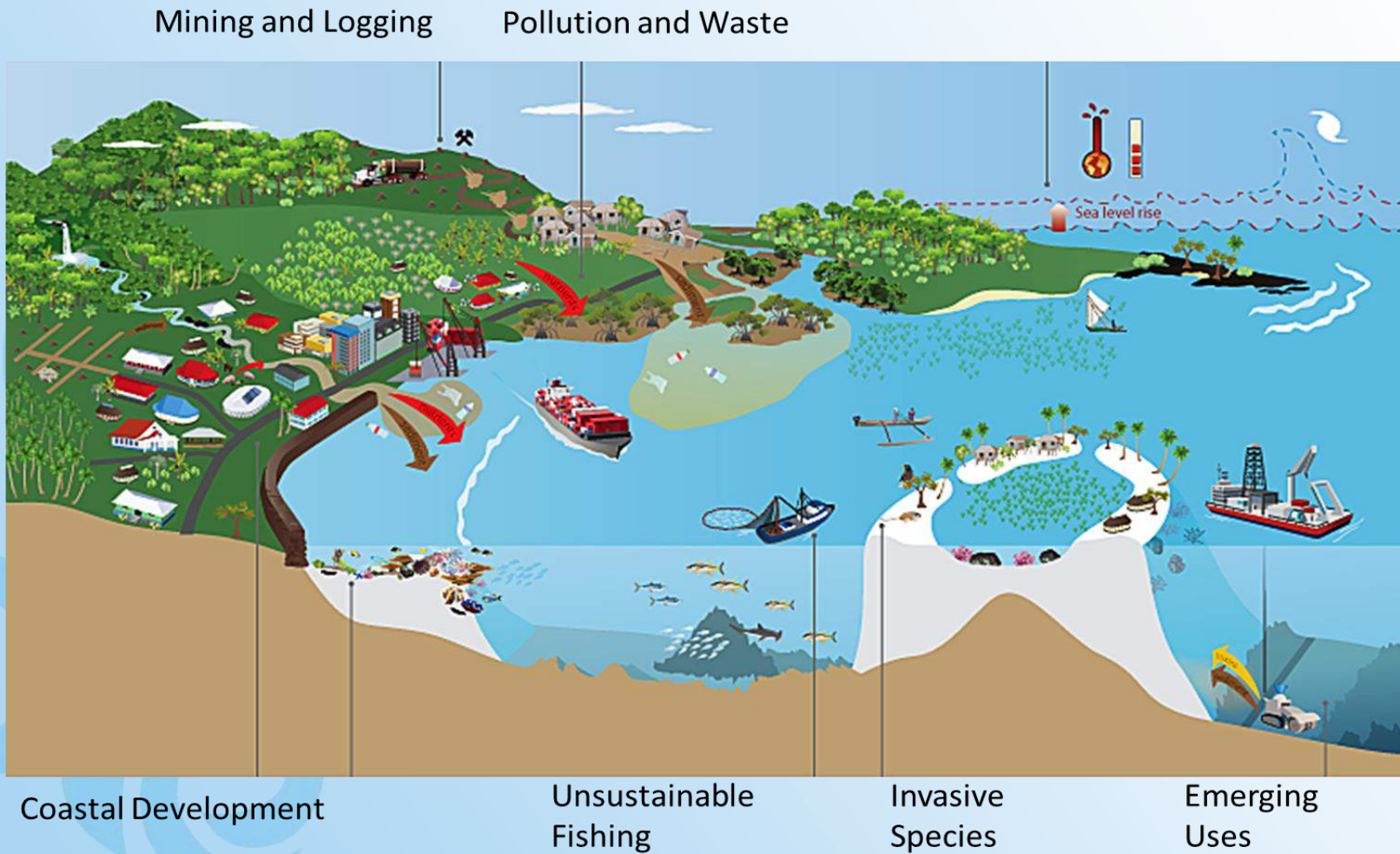


## ECOSYSTEM-BASED ADAPTATION

**Harnessing the resilience of ecosystems to build social and economic resilience to climate change = natural solutions**

- Responds to the challenge of finding workable adaptation options to climate change in the Pacific island region
- Embraces the concept of 'resilience' as an adaptation strategy
- Recognises that ecosystems form the foundations for life, livelihoods and economies and that human well-being and socio-economic resilience is linked to healthy and intact ecosystems
- Capacity of a system to adapt to changing conditions is a function of its structure and diversity

- EbA recognises that the main current drivers of ecosystem degradation are related to unsustainable development processes



## EBA Approach

- Understanding how ecosystems contribute to social and economic resilience to climate change in a particular setting
- Designing and assessing EbA options to address vulnerabilities in the social-ecological system
  - Ecosystem restoration
  - Conservation strategies
  - Sustainable land management
  - Eco-DRR and green infrastructure
  - Policy options
  - Education and awareness raising
  - etc
- Implementing selected EbA options
- Monitoring and evaluation

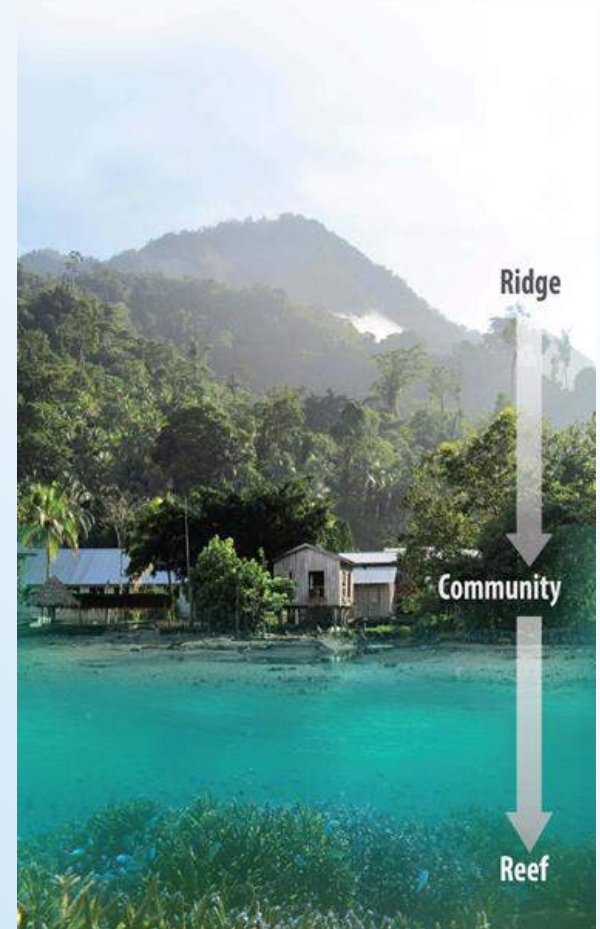


EbA is aligned with:

- Ridge to Reef; Integrated Island Development; Integrated Catchment Management; Integrated Coastal Zone Management; Whole-of-Island Approach; Community-based Natural Resource Management; Community-based Ecosystem Approach to Fisheries Management

Added value:

- Provides a deeper understanding of the role of biodiversity and ecosystems in maintaining resilience
- Systems perspective focusing on the interconnectedness between social science, economics, and ecology
- Serves as an entry point for the conservation community to engage with the climate change negotiations process



# Understand the Options

**Village without adaptation**

- ✗ Most vulnerable to climate change impacts
- ✗ No management of ecosystem services

**Village with hard engineering adaptation options**

- ✓ Effective in reducing potential damage
- ✗ No management of ecosystem services

