Planning for **ecosystem-based adaptation** in **Port Vila** VANUATU

SYNTHESIS REPORT

SPREP
Secretariat of the Pacific Regional Environment Programme

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FRONT COVER: Port Vila, overlooking Iririki Island and Ifira Island. Photo | Stuart Chape

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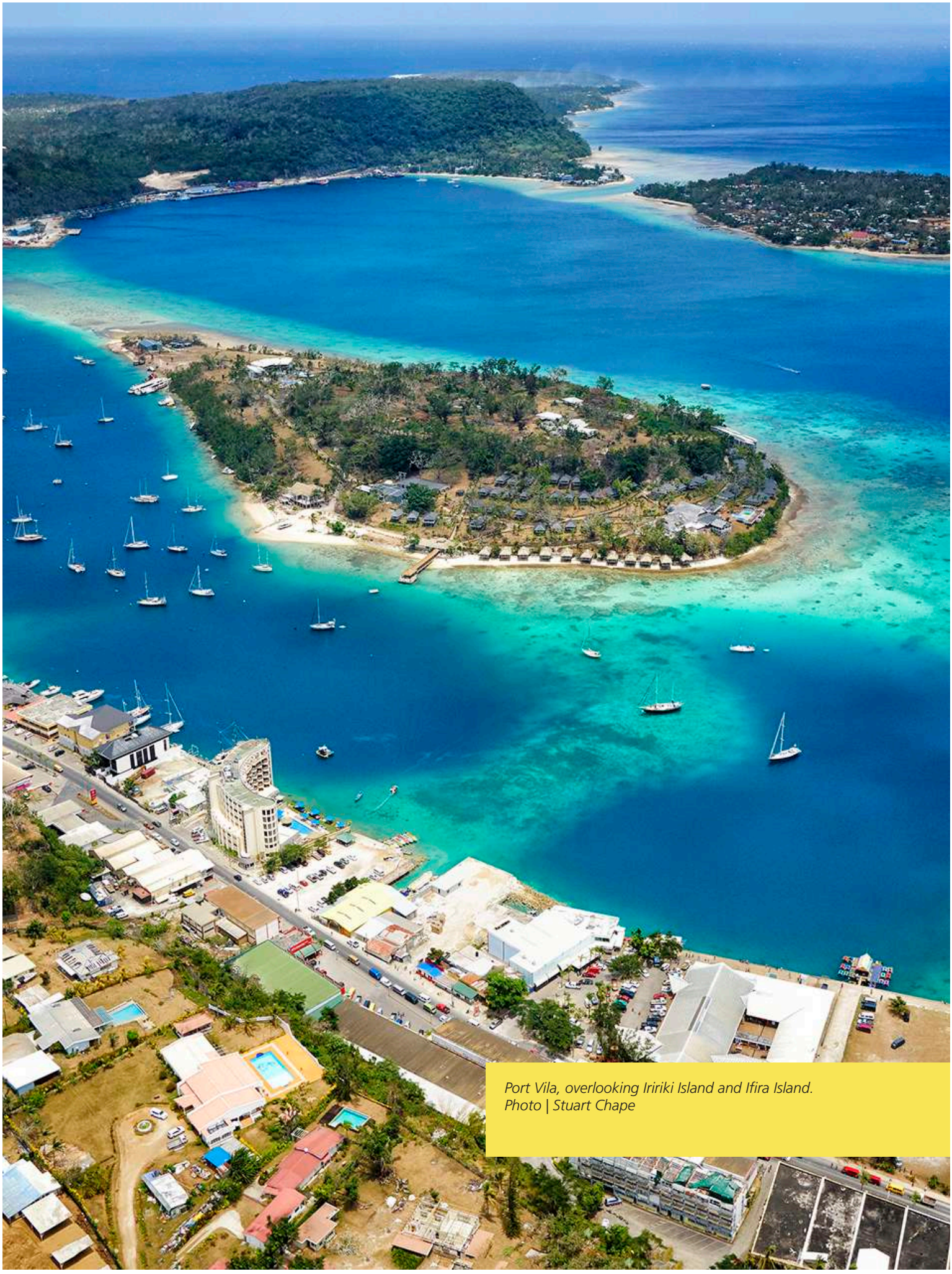
Photo | Stuart Chape



Port Vila, overlooking Iririki Island and Ifira Island.
Photo | Stuart Chape

Adapting to climate change in the Pacific

Our Pacific island countries and territories are highly vulnerable to climate change. In the next few decades, our countries will face increasing threats to sustainable development from climate change impacts on: marine and terrestrial ecosystems, human health, infrastructure, coastal resources, fresh water availability, agriculture, fisheries, forestry, and tourism.

High levels of connectedness between our socioeconomic and biophysical environments make it important that adaptation strategies include a strong focus on the management of natural ecosystems. Ecosystem-based adaptation (EbA) is an approach for building community resilience to climate change by investing in the maintenance of the ecosystem functions and services that we depend on for our survival.

The Pacific Ecosystem-based Adaptation to Climate Change (PEBACC) project provides Pacific Island stakeholders with EbA policy, planning, and implementation support, and is funded by the German government.

Goals of this report

This synthesis report provides an overview of the first seven steps involved to identify, prioritise, and implement ecosystem-based adaptation (EbA) projects in Port Vila, Vanuatu, and is based on a detailed series of technical reports prepared for the PEBACC project by RMIT University, Griffith University, and Victoria University Wellington.

Local communities and stakeholders were engaged throughout the process to map ecosystem types; define key ecosystem functions and services; define the economic value and identify possible threats to these ecosystem services; identify and prioritise possible EbA projects to improve ecosystem health and increase community resilience; and develop an implementation plan for the selected EbA projects.

It is envisioned that this process provides a coordinated plan for EbA projects to be implemented, through the PEBACC project and other funding mechanisms. This EbA planning approach provides a test case and model for other Pacific islands. The overall goal is to support the organisation, planning, policy, capacity building, and actions that will build community resilience to the effects of climate change and other development related impacts on coastal and terrestrial ecosystems.

The steps used to plan and implement EbA in Port Vila, Vanuatu. This report provides an overview of the first seven steps of the project, from knowledge and synthesis, prioritisation, and implementation. Steps eight through ten are currently underway.

Process to plan and implement EbA

KNOWLEDGE & SYNTHESIS

1. **MAP ECOSYSTEMS**
   Identify and map ecosystem types in relevant watersheds.
2. **DEFINE ECOSYSTEM FUNCTIONS & SERVICES**
   How do the ecosystems support communities?
3. **DEFINE ECONOMIC VALUE OF ECOSYSTEM SERVICES**
   Calculate value of ecosystem services for communities
4. **IDENTIFY THREATS TO ECOSYSTEM SERVICES**
   Identify threats affecting ecosystem services.

