The Effect of Sampling Effort on the Mean of Range Size Distributions

Megan Ruffley Iván Jiménez

Talk Outline

- Introduction
- Working Hypothesis
- Methods
  - Study System
  - Quantification of Sampling Effort
  - Computer Simulation Experiment
- Results
- Conclusions & Implications

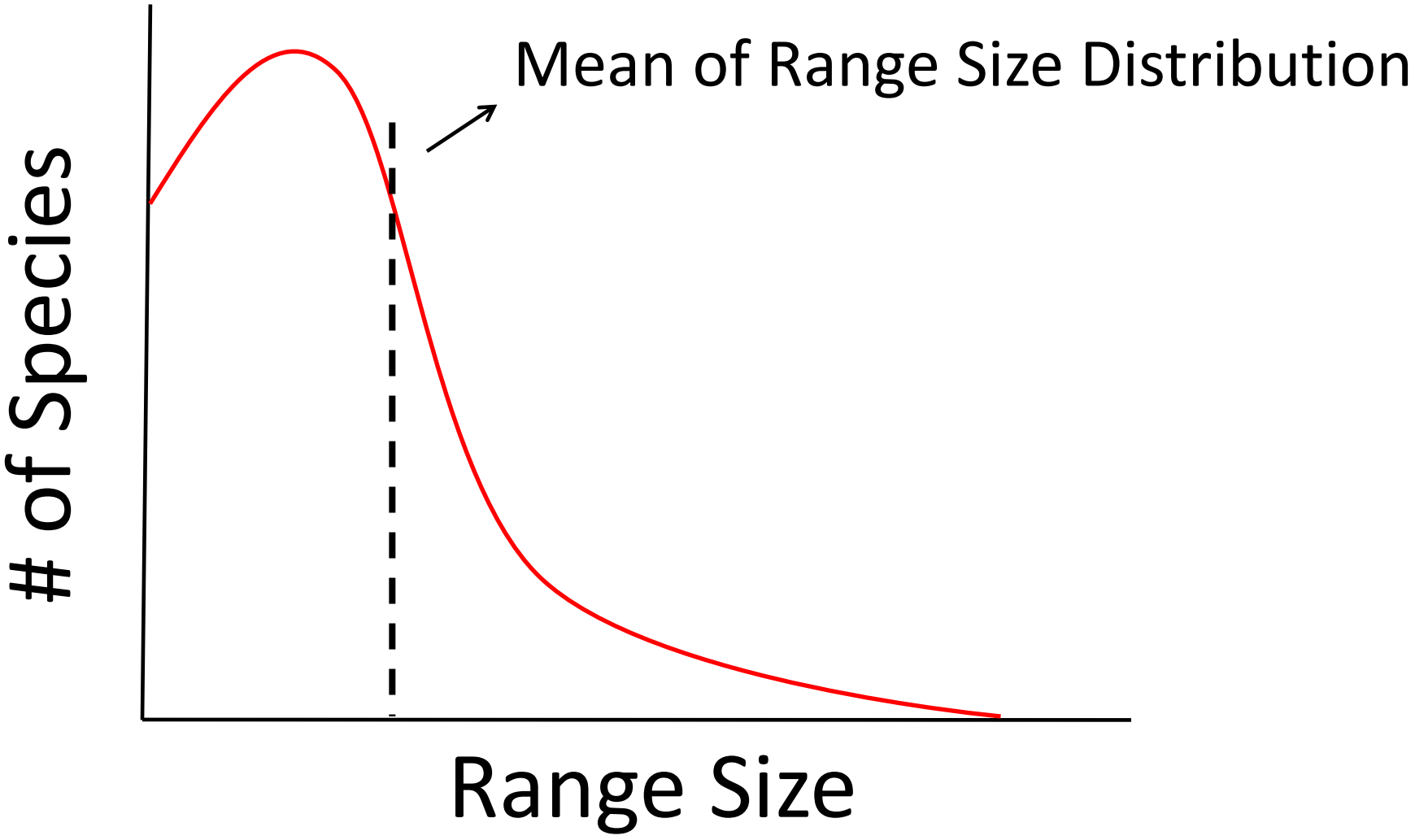
Species' Range Size Distributions

# of Species

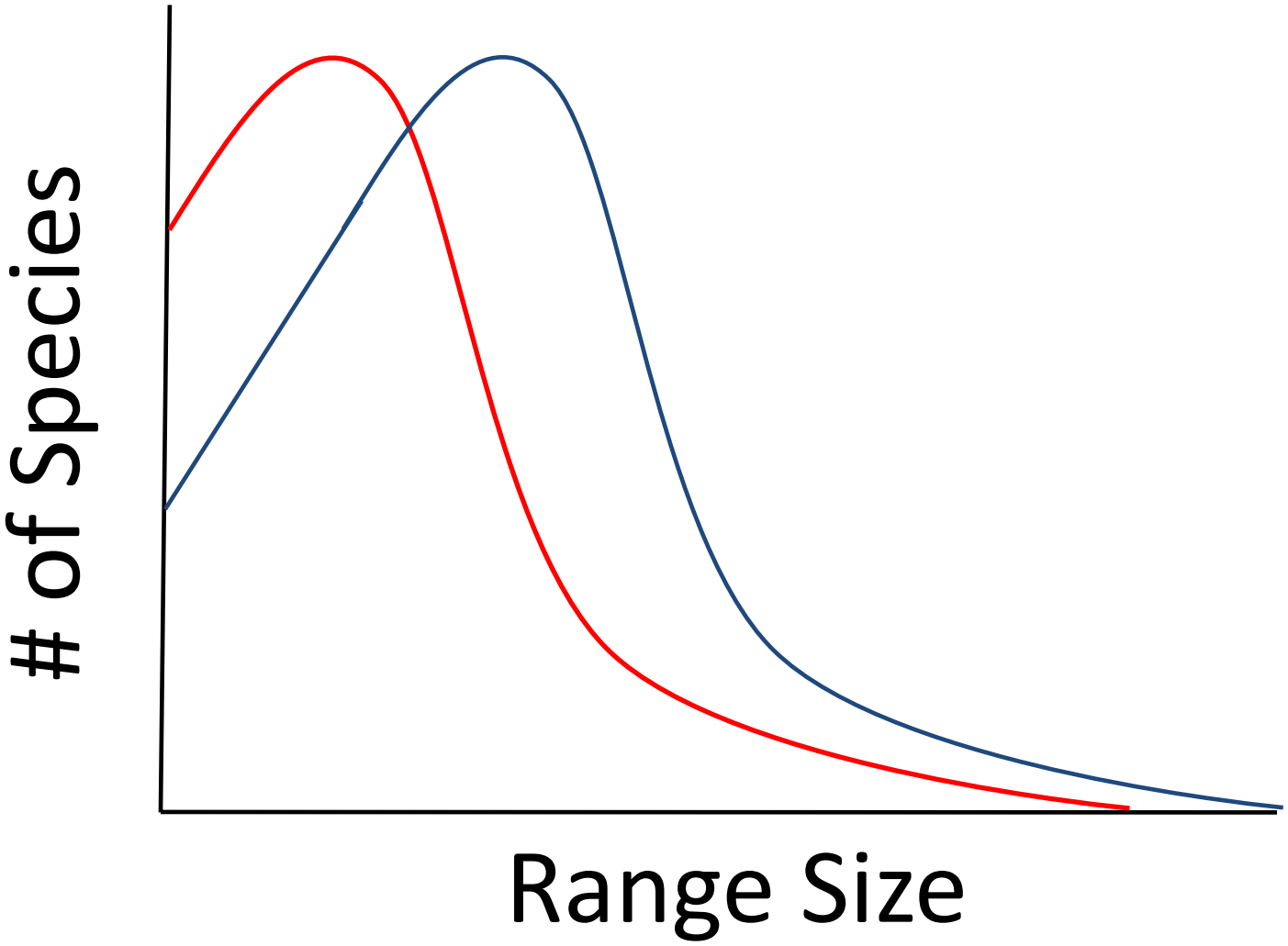
Range Size

Gaston, 2003

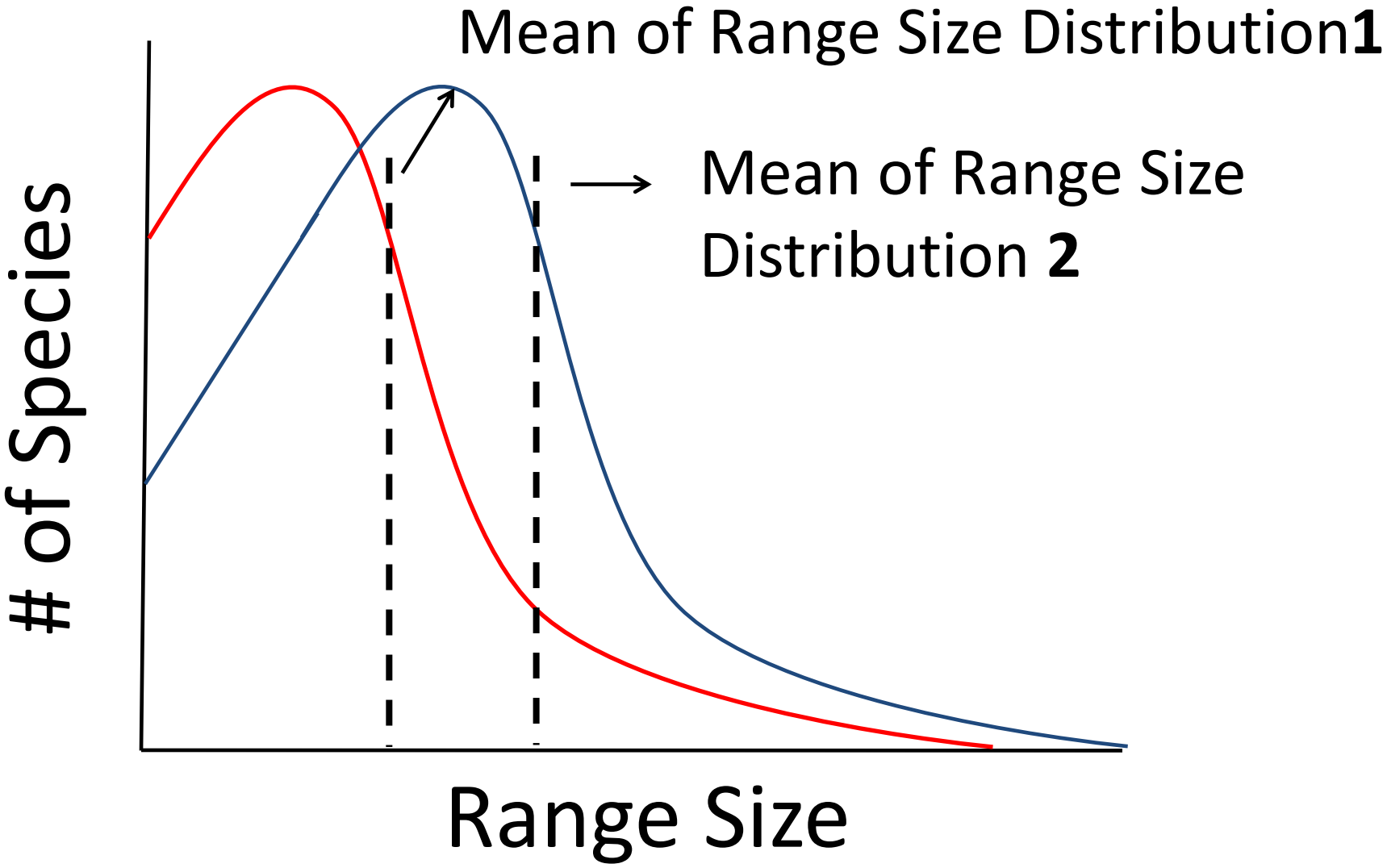
Species' Range Size Distributions

