Biomass and carbon stocks of tropical African forests: synthesis and perspectives

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1. Context

Tropical forests contain **50 % of carbon stocks** (Pan *et al.* 2011). Deforestation and degradation of these forests contribute to **12 %** of annual global emissions (van der Werf *et al.* 2009).

The implementation of **REDD+** (Reducing Emissions from Deforestation and forest Degradation) depends on the estimation of the **biomass and carbon stocks** contained in tropical forests.

The aim of this study is to present the current state of knowledge on **the estimation of biomass and carbon stocks** contained in tropical African forests and to identify priorities for **future research**.
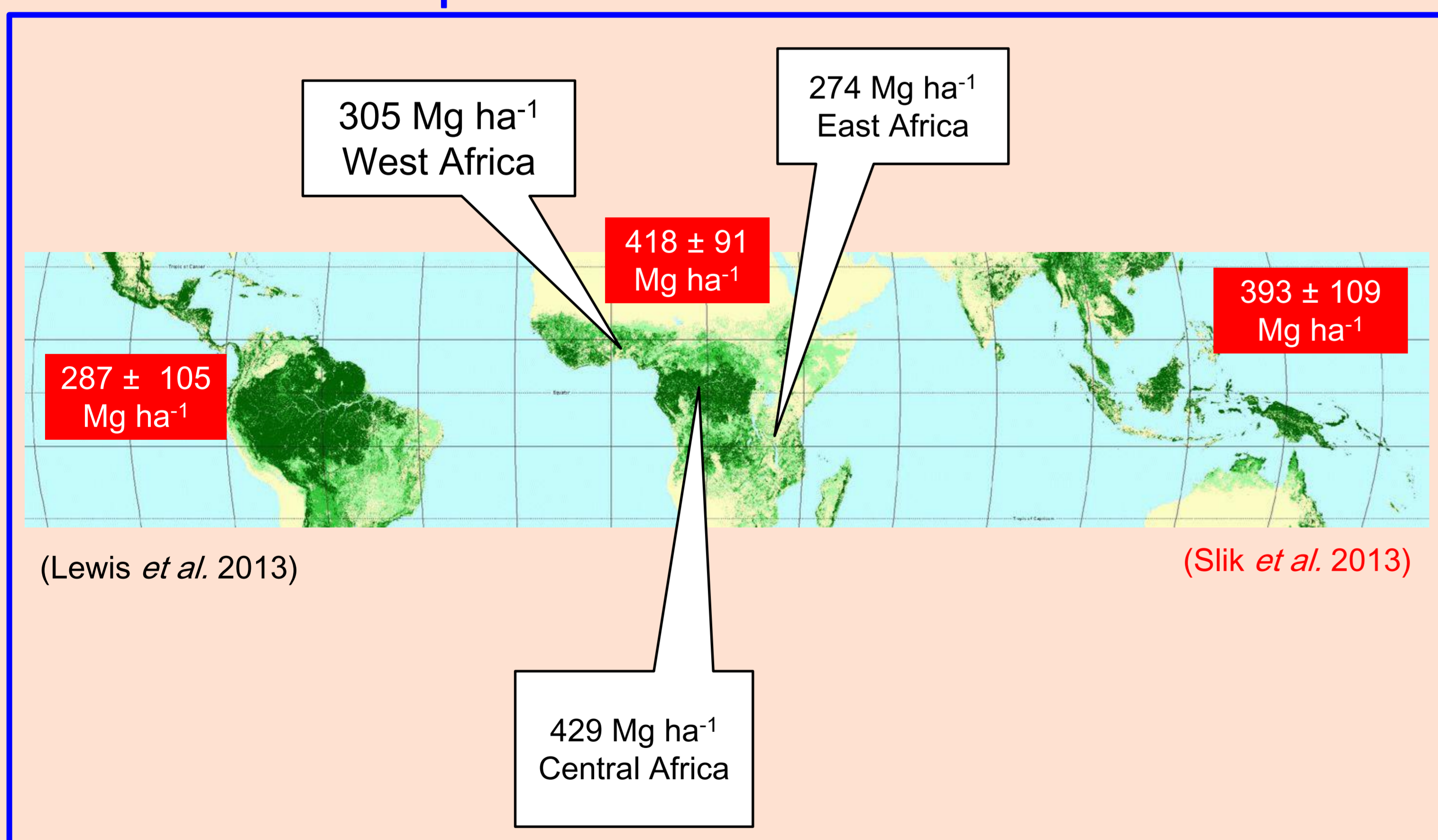
2. Methods to estimate biomass and carbon stocks