PRIORITISATION

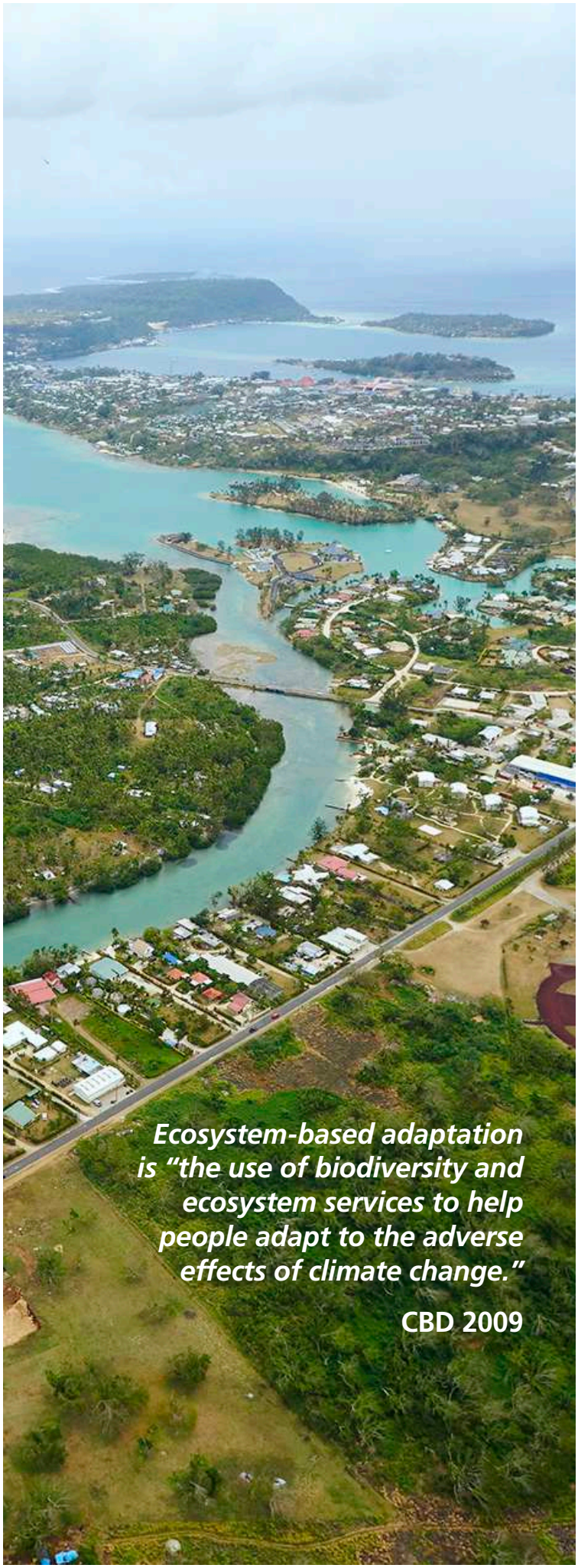
5. **IDENTIFY EbA OPTIONS**
   Identify EbA actions that can improve ecosystem health and increase community resilience.
6. **PRIORITISE EbA OPTIONS**
   Which EbA options provide the most benefit and value?

IMPLEMENTATION

7. **DEVELOP AN EbA IMPLEMENTATION PLAN**
   How? Where? Why? What? When? Cost?
8. **IMPLEMENT SELECTED EbA PROJECTS**
   Implement EbA options as a test case and model.

ADAPTIVE MANAGEMENT

9. **EVALUATE SUCCESS**
   What worked? What didn't work? How can we improve next time?
10. **DEVELOP POLICY**
    Address any policy limitations for effective EbA implementation.



What is ecosystem-based adaptation (EbA)?

EbA is an approach for building the resilience of local communities to climate change through the protection or restoration of ecosystems. Sustainably-managed and intact ecosystems are critical for the future provision of ecosystem services to maintain the health, well-being, and livelihoods of island communities.

EbA often provides a primary protection goal, such as planting coastal vegetation to reduce wave impacts, or replanting stream or watershed areas to reduce soil erosion and reduce flooding; while also supporting secondary benefits including provision of food, shelter, water, medicine, or income. These approaches are particularly appropriate in areas such as Port Vila which has a high poverty rate, with high reliance on forests, rivers, wetlands, and coastal marine ecosystems for subsistence supply of essential needs.

When implemented and managed effectively, EbA can be cost-effective, with low infrastructure requirements, and has the potential to be self-sustaining. One challenge is that communities may need outside investment to ensure they can undergo transitions in livelihood or management practices while maintaining essential daily needs, but once implemented EbA projects provide communities with more choices in the future through increased access to social, economic, and cultural benefits.

EBA OPPORTUNITY FOR PORT VILA:

Most households in Greater Port Vila gain benefits from terrestrial (80%) or marine and freshwater ecosystems (85%). In this relatively small but rapidly developing urban area, climate change compounds the pressures from urbanisation, pollution, and overexploitation. Ecosystem-based approaches for climate change adaptation in the Greater Port Vila area have potential to increase resilience of communities and ecosystems, supporting alleviation of poverty and increased community health and wellbeing.

Ensuring the resilience of seagrasses and mangroves by reducing pollution (ecosystem based restoration) means that there are healthy fish populations (ecosystem function) which then provide food or income for people that live in Port Vila (ecosystem services). Photo | Stuart Chape

About Port Vila

In 2009, the population of Port Vila and surrounding peri-urban areas was 74,775, representing more than 25% of the total population of Vanuatu. Annual population growth within the Greater Port Vila Area is up to 6%, well above the national rate for Vanuatu of 2.5% (1999–2009). The urban growth rate is primarily driven by migration of people from rural areas to seek work, education, and healthcare opportunities. Largest growth is in the northern peri-urban fringe, as well as informal and semi-formal settlements.

Income in one in four households in the Greater Port Vila Area is fully or partially dependent on production of goods such as fruit and vegetables, seafood, livestock, handicrafts, or manufactured items. More than half the households in the city grow supplemental fruit and vegetables. Essential services are lacking in the peri-urban areas, for example residents in Etas typically travel 3 km to collect water for household use.

