Beyond Mitigation: Forest-Based Adaptation to Climate Change

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THINKING beyond the canopy

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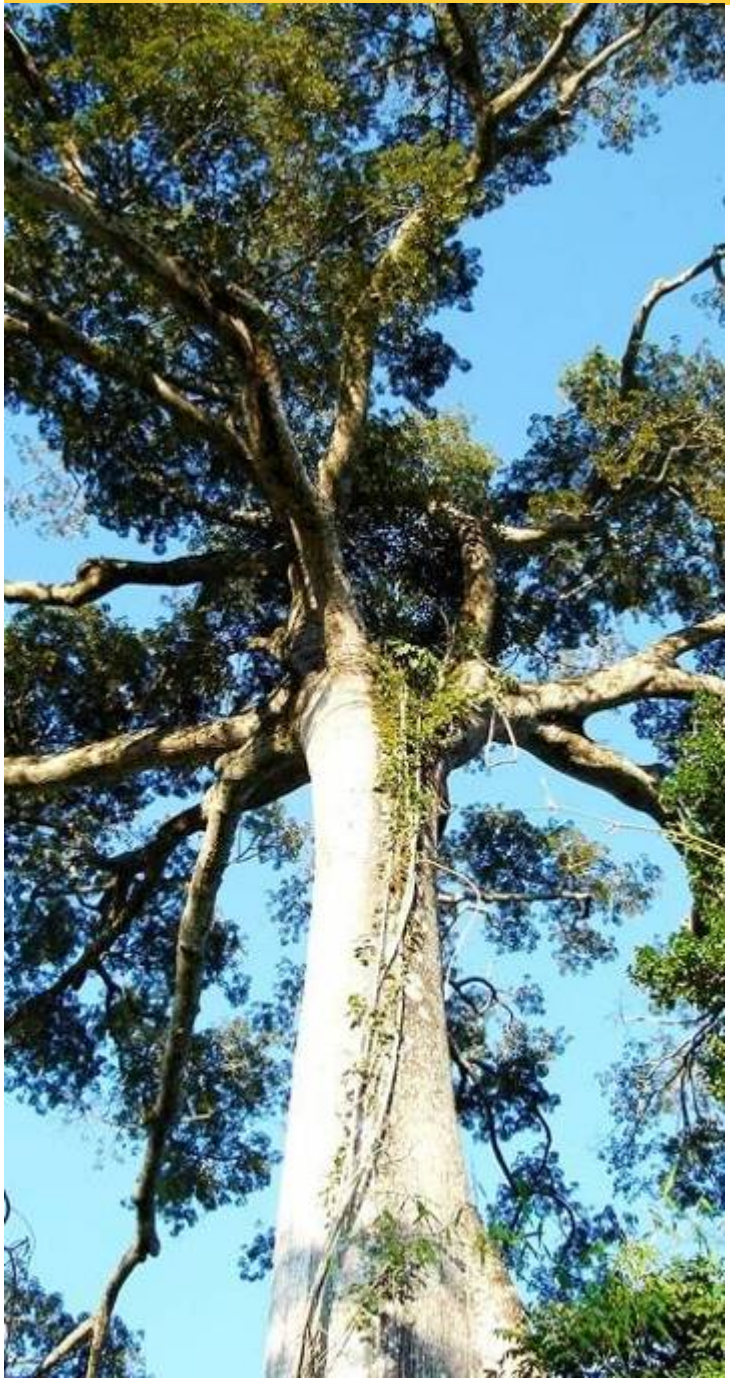


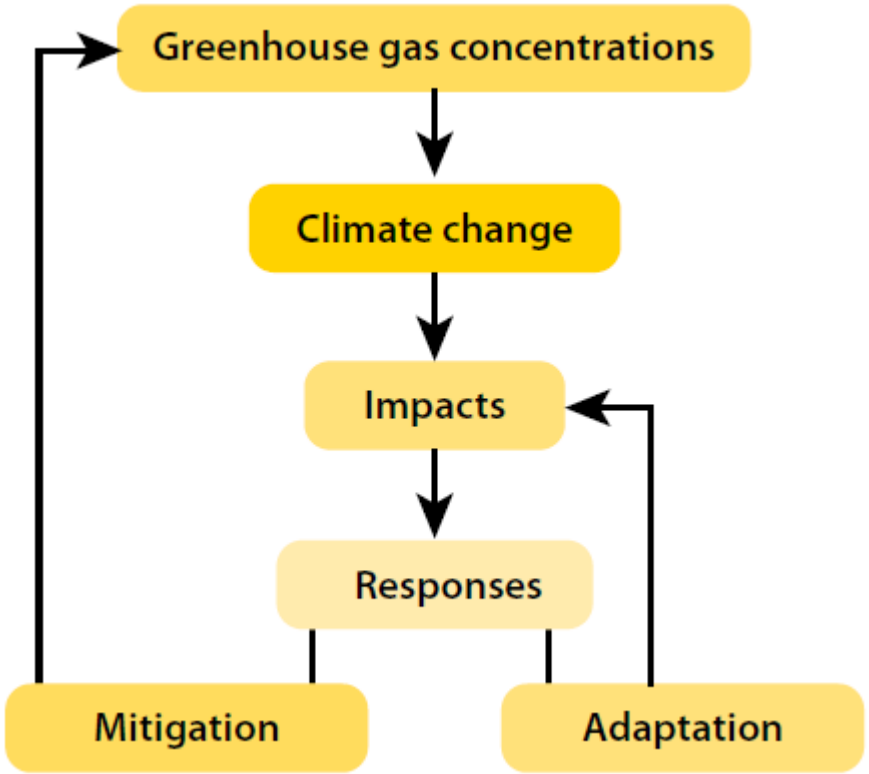
Outline

1. Introduction
2. Adaptation for forests
3. Forests for adaptation
4. Links between adaptation and mitigation
5. Example: Wetland ecosystems

1. Introduction

Strategies for climate change

- Mitigation and adaptation: Different objectives



Mitigation: To reduce emissions or enhance sinks

Adaptation: To moderate harm or exploit beneficial opportunities

Linkages between forests and adaptation are twofold

- Adaptation for forests
  - CC will affect forests
  - Adaptation measures needed for forests

