Complete tree species of Panama

Full ranges for every species > 3 m tall

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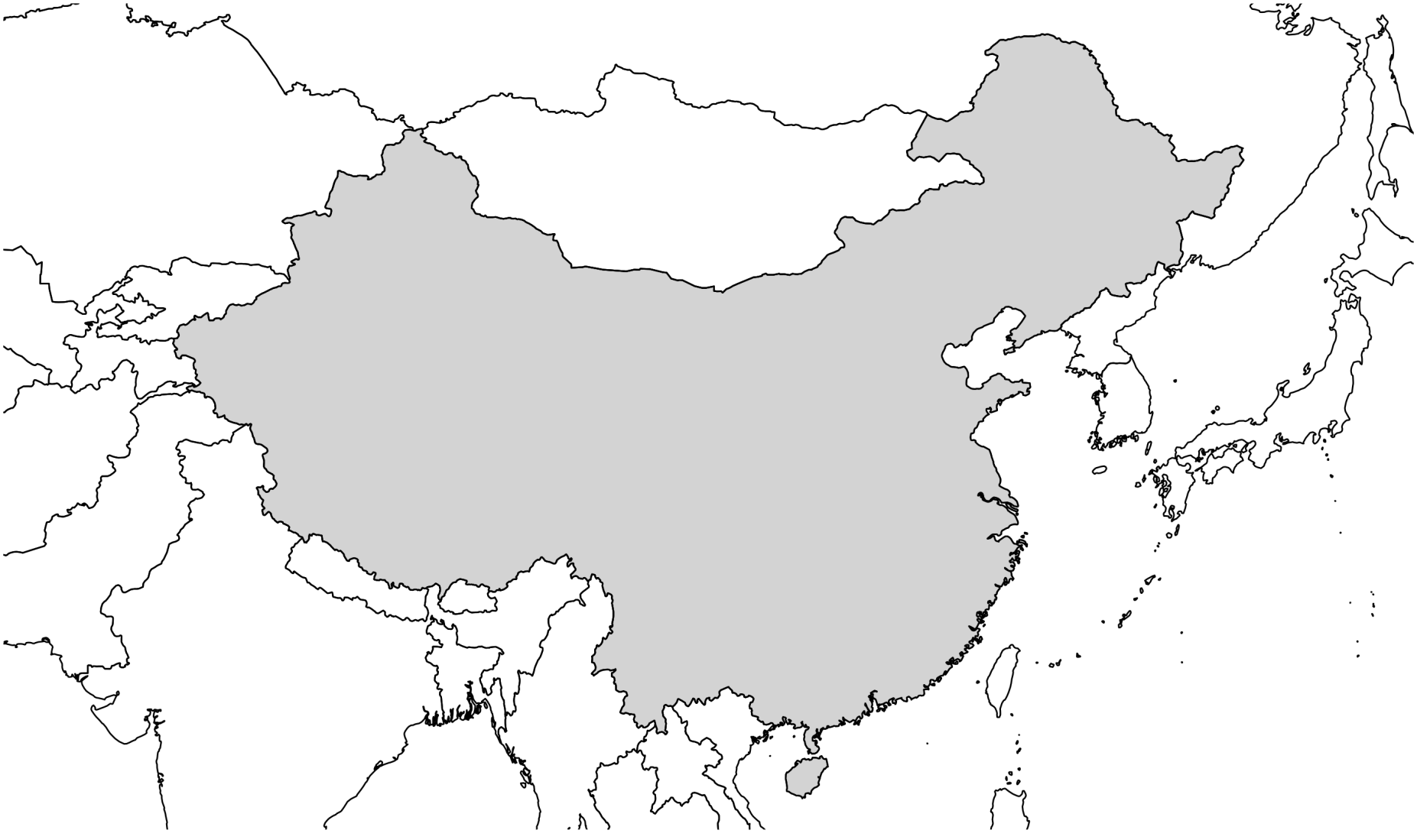
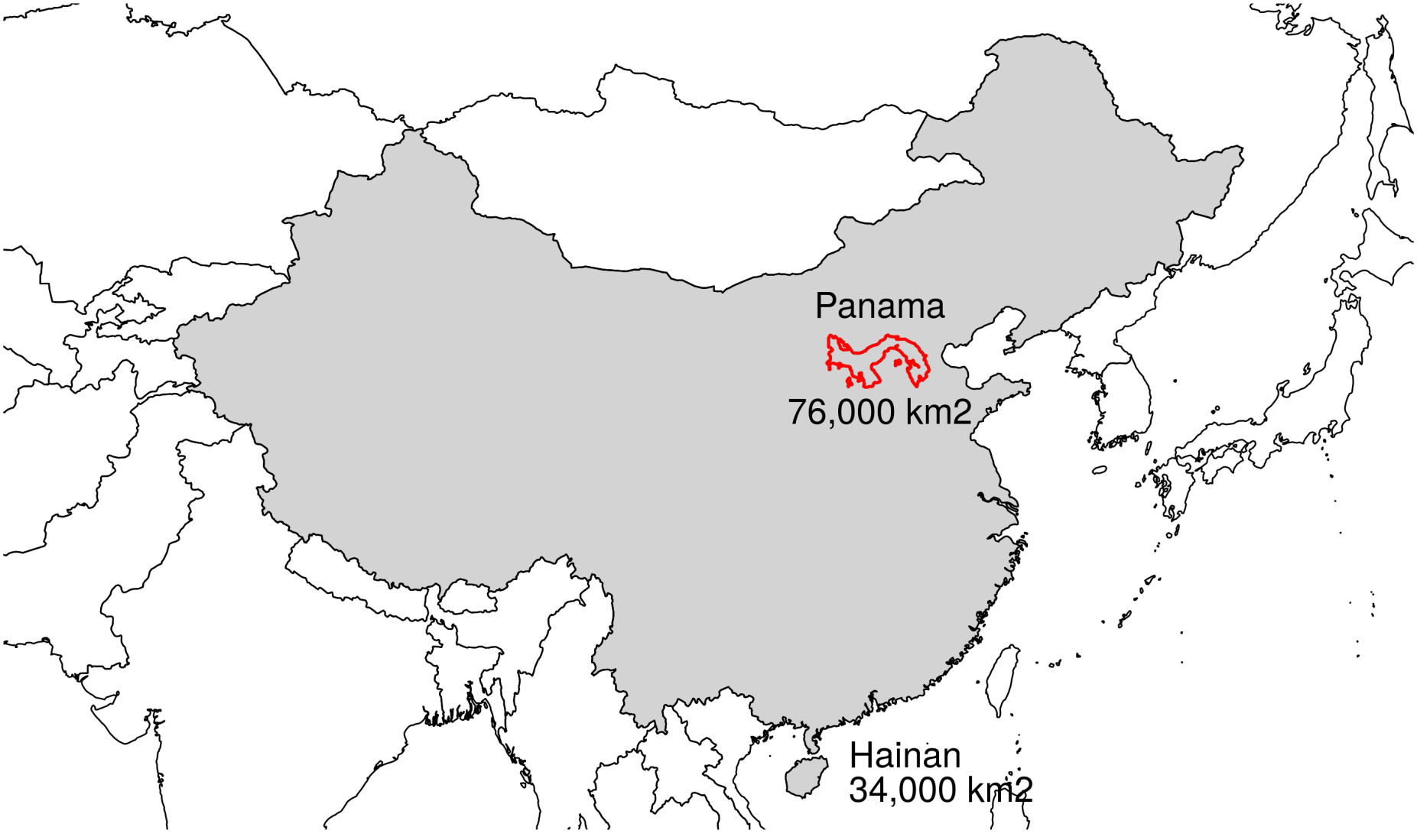
January 2020