Land area
24.3 km²

Population
74,775

Temperature
26.0–32.0˚C

Population growth
up to 6% per year

Rainfall
2,000 mm/year

Governance structure

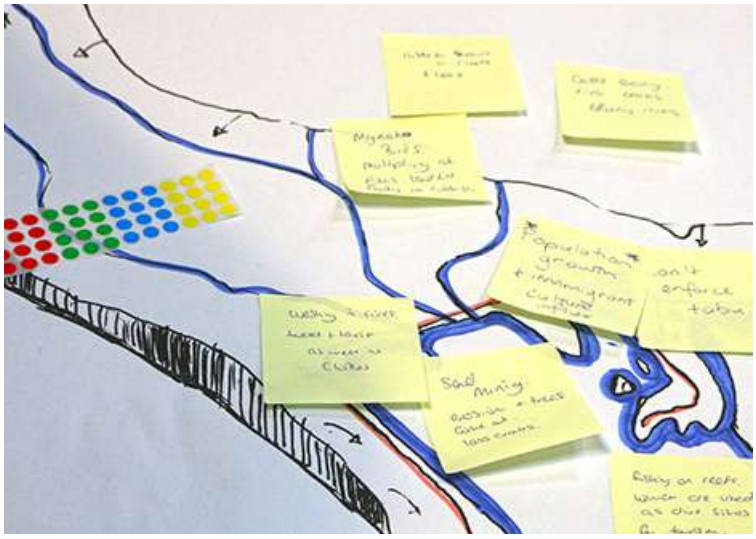
The Greater Port Vila Area is evenly split between urban land under municipal jurisdiction (55% of population) and peri-urban land, or informal settlements, on customary land under provincial jurisdiction.

Port Vila Municipal Council holds jurisdiction over the municipality of Port Vila, which includes five wards, each with a Ward Council to increase connection and communication between the Municipal Council and communities. The remainder of the Greater Port Vila Area is customary land that is governed by the Shefa Provincial Council and, under customary law, by the Malvatumauri or National Council of Chiefs. Village Chiefs are also primarily responsible for coastal marine area management through the use of 'tabu,' or no take, areas that are opened periodically. The national government maintains oversight of the municipal council and Shefa Provincial Council, reporting to the Department of Local Authorities.

Cross-boundary collaboration between the Port Vila Municipal Council, Shefa Provincial Council, and the National Council of Chiefs is critical to improve management at a water catchment scale for the rapidly expanding peri-urban areas outside of the municipality.

Top: More than 25% of the total population of Vanuatu lives in the Greater Port Vila Area. Photo | Thomas Cockrem

Middle & Bottom: One in four households in the Greater Port Vila Area generates income by selling fruit and vegetables, seafood, livestock, handicrafts, or manufactured items. Photos | Louisa Cass (AusAID) and Phillip Capper



Top: Household survey in the peri-urban community of Etas on 14th April 2016. Photo | Naomi DeVille (RMIT)

Middle: Community workshop at Seaside, 31st March 2016. Photo | Naomi DeVille (RMIT)

Bottom: Mapping exercise from the stakeholder workshop in Port Vila. Photo | Maibritt Pedersen Zari

Stakeholder and community engagement

There were three components to community engagement in the Greater Port Vila area: household surveys and community workshops in each of ten communities, followed by a broader stakeholder workshop to receive feedback and input on the results of the mapping process.

HOUSEHOLD SURVEYS

A total of 823 households across ten communities in the Greater Port Vila area were surveyed to identify, document, and map ecosystem goods and services critical to the livelihoods and day to day living of residents. Surveys were made available in English, French, and Bislama.

COMMUNITY WORKSHOPS

One workshop was held in each of the ten surveyed communities, summarising key information from the survey, including the main ecological services as well as priority issues and threats for marine, coastal and terrestrial ecosystems, identified in the household survey. Each workshop was arranged through local chiefly structures and aimed to develop discussion on shared local visions of resilience. Participants also considered plans for sustainability and protection of natural resources, and the ecosystem services they provide to communities.

STAKEHOLDER WORKSHOP

The second phase included mapping and assessment of ecosystems, impacts of climate change and human activities, and development of ecosystem based adaptation options and priorities. This information was presented in Port Vila to a broad range of stakeholders representing communities, Government Ministries, Provincial Government, Ward Councils, non-government organisations, and regional agencies. The results were discussed in terms of climate change adaptation approaches and participants provided input to select potential ecosystem based adaptation actions.

823 households surveyed

10 workshops in 10 communities

255 workshop participants

40% male and 60% female participants

Mapping key ecosystems

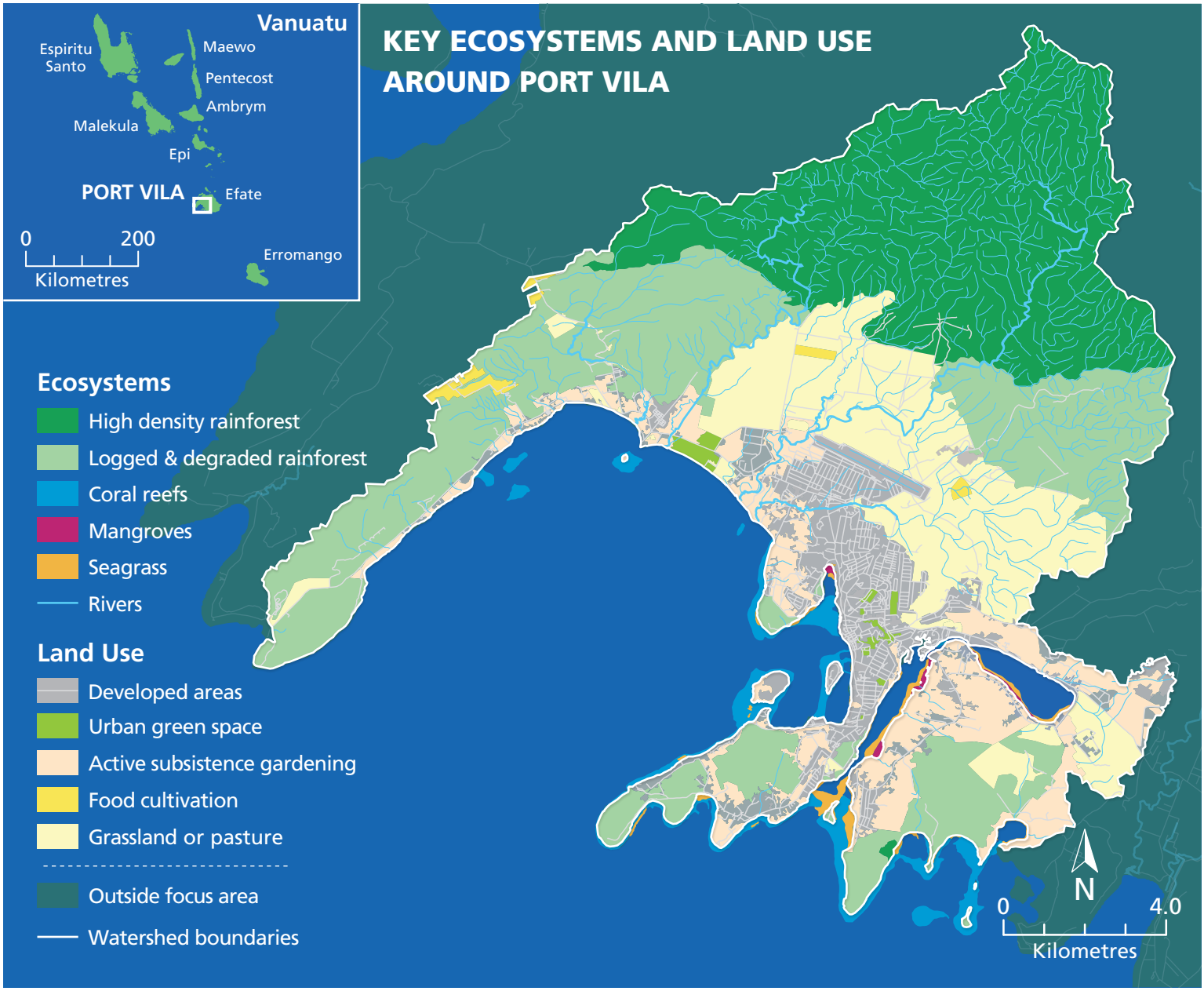
Ecosystem types were identified and mapped using GIS-based ecosystem mapping at a catchment scale and an urban scale. Mapping at the catchment scale used 2016 satellite imagery, which was then validated by on-the-ground observations. More detailed mapping at the urban scale was conducted to distinguish different, and sometimes overlapping types of urban, rural, and informal built-up areas across the catchment.

