UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"

MICHIGAN STATE UNIVERSITY

Determining landscape factors influencing tropical amphibians using a multispecies occupancy model

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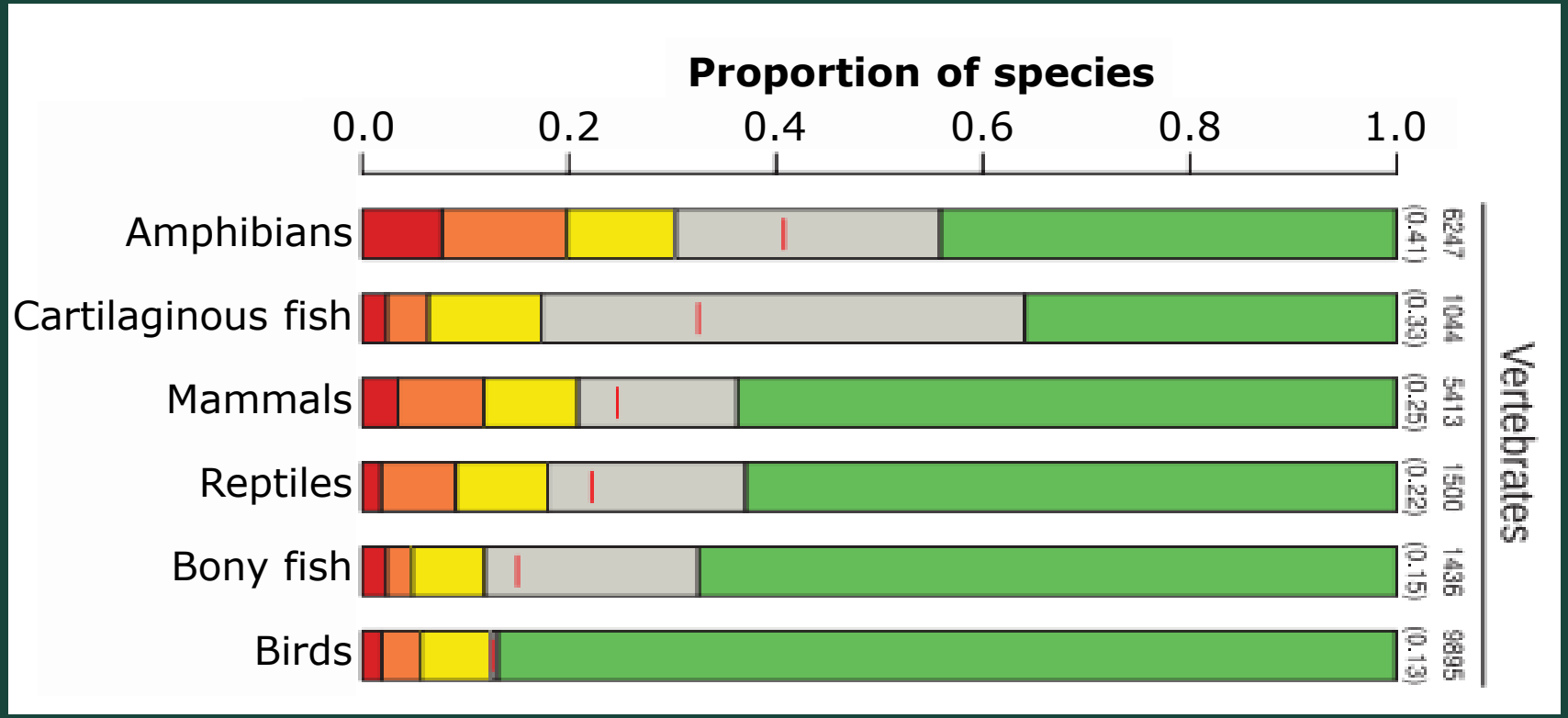
Introduction

Why Amphibians?