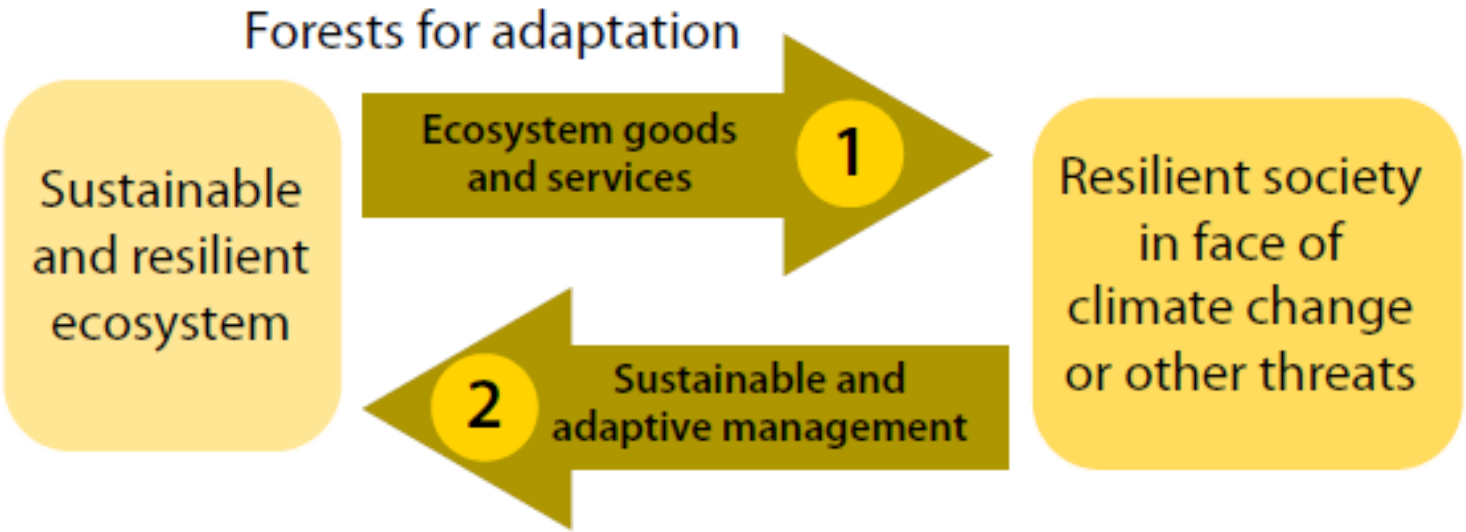
    New challenges -> understanding impacts, adapting management

- Forests for adaptation
  - Forest ecosystems contribute to social adaptation
  - They provide ecosystem services that reduce the vulnerability of local communities and the broader society

    New challenges -> forests in adaptation of sectors outside of the forest sector

(Locatelli et al., 2010)

Should we pursue 'forests for adaptation' and 'adaptation for forests' together?



Sustainable management for sustainable provision of services + **Adaptation for forest** if sustainable management is in place

For ensuring that forests contribute to the adaptation of society (1), sustainable management must first be achieved (2).

When immediate pressures on forests are addressed, a longer term perspective and CC can be considered (2)

(Locatelli, 2011)

2. Adaptation for forests

Why adaptation for forests?

- Climate change expected to cause significant shifts in the distribution of tropical forests and disturbance patterns

- Non - climatic pressures, such as forest conversion and fragmentation, increase the vulnerability of tropical forests

Components of the exposure and sensitivity of forest ecosystems

Exposure	Sensitivity
Climate change and variability Increase in temperature Changes in precipitation Changes in seasonal patterns Hurricanes and storms Increase in CO_2 levels Sea level rise Other drivers Land use change Landscape fragmentation Resource exploitation Pollution	Changes in disturbance regimes e.g., fires, pests and disease Changes in tree level processes e.g., productivity Changes in species distribution Changes in site conditions e.g., soil condition Changes in stand structure e.g., density, height

(after Johnston and Williamson 2007).

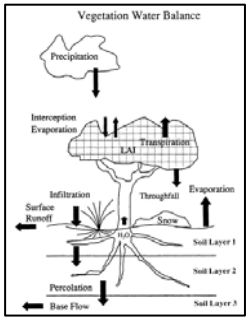
Impacts on specific types of tropical forests

- **Tropical rainforest**
  - Ex.: possible drought in the Amazon => wildfire, forest dieback, large - scale conversion to savannas
- **Tropical cloud forests**
  - Higher altitude of cloud cover => habitats and species forced to shift up into increasingly smaller areas
- **Tropical dry forests**
  - Slight annual decrease in precipitation can increase forest fire risk
- **Tropical mangroves**
  - Threat from sea level rise and associated changes in sediment dynamics, erosion and salinity

(Locatelli et al., 2010)

