



# Mangrove forests for adaptation: potential and vulnerability

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## ► To cite this version:

Emilia Pramova, Florie Chazarin, Bruno Locatelli. Mangrove forests for adaptation: potential and vulnerability: In: SWAMP toolbox: Theme B section B2. École thématique. Indonesia. 2015. cel-01116260

**HAL Id: cel-01116260**

**<https://hal.science/cel-01116260>**

Submitted on 12 Feb 2015

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## Topic B2. Mangrove forests for adaptation: potential and vulnerability

Emilia Pramova, Florie Chazarin and Bruno Locatelli





## Introduction & Objectives

### Climate change in mangrove socio-ecological systems

- **Part 1: climate change impacts on mangroves**
  - Main stressors, vulnerability and impacts
  - Adaptation options
  
- **Part 2: climate change impacts on coastal societies**
  - Main stressors, vulnerability and impacts
  - Adaptation options with mangrove ecosystem services



## Part 1. Climate change impacts on mangroves: stressors

### Climate stressors

- Sea-level rise
- Hurricanes & storms
- Changes in precipitation

+

### Anthropogenic stressors

- Pollution
- Deforestation, land-use conversion
- Sedimentation

= compound effects





## Sea-level Rise → Mangroves

- Significant threat to mangroves if it outpaces mangrove sediment accretion and elevation.
- Leads to increased erosion, salinity, and mangrove inundation.
- Forces mangroves to retreat landwards but success of migration depends on multiple factors.
- Site conditions, biodiversity, and the effects of other stressors influence resilience and vulnerability.





## Hurricanes & Storms → Mangroves

- **Impacts through waves, wind, sediment burial and changes in water levels.**
- **Direct impacts:**
  - Defoliation, uprooting, mortality
  - Alterations in sediment elevation
- **Indirect impacts:**
  - Upland flooding -> debris flow to mangroves
  - Changes in structure, composition, biodiversity
  - Lower seedling recruitment
  - Increase in vulnerability to SLR



## Changes in precipitation → Mangroves

- **Increases in rainfall**
  - Expansion
  - Higher diversity & productivity
  - Increased peat production
  
- **Decreases in rainfall -> increased salinity**
  - Net losses of peat
  - Decreases in productivity, growth, seedling survival
  - Decreases in biodiversity
  - Contraction of mangrove areas



## Anthropogenic pressures

### ■ **Pollution**

- Low pneumatophore density
- Stunted growth

### ■ **Excess input of sediment**

- Burial of roots
- Reduced productivity, mortality

### ■ **Deforestation & land-use conversion**

- Reduced biodiversity
- Modification of soils → slower nutrient cycling
- Microclimate alteration → increase in °C
- Alteration of hydrology → impacts regeneration





## Adaptation options for mangroves

- "No regrets" reduction of human stressors
- Catchment management to enhance mangrove sediment elevation
- Ridge-to-reef management
- Managed retreat
- Representation, replication and refugia through a system of protected area networks
- Mangrove rehabilitation
- Regional monitoring network



## Part 2. Climate change impacts on coastal societies

### Climate stressors

- Sea-level rise
- Hurricanes, storms & coastal floods
- Changes in precipitation

+

### Changes in ecosystem services

- Decreased flow due to ecosystem degradation or land-use change
- Restricted access

= compound effects



## Sea-level Rise → People

### ■ **Direct impacts**

- Land loss and inundation, erosion
- Salt water intrusion
- Coastal flooding
- Changes in fish populations & migration patterns

### ■ **Indirect impacts**

- Migration
- Conflicts
- Food insecurity and health problems
- Infrastructure damage
- Loss of wetlands & other ecosystems → loss of ecosystem services





## Hurricanes, storms, flood → People

### ■ Direct impacts

- Loss of life and property
- Damage to infrastructure
- Loss in agricultural yields and aquaculture

### ■ Indirect impacts

- Population displacement
- Decline in tourism
- Food insecurity and health problems
- Pollution
- Loss of wetlands & other ecosystems → loss of ecosystem services