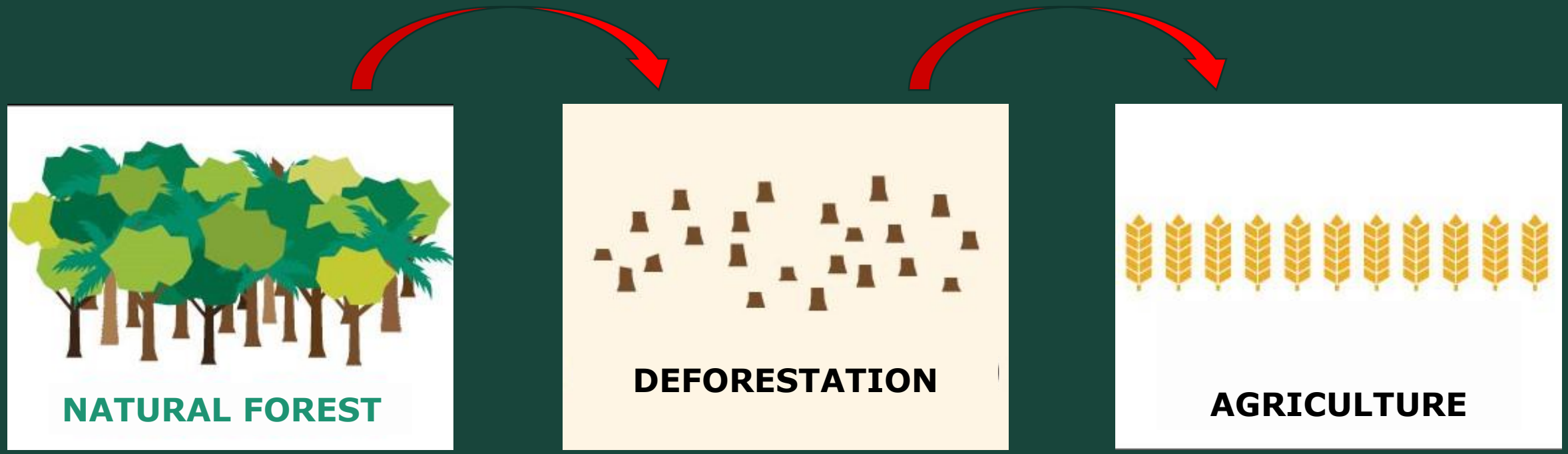


- **Critically endangered**
- **Endangered**
- **Vulnerable**
- **Data Deficient**
- **Least concern + Near threatened**

