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Mangrove forests for adaptation: potential and vulnerability

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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

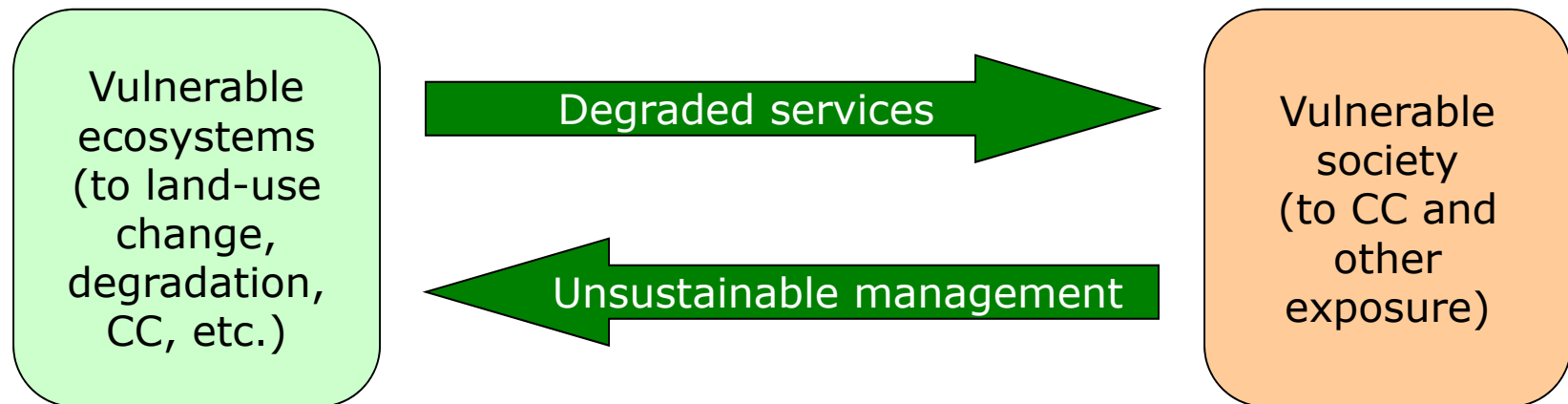


Changes in precipitation → People

- **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

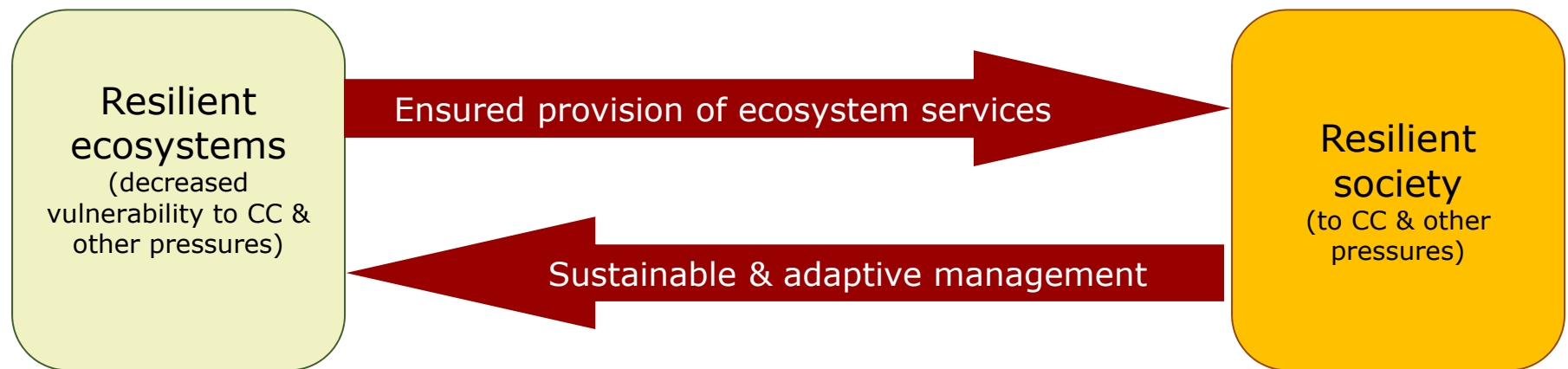




Mangrove ES for the adaptation of people

- 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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