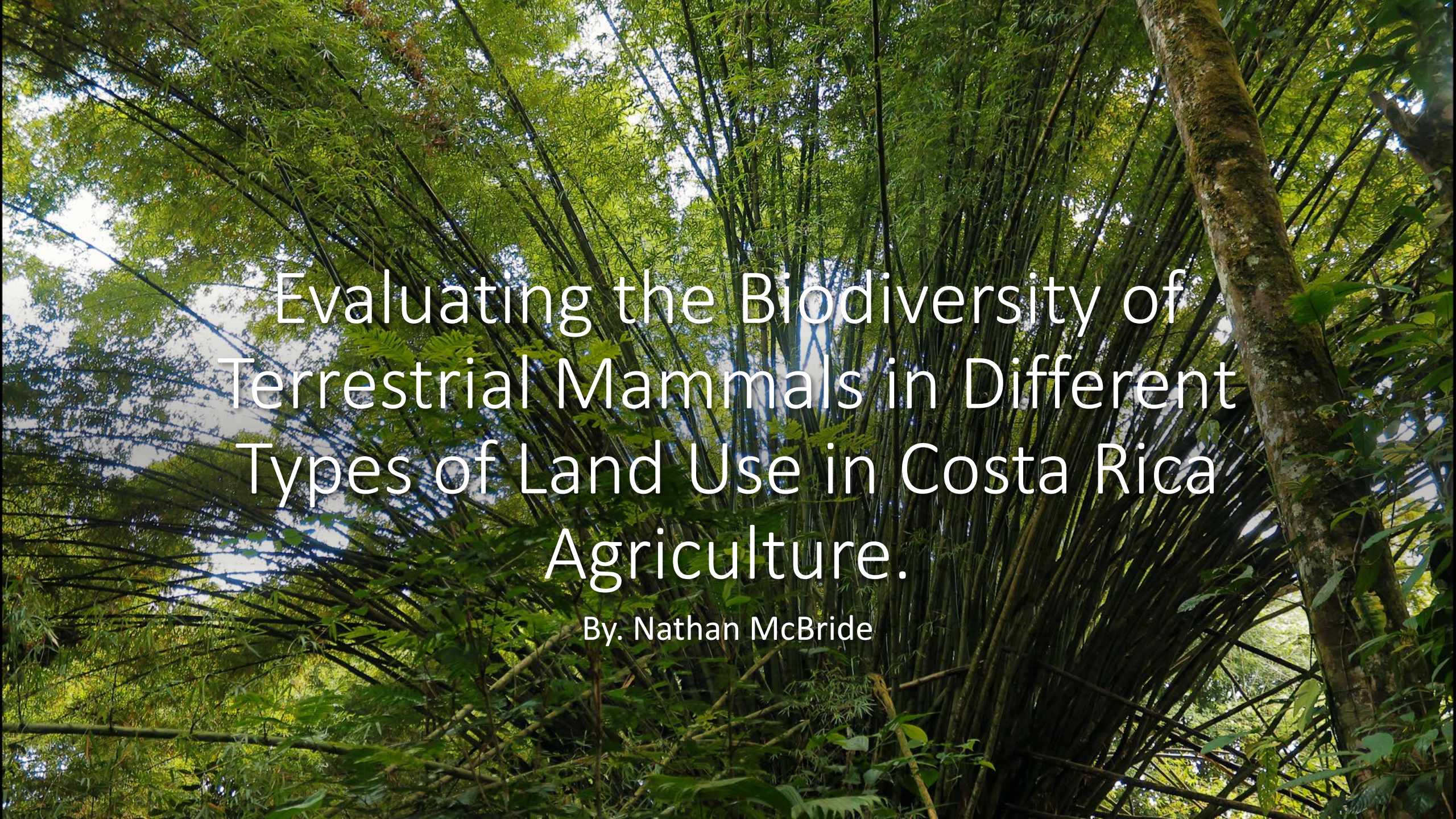


Evaluating the Biodiversity of Terrestrial Mammals in Different Types of Land Use in Costa Rica Agriculture.

By. Nathan McBride

Introduction

- In Costa Rica, Agriculture is the 2nd most in land use within the country.
- Natural forest makes up for 51% of the land
- 37 % of the country is agriculture.
- Leading cause of habitat loss/fragmentation is agriculture.
- Mammals are affected the most by either:
  - Land Use
  - Hunting
  - Poaching

Introduction

- Camera traps are noninvasive way to determine mammal biodiversity
- Mammals are key to an ecological chain
- There are 240 different mammal species in Costa Rica
    - Costa Rica holds 6% of the Endangered mammal Species
- One of the leading counties regarding the loss of mammals.
- We could determine what mammal species are affected the most.

