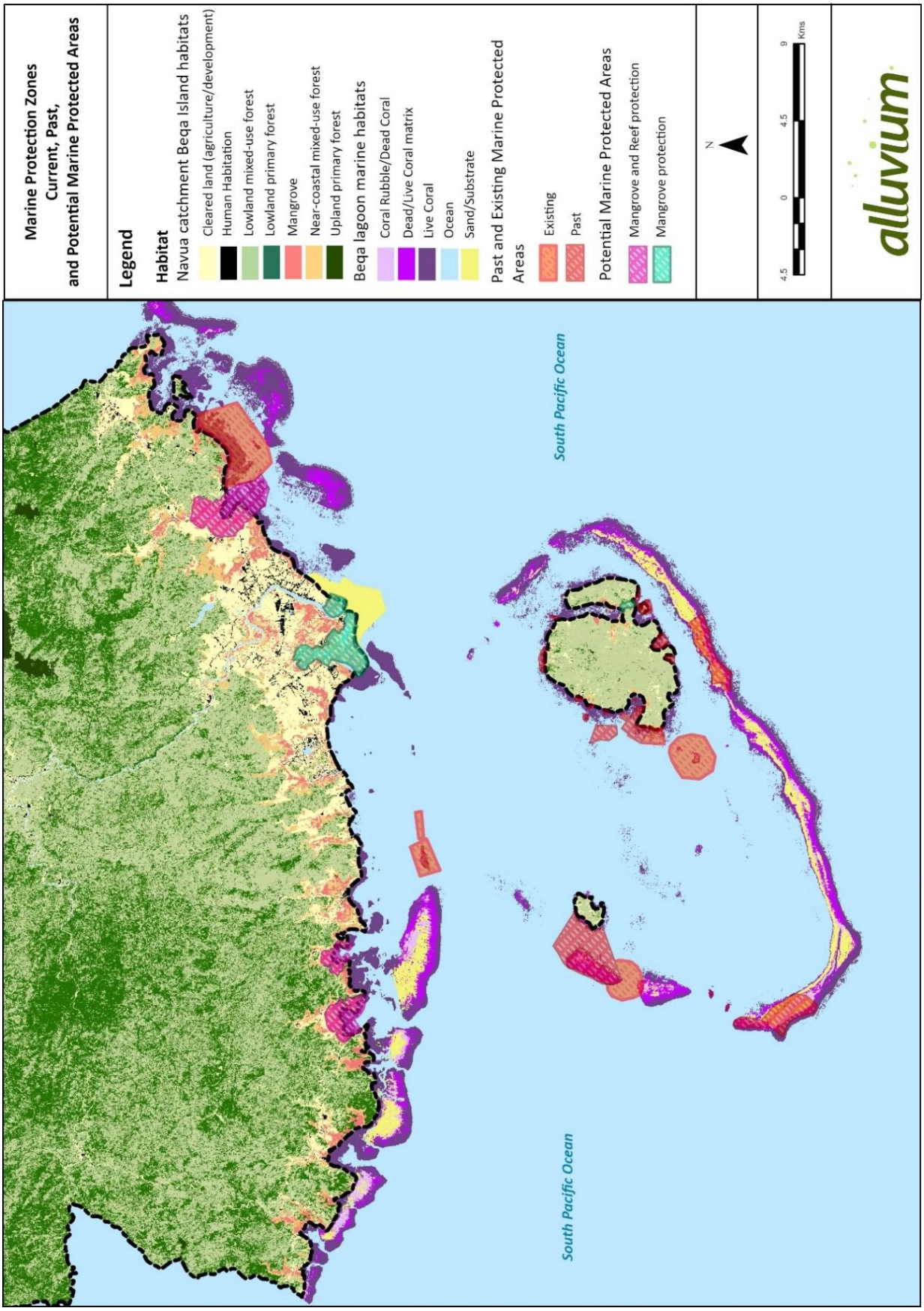

Figure 13. Recommendations for a network of Marine Protected Areas across the Beqa lagoon for mangrove and reef protection

Strategy 3 – Promote opportunities for use of Nature-based Solutions

This strategy aims to enhance resilience in the Navua catchment by promoting Nature-based Solutions (NbS) for resilient water supplies, riverbanks, flood protection, and transportation. By integrating natural processes through mangrove restoration, coral reef rehabilitation, and rainwater harvesting, it seeks to improve water quality and protect against erosion and inundation. This approach not only addresses immediate environmental and infrastructural challenges but also supports long-term sustainability and community well-being, ensuring a robust foundation for future resilience and economic stability.

