Role of biodiversity for high carbon ecosystems

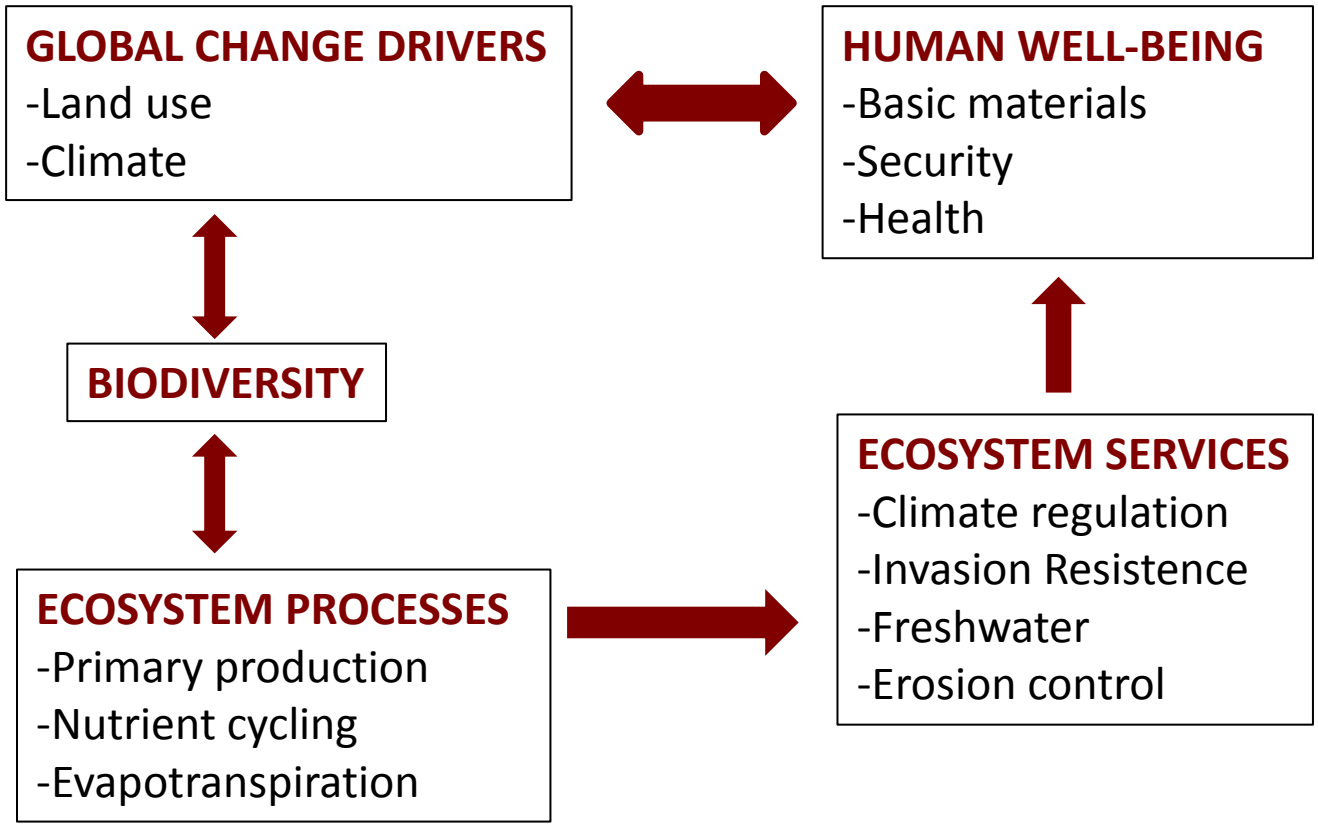
Sandra M. Durán. PhD Candidate
Dr. Arturo Sánchez-Azofeifa
University of Alberta, Edmonton, Canada
sduran@ualberta.ca

INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH
IAI

UNIVERSITY OF ALBERTA
QUAECUMQUE VERA

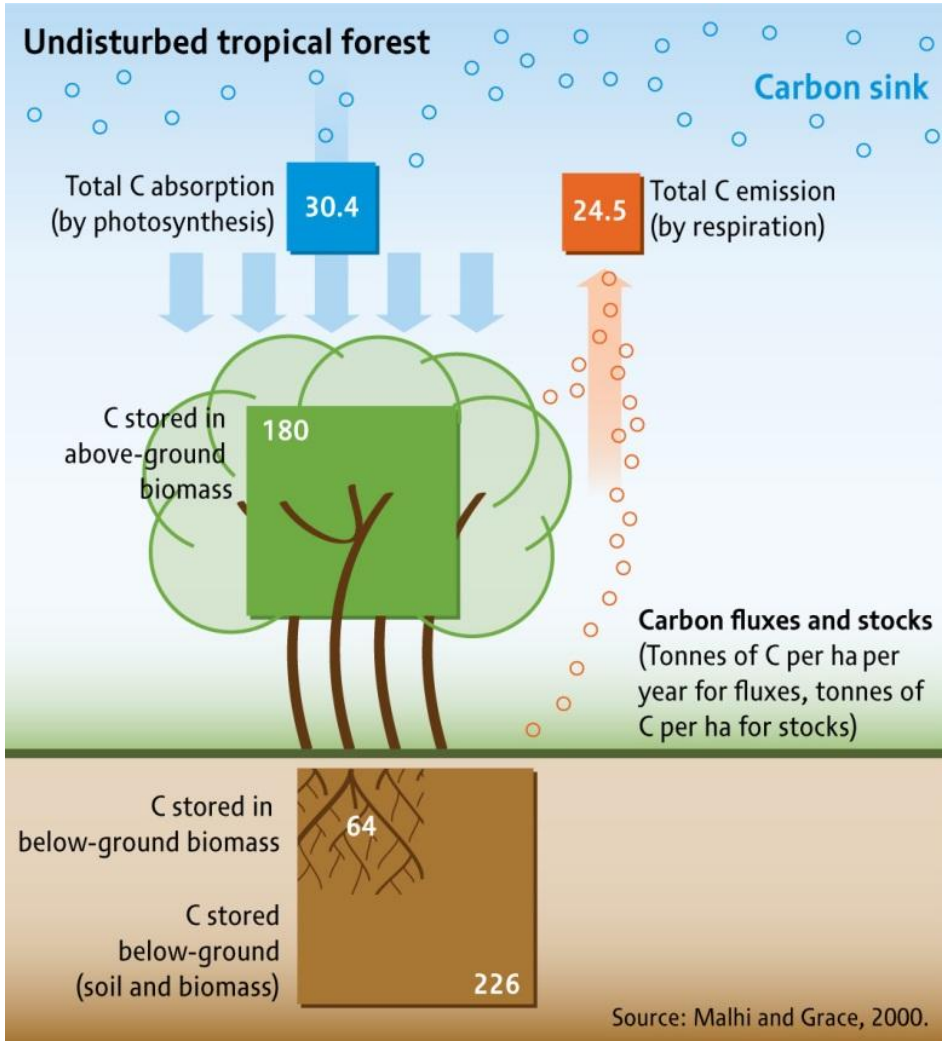
TROPI-DRY
building bridges between research and conservation