Expected Results

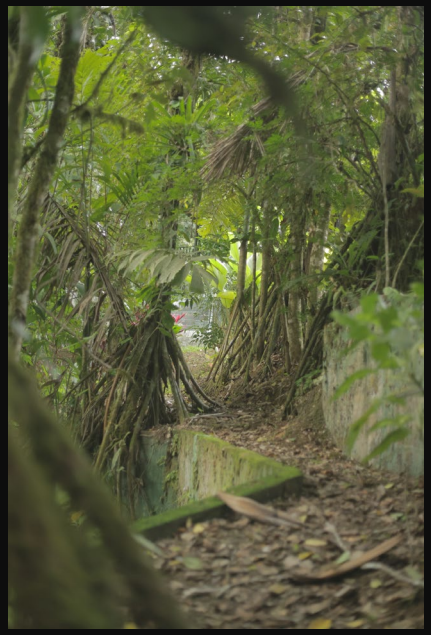
- Coconut Groove Plantation have lowest biodiversity
  - Limited resources
  - Reduced habitat
- Rain Forest to have highest biodiversity.
  - Natural Habitat & Resources
- Compared results to similar study in Colombia

Methods-Study Area

- LaSuerte Biological Field Station (LBFS)
  - Lowland wet forest in the limon province of Costa Rica
- 400 hectares of various habitats
  - Primary Forest
  - Secondary Forest
  - Swamps
  - Marshes
  - Pasture
- Low human activity
- Has faced deforestation
  - Spent 30 years of regrowth

Methods-Study Area

- LBFS divided into 3 different forest types
  1. Small Forest
     - 14 ha
     - Borders other plantations
     - Younger Trees (Less than 50 year)
  2. Large Forest
     - 55 ha
     - Cover 2 regions
     - Various age of tress
     - Selective logging and cattle grazing
  3. Far Forest
     - 120 ha
     - Longest standing forest
     - Oldest Trees



Methods-Data Collection

- Trail Camera were placed in 5 different habitats.
    1. Large Forest
    2. Coconut Groove (Cattle Ranch)
    3. Teak Plantation
    4. Palm Oil
    5. New Teak (Reforestation)

Methods-Data Collection

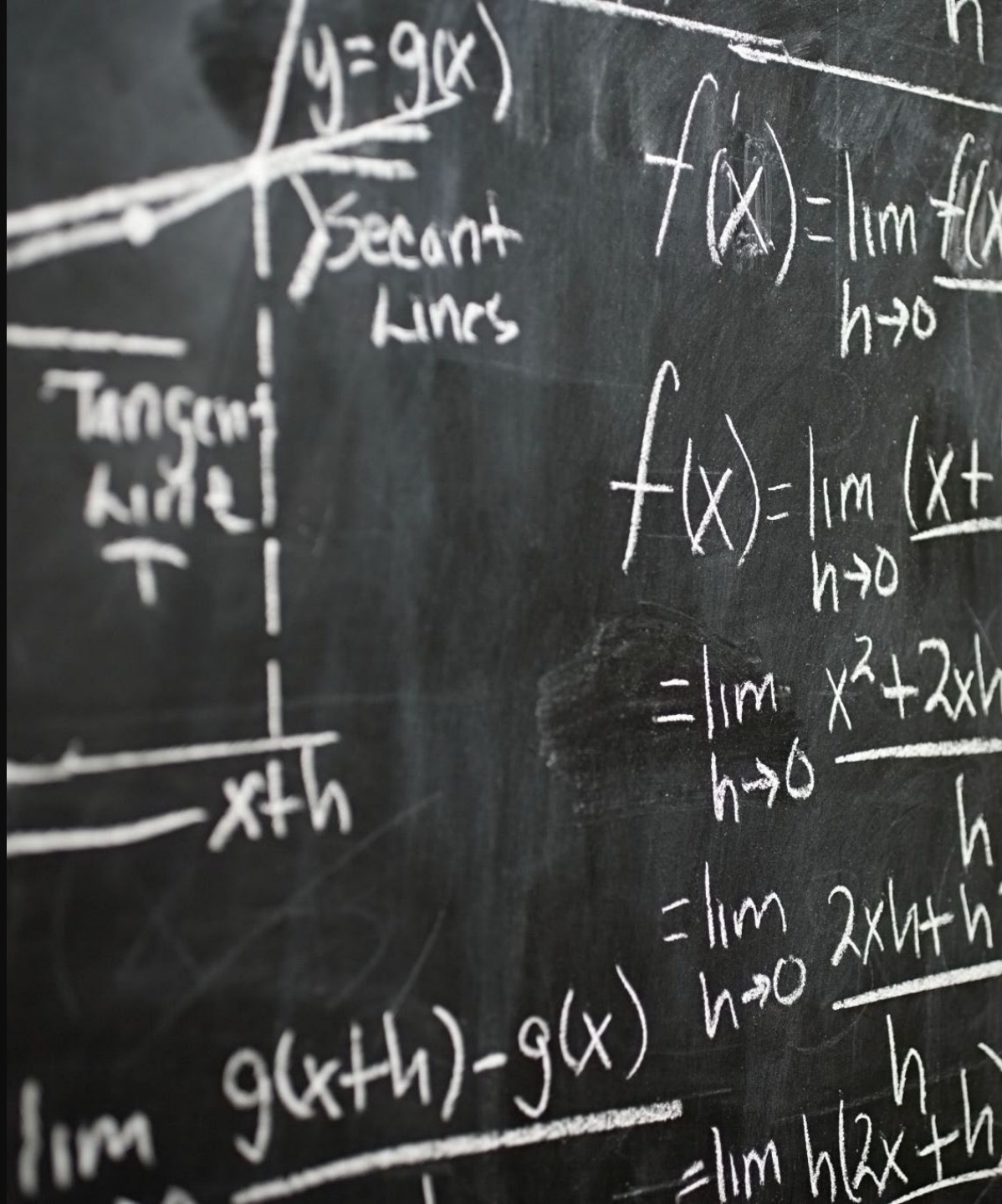
- Trail Camera were evenly spread out
- Camera places on the lower section of trees
- Gathered data for a month
- Data organized by:
    1. Habitat
    2. Species
    3. # of Species
    4. Date & Time
    5. Weather
    6. Temperature
    7. Location

