

# The rarest species of Colombia: Local abundance and range sizes

Conservation of the most vulnerable

Richard Condit<sup>1</sup>



Smithsonian Tropical Research Institute

<sup>1</sup>SIGEO & Center for Tropical Forest Science

Instituto Alexander von Humboldt  
Bogotá, Colombia, September 2011

Tropical forest renowned for rarity

Habitat heterogeneity relates to beta-diversity and range limits

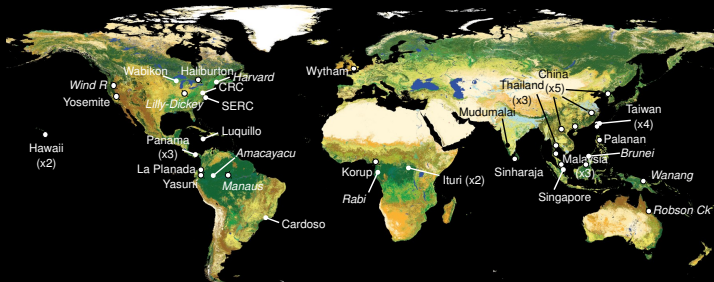
Tropical forest renowned for rarity

Habitat heterogeneity relates to beta-diversity and range limits

- Does Colombia have very rare species?
- Does Andean heterogeneity lead to species with small ranges?
- Are there 'hot spots' where very rare species are concentrated?

# Center for Tropical Forest Science: Smithsonian & Harvard

SIGEO-CTFS: A network of forest censuses following common methods



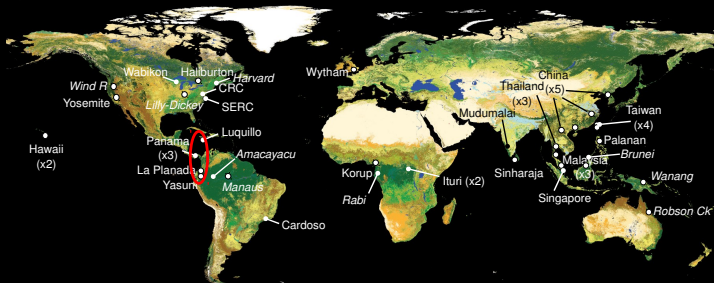
33 completed plots have data in a common database format on one of 4 servers

-- 3,802,654 trees (ie  $3.80 \times 10^6$ )

-- 9,073,531 measurements (ie  $9.07 \times 10^6$ ) in 89 plot censuses

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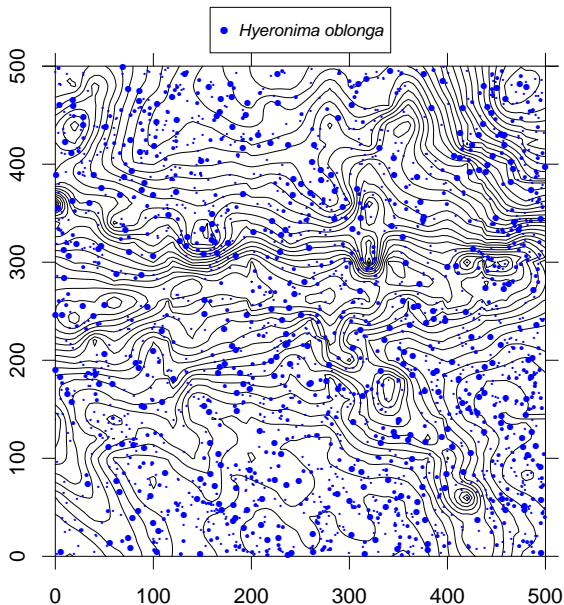
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# CTFS South American census plots

