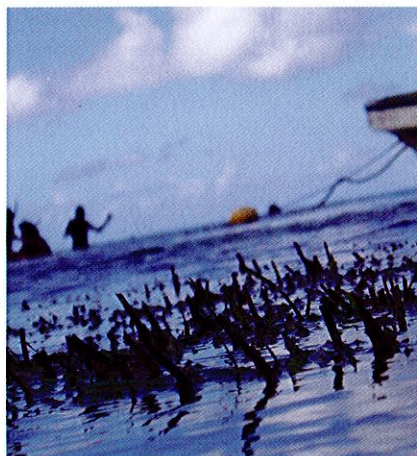


## sea grass as

### CARBON SEQUESTER

Our ocean realm including *mangroves*, *coral reefs* and *seagrass* areas are daily absorbing and removing large quantities of carbon from the atmosphere. Oceans absorb about *25% of the annual CO<sub>2</sub> emissions* with seagrass meadows storing 15% of the ocean's total carbon. Seagrasses "*pastures of the sea*" are flowering plants found on inter-tidal, shallow sub-tidal waters of reef flats and protected soft shores. *Seagrass stabilize* coastal sediments and maintain water quality of surrounding lagoon and coral reef environment. *Seagrass provide* food and shelter for many organisms like green turtles, fish, geese, heron, sea urchins and crabs.



*Seagrass acts* as nursery ground for commercially important fish and other marine species.

## the rainforests of the sea

### CORAL REEFS



*Coral reefs form* some of the richest and most diverse ecosystems on earth yet occupy less than 1% of the world's ocean surface and found at shallow depths in tropical waters. Annual global economic value of coral reefs has been estimated at more than \$30 billion. *Coral reefs provide* food and income to millions of people globally, *protect* coastal communities from damaging storms

and tsunamis, *home and nursery* to 25% of all marine life.

Long-term monitoring of sea surface temperature in relation to episodic coral bleaching events improves knowledge on bleaching threshold of local reef areas important for subsistence fishing. Placement of temperature loggers on reef site provides real time sea temperature data to detect thermal stress and possible coral bleaching. This occurs when coral animals become stressed by heat or ultraviolet radiation and expels the algae that lives within its coral tissues. Fiji reefs are historically healthy but are currently under threat from environmental stressors such as bleaching, pollution, physical damage from unsustainable fishing practices, coastal development, harmful land-use and ocean acidification.

#### Coral Reef

- buffering of waves & current
- export of fish & invertebrate larvae
- migration of adult fish & invertebrates (influencing productivity of seagrass bed through grazing & nutrient export)
- export of organic material & nutrients supporting pelagic food web

## crafting climate

### ADAPTATION RESPONSES

*Strong links exist* between healthy mangroves and healthy coral reefs in Fiji that builds resilience to climate change. *Actions needed* to protect these important habitats include awareness and education efforts for mangrove conservation and emphasizing their traditional values through making reconstructions with the local community. Additionally, it is critical to rally *public support* for regulations, improvement in *enforcement* of existing legislation and *political will* to support management of these coastal mangrove systems. Herein lies the practical solution for addressing Fiji's adaptation needs to the adverse impacts of climate change.

## story of the salt-maker

### CLIMATE WITNESS

Tai Butani is an 80 year old woman who lives in Wai district along the Nadroga coastline who continues to pond water in salt flats for cooking salt. Saltpans are areas of bare mud, often found behind mangrove forests in regions of low rainfall. Due to the little rainfall and salt left behind by the tide, this causes the saltpans to be very salty. Tai Butani is dedicated to her salt cooking tradition. She has learnt to observe and understand the phenology changes in her mangroves that enables her to prepare during the dry season. From her many tales about the mangroves, a clear pattern of wet and dry season, right to the signal of crabs migrating to the shade of the mangrove forest informs her group of women to start the fire, pot and cook the saltwater. *Tikina Wai* is located on the dry leeward side of the high island Viti Levu. Fiji meteorological record for the past 100 years recorded an increase in the wet season (Lautoka station).



Tai Butani talks about the dry season being very dry and the unusual rains disrupting the timing of cooking salt and rare occurrence of the mud crabs leaving its burrows out at the salt pans. The premature rains affect her traditional knowledge of when best to start the cooking, and disrupting the many biotic interactions in the mangrove ecosystem. Notably, there have been temperature increases (~0.60C°) widespread across Fiji over the last 50 years.

## fiji mangrove

### MANAGEMENT PLAN

*WWF in partnership* with the Global Environment Facility is developing and testing a generalised approach for assessing vulnerability and adaptation of mangroves and associated coastal systems to the effects of climate change. WWF is working with local natural resource managers and other stakeholders to integrate climate adaptation strategies into their management philosophies and plans.