Box 3 outlines several GEDSI considerations specifically for implementation of NbS.

Box 3. GEDSI considerations for NbS

There are several critical GEDSI considerations in implementing NbS projects:

- Restoration projects, such as creating mangrove buffers, may require land that women, youth, persons with disability (men, women and youth), and men in all their diversities rely on for their livelihoods.
- The establishment of natural barriers may unintentionally restrict access to fishing or farming areas for women, youth, persons with disability (men, women and youth), women and men in all their diversities. Without inclusive design considerations, these communities could face physical barriers that limit their participation in traditional, livelihood and food security activities.
- If employment opportunities arising from NbS are not equitably distributed, women, youth, persons with disability (men, women and youth), women and men in all their diversities may miss out on the potential economic benefits. For example, if job training and employment in restoration projects primarily target already privileged individuals, inequalities can worsen.
- If NbS initiatives prioritise environmental goals without considering local cultural practices and knowledge, they may undermine traditional livelihoods or customs associated with land and resource use, disproportionately affecting marginalised groups.
- It is important to ensure the delivery of effective community awareness programmes about NbS that promote understanding and support. For instance, utilising youth and religious groups to create advocacy events and awareness sessions (poster development, skits) with a culmination of community events.

Action 3.1 Develop and implement Nature-based solutions for improving village water supplies and sewerage

Action description

Addressing water supply and sewerage challenges in the Navua catchment is essential for improving public health and environmental sustainability. Poor water quality and the prevalence of water-borne diseases such as typhoid and leptospirosis are significant issues, exacerbated by contamination from inappropriate harvesting practices, livestock pollution, and inadequate infrastructure. Rainfall and flooding, particularly during heavy rain events, further strain water resources and infrastructure. The adoption of NbS can enable addressing these pressing issues whilst also contributing to healthy ecosystems.

Possible nature-based solutions to be considered for improving village water supplies and sewerage include:

- **Managed aquifer recharge**, which involves the intentional recharge of water to aquifers for human use or environmental benefit. Investigating the primary drivers of aquifer resource decline can help determine the effectiveness of this approach. This is particularly relevant in communities reliant on aquifer resources, such as Beqa Island, where strategies might include revegetation for improved infiltration or diversification of water sources.

- **Revegetation for improved infiltration or protection of water sources,** which involves revegetating areas around village water sources (e.g. around infiltration or spring areas for groundwater) to help protect their provision and quality of water.
- **Rainwater harvesting**, which may not be an NbS in itself, but can reduce pressure on aquifers and other freshwater resources. This method provides clean water, especially when other sources have poor quality, such as during heavy rainfall. Expanding rainwater harvesting systems to more households and community buildings can enhance water supply reliability and quality.

Similar to solid waste management, a region-wide programme to provide water supply resilience using NbS may help in securing funding that leverages economies of scale.

This action can be applied within the mixed-use native forest and agriculture biome and terrestrial waterway biomes and will primarily benefit these biomes.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Developing community management plans for frequently used dams and water sources.
- Establishing village bylaws to restrict movements within a specified boundary surrounding community water sources.
- Support for village-led reforestation of land (to include strong rooted natives) close to water sources.
- Programme to supply water tanks and water filtration for villages.

Box 4. Community case study on sewerage management and maintenance

The Navutulevu Village, Serua Province representatives described how improvement to their septic and sewerage systems improved the quality of the coral reef in front of their village. Previously, sewage overflows from their septic systems were discharged onto the reef flat. At low tide the black water bubbled out onto the reef, which caused community and ecosystem health issues. Improvements to septic and sewerage systems decreased overflow events and the community began to see an improvement of coral reef health in addition to improvements in human health in the community.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Contamination of water sources	• Enhanced public health • Improved water quality • Increased water supply resilience • Better and reliable infrastructure • Support for community wellbeing • Environmental sustainability	• Improve community wellbeing • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of iTaukei Affairs
- Ministry of Environment and Climate Change
- Fiji National WASH Cluster
- SPREP (PEBACC+)
- Fiji REDD+ Programme – Ministry of Forestry
- Ministry of Health and Medical Services
- Department of Water and Sewerage along with Water Authority of Fiji
- CSO partners (Habitat for Humanity Fiji, Field Ready, Red Cross Fiji, Rotary Pacific, WCS (catchment programme) and Pacific Blue Foundation).