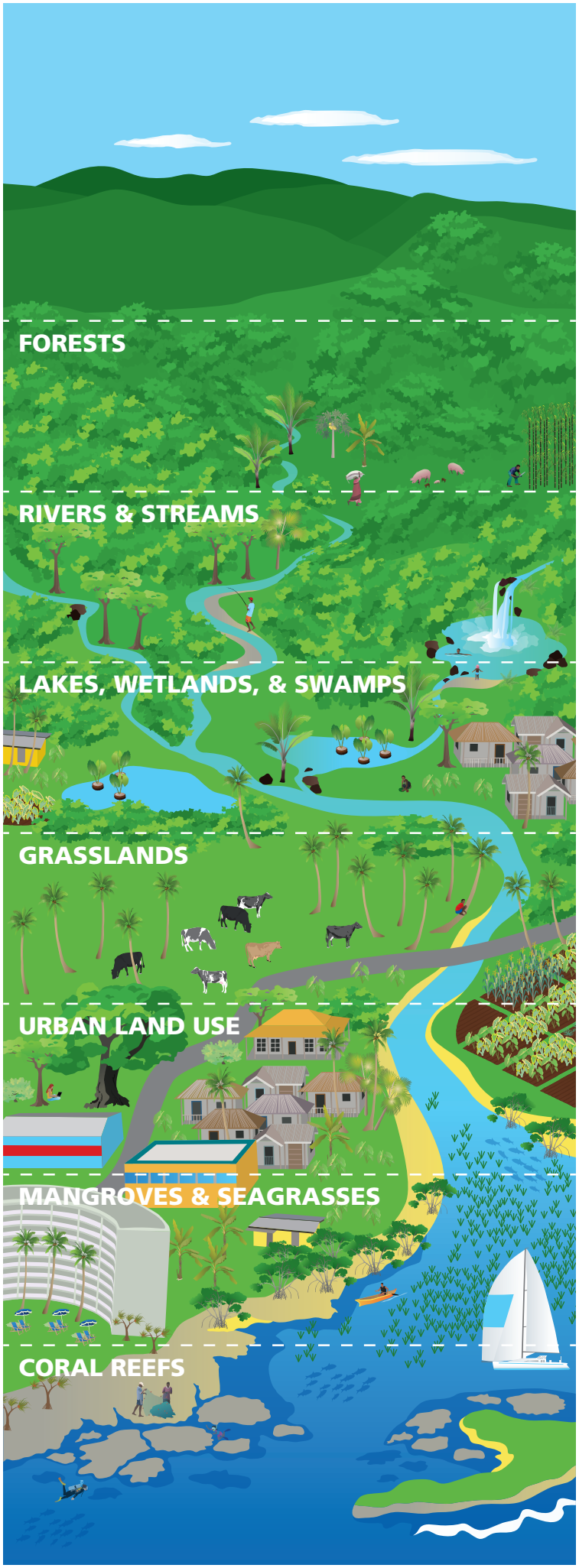
Ecosystem services were identified by community stakeholders for each ecosystem, and documented using interactive mapping exercises with a focus on high-use areas.

Ecosystem functions and ecosystem services

An ecosystem is a set of plant and animal communities, plus the physical environment that supports them. Ecosystem functions are natural processes within an ecosystem—for example, healthy coral reefs provide essential habitat for fish and many other species.

When ecosystem functions are actively used by communities they become ecosystem services that provide economic, social, or cultural benefits—for example, a biodiverse and plentiful fish population (ecosystem function) can support a sustainable artisanal or commercial fishery that provides food, generates income, and supports cultural values and societal well-being (ecosystem services).





Ecosystem functions and services from ridge to reef

Only those ecosystem functions and services that were monetised are included below, except for urban land use.