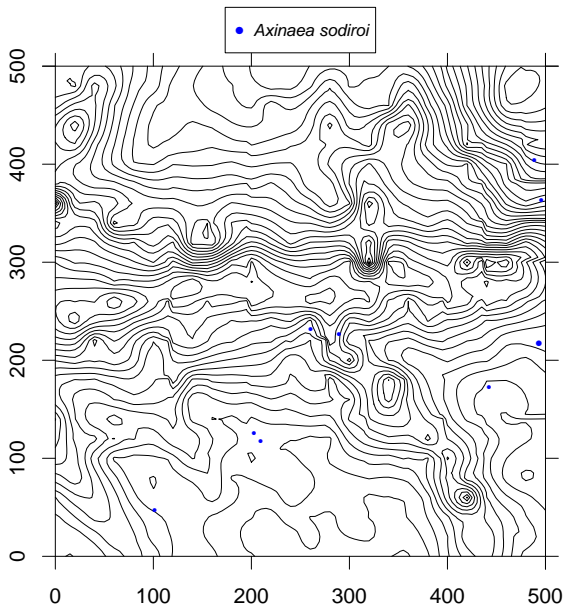


# La Planada, Colombia, CTFS census plot



- 1996-2004
- Instituto von Humboldt  
C. Samper  
H. Mendoza  
M. Vallejo

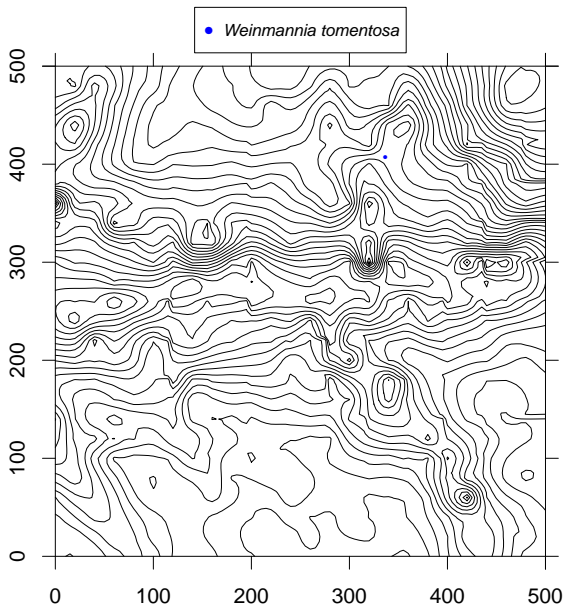
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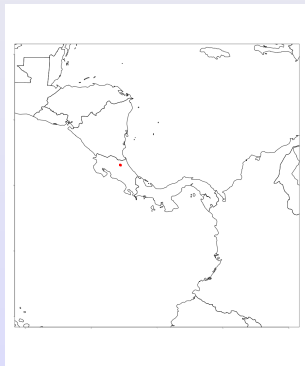
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## Abundance of all 241 species in La Planada plot, Colombia

Family	Species	Population
Rubiaceae	<i>Faramea coffeoides</i>	16417
Rubiaceae	<i>Palicourea gibbosa</i>	6145
Rubiaceae	<i>Elaeagia utilis</i>	4495
⋮	⋮	⋮
Phyllanthaceae	<i>Hyeronima oblonga</i>	2185
⋮	⋮	⋮
Myrtaceae	<i>Matisia bolivarii</i>	1725
⋮	⋮	⋮
Clusiaceae	<i>Clavija laplanadae</i>	46
⋮	⋮	⋮
Ericaceae	<i>Psammisia urichiana</i>	1
Cunoniaceae	<i>Weinmannia tomentosa</i>	1
	17 more species	1

# BIEN: Botanical Information for Ecology Network

BIEN is a group of botanists interested in broad-scales in ecology and seeking ecoinformatic solutions



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BIEN is a group of botanists interested in broad-scales in ecology and seeking ecoinformatic solutions

- seeking very large collections of plot and specimen data publicly available
- harmonizing the format and the taxonomy in order to maximize the records available
- offering convenient access



