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## Ecosystem-based adaptation

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## Topic B1. Ecosystem-based adaptation

Bruno Locatelli and Emilia Pramova





## Introduction

- Ecosystem-based adaptation (EBA)
- “The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change.” (CBD 2009)
- “Adaptation policies and measures that take into account the role of ecosystem services in reducing the vulnerability of society to climate change” (Vignola et al. 2009)
- “Local and landscape scale strategies that enable both people and nature to adapt in the face of climate change” (IUCN 2009)
- EBA is human-centered

## EBA framework



1

Ecosystems for the **adaptation of society** to climate variations

2

**Sustainable management** of ecosystems for sustainable provision of services  
+ **Adaptation of ecosystems** to climate change (if sustainable management is in place and human drivers of degradation are under control)

*(Locatelli 2011)*

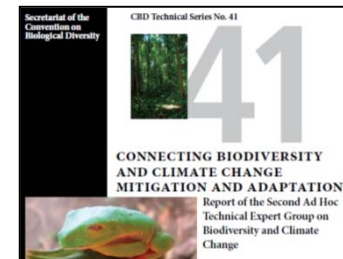
## EBA actors

- The term “EBA” is mainly used by:
- international NGOs and their projects



- international conventions (CBD, UNFCCC) and their parties
- UNFCCC (2008): Submissions from countries
  - (e.g. Colombia, Sri Lanka) or groups of countries
  - (e.g. the African Group)

- What about:
- national policymakers?
- National Adaptation Programs of Action (NAPAs)
- scientists?





## Objectives of this presentation

- Present the scientific evidence on EBA
  - Analysis of literature(\*): Peer-reviewed papers on forests or trees and human vulnerability
  - Six major stories emerged from the analysis
- Discuss the opportunities and challenges of EBA
  - Adaptation policies
  - Co-benefits
  - Challenges

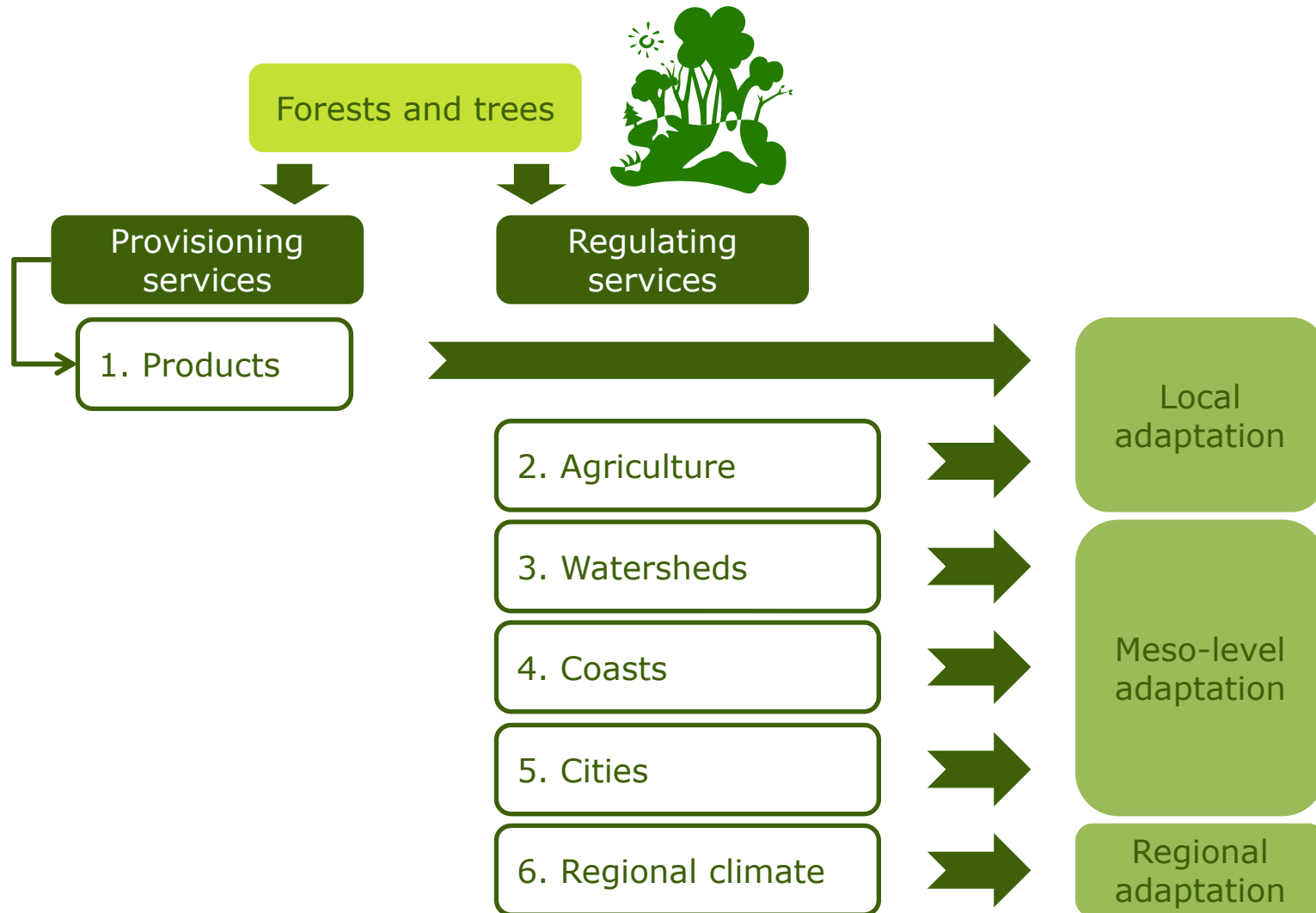
\* (*Pramova et al. 2012b*)