Methods-Statistical Analysis

- Specrich2 was used to analyze trail camera data to estimate species richness in each habitat
  - Specrich2 uses presents, absent data to produce richness estimates and uses bootstrap resampling to generate standard error for each estimate.
  - The standard error that bootstrap generates is not a considered a traditional parametric statistic.
  - Consequently, you can do traditionally parametric statistic test.

Methods-Statistical Analysis

- Current accepted method is to use the variance sum law to compare two data sets
  - $\mathrm{var}(\hat{S}1 - \hat{S}2) = \mathrm{var}(\hat{S}1) + \mathrm{var}(\hat{S}2) - 2\mathrm{cov}(\hat{S}1, \hat{S}2)$
- We utilize the variance sum law to identify difference in species richness across habitats.
- After calculating the variance difference, confidence intervals were calculated to estimate the levels of significance



Results

- Coconut Plantation/Cattle Ranch had the lowest biodiversity
  - 5 different species present
- Coconut Plantation captured an interesting species
  - First siting since research began in 2012
- Large Rain Forest had highest Biodiversity
  - 17 different species, 21 total seen.
- Baird's Tapir was seen the most in the Large Forest
  - Even showing signs of reproduction

Results-Statistics

- Forest is no different than Old Teak or Palm Oil
- Forest is better than New Teak and Coconut
- Old teak is also no different from Palm Oil and New Teak
- Palm Oil is also no Different from New Teak
- New Teak is also no different from Coconut

	90%		95%		99%	
	lower	upper	lower	upper	lower	upper
Coco to OT	2.189254919	19.81075	**0.533903**	21.4661	-2.7768	24.7768
Coco to F	11.67480818	34.32519	**9.547045**	36.45296	5.291518	40.70848
Coco to P	1.986898598	20.0131	**0.293528**	21.70647	-3.09321	25.09321
Coco to NT	-0.544188485	16.54419	**-2.14946**	18.14946	-5.36	21.36
OT to F	-0.556310281	24.55631	**-0.55631**	26.91537	-0.55631	31.6335
OT to P	-10.51841029	10.51841	**-12.4946**	12.4946	-16.447	16.44697
OT to NT	-7.119491835	13.11949	**-9.02073**	15.02073	-12.8232	18.82321
F to P	-0.699121854	24.69912	**-3.08502**	27.08502	-7.85681	31.85681
F to NT	2.629274238	27.37073	**0.305077**	29.69492	-4.34332	34.34332
P to NT	-7.296158653	13.29616	**-9.23059**	15.23059	-13.0994	19.09945

Better Biodiversity

No Biodiversity Change

Results- Best Habitat

- These would be the best habitats for biodiversity
    1. Forest
    2. Old Teak & Palm Oil
    3. New Teak
    4. Coconut

Future Impacts

- LaSuerte Biological Field Station (LBFS) is between 2 National Parks
  - Creating a corridor between them
- Provides protection for endangered species
  - Especially those reproducing within (LBFS)
  - Limit habitat loss from agriculture use
  - Decrease the amount of poaching

Future Impacts

- Overall species richness of LaSuerte Biological Field Station (LBFS)
  - Overall species richness= 19
  - Standard Error 2.49
- We can see that this is close to the regular forest species richness
- Could the regular forest reach a max from species migrated in from there loss of habitat?

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