- B. Enquist (Arizona)
- P. Jørgensen (Missouri)
- B. Boyle (Arizona)
- S. Dolins (Bradley)
- R. Condit (STRI)
- M. Schildauer (NCEAS)
- R. Peet (N. Carolina)
- ... and more



## 1 CTFS plot network

Complete local censuses

Many rare species

## 2 BIEN Working Group

## 3 Range statistics from 9 million specimens

Species in the Americas

Colombian species

Species with very localized records

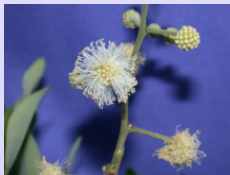
Plot abundance vs. range size

## 4 Conclusions

Range of Colombian species

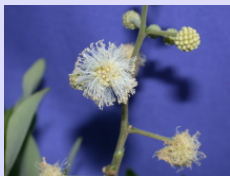
Hot spots

- 12 million occurrences in a single table



*Albizia adinocephala*

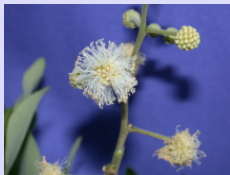
- 12 million occurrences in a single table
  - Abundances for a single taxon from a single plot
  - Herbarium specimens with locations (e.g. Missouri)



*Albizia adinocephala*

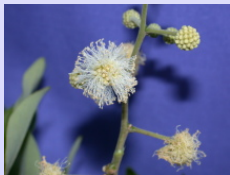


- 12 million occurrences in a single table
- 11.3 million occurrences in the Americas



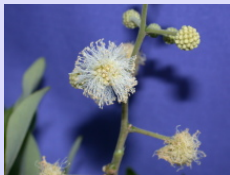
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- 10.3 million have a verified province name
- 6.6 million have precise coordinates



*Albizia adinocephala*

- 11.3 million occurrences in the Americas
- 10.3 million have a verified province name
- 6.6 million have precise coordinates
- The taxonomy challenge
  - 9.5 million have a verified, harmonized, complete Latin binomial
  - 5.6 million have coordinates and a verified Latin name



*Albizia adinocephala*

## Taxonomic Name Resolution Service

<http://tnrs.iplantcollaborative.org/TNRSapp.html>

a product of the BIEN group which will check 1000s of names and report misspellings and synonymy

- 315,488 distinct taxa names in 12 million records
  - Many incorrect, or are spelling 'variants'
  - Many are not complete binomials
  - Some are ferns, algae, mosses
- 180,283 names can be matched to an authoritative list (Missouri)
- 129,998 species of higher plants in the Americas



*Lacistema aggregatum*  
(plant photos Rolando Pérez)

129,998 valid names in the Americas:



*Ocotea whiteii*

129,998 valid names in the Americas:

- 11,999 have no records with coordinates nor with province name
  - 7,197 with just one record
  - 11,177 occur in only one country



*Ocotea whiteii*

129,998 valid names in the Americas:

- 11,999 have no records with coordinates nor with province name
- 117,999 have at least one province name
- 85,889 have at least one record with coordinates



*Ocotea whiteii*



129,998 valid names in the Americas:

- 22,841 have exactly one record, period (singletons)



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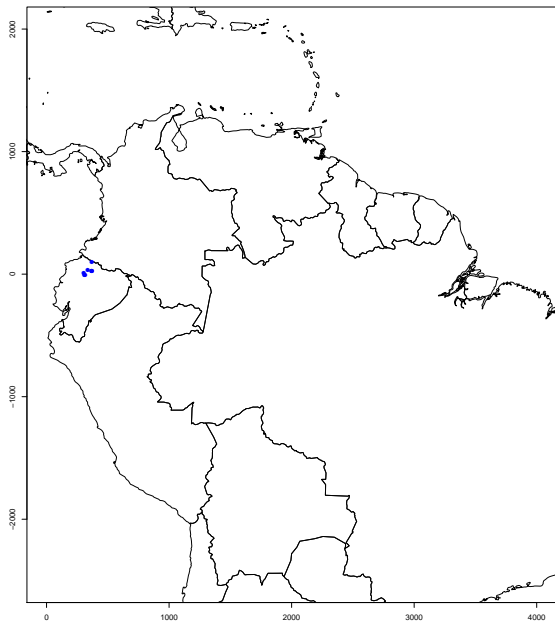
20,299 valid names in Colombia:

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- 228 have exactly one record anywhere, and it has coordinates
- 4,346 are endemic to Colombia



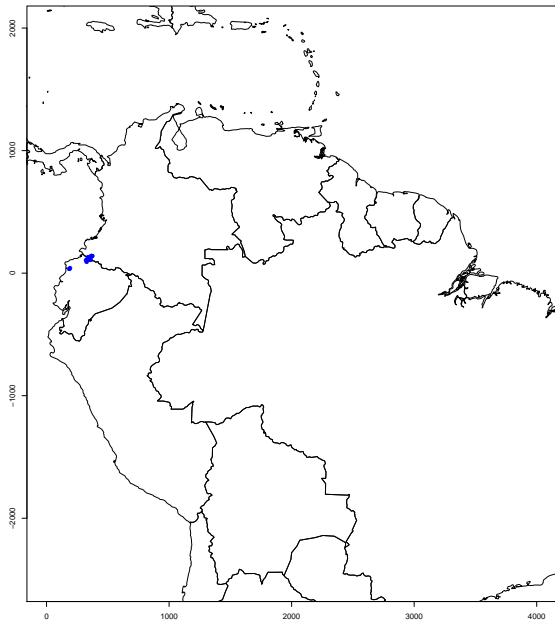
*Maranthes panamensis*

# Range sizes in South American tropics



*Axinaea sodiroi*  
 $1.5 \cdot 10^4 \text{ km}^2$

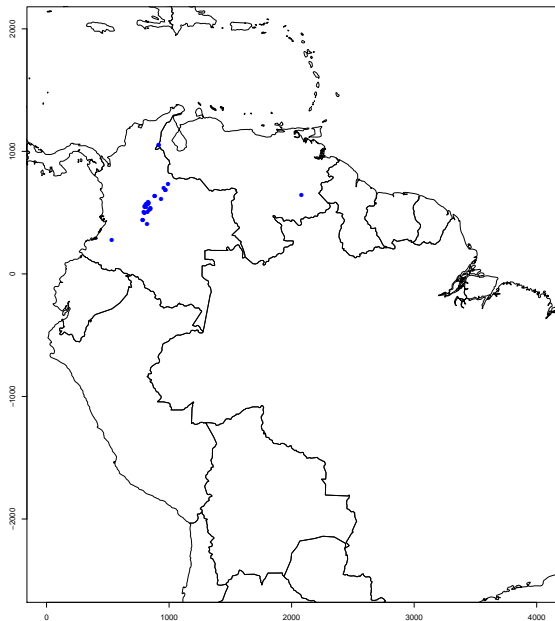
# Range sizes in South American tropics



*Faramaea coffeoides*  
 $3.8 \cdot 10^4 \text{ km}^2$

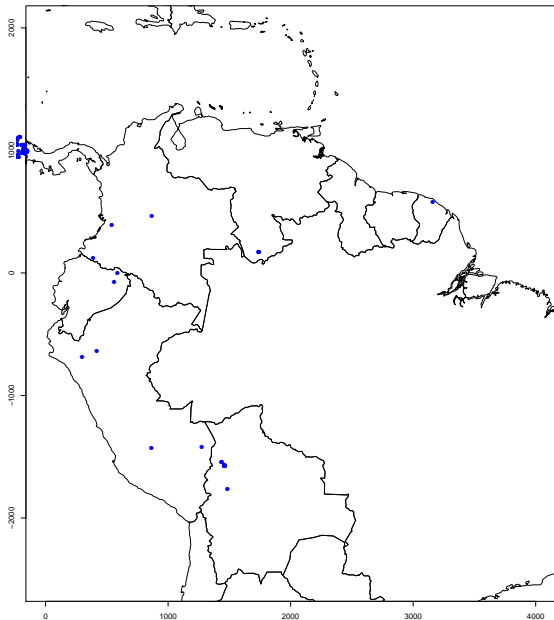


# Range sizes in South American tropics



*Weinmannia tomentosa*  
 $1.4 \cdot 10^6 \text{ km}^2$

# Range sizes in South American tropics



*Hyeronima oblonga*  
 $11.1 \cdot 10^6 \text{ km}^2$

# Range size and singletons

Colombian range sizes

	American	Colombian	Amazonian	La Planada
singleton	22687 (17.6)	1581 (7.8)	1190 (4.7)	2* (1.4)