## Part 1. Presenting the scientific evidence on EBA

- The question:
  - What is the scientific evidence on EBA?
  
- The justification:
  - We need this evidence to move EBA from concepts to action

# Six major stories







## 1. Products

- Forests and trees
- Provide safety nets for local communities coping with climate shocks
- Increase livelihood diversification (anticipatory strategy)
  
- Examples:
- Indonesia (Kalimantan) – the most heavily affected, the poorest and the least-educated relied more on forests for their coping strategies after a flood (Liswanti et al. 2011)
- Honduras – smallholders sold timber to recover from asset loss due to Hurricane Mitch (McSweeney 2005)
  
- Issues:
- Poverty trap? (out of the forest, out of vulnerability?)
- Sustainability of natural resources for adaptation
- Property rights and access



## 2. Agriculture

- Trees in agriculture
- Maintain production under climate variability and protect crops against extremes
- Local shade cover, soil fertility and moisture, wind breaks, water infiltration
- Examples:
  - Indonesia (Sulawesi) – cacao systems shaded by Gliricidia trees were not significantly affected by drought because of shade and water uptake from the trees (Schwendenmann et al. 2010)
  - Malawi – agroforestry using Faidherbia and Gliricidia showed modest grain yields during drought (Garrity et al. 2010)
- Issues:
  - Trade-offs: Production vs. resilience



### 3. Watersheds

- Forests in watersheds:
- Regulate base flows (dry seasons), peak flows (intense rainfall), and stabilize soil (landslide risks)
- Examples:
- Indonesia (Flores) – Agrarian communities near forested watersheds in Flores showed lower impacts and higher profits during droughts (Pattanayak and Kramer 2001)
- Bolivia – reduction of landslide risks with forest plantations and regeneration (Robledo et al. 2004)
- Issues:
- Trade-offs between services (e.g. more regularity but less total water)
- Not enough evidence, many studies based on common wisdom, controversies (e.g. floods and forests)



## 4. Coasts

- Coastal forests
- Absorb and dissipate wave energy and stabilize coastal land
- Protection from tropical storms, sea level rise, floods and coastal erosion
- Examples:
- India (Orissa) – Cyclone protection. Villages behind mangroves suffered less losses of life, property and crops during the 1999 cyclone (Badola and Hussain 2005)
- Vietnam – Reducing dyke maintenance costs. Benefits of US\$70–130 per ha/year (Tri et al. 1998; Das and Vincent, 2009)
- Issues
- What level of protection from extremes do they provide?