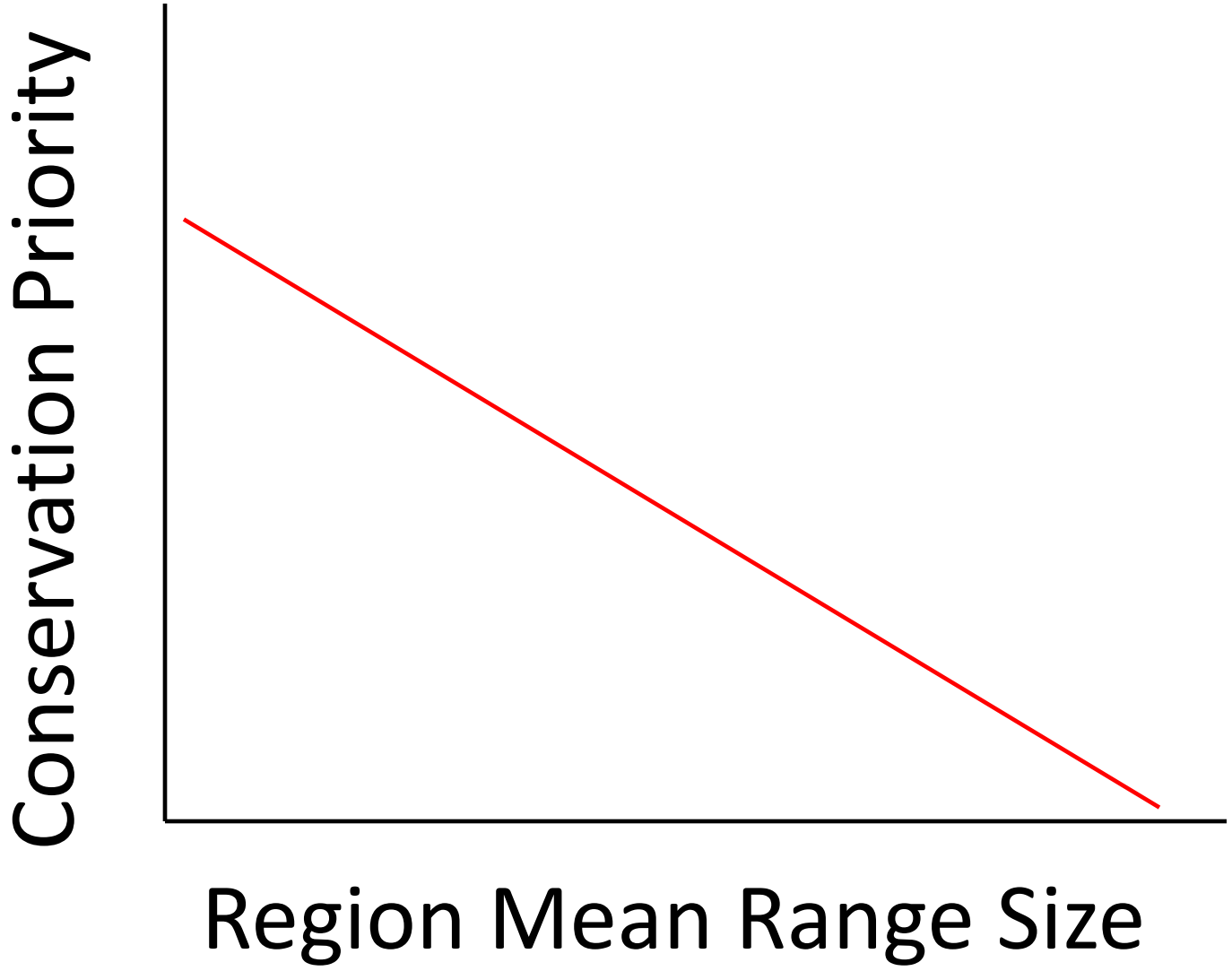


Species' Range Size Distributions

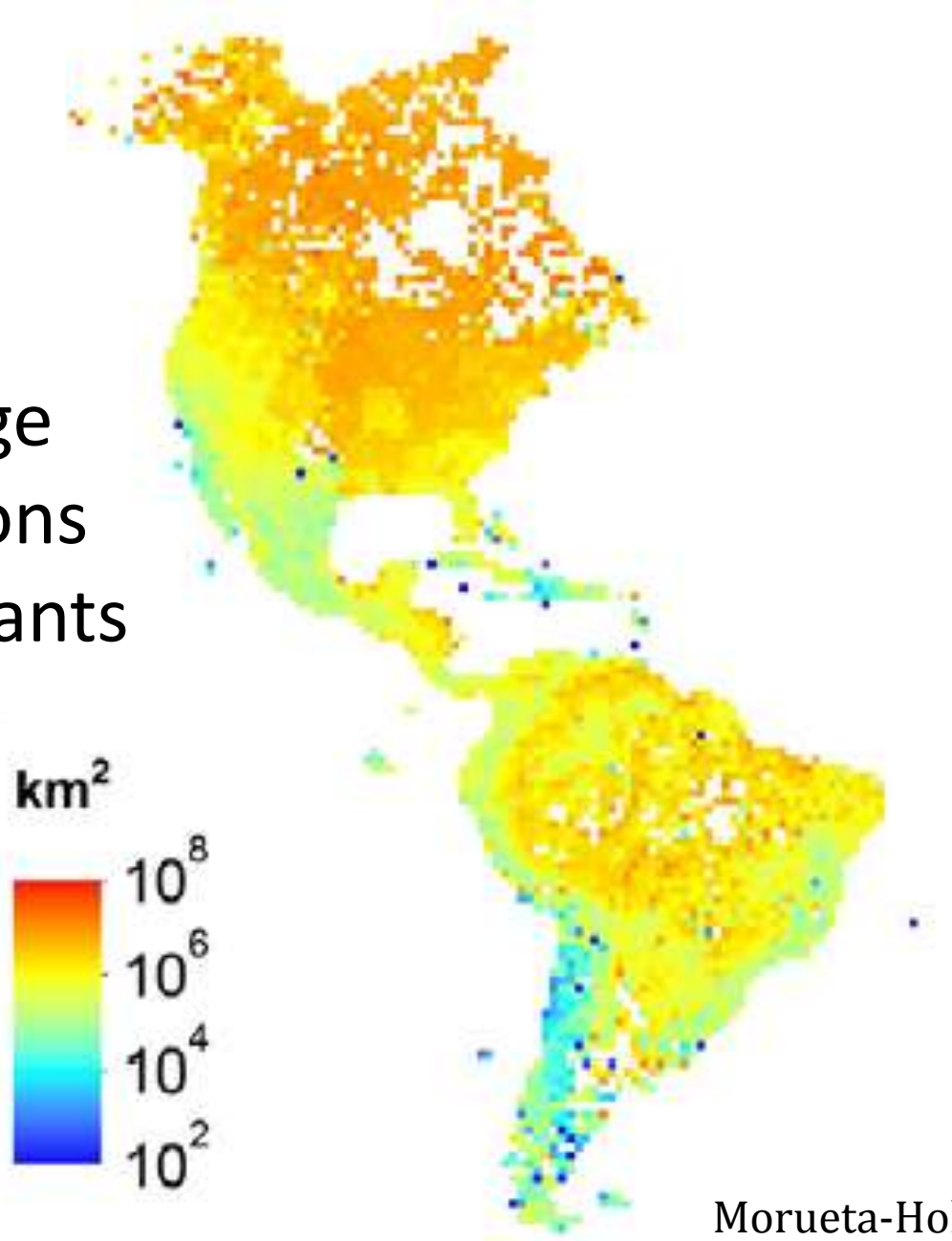


Species' Range Size Distributions




Conservation Priority
Region Mean Range Size

Means of Range Size Distributions for Vascular Plants



Morueta-Holme, et al. 2013

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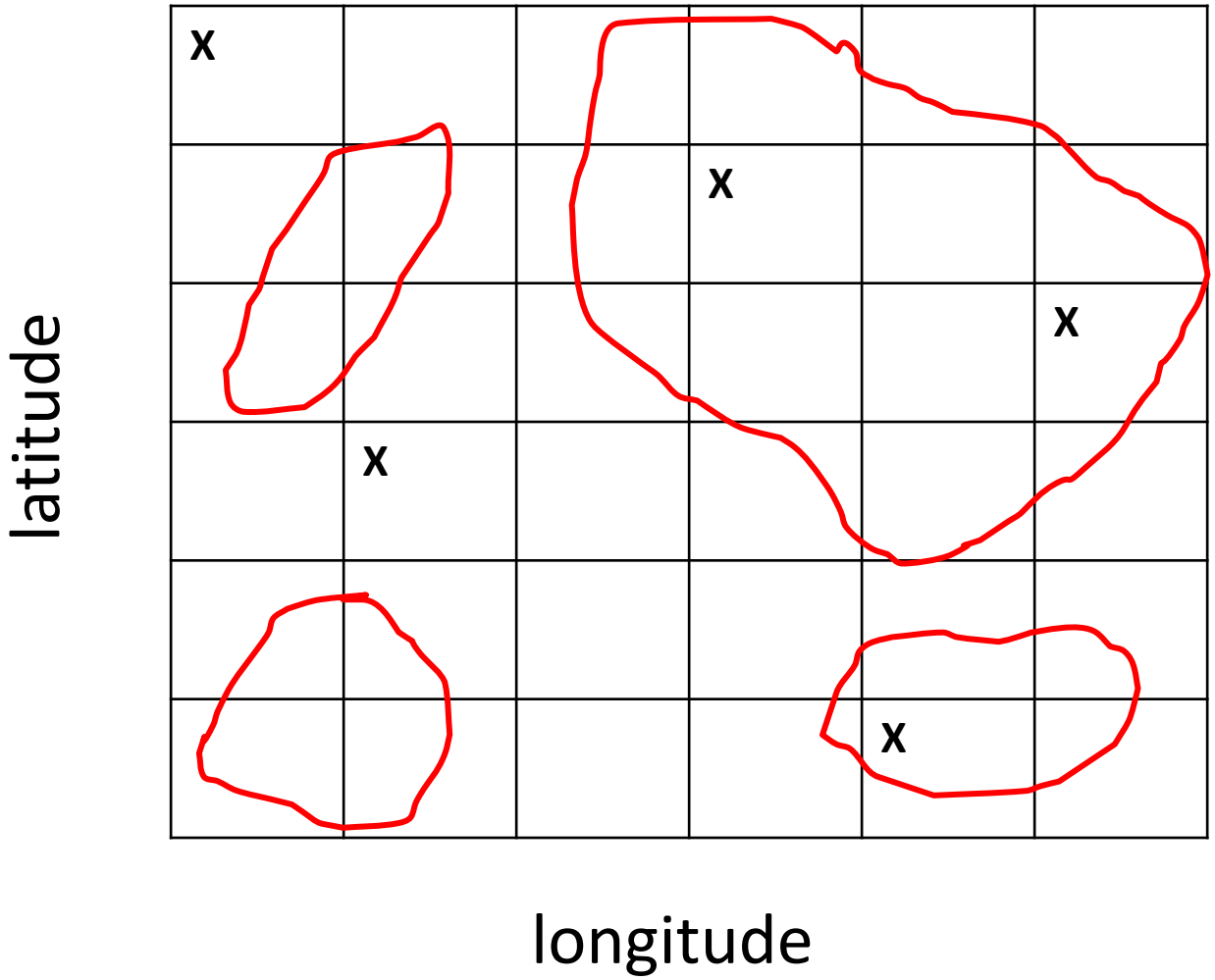
Working Hypothesis

A quantitative model that relates the effects of sampling effort to bias in estimates of the mean of range size distributions.

