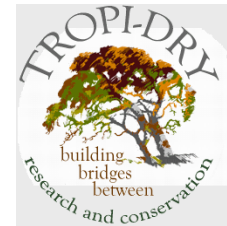


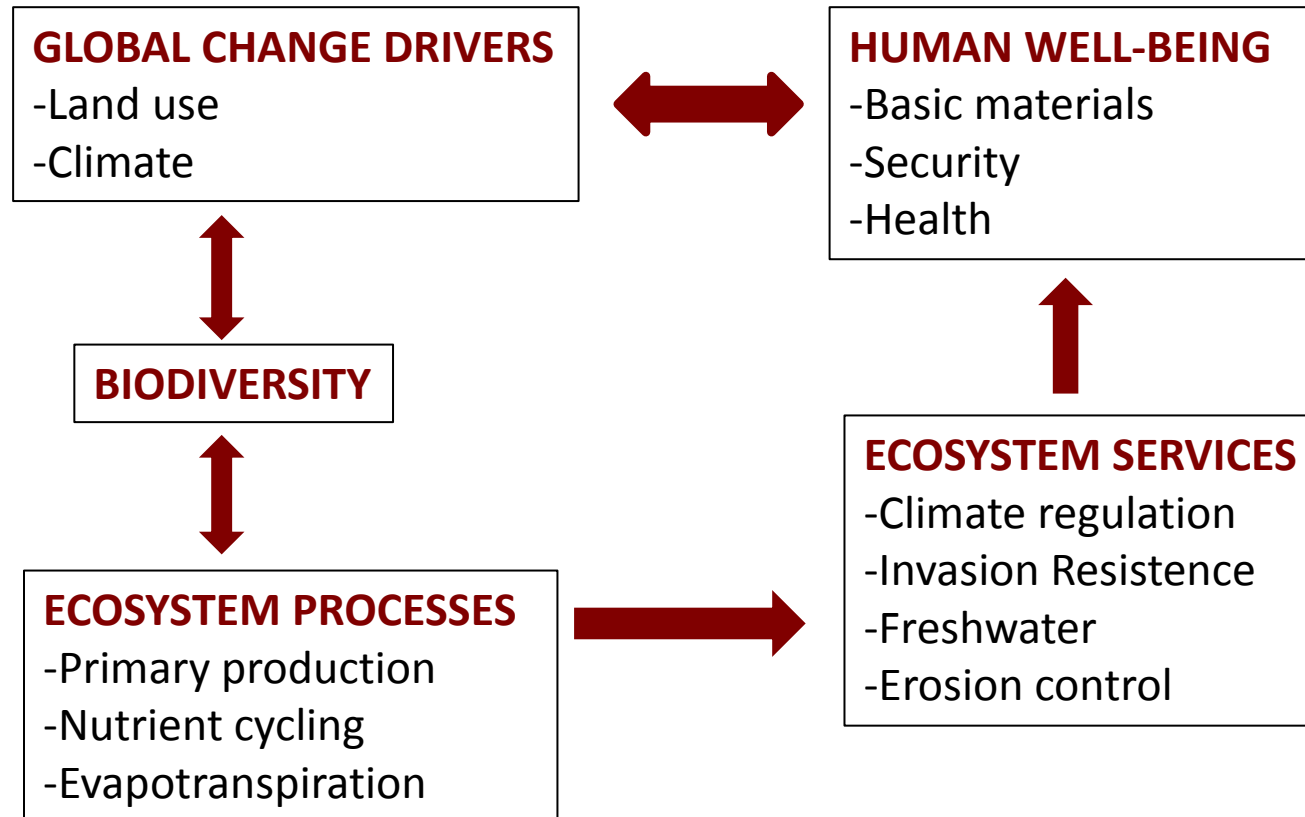


# Role of biodiversity for high carbon ecosystems

Sandra M. Durán. PhD Candidate  
Dr. Arturo Sánchez-Azofeifa  
University of Alberta, Edmonton, Canada  
[sduran@ualberta.ca](mailto:sduran@ualberta.ca)