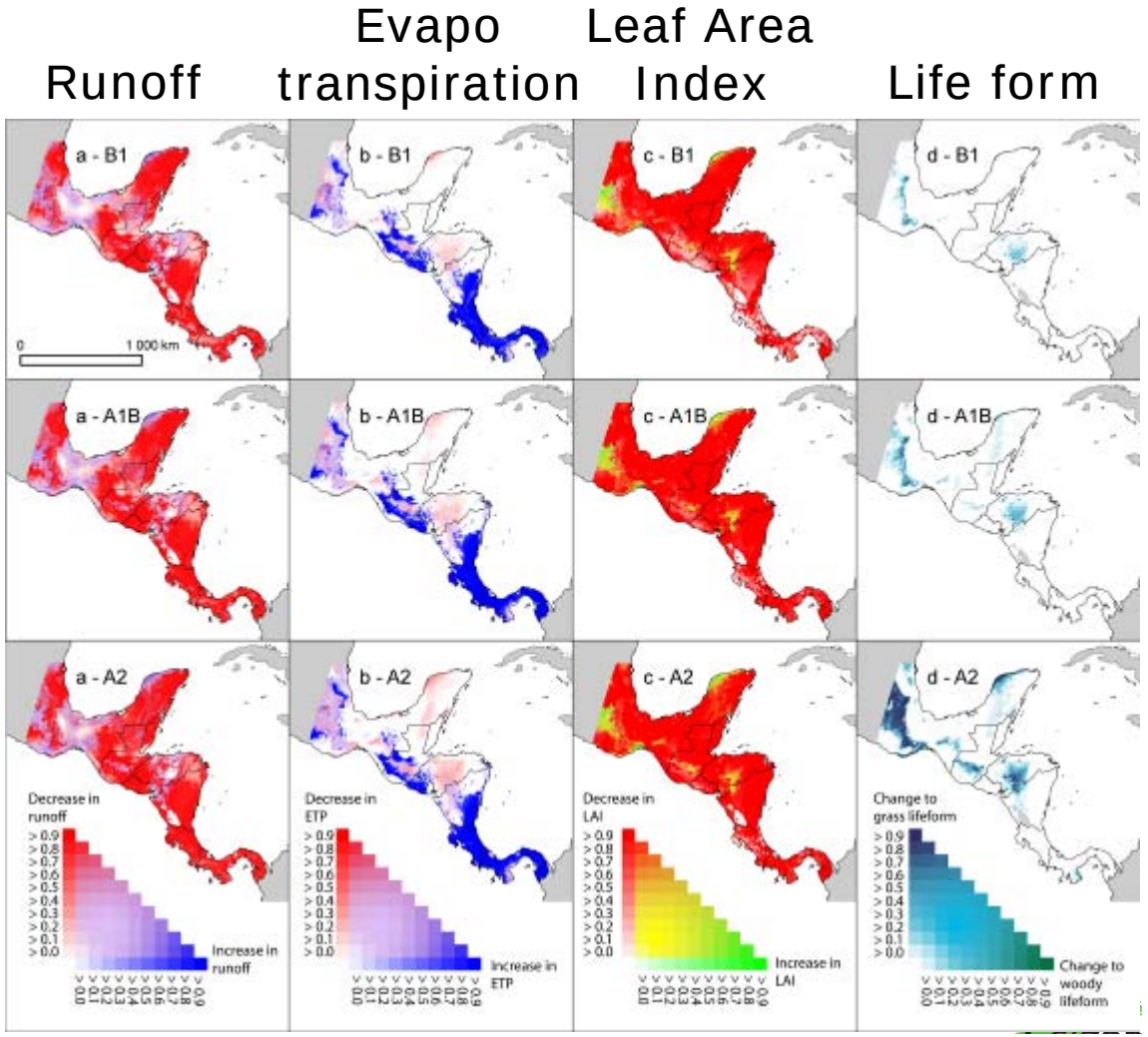
Example: Future of forests and water in Central America

Focus on uncertainties (and certainties!)



MAPSS (Mapped Atmosphere-Plant-Soil System; Neilson, 1995)

136 climate scenarios in 3 groups



(Imbach, Molina, Locatelli, 2010. Hydr Earth Syst Sc)

(Imbach, Molina, Locatelli, et al. subm)

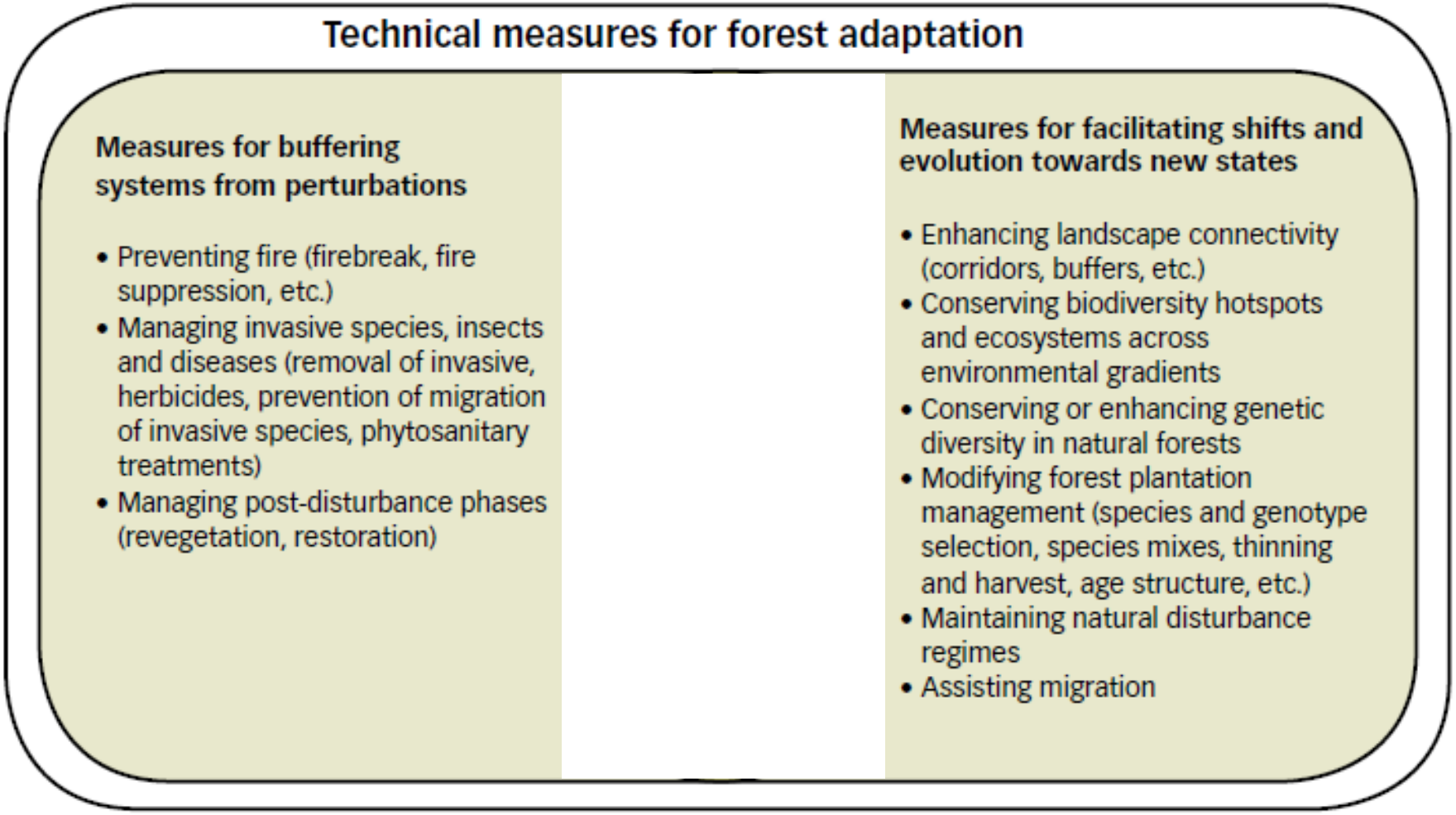
Measures for forest adaptation

Measures for buffering systems from perturbations

- Preventing fire (firebreak, fire suppression, etc.)
- Managing invasive species, insects and diseases (removal of invasive, herbicides, prevention of migration of invasive species, phytosanitary treatments)
- Managing post-disturbance phases (revegetation, restoration)

