



# Enhancing forest C monitoring and GHG emissions projection using a systems approach: lessons learned from Mexico

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Natural Resources  
Canada

Ressources naturelles  
Canada



# 1. Background

Since 2011, the Commission for Environmental Cooperation and forest services of North America have collaborated to **improve modeling tools/methods** for monitoring GHG fluxes, while being able to **assess, project and communicate the effect that policy decisions can have on GHG emissions in the future.**

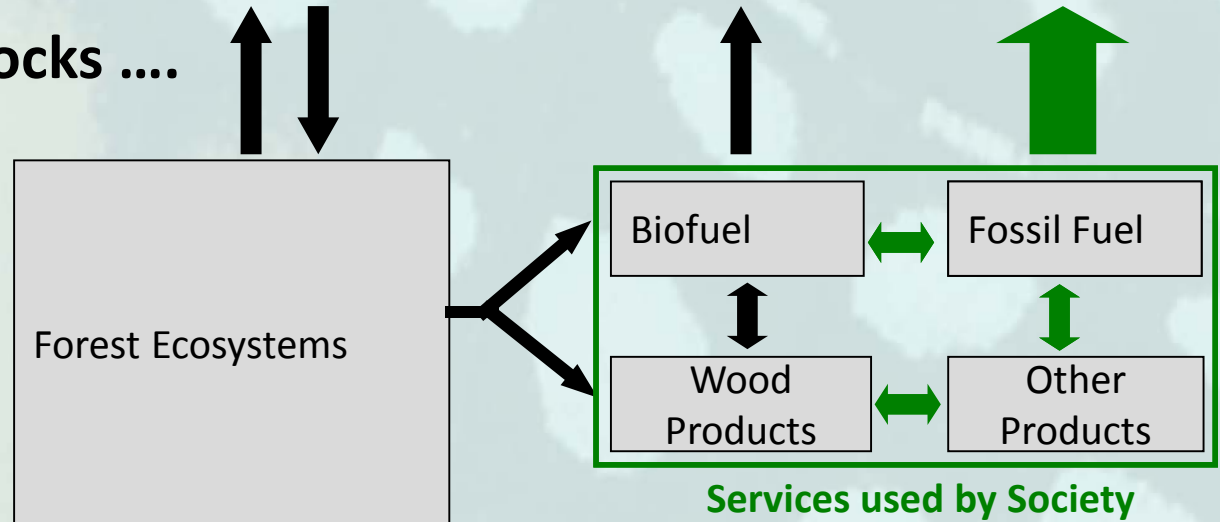
## Examples of pilot areas



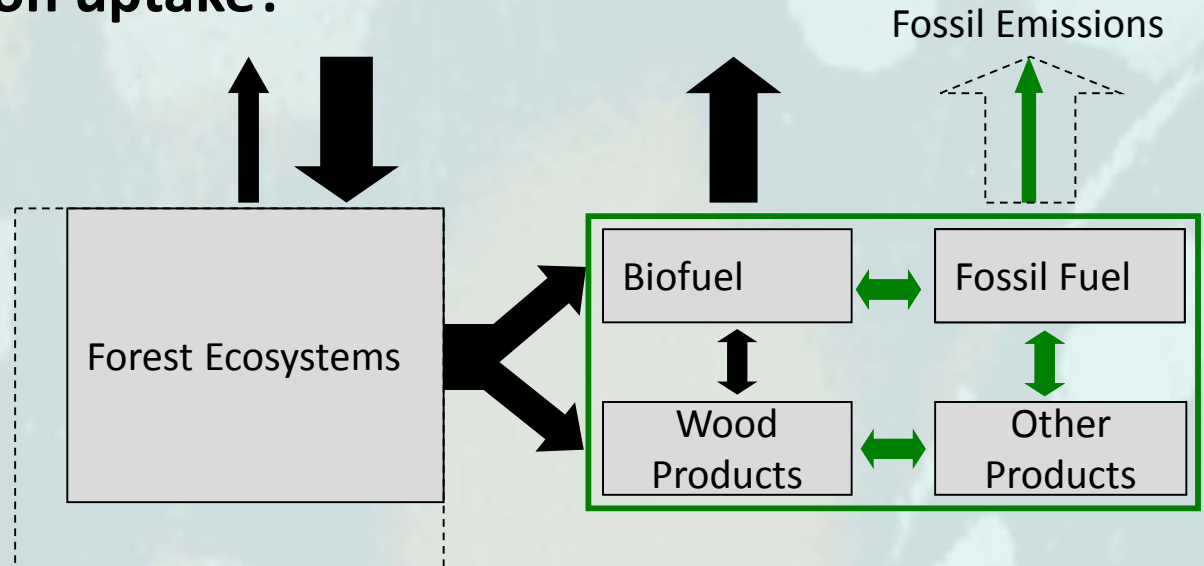


# Activity options

Maximise Carbon stocks ....