Biodiversity as a response variable



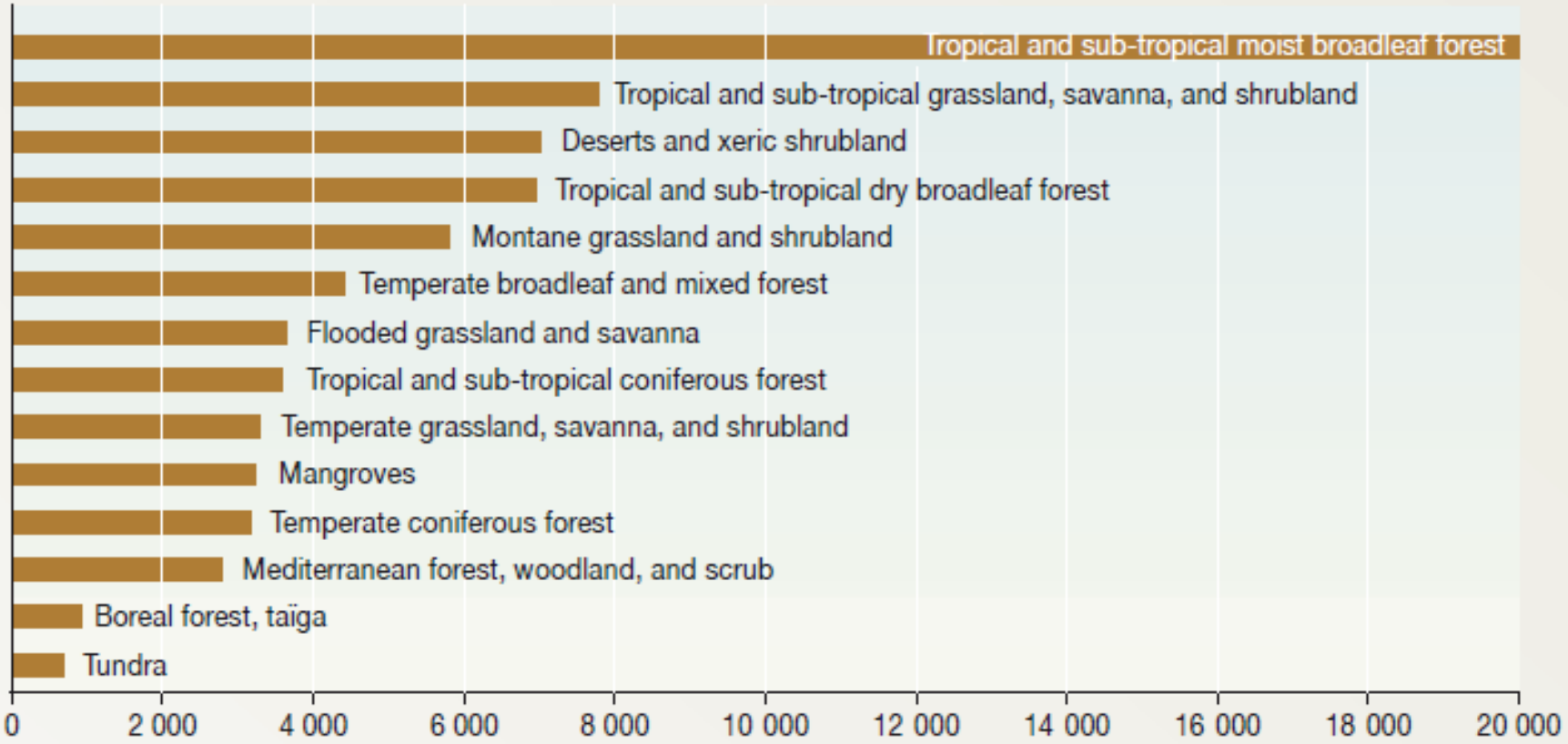
Adapted from MEA 2005; Díaz et al. 2005. *PloS Biol* 4 (8)

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?