**Village with ecosystem based adaptation (EbA)**

- ✓ Natural buffers reduce climate change impacts
- ✓ With secondary benefits from ecosystem services

<b>UPSLOPE</b>	<b>Deforestation:</b> - causes greater landslide risk & higher flood levels - results in biodiversity loss	<b>Improved drainage:</b> - reduces landslide risk & groundwater recharge - but can increase sediment flows to rivers and reefs
<b>RIVERSIDE</b>	<b>Removal of riverside vegetation:</b> - causes reduced freshwater quality - increases flooding risk	<b>Artificial banks, dredging &amp; river realignment:</b> - reduces flooding risk - but can cause poor freshwater quality & loss of biodiversity
<b>COASTAL</b>	<b>Removal of coastal vegetation &amp; mangroves:</b> - causes erosion & coastal flooding - degrades fish & crustacean habitat	<b>Seawalls:</b> - reduce erosion in targeted areas - but can cause erosion nearby & reduce fish & crustacean habitat - heavy building material can be projected inland by tsunamis & storm surges
<b>MARINE</b>	<b>Inappropriate watershed management:</b> - reduces water quality - degrades health of fisheries and reefs	<b>Increased aquaculture &amp; access to fisheries technology:</b> - supplements declining fisheries
		<b>Intact &amp; replanted forests:</b> - reduce landslide risk & less sediment flow to rivers & reefs - provide building material, crops & firewood & store carbon
		<b>Intact &amp; replanted riverside vegetation:</b> - reduces sediment flows & flooding risk - protects freshwater supply & biodiversity
		<b>Intact &amp; replanted coastal vegetation &amp; mangroves:</b> - reduce coastal erosion & flooding - provide building material, crops, firewood & store carbon
		<b>Integrated ridge to reef management:</b> - protects intact habitats & biodiversity - supports healthy fisheries & reefs

Original illustrations: Sevloni Tora Symbols: Courtesy of the Integration and Application Network University of Maryland Center for Environmental Science ([ian.umces.edu/symbols/](http://ian.umces.edu/symbols/))

## **EbA Policy Provisions**

### *International*

- Promoted by the Convention on Biological Diversity
- Promoted by the Sendai Framework on DRM
- Gaining ground in the UNFCCC
- Links well with the SDGs and Aichi targets

### *Regional*

- Framework for Resilient Development in the Pacific (FRDP)
- Regional Framework for Nature Conservation and Protected Areas

### *National*

- Increasingly finding expression in NBSAPs, NAPs, Climate Change Policies, NDC's, etc.

SPREP has embraced 'resilience' as a **core thematic area** in the new 10 year regional strategic plan and EbA is seen as a unifying concept for its work.

## PEBACC – Pacific Ecosystem-based Adaptation to Climate Change project

Five year project in partnership with the governments of:  
(2015 – 2020)

**Objective** is to raise the profile of EbA (and Eco-DRR) as a low-cost, appropriate response to building CC resilience in the Pacific



**Intended Outcome** is to have EbA included in relevant policy and planning processes

Supported by:



Federal Ministry for the  
Environment, Nature Conservation,  
Building and Nuclear Safety

based on a decision of the German Bundestag



## PROJECT DESIGN

Phase 1 – Baseline technical assessments (ESRAMs)

Phase 2 – EbA options identified and evaluated. EbA plans developed.

Phase 3 – Implementation of EbA demonstration activities

Phase 4 – Policy integration

Communication and outreach  
products developed throughout



[www.sprep/pebacc](http://www.sprep/pebacc)





**PROJECT SITES**

Macuata  
Province

Taveuni Island



# Solomon Islands

Wagina Island

Honiara (urban)



Vanuatu

Port Vila

Tanna Island





## PROJECT STAFFING AND LOCATION

Fiji project office – 8 Thurston St



Herman  
Timmermans  
Project  
Manager



Roneel Prasad  
Finance &  
Admin Officer



Jilda Shem  
Communicatio  
ns Officer



Filomena Serenia  
Project Officer –  
based in Labasa

### Vanuatu – MSG Secretariat



Dave Loubser  
Country  
Manager



Allan Dan  
Project Officer –  
based at Tanna

### Solomon Islands – MECDM



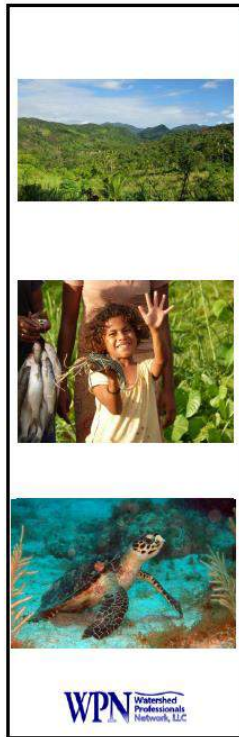
Fred Patison  
Country  
Manager



Fred Tabepuda  
Seconded to  
LLCTC - Choiseul

## INSIGHT TO FIJI COMPONENT

- Technical support from Watershed Professionals Network
- Extensive community consultations



PEBACC: FIJI ESRAM

### ESRAM

**Ecosystem & Socio-economic Resilience Analysis & Mapping (ESRAM) at Multiple Scales and Locations in Fiji**

DRAFT Submittal  
26 February 2017

Herman Timmermans et al.  
Secretariat of the Pacific Regional  
Environment Programme -- SPREP  
Email: [hermant@sprep.org](mailto:hermant@sprep.org)

Submitted By:  
Watershed Professionals Network (WPN)  
PO Box 1641 | Philomath, OR 97370 USA  
[cheider@watershednet.com](mailto:cheider@watershednet.com)  
+1(541) 760-0712



WPN Watershed Professionals Network, LLC

## Ecosystem-Based Adaptation Options Assessment for Taveuni Island, Fiji:

PEBACC: Pacific Ecosystem-Based Adaptation to Climate Change Project



Naselesale Lagoon & Watershed

Prepared For:

Herman Timmermans  
PEBACC Project Leader, SPREP

Prepared By:



WPN Watershed Professionals Network, LLC  
August 2017



Supported By:  
Funding allocated for the  
Coastal Resilience, Silver Coastmaster,  
Living and Working Group  
Funded as a Decision of the German Bundestag

## Ecosystem-Based Adaptation Implementation Plan for Taveuni Island, Fiji:

PEBACC: Pacific Ecosystem-Based Adaptation to Climate Change Project



Lina Watershed

Prepared For:

Herman Timmermans  
PEBACC Project Leader, SPREP

Prepared By:

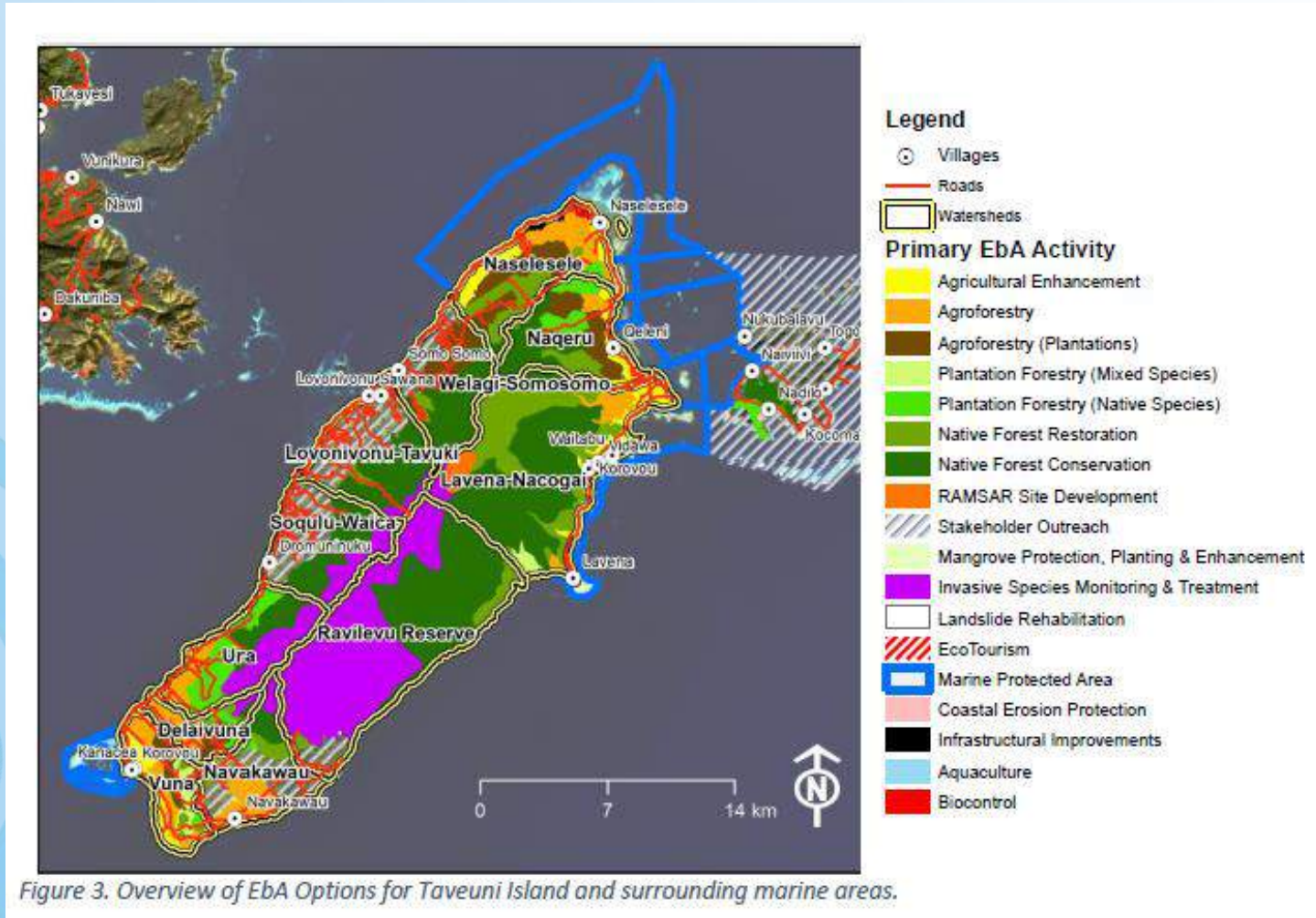


WPN Watershed Professionals Network, LLC  
August 2017



Supported By:  
Funding allocated for the  
Coastal Resilience, Silver Coastmaster,  
Living and Working Group  
Funded as a Decision of the German Bundestag

## Taveuni Island – EbA Options considered



### 3.3.3 WAINIKELI: NASELESELE WATERSHED

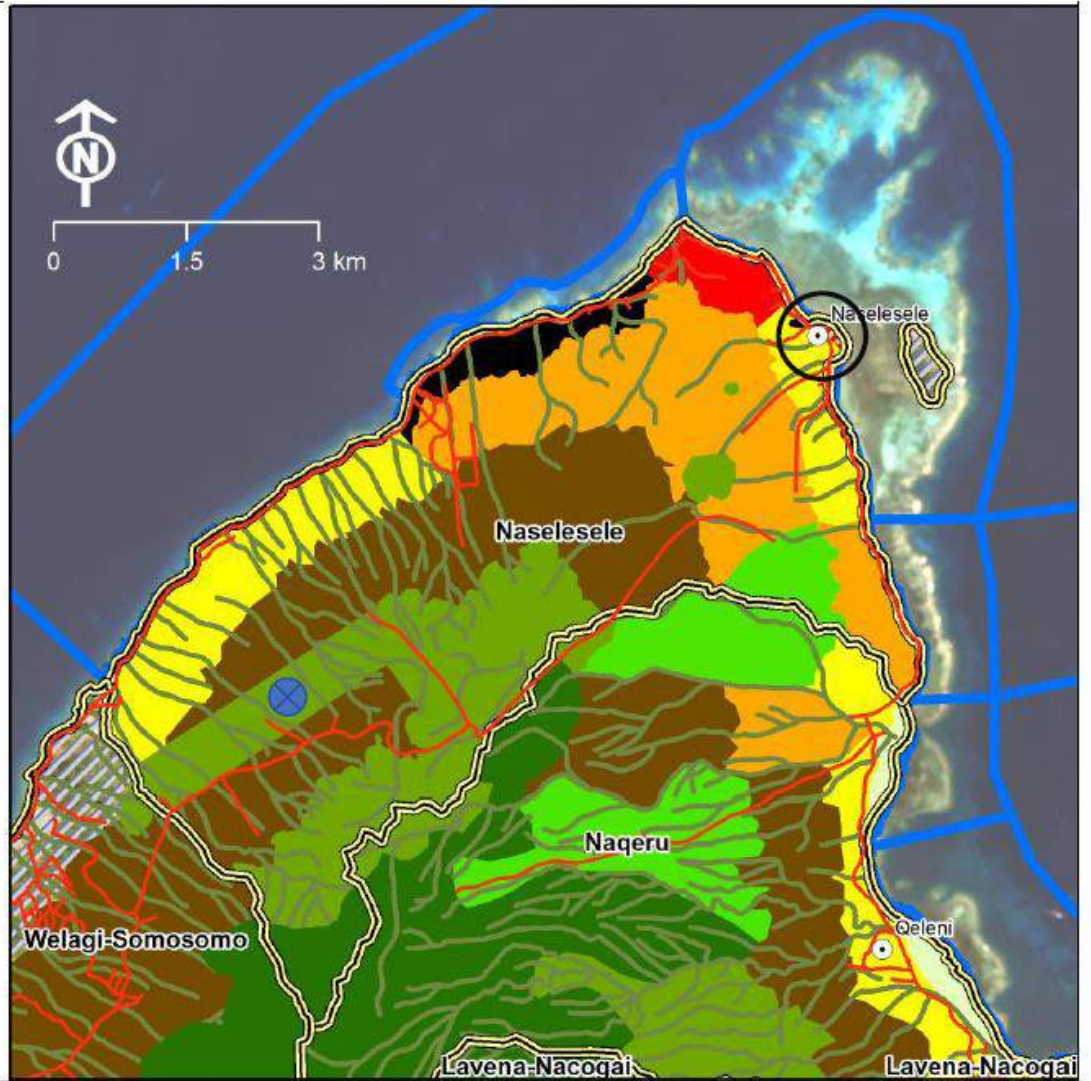
#### Legend

-  Villages
-  Watersheds
-  Riparian Enhancement
- Primary EbA Activity**
-  Agricultural Enhancement
-  Agroforestry
-  Agroforestry (Plantations)
-  Plantation Forestry (Native Species)
-  Native Forest Restoration
-  Native Forest Conservation
-  Stakeholder Outreach
-  Mangrove Protection, Planting & Enhancement
-  EcoTourism
-  Marine Protected Area
-  Infrastructural Improvements
-  Biocontrol

#### Priority Actions:

- Develop spring water sources and improve forest cover to protect springs
- Develop ecotourism site on lagoon
- Improve tree cover through agroforestry, mixed plantations and native species plantations
- Work with community and neighboring areas to minimize deforestation in upper elevations

<b>Number of Matagali</b>	24
<b>Itaukei Land</b>	21%
<b>Private Freehold</b>	36%
<b>State Land</b>	43%
<b>Watershed Area (ha)</b>	3,503



Circled area = spring and ecotourism priority area. Blue marker area has safeguards by landowners to require lessees plant native trees.