... or maximise Carbon uptake?



## 2. Scenarios for Mexico

- **Historic:** 2000 to 2016
- **Future:** a) **Baseline:** 2017 to 2050 (e.g. average rate of AD as in historic)  
b) **Mitigation scenarios (2018-2050)**

Forest ecosystem



Harvested Wood Products



Substitution benefits



**M1\*** Net 0 deforestation by 2030

**M2\*** M1 + increase 10% forest recovery

**M3\*\*** Increase forest productivity and harvests up to 50%

**M4** All of the above

**Increase carbon retention in long-lived products (LLP).**

- **M3a.** Same % as in base
- **M3b.** 100% of increased harvest goes to LLP

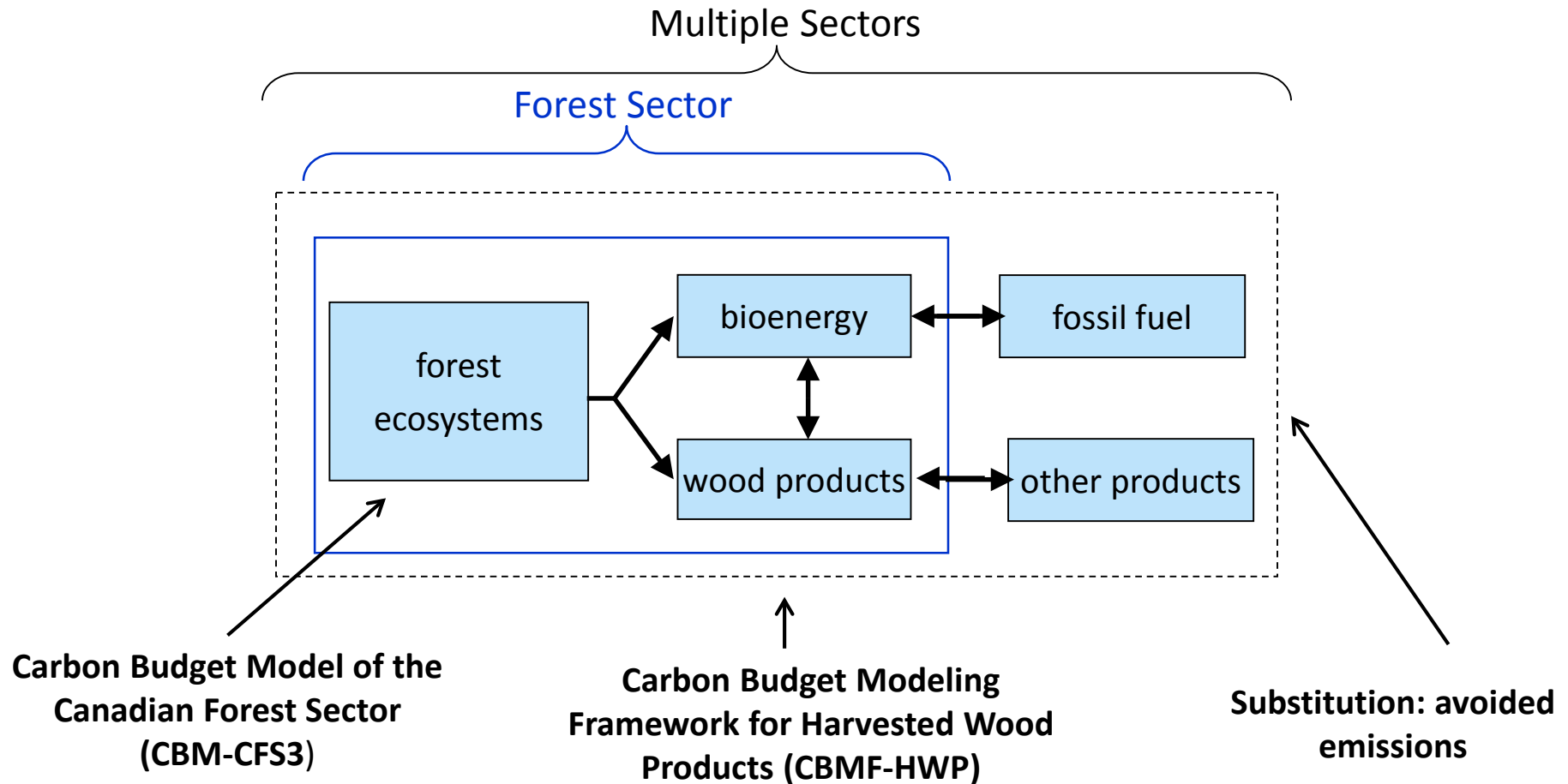
**Use wood products or wood waste (bioenergy) to replace:**