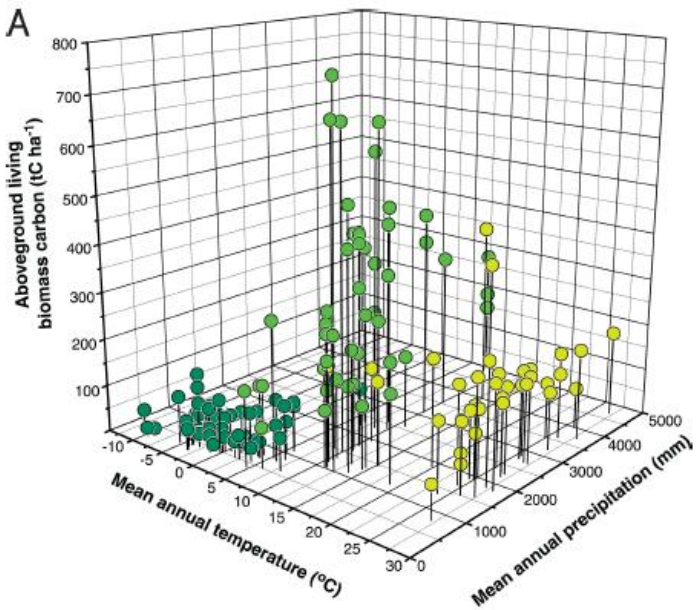
- the number, **abundance**, composition, spatial distribution, and interactions of genotypes, populations, **species richness**, **functional types** and **traits**, and landscape units in a given system

Díaz et al. 2006. *PLoS Biol* 4:1300.

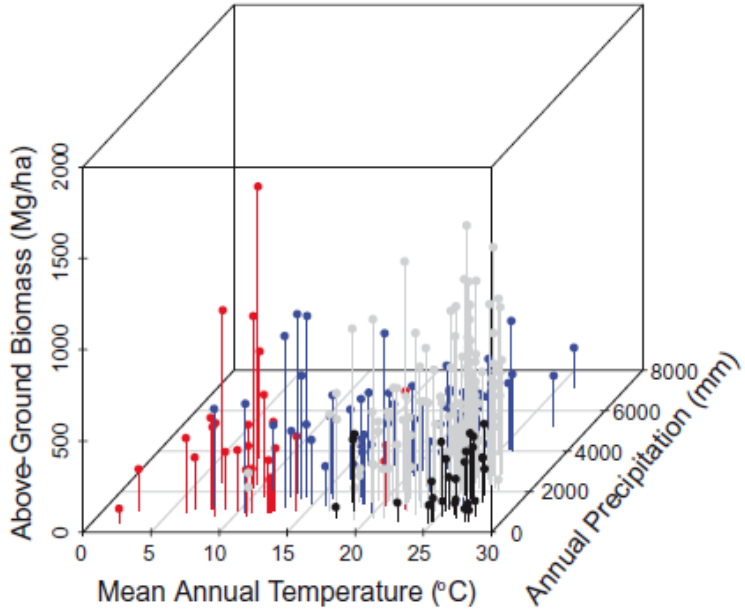
What do we know?

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

Heather Keith[1], Brendan G. Mackey, and David B. Lindenmayer



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

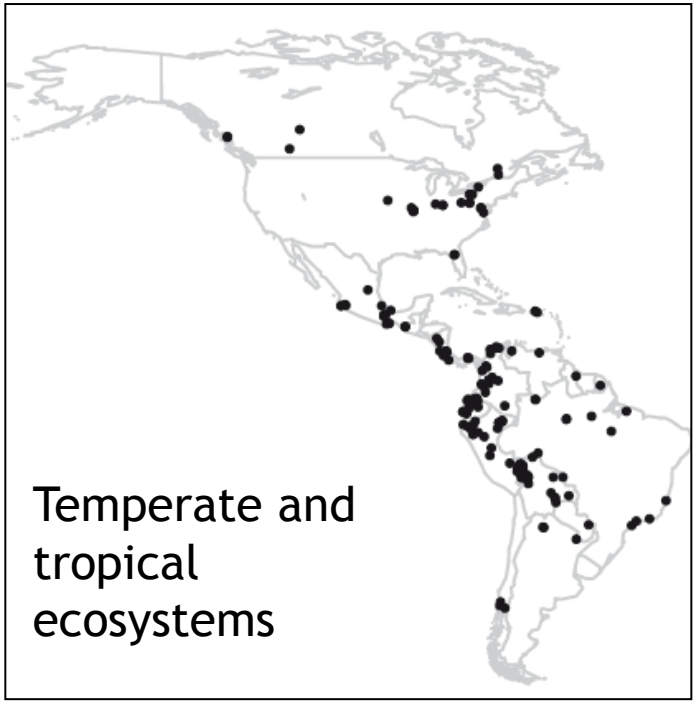


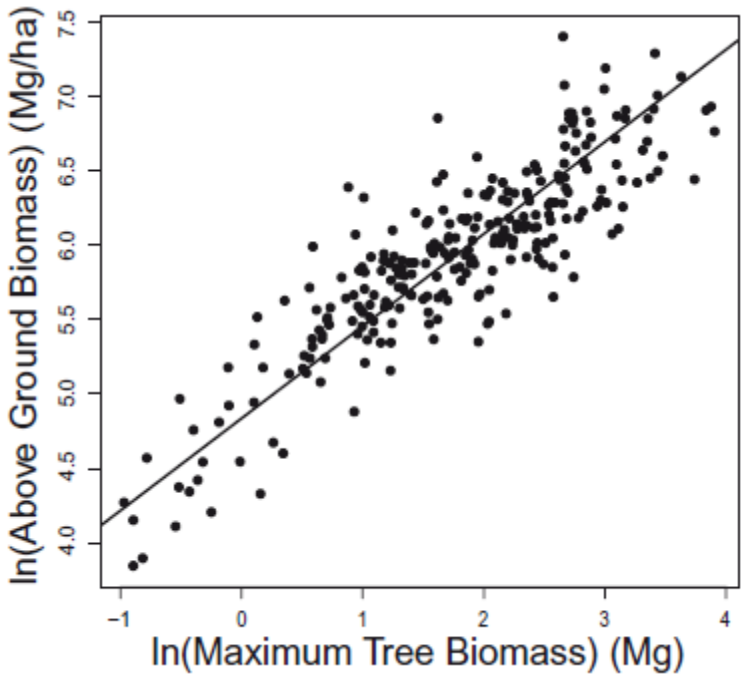
Variation in above-ground forest biomass across broad climatic gradients

