

From forest inventories to carbon balance at the plot scale

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Logging and carbon stocks

From field data to biomass

Evolution of AGB stocks

Modeling carbon fluxes

Carbon emissions

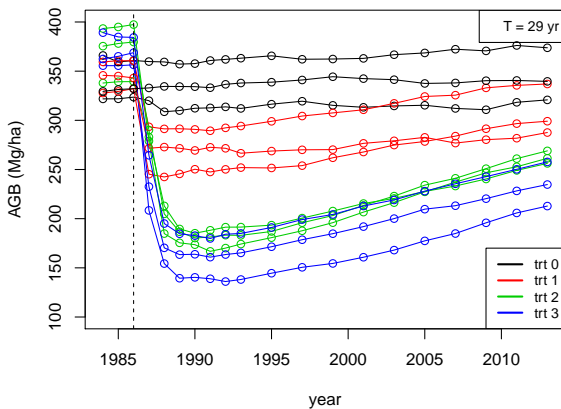
Carbon accumulation

Some results

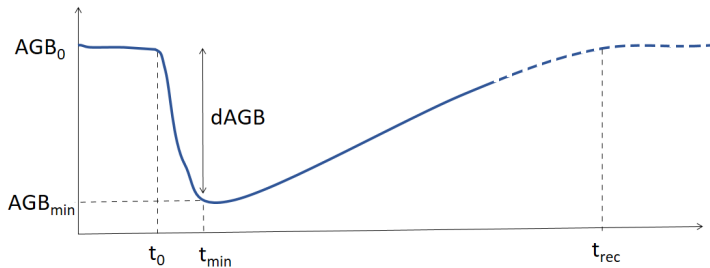
From DBH to biomass stocks

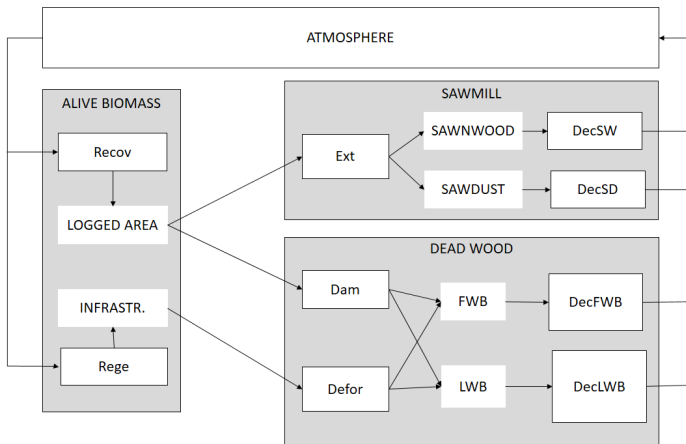
- ▶ All live trees :
 - ▶ DBH_i
 - ▶ (H_i)
 - ▶ botanical identification $\rightarrow WSG_i$
- ▶ Allometric equations $\rightarrow AGB_i$
- ▶ $AGB_{tot} = \sum AGB_i$

At the plot scale



Defining some variables





Uncertainty propagation

- ▶ Parameters = uncertain quantities
- ▶ Parameters distribution
- ▶ 1 iteration :
 - ▶ Take parameters in their distribution
 - ▶ Run the model
 - ▶ Stock the results
- ▶ Repeat n times
- ▶ Calculate statistics : mean, 95% confidence intervals

Logging and carbon stocks

Carbon emissions

Extracted biomass

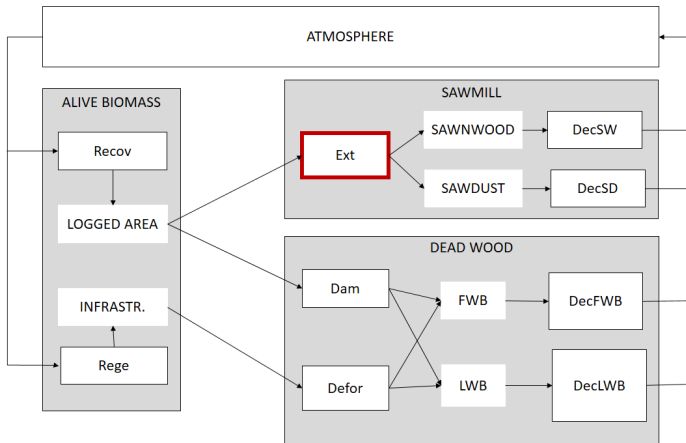
Damages

Infrastructure

Biomass decay

Carbon accumulation

Some results

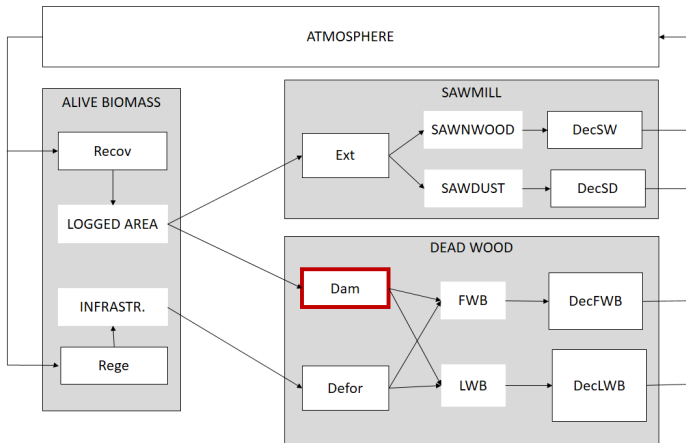


The fate of extracted logs

$$Ext_p = Vext_p \times dext \quad (1)$$

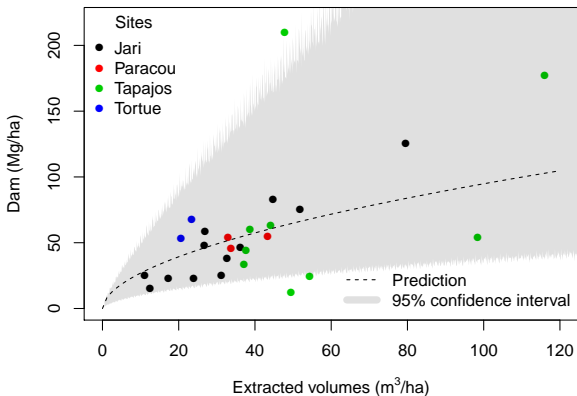
- ▶ Log transformation
 - ▶ 0.33 = Sawnwood
 - ▶ 0.67 = Sawdust

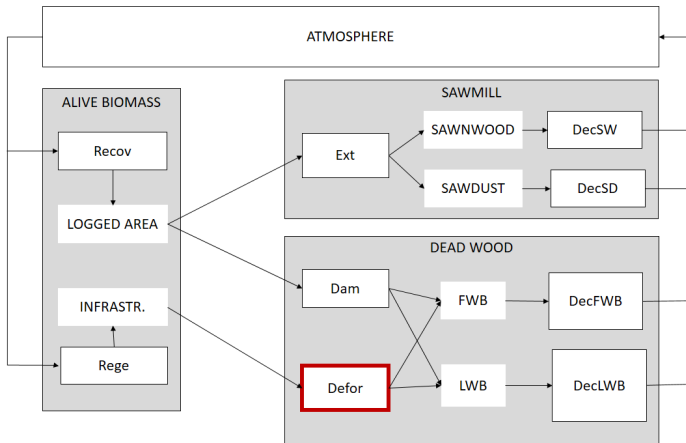
Keller et al. 2003



Biomass loss from damages

- ▶ $Dam_p = dAGB_p - Ext_p$
- ▶ $Dam_p = f(Vext_p)$



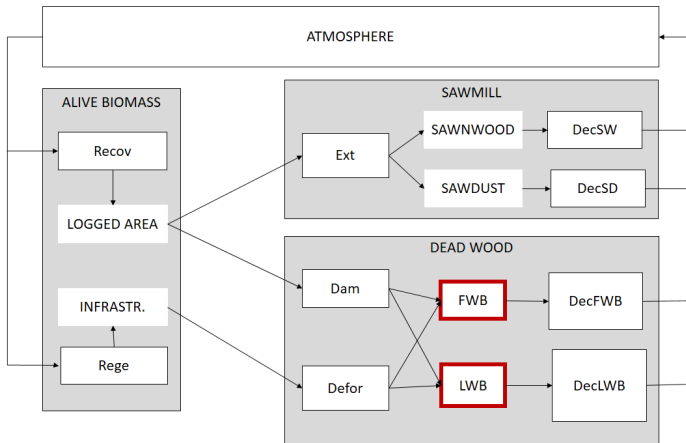


Biomass loss from infrastructure

- ▶ Deforested area = roads + skid trails (+ logging decks)

$$Defor_p = Sdef_p \times AGB0_p \quad (2)$$





Fine and Large Woody Biomass

- ▶ Large (or Coarse) Woody Biomass : diameter ≥ 10 cm

$$LWB_i = 0.774 + 0.0018 \times DBH_i \quad (3)$$

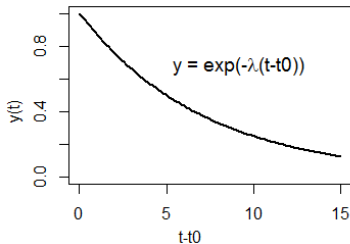
Chambers et al. 2004

$$f_{LWBp} = \frac{\sum_p LWB_i}{\sum_p AGB_i} \quad (4)$$

- ▶ Paracou : $f_{LWB} = 0.85$

Exponential decay

$$C(t - t_0) = C(t_0) \times \exp(-\lambda \times (t - t_0)) \quad (5)$$



Half-life time $t_{0.5}$: $y(t_{0.5}) = 0.5$

Parameters value

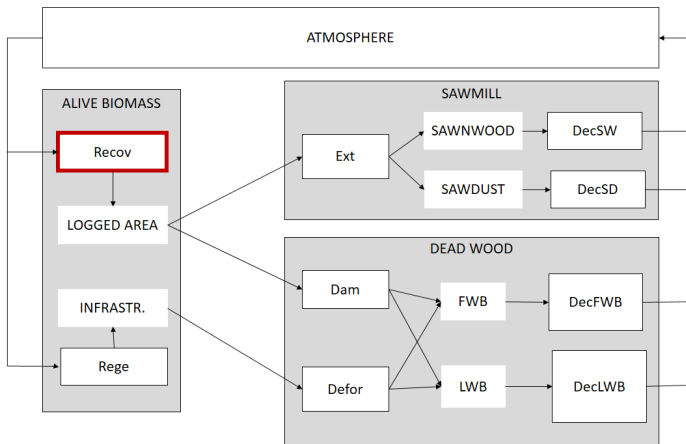
	λ	$t_{0.5}$	Source
Sawnwood	0.02	30	IPCC 2006
FWB	0.19	3.5	Chambers 2004
LWB	0.09	7.5	Paracou

Logging and carbon stocks

Carbon emissions

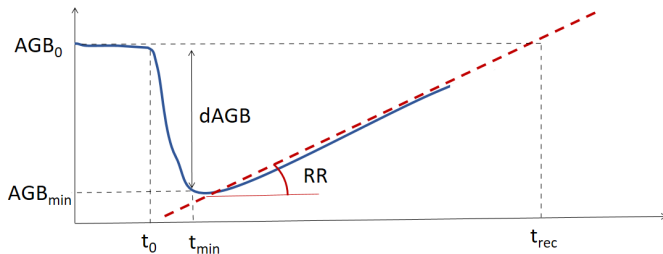
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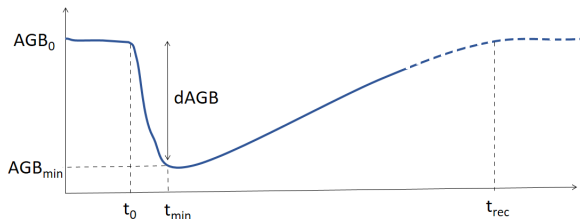
The hypothesis of a linear recovery

$$t_{rec} = t_{min} + \frac{dAGB}{RR}$$



The hypothesis of a linear recovery

$$Recov_t = \min \left(dAGB; (t - t_0) \times \frac{dAGB}{t_{rec}} \right)$$

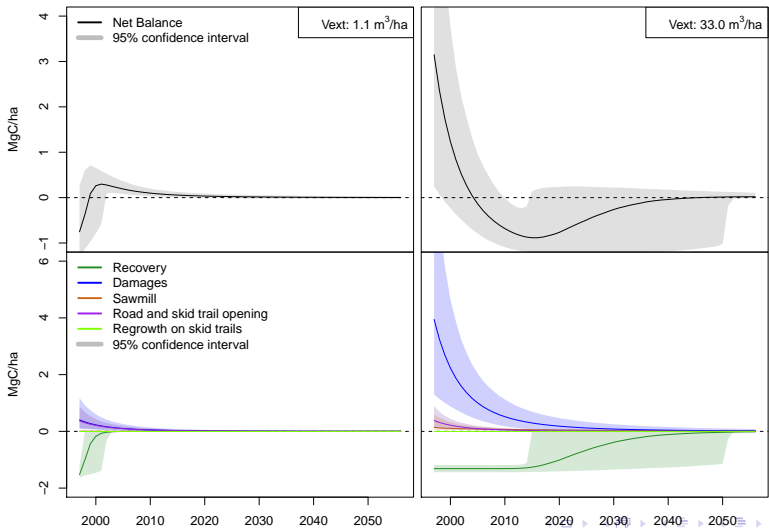


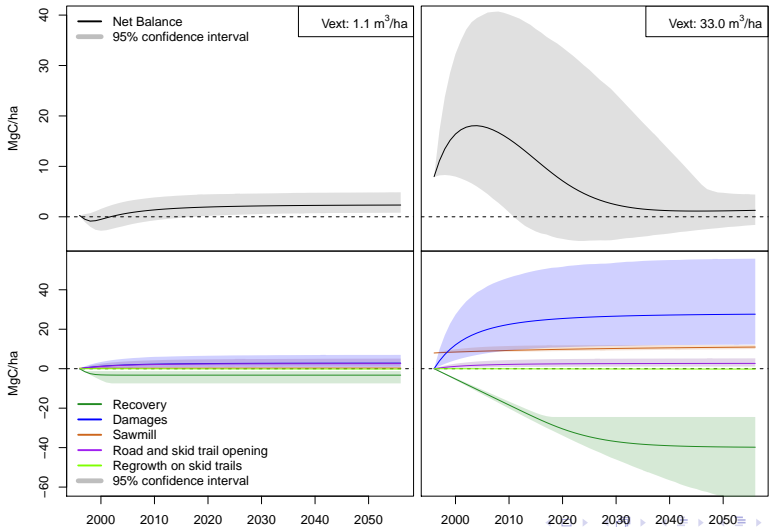
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Conclusion

- ▶ Field data \Rightarrow carbon fluxes at the plot scale
- ▶ Mechanistic model, conservative approach
- ▶ Carbon balance at the regional scale?