Action 3.2 Develop and implement Nature-based Solutions for strengthening riverbank, flood and coastal protection

Action description

Developing and implementing NbS for strengthening riverbank, flood and coastal protection involves integrating natural processes and ecosystems to enhance resilience against erosion and flooding. Key measures include:

- **Mangrove Restoration and Conservation:** Restore and protect mangrove habitats to reduce coastal erosion, improve water quality and support marine biodiversity. Mangroves act as natural barriers against storm surges and provide vital nursery grounds for fish. Restoration efforts can be particularly beneficial in areas such as Queens Road for erosion control, Beqa Island, coastal mainland communities, and small islands like Naqara and Yanuca in Serua Province, which can enhance fish nursery habitats.
- **Coral Reef Restoration:** Restore coral reefs using coral rubble and other techniques to enhance coastal protection and create low-energy environments that support diverse marine life. Key locations for these restoration efforts include Beqa Island and coastal mainland communities (linked to activity 2.3).
- **Environmental Setbacks and Buffers:** Establish setbacks and buffers along coastlines to limit development and protect areas vulnerable to erosion and sea level rise. Beqa Island and coastal mainland communities are important areas where such measures should be implemented.
- **Seawalls and Breakwaters combined with NbS:** Construct these structures where necessary to prevent erosion and mitigate the impacts of wave action and sea level rise, especially in locations where natural solutions alone may be insufficient (Figure 14). Areas such as Queens Road, where softer approaches may no longer be viable, along with Beqa Island and coastal mainland communities, are prime candidates for these interventions.
- **Beach Nourishment:** Implement beach nourishment programmes to maintain beach profiles, safeguard road access, and preserve community areas while supporting recreational values. This approach is particularly suited for locations like Queens Road, where mangrove restoration might not be enough, as well as Beqa Island and coastal mainland communities.
- **Improved licensing of gravel extraction**: Improve review and approval processes for licensing of river gravel extraction including requiring departmental staff to undertake a site visit.

Figure 14. Rock wall and mangroves combining to provide safe harbour at Lalati Village on Beqa Island

GEDSI considerations should be paramount in application of this action. NbS development can actively promote the participation of women, youth, persons with disability (men, women and youth), women and men in all their diversities. Creating inclusive spaces and policies that respect and value diversity ensures that everyone is engaged and learning together and can foster a commitment to sustainability among future leaders.

Ensuring that restoration sites and community programmes are accessible to persons with disability promotes their participation in conservation efforts. Additionally, providing targeted training on coral cultivation and mangrove restoration enhances the capacity of community leaders, persons with disability (men, women and youth), subcommittees for natural resource and religious teachers to actively engage in NbS projects, allowing them to contribute meaningfully while benefiting from the initiatives.

The construction of seawalls and breakwaters may restrict access to traditional fishing and farming areas, impacting local livelihoods women, youth, persons with disability (men, women and youth), and men in all their diversities. To mitigate this, designs should include access points and environmentally sensitive features that maintain ecosystem integrity. Compensation mechanisms, such as financial support or alternative livelihood programmes, may be required.

This action can be applied within the terrestrial waterway and marine and coastal biomes and will primarily benefit these biomes.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Reviving knowledge on native plant species that support reduction in nutrient load in nearby water systems.
- Reviving knowledge on filtering plants that support reduction in nutrient load in nearby water systems.
- Village-led reforestation of native trees to protect against sea level (e.g. mangroves) and river estuarine erosion.
- Village-led limiting of gravel extraction in nearby rivers/streams to lessen erosion impacts.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Coastal erosion and flooding • Loss of reef habitat: • Clearing of mangroves for development • Sedimentation • Nutrient pollution • Gravel extraction	• Enhanced coastal resilience • Improved water quality • Biodiversity conservation • Economic stability • Community well-being	• Improve community wellbeing • Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of Fisheries and Forestry
- Ministry of Agriculture and Waterways
- Ministry of Infrastructure
- SPREP and SPC
- CSO partners (IUCN, Conservation International)
- Ministry of Environment and Climate Change
- Water Authority of Fiji