- emissions-intensive products (steel and concrete) and fossil fuels

\* e.g. Mexico's NDC goal, Climate Change Law

\*\* e.g. ENAIPROS goal

# Systems approach to emission reductions




*\* Consistent with IPCC-GPG (2003), National Inventories of GHG (2006)*





# Pilot areas in Mexico


## Legend

 Federal State Boundaries

## Land Use / Land Cover


 Coniferous

 Broadleaf

 Tropical humid

 Tropical dry

 Others

 Grasslands

 Agriculture



## ■ Durango

**5.8 M ha of forests**

-~62% managed forest  
(coniferous and  
broadleaf)

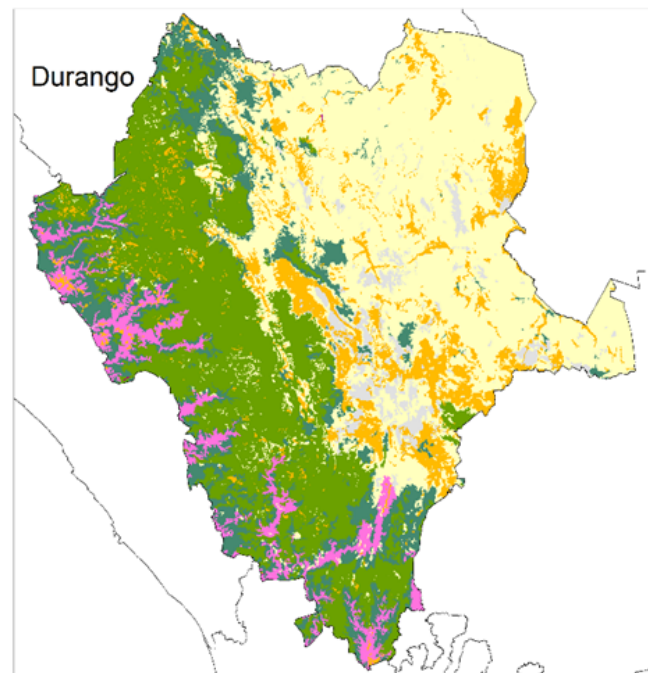
-contributes ~30% of the  
national wood volume