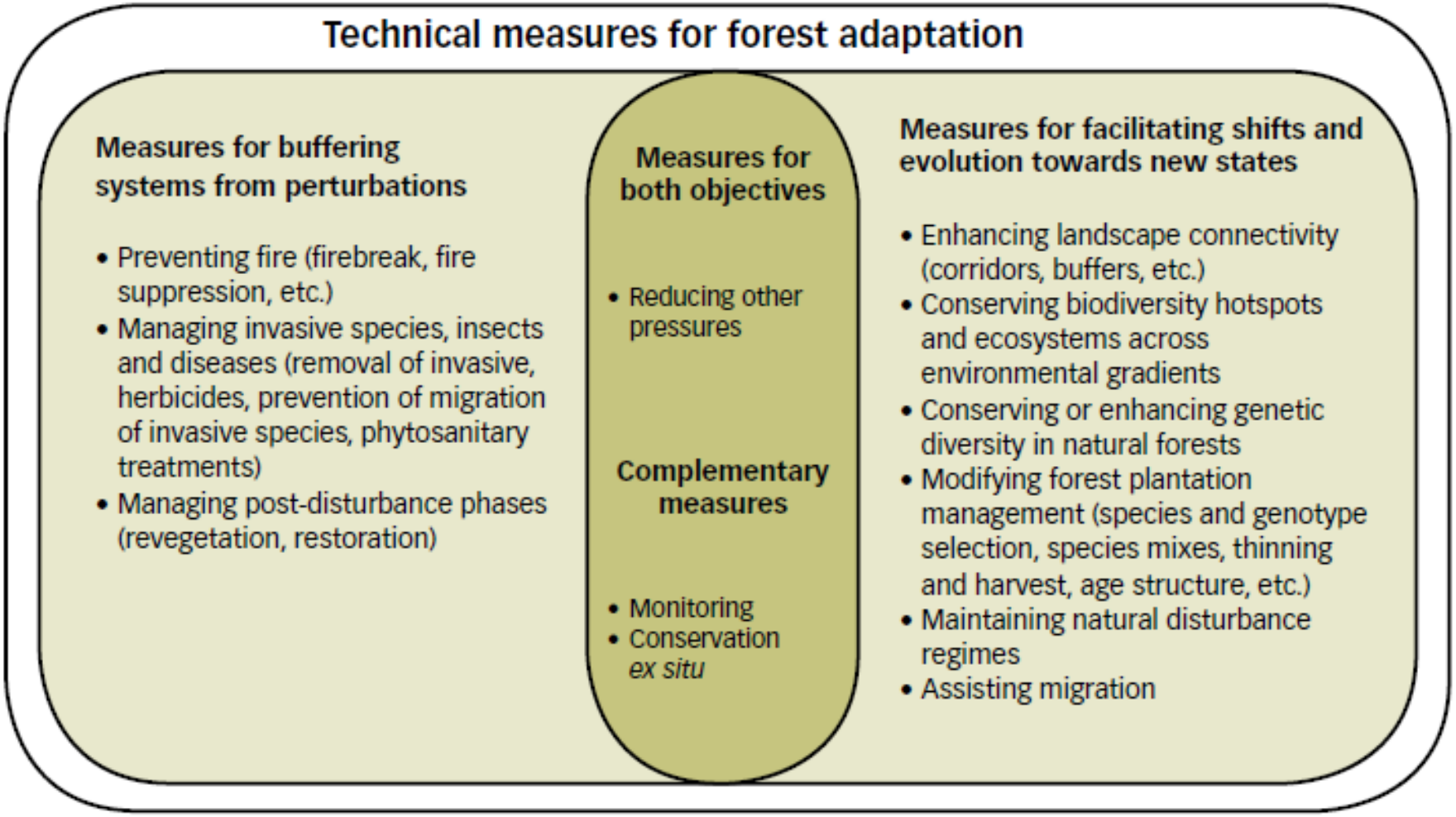
(Locatelli et al., 2008)