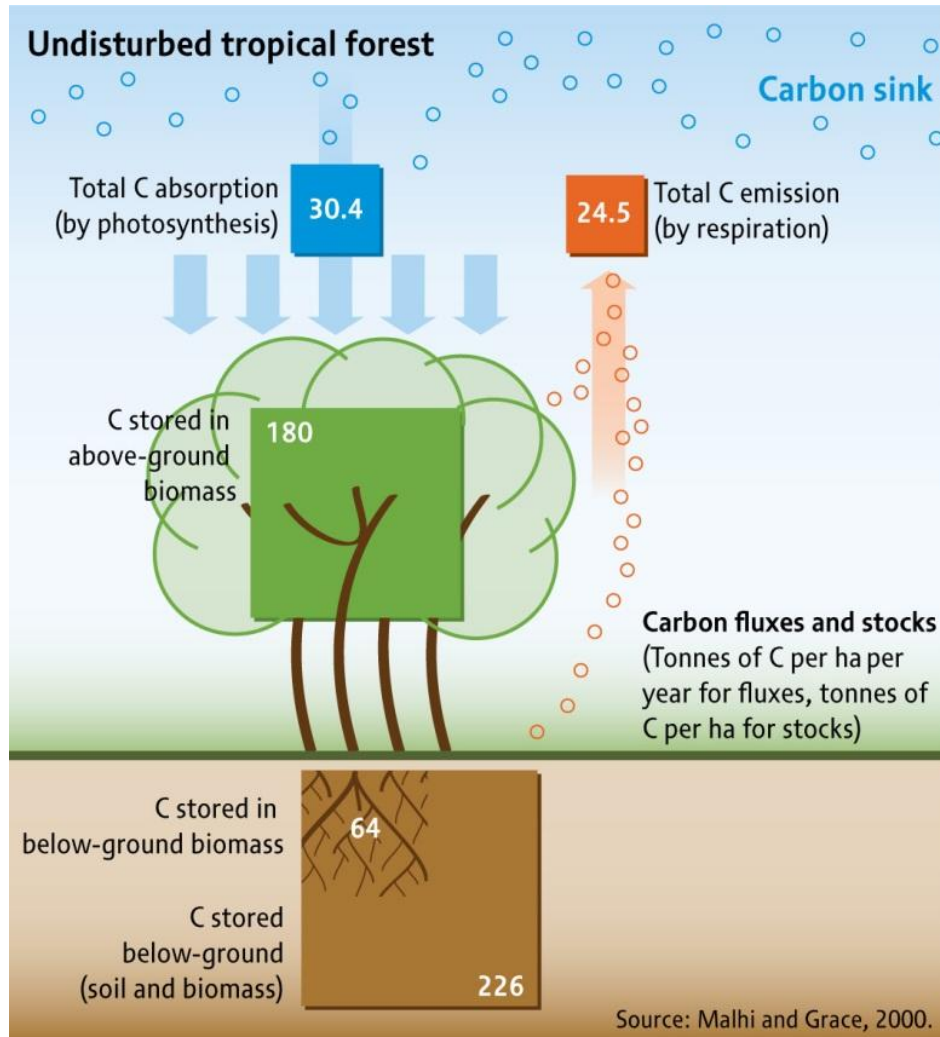


# Biodiversity as a response variable



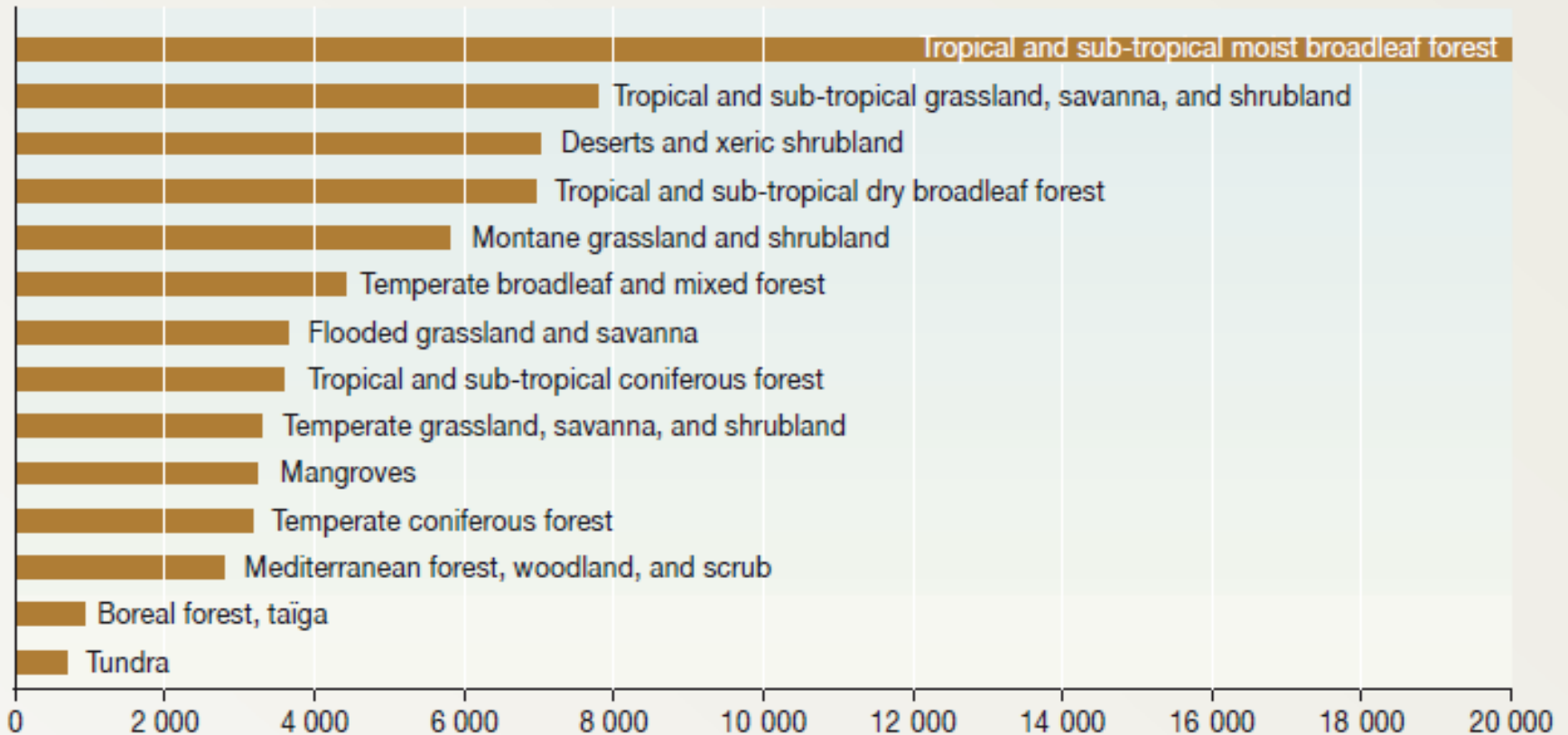
Adapted from MEA 2005; Díaz et al. 2005. *PLoS Biol* 4 (8)

# Climate regulation: net carbon sequestration



Changes in biodiversity influence carbon gain and loss in tropical ecosystems

# Animal species richness per biome



Source: MA 2005.