802107 (R00769) 8-93




Panama
76,000 km2
Hainan
34,000 km2

The tree

Including species

- Reaching 3 m tall
  (matching minimum dbh 1 cm in tree plots)
- usually free-standing as reproductive (stranglers included)
- any number of stems (ie clonal or not)

Excluding species

- lianas
- epiphytes
- herbs
- shrubs < 3 m tall

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· All beg for precise records of many individuals
· But data either do not exist or are difficult to compile

3044 tree species known in Panama

141 families

752 genera

Tree height:

- 3-5 m: 518 species
- 5-10 m: 773 species
- $\geq$ 10 m: 1753 species

Tree species with very narrow ranges in Panama in Panama

- 3044 total species:
  - 284 endemic to Panama (9.3%)
  - 474 in one other country (15.6%)
    (usually Costa Rica, some Colombia and other oddities)
  - 492 have range < 20,000 km^2 (16.2%)

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Taxonomic variation in narrow ranges

Important families illustrating wide variation

Family	Narrow	Wide	% narrow
Moraceae	0	72	0.0
Sapotaceae	2	50	3.8
Fabaceae	17	241	6.6
Lauraceae	20	96	17.2
Annonaceae	27	72	27.3
Myrtaceae	28	66	29.8
Primulaceae	41	60	40.6
Total	492	2552	16.1