Action 3.3 Develop and implement Nature-based Solutions for improving transport and accessibility options (road resilience)

Action description

The Navua catchment has nationally important road infrastructure (Queens Road) as well as smaller road networks that form critical transport connections for villages (often there is only one road available to access a village). These road networks are at risk from landslides (smaller networks in the catchment) and coastal erosion (Queens Road). NbS can provide a cost-effective approach for building road resilience to these risks.

In the catchment, NbS such as revegetation with native trees, shrubs and grasses can help the soil absorb water and reduce erosion, thereby reducing landslide impacts on roads. Figure 15 outlines four areas in the catchment where the road network is prone to landslides that would be appropriate to consider for NbS interventions.

Queens Road, a crucial transportation route for Fiji and the Navua catchment, is under threat from significant erosion, particularly near Galoa. The erosion poses risks to road infrastructure, leading to potential road damage, loss of connectivity, and significant economic impacts on local communities and the tourism industry. Disruptions to Queens Road can lead to lengthy detours or delays, significantly increasing travel time and costs, especially for freight transport and daily commuting.

To address these challenges whilst also benefiting the local ecosystems, NbS such as mangrove restoration and conservation should be implemented to protect road access and enhance the resilience of Queens Road against environmental stressors. Mangroves and beach dune vegetation communities, acting as natural barriers, help prevent erosion, improve water quality, and provide critical habitats for marine life. While mangrove restoration may not be sufficient in all areas, particularly where erosion has already advanced, it can be a key component of a broader strategy to maintain and enhance road resilience. This could be complemented by the placement of coral rubble to create lower energy environments and support the establishment of mangroves. Figure 15 provides an indication of potential NbS sites for road resilience including locations where Queens Road hugs the coastline, which currently have limited protection from existing mangroves (but are ideally adjacent to existing mangrove areas or have historically been mangroves).

This action can be applied within the mixed-use native forest and agriculture and marine biomes, benefitting both.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Establishing a programme of community revegetation efforts along roads at high risk.
- Ensuring gravel is placed on all village access roads, particularly main roads used to transport people to work and to get produce to market.
- Building capacity and providing guidance to villages in the use of vetiver grass as rehabilitation efforts for landslides.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Coastal erosion and storm damage threats	• Reduced infrastructure maintenance costs. • Reduced risk of flooding • Road users safety and route reliability • Reduced infrastructure damaged	• Improve community wellbeing • Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Fiji Roads Authority
- Ministry of Infrastructure
- Ministry of iTaukei Affairs Cultural Heritage and Arts – Natural Resource Owners Committee (NROC)
- Ministry of Environment and Climate Change
- Water Authority of Fiji