## ■ Quintana Roo:

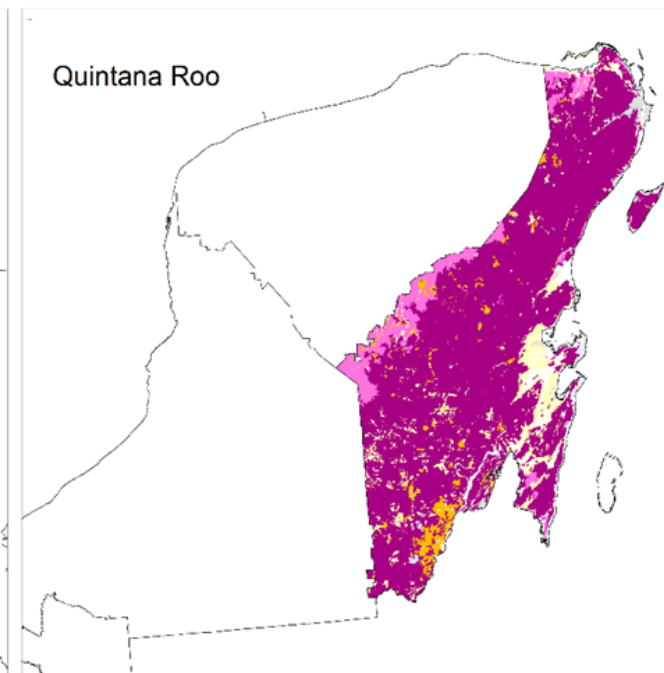
**3.8 M ha of forests**

-~14% managed forest  
(tropical humid);