- Food
- Water
- Raw materials
- Medicinal resources
- Climate regulation
- Disturbance moderation
- Regulation of water flows
- Waste treatment
- Erosion prevention
- Pollination
- Recreation

- Food
- Water
- Waste treatment
- Recreation

- Food
- Water
- Raw materials
- Medicinal resources
- Ornamental resources
- Climate regulation
- Disturbance moderation
- Regulation of water flows
- Waste treatment
- Erosion prevention
- Nutrient cycling
- Nursery service
- Recreation

- Food
- Raw materials
- Medicinal resources
- Climate regulation
- Recreation

- Food
- Raw materials
- Ornamental resources
- Climate regulation
- Disturbance moderation
- Pollination
- Recreation
- Genetic resources
- Supports cultural identity

- Food
- Water
- Raw materials
- Medicinal resources
- Climate regulation
- Disturbance moderation
- Waste treatment
- Erosion prevention
- Nutrient cycling
- Nursery service
- Recreation

- Food
- Raw materials
- Genetic resources
- Ornamental resources
- Climate regulation
- Disturbance moderation
- Waste treatment
- Erosion prevention
- Nursery service
- Recreation

Threats to ecosystem services

As the population continues to grow, human impacts threaten the health of Port Vila's ecosystems, and therefore the ecosystem functions and services that they provide. Community stakeholders identified the following specific threats affecting the delivery of ecosystem services in Port Vila:

- Unsustainable development results in loss of coastal/riparian vegetation and wetlands.
- Pollution from poor sanitation and solid waste practices by communities, industry, agriculture, and ocean-based pollution from boats.
- Poor land management practices results in erosion, agricultural runoff, and sedimentation.
- Restricted access to clean water limits backyard food production and affects human health.
- Overharvesting of firewood and Natangura (pandanus) and poor management practices.
- Overharvesting of fish, freshwater prawns, sea birds, sea cucumber, trochus, and green snail.
- Sandmining has caused the shoreline to recede inland and reduced water quality.

Climate change projections

Climate change will also influence the delivery of ecosystem functions and services, and further exacerbate the human impacts listed above. The following climate change projections for Vanuatu were identified in the PACCSAP (2014) report:

- **Sea level** is projected to rise 8–19 cm by 2030, and 42–89 cm by 2090 (very high confidence);
- Annual mean **temperatures** and extremely high daily temperatures are projected to increase by up to 1.0°C by 2030, and up to 4.0°C by 2090 (very high confidence);
- Mean annual **rainfall** could increase or decrease with the model average indicating little change (low confidence), with more extreme rain events (high confidence);
- Decreased frequency but increased intensity of **tropical cyclones** (medium confidence);
- Continued **ocean acidification** (very high confidence);
- Increased **coral bleaching** (very high confidence).

Top: Unsustainable development near rivers and the coast results in loss of critical habitats. Photo | Ikonya

Middle: Overharvesting of firewood is a human-caused threat to ecosystem services. Here firewood is being sold at the market in Port Vila. Photo | Scott Barclay

Bottom: Loss of mangroves from overharvesting of firewood and development. Photo | Maibritt Pedersen Zari

Identifying EbA options

A five-step process was carried out to identify possible EbA options for implementation within the Greater Port Vila Area and associated coastline and watershed. The process started with household surveys and ended with stakeholder input prior to final assessment of potential ecosystem benefits.

STEP 1: ASSESS CAUSES AND IMPACTS OF DEGRADATION

Household surveys, summaries of available published information, and identification of potential climate change scenarios were used to develop linkages between local development threats, climate change threats, and community wellbeing.

STEP 2: IDENTIFY EBA OPTIONS

Possible EbA options were identified that had potential to address the identified threats and reduce the community impacts from degradation of key ecosystem components.

STEP 3: GROUP EBA OPTIONS

Identified EbA options were grouped into six categories: water security, urban and peri-urban agriculture, urban forests and agroforestry, coastal ecosystem regeneration, integrated urban water systems, and sustainable urban development and housing.

STEP 4: STAKEHOLDER REVIEW

A broad range of stakeholders from communities; regional, national, and local governments; non-government organisations; and regional agencies were asked to provide input on potential merits or difficulties with proposed projects, and to spatially locate these comments in a participatory process.

STEP 5: DEVELOP FUTURE SCENARIOS

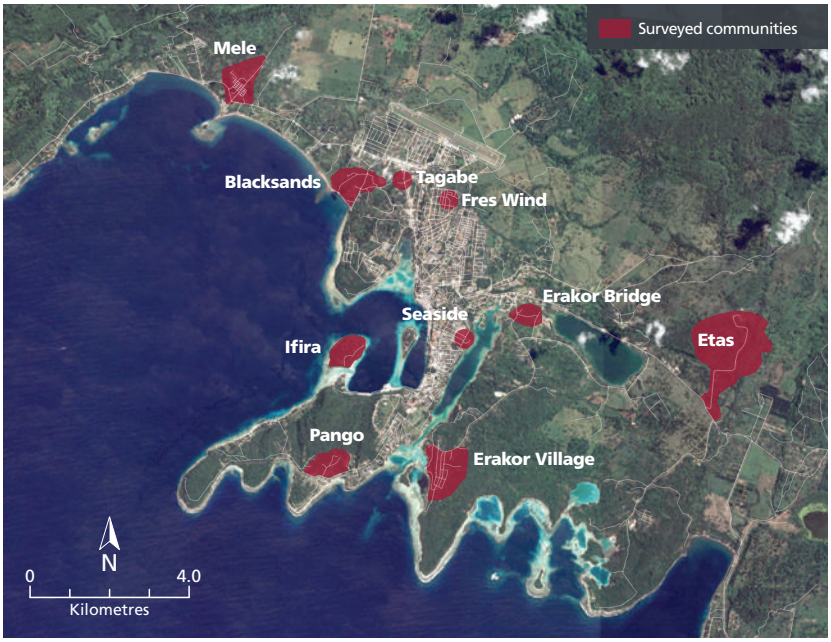
To assess the potential sustainability of EbA options, each option was considered in terms of future scenarios of population growth, economic development, and rate of climate change (based on amount of global warming by 2030).

Prioritising EbA options

The eleven identified EbA options were assessed and prioritised based on the following nine selection criteria:

- Climate change resilience
- Magnitude of resilience benefits
- Cost
- Risk of failure
- Relative area, scope and size
- Implementation timeframe
- Visibility and public awareness
- Complementarity to other projects
- Ridge to reef relevance

This resulted in a short-list of five projects (included in the table on page 9) which were then assessed for potential ecosystem services delivered to communities from each project (see table on page 11).



Right: Map showing the locations of the ten communities that participated in community workshops as stakeholders. Satellite image | Google Earth

Opposite page: Restoration and protection of coastal vegetation was a prioritised EbA option.

Nine selection criteria were used to prioritise EbA options for Port Vila. L = Low; M = Medium; H = High.