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# F I J I

mangroves  
people  
livelihoods

*Mangroves play a major role in the cultural and economic livelihoods of coastal communities in Fiji. Climate change will have significant impacts on people's knowledge, innovation and practices.*

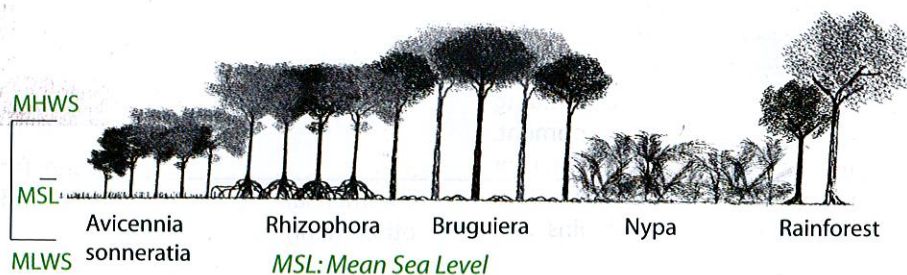


# how do mangroves

## HELP US ADAPT to climate change?

Mangroves are trees and shrubs that grow in saline coastal habitats where zonation patterns of various mangroves species will retreat with sea level rise inland. Mangroves living at the interface of marine, land and freshwater ecosystems act as health indicators for each system.

*Mangroves are crucial in adapting to climate change with its ability to withstand a broad range of environmental conditions made possible by its water regulating and storage functions.*



*Mangroves build* its own environment with its intricate root system that traps sediment especially in depositional coastal environments like deltas and inter-tidal areas where fine sediment collect in areas protected from high energy wave action. The rate of sediment growth in the area determines mangroves' ability to keep up with sea level rise. *Mangroves protect* coastal areas from erosion, storm surge especially during cyclones and extreme weather events. Interestingly, increase in atmospheric CO<sub>2</sub> can be expected to improve mangrove tree growth and litter production unless limited by salinity or humidity.



*Mangroves host* a unique ecosystem from its canopy cover to its aerial root system upon which algae, barnacles, oysters and sponges anchor whilst filter feeding. The valued crabs use the muddy bottom under the cover of the mangrove forest as their home.



*Mangroves are borderline species worthy of protection as they provide risk reduction measures in combatting our vulnerability to climate change.*



### Mangrove

- prevents erosion
- absorbs nutrients
- interrupts freshwater discharge
- nursery grounds for fish and other marine life
- controls aspects of water chemistry



### Seagrass Beds

- binds sediment
- absorbs nutrients
- export of maturing
- export of fish and

## mangroves & PEOPLE

Mangroves dominate three quarters of tropical coastlines and Fiji has the third largest mangrove area of an estimated 517km<sup>2</sup> in the Pacific region comprising seven true mangrove species and a hybrid. Largest areas of mangroves are usually found on the southeast, northwest shorelines of Viti Levu and the northern shore of Vanua Levu. Different locations in Fiji are expected to experience distinct effects of climate change due to the climatic variation and tectonic setting of the islands. There will also be differences in the rate of sea level rise within Fiji as certain areas are experiencing tectonic uplift or subsidence, while others are tectonically stable. Climatic variation across the larger islands in Fiji influences mangrove distribution and ecology.



