

# The Relationship Between Biodiversity and Human Population

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# Hypothesis

We predict that biodiversity will decrease as human population increases

# Methods

- Transects
  - 3 elevation points
  - 100 meter segments (3)
- Species count + coverage



- 100 m to and from each transect
- Coin flip
- 1m x 1m transect
- Recorded GPS coordinates & elevation





# East Side

## *Wa'ahila Ridge State Recreation Area*

- Free-ranging cattle grazed up and down the valleys of Oahu
- Early 1900's, healthy forests were required to recharge ground water tables
- Hawaii Sugar Planter's Association (HSPA) purchased acres to evaluate trees best suited for reforestation efforts





**LOW**  
50 ft



**MID**  
1000 ft



**HIGH**  
1380 ft



## Common Species Found



Cook Pine (*Araucaria columnaris*)

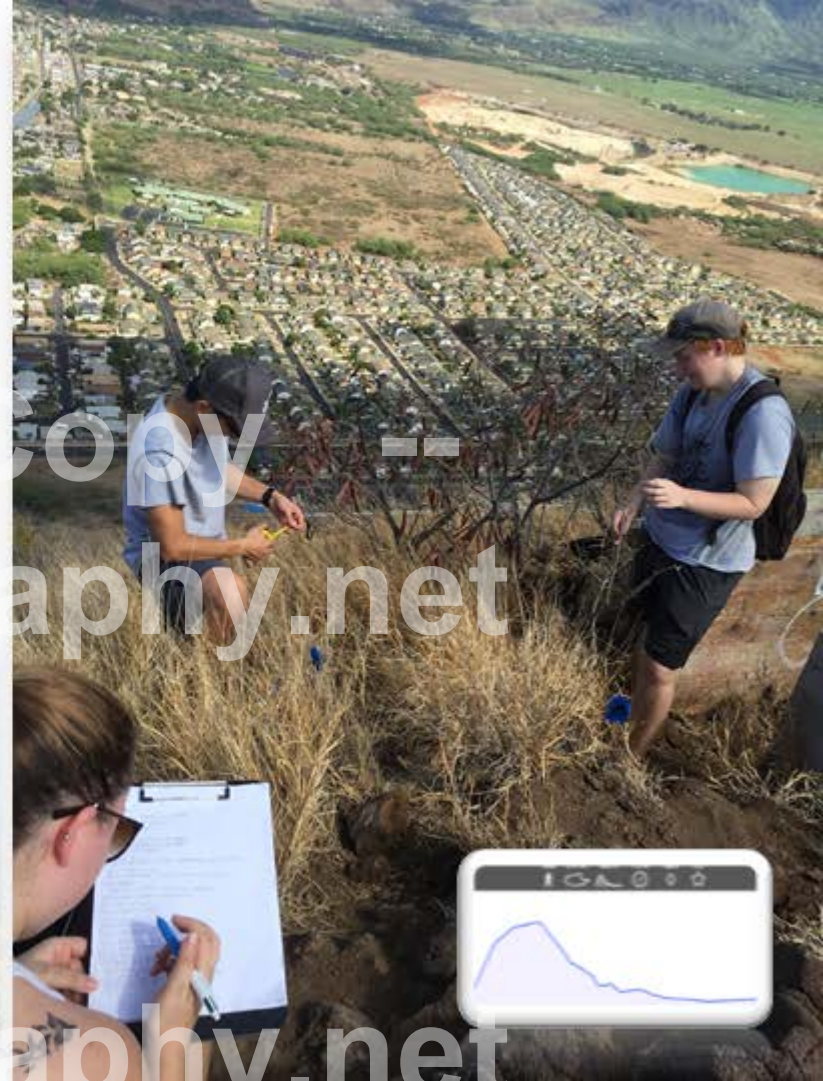


Strawberry Guava (*Psidium Cattleianum*)

# West Side

## *Puu o Hulu Kai Pink Pillbox Hike*

- Became a military reservation in 1923
- Construction was abandoned at the end of the war





**LOW**  
50 ft



**MID**  
600 ft



**HIGH**  
810 ft

## Common Species Found



Guinea grass  
*Urochloa maxima*



Koa Haole  
*Leucaena leucocephala*

# Overview

**16**

Total distinct species

*Waahila*(13) -- *Puu O Hulu Kai* (4)

1 species found at both

*Leucaena leucocephala* (*Koa haole*)

Most common family

*Poaceae* (*grasses*)



