The role of ecosystems in adaptation to climate change

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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, Locatelli, 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

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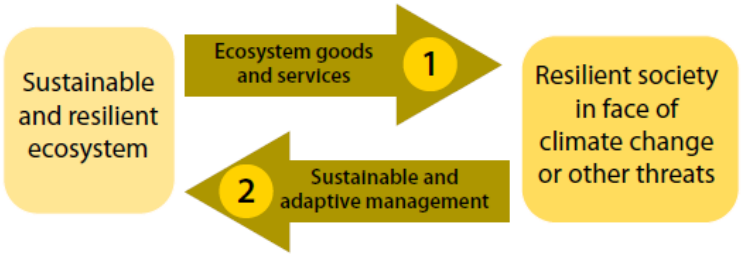
EBA Framework



1. Forests for adaptation
2. **Sustainable** management for sustainable provision of services + **Adaptation for forest** if sustainable management is in place

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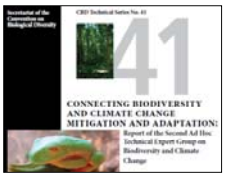
EBA Actors

- The term "EBA" is mainly used by :
  - International NGOs and their projects

ELAN ECOSYSTEMS AND LIVELIHOODS ADAPTATION NETWORK

IUCN Ecosystem-based adaptation and lessons from the field

  - International conventions (CBD, UNFCC) 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?
    - Example of National Adaptation Programs of Action (NAPAs)
  - Scientists?

Pramova, Locatelli et al., 2012. Ecosystem services in the National Adaptation Programmes of Action. *Climate Policy* 12(4): 393-409

A review of scientific evidence on EBA

- What scientific evidence on EBA?
  - We need this evidence to move EBA from concepts to action
- Literature review
  - Peer-review papers on forests or trees and human vulnerability
- Six major stories emerged from the review

(Pramova E., Locatelli B., Djoudi H., Somorin O., forthcoming. Forests and trees for social adaptation to climate variability and change. WIREs Climate Change, online first. doi: 10.1002/wcc.195)

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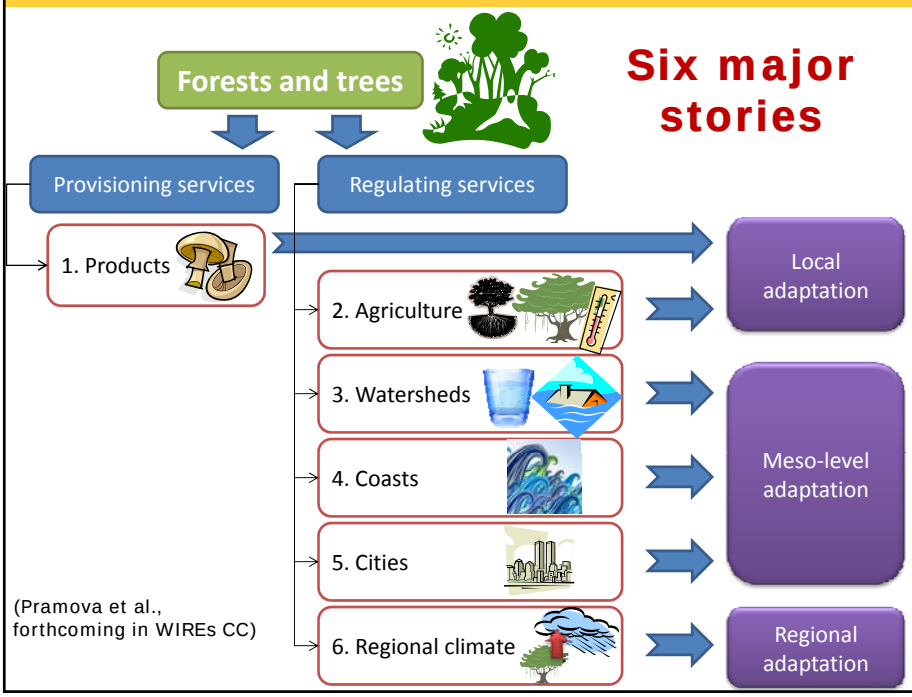
Six major stories



(Pramova et al., forthcoming in WIREs CC)

1. Products

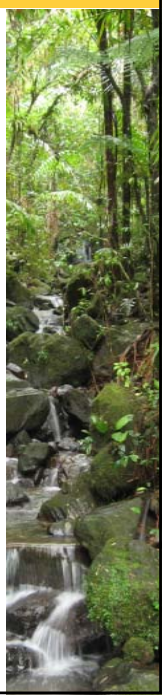
- Forests and trees
  - Provide safety nets for local communities coping with climate shocks
  - Increase livelihood diversification (anticipatory strategy)
- Examples:
  - Indonesia (Kalimantan): the most heavily affected, the poorest and the least-educated relied more on forests for their coping strategies 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 & moisture, wind breaks, water infiltration
- Examples:
  - Indonesia (Sulawesi): cacao systems shaded by Gliricidia trees are not significantly affected by drought because of shade and water uptake from the trees (Schwendenmann et al., 2010)
  - Malawi: agroforestry with Faidherbia & Gliricidia. At least 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 in the proximity of forested watersheds in Flores show lower impacts and higher profits during droughts (Pattanayak and Kramer, 2001)
  - Philippines: Cyclone damage linked to watershed deforestation (landslide, river overflows, flooding) (Gaillard et al., 2007)
- 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

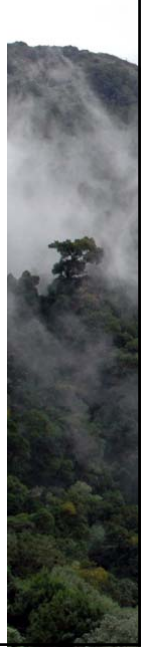
- Coastal forests
  - Absorb and dissipate wave energy and stabilize coastal land
  - Protection from tropical storms, sea level rise, floods and coastal erosion
- Examples:
  - India (Orissa): Cyclone protection. Villages behind mangroves suffered less losses of life, property and crops during 1999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

5. Cities

- Urban forests & 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%) (Gills 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

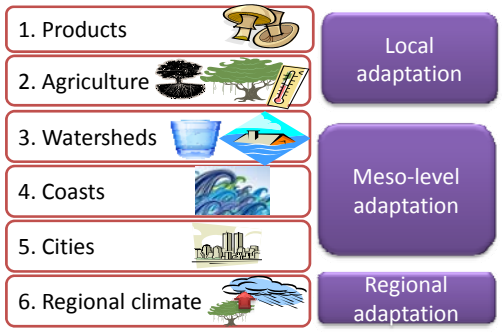
6. Regional climate

- Forests can influence regional climate:
  - Cooling effect through increased evaporation and cloud cover
  - Influence on precipitation: water pumping & 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., 2009)
- Issues
  - Controversies
  - Multiple scales involved (local, regional, global)
  - => How policies could address this role of forests?



Conclusions

- Scales and evidence on EBA



- A lot of 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, CC mitigation)

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