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%

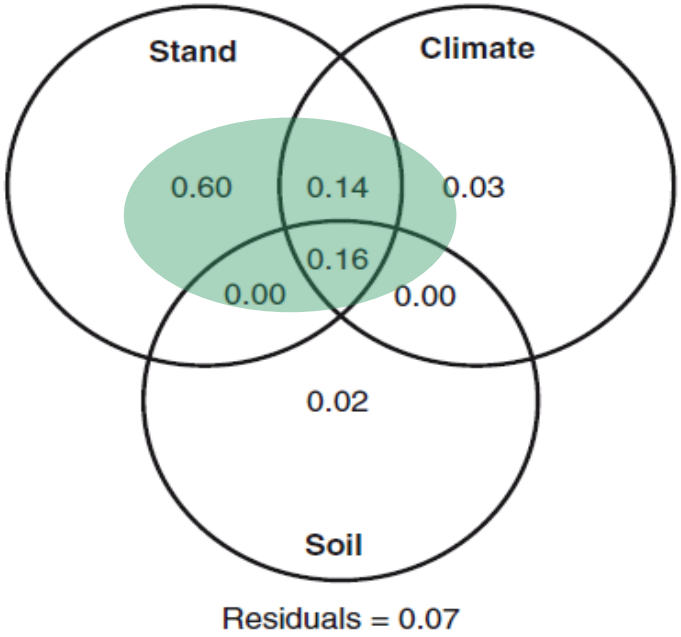
J. C. Stegen *et al.* *Global Ecology and Biogeography, (Global Ecol. Biogeogr.)* (2011) **20**, 744–754