- included in REDD+  
program

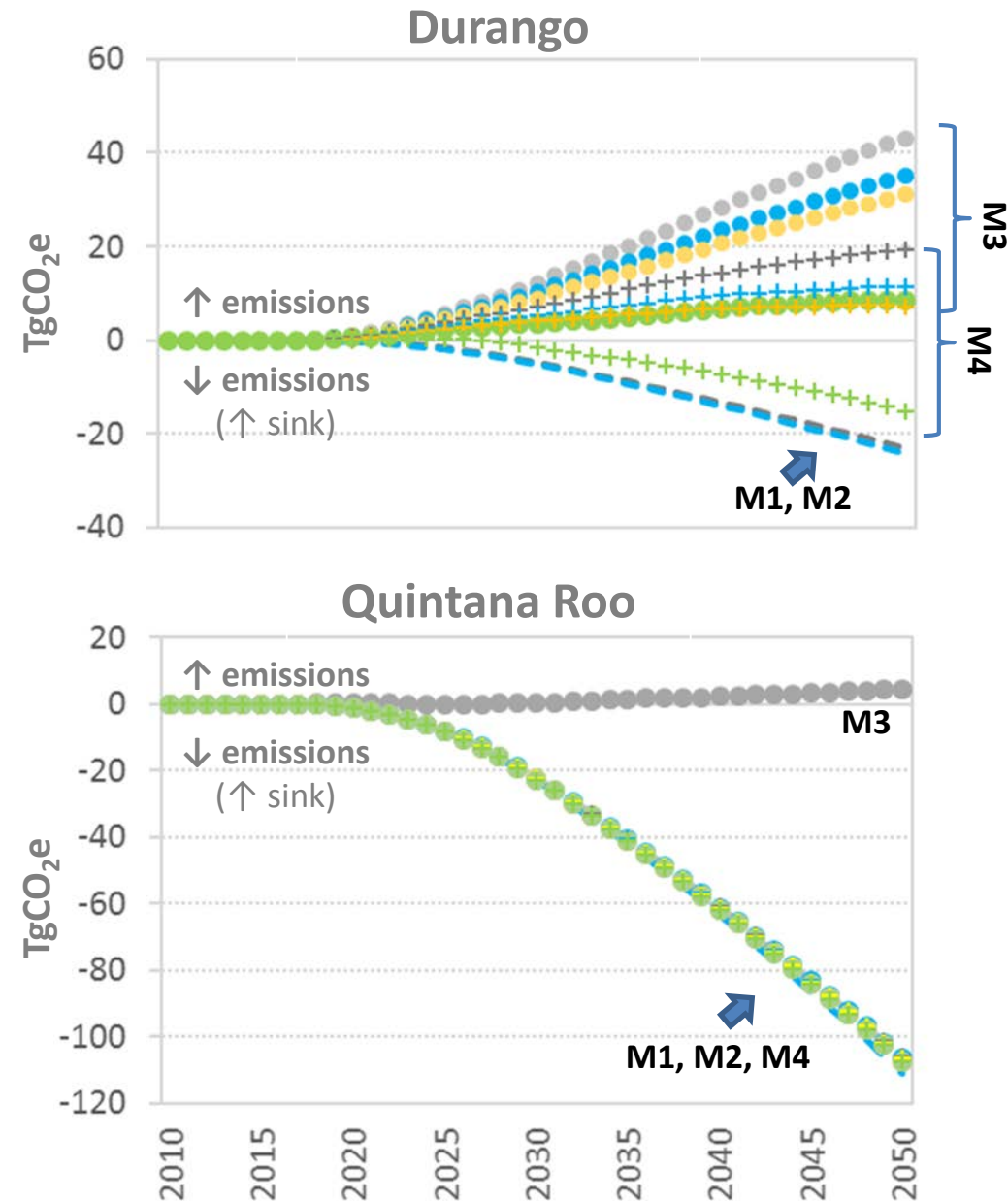


0 50 100 200 300 Kilometers



0 50 100 200 300 Kilometers

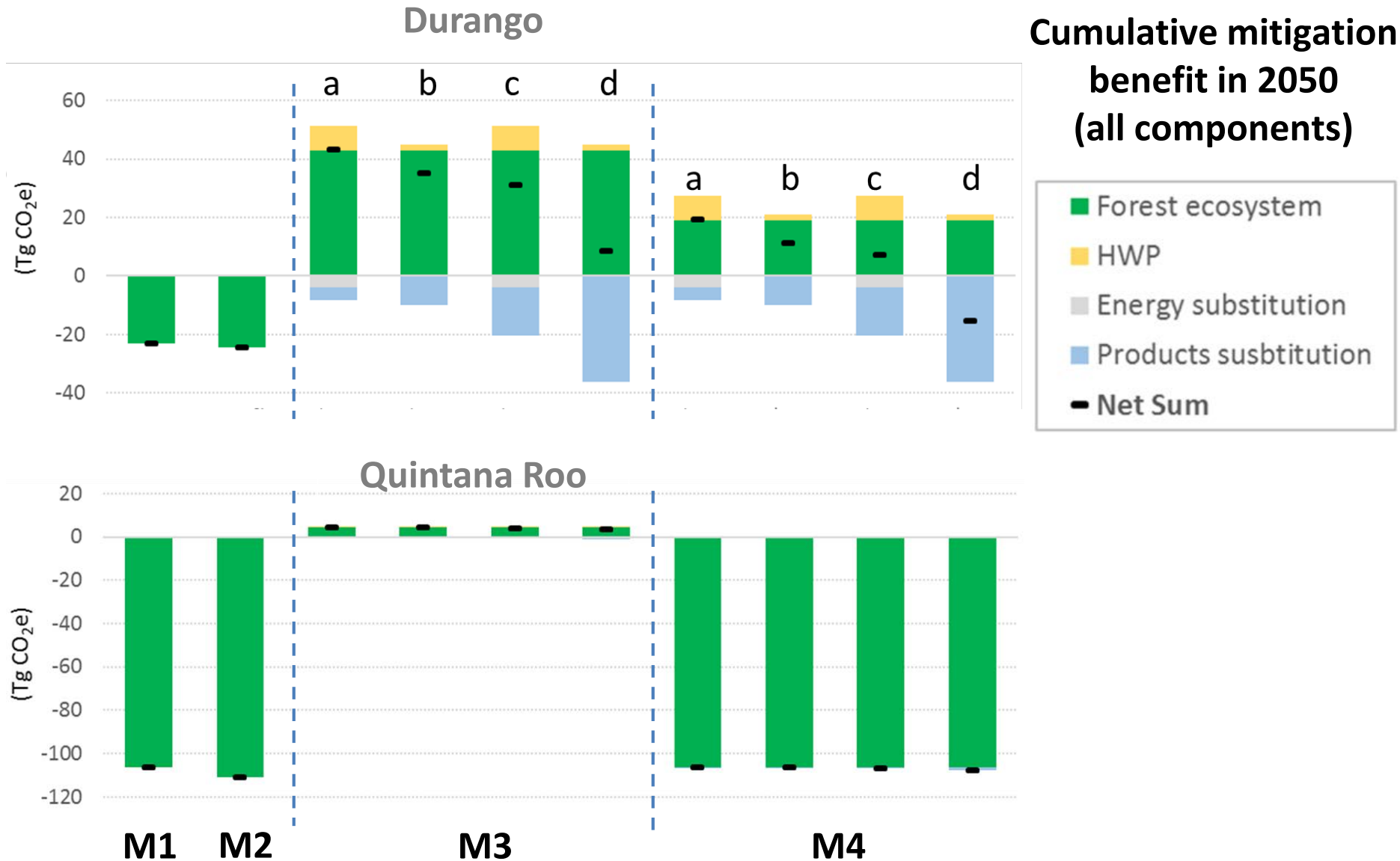
### 3. Results and key messages



Cumulative mitigation benefit in the forest sector (baseline = 0)

- Importance of reducing **deforestation** (immediate avoided emissions) **relative to increasing forest recovery or forest productivity** (slow future sink)
- Crucial to consider a **systems approach to include multiple sectors** (e.g. ↑Harvests ↑ CO<sub>2</sub>e emissions, but ↑ CO<sub>2</sub> “sink” if LLP + substitution benefit are considered)

- Country's mitigation targets should acknowledge state (municipal?) characteristics and components.