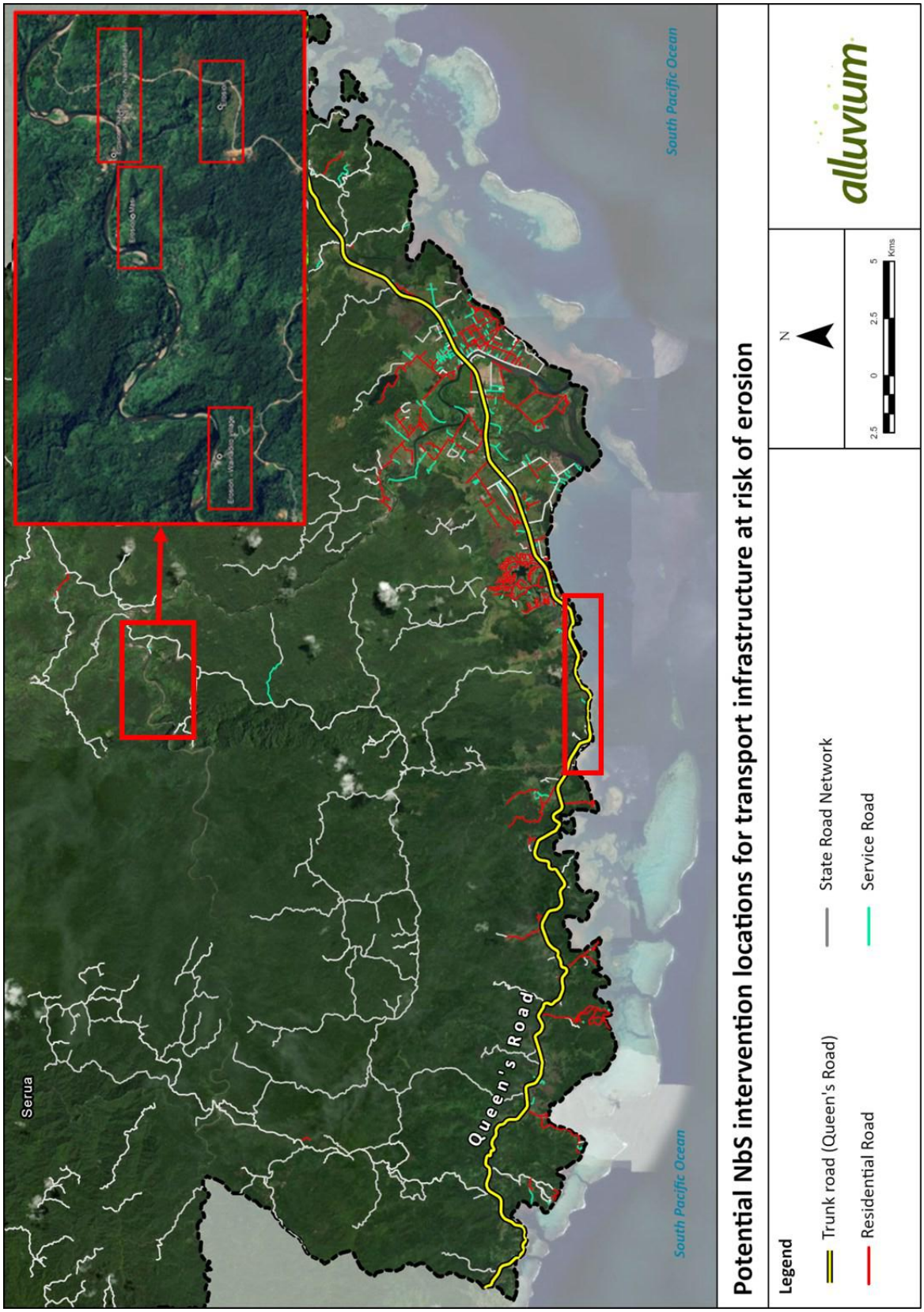

Figure 15. Indicative locations for NbS interventions to build road resilience

Strategy 4 – Build ecosystem-based livelihoods

This strategy focuses on fostering sustainable economic growth by integrating community livelihoods with the conservation and responsible use of natural resources. By supporting responsible ecotourism and enhancing opportunities from NTFPs, this strategy aims to reduce environmental pressure, preserve cultural heritage, and empower local communities. Through skill development, income diversification, and sustainable resource management, communities can achieve greater resilience to economic and environmental challenges, ensuring long-term prosperity while safeguarding vital ecosystems.

Action 4.1 Develop a responsible ecotourism strategy

Action description

This action calls for development of a carefully planned ecotourism strategy for the catchment and lagoon that provides a foundation for the sustainable development of this local industry. The strategy could consider a range of different principles for local tourism development, including items such as:

- **Links to existing frameworks** – The local strategy may need to align with existing frameworks and plans such as the National Sustainable Tourism Framework (currently in development) or the World Bank Sustainable Tourism Plan (currently in development).
- **Gaps in capacity** – The local strategy should consider the capacity required to operate successful ecotourism ventures and where capacity building may be required (e.g. developing understanding of tourism value chains). This would support the development and implementation of *targeted* training programs.
- **Legislative barriers or constraints** – The local strategy should identify any legislative barriers or constraints, and approaches to address them. For example, approvals timeframes and requirements for paperwork with inaccessible language may present significant barriers to community-led enterprises.
- **Provide models for equitable development across communities** – Intense competition between communities for tourism activity may reduce the benefits and longevity of ecotourism development. Co-ordination may be required to maximise the chances of long-term sustainability. Considering approaches like rostering across communities or the identification or development of distinctive products/experiences for each may be necessary.
- **Governance** – Governance arrangements will likely be a key determinant of success. Transparency of arrangements and payments processes in particular may be important for adoption of the strategy.
- **Establish measures of success** – These may need to include broader thinking beyond profit or return-on-investment focused measures. Key outcomes could simply relate to the longevity of businesses or link to environmental management through monitoring of the condition of key ecotourism assets.
- **Reinforce linkages with community objectives and environmental management** – Aligning tourism opportunities with other community objectives and communicating the necessity of effective environmental management to maintain tourism assets (i.e. synergy between commercial and environmental values) will serve to maximise community buy-in.
- **Involvement of experts** – The development of this strategy will need to include the involvement of experts in locally-led and iTaukei-led tourism development.

Aligning tourism opportunities with other community objectives and communicating the necessity of effective environmental management to maintain tourism assets (i.e. synergy between commercial and environmental values) will serve to maximise community buy-in. Providing ongoing training and skill development opportunities to ensure communities adapt to changing circumstances, enhancing resilience and independence. Integrating training on alternative livelihoods, such as ecotourism, into disaster risk reduction efforts to help communities build resilience, reduce vulnerabilities, and recover from natural disasters. In addition, ensuring targeted trainings are inclusive of literacy and numeracy skill levels.

This action can be applied in and can benefit all the biomes.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Establishing training and capacity building for villages to raise awareness and to provide guidance on ecotourism opportunities.
- Include in village bylaw the financial management of ecotourism ventures.
- Revamping local picnic areas with facilities to attract tourists.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Lack of alternative income sources	• Provision of livelihood • Contribution to intergenerational transfer of knowledge • Better aligns objectives of communities with ecosystem health	• Improve community wellbeing • Promote economic empowerment • Build conservation and climate change resilience

Types of organisations that could be involved

- Fiji Hotel and Tourism Association
- Tourism Fiji
- Duavata Collective
- Women in Business Council (FCEF/WEBC)
- Young Entrepreneurs Council (FECF/YEC)
- Soqosoqo vakamarama (Provincial and District)
- Fiji Ministry of Tourism and Civil Aviation
- Tour operators/ Private Sector partners that are not part of the Duavata Collective (Business, etc)
- Ministry of iTaukei Affairs Cultural Heritage and Arts – Natural Resource Owners Committee (NROC)

Box 5. Community case study on waterfall road access in Serua

Consultations with the Serua Province communities identified keen interest in ecotourism opportunities and the wide-ranging benefits they provide the community beyond the income received from the tourism venture. One example was from a community who are custodians of a waterfall and receive royalties from tourist visits. The road to the waterfall has been upgraded, which provides better access for tourists as well as local farmers, who use the improved road to transport produce to market. This is a good example of the additional benefits that ecotourism ventures can bring to a community.

Figure B1: Waterfall in Serua

Action 4.2 Improve livelihood opportunities from Non-Timber Forest Products (NTFP)

Action description

Enhancing livelihood opportunities through the sustainable use of NTFPs such as making handicrafts can be vital for the economic empowerment of women and youth in the Navua catchment. By leveraging traditional knowledge and cultural practices associated with mangrove ecosystems, women can diversify their income streams through activities such as basket weaving and mangrove seed collection. These efforts not only provide alternative livelihoods but also contribute to the preservation of cultural heritage and environmental stewardship. Training and support for community-based enterprises across the region, particularly those focused on sustainable resource management, further reduces pressure on natural resources while promoting economic resilience and environmental sustainability in the region.

This action can be applied within the native forest biome and will primarily benefit this biome.

Opportunities for implementation of this action at the local level, identified through consultation with communities, include:

- Dedicated economic officer for the catchment to assist villages in building income opportunities from NFTPs.