Hoffmann et al. 2010, IUCN 2016

Introduction

Forest loss



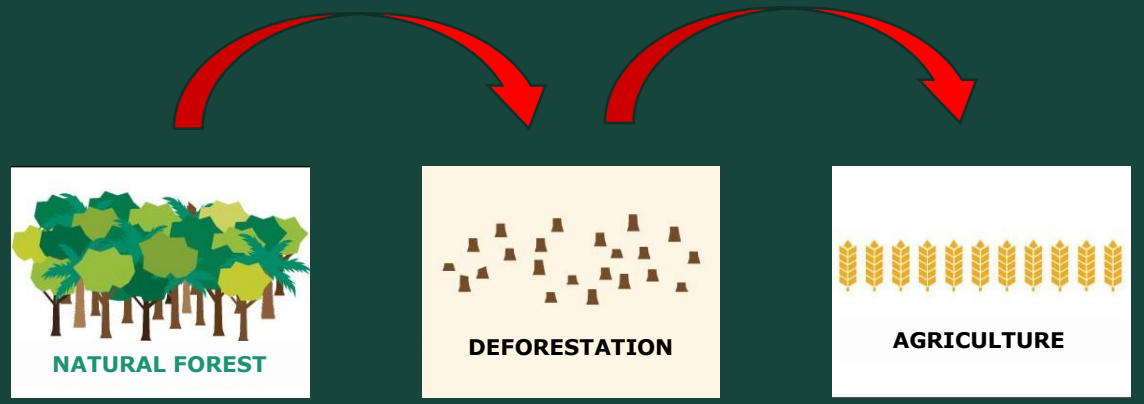
- Major driver of biodiversity loss

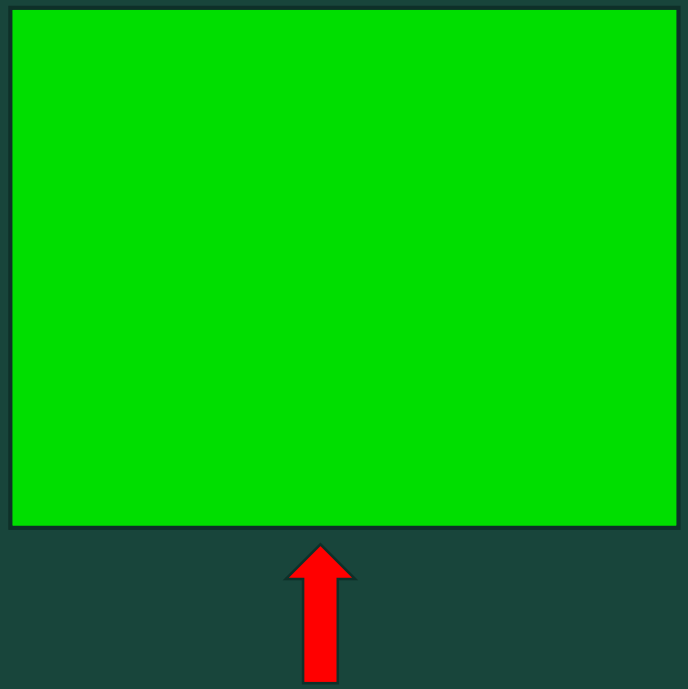
Figures credit: http://blog.globalforestwatch.org