## Changes in precipitation → People

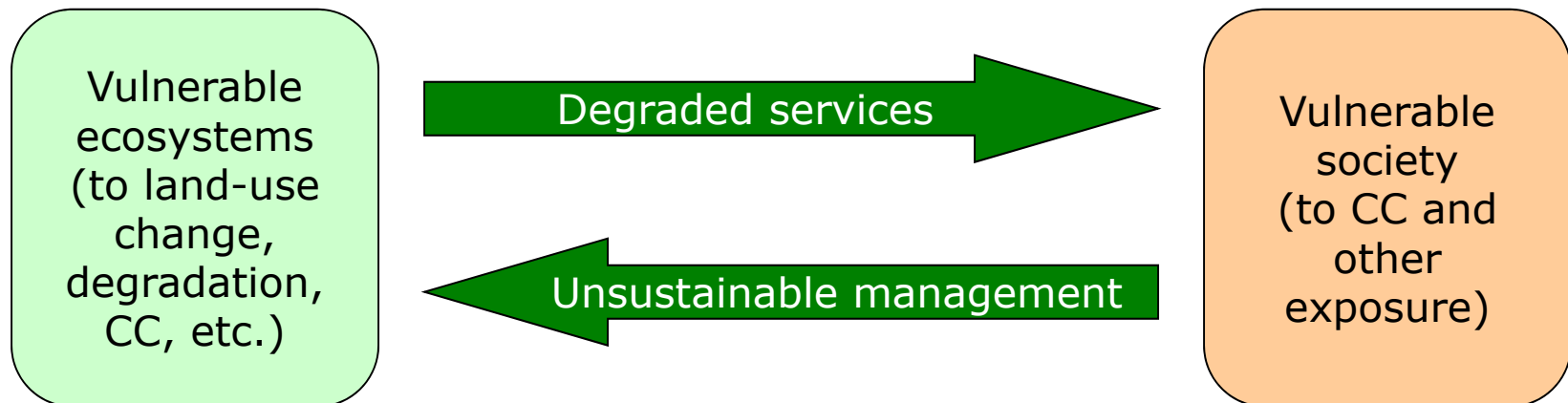
### ■ Decreases in precipitation

- Fresh water decrease
- Increases in salinity
- Losses in yields

### ■ Intense precipitation events

- Coastal flooding and resulting direct & indirect impacts

## The problem: Vulnerability of coupled social-ecological systems

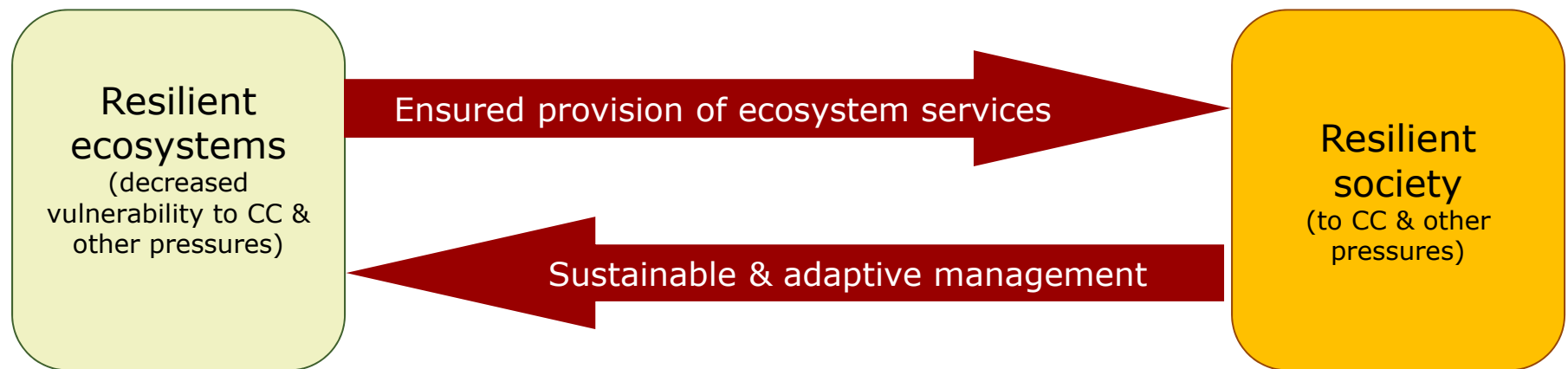




## Mangrove ES for the adaptation of people

- Storm protection (wave energy dissipation, wind buffer)
- Erosion control
- Binding/trapping of sediments
- Coastal flood regulation
- Provision of habitat for fish nurseries
- Provision of products (timber, honey, NTFPs)
- Support of tourism activities
- Accommodation of sea-level rise
- Regulation of flows (nutrients, fresh water, sedimentation) towards seagrasses & corals

## Concluding remarks







## Points for discussion

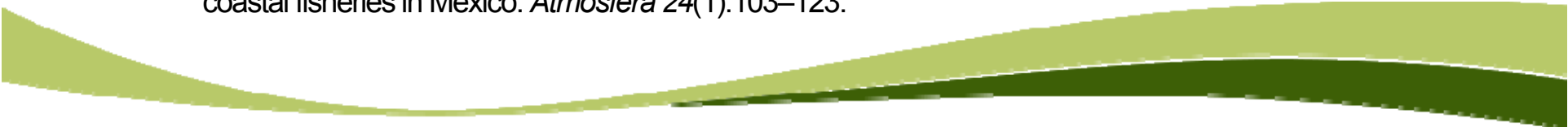
- Which drivers of change (climatic, anthropogenic) are the most important in the mangrove socio-ecological systems you are familiar with?
  - What interactions between drivers?
- What is the potential and challenges of using mangrove ecosystem services for the adaptation of people in the areas you work in?

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The Sustainable Wetlands Adaptation and Mitigation Program (SWAMP) is a collaborative effort by CIFOR, the USDA Forest Service, and the Oregon State University with support from USAID.

**How to cite this file**

Pramova E, Chazarin F, and Locatelli B. 2015. Mangrove forest for adaptation: potential and vulnerability [PowerPoint presentation]. In: SWAMP toolbox: Theme B section B2 Retrieved from

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