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

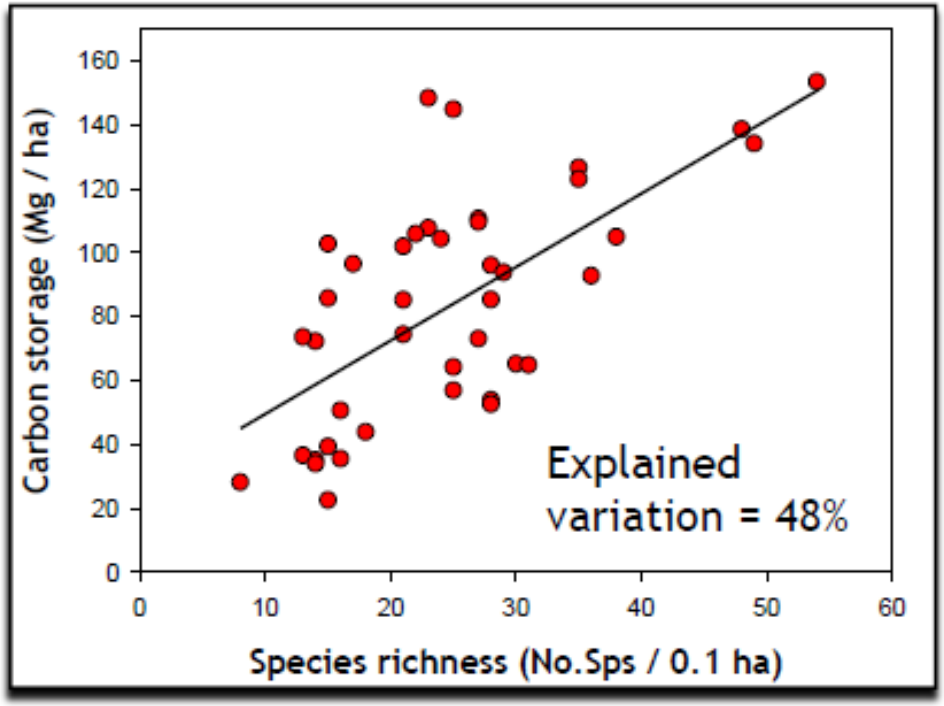


Functional traits include

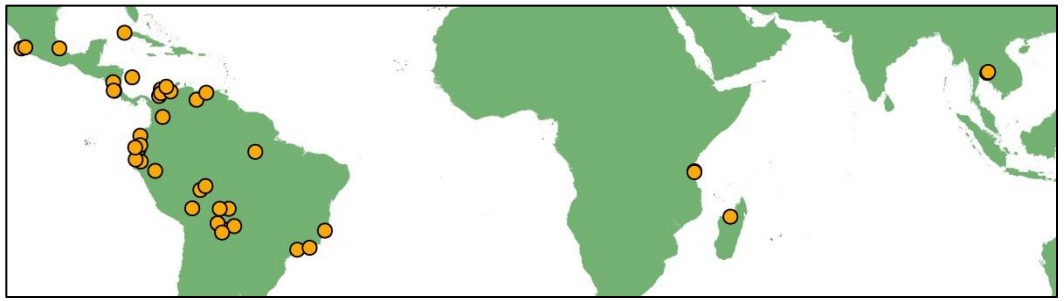
- wood density
- Plant height

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

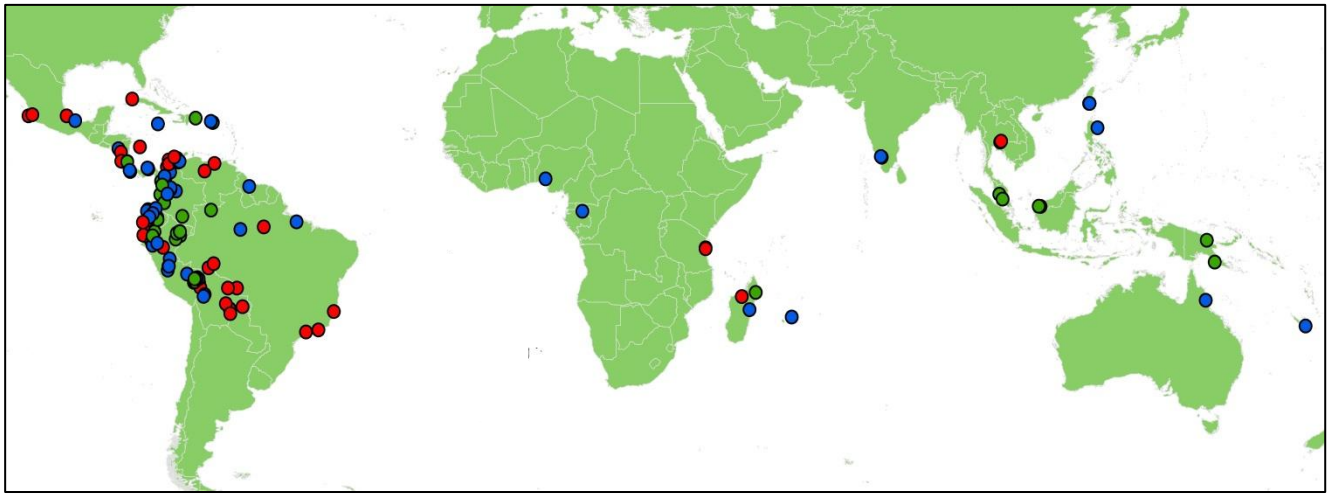
Biodiversity component: Positive effects of species richness



Carbon stocks in mature savannas



Biodiversity component: Functional types: lianas

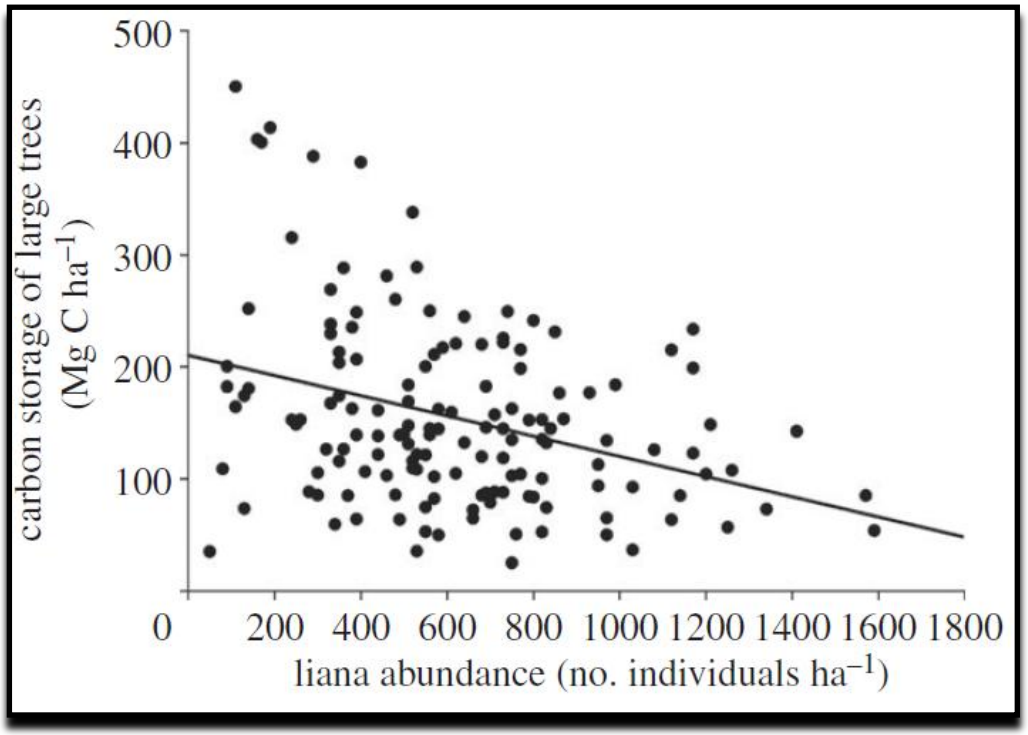


Ecosystems

- Deciduous
- Semideciduous
- Evergreen

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

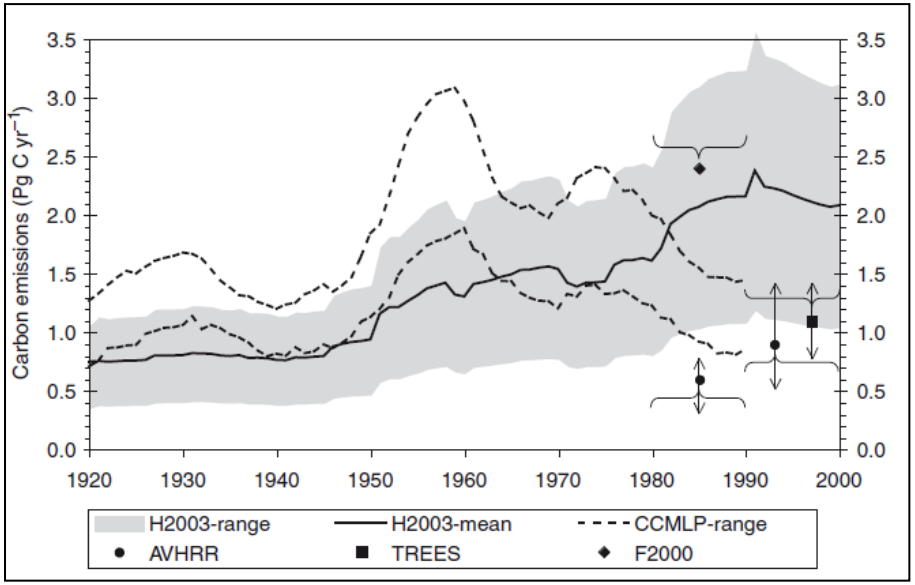
Carbon stocks decrease with liana abundance