## 5. Cities

- Urban forests and trees
- Regulate temperature and water for resilient urban settlements
- Services: Shading, evaporative cooling, rainwater interception, storage and infiltration
- Examples
- Manchester (UK) – Reducing urban flood risk. Trees can reduce volume of surface runoff (by 5 to 6%) (Gill et al. 2007)
- New Jersey (USA) – Reducing “urban heat island” effect and heat stress. Areas with mature canopies are 2.7–3.3° C cooler than areas without trees (Solecki et al. 2005)
- Issues
- Opportunity costs
- Studies almost only in developed countries

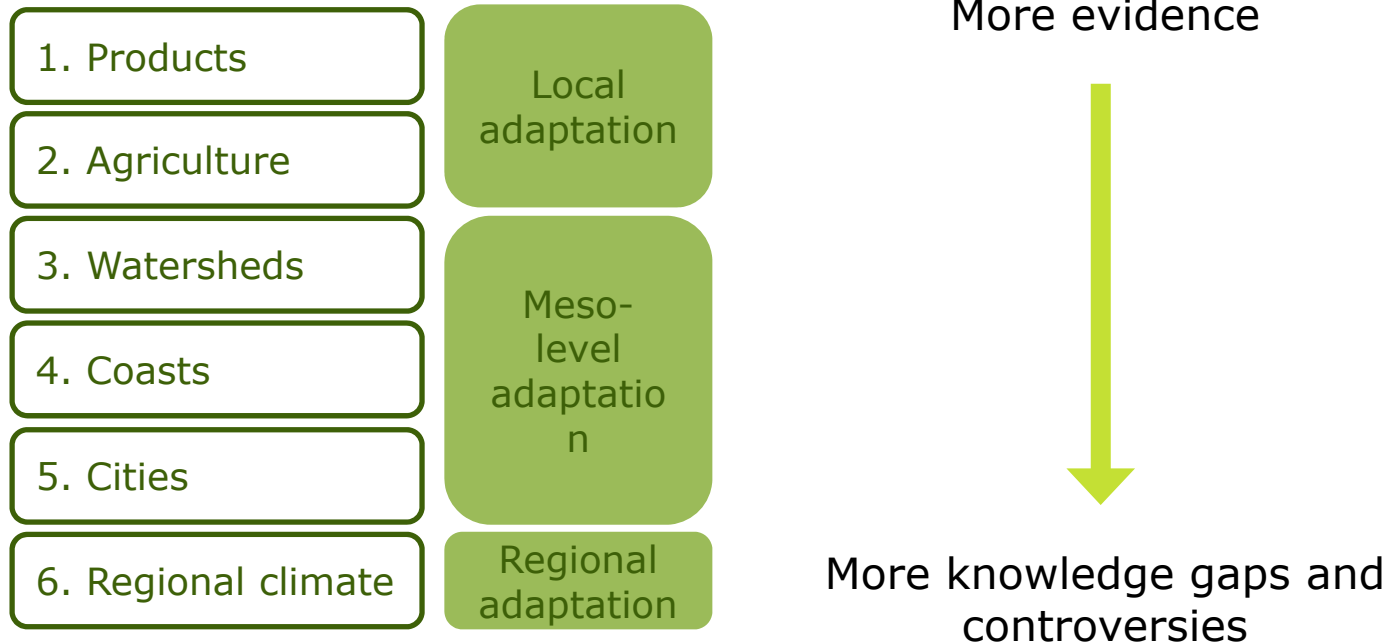


## 6. Regional climate

- Forests can influence regional climate:
  - Cooling effect through increased evaporation and cloud cover
  - Influence on precipitation: water pumping and rainfall recycling
- Examples:
  - Amazon and West Africa – 40% of rainfall come from evapotranspiration over land (Ellison et al. 2012)
  - Sahel – Biotic pump effect of forests, facilitating movements of water vapor from the Gulf of Guinea to the Sahel (Makarieva et al. 2007)
- Issues
  - Controversies
  - Multiple scales involved (local, regional, global)
  - => How policies could address this role of forests?