Port Vila ecosystem-based adaptation options	Climate change resilience	Magnitude of resilience benefits	Cost	Risk of failure	Relative area, scope, size	Implementation timeframe	Visibility and public awareness	Complentary to other projects?	Ridge to reef relevance
Tagabe riparian corridor regeneration	M	M	H	M-H	Large	Long term	L	H	H
Restoration and protection of coastal vegetation	H	H	M	M	Medium	Medium term	L-M	H	Indirect
Intensification of home gardens	L-M	L-M	L	L	Medium	Short term	H	M	M
Urban trees	H	M	M	M-H	Small	Medium to Long term	H	M	H
Sustainable housing development	H	H	M-H	M	Small	Short to Medium term	H	M	Indirect
Increase trees in the informal and peri-urban settlements	L	L	L-M	M-H	Medium	Medium to Long term	L-M	M	Low and indirect
Rainwater harvesting and storage in informal settlements	L-M	M	M	L-M	Medium	Short to Medium term	M	M-L	L
Reduce freshwater and coastal water pollution	H	H	M	H	Medium	Medium to Long term	L	M	H
Environmental impact reduction in the tourism sector	L	L-M	L-M	M-H	Small	Medium term	L	L	L-M and indirect
Rubbish reduction policies and activities	L	L	L	L-M	Small	Short term	M	L	L-M
Ecological / climate focus added to the draft Greater Port Vila Plan	H	H	L	H	Medium	Short term	L	H	H

Developing an EbA implementation plan

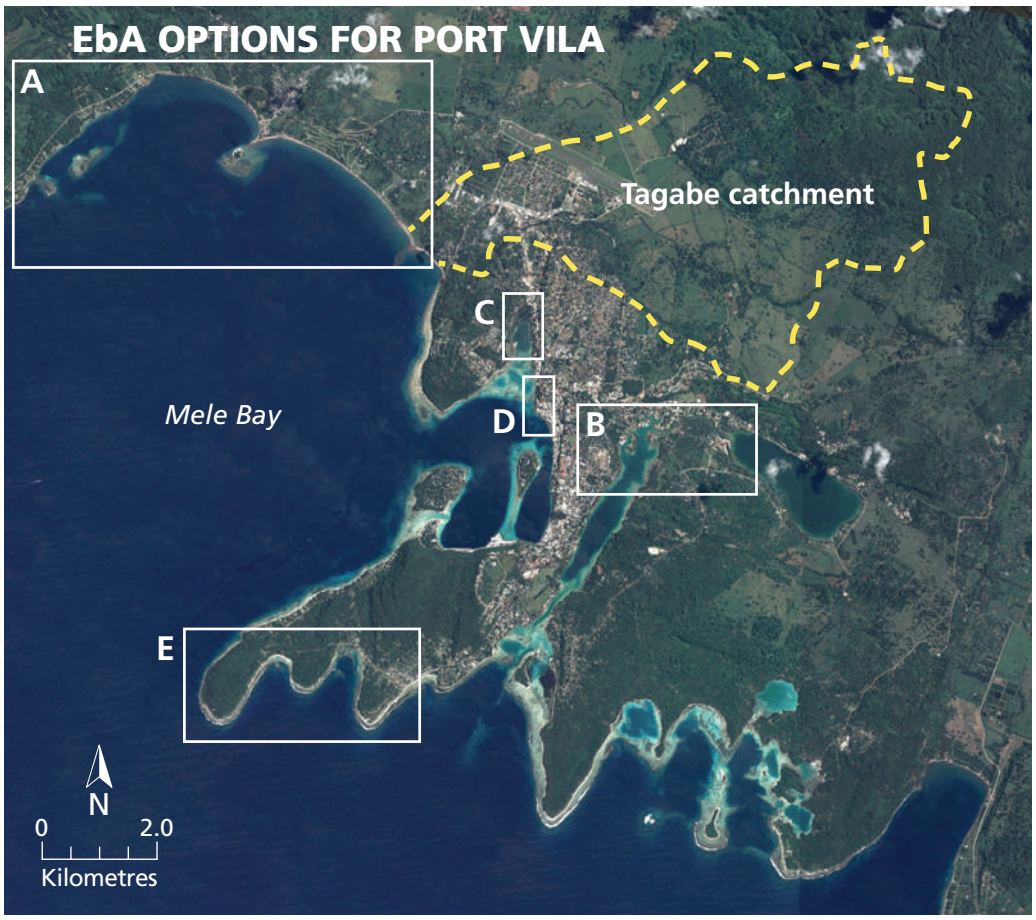
Following prioritisation of the eleven EbA options, five projects were selected to develop an EbA implementation plan:

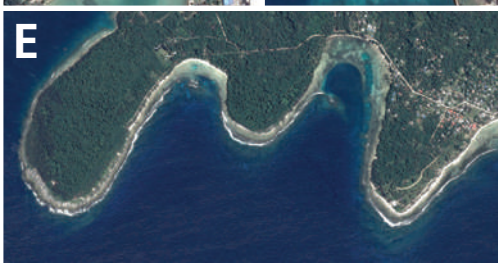
1. Tagabe riparian corridor regeneration;
2. Restoration and protection of coastal vegetation
3. Intensification of home gardens;
4. Urban trees;
5. Sustainable housing development.

These demonstration projects for Port Vila are highlighted in the following pages, along with the estimated potential benefits of each project on ecosystem services (see table page 11).

Right: Engaging with community stakeholders. Photo | SPREP

Below: Location of selected EbA options, showing the Tagabe catchment (left panel), Tagabe-Mele potential mangrove restoration areas (A) and Erakor Bridge potential mangrove restoration areas (B), Fatumaru Bay potential mangrove restoration areas (C), Fatumaru Bay potential mangrove restoration areas (D), Pango potential coastal reforestation areas (E), and primary location for the Urban Trees project within Central Port Vila (D). Satellite images | Google Earth





Ecosystem services provided or supported by EbA projects

Estimated impact of each EbA project on ecosystem services: = high, = medium, = low, = none

Ecosystem services		Riparian corridors	Coastal regeneration	Home gardens	Urban trees	Sustainable housing
PROVISIONING SERVICES	Food					
	Biochemicals					
	Raw materials					
	Fuel/energy					
	Freshwater					
	Ornamental resources					
	Genetic information					
REGULATING SERVICES	Pollination/seed dispersal					
	Biological control					
	Climate regulation					
	Decomposition					
	Purification					
	Prevention of disturbance					
SUPPORTING SERVICES	Soil health					
	Fixation of solar energy					
	Nutrient cycling					
	Habitat provision					
	Species maintenance					
CULTURAL SERVICES	Artistic/spiritual inspiration					
	Aesthetic value					
	Creation of a sense of place					
	Cultural diversity & history					
	Education & knowledge					
	Psychological well-being					
	Recreation & tourism					

EbA OPTION #1

Photo | Jae Lee

Tagabe riparian corridor regeneration

DESCRIPTION

Integrated catchment management program targeted at key Port Vila catchment and designed to build resilience into the riparian system to safeguard human wellbeing in the face of current and future climate change challenges and key population/resource demands. Activities include: a) riparian revegetation and stream bank protection; b) sustainable land management of adjacent farmlands; and c) point source pollution prevention and remediation.