Table 22. Scenarios considered for funding under the PEBACC implementation phase.



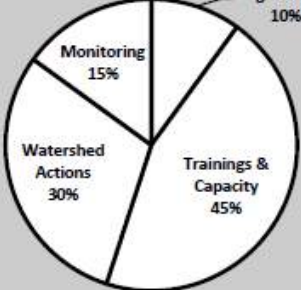
Objective	Scenario Description	Budget Allocation										
<p><b>Scenario 1:</b> Emphasize Ground-Based Activities</p>	<p>Emphasizes activities that directly result in land use and land cover change with the broadest stakeholder base, with focused training to support those activities.</p>	 <table border="1"> <caption>Budget Allocation for Scenario 1</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Watershed Actions</td> <td>45%</td> </tr> <tr> <td>Trainings &amp; Capacity</td> <td>25%</td> </tr> <tr> <td>Monitoring</td> <td>15%</td> </tr> <tr> <td>Organization</td> <td>15%</td> </tr> </tbody> </table>	Category	Percentage	Watershed Actions	45%	Trainings & Capacity	25%	Monitoring	15%	Organization	15%
Category	Percentage											
Watershed Actions	45%											
Trainings & Capacity	25%											
Monitoring	15%											
Organization	15%											
<p><b>Scenario 2:</b> Emphasize Organizational, Policy &amp; Planning Activities</p>	<p>Draws deeper focus onto several issues involving planning and policy, with less emphasis on ground-based activities or training, and involves only selected groups of stakeholders.</p>	 <table border="1"> <caption>Budget Allocation for Scenario 2</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Organization</td> <td>45%</td> </tr> <tr> <td>Watershed Actions</td> <td>20%</td> </tr> <tr> <td>Trainings &amp; Capacity</td> <td>20%</td> </tr> <tr> <td>Monitoring</td> <td>15%</td> </tr> </tbody> </table>	Category	Percentage	Organization	45%	Watershed Actions	20%	Trainings & Capacity	20%	Monitoring	15%
Category	Percentage											
Organization	45%											
Watershed Actions	20%											
Trainings & Capacity	20%											
Monitoring	15%											
<p><b>Scenario 3:</b> Emphasize Training &amp; Capacity Building Activities</p>	<p>Maximizes broader training for communities and stakeholders with some correspondence to a few ground-based activities through small pilot projects and minimal policy-related activities.</p>	 <table border="1"> <caption>Budget Allocation for Scenario 3</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Trainings &amp; Capacity</td> <td>45%</td> </tr> <tr> <td>Watershed Actions</td> <td>30%</td> </tr> <tr> <td>Monitoring</td> <td>15%</td> </tr> <tr> <td>Organization</td> <td>10%</td> </tr> </tbody> </table>	Category	Percentage	Trainings & Capacity	45%	Watershed Actions	30%	Monitoring	15%	Organization	10%
Category	Percentage											
Trainings & Capacity	45%											
Watershed Actions	30%											
Monitoring	15%											
Organization	10%											



Table 20. Evaluation of Training & Prerequisite EbA activities.

Section	Name	Description	Benefit Attributes				Project Constraints				Priority		Est. Cost (USD)
			Socio-Economic	Ecological	Timing	Duration	Durability	Cost	Feasibility	Needs	Total	Rank	
3.2.1	Plant Nursery Construction & Operation	Training and demonstration of low-cost plant (tree) nurseries to install and operate in communities for EbA implementation	1	2	1	2	1	1	1	2	11	1	\$6,000
3.2.2	Native Plant Seed Collection to Enhance Biodiversity	Develop native plant seed collection, including repository exchange and propagation programme	2	1	1	1	2	1	1	2	11	1	\$3,000
3.2.3	Riparian & Wetland Planting & Management	Training in riparian and wetland enhancement and special considerations in species and site selection	2	1	2	2	3	1	2	2	15	4	\$5,000
3.2.4	Agricultural Improvement & Diversification Trials	Conduct science-based field trials for diversified crop systems with goal of improving soil fertility and crop diversity	2	1	2	3	2	2	2	2	16	5	\$20,000
3.2.5	Agroforestry Practices & Management	Training for establishing agroforestry systems and implementation guidance to landowners	1	1	1	1	2	1	2	2	11	1	\$30,000
3.2.6	Plantation Management & Certified Sustainable Products	Training for establishing a range of plantation systems and implementation guidance to landowners	1	1	3	1	1	1	2	2	12	2	\$30,000
3.2.7	Native Forest Restoration & Expansion	Community-based training in select locations for out-planting and other forest expansion techniques	2	1	3	1	2	1	2	2	14	3	\$5,000
3.2.8	Invasive Species Detection & Management	Develop training with low-tech tools for community to identify, monitor and report invasive species	3	1	1	1	3	1	3	2	15	4	\$20,000
3.2.9	Coral Cultivation & Transplanting in Shallow Coral Reef Habitats	Provide training and localized program for coral rearing and transplanting	3	1	3	2	3	2	3	3	20	6	\$10,000

## **EbA Portfolio selected = Emphasise Training and Capacity Building Activities**

1. Creation of a Taveuni Watershed Coordination Network
2. Youth Stewardship Programme with “Living Classrooms”
3. Training in Plant Nursery Construction and Management
4. Training in Native Plant Seed Collection
5. Agricultural Improvement & Diversification Trials
6. Training for Developing and Managing Agroforestry Ecosystems
7. Training for Plantation Management & Certified Sustainable Products Markets
8. Support for Supplementary Materials or Actions
9. Project Monitoring

PEBACC now gearing up to support implementation of selected EbA activities.

Will be marketing the additional EbA options to interested development partners.

To date **partnerships** have been established with:



- Water Institute of the Gulf
- Pacific Partnership on Ocean Acidification
- CEFAS
- Victoria University of Wellington
- CHICCHAP
- Solomon Islands National University
- SPC Ridge-to-Reef
- SPC RESCCUE
- UN-Habitat