## Conclusions of part 1

- Scales and evidence on EBA



- The knowledge (e.g. on forest hydrology) should be revisited with a climate change adaptation lens
- Uncertainties on some benefits of EBA to adaptation but need to consider co-benefits (biodiversity, climate change mitigation)



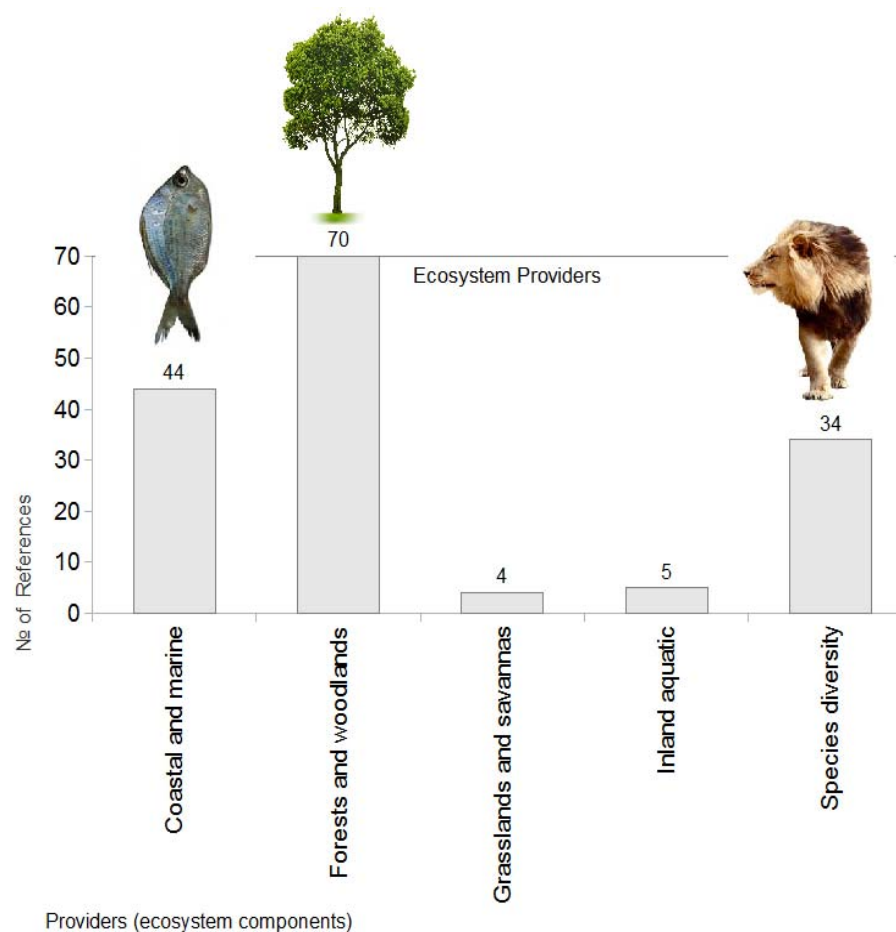
## Part 2. Discussing the opportunities and challenges of EBA

- The question:
  - Is EBA just theoretical? Is it applied?
  - What are the opportunities?
  - What are the challenges?
  
- Discussion with the participants:
  - Do you know concrete examples of EBA interventions? What make them interesting? What have been the challenges in implementing them?



## Examples of EBA in adaptation policies

- Analysis of 44 NAPAs (National Adaptation Programmes of Action) and their 468 projects
  - To what extent are ecosystem services considered?
- 68% of NAPAs have at least one reference to ecosystem services
  - Mainly from forests and coastal or marine ecosystems
- 22% of the projects include ecosystem services for social adaptation or well-being