## 4. Final comments

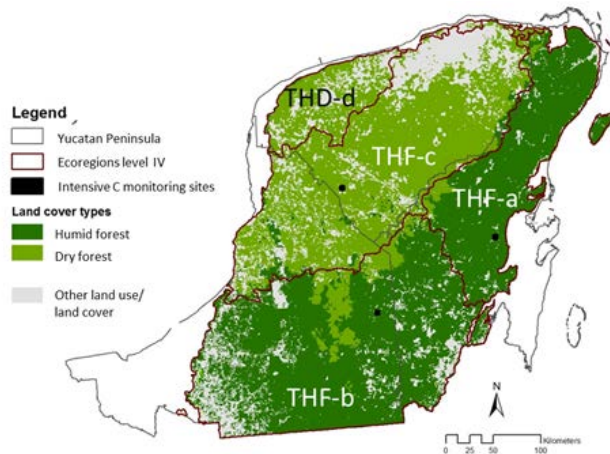


**This study provides initial insight since it:**

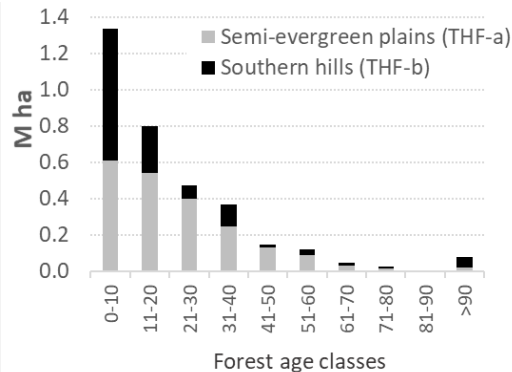
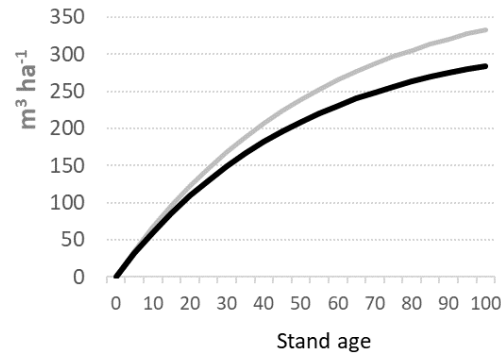
- Inputs are the same as used in national official GHG emissions reporting.  
In addition:
  - Does not assume a fixed mitigation potential
  - Tracks carbon in HWP
  - Assesses the potential interaction with other sectors to reduce emissions
  - Shows the implication of non-carbon objectives on the forest sector affecting the achievement of mitigation targets.
- Provides specific information related to Mexico's NDC and Mid-Century plans for 2030 and 2050 using a systems approach
- Can be expanded to other regions of Mexico and other more complex scenarios can now be implemented