**VANUATU – PORT VILA COMPONENT**

# Efate Island and Port Vila Catchment

-  Efate Island
-  Port Vila Catchment



0 4.75 9.5 19 Kilometer

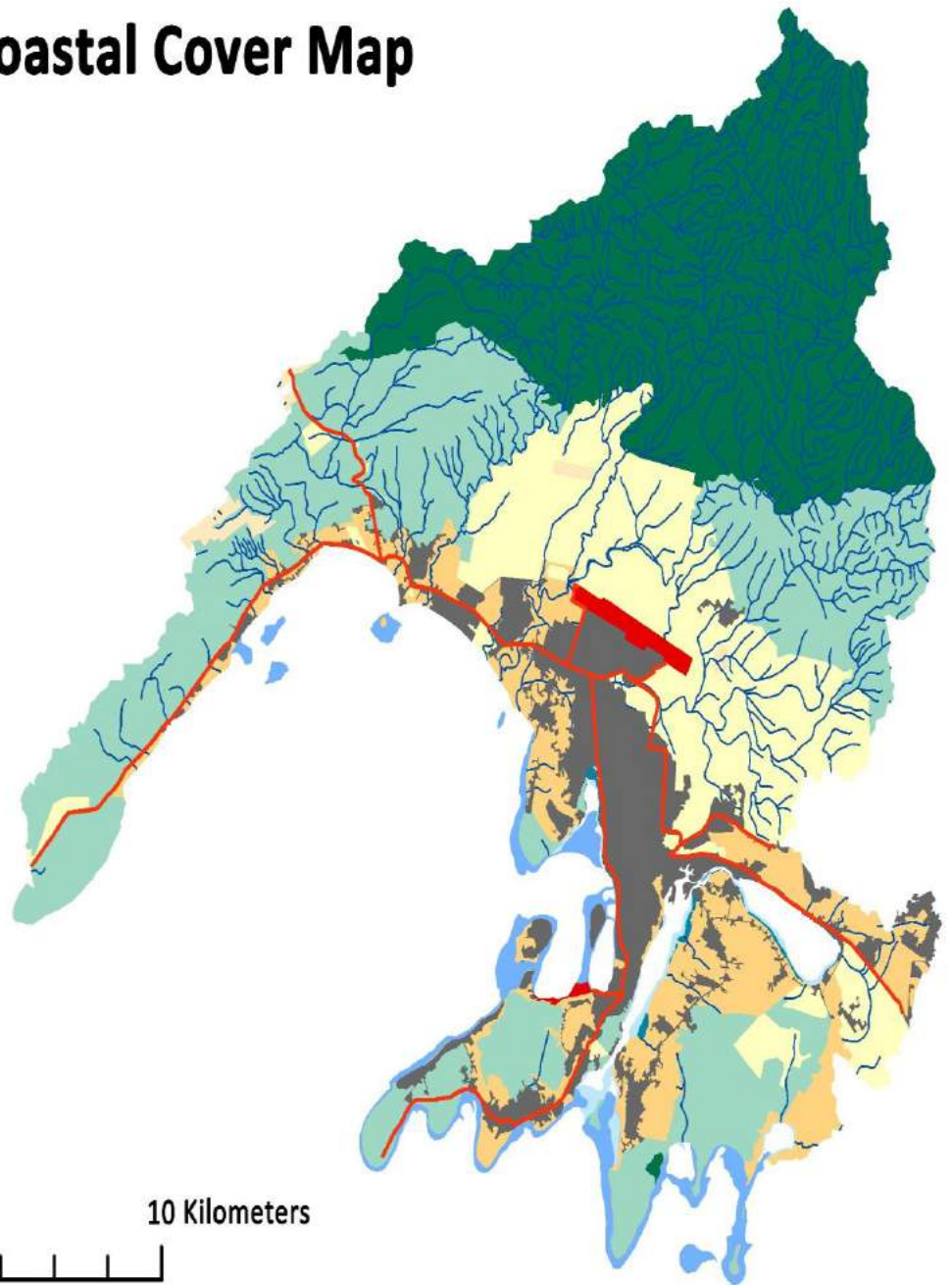


# Port Vila Land & Coastal Cover Map

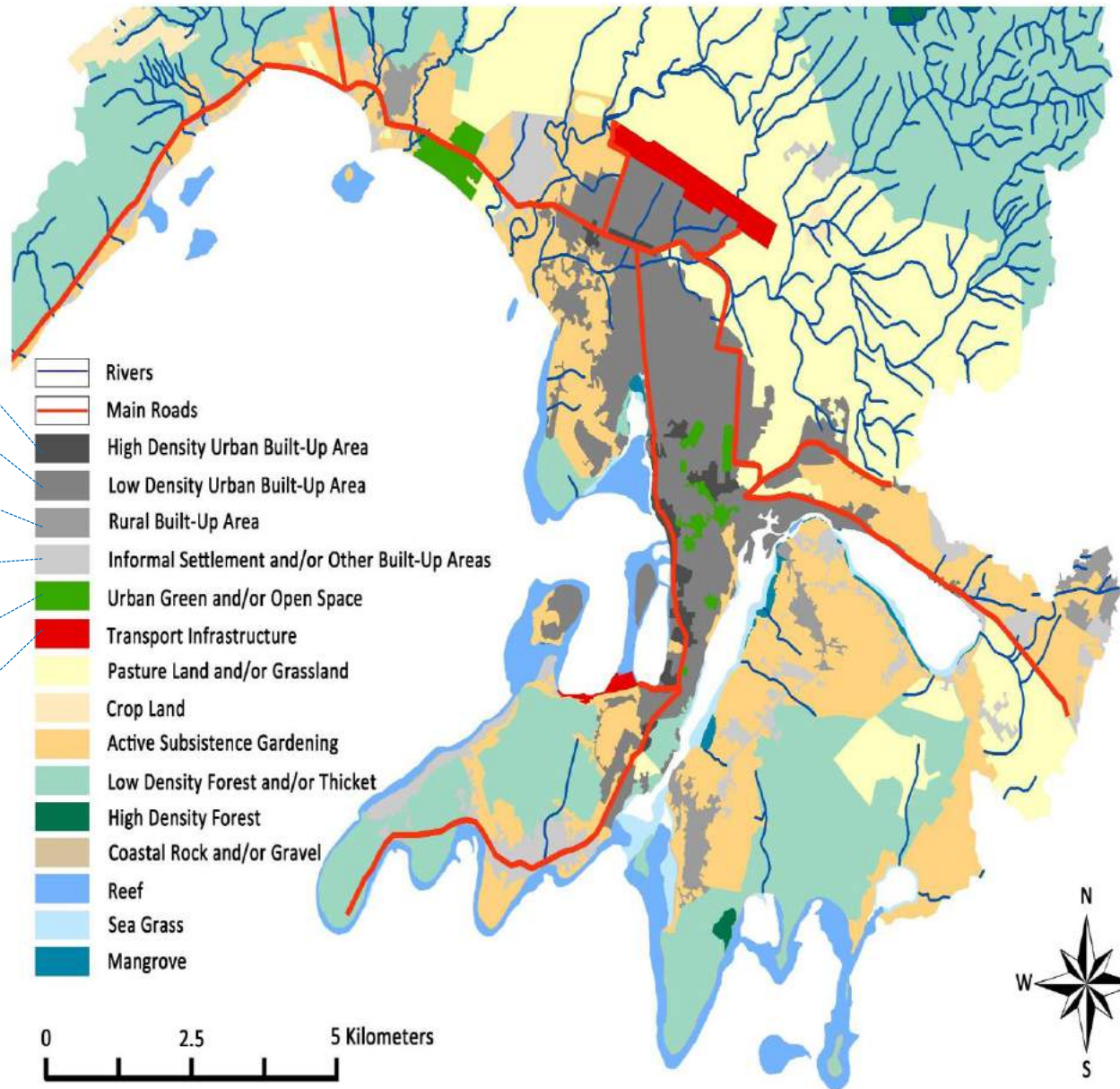
- Rivers
- Main Roads
- Built-Up Area
- Transport Infrastructure
- Pasture Land and/or Grassland
- Crop Land
- Active Subsistence Gardening
- Low Density Forest and/or Thicket
- High Density Forest
- Coastal Rock and/or Gravel
- Reef
- Sea Grass
- Mangrove



0 2.5 5 10 Kilometers



# Greater Port Vila Urban Land & Coastal Cover Map



Causes of changes to land



**Causes - local humans:**

- Rapid unplanned development
- Population growth



**Causes - local humans:**

- Overharvesting / poor management of resources
- Removal of vegetation for agriculture / infrastructure / settlement / bush garden / fire wood