LOCATION

Riparian margins of mid to lower catchment streams in the Tagabe catchment.

SOCIO-ECOLOGICAL RESILIENCE BENEFITS

- Hazard reduction through regulation of water flow reducing risks from floods and cyclones;
- Improved water quality for human consumption;
- Increased ecosystem health of coastal waters from reduction in sediment and nutrients;
- Sustained biodiversity through provision of habitat for terrestrial fauna and flora through riparian restoration;
- Improved economic opportunity through provision of food, wood, and fibre;
- Increase community resilience and wellbeing through sustainable approaches to watershed protection and enhancement.

EbA OPTION #2

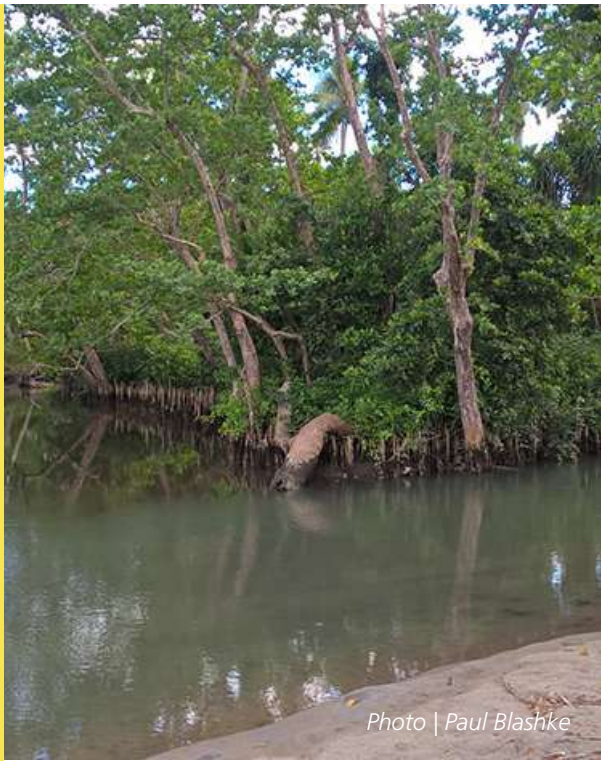


Photo | Paul Blashke

Restoration and protection of coastal vegetation

DESCRIPTION

To restore and protect coastal vegetation, particularly mangrove habitats, along key parts of the greater Port Vila coastline. The project includes replanting and regenerating areas where mangroves and other important coastal tree species have been depleted, and implementing policy to strengthen protection of mangrove habitat at the urban, provincial, and national level.

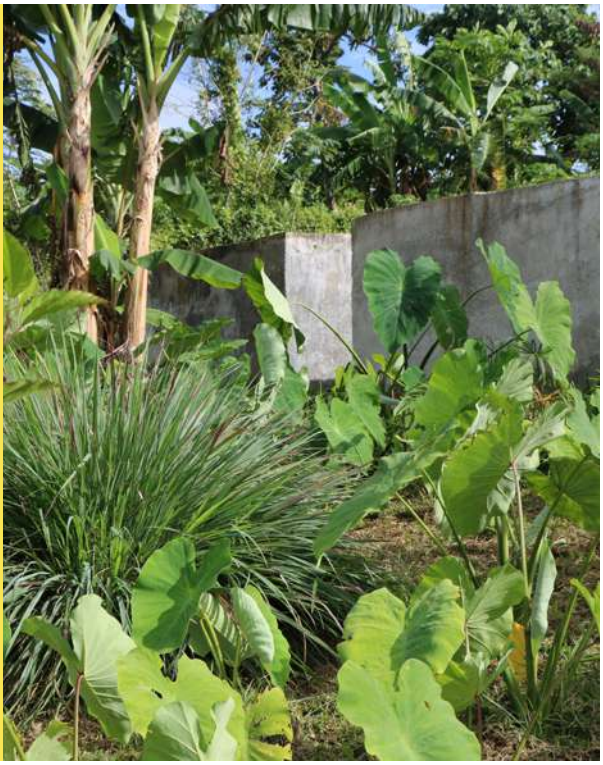
LOCATION

Tagabe River mouth, the Fatumaru estuary, and the Erakor and Emten Lagoons.

SOCIO-ECOLOGICAL RESILIENCE BENEFITS

- Increased shoreline protection through increased wave attenuation and reduced shoreline erosion;
- Increased biodiversity through habitat provision for a range of coastal fauna;
- Provision of natural coastal viewshed and opportunities for recreation;
- Improved water quality through sediment trapping and nutrient retention;
- Food security through provision of increased habitat for juvenile fish, supporting inshore fish populations;
- Greater resilience for coastal housing and communal infrastructure.

EbA OPTION #3



Intensification of home gardens

DESCRIPTION

To increase the extent and productivity of home gardens to help maintain and improve food and cooking fuel security for communities in Greater Port Vila, and build resilience to climate change.

LOCATION

Residential areas of urban and peri-urban Port Vila.

SOCIO-ECOLOGICAL RESILIENCE BENEFITS

- Maintained or improved cooking fuel security through more efficient fuel supply and use;
- Increased food security through household freshwater fish ponds;
- Improved resilience of marine fish populations through reduction in fishing pressure;
- Improved human health through increase of traditional staple food crops in diet;
- Increased firewood security through improved storing and drying practices;
- Maintained or improved opportunities for generating income;
- Decreased reliance on imported food.

EbA OPTION #4

Photo | Paul Blashke

Urban trees

DESCRIPTION

Strategic introduction of multi-value trees and vegetation to key urban areas and coastal environments in Port Vila. The project will educate people about the use of trees species, provide tangible resources (including food), increase vital urban ecosystem services, and act as a seedbank to safeguard vulnerable species against climate change.

LOCATION

Along streets, promenades, and key transport routes of Port Vila with particular focus on existing areas of ecological degradation, polluted sites, flood-prone areas, and those urban areas that are near rivers and/or the foreshore.

SOCIO-ECOLOGICAL RESILIENCE BENEFITS

- Increased wellbeing and amenity by increasing shade and cooling urban areas;
- Improved health through increases in air quality;
- Increased food security through provision of harvestable products;
- Increased economic opportunities through access to tree resources and attractiveness of urban environment;
- Retained cultural identity through access and awareness of medicinal species;
- Improved water quality and control of water flow, through planting along transport corridors.