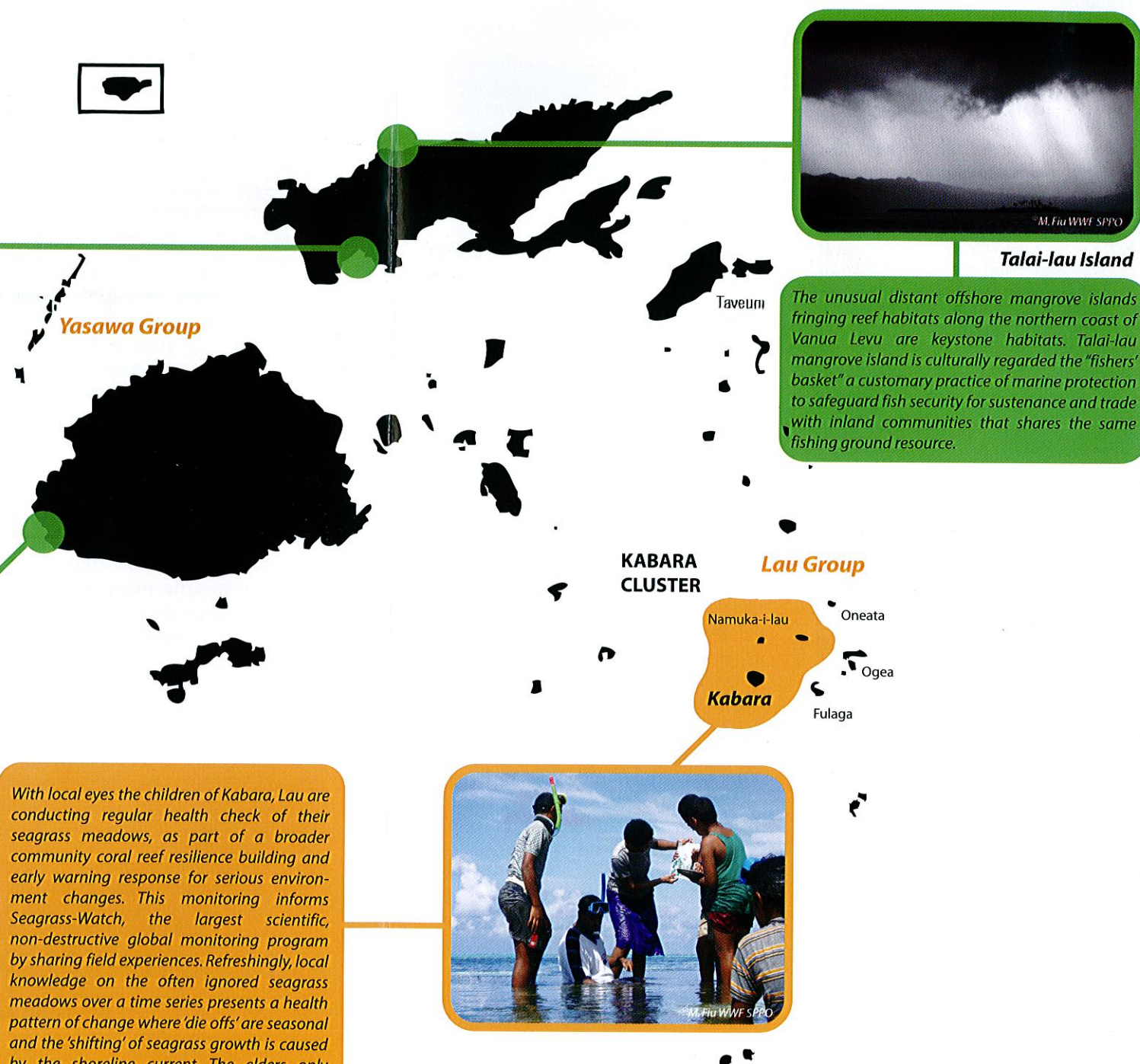
### Kubulau

Precipitation Standards : WET  
Holocene tectonics : UPLIFTING  
Sea Level : Negligible relative sea level rise  
Status of data on coastal systems: Relatively Good  
Status of Mangrove area: INTACT  
Project Status/Reference : ACTIVE/WCS



### Tikina Wai

Precipitation Standards : DRY  
Holocene tectonics : STABLE  
Sea Level : Can be Predicted Globally  
Status of data on coastal systems: GOOD  
Status of Mangrove area: DEGRADED  
Project Status/Reference : ACTIVE/WWF Fiji



### Talai-lau Island

The unusual distant offshore mangrove islands fringing reef habitats along the northern coast of Vanua Levu are keystone habitats. Talai-lau mangrove island is culturally regarded the "fishers' basket" a customary practice of marine protection to safeguard fish security for sustenance and trade with inland communities that shares the same fishing ground resource.

With local eyes the children of Kabara, Lau are conducting regular health check of their seagrass meadows, as part of a broader community coral reef resilience building and early warning response for serious environment changes. This monitoring informs Seagrass-Watch, the largest scientific, non-destructive global monitoring program by sharing field experiences. Refreshingly, local knowledge on the often ignored seagrass meadows over a time series presents a health pattern of change where 'die offs' are seasonal and the 'shifting' of seagrass growth is caused by the shoreline current. The elders only recollect the warmer months when the sea gets warm and the meadows turn brown before it dies off, however, it is becoming more frequent.



## THREATS to mangroves

These future mangrove habitats are lowland forests on the windward areas or salt flats in the leeward areas of large islands. Unfortunately, the areas where mangroves will seek habitat with sea level rise are those areas most favored for coastal tourism development. *Other threats* to mangrove ecosystems include reclamation, firewood collection, utilizing the area as a dumping ground for solid waste-both household type and industrial; *medium level threats* also include overfishing, watershed alteration, coastal sedimentation, aquaculture ponds, sewerage, pesticide and animal waste runoff, logging, etc. According to Fiji Mangrove Management Plan, the mangroves of Rewa delta were listed (Singh, 1994) as needing urgent consideration for biodiversity conservation while the mangroves of the Ba and Labasa deltas were listed as requiring consideration in terms of their hydrological functions. Mangroves play an important role in Fiji's sewerage treatment programs, where most facilities are associated with mangroves.