Measures for forest adaptation



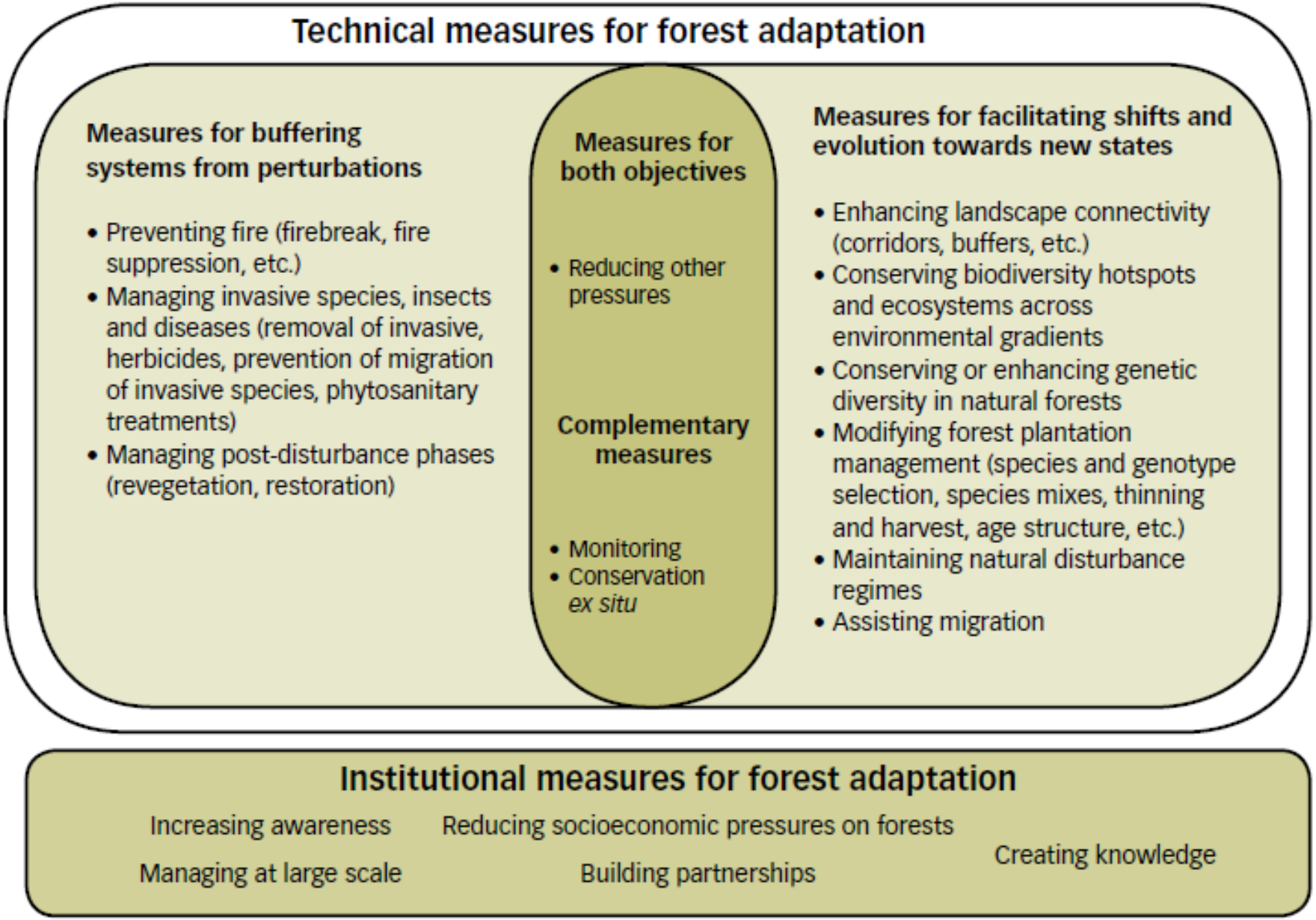
(Locatelli et al., 2008)

Measures for forest adaptation



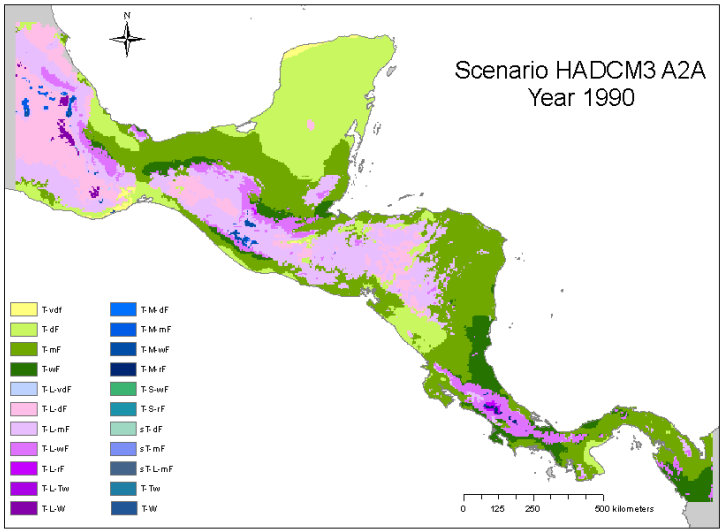
(Locatelli et al., 2008)