**Causes - local humans:**

- Spread of invasive species



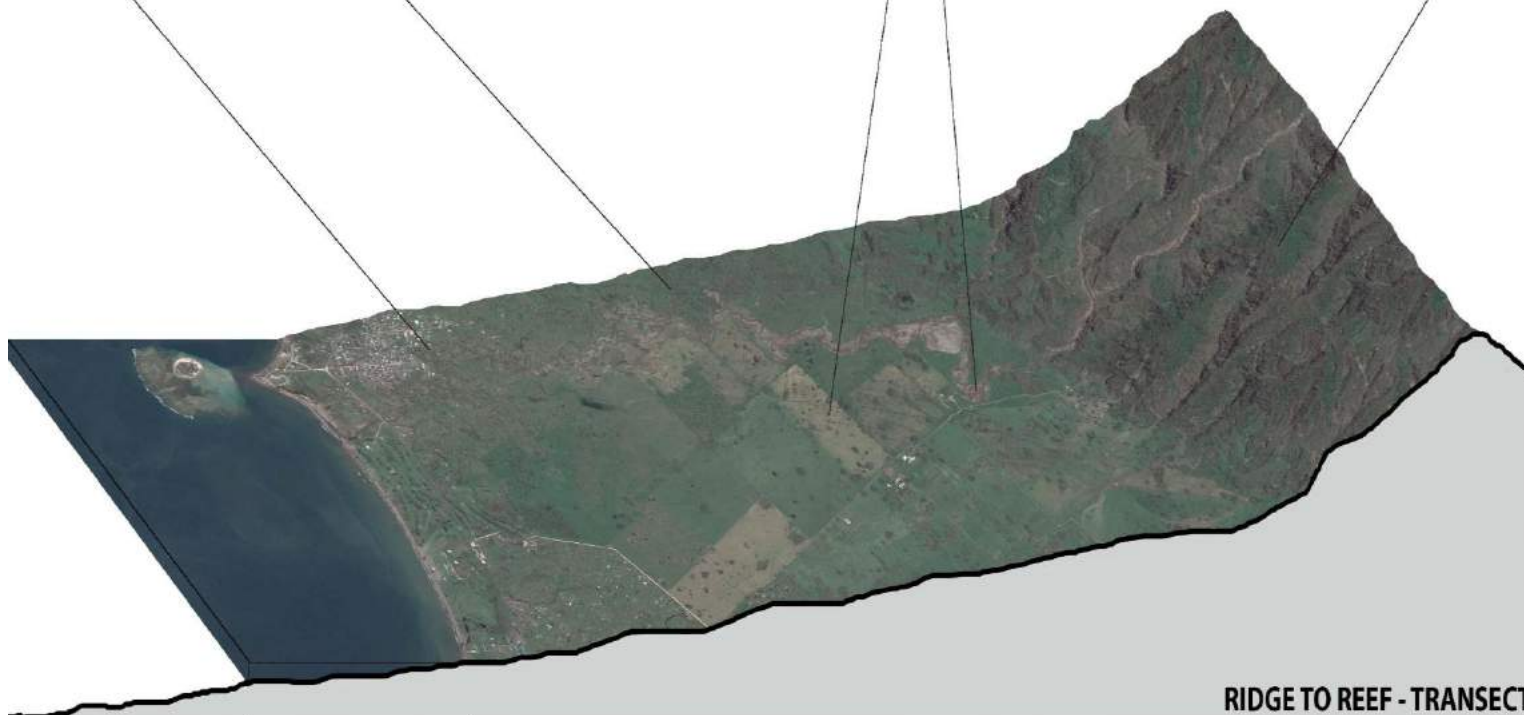
**Causes - climate change:**

- Unpredictable effect on health and biodiversity of forest
- Changes to invasive species locations / behaviour due to temperature and rainfall changes
- Increased disease



**Causes - climate change:**

- Increased intensity of extreme rainfall events
- Increased flood / landslide
- Possible changes to rain and weather patterns



RIDGE TO REEF - TRANSECT

MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS





### Causes - local humans:

- Spread of invasive species



### Causes - local humans:

- Input of pollutants into rivers / ground water (sewage, livestock, urban storm water, factory effluents, leachates, fertilizer, chemicals, solid waste)
- Rapid unplanned urbanisation encroaching on riparian areas



### Causes - local humans:

- Overharvesting / poor management of resources
- Removal of vegetation for agriculture / infrastructure / settlement / bush garden.
- Increased sedimentation in rivers (devegetation)
- Catchment alteration for irrigation / weirs / hydropower dams / flow alteration / barriers in rivers



### Causes - climate change:

- Changes to invasive species locations / behaviour due to temperature and rainfall changes
- Increased disease



### Causes - climate change:

- Increased intensity of extreme rainfall events
- Increased flood / landslide
- Possible changes to rain and weather patterns



RIDGE TO REEF - TRANSECT

MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS

# Causes of changes to coast



**Causes - local humans:**

- Rapid unplanned urbanisation near river / lagoon / coast
- Physical breakage of reefs
- Sand mining
- Over fishing



**Causes - local humans:**

- Run-off of land based pollutants (sewage, livestock, urban storm water, factory effluents, leachates)
- Ocean based pollution (boats)



**Causes - local humans:**

- Coastal erosion (devegetation)
- Increased sedimentation in rivers (devegetation)
- Increased ocean water turbidity (caused by river pollution, erosion, sedimentation, agriculture run off)



**Causes - climate change:**

- Sea level rise
- Sea temperature rise
- Ocean acidification
- Possible changes to wave and current patterns



**Causes - climate change:**

- Increased intensity of extreme rainfall events
- Increased flood / landslide
- Unpredictable effect on health and biodiversity of forest / mangrove / reef systems
- Increased disease / pest outbreak



**RIDGE TO REEF - TRANSECT**

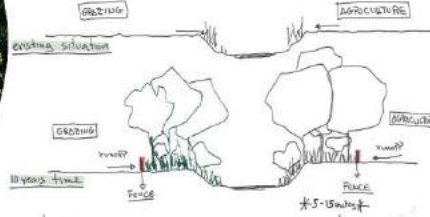


Project group 1: Ridge to reef



**Ridge to reef corridor:**

- Ecological corridor concept – protection and restoration
- Improvement of biodiversity
- Improvement of water quality: filter the runoff from grazing and agriculture
- Reduction of flooding intensity
- Reduction of erosion and sedimentation on coral reefs
- Useful for tourism and local economy



**Watershed restoration:**

- Riparian protection for weed and erosion control (planting eg bamboo, or fencing for natural succession)
- Fencing: Protection of riparian vegetation for natural succession
- Education of local community



**Strategic planting:**

- Planting: just strategic areas
- Mid slope, eroded or cleared areas transformed from thickets into plantations / agroforestry
- Energy - firewood