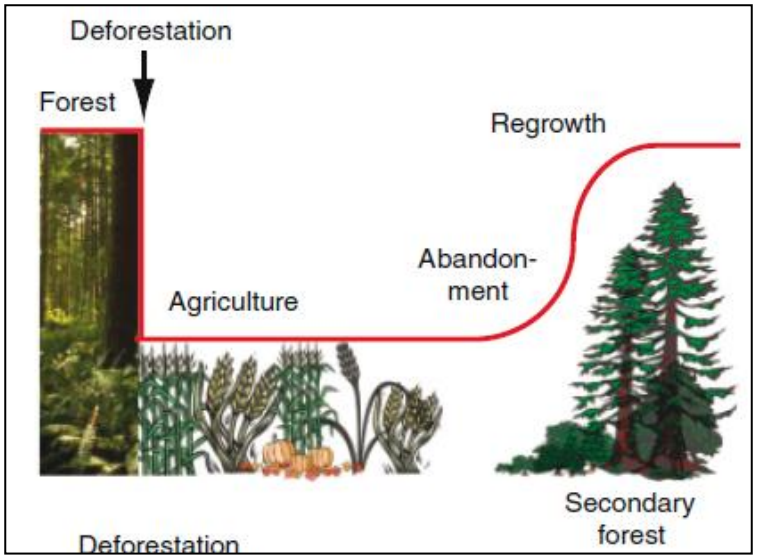
- Explained variation 11% as much as temperature
- lianas could reduce carbon stocks by up to 50%