Remote sensing data

Stand level ~ mean (all plot) = 1 plot

Tree level

3 – Regional mapping

2 – Sum over trees $AGB_{plot} \sim \sum AGB_{tree}$

1 – Allometric eq. $AGB_{tree} \sim f(D,H,\rho)$

3. Biomass and carbon stocks in tropical African forests

▪ Tree level

Allometric equation

Pantropical
→ Without African data → Significant biases (**10 to 40 %**) in biomass
→ Including African data → A new pantropical model for **all types of forests** (Chave *et al.* 2014)

Local (5 studies)
→ 2 in Rainforests
→ 3 in Miombo woodlands
→ Biases (**24 to 72 %**) asssociated with the use of local allometric equations elsewhere

▪ Stand level

→ **Spatial variation of biomass**

305 Mg ha⁻¹ West Africa
274 Mg ha⁻¹ East Africa
418 ± 91 Mg ha⁻¹
287 ± 105 Mg ha⁻¹
393 ± 109 Mg ha⁻¹
429 Mg ha⁻¹ Central Africa
(Lewis *et al.* 2013)
(Slik *et al.* 2013)

→ Temporal variation of biomass

SOURCES
• selective logging 1-2 trees ha⁻¹ or 17 to 20 Mg ha⁻¹
• slash and burn agriculture

SINKS

• 12 years in the DRC
• Monodominant forests 1.1 Mg ha⁻¹ yr⁻¹
• Mixed forests 3 Mg ha⁻¹ yr⁻¹
(Makana *et al.* 2011)

(Lewis *et al.* 2009)

▪ Regional level

Baccini et al. (2012)
Strong biomass in DRC

Saatchi et al. (2011)
Strong biomass in GABON

Strong disagreement
There is no consensus on a regional biomass map

0   100   200   300   400   500 Mg ha⁻¹
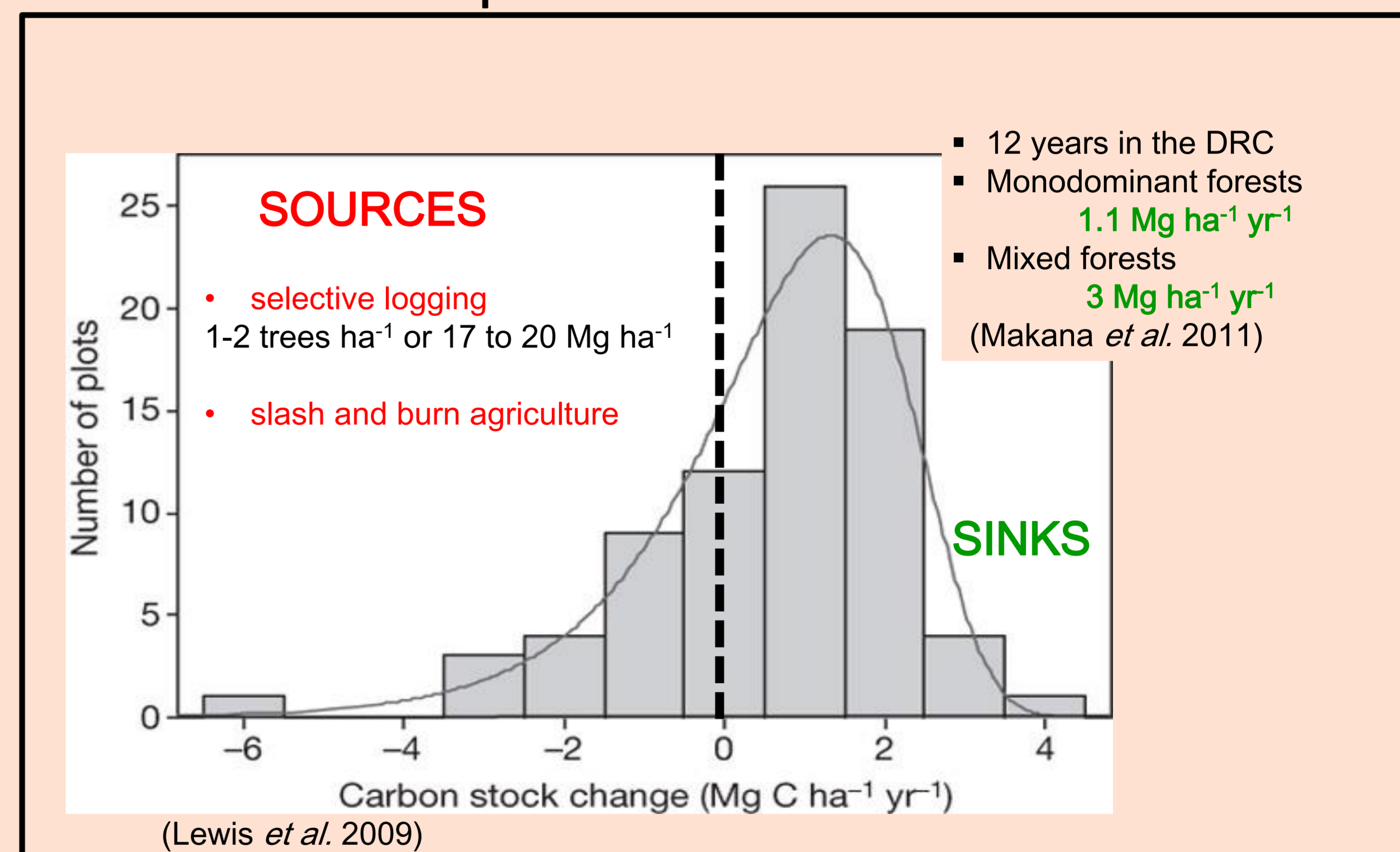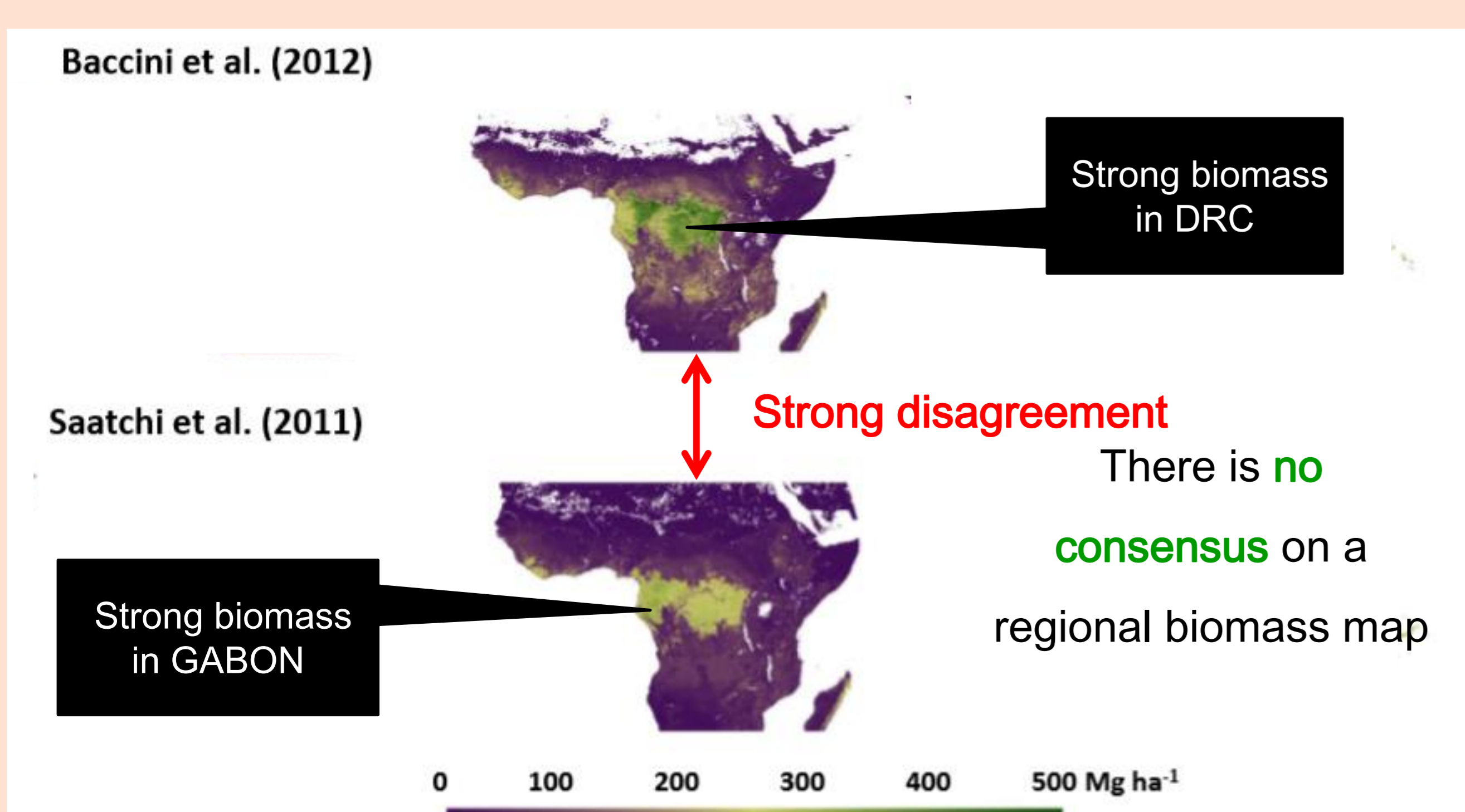
4. Conclusion and perspectives

• **UNCERTAINTIES** on biomass and carbon stocks in tropical African forests

→ Lack of both **forest inventory data** over large spatial scale and **appropriate allometric models**

• **NEED FOR REFERENCE SITES** (both allometry and forest inventory) to provide accurate biomass estimates for an effective implementation of the REDD +