# Role of biodiversity

- ❑ Different components of biodiversity are important for carbon storage
- ❑ Biodiversity components explain greater variation in carbon stocks than climate
- ❑ Biodiversity can have positive and negative effects on carbon storage
- ❑ Biodiversity-carbon links vary across ecosystem types

# How we define biodiversity?

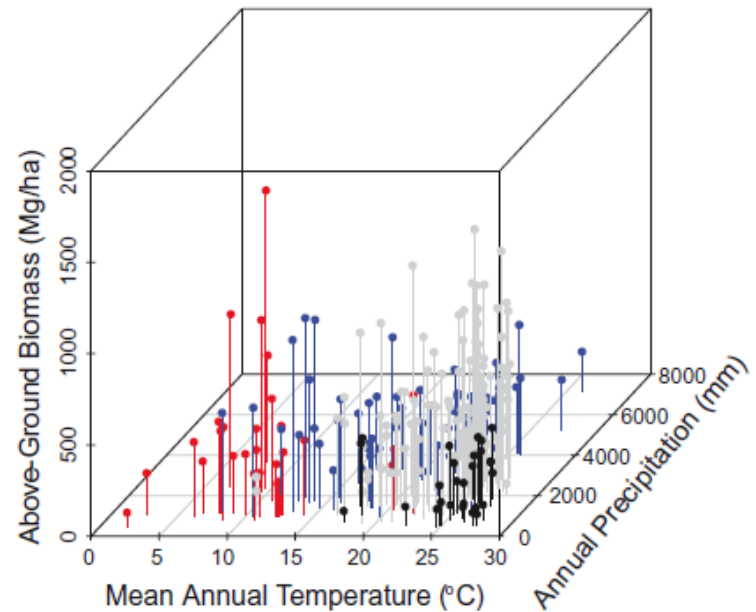
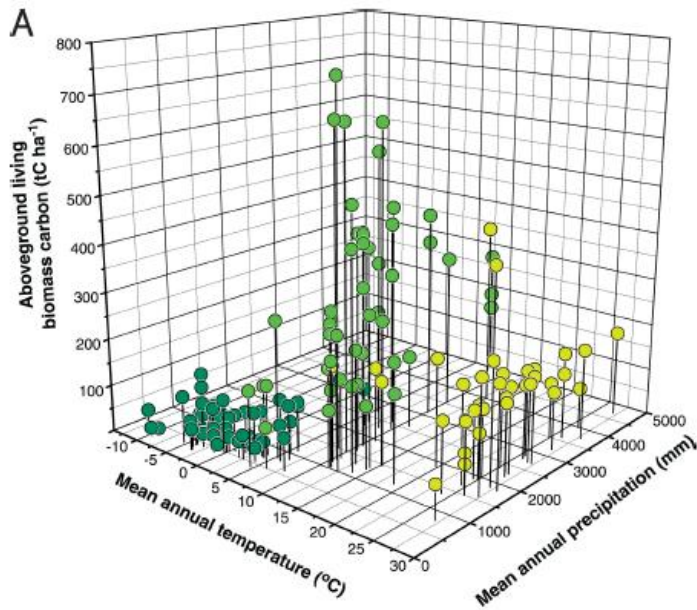
- the number, **abundance**, composition, spatial distribution, and interactions of genotypes, populations, **species richness**, **functional types** and **traits**, and landscape units in a given system

Díaz et al. 2006. *PLoS Biol* 4:1300.

# What do we know?

## Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests

Heather Keith<sup>1</sup>, Brendan G. Mackey, and David B. Lindenmayer



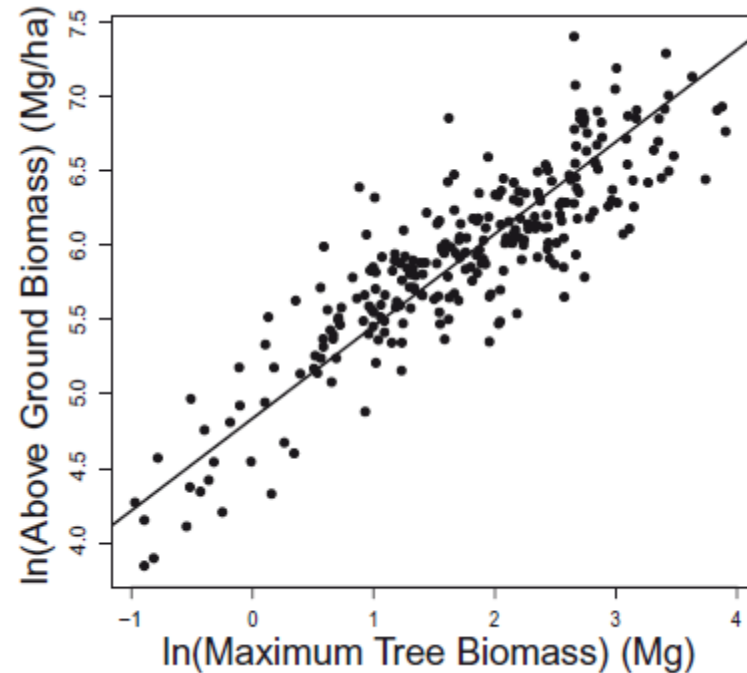
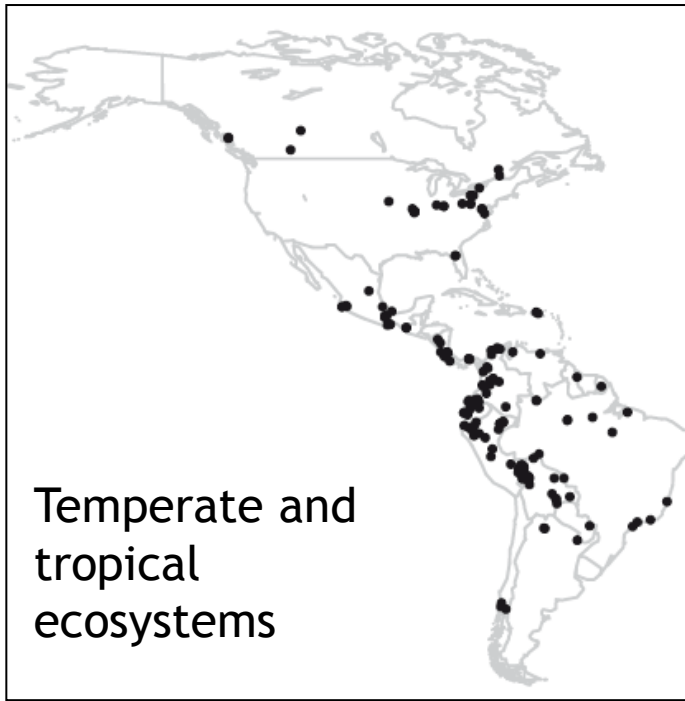
## Variation in above-ground forest biomass across broad climatic gradients