# 5. Potential future work

- Continuing to collaborate to find resources and new partners, to improve information exchange and development of tools and their application



## Quintana Roo



- Growth curves by spatial unit and classifier set**, using MLE routine + NFI plot pairs t2-t1

### Proxy of age:

- Time since last major disturbance.
- Forest structural attributes

### GlobBiomass products provide:

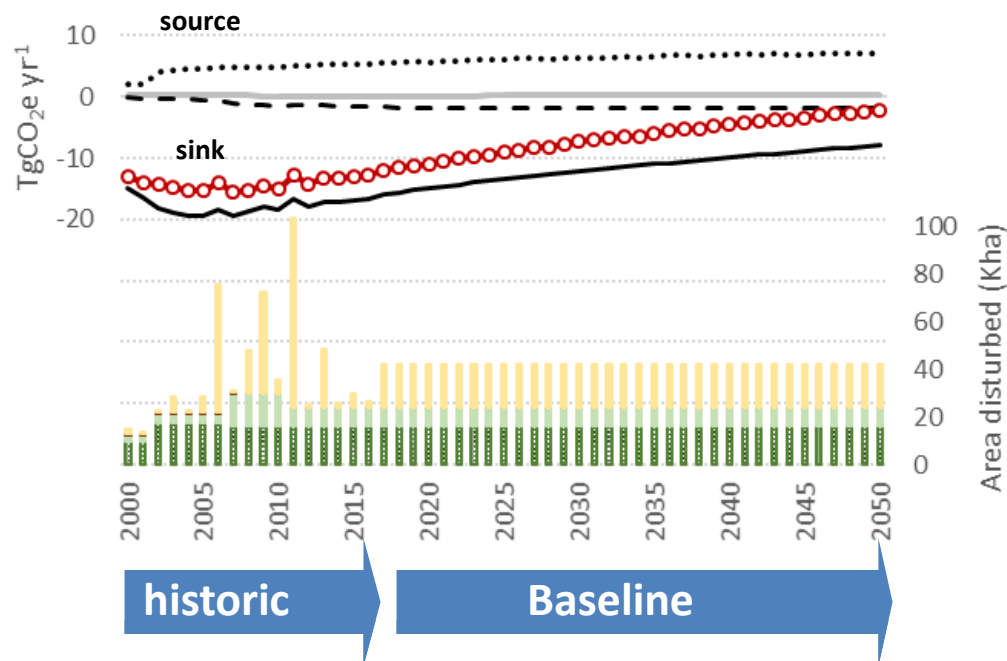
- ✓ New opportunities to develop, compare and improve biomass accumulation rates and age-class structure assumptions

# 5. Potential future work

## ■ Improve assumptions on the effect of disturbances over time

- Improve the efforts modeling of stand-replacing changes (and non-stand-replacing?)
- Move towards more spatially-explicit analysis

### Estimated contribution to future net CO<sub>2</sub>e ecosystem balance in BAU



## ■ Main drivers of net GHG balance:

- FL→FL (growth + harvest + fire)
- FL→OL (deforestation)

## ■ Considerations for baselines:

Same rate of disturbances yields different net GHG balance over time.

- aging of forest
- less forest area over time

### Disturbances

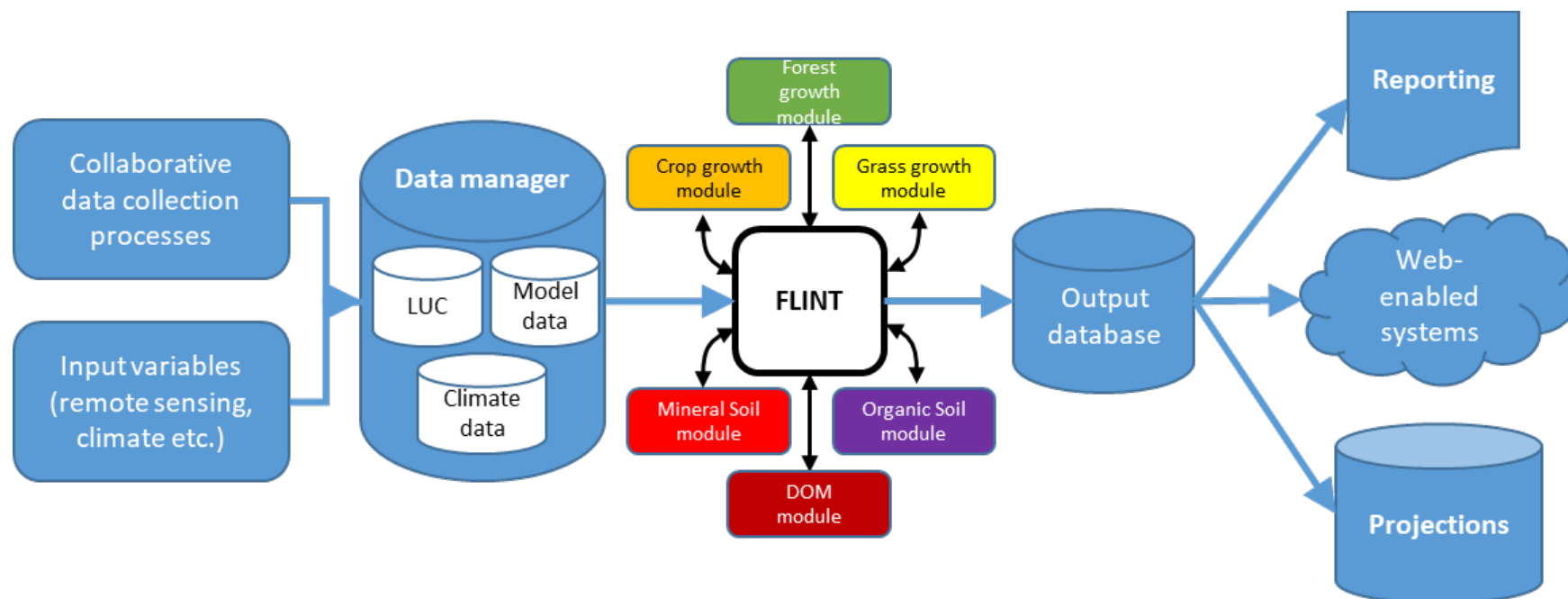
- Deforestation
- Forest Recover
- Harvests
- Fires

### CO<sub>2</sub>e fluxes

- FLFL
- OLOL
- OLFL
- FLOL
- Net CO<sub>2</sub>e

- Transition to generic integration tools for MRV systems and more...

## “Full Lands Integration Tool – FLINT”



- ✓ Cover all land uses and carbon pools
- ✓ Have projection capabilities and allow scenario testing
- ✓ Use existing country-specific data of varying completeness and quality
- ✓ Allow for continuous improvement
- ✓ Not be locked to a specific data set or method (e.g. spatially-explicit and spatially referenced, Tier 1, 2 &3)
- ✓ Support policies beyond GHG reporting



# Collaborators

**Canada:** Werner Kurz, Carolyn Smyth, Michael Magnan, Max Fellows

**United States:** Richard Birdsey, Alexa Dugan, Craig Wayson, Sean Healey, Grant Domke

**Mexico:** Marcela Olguin, Vanessa Mascorro, Armando Alanís, Enrique Serrano

**CEC:** Karen Richardson, Lucie Robidoux

## ***Submitted to Environmental Research Letters:***

- Olguin *et al.*, Applying a systems approach to assess carbon emission reductions from climate change mitigation in Mexico's forest sector
- Dugan *et al.*, A systems approach to assess climate change mitigation options in landscapes of the United States forest sector
- Smyth *et al.*, Climate change mitigation in Canada's forest sector: a spatially-explicit case study for two regions

***Technical Report submitted to CEC:*** Magnan et al., Carbon flows and stocks in North America's forest product sector





# Grazie mille



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