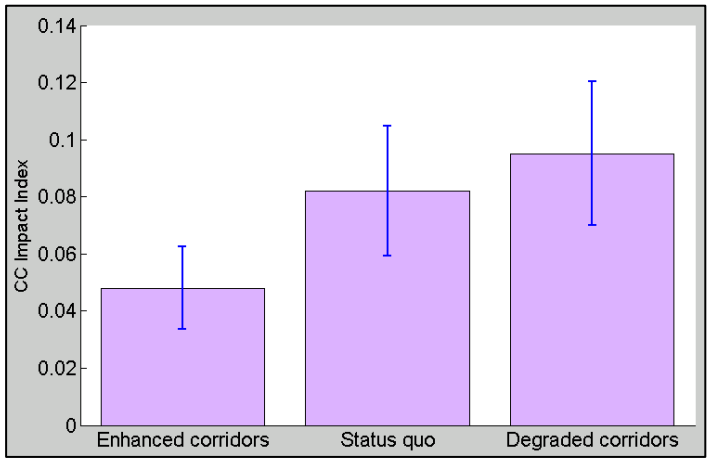
Measures for forest adaptation

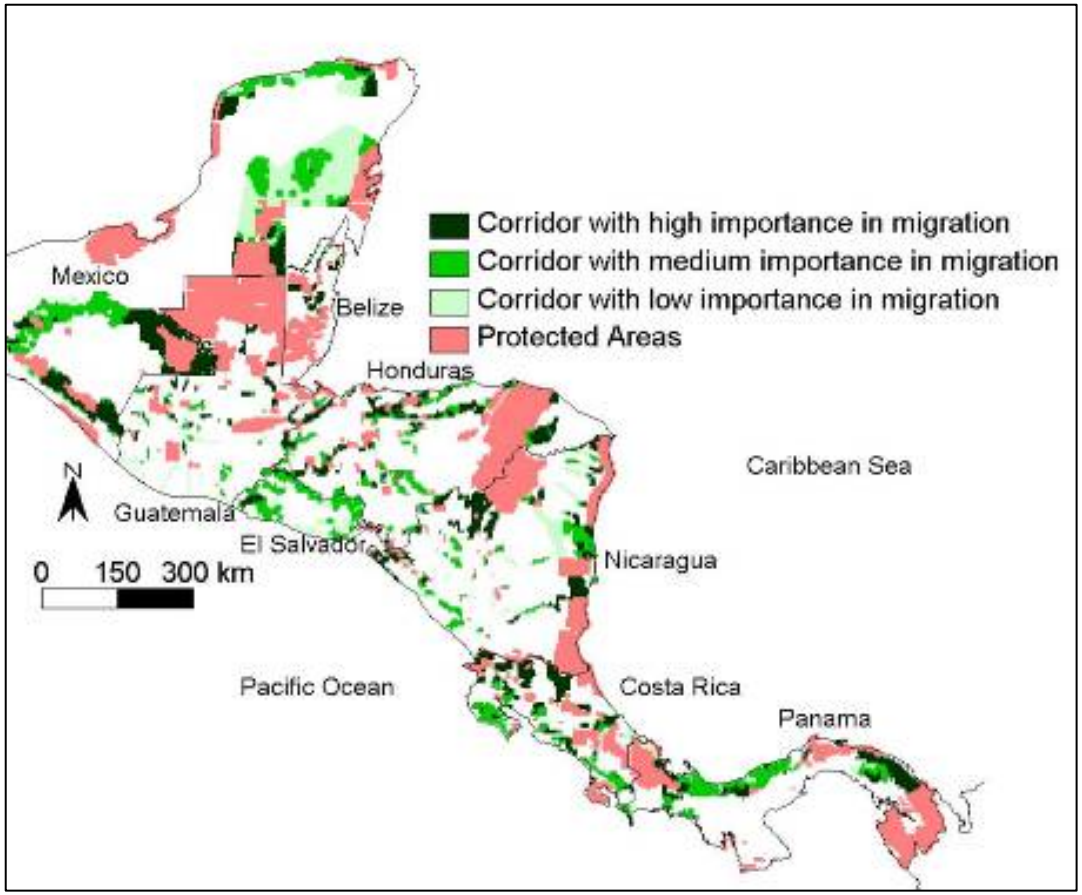


(Locatelli et al., 2008)

Example: Landscape connectivity and species migration in Central America







(Locatelli, Imbach et al.)

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How to implement forest adaptation

- **No regret**: Reduce current threats as an important first step
  - If not, adaptation of forests purely academic
- **Good practices**:
  - build on previous experiences and local practices and knowledge, strengthen local institutions and collaboration at multiple levels
- **Uncertainty**: Need for flexible and diverse approaches and a portfolio of measures
- **Adaptive management**: Monitor, evaluate, adjust based on re-assessment of risks & vulnerabilities

Sustainable Forest Management (SFM) and Forest Adaptation

- SFM
  - Holistic approach including social, economic and environmental goals.
    - Extent of forest resources / Biological diversity / Forest health and vitality / Productive functions of forest resources / Protective functions of forest resources / Socio-economic functions / Legal, policy and institutional framework
- Effective framework for adaptation in an integrated way.
- SFM may not need substantial modification from existing good practice in order to reduce the vulnerability of the forest to CC

(Guariguata et al., 2008; FAO, 2008; Locatelli et al., 2010)

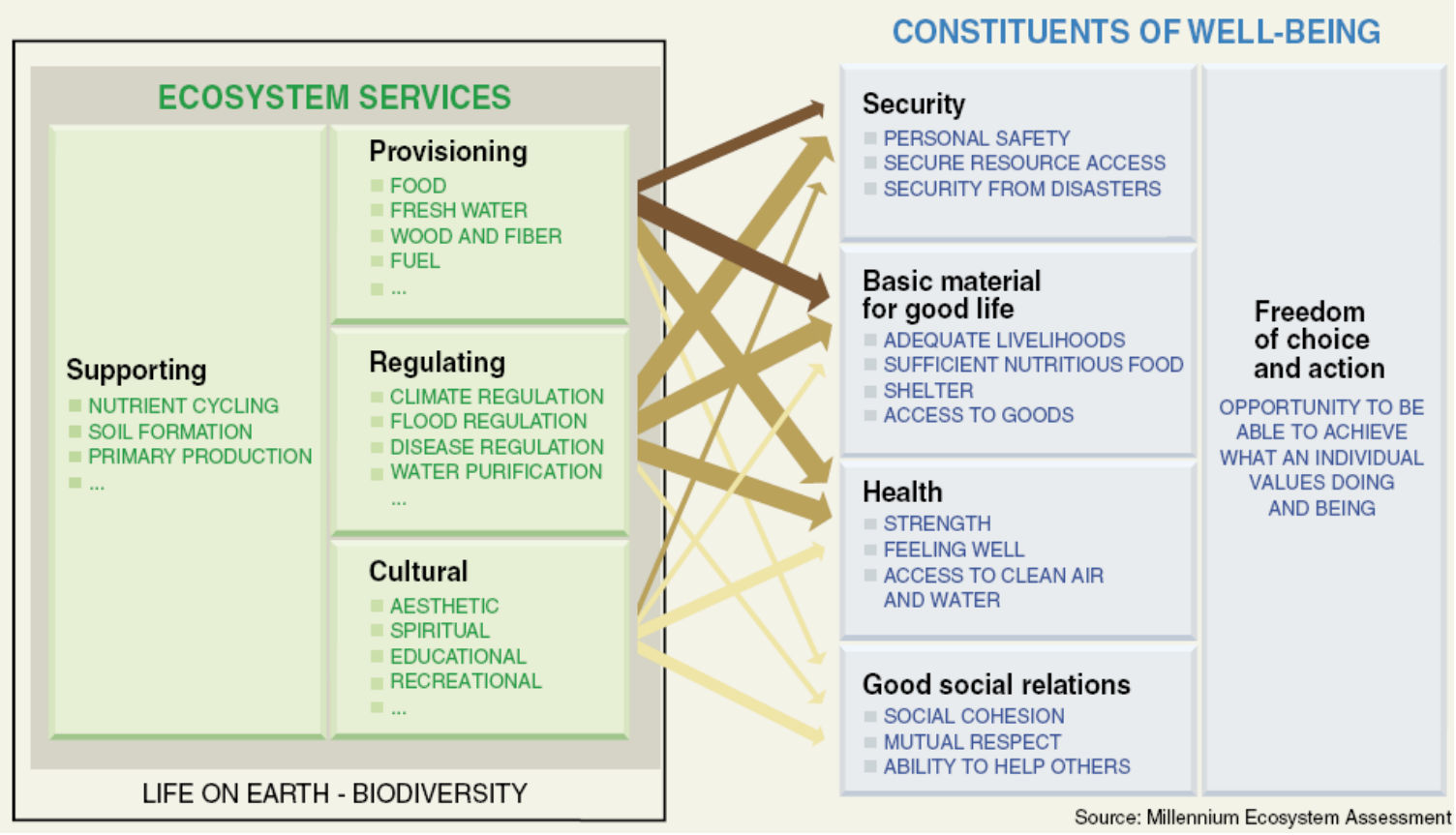
Adaptation for forests:

Questions?