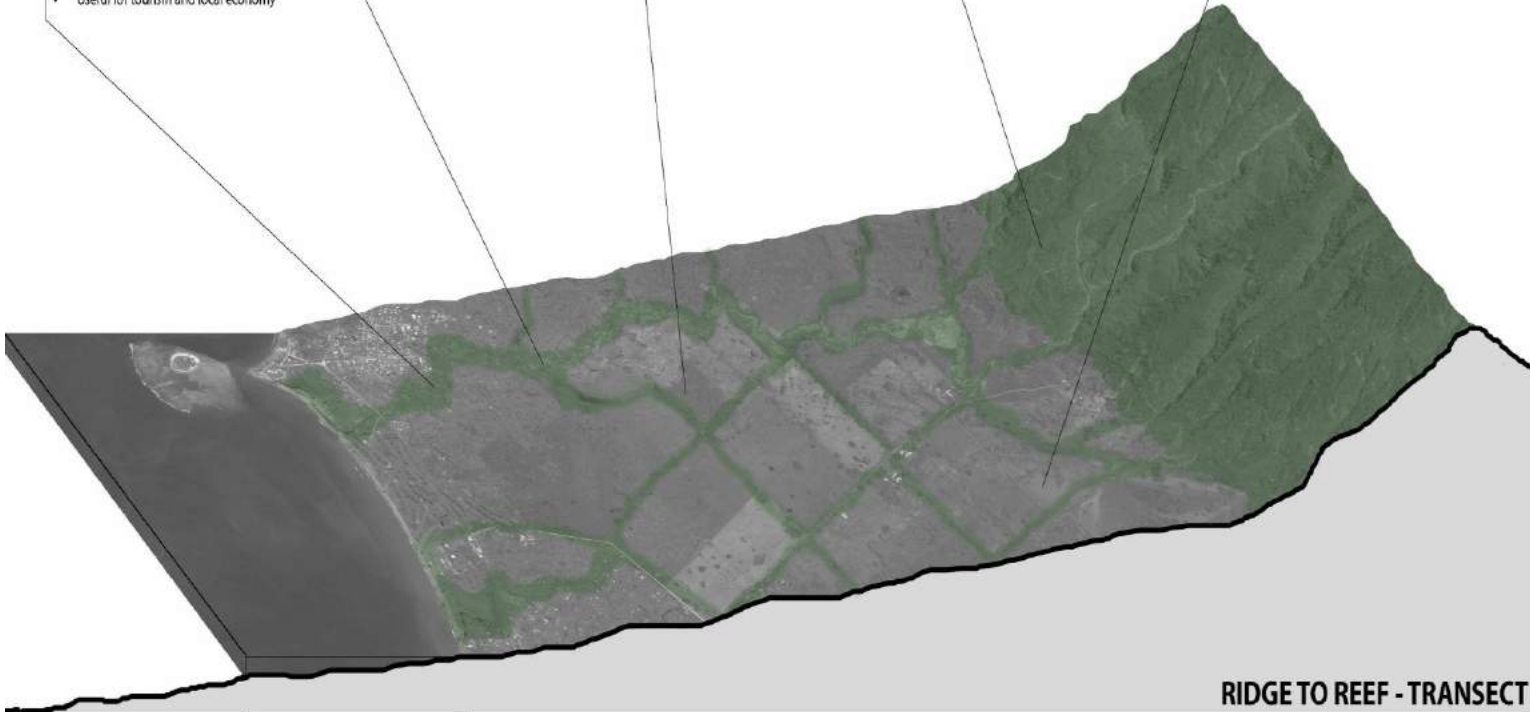
**Land protection:**

- Tabu areas for tree-cutting
- National parks models
- Personhood models
- Education of local community



**Funding:**

- Payment mechanisms for ecosystem protection
- Part of Ridge to Reef ICM project
- New economic activities: agroforestry, ecological farming, aquafarming



RIDGE TO REEF - TRANSECT

MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS



**Community garden plots:**

- Allocation of individual / communal community garden plots
- Tool share
- Educational opportunities



**New arable land:**

- Increased edible planting in urban street and riparian areas



**Replace bush gardens:**

- New gardens closer to or within community environment.
- Monitoring of bush gardens in terms of size, location and rotation



**New economic activities:**

- Aquaculture, Urban/Agro forestry
- Seed banks



**Sustainable practices:**

- Composting and garden waste recycling
- Stormwater harvesting for irrigation
- Control of fertilizers



RIDGE TO REEF - TRANSECT

MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS



**Biodiversity:**

- Lagoon/coast plantation of mangroves and for filtering heavy metals and nutrients
- Conservation of wetlands and marshlands
- Landscape fragmentation / connectivity analysis
- Planting for habitat provision / biodiversity (targeted species)



**Water quality:**

- Planting for phyto-remediation of water / soil
- Fencing of urban riparian corridors for natural succession
- Living machines to increase water quality



**Control of erosion:**

- Planting for riparian protection and weed control
- Planting for erosion stabilisation / sedimentation reduction
- Planting at junctions of tributaries in mid-low catchment area



**Energy:**

- Planting combined with urban agriculture
- Plantings or plantations of renewable fire-wood sources e.g. bamboo
- Planting for energy production



**Multi-function:**

- Planting for increased public amenity / tourism
- Planting of useful building / craft / traditional skills species
- Energy, biodiversity, water quality, flooding



MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS

RIDGE TO REEF - TRANSECT



### Sustainable fishing practices:

- Deep sea fishing skills / equipment
- Education and provision of equipment for sustainable fishing techniques (targeting mosquito nets / chicken wire etc.)



### Coral reef and seagrass:

- Grow coral reefs artificially
- Coral reef seeding
- Regeneration of seagrass to affect local Ph balance around reefs



### Protection:

- Protected / Tabu areas mangroves, seagrass and reefs
- Regeneration of historic areas of mangroves
- Mangrove nursery / seed saving sites



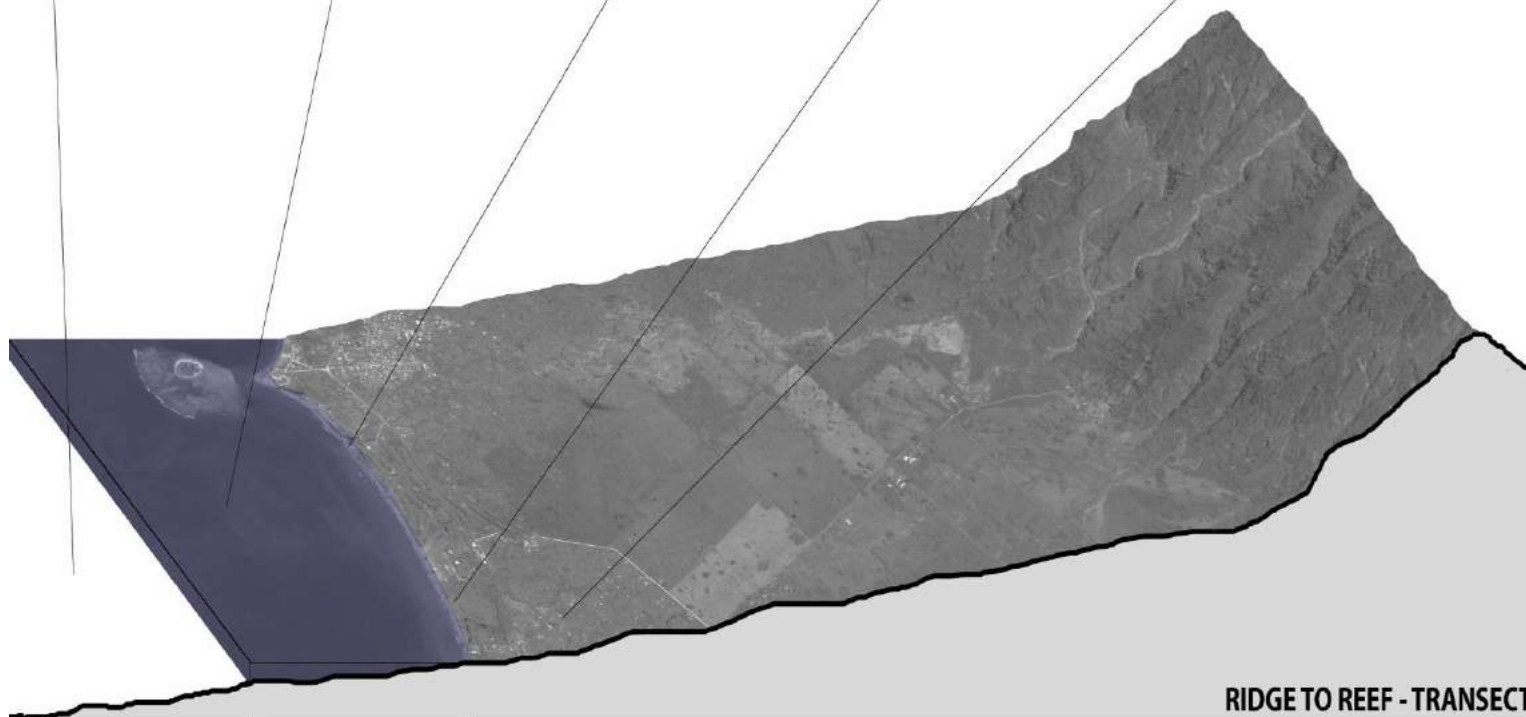
### Restoration and planting:

- Restoration of access for local communities
- Replanting / protection of coastal edge vegetation



### Education and policy:

- Prevention of land and ocean based pollution entering ocean
- Education about importance of mangrove / coral / seagrass
- Policy / education / economic instruments



MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS

RIDGE TO REEF - TRANSECT



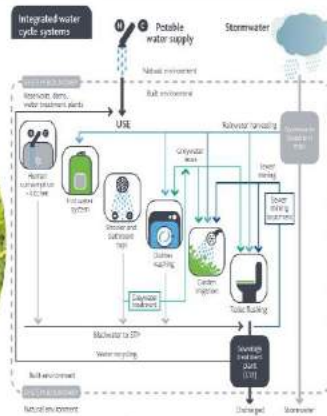
**Surface water:**

- Reduction of groundwater extraction using surfacewater
- Store more water in urban and peri-urban environments through rain water harvesting
- Control of pollutants in surfacewater and groundwater



**Stormwater:**

- Provide tanks individual or community water tanks
- Replace roofing materials for water collection



**Water cycle:**

- Re-use of stormwater for irrigation, sinks and washing.
- Re-use of grey water for toilets
- Policy towards effective urban storm water systems
- Specific policy for new tourist developments



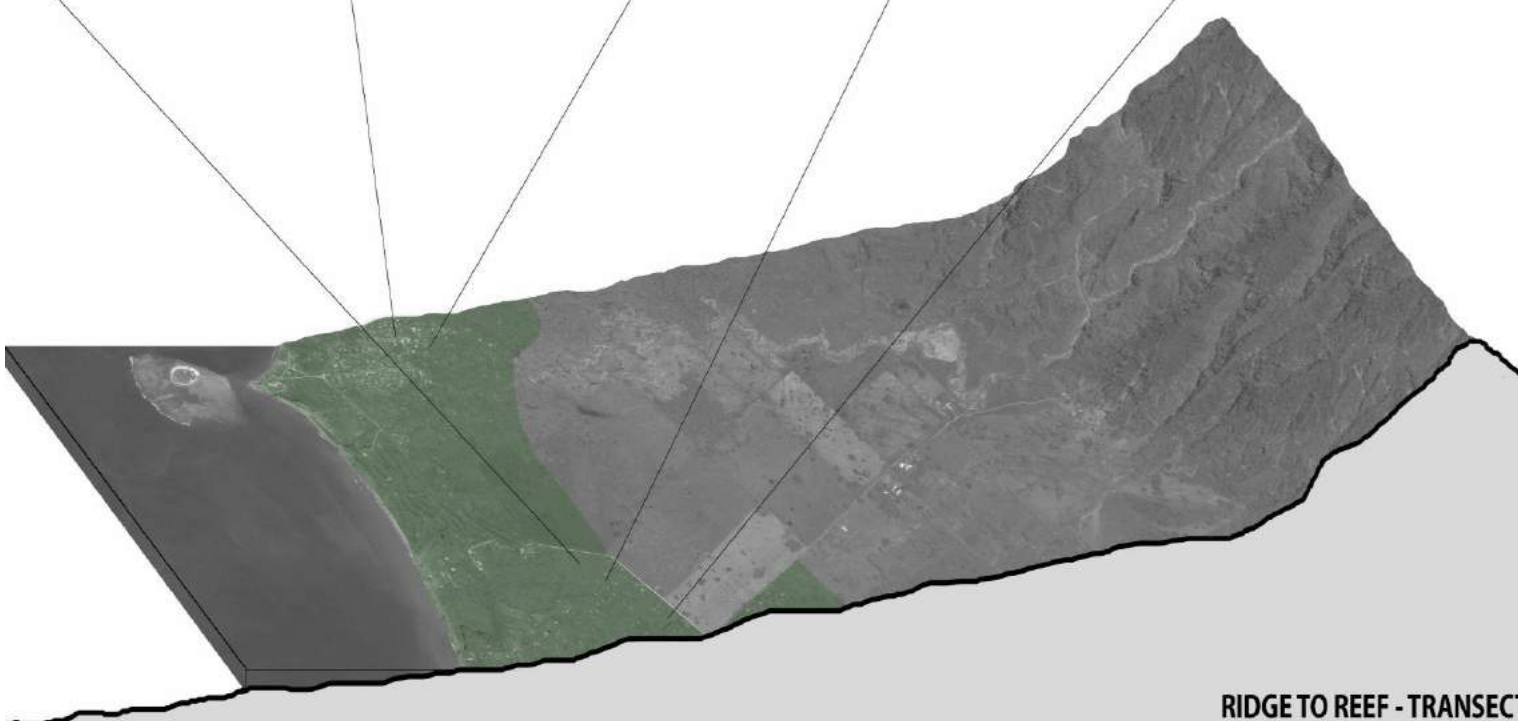
**Sewage:**

- Sustainable sewage solutions
- Urban grey water recycling / filtering
- Restore mangroves / wetlands



**Education and policy:**

- Education about importance of groundwater contamination
- Policy / education / economic instruments for implementing sustainable water culture.





Project group 6: Housing



**Strategic planning:**

- Focus on strategic planning for future growth of urban area that does not impact on important ecosystems / ecosystem services
- Focus on cyclone / earthquake / storm surge / tsunami resilience
- Integrate urban development and tourist resorts in strategic sustainable planning



**Community centred:**

- Community centred (cultural inputs, migration patterns etc.)
- Increase of density (from low to medium)
- Income generation integrated housing



**Food, energy and vegetation:**

- Integrate urban agriculture and urban forestry in new developments
- Strategic multi-purpose revegetation
- Integrate food growing (fruit, vegetables, nuts, fish)
- Passive solar / ventilation / daylighting
- Alternative energy sources (solar panels, solar hot water, wind, hydro, tidal, wave etc.)



**Water cycle and waste:**

- Integrate rainwater harvesting
- Integrate effective storm and grey water recycling / filtering
- Consider alternative treatments for septic tank waste (living machines)
- Compost from human and agricultural waste



**Construction:**

- Emphasis on indigenous knowledge of resilient building materials, construction methods and vernacular forms
- Investigate sand aggregate and/or concrete alternatives
- Investigate locally growable alternative construction materials



MARINE ECOSYSTEMS

COASTAL ECOSYSTEMS

TERRESTRIAL ECOSYSTEMS

RIDGE TO REEF - TRANSECT



**Thank You**