$$(\qquad)$$

Where ***P.m*** is the probability of not discovering a species, ***d*** is detectability, ***Ci*** is sampling effort, **AOO** is geographic range size measured as area of occupancy

Working Hypothesis



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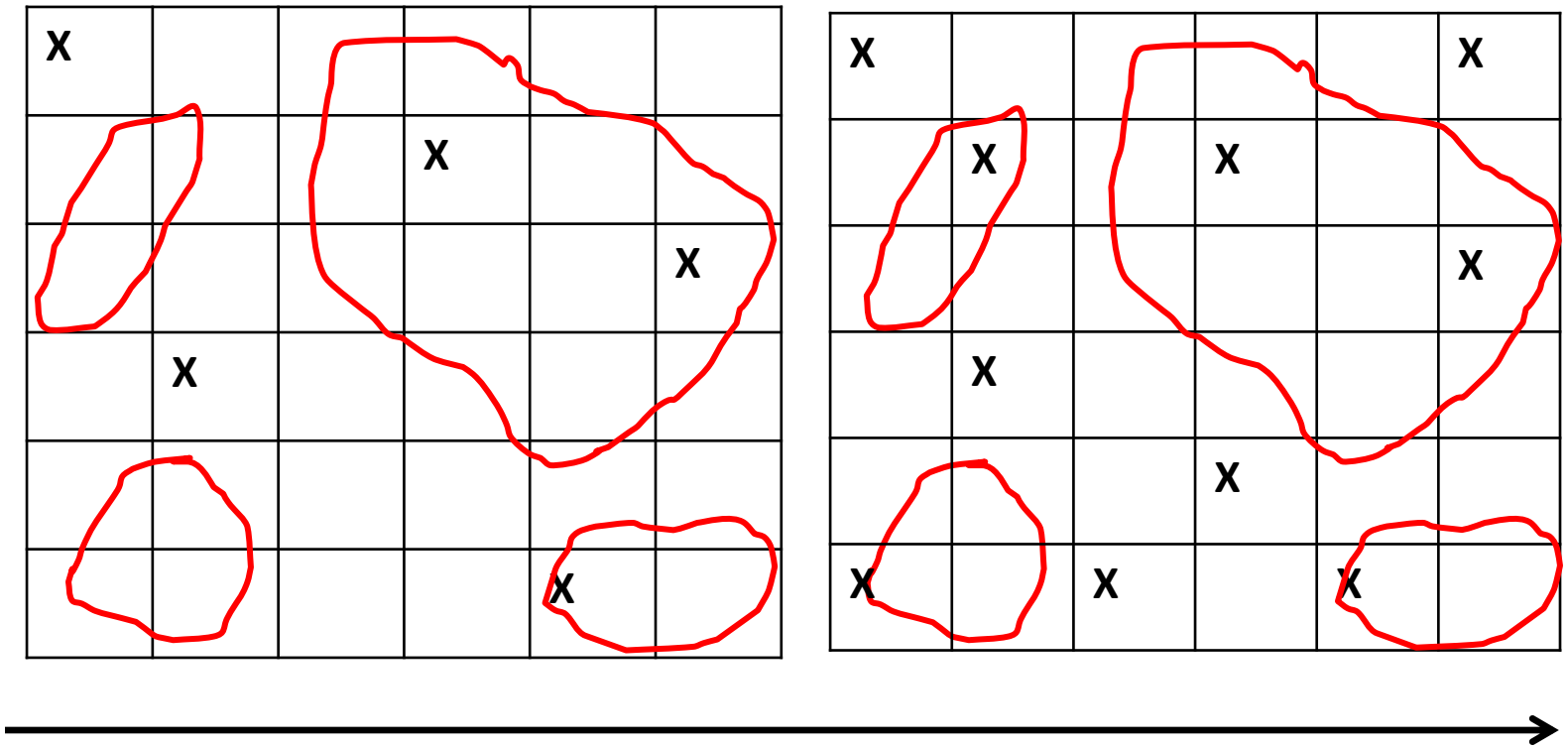
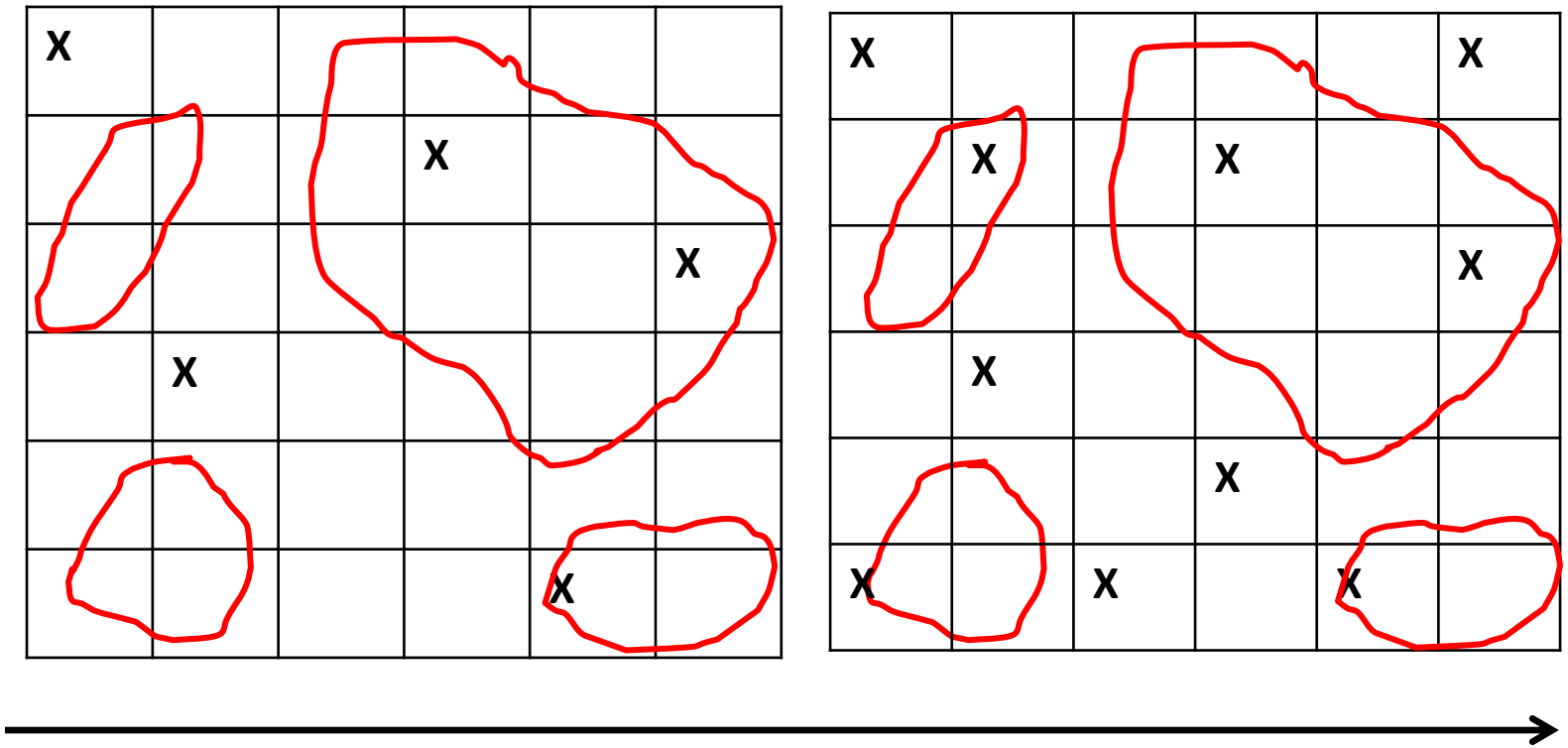


Working Hypothesis

Bias in Estimates of the Mean of Range Size Distributions is defined as:

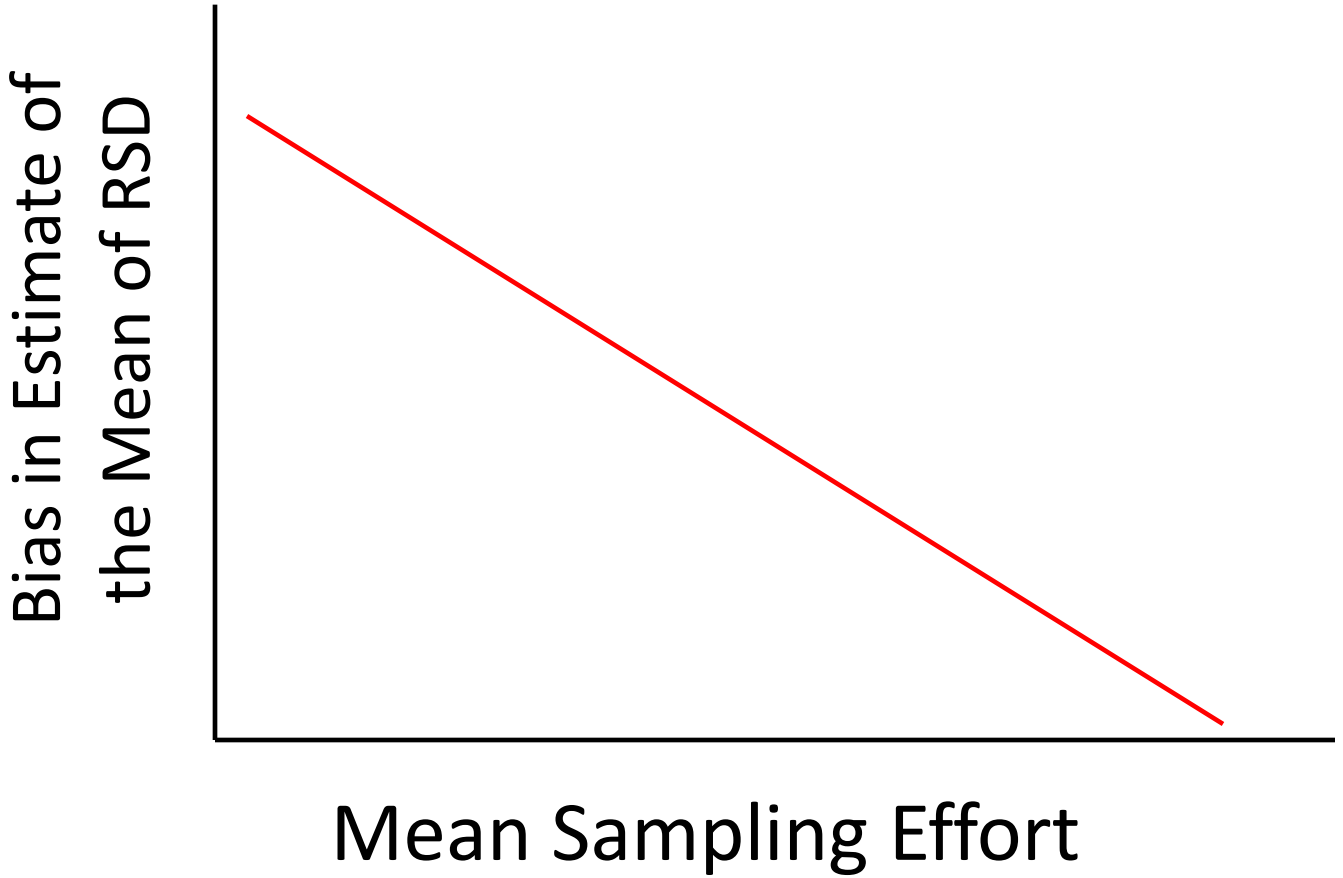
(Mean Range Size of discovered species –
Mean Range Size of all species)