- Establish sustainable power supplies and mobile coverage for all villages to help support economic opportunities.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Overexploitation of natural resources • Lack of alternative income sources	• Reduced pressure on resources. • Poverty alleviation • Preserved indigenous knowledge and cultural heritage • Empowered local communities • Diversified income sources	• Improve community wellbeing • Promote economic empowerment • Build conservation and climate change resilience •

Types of organisations that could be involved

- Ministry of iTaukei Affairs
- Department of Heritage and Arts
- Fiji Hotel and Tourism Association
- Tourism Fiji
- Duavata Collective
- Women in Business Council (FCEF/WEBC)
- Young Entrepreneurs Council (FECF/YEC)
- Soqosoqo vakamarama (Provincial and District)
- CSO (Think Pacific, FRIEND Fiji, Makoi's Women Training Centre – utilisation of venues within districts or provinces)
- Faith based organisations (e.g: Fiji Muslim League, Methodist, , Catholic, AOG churches)
- Ministry of Industry and Trade
- Fiji REDD+ Programme – Ministry of Forestry
- Investment Fiji

Strategy 5 – Share knowledge and build capacity of communities

All stakeholders have a role in environmental management of the catchment and lagoon. It is therefore important that communities understand key drivers of change of the environment, and how they can adapt. By building the capacity of, and sharing knowledge with communities, they are better able to engage with and support environmental protection efforts.

This strategy outlines two focus areas for knowledge sharing and capacity building: 1) building capacity on the likely impacts of climate change, and how these can be responded to and prepared for; and 2) monitoring, evaluation and reporting of the environmental health of the catchment and lagoon through a Report Card.

Action 5.1 Build capacity on climate change

Action description

Climate change is likely to be a key driver of change in the ecosystems of the catchment and lagoon, and the ecosystem services that they provide. Most IVDPs within the area identified building capacity of communities on climate change as a priority action. The IEMP supports this action as it will result in significant benefits for the environment as well as communities.

This action involves the development of a training programme on climate change, developed for delivery at the village level. The training programme should cover: i) the causes of climate change; ii) projections for how climate will change at the regional scale, the Fiji scale and, if possible, within the catchment and lagoon (e.g. changes in temperature, rainfall patterns and sea level); iii) the impact these changes will have on ecosystems and communities (e.g. higher flood risk, coral bleaching); and iv) options to prepare for and respond to these risks. Where possible, the training materials should draw on examples from Fiji and the region and seek to promote the use of nature-based solutions and ecosystem-based adaptation.

Training development and delivery should consider GEDSI – for example, by ensuring training venues are accessible and training is undertaken at times that all people can attend.

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Climate change • Invasive species • Pest animal • Saltwater inundation • Erosion • Heavy rainfall: • Droughts • Loss of reef habitat	• Carbon sequestration • Mangrove coastal protection • Eco tourism • Flood mitigation	• Improve community wellbeing • Build conservation and climate change resilience

Types of organisations that could be involved

- Ministry of Environment and Climate Change
- Ministry of iTaukei Affairs (PCOs)
- Ministry of iTaukei Affairs Cultural Heritage and Arts – Natural Resource Owners Committee (NROC)
- Fiji Roads Authority
- Ministry of Infrastructure
- Fiji National WASH Cluster
- SPREP (PEBACC+)
- Ministry of Health and Medical Services
- Department of Water and Sewerage along with Water Authority of Fiji
- CSO partners (Habitat for Humanity Fiji, Field Ready, Red Cross Fiji, Rotary Pacific, WCS (catchment programme) and Pacific Blue Foundation).
- Ministry of Forestry and Agriculture
- Ministry of Industry and Trade
- Fiji REDD+ Programme - Ministry of Forestry
- Investment Fiji

Action 5.2 Monitoring, Evaluation and Reporting

Action description

The condition and trend of the biodiversity values in the catchment and lagoon are not currently actively monitored beyond short-term projects and philanthropic programmes run by research organisations and NGOs like Nature Fiji-MareqetiViti (NFMV) and the Pacific Blue Foundation (PBF). This action is therefore, to monitor and evaluate the condition and longer-term trends of the catchment and lagoon's biodiversity values and the threats to those values.

Once the strategies and actions outlined in this management plan are implemented, a monitoring and evaluation plan will be needed to track the success of the actions and used to evaluate the plan over time. An ongoing monitoring and reporting programme will also be important to attract additional funding and to focus stakeholders in understanding the condition and trend of the catchment and lagoon.