3. Forests for adaptation

Why forests for adaptation?

- Role of ecosystem services for human well-being, as well as increasing social resilience to climate change



Source: Millennium Ecosystem Assessment

What is 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 CC."
  - CBD, 2009. Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Technical Series No. 41, Secretariat of the Convention on Biological Diversity, Montreal, 126 p.
- "Adaptation policies and measures that take into account the role of ecosystem services in reducing the vulnerability of society to CC, in a multi-sectoral and multi-scale approach".
  - Vignola, R., Locatelli, B., Martinez, C. and Imbach, P., 2009. Ecosystem-based adaptation to climate change: what role for policy-makers, society and scientists? Mitigation and Adaptation Strategies for Global Change, 14: 691–696.
- "Local and landscape scale strategies that enable both people and nature to adapt in the face of CC"
  - IUCN, 2009. Ecosystem-based Adaptation (EbA): Policy Briefing. Fifth session of the UNFCCC Ad Hoc Working Group on Long-Term Cooperative Action under the Convention (AWG-LCA), 29 March to 8 April 2009, Bonn.

Why EbA?

- Multiple benefits
  - Livelihoods, biodiversity, CC mitigation (carbon)…
  - EbA: not a panacea but potential to improve sustainability of a project portfolio
    - e.g., ecosystem conservation for regulating water flows provided to an infrastructure for irrigation
- Cost efficiency
  - Economists of TEEB (2009): EbA can be “more cost-effective than technological solutions (built infrastructure)”
  - Adaptation projects should invest in ecological infrastructure
    - Ex: planting mangroves in Vietnam, Cost USD=1.1 million, Benefit USD=7.3 million annually in avoided costs for dyke maintenance.

The 5 major stories about forest ecosystem services and adaptation

1. **Livelihoods**: Forests and trees provide goods to local communities affected by climate events

(Pramova et al., 2011)

The 5 major stories about forest ecosystem services and adaptation

2. Agriculture: Forests and trees conserve and regulate soil, water and microclimate in agricultural lands

(Pramova et al., 2011)

The 5 major stories about forest ecosystem services and adaptation

3. Watersheds: Forests and trees regulate water & soil in watersheds and at the landscape scale

(Pramova et al., 2011)

The 5 major stories about forest ecosystem services and adaptation

4. Coasts: Coastal ecosystems protect coastal areas from extreme events and sea level rise

(Pramova et al., 2011)

The 5 major stories about forest ecosystem services and adaptation

5. Cities: Urban forests and trees regulate temperature and water in cities

(Pramova et al., 2011)

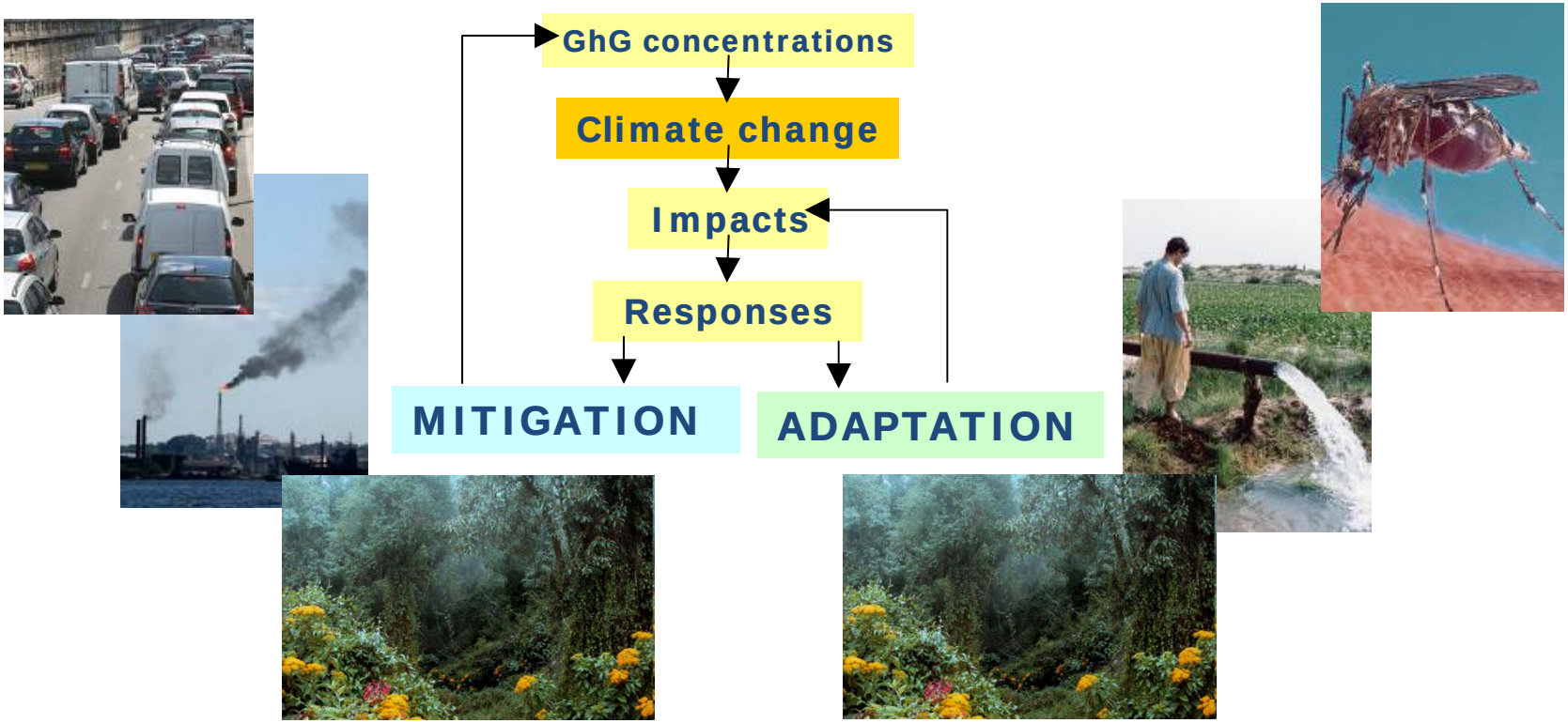
Cross-sectoral linkages

- Forest benefits and management **costs** generally occur in **different locations** and in **different sectors** of society
- Challenge: involving these sectors in forest-based adaptation -> opportunities for inter-sectoral planning and financing of forest conservation, restoration and sustainable management
- E.g. hydropower & drinking-water facilities
  - Problems of siltation or water quality
  - Invest in upstream forest management instead of more costly measures such as technical filtration or infrastructure
- Incentive-based policy instruments like payments for ecosystem services (PES)