narrow	6463 (5.0)	348 (1.7)	562 (2.2)	3* (2.1)
wide	44458 (34.6)	12964 (63.9)	17458 (69.0)	117 (83.6)
total	128668	20295	25285	140
median range	0.12	1.61	1.60	2.15

Singleton: one specimen only (often lack coordinates)

Narrow: > 1 specimen, but only known at one location

Wide: > 10<sup>5</sup> km<sup>2</sup>

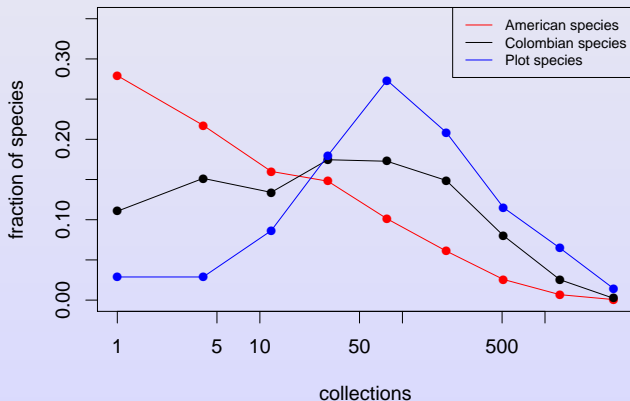
\* including *Matisia bolivarii* and *Clavija laplanadae*

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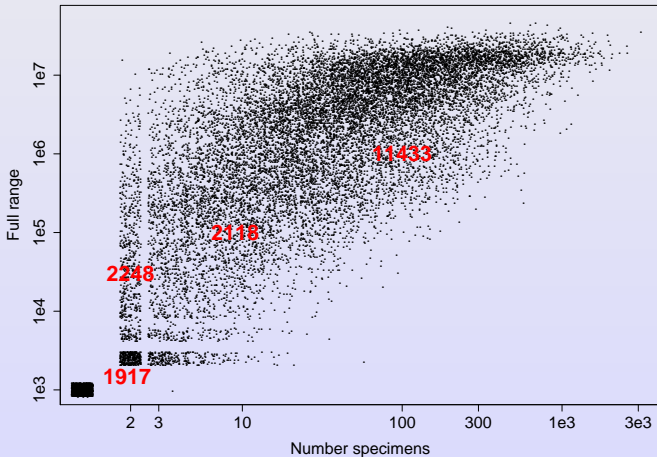
Histogram of collections per species in BIEN database (9 million total)

- Across Americas: high proportion have one specimen only
- Colombian species and plot species: many collections



# Range size vs. specimen number

Colombian species



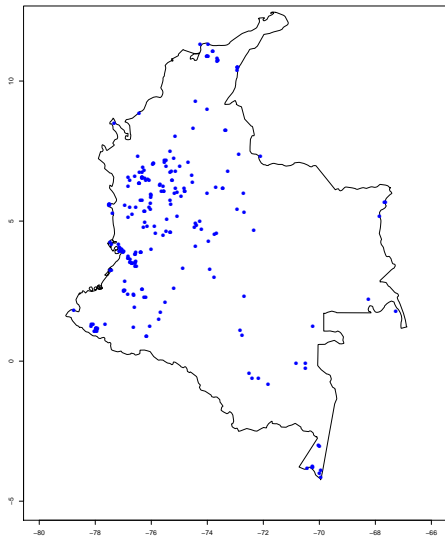
22,413 species:

11K have < 10 records  
spanning >  $10^5$  km<sup>2</sup>

2,100 have < 10 records  
spanning >  $10^4$  km<sup>2</sup>

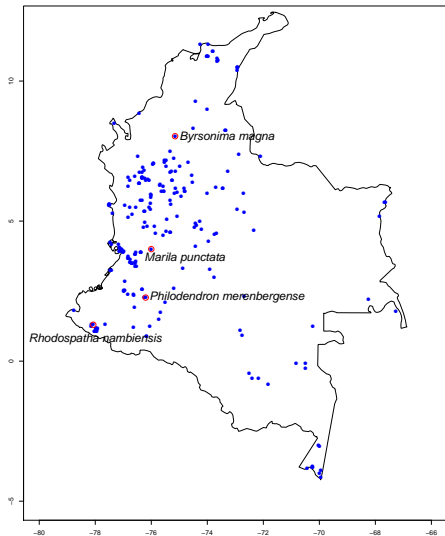
4,000 have < 10 records  
spanning < 2.5 km<sup>3</sup>

# 219 singleton species of Colombia



Hot spots?

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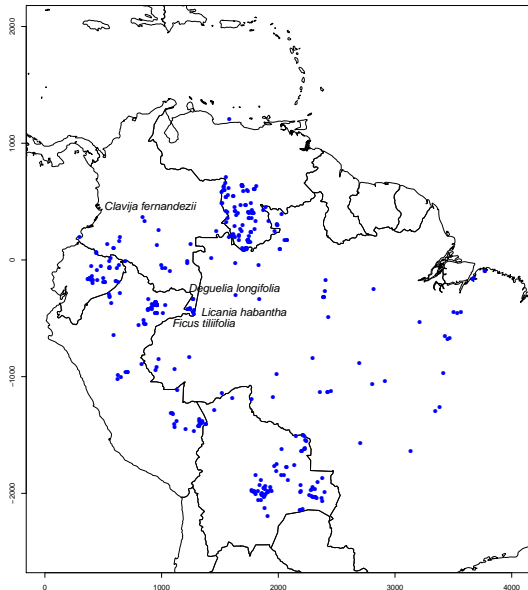


## Hot spots?

- Many in the Andes
- Concentrations due to favored collecting sites?



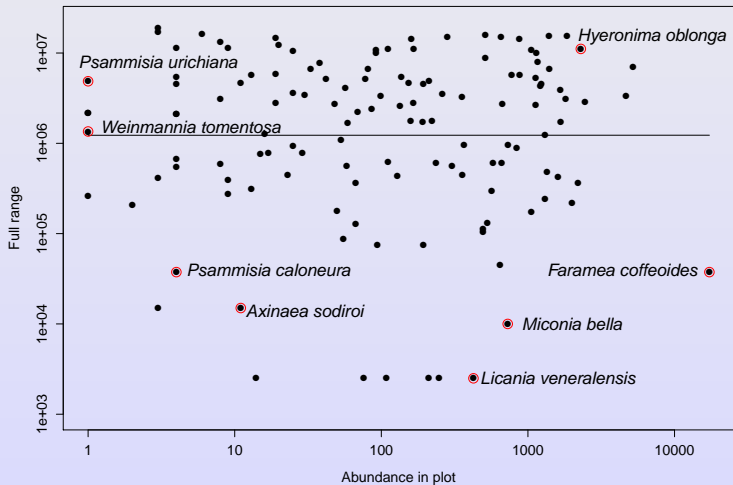
# 387 singleton species of Amazonia



Hot spots?

- Problem:  
cultivated species

# La Planada abundance and range size



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- 2,000 species with single collection known are an invitation for more study

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- Are they real or ghosts?



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Fun facts to remember:

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