PNAS | July 14, 2009 | vol. 106 | no. 28 | 11635–11640

J. C. Stegen *et al.* *Global Ecology and Biogeography*, (*Global Ecol. Biogeogr.*) (2011) 20, 744–754

# Biodiversity component: Positive effects of abundance on carbon

Variation in above-ground forest biomass across broad climatic gradients



**Maximum individual biomass > 70%**

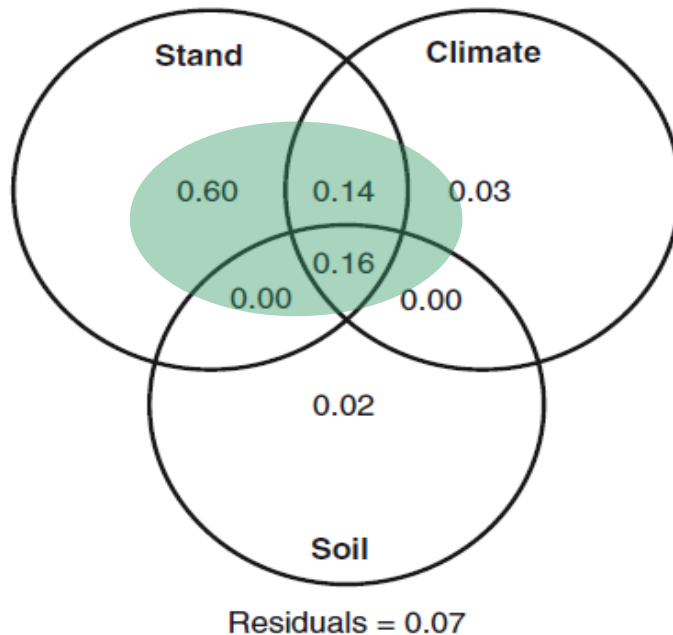


# Biodiversity component: Positive effects of abundance and functional traits

Disentangling stand and environmental correlates of aboveground biomass in Amazonian forests

Evergreen ecosystems

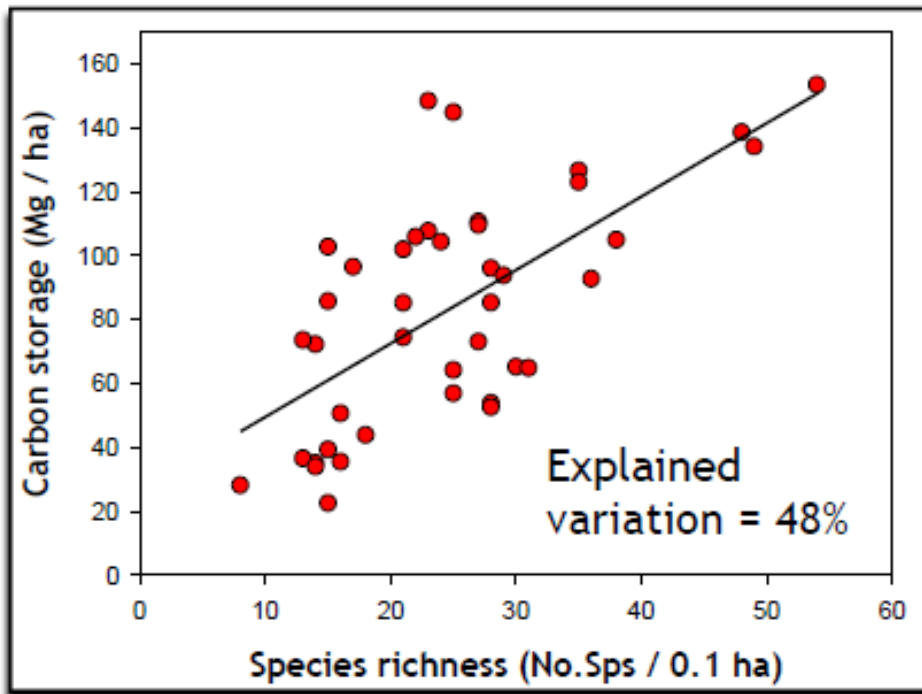
Proportion of explained variation



**Functional traits include**

- wood density
- Plant height

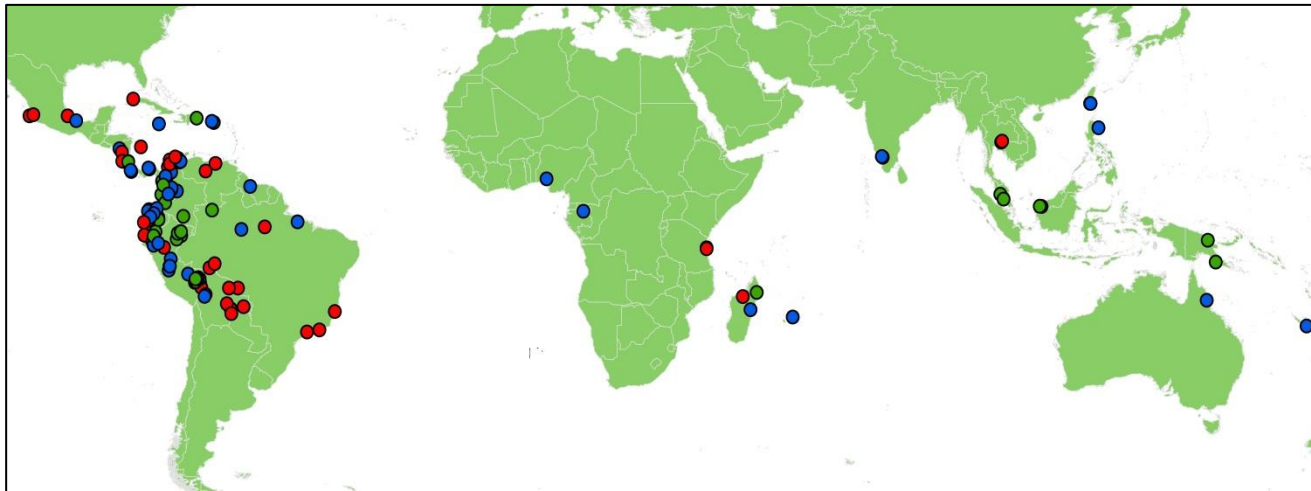
# Biodiversity component: Positive effects of species richness



**Carbon stocks in mature savannas**



# Biodiversity component: Functional types: lianas



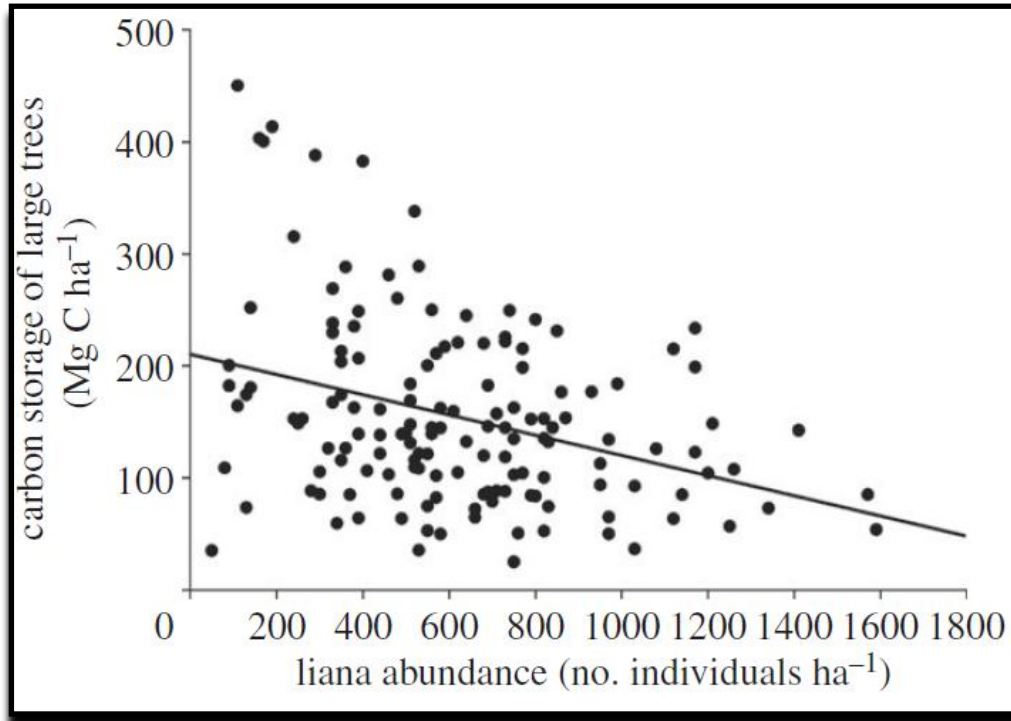
## Ecosystems

- Deciduous
- Semideciduous
- Evergreen



- 40% of woody stems
- Up to 25 % of species richness

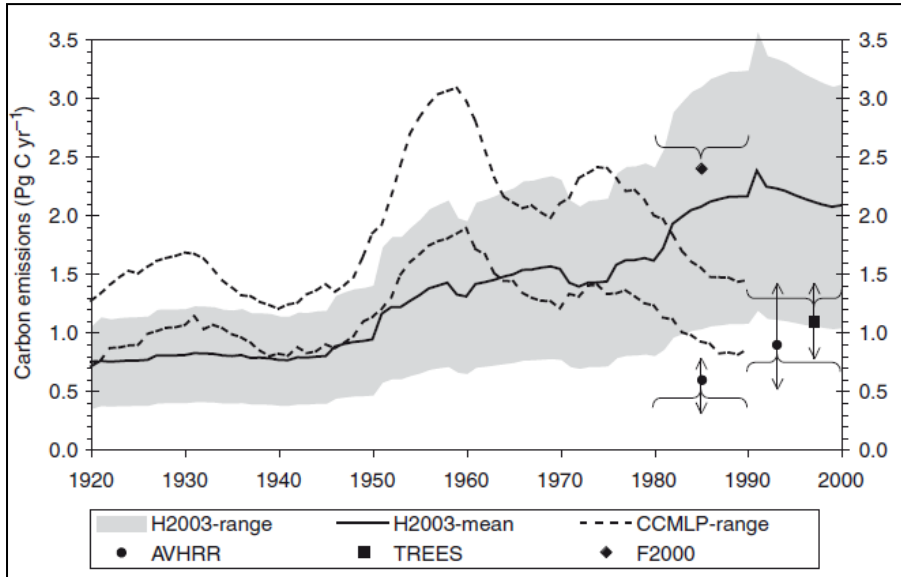
# Carbon stocks decrease with liana abundance



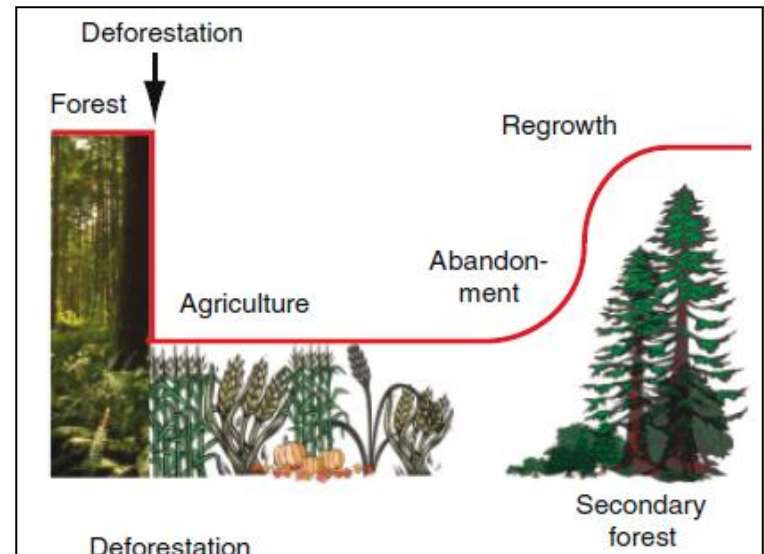
- Explained variation 11% as much as temperature
- lianas could reduce carbon stocks by up to 50%

Durán & Gianoli 2013. *Biol Lett* 9:20130301.