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

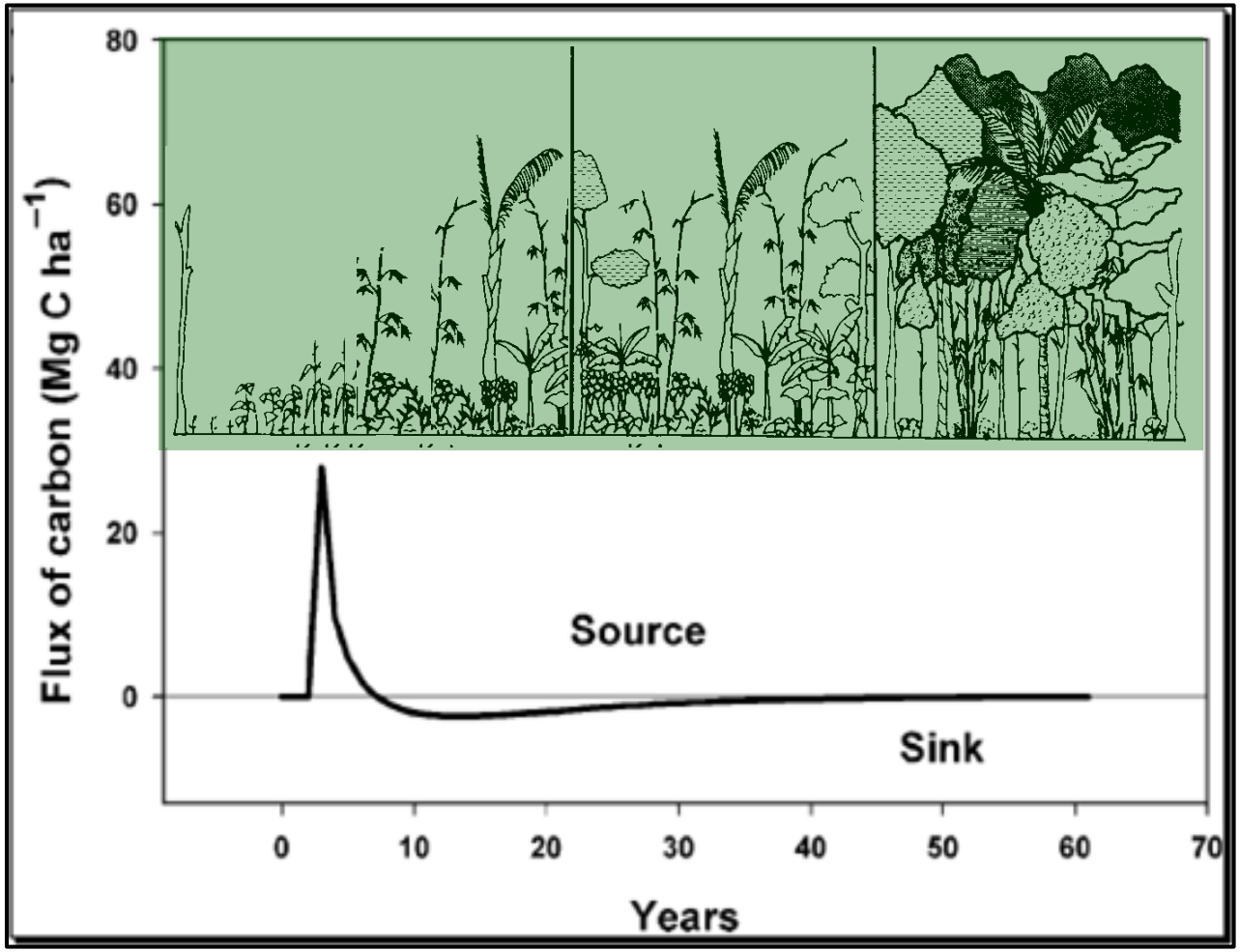
Carbon emission from deforestation



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



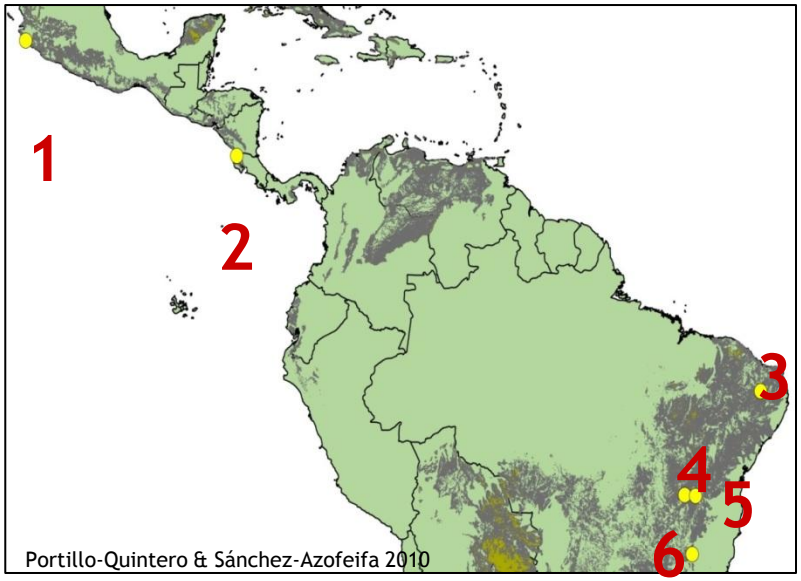
Secondary growth



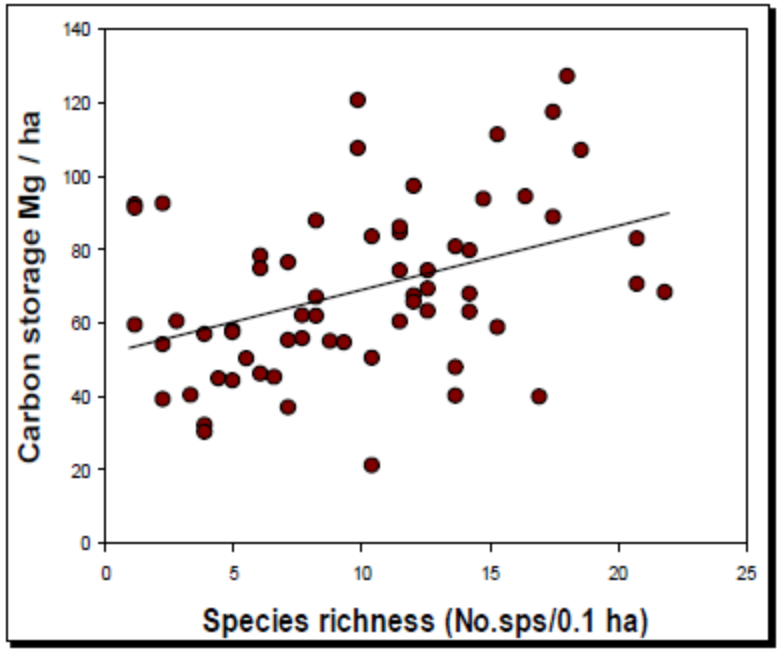
http://www.cd3wd.com/cd3wd_40 (green square)