Jaccard Similarity Coefficient: 0.06

# Waahila



*Proportion of Coverage by Species*

<b><i>Megathyrus maximus</i></b>	<b>Unknown Succulent</b>	<b><i>Stachys cooleyae</i></b>	<b><i>Leucaena leucocephala</i></b>	<b>Unknown grass 1</b>	<b>Unknown tree 1</b>	<b><i>Psidium cattleyanum</i></b>
0.144	0.052	0.003	0.022	0.044	0.022	0.211
<b>Ironwood</b>	<b>Eucalyptus</b>	<b>Cook Pine</b>	<b>Unknown vine 1</b>	<b>Unknown Moss 1</b>	<b>Unknown Vine 2</b>	<b>Bare</b>
0.050	0.022	0.033	0.011	0.028	0.006	0.35

# Puu o Hulu Kai



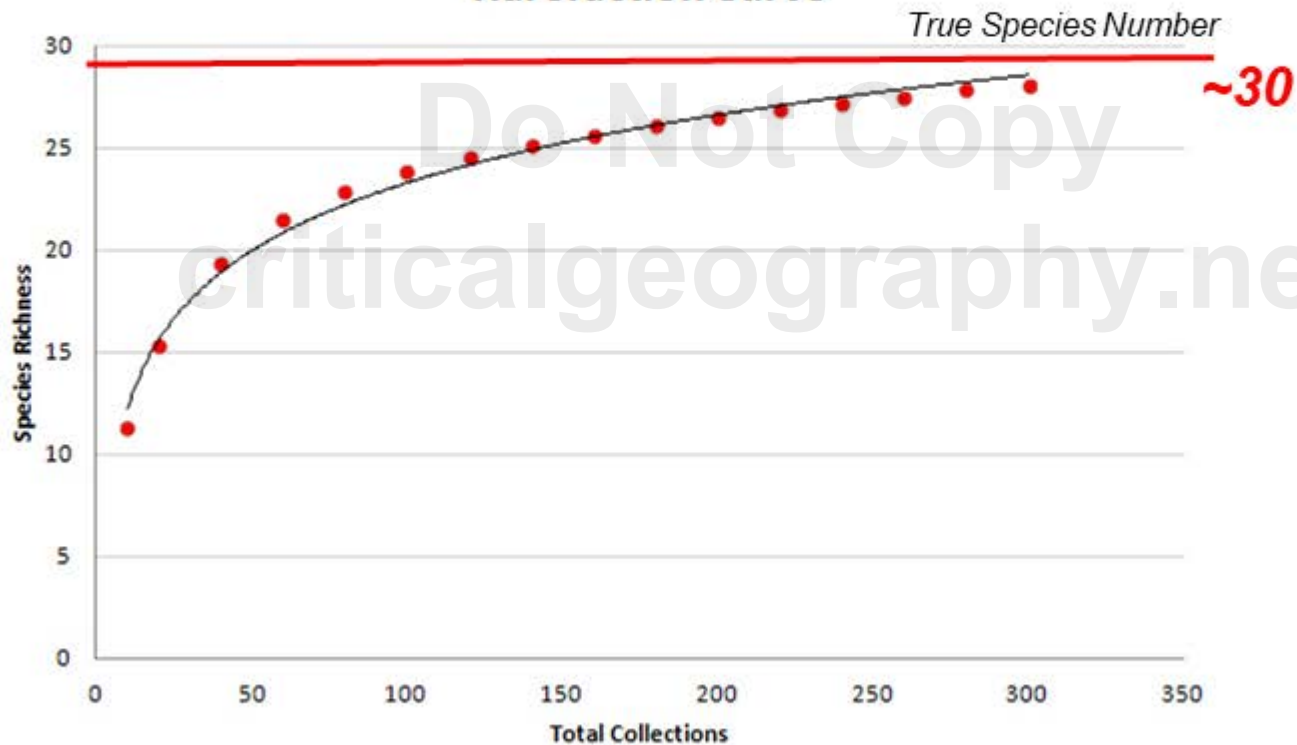
*Proportion of Coverage by Species*

<i>Leucaena leucocephala</i>	Unknown Grass 2	<i>Vachellia caven</i>	<i>Urochloa maxima</i>	Bare
0.089	0.144	0.022	0.167	0.578