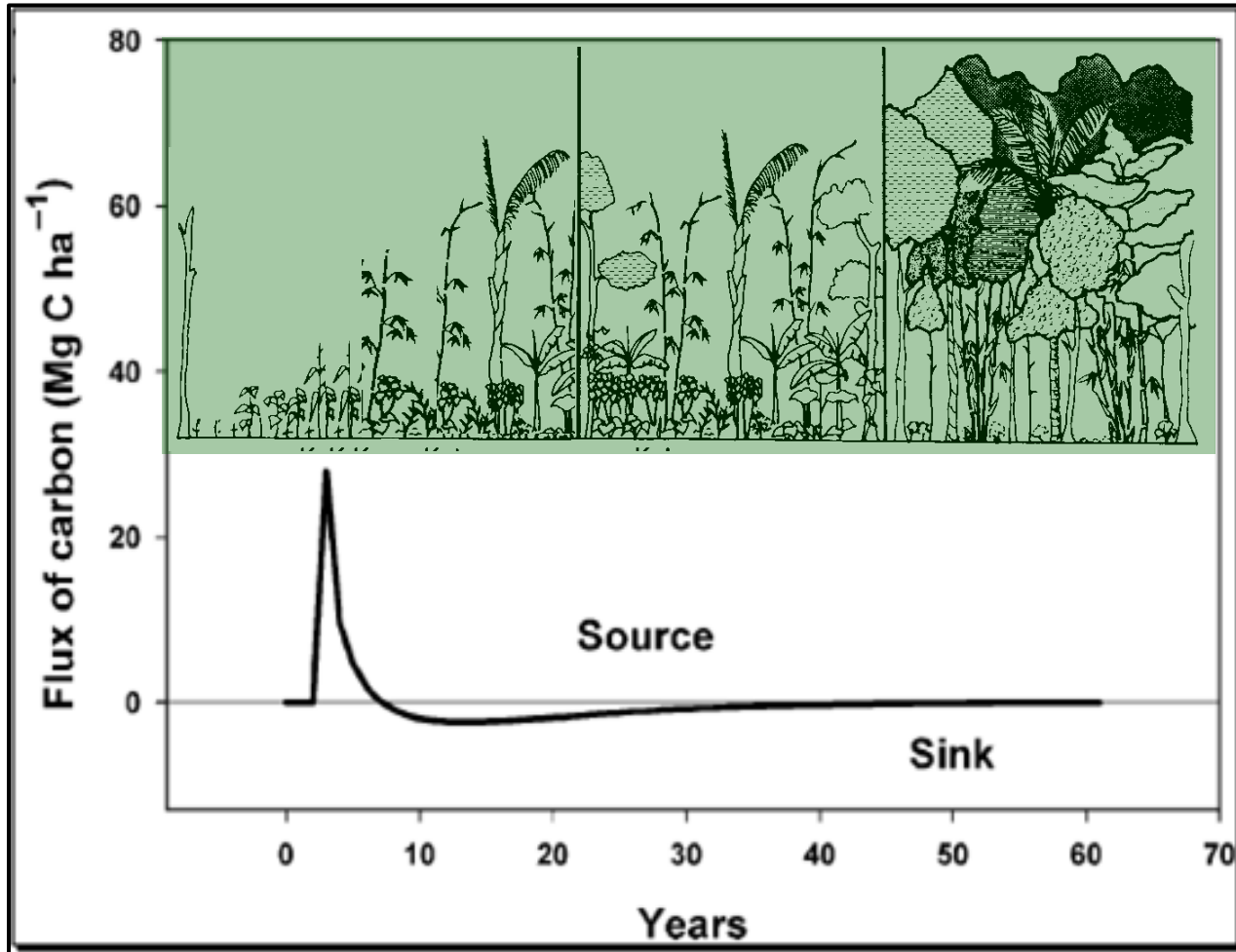
# Carbon emission from deforestation



Ramankutty et al. 2006. Global Change Biol 13: 51-66



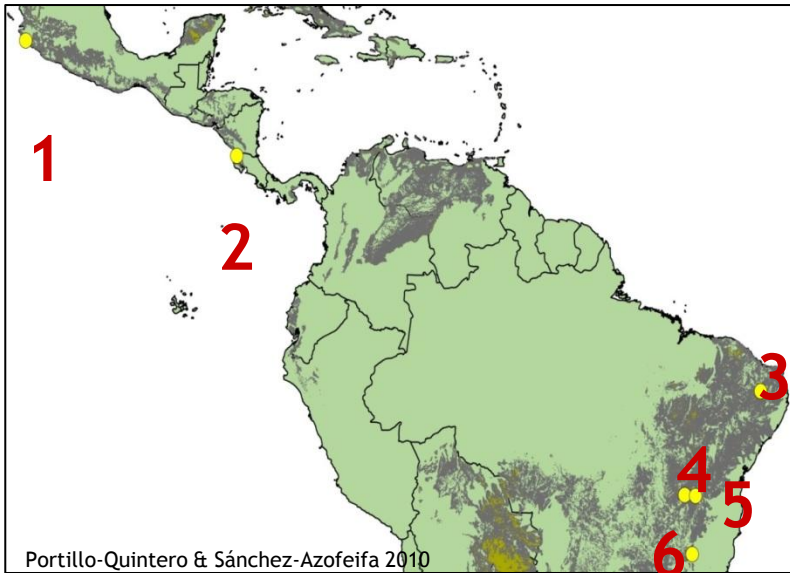
# Secondary growth



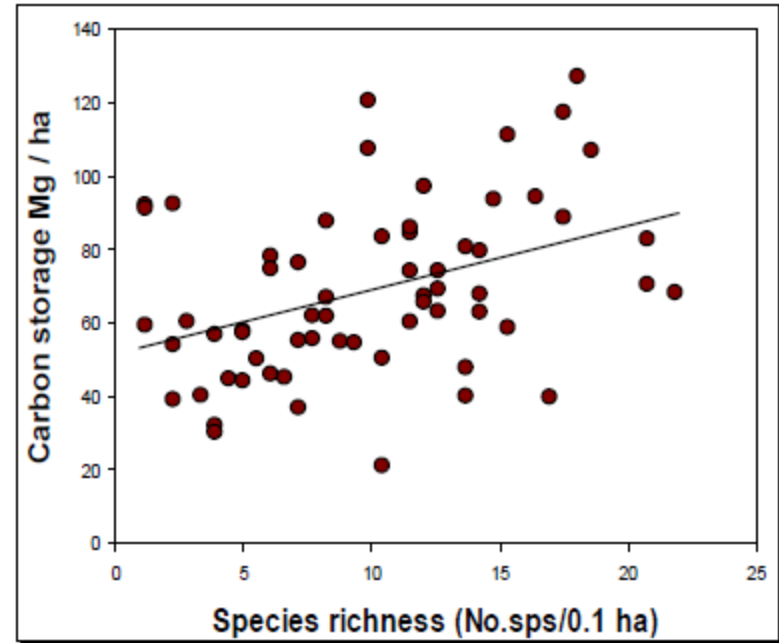
[http://www.cd3wd.com/cd3wd\\_40](http://www.cd3wd.com/cd3wd_40) (green square)

Houghton 2005. *Global Change Biol* 11:945 (figure)