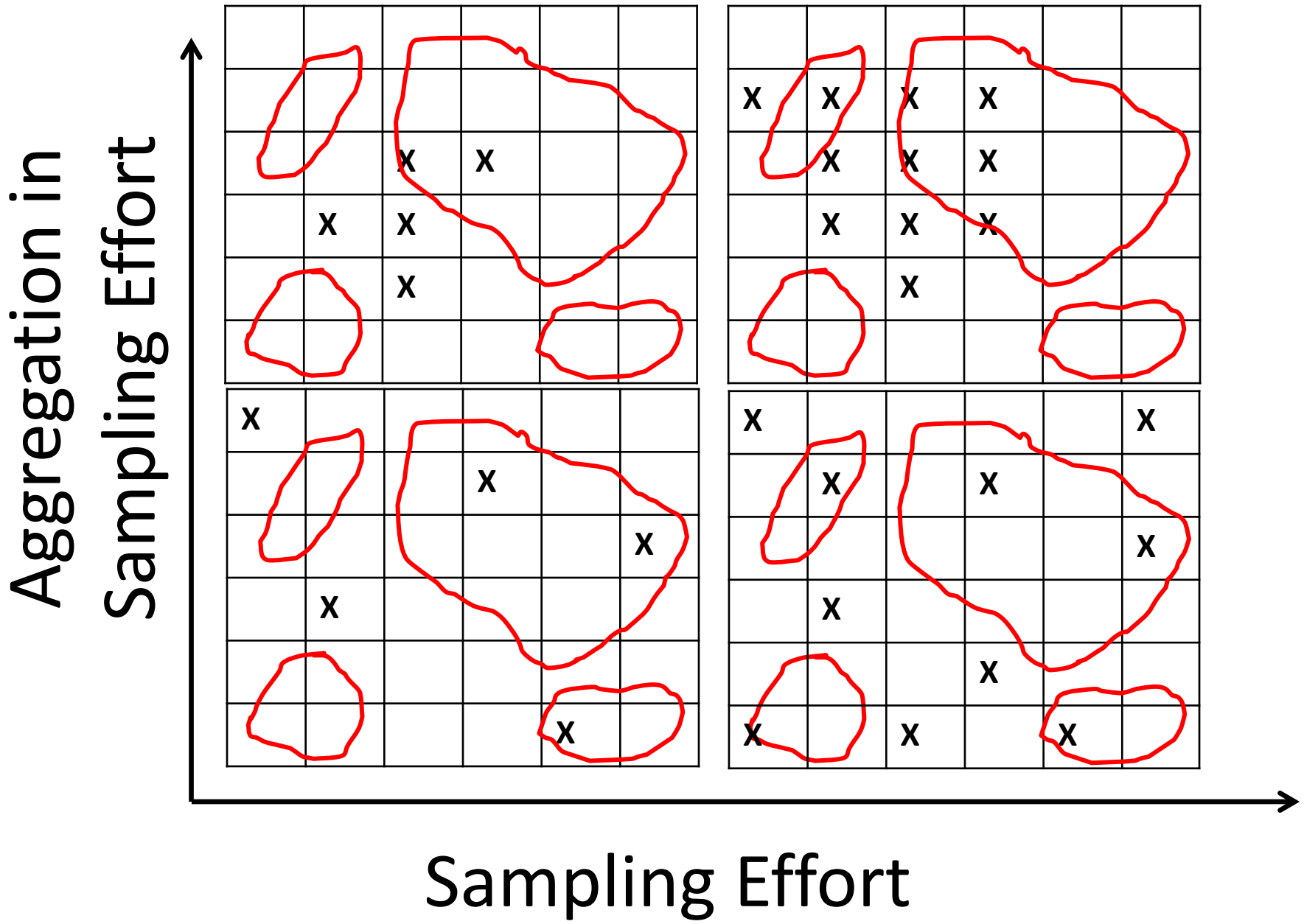
Working Hypothesis



Working Hypothesis

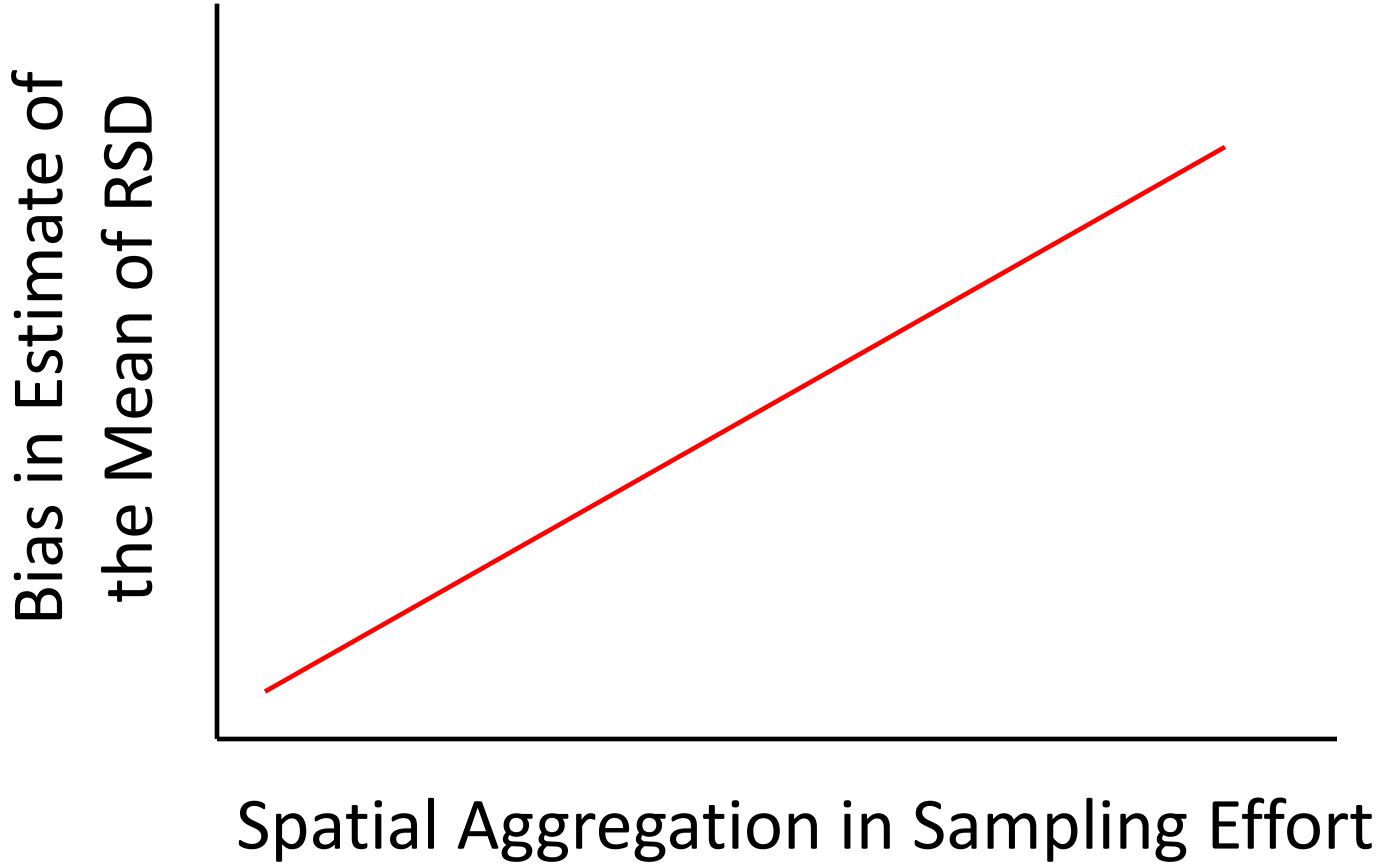
- **Prediction 1**: As mean sampling effort increases, the bias in the estimate of the mean of range size distributions will decrease.




Aggregation in Sampling Effort
Sampling Effort

Working Hypothesis

- **Prediction 2**: As spatial aggregation in sampling effort increases, the bias in the estimate of the mean of range size distributions will increase.



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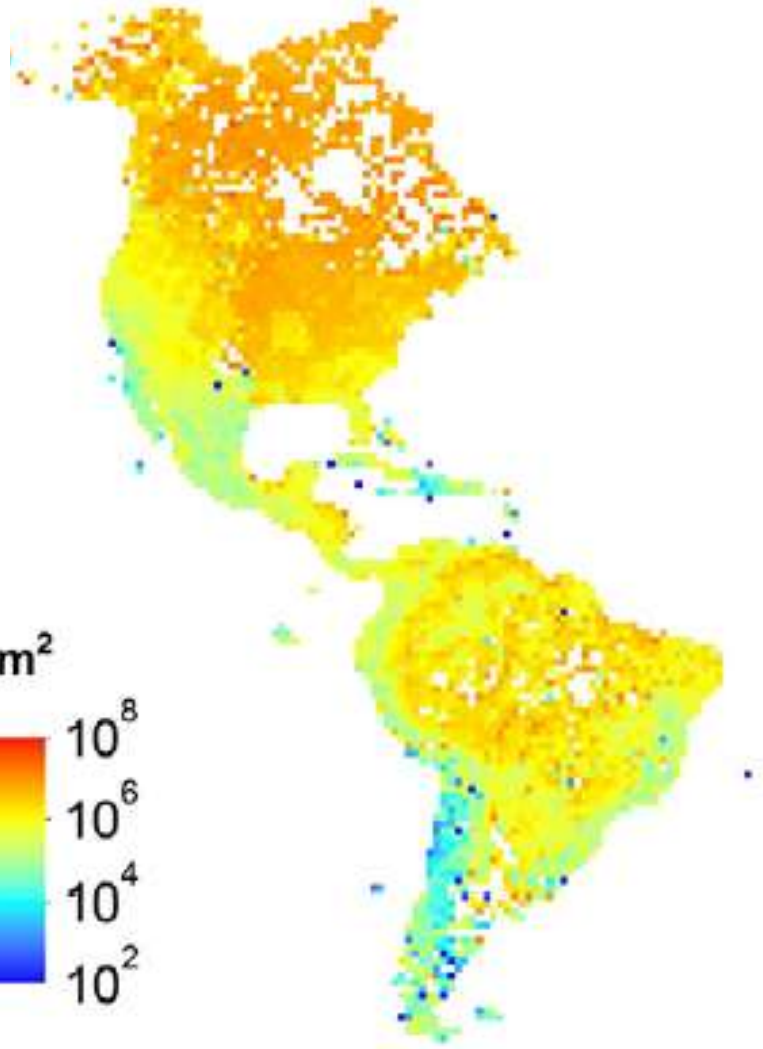
Study System