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

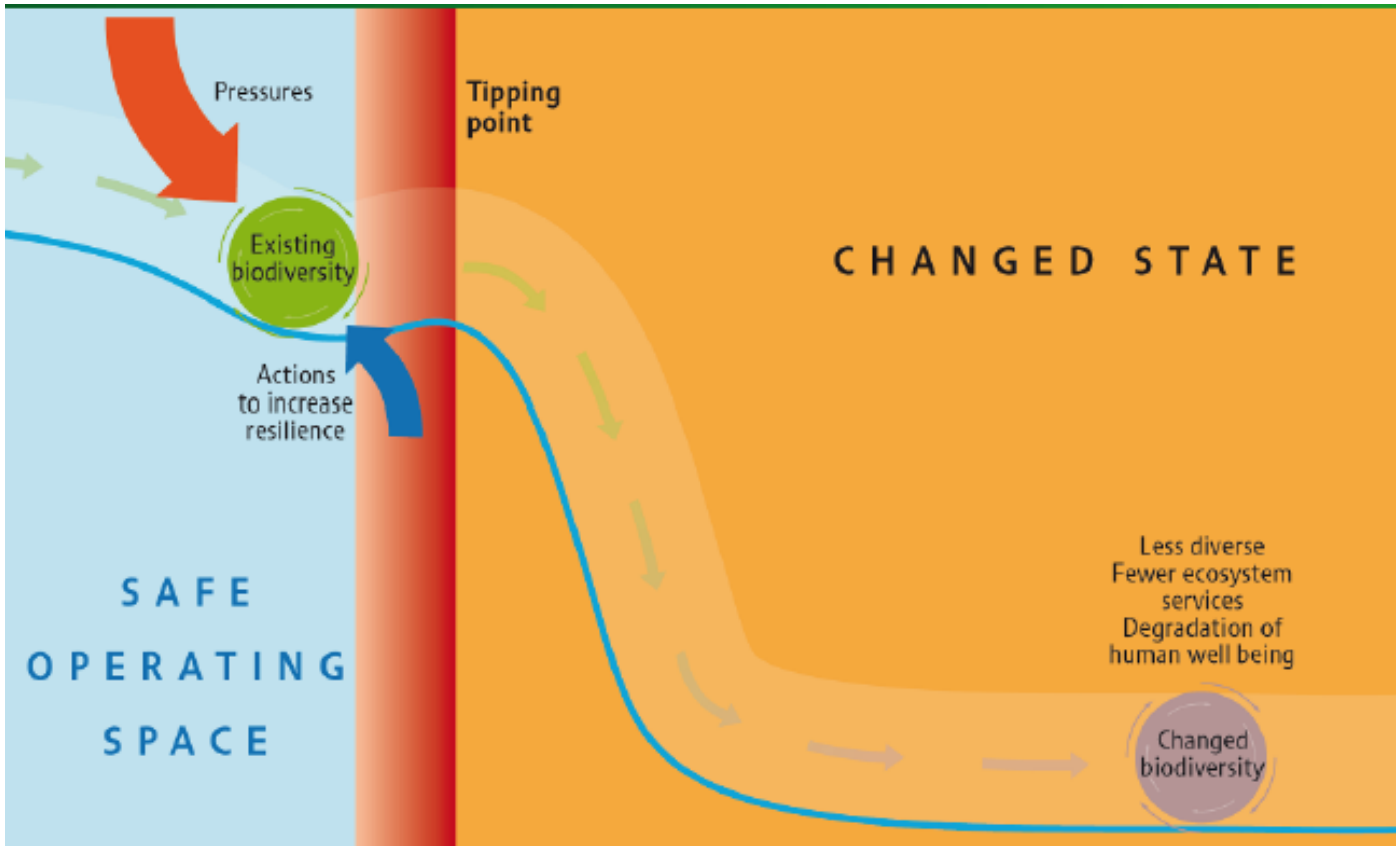
Late > 50 years

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

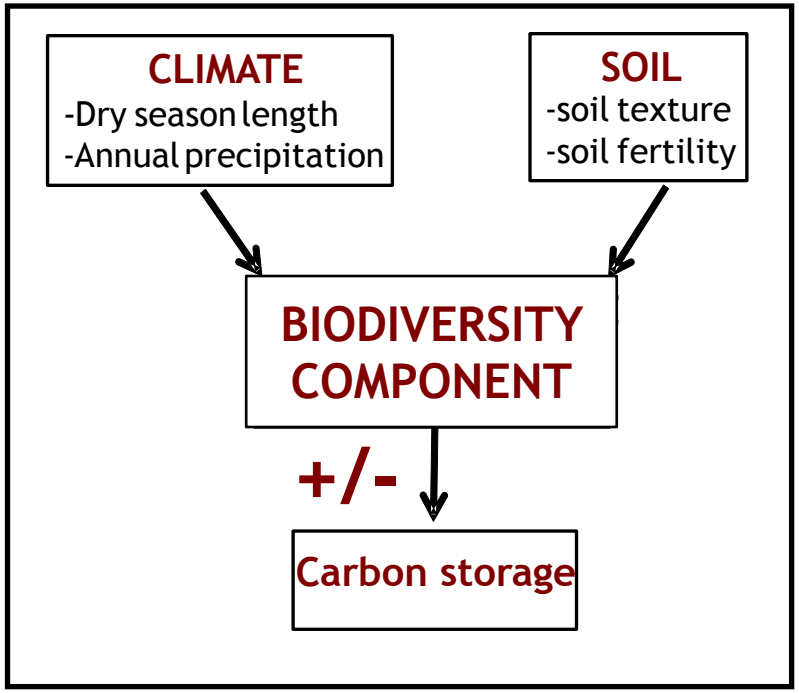
Ecosystem resilience: the capacity to recover after perturbation



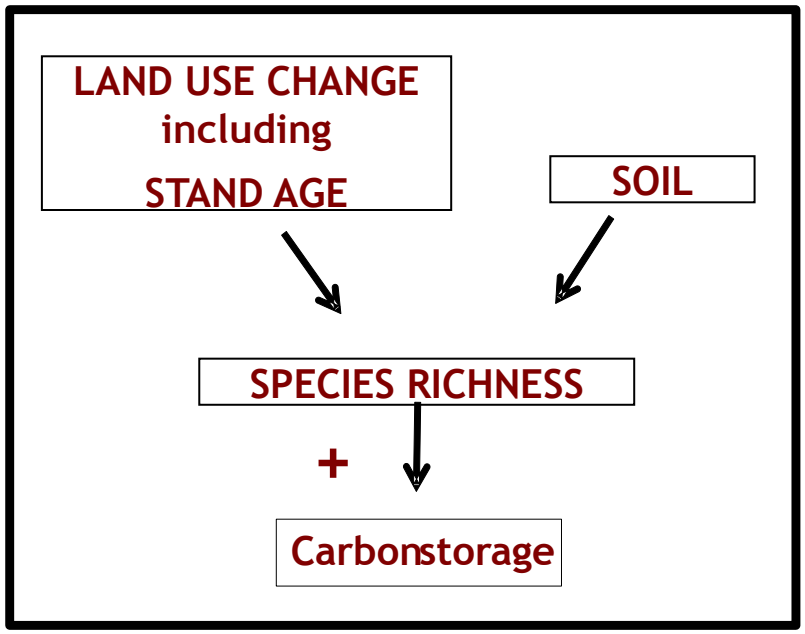
Thompson et al., 2009. CBD Technical Series No 43

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

Thank you!

INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH
IAI

TROPI-DRY
building bridges between research and conservation

The Rufford Small Grants Foundation
www.ruffordsmallgrants.org

UNIVERSITY OF ALBERTA
QUAECUMQUE VERA
CEOS

IBM