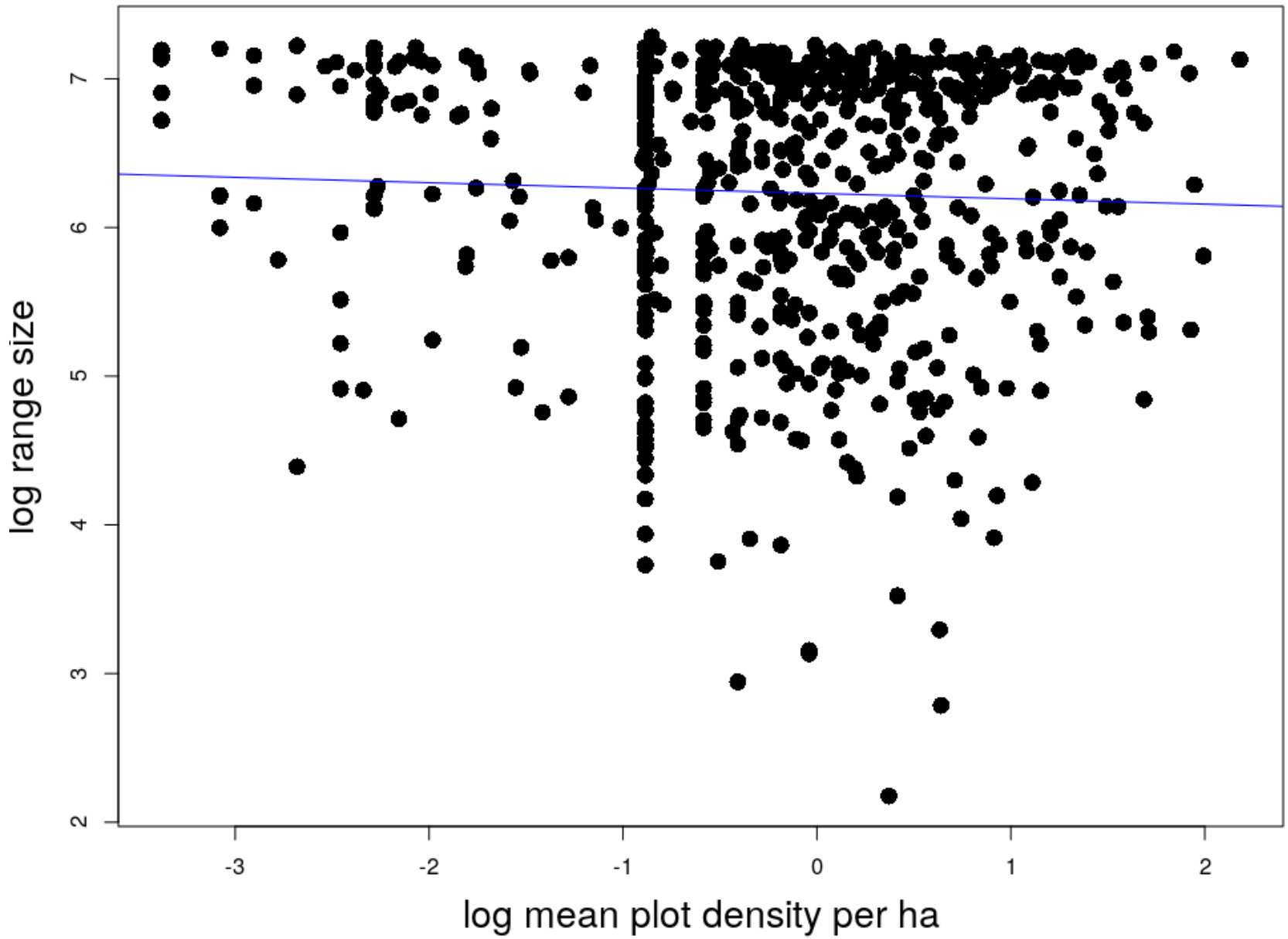
Is the difference due to biology?

Or taxonomists?