EbA OPTION #5

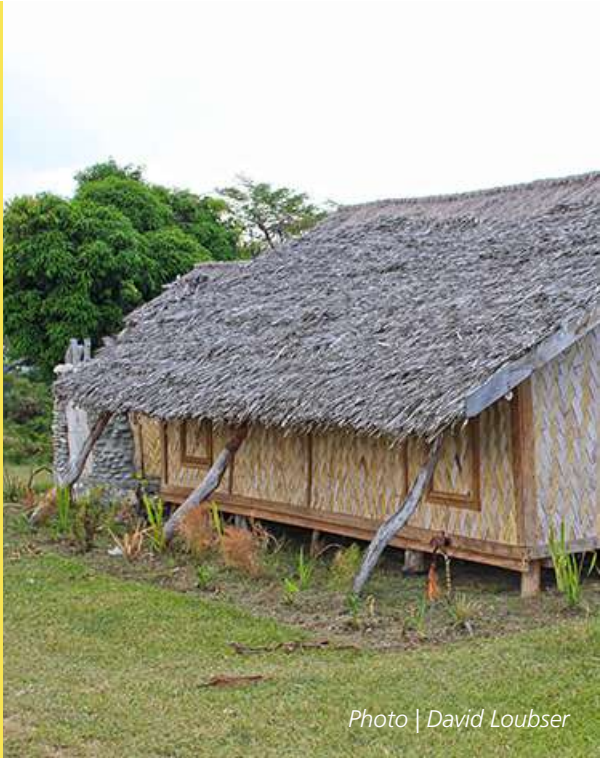


Photo | David Loubser

Sustainable housing development

DESCRIPTION

Design and implement a demonstration housing project using contemporary bioclimatic architecture following traditional housing technologies to introduce concepts related to social, economic, and environmental sustainability. Applicable for new housing developments and for refurbishment of existing informal settlements.

LOCATION

In areas where the city is rapidly expanding, or where informal settlements already exist, such as Blacksands or Ekasup. Exact location to be determined during the project design stage.

SOCIO-ECOLOGICAL RESILIENCE BENEFITS

- Improved water sustainability through integrated water systems;
- Increased food security through urban agriculture;
- Sustainable energy provision through agroforestry or renewable energy projects;
- Improved community engagement through participatory design process.

Policy context

While there is a need to strengthen ecosystem-based adaptation policy in Vanuatu, the Climate Change and Disaster Risk Reduction Policy, National Environment Policy and Implementation Plan, Vanuatu Forest Policy, and the National Oceans Policy, provide enabling policy frameworks at the national level.

At the regional level, enabling policy frameworks for ecosystem-based adaptation in the Pacific islands are:

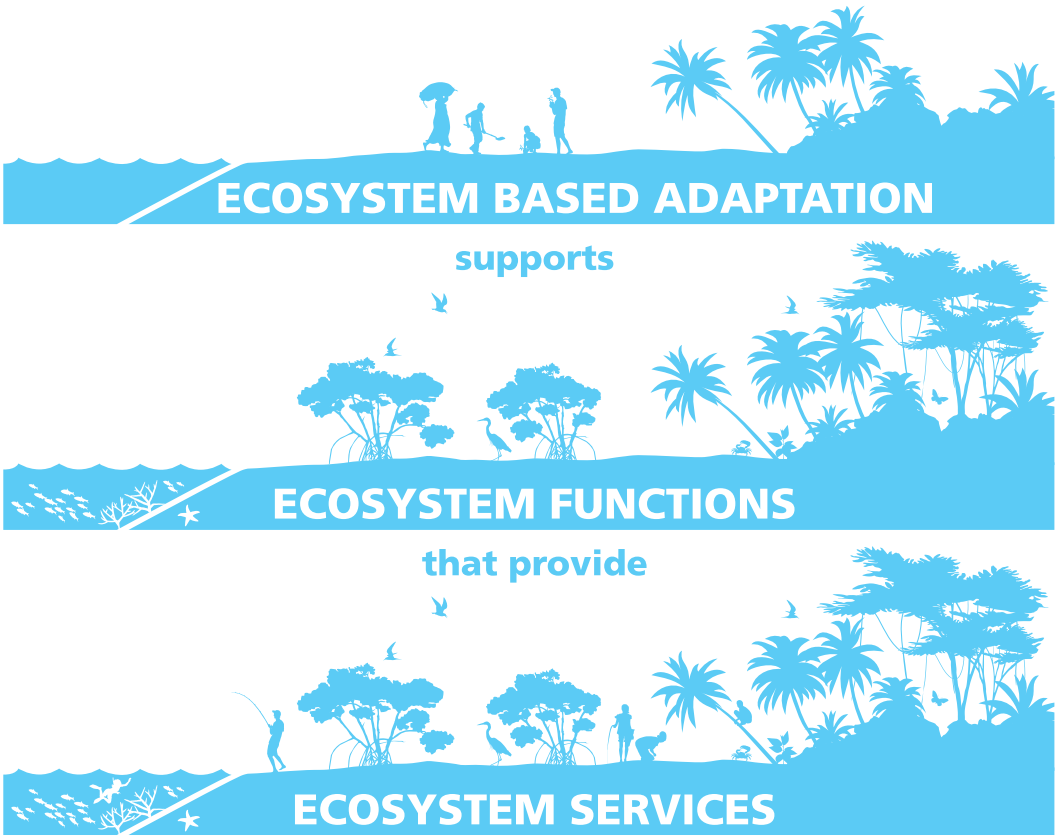
- Framework for Resilient Development in the Pacific;
- Framework for Nature Conservation and Protected Areas in the Pacific Islands;
- Pacific Regional Action Plan for Sustainable Water Management (Pacific RAP); and
- Framework for a Pacific Oceanscape.

At the international level, the ecosystem-based adaptation approach is strongly advocated by:

- UN Framework Convention on Climate Change;
- Sendai Framework for Disaster Risk Reduction (2015–2030); and
- Convention on the Conservation of Biological Diversity (CBD).

Benefits of EbA implementation in Port Vila

Based on the vulnerable ecosystem services identified, EbA options have been proposed to protect, restore and strengthen ecosystems to increase the resilience of Port Vila's communities and economies. Building environmental resilience to give ecosystems the best chance to adapt will, in turn, increase the ability of communities to adapt to the adverse impacts of climate change. Healthy ecosystems buffer communities from the impacts of climate change.



for communities
to build resilience to climate change

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A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures