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The guadua bamboo forests in the Coffee region of Colombia: beyond of carbon sequestration

Juan Carlos Camargo G.

WORLD BAMBOO CONGRESS
ANTWERP, BELGIUM APRIL 10-15, 2012

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Some reflections: From research and possibilities of bamboo to provide ecosystems services...

Ministerio de Ambiente Vivienda y Desarrollo Territorial

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Contents

1. Context and bamboo forests (guadua)

2. Bamboo forests and ecosystems services

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1. Context…

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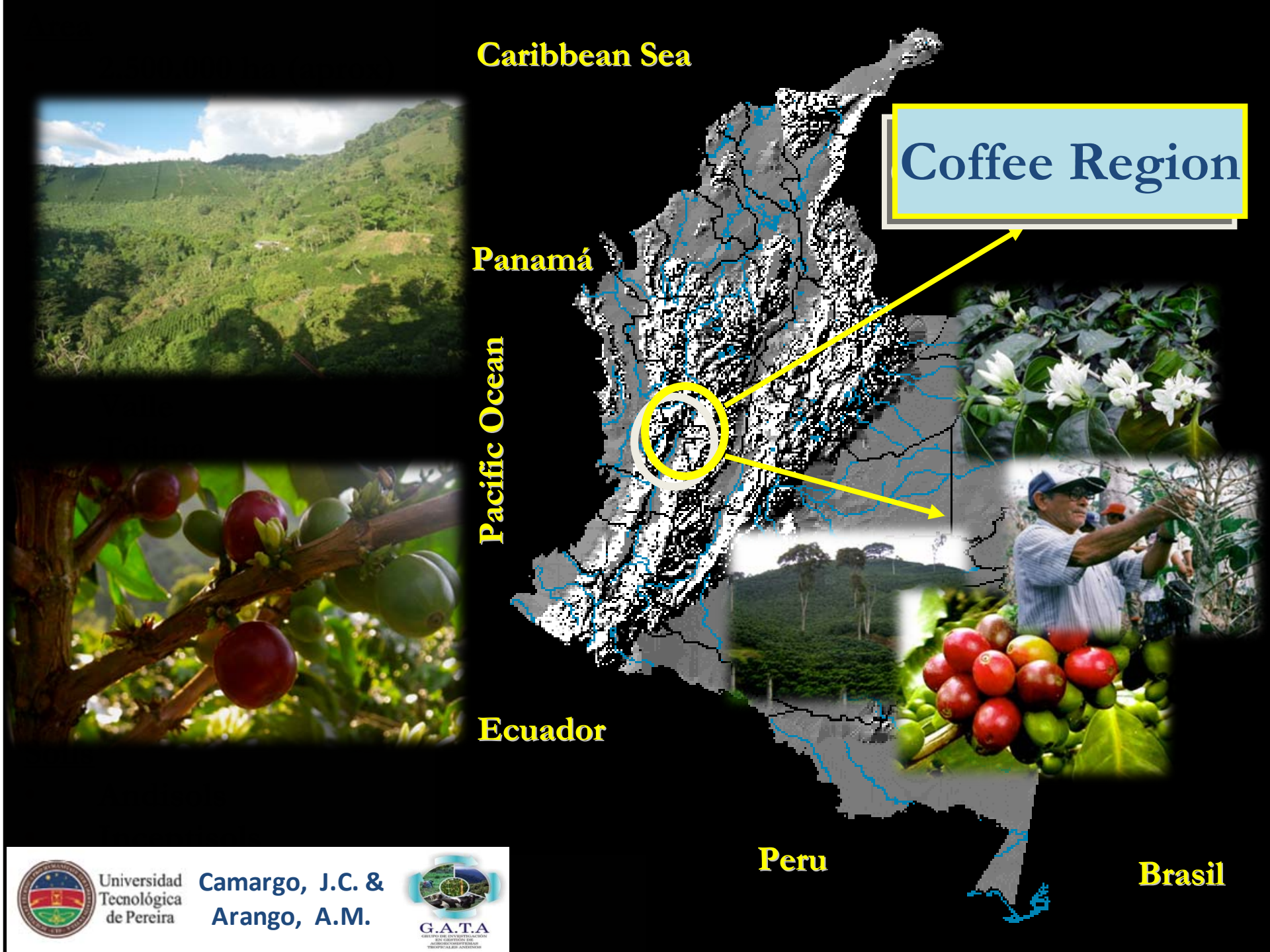

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The original forest cover was transformed by farmers, first to coffee plantations and thereafter to pastures (with negative consequences).

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Within a matrix of pastures the remnants of forest are dominated by the bamboo species *Guadua angustifolia*....

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Guadua angustifolia in the coffee region of Colombia

Distributed from 900 up to 2000 m

According to the last inventory 28000 ha (Kleinn & Morales 2006)

Mostly (97%) natural

Different in terms of structure and floristic composition (Ospina 2002, Camargo & Cardona 2005)

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Riparian forests...

Pattern highly fragmented:

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2. Guadua bamboo forests and ecosystems services

- Remnants of forests
- Fragmented
- Riparian

Contribute to enhance their value

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Soil protection

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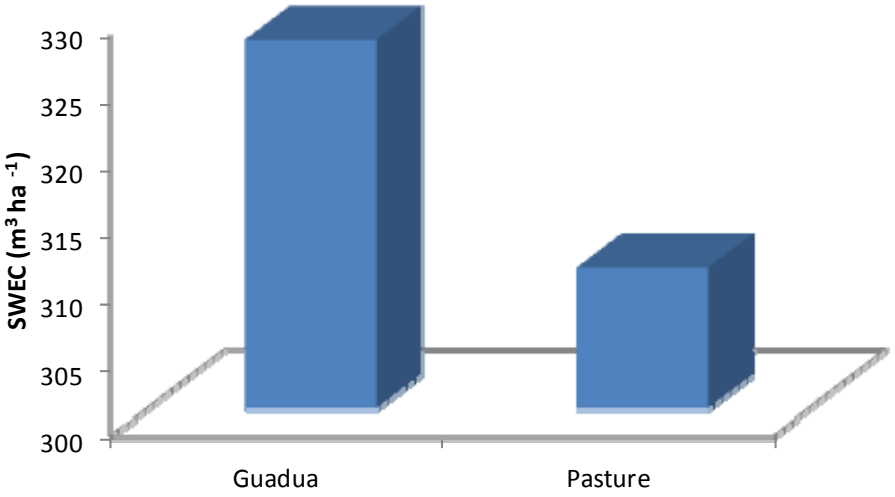

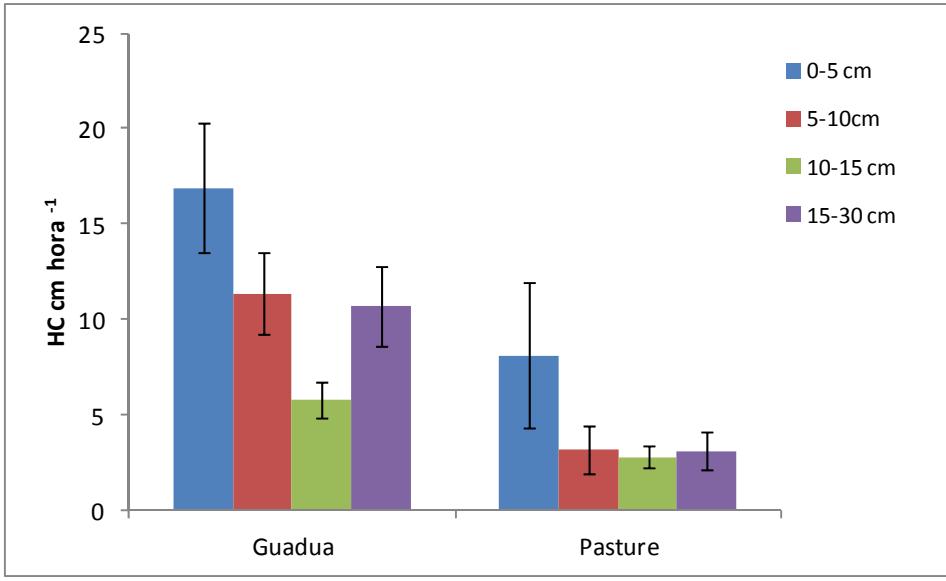

A) **B)**

Soil water storage capacity (m^3 ha^{-1}) A) and Hydraulic conductivity (cm $hour^{-1}$) B) of soils under guadua bamboo forests and pastures. Coffee region of Colombia

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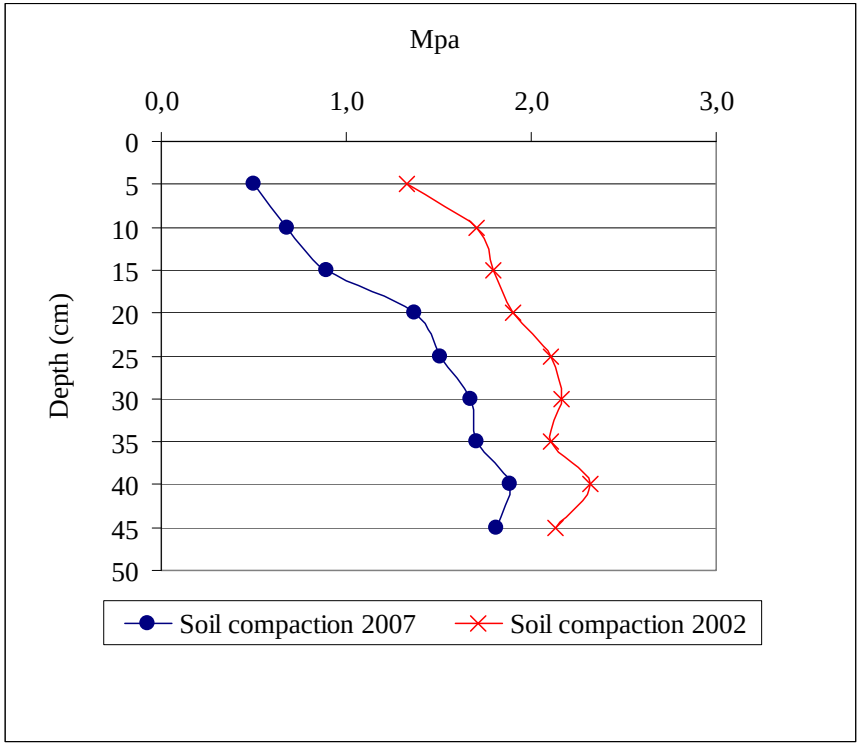

Changes in soil compaction after planting guadua. Coffee region of Colombia

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Biodiversity conservation...

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Biodiversity values registered within guadua bamboo forests

Organisms	Number of species	Source	Observations
Vegetation	63	Ospina (2002)	Dbh > 10 cm
Vegetation	182	Ospina (2002)	Dbh < 10 cm
Birds	69	Fajardo et al. (2009)	
Bats	5	Perez et al. (2009)	

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About 70% of plants biodiversity in this area is confined within guadua bamboo patches .

Organisms fulfil ecological functions and provide benefits to surrounding agroecosystems.

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Contribution to the ecological restoration

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3. Bamboo and carbon sequestration:

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may bamboo really contribute to mitigate climate change?

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Species	Culms ha^{-1}	C t ha^{-1}	Reference
Guadua angustifolia	11827	20,9 (7 años)	Camargo 2012
Bambusa oldhammi	10101	51,98* (7 años)	Castañeda-Mendoza *et al*. 2005
Phyllostachys heterocycla		40.6*	Tian-Ming y Joou-Shian. 2011
Phyllostachys heterocycla		9,9 - 34.16*	Xiaojun X. *et al.* 2011
Phyllostachys heterocycla var. pubescens)		37,1	Huaqiang, *et al.* 2011
Phyllostachys pubescens	3300	3,1** (10 años)	Lou *et al*. 2010
Phyllostachys pubescens		91*(5-8 años)	Isagi *et al*. 1997
Bambusa bambos		149* (6 años)	Shanmughavel *et al.* , 2002

C = carbon * = Above ground carbon ; ** = Average of net anual carbon ; age in parentheses

"The answer is yes"

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However that's not enough :

As bamboo culms die after 10 or 12 years (*G. anstutifolia*) and consequently decay.

CO_2 - Products- Durability

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Beyond of the bamboo capacity to fix CO_2, there is an economical interest...

- CDM
- VCS
- REDD+

- Standards
- Approaches
- Good estimates

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Critical factors of biomass estimates

- Species
- Growth pattern
- Density (culms per ha)
- Maturity or age (plantation vs. natural)
- Losses
- Approaches

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Growth pattern...

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Consequences:

- Mensuration should be adjusted in inventories
- Expression of growth and productivity should be modified
- Specific models and factors should be developed

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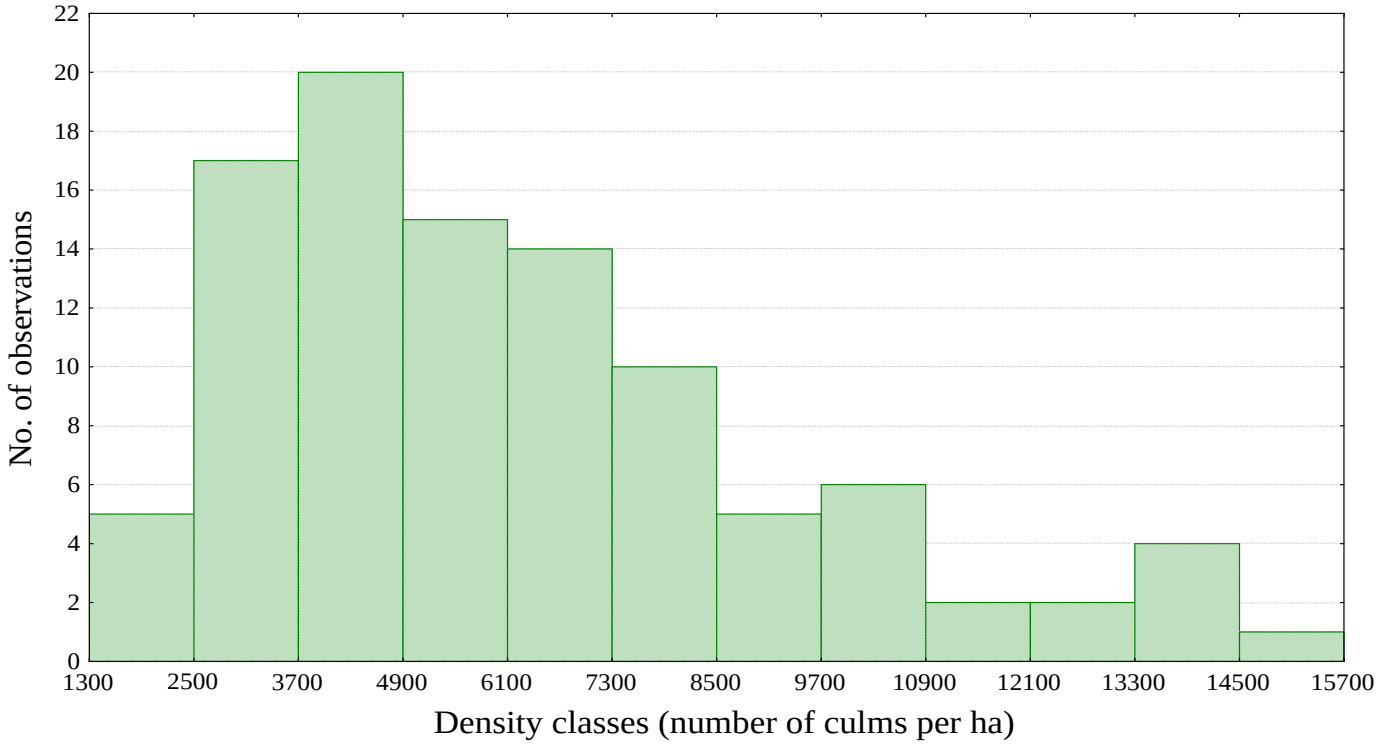
Density of culms per ha



Distribution of stand density of sampled field plots. *G. angustifolia* inventory coffee region of Colombia.

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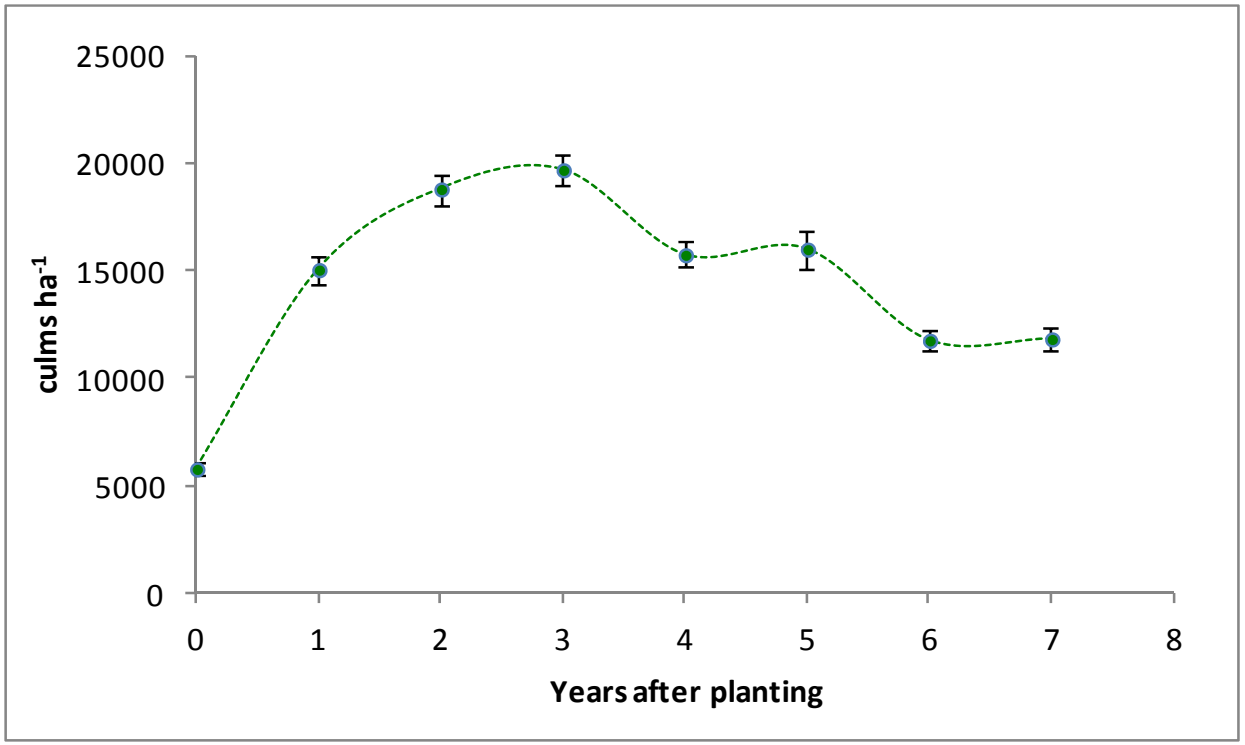
Density of culms per ha



Culms per ha within a plantation of *G. angustifolia*. Coffee region of Colombia.

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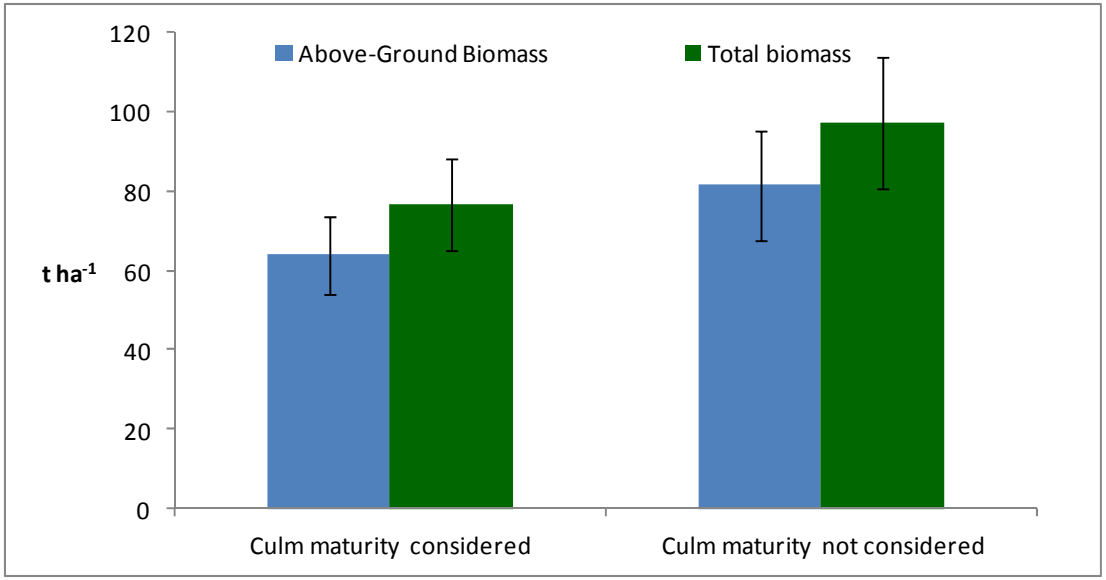
Maturity of culms:



Total and above-ground biomass of a *G. angustifolia*. Plantation . Coffee region of Colombia.

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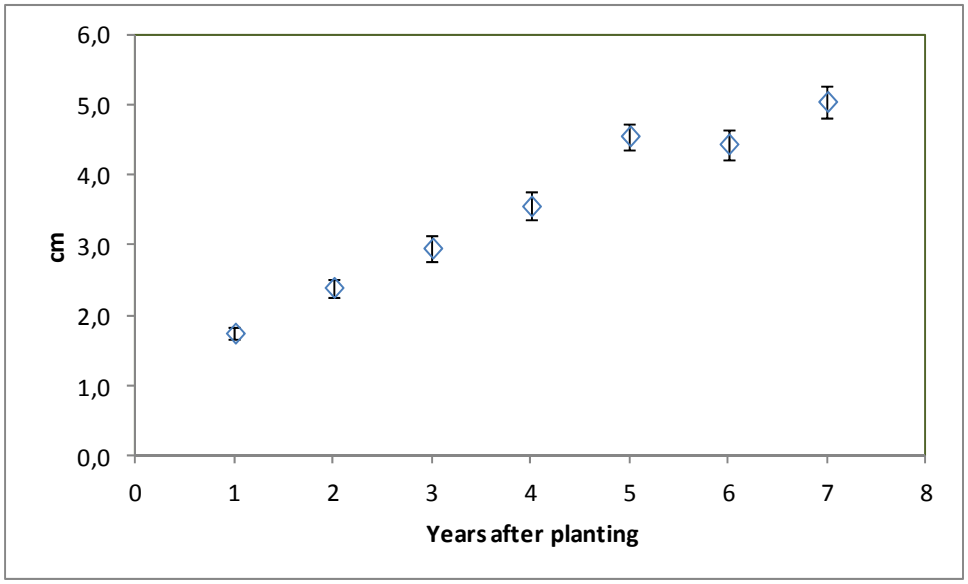
Age (plantation vs natural):



Year	Basal diameter	% of Total
1	1,7	62
2	2,4	20
3	3,0	5
4	3,6	12
5	4,6	2
6	4,4	43
7	5,0	1

Average basal diameter of new and largest culms of *G. angustifolia* plantation . Coffee region of Colombia.

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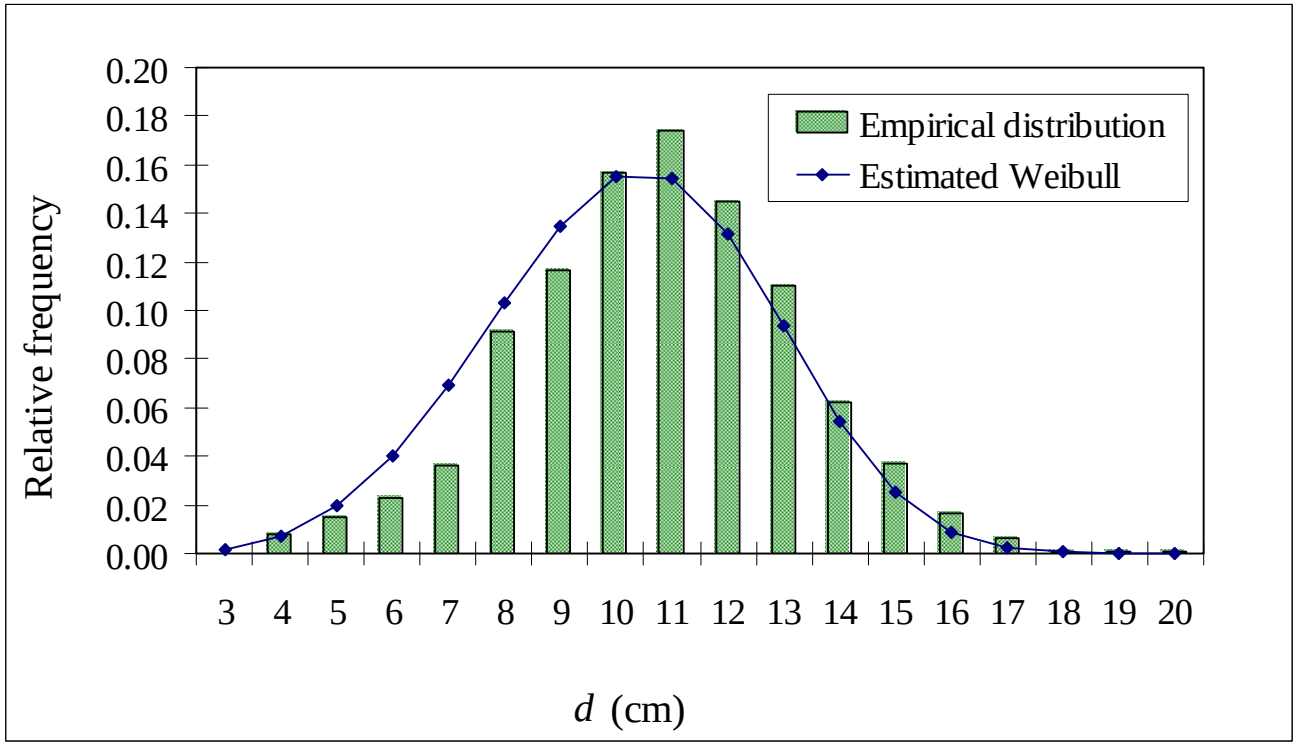
Age (plantation vs. natural):



Diameter distribution for the total number of sampled culms. The empirical distribution and the fitted Weibull function (*n*=6242). *G. angustifolia.* Natural stands coffee region of Colombia

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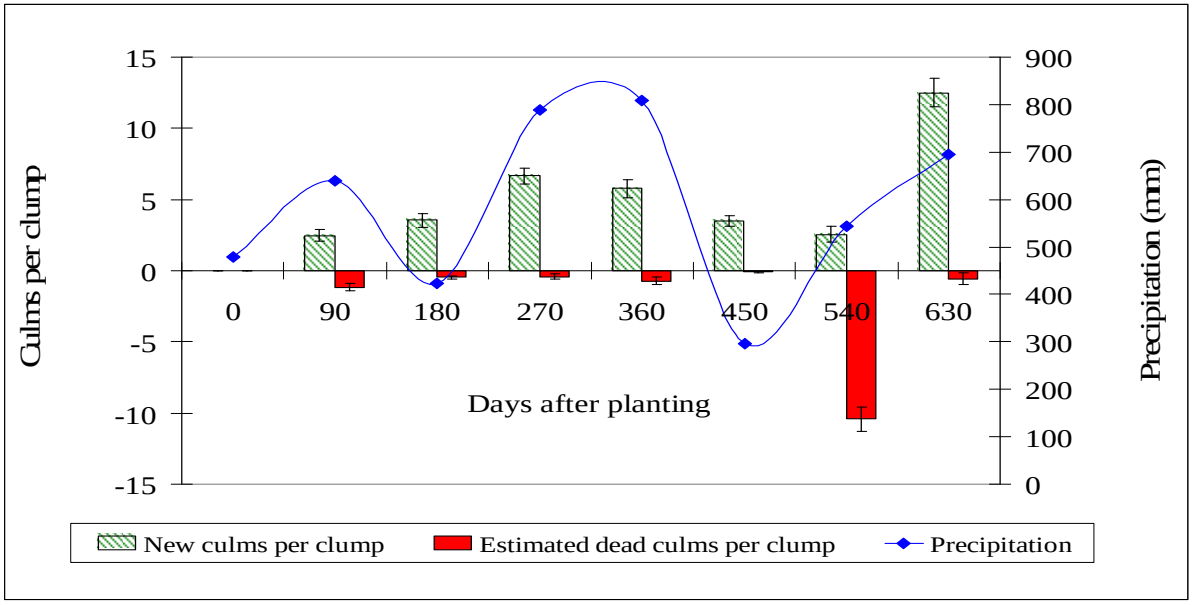
Losses:



New (shoots) and estimated dead culms per clump over time, compared accumulated precipitation (mm) during the time prior to data gathering. Vertical bars indicate the standard error

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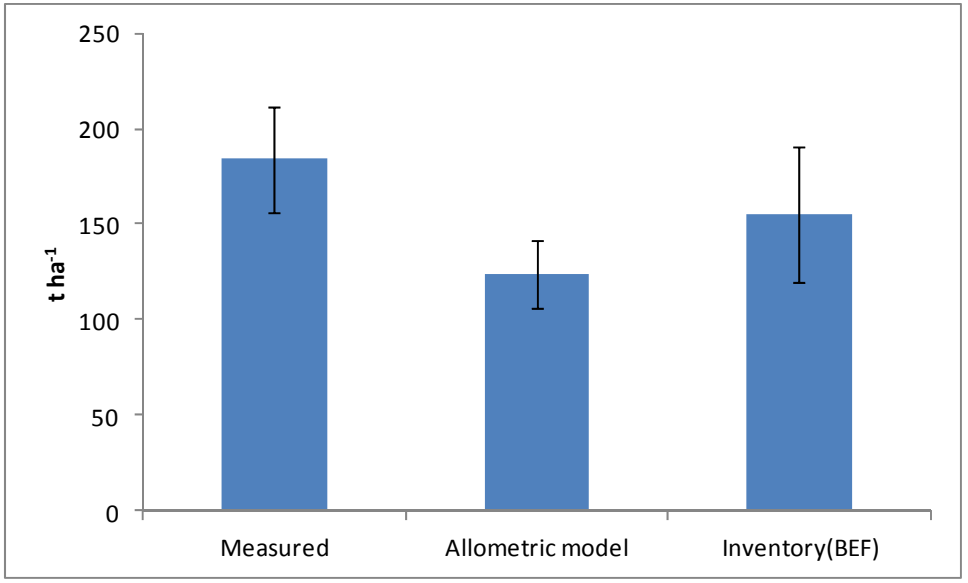
Approaches

Remote sensing images...



Biomass t ha^{-1} of natural bamboo forests estimated by difference approaches: From destructive samples, fitting allometric model and BEF (volume, wood density).

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In the framework of REDD+: Forest degradation and deforestation should be demonstrated:

Pressure from nearby land uses?

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Urban expansion

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Degradation associated with management?

Harvest is done on selected culms (low scale)

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Opportunities from forest governance and forest planning

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Forest Governance

Forest Certification

Experiences with Local governments

Proper Management

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4. Final considerations

• Good estimates = good information= better decisions

• Guadua forests are more than carbon: other ecosystems services, products.

• Guadua products are the key for maintaining carbon stored (stable)

•The so called here: critical factors on bamboo carbon estimates, should be studied and analysed. Research should be addressed to these topics.

• Forest planning and forest governance can contribute with REDD initiatives.

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Thanks¡

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