Waahila: 0.35

# Missing Species

Rarefaction Curve





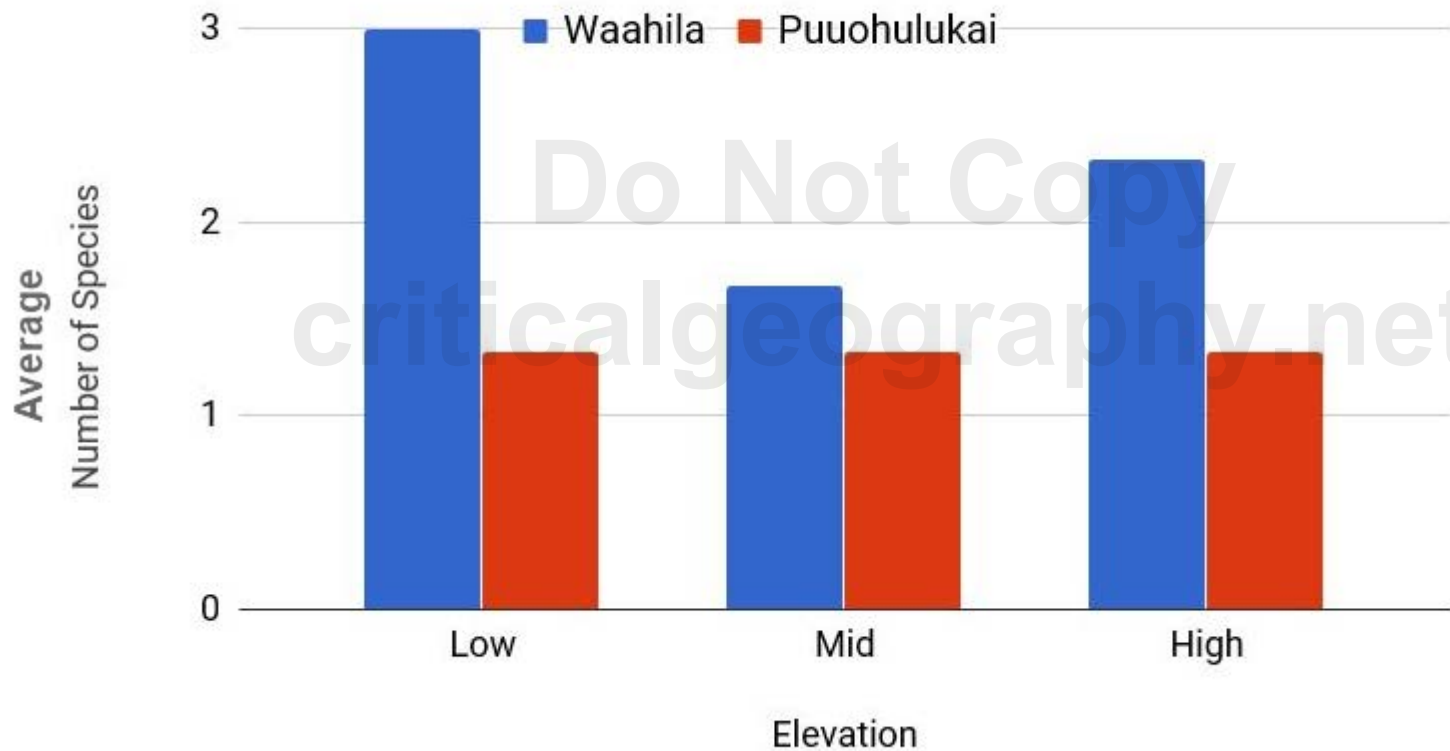
# Methods of Estimating Species Richness

- Bootstrap
- Jackknife
- Chao

Singletons: species found once

Doubletons: species found twice

### Species Richness (Observed)



# Biodiversity Calculators

- Shannon Index (aka Shannon Weiner)

$$H' = - \sum_{i=1}^R p_i \ln p_i$$

- Simpson Index

$$\ell = \frac{\sum_{i=1}^R n_i(n_i - 1)}{N(N - 1)}$$

- Inverse Simpson

$$\frac{1}{\lambda} = \frac{1}{\sum_{i=1}^R p_i^2} = {}^2D$$

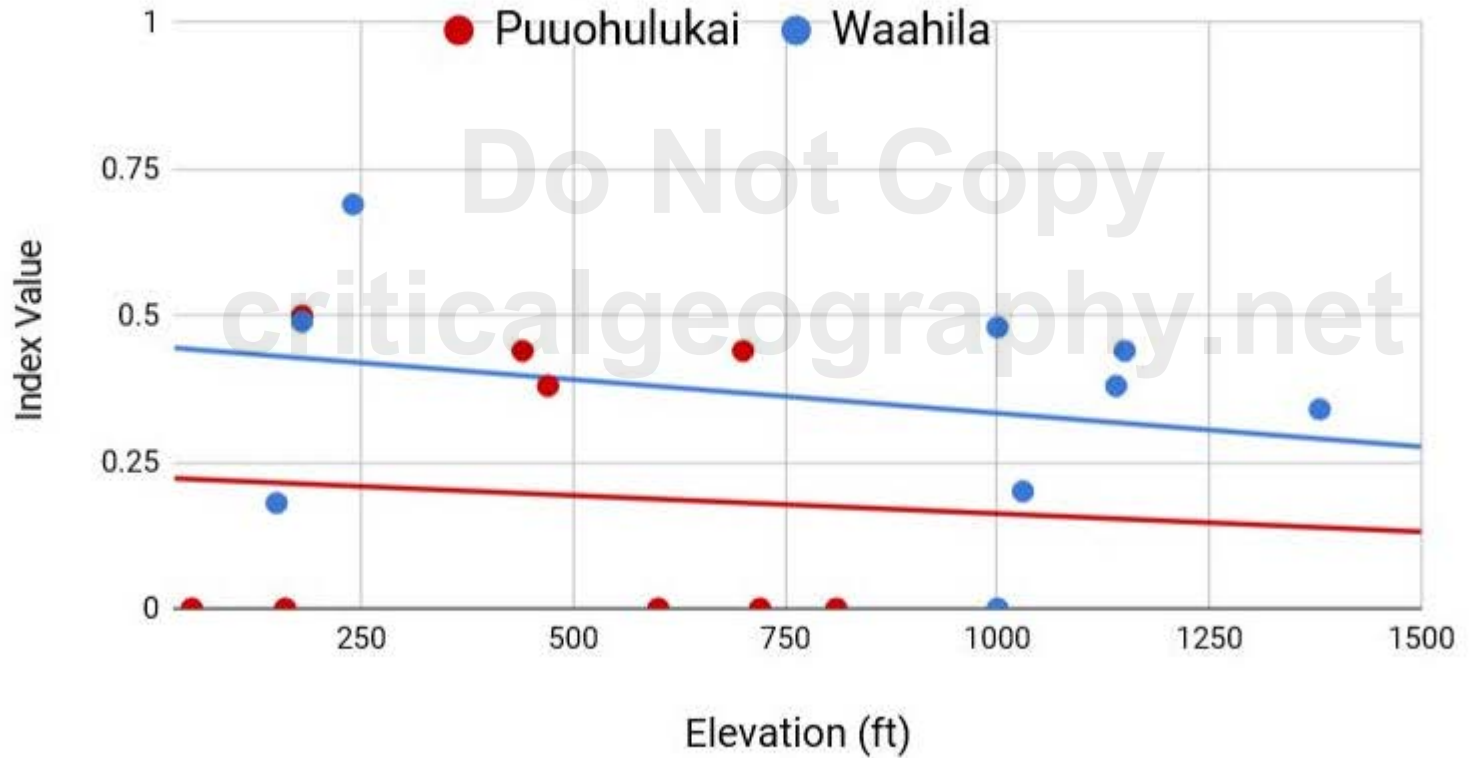
Index Values range from 0 to 1

0 means least diverse

1 means most diverse

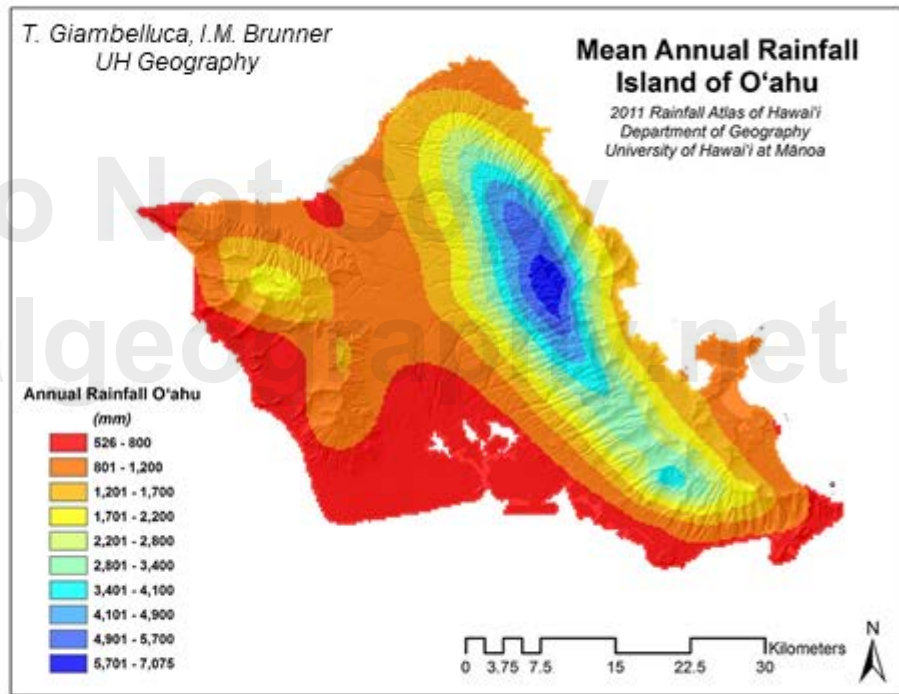


# Diversity - Simpson Index



# What happened?

- Population
- Better metrics
- More time
- Increased sample sizes
- Technology



# Conclusions

Our hypothesis was not supported with our data

More sample sizes were required for a more thorough experiment

Variables were difficult to control (weather, time, seasonality)