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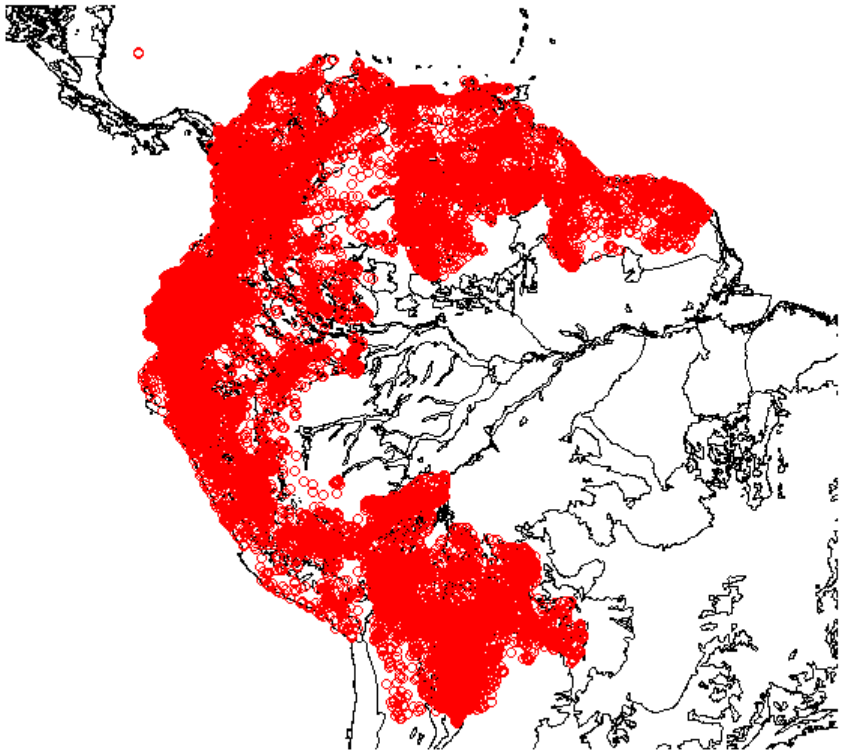
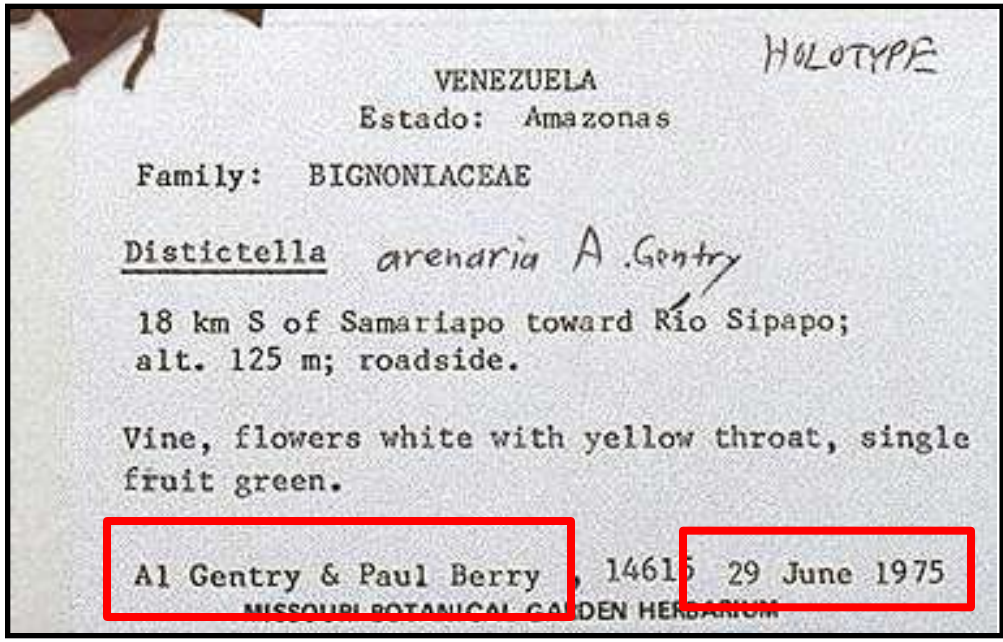
Quantification of Sampling effort

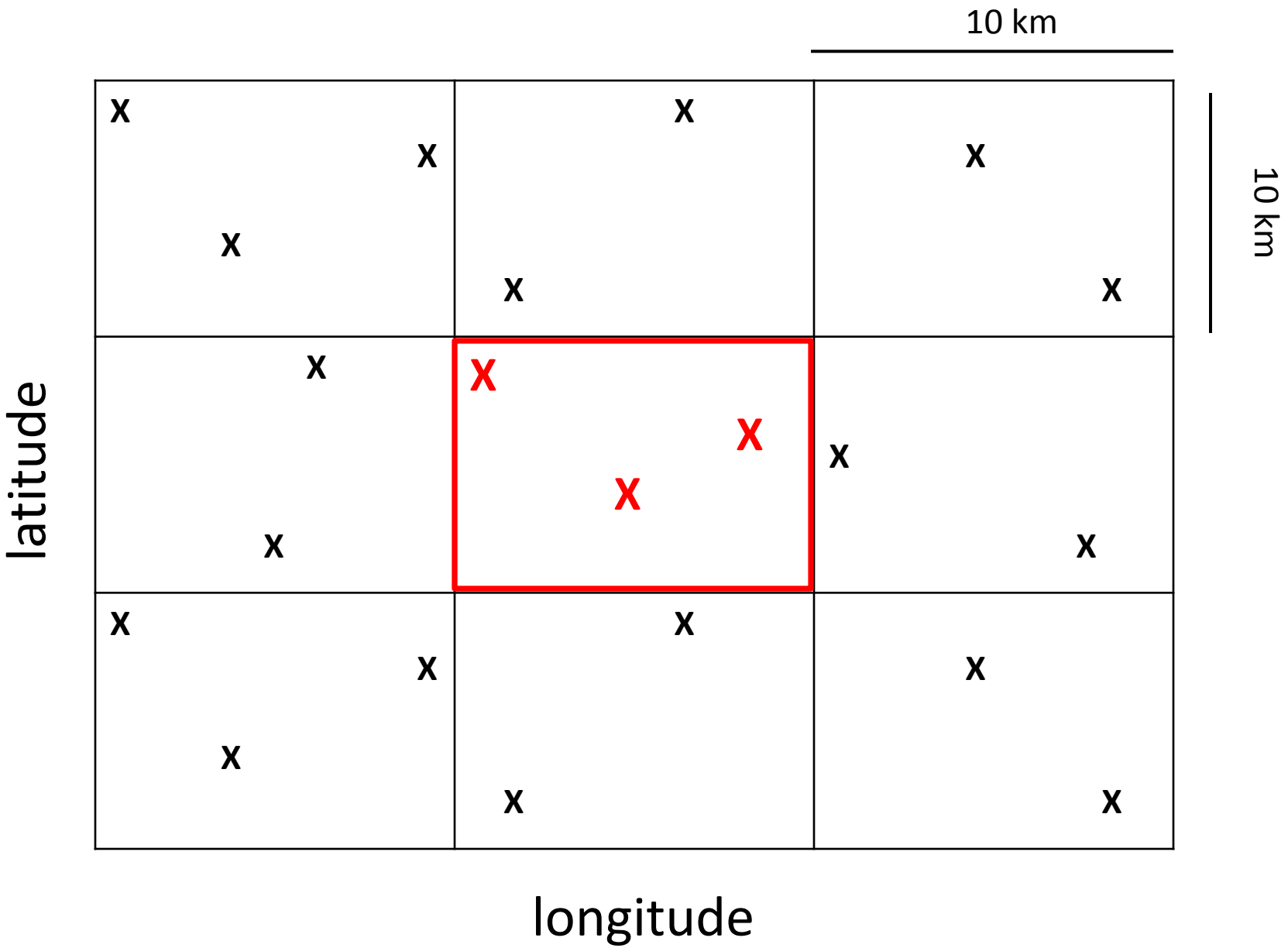
- 986,107 herbarium specimen records used



- Collector Days = unique combinations of collector name and collection date (Sheth, et al. 2012)



Quantification of Sampling effort



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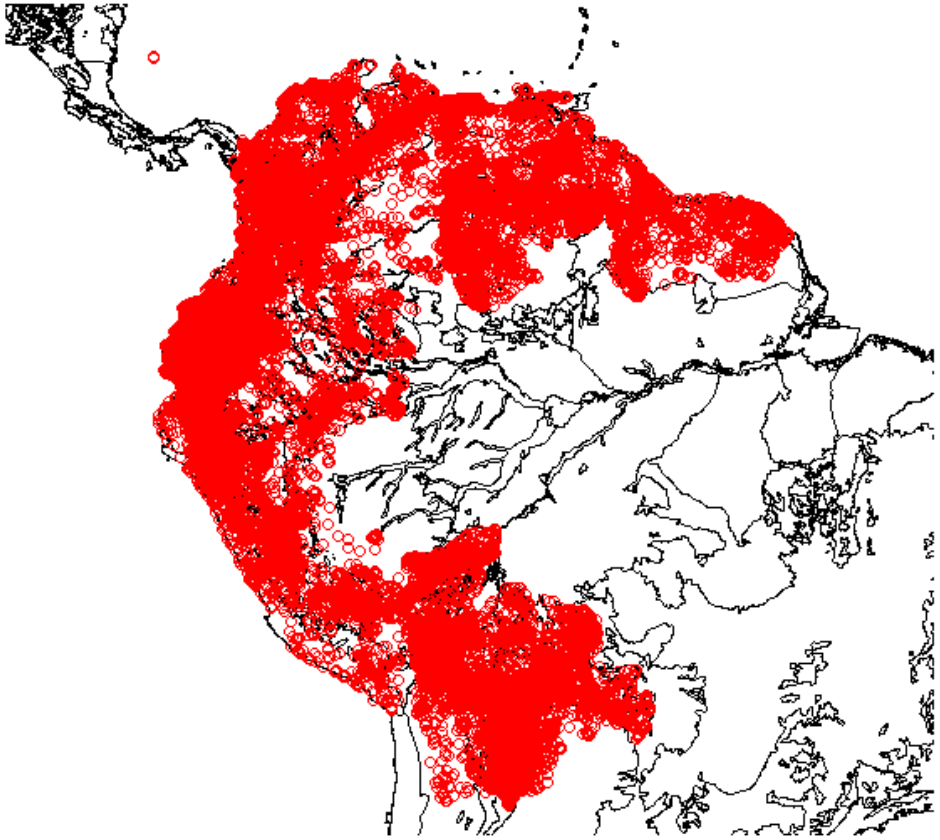
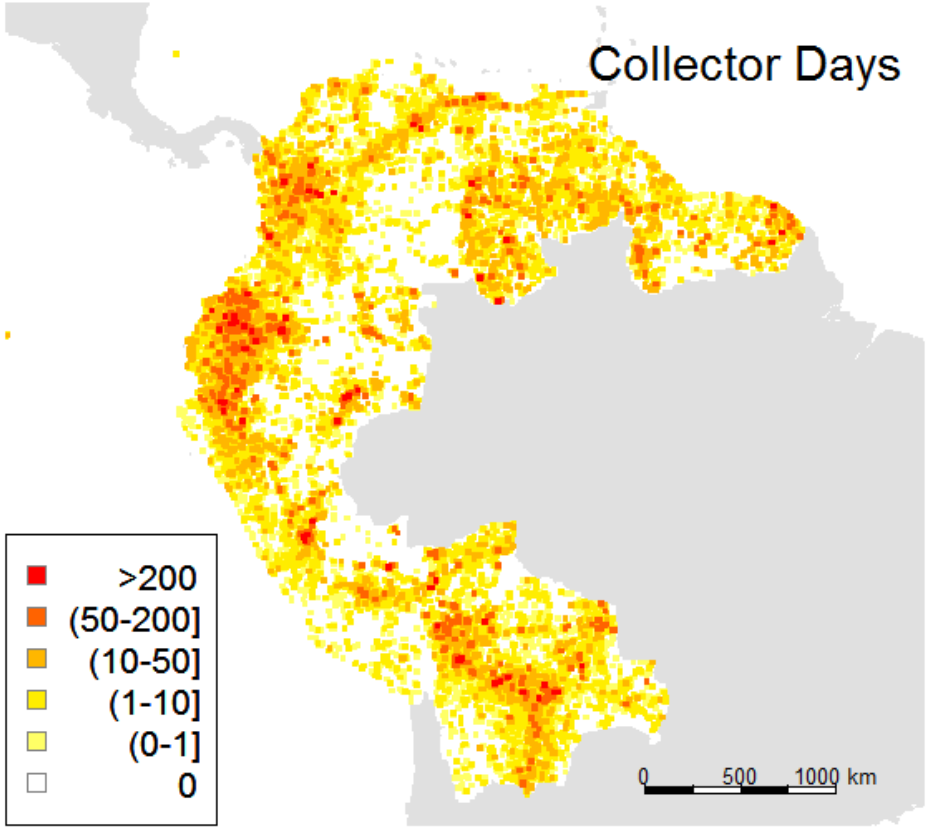
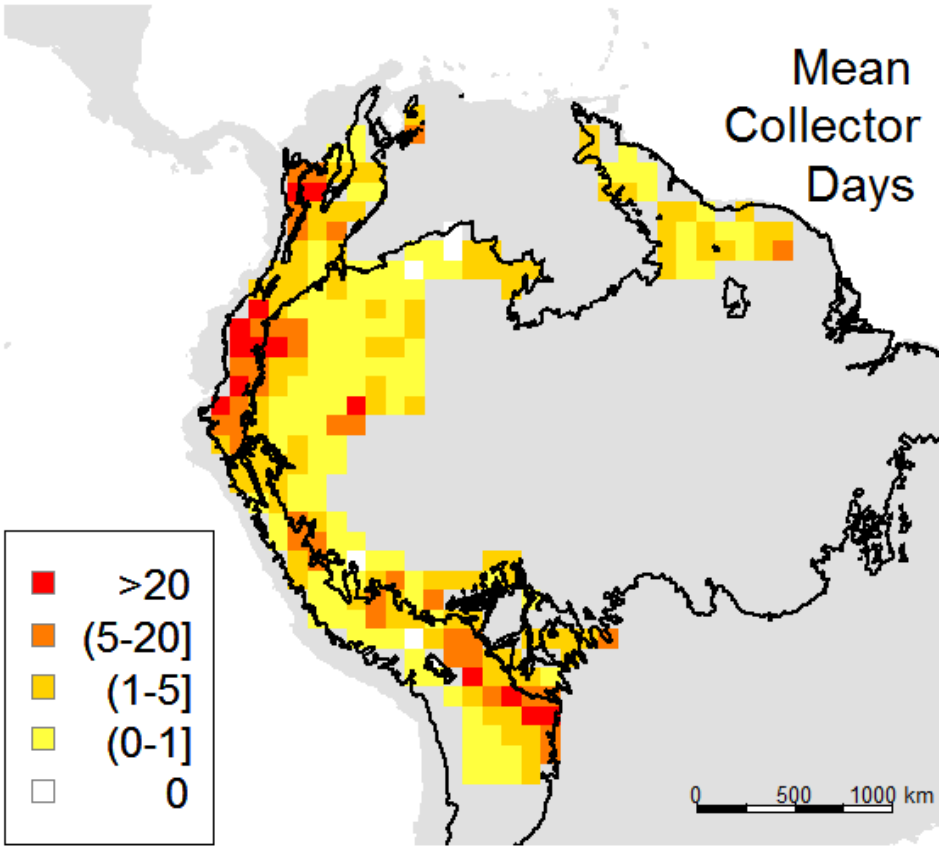
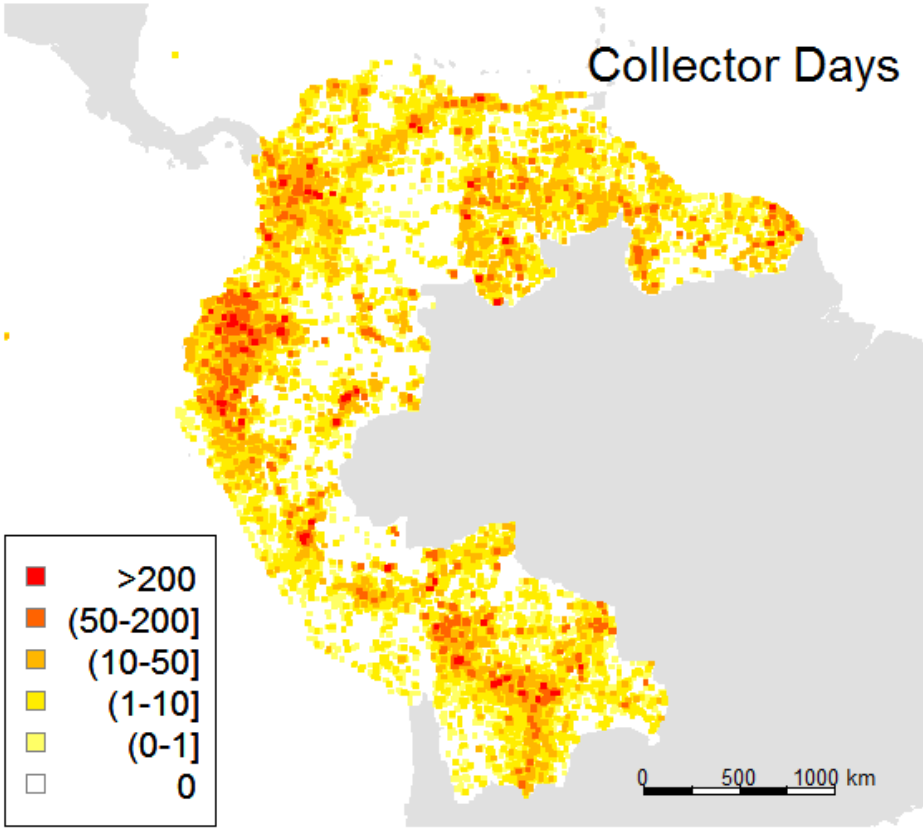




10 x 10km cells

Quantification of Sampling effort





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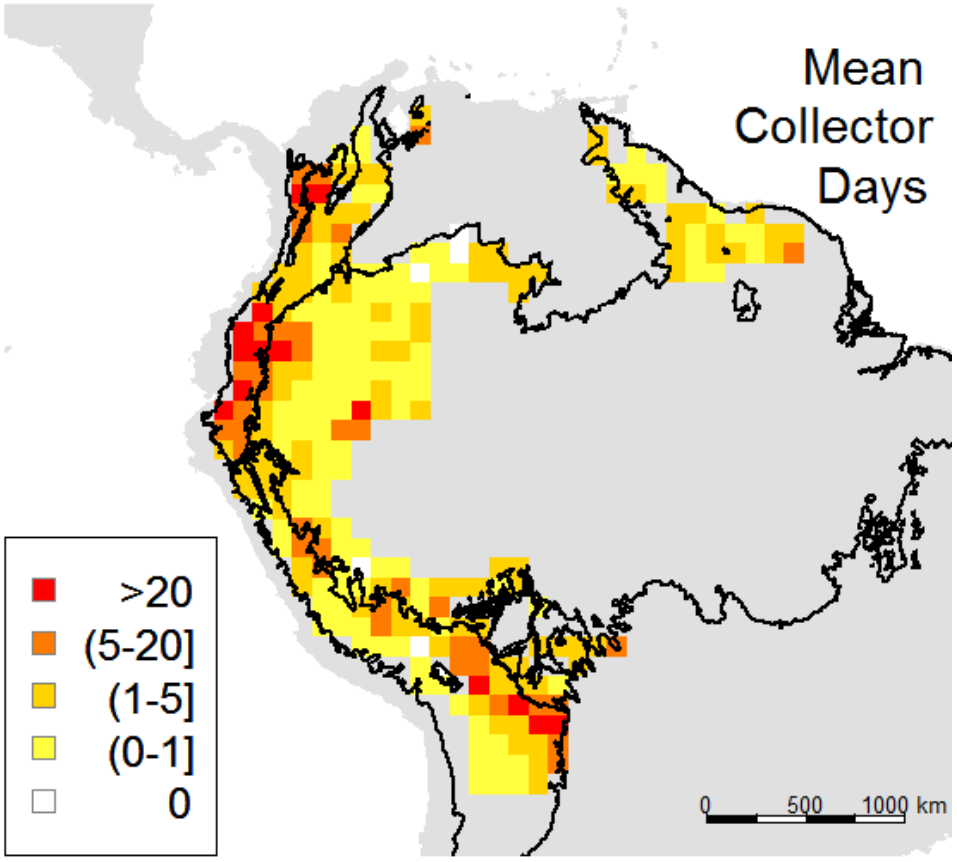

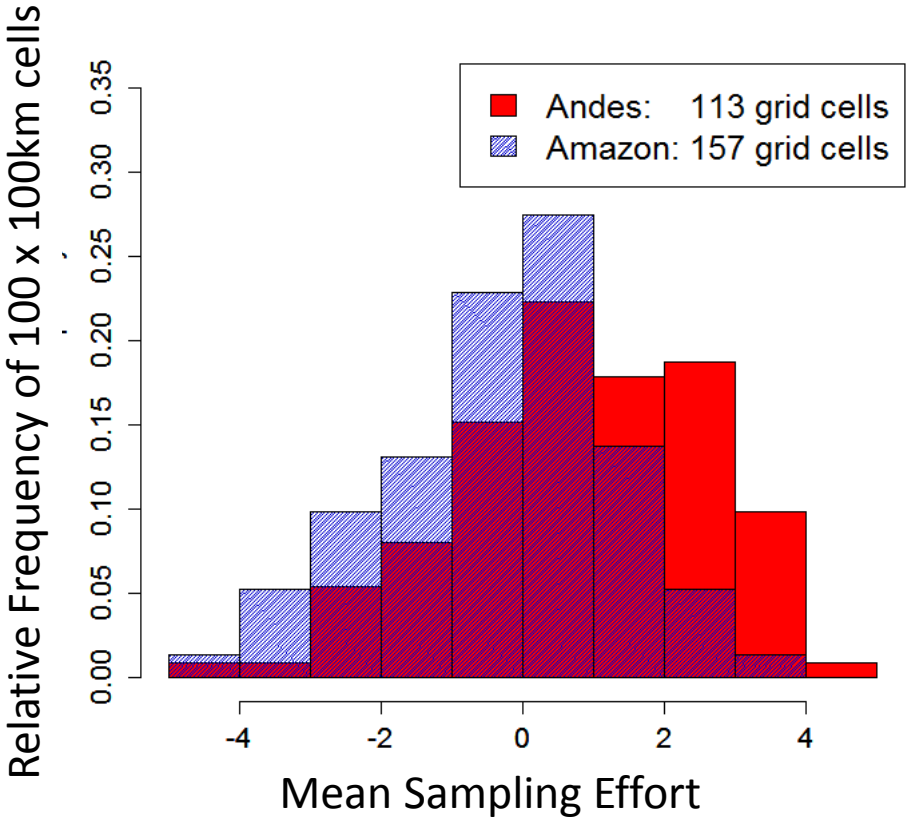

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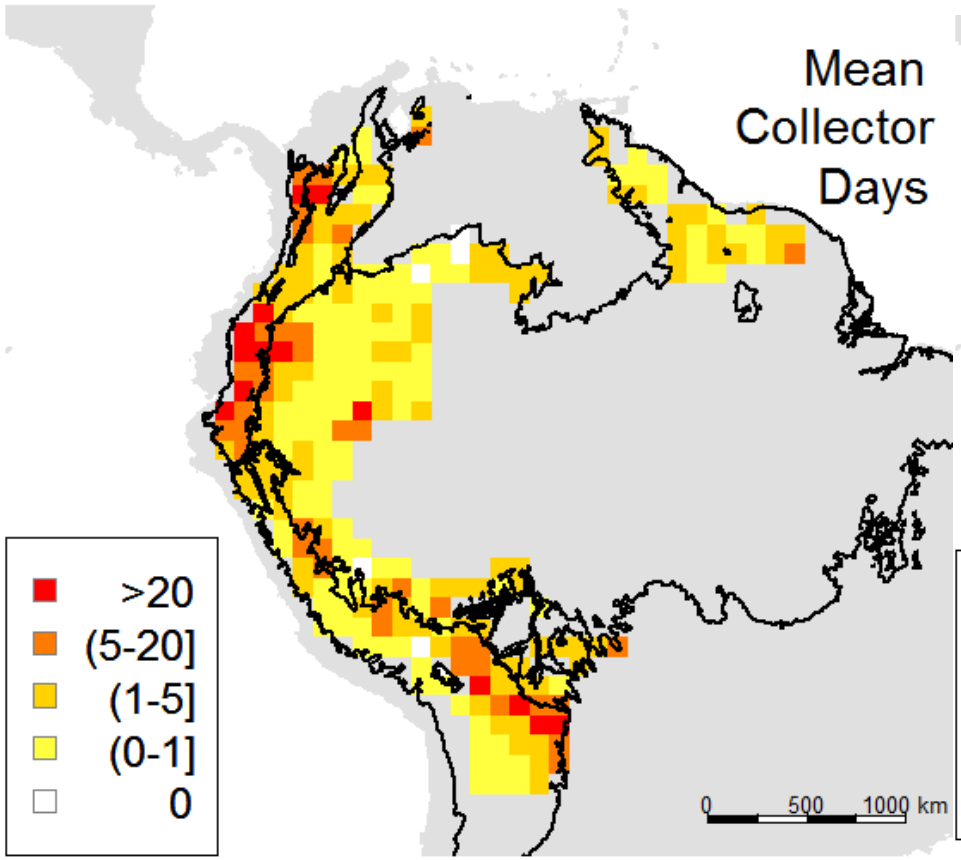

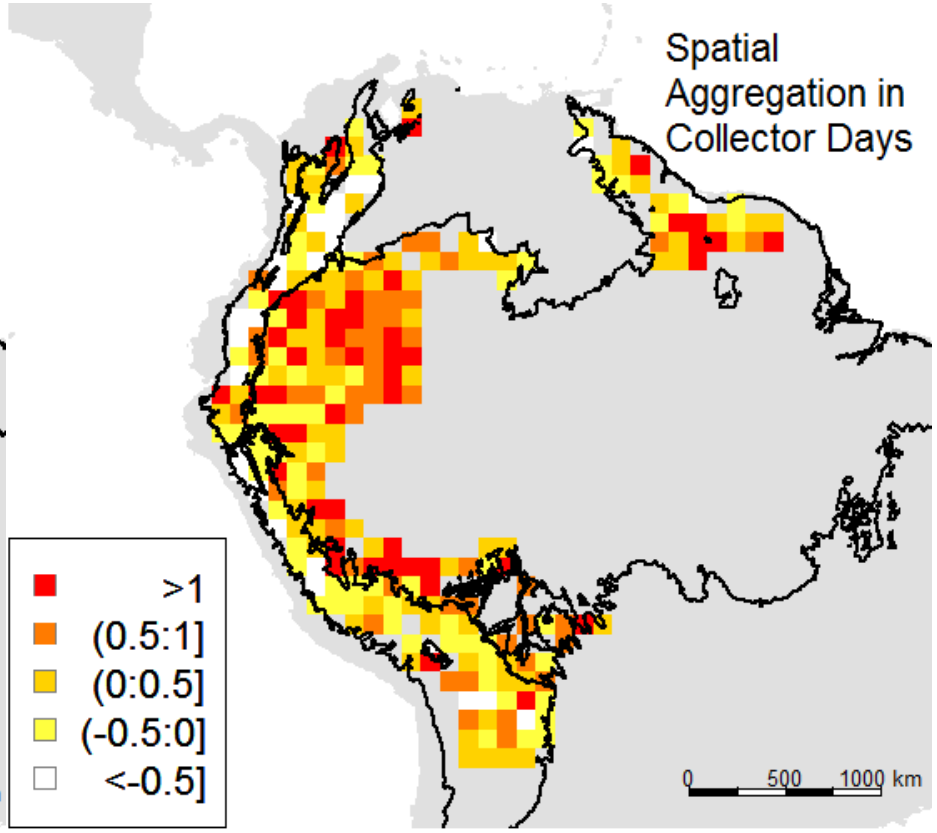

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Computer Simulation Experiment

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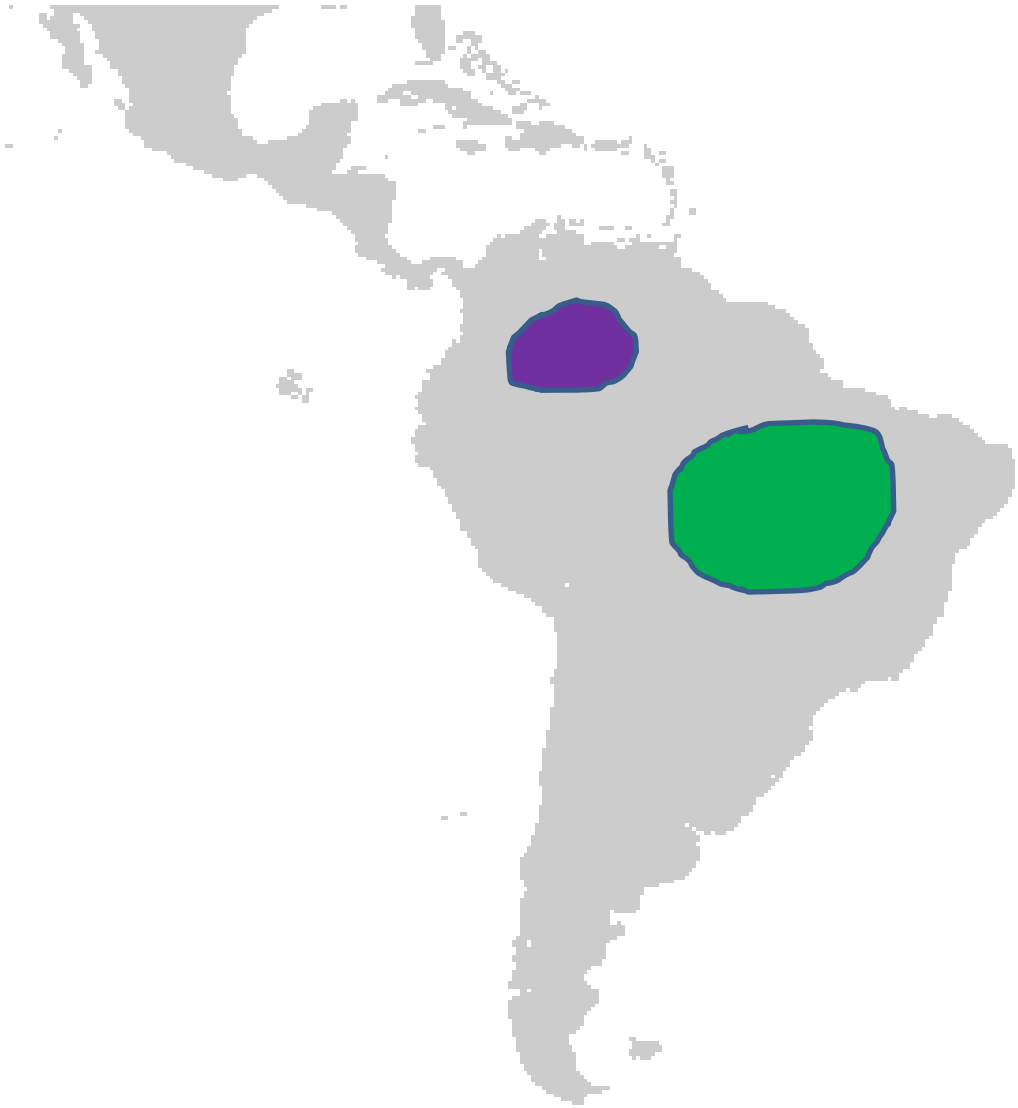

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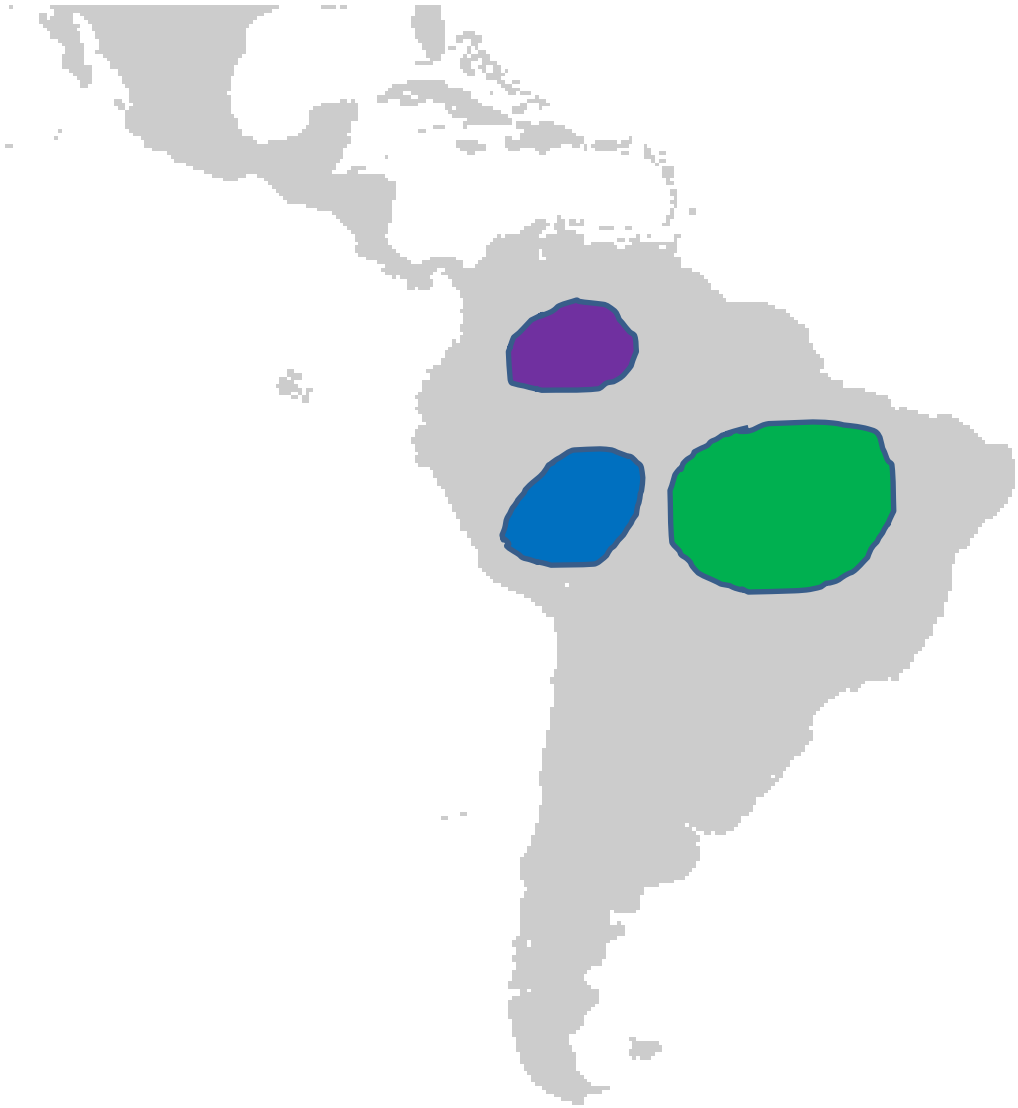
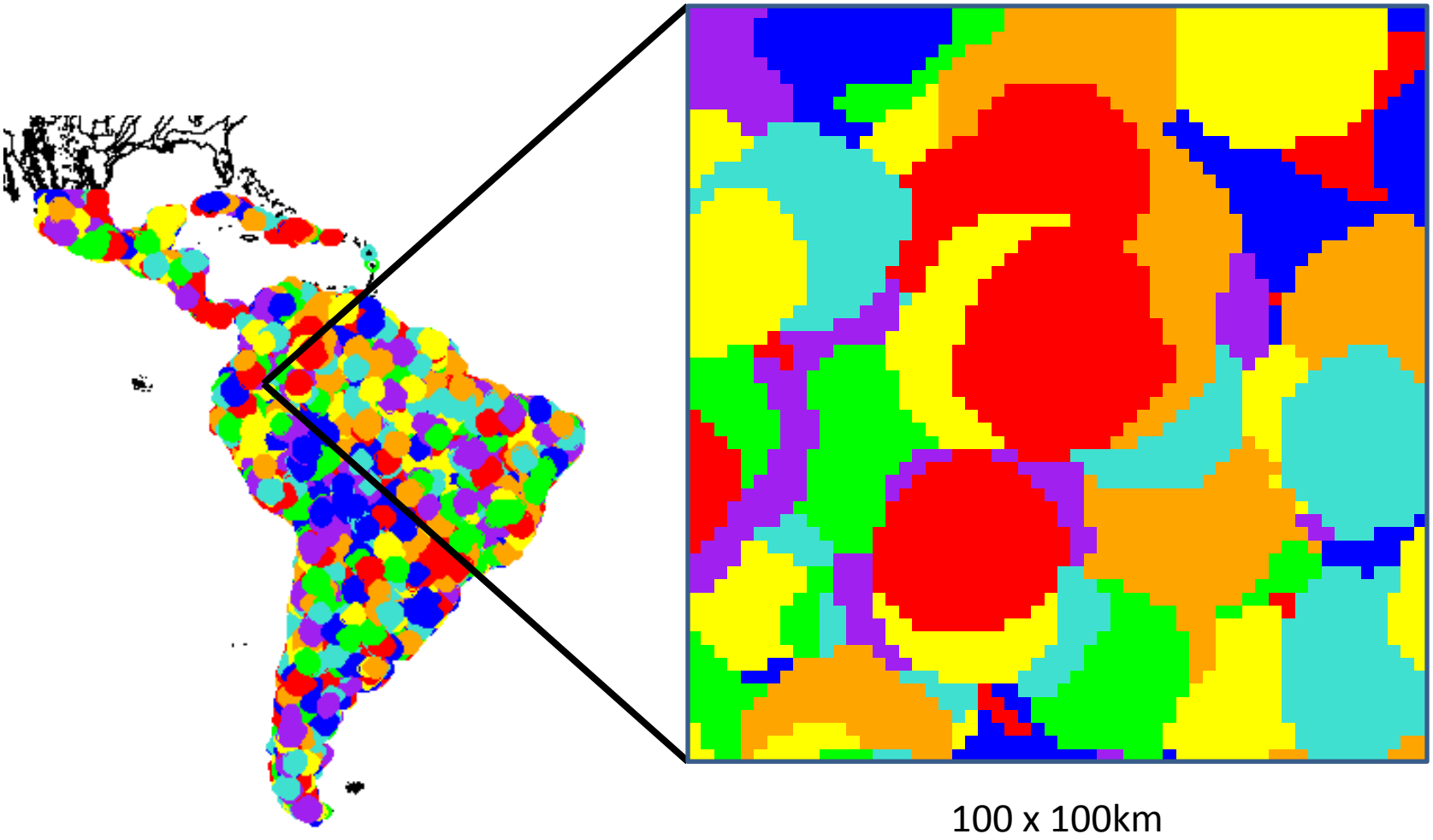


Computer Simulation Experiment

100,000 Species

Computer Simulation Experiment



100 x 100km

Computer Simulation Experiment

Bias in Estimates of Mean Range Size is defined as:

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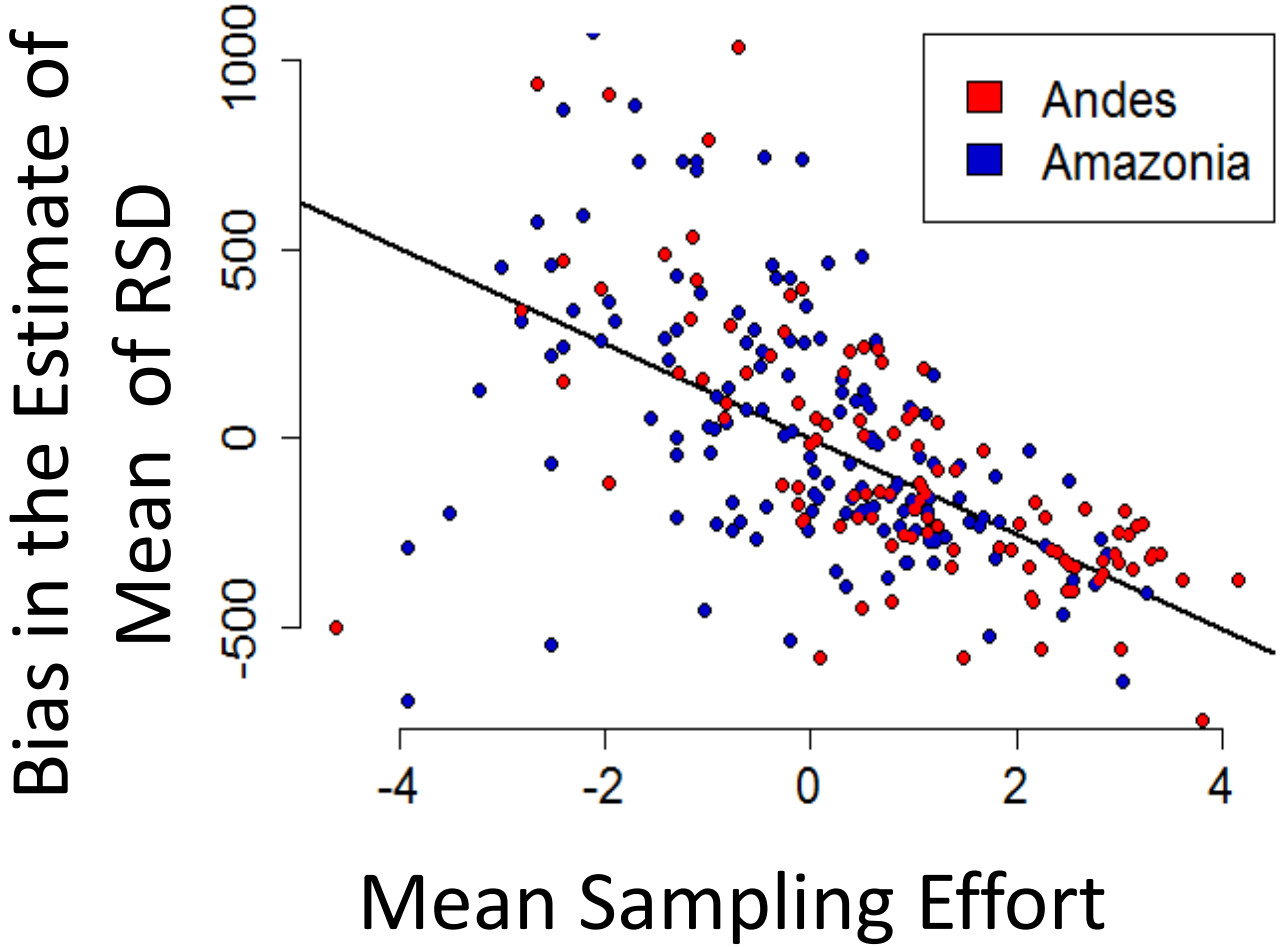

Prediction 2: As spatial aggregation in sampling effort increases, the bias in the estimate of the mean of range size distributions will increase.

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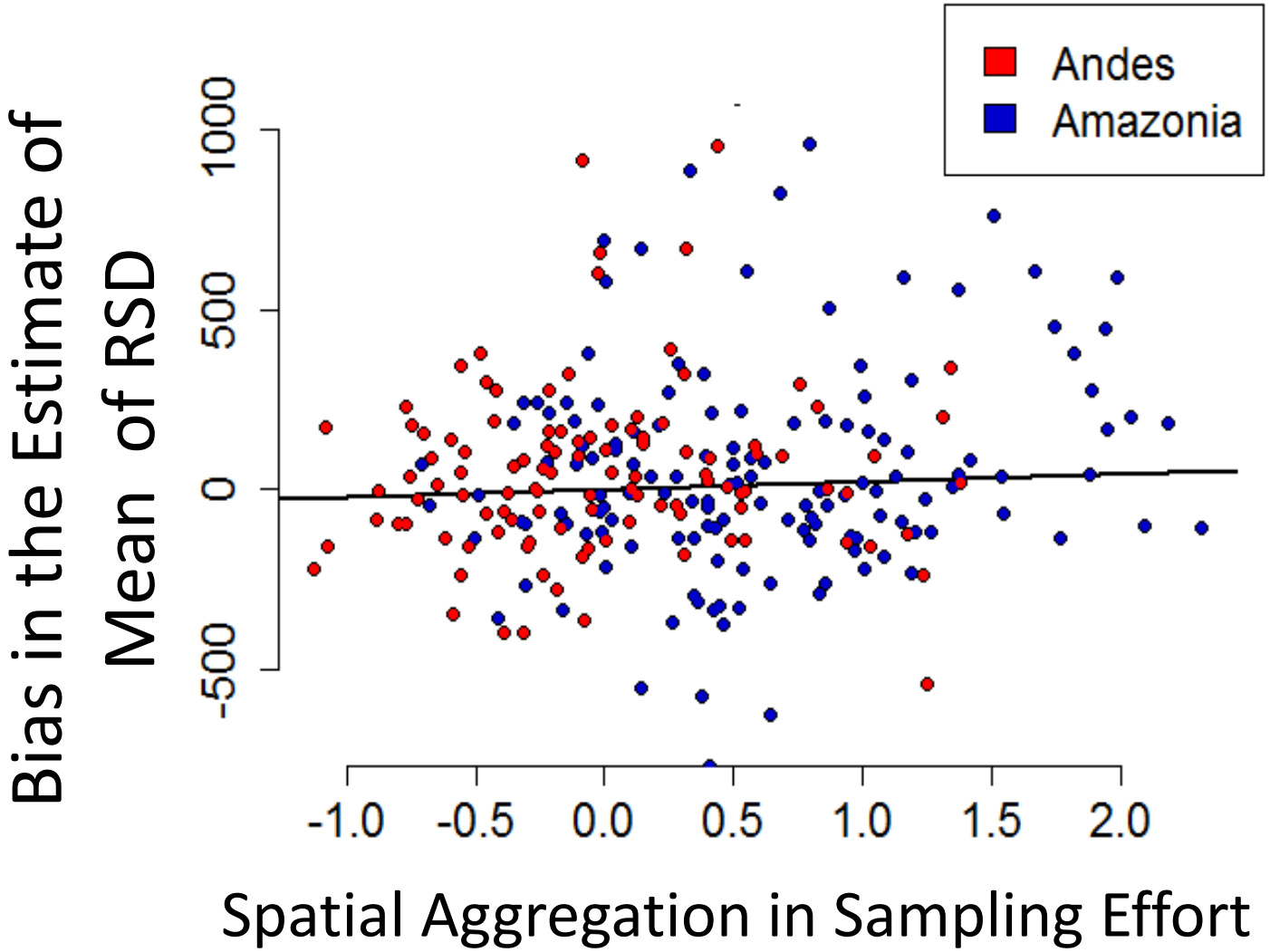

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Conclusions

- **Mean sampling effort** is higher in the Andes than Amazonia.

- **Spatial aggregation** of sampling effort is lower in the Andes than Amazonia.

Conclusions

- **Mean sampling effort** has a negative relationship with bias in estimates of the mean of range size distributions.

- **Spatial aggregation** in sampling effort has a positive relationship with bias in estimates of the mean of range size distributions.

Implications

- Current descriptions of geographic variation in RSD (Morueta-Holme, et al. 2013) and the density of narrowly distributed plant species across the Neotropics (Myers, et al. 2000; Pimm, et al. 2014) **may be more fiction than substance, and should be regarded as highly tentative at best.**

Acknolwedgments

- David Bogler
- Burgund Bassuner
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- National Science Foundation.

Questions?