From the monitoring programme, a simple communication publication should be considered like a Report Card (Figure 16) that outlines the condition of the key social, environmental and economic values of the catchment and lagoon. A communication strategy should be developed to underpin the release of the Report Card at regular intervals (e.g. annually or biennially). This would attract attention and funding to support the management plan.

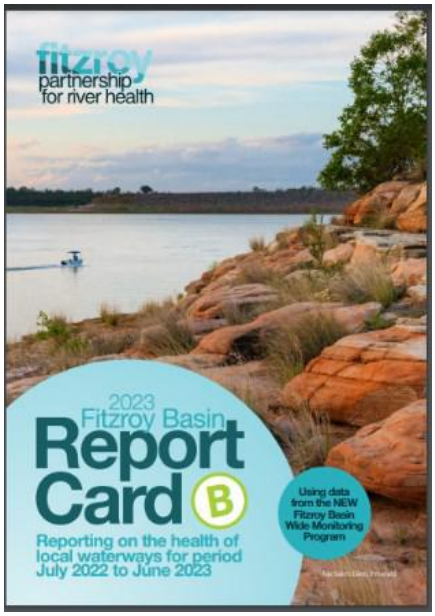

Figure 16. Example Report Card report for the Fitzroy Basin, Australia

Justification for the action

Threats mitigated	Benefits promoted	Contribution to IVDP goals
• Lack of integration with community and stakeholders	• Keeping all stakeholders aware of progress and maintaining the partnership	• Improve governance (supporting goal) • Build conservation and climate change resilience • Empower traditional leadership and Vanua (supporting goal)

Types of organisations that could be involved

- Ministry of Environment and Climate Change
- Ministry of iTaukei Affairs (PCOs)
- Ministry of iTaukei Affairs Cultural Heritage and Arts – Natural Resource Owners Committee (NROC)
- Fiji Roads Authority
- Ministry of Infrastructure
- Fiji National WASH Cluster
- SPREP (PEBACC+)
- Ministry of Health and Medical Services
- Department of Water and Sewerage along with Water Authority of Fiji
- CSO partners (Habitat for Humanity Fiji, Field Ready, Red Cross Fiji, Rotary Pacific, WCS (catchment programme) and Pacific Blue Foundation).
- Ministry of Forestry and Agriculture
- CSO partners
- Rivers Fiji
- Fiji Hotel and Tourism Association
- Tourism Fiji
- Duavata Collective
- Women in Business Council (FCEF/WEBC)
- Young Entrepreneurs Council (FECF/YE)

Appendix A – The Pacific-European Union Marine Partnership

The Pacific-European Union Marine Partnership (PEUMP) programme promotes sustainable management and sound ocean governance for food security and economic growth, while addressing climate change resilience and conservation of marine biodiversity. It follows a comprehensive approach, integrating issues related to oceanic fisheries, coastal fisheries, community development, marine conservation and capacity building under one single regional action. The PEUMP is built around six Key Result Areas (KRA).

Designed to meet KRA 5 of the PEUMP, the By-catch and Integrated Ecosystem Management (BIEM) Initiative is led by the Secretariat of the Pacific Regional Environment Programme (SPREP) to support Pacific countries deliver their priorities to halt the decline of protected marine species, strengthen the sustainable management of their coastal and marine ecosystems and support poverty reduction. The objective of the BIEM Initiative is "*to reduce the by-catch of threatened species in Pacific islands' fisheries and to improve the health of coastal ecosystems through an integrated approach to coastal management and ecosystem-based adaptation to climate change".*

The current project underpins KRA 5.2 and 5.3 of the BIEM which focus on supporting adoption of integrated 'ridge to reef' ecosystem management and climate change adaptation. To support these KRAs the project seeks to address the economic, social and environmental challenges of the Navua catchment and Beqa lagoon by halting the decline of biodiversity and strengthening the sustainable management of the coastal and marine ecosystems through an integrated ridge-to-reef management approach.

Specifically, this project aims to:

"Address these challenges by developing and implementing a gender, social inclusion (GSI) and human rights sensitive integrated ecosystem management (IEM) plan for Navua catchment and Beqa lagoon area, Central Division that identifies realistic activities to increase the natural adaptive capacity of coastal habitats to promote human health and poverty reduction, support sustainable livelihoods and contribute to the delivery of Fiji's conservation priorities.

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