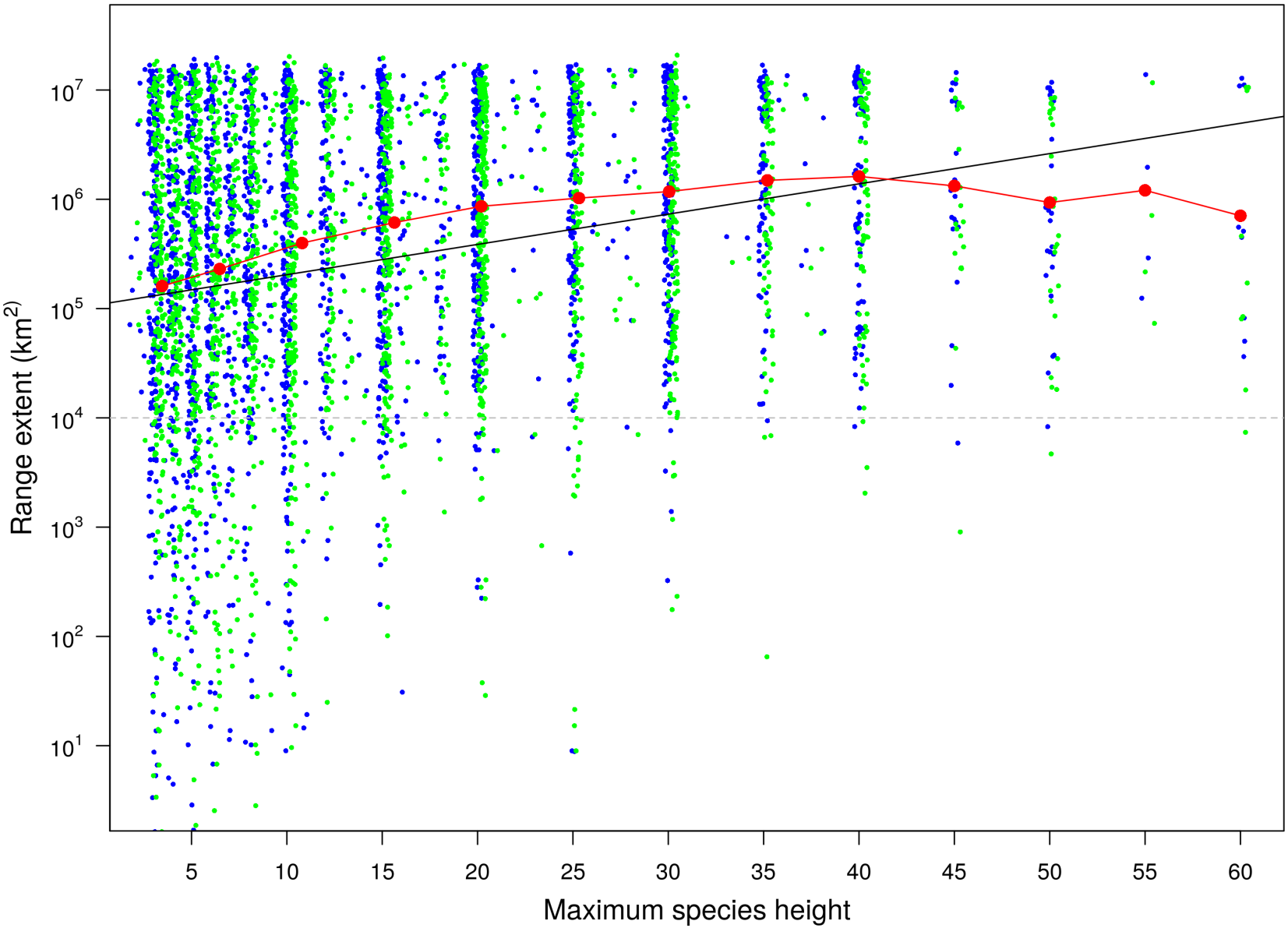
Plot occurrence correlates with range size

Range (km^2)	Found in plots	Not found	% found
$< 2 \cdot 10^4$	37	455	7.5
$2 \cdot 10^4$ - 10^5	72	333	17.8
10^5 - 10^6	217	573	27.5
$> 10^6$	324	655	33.4
Total	836	2208	27.5

Plot abundance does not correlate with range size



Tall trees have wider ranges



Online maps

Conclusions and hypotheses for future work

- Plots capturing tree species
  - In Panama, 33% of tree species appear in plots
  - But only 7% of narrow endemics are in plots
  - Without thousands of plots, most species will be missed
- Range size
  - Highly variable taxonomically
  - No correlation with plot abundance
  - Wider ranges in tall trees
- Understanding environmental response
  - Large amounts of location data to correlate with climate
  - Solving the many errors in location, identification

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