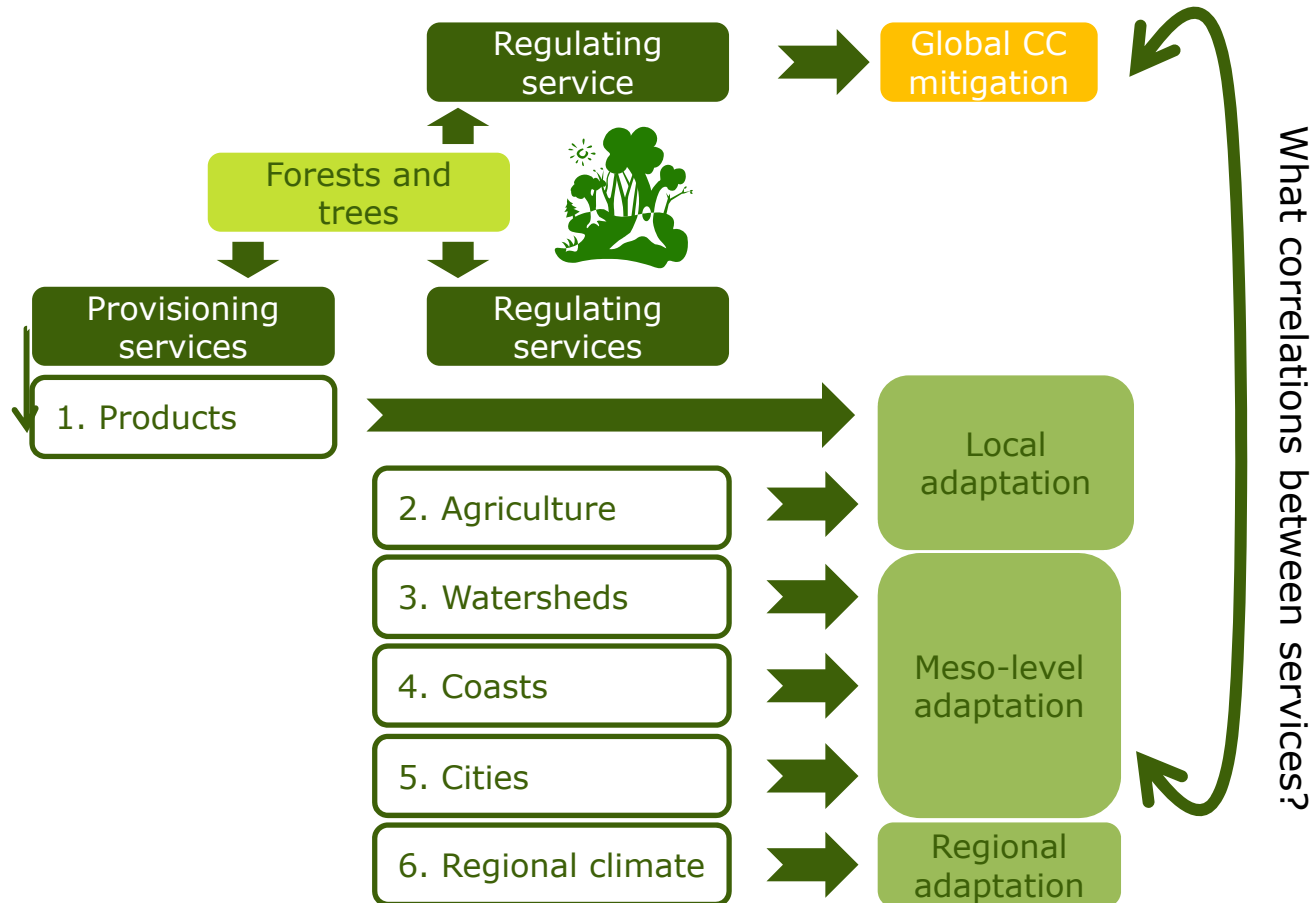


## Opportunities

- Multiple benefits across landscapes
  - Biodiversity conservation and enhancement
  - Contribution to mitigation
    - Conserving ecosystems for adaptation also conserves carbon
    - EBA projects may also tap carbon financing
- No-regret and flexible measures
- Cost-effectiveness
  - TEEB (The Economics of Ecosystems and Biodiversity): maintaining nature's capacity to buffer the impacts of climate change on people is often less costly than having to replace lost ecosystem functions through the use of heavy infrastructure or technology.
- Multiple benefits across sectors
  - But can be also a challenge of cross-sectoral coordination
  - Example: Forestry sector, water agencies, etc.