Forests for adaptation: Questions

4. Links between adaptation and mitigation

Forests are relevant to both A&M



Ecosystem-Based Mitigation

- Global ecosystem service: Carbon sequestration.
- Policies: CDM, REDD+.

Ecosystem-Based Adaptation

- Local ecosystem services: Water regulation, products...
- Policies: EBA.

Links between mitigation and forest adaptation

Link	Rationale	Examples in projects/ policies
M => forest A	REDD+ projects can increase forest resilience	No explicit reference
Forest A => M	Adaptation measures can increase the permanence of carbon in a changing climate	Klinki (Costa Rica), Return to Forests (Nicaragua)

Locatelli et al., 2011

Links between mitigation and social adaptation in forests

Link	Rationale	Examples in Projects/ Policies
M => social A	REDD+ projects influences livelihoods and community adaptation	Noel Kempff (Bolivia), Chinchiná (Colombia), Scolel Té (Mexico), Juma (Brazil)
Social A => M	(i) EBA projects conserve ecosystems (and carbon). (ii) EBA projects can benefit the clean energy sector (iii) Adaptation in agriculture can preserve agricultural yield and avoid displacement of agriculture to forests	(i) Tegucigalpa water (Honduras), Colombian mountains (Colombia), AdapCC (Peru) (ii) Chingaza (Colombia) (iii) No explicit reference

Locatelli et al., 2011

Reasons for integrating M&A in forestry projects

- M needs A.
  - REDD+ projects more sustainable & carbon more permanent with A measures for communities and ecosystems.
  - Integrating A also increases the local legitimacy of the project, as A puts emphasis on local needs.
- A needs M.
  - An A project contributing to M may benefit from carbon funding.
  - Donors may favor projects with global benefits such as M, in addition to the local A benefits.

What can facilitate the integration of M and A in forests? (1/2)

- National policies.
  - Approval procedures of M projects.
  - National conservation or development policies (Mexico‘s strategy for protected areas: “adaptive capacity of ecosystems and people […] and GHG mitigation”).
- International policies.
  - So far A and M have been treated separately, even though some countries have asked for synergistic measures.

What can facilitate the integration of M and A in forests? (2/2)

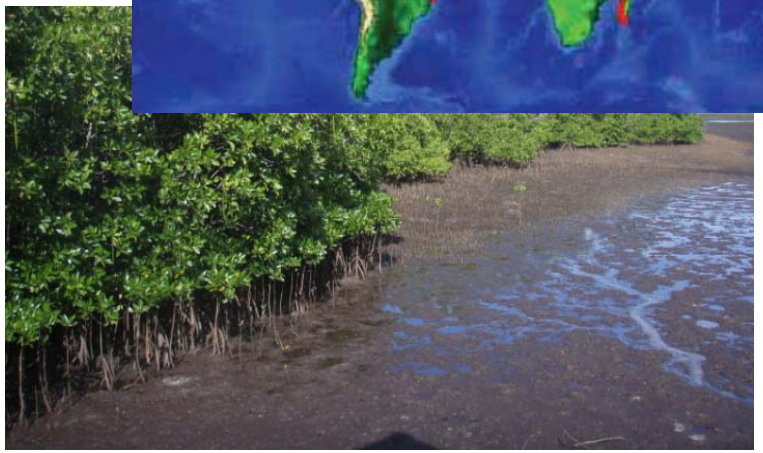
- Standards.
  - Ex: the Climate Community Biodiversity Standards integrate A criteria for evaluating impact of M projects.
- Knowledge generation, communication and capacity-building.
  - Bridge the two 'separate' communities → need for informing M stakeholders about A and vice-versa.
- Need for more research on synergies and trade-offs.

Links between adaptation and mitigation: Questions

5. Example: Wetland ecosystems

Tropical Wetlands

- Mangroves
  - Tidal wetland forests
  - 14,653,000 ha (FAO, 2000)
  - Indonesia: 23%



- Peat swamp forests
  - on organic soils that can be up to several meters deep
  - Southeast Asia: 25 million ha (56% of all tropical peatlands)

Ecosystem vulnerability

- Mangroves
  - Physically vulnerable to CC, especially when degraded
  - Temperature, precipitation, tidal dynamics
  - Storms, sea-level rise & coastal floods
  - Lucrative land use change (aquaculture, settlements, industry, tourism)

- Peat swamp forests
  - Prolonged droughts, El Niño (can burn for months)
  - Land use change (oil palm, rice, timber extraction, rubber)
  - Drainage => increased surface temperature and reduced moisture => more fires

Role in EbA

- Mangroves
  - Critical role: Protection from coastal storms, floods & erosion
  - Integral part of coastal livelihoods and economies
    - Fish nursery, products (timber, charcoal, NTFPs)

- Peat swamp forests
  - Critical role: act as sponge that gradually release water in times of drought.
  - Other services: protection from natural forces, sediment retention, nutrient detention, products (wood, NTFPs, etc.)

Adaptation-Mitigation synergies

- Mangroves
  - Significant C storage
  - Some REDD+ initiatives under development
- Peat swamp forests
  - Total C storage may be among the largest forest C pools on Earth, with a vast amount below ground, but data is lacking

Challenges

- Mangroves
  - Low success of restoration programmes
  - Species selection
  - Community ownership
  - Valuation of the whole range of services provided
- Peat swamp forests
  - Governance drivers of land-use change
  - Fires (local practices, fire management…)
  - Rewetting

- For discussion: Other challenges?

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