# Biodiversity component: Positive effects of species richness



**Regrowth vegetation in  
savannas & caatinga**



Explained variation = 15% after  
controlling for stand age and climate

# Biodiversity component: Positive effects of species richness



**Early (~ 11 years)**



**Intermediate ~  
31 years**



**Late > 50 years**

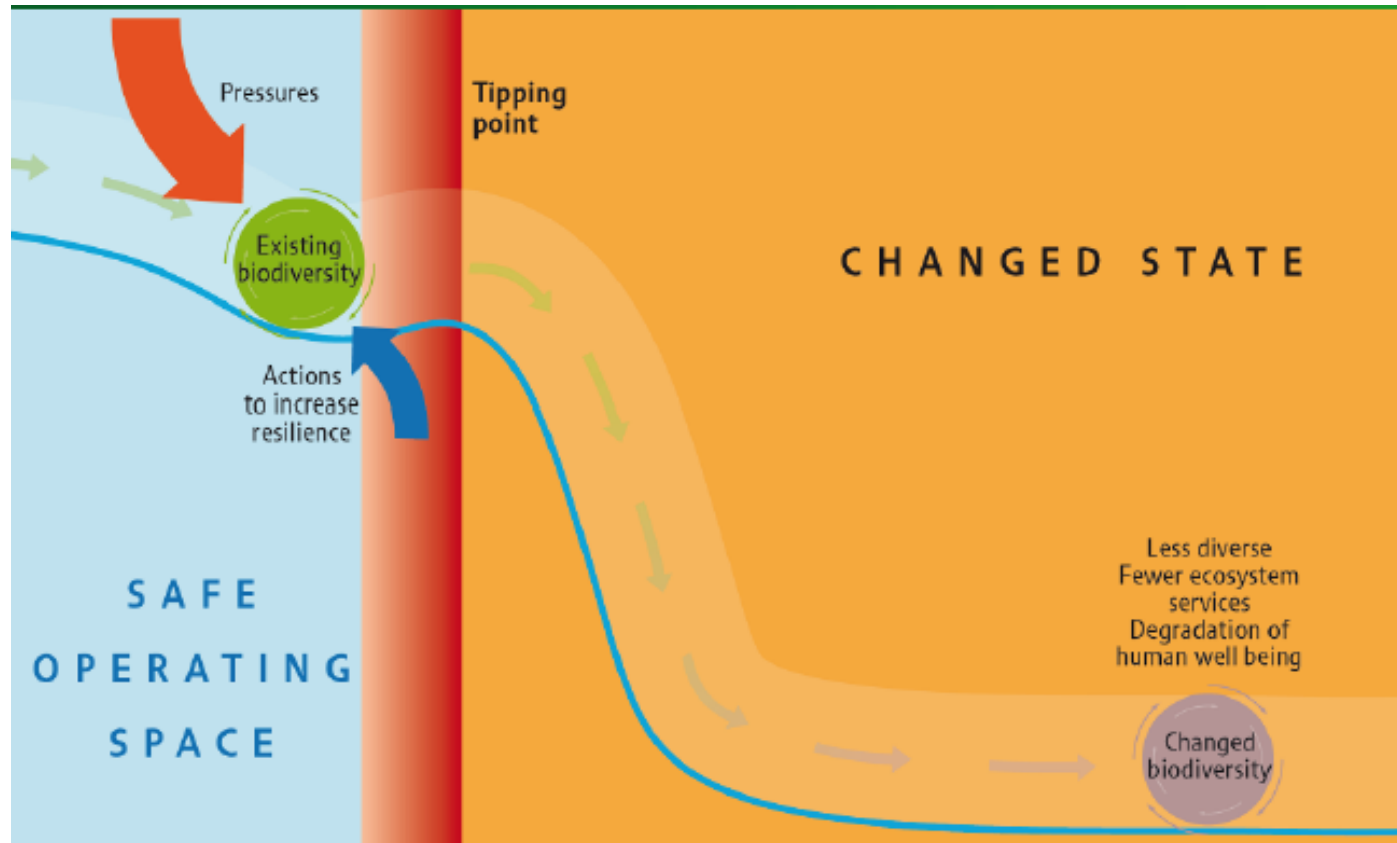


# Biodiversity important for carbon stocks estimations

- ❑ Carbon stocks maximized by abundance and functional traits on wet areas
- ❑ Biodiversity components explain greater variation in carbon stocks than climate in **evergreen** and **semideciduos** ecosystems
- ❑ Functional types such as lianas have the potential to reduce up to 50% of carbon stocks
- ❑ Carbon stocks are maximized by mixed-species stands in **mature** and **secondary savannas**

# Biodiversity important for resilience

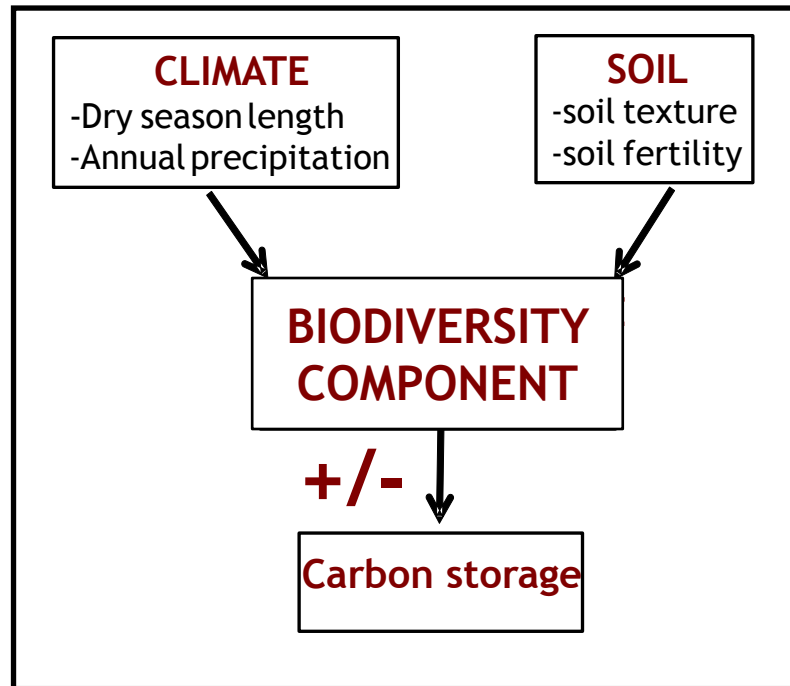
Ecosystem resilience: the capacity to recover after perturbation



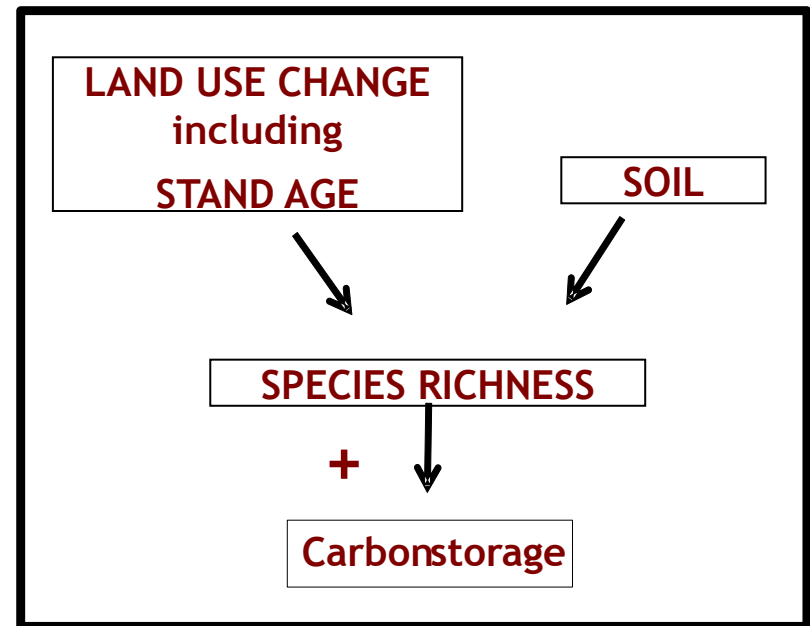
Thompson et al., 2009. CBD Technical Series No 43

# Including biodiversity in carbon stock estimations

## Evergreen/semideciduous



## Tropical savannas



Adapted from Baraloto et al. 2011 *Global Change Biol* 17: 267

## Capacity-Building in Latin America



IAI within Tropi-dry has provided scholarships for 177 students since 2007 in Latin America

*SBSTA-38 encouraged higher level of participation by scientists from developing countries in climate change research and dissemination*



INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

# Thank you!