# Conserving ecosystems for their 'adaptation services' can contribute to conserving its 'mitigation service'

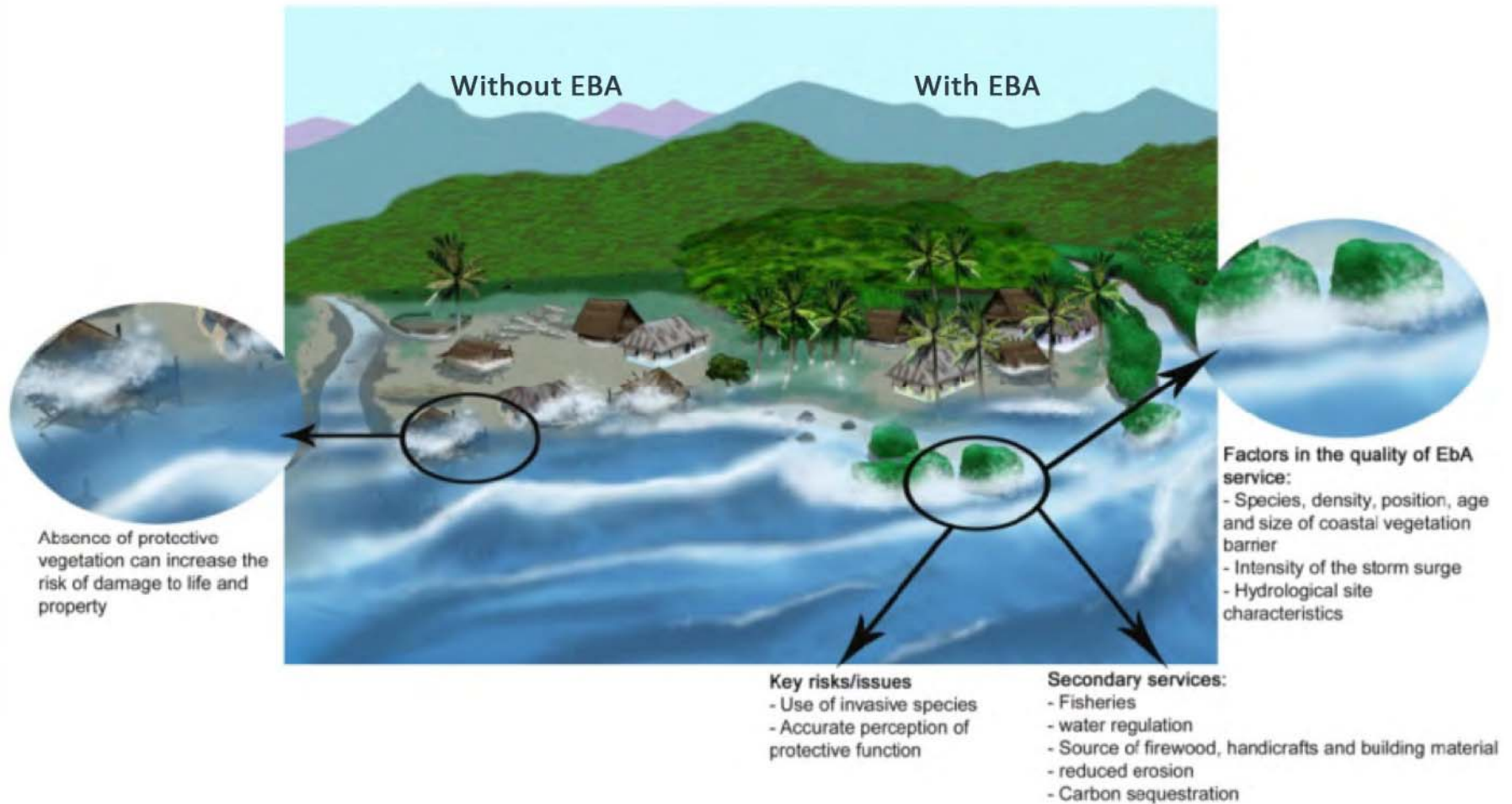


## Challenges

- How to deal with complexity and diversity?
  - Feedback loops, diversity of stakeholders, sectors, scales, contexts
- How to adapt ecosystem management to climate change or changes in social vulnerability?
  - Adaptive management
- How to characterize ecosystem?
  - E.g. what mangrove width, height, or species for protection?
- How to balance trade-offs?
  - Short- vs. long-term needs (e.g. aquaculture vs. mangroves in coasts)
  - Trade-offs between different ecosystem services
- How to finance?
  - Transfers from beneficiaries of services to ecosystem managers
  - Carbon funding



## Vegetation barrier for storm protection



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