Collins and Crump 2009, Gámez-Virués et al. 2015

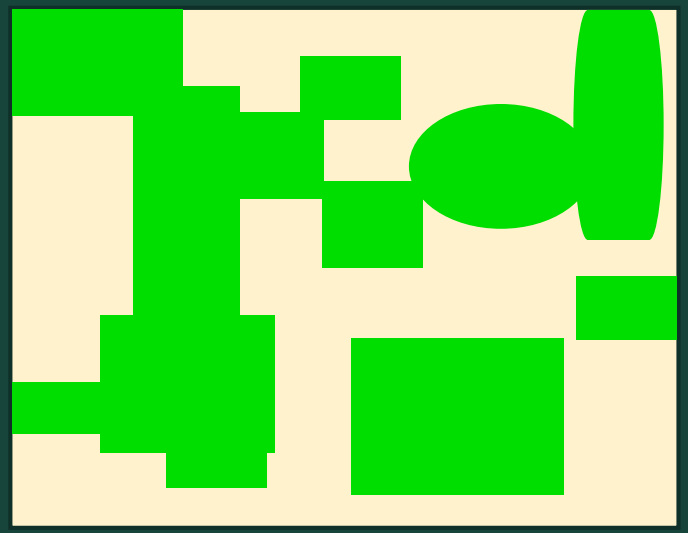
INTRODUCTION

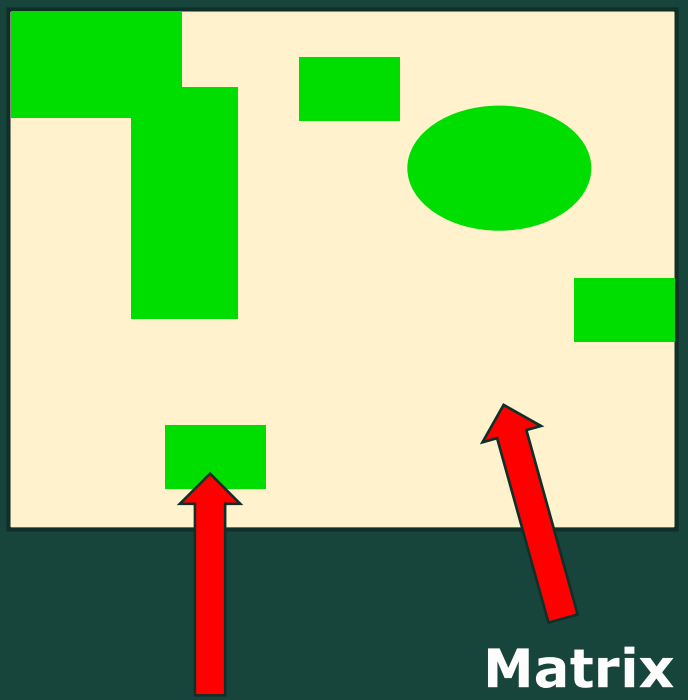
Habitat fragmentation





Forest habitat



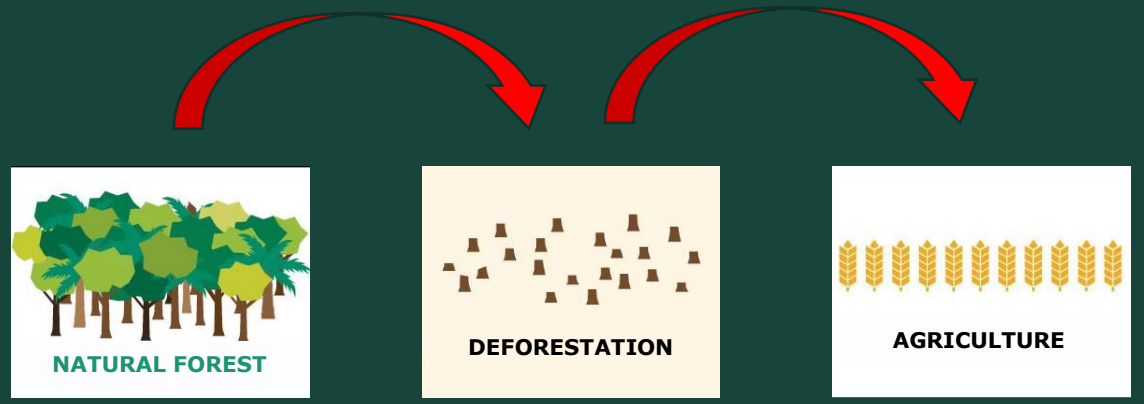


Forest patch

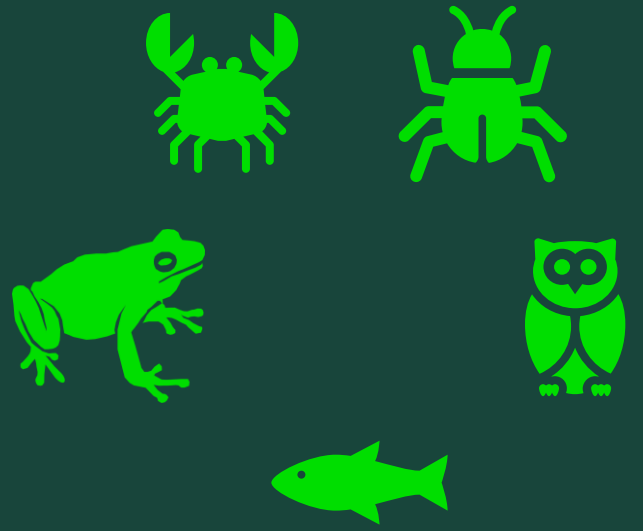
Matrix

Introduction

Habitat fragments



- Alters vegetation composition
- Increase light
- Increase temperature
- Decrease water quality



Collins and Crump 2009, Ewers and Banks-Leite 2013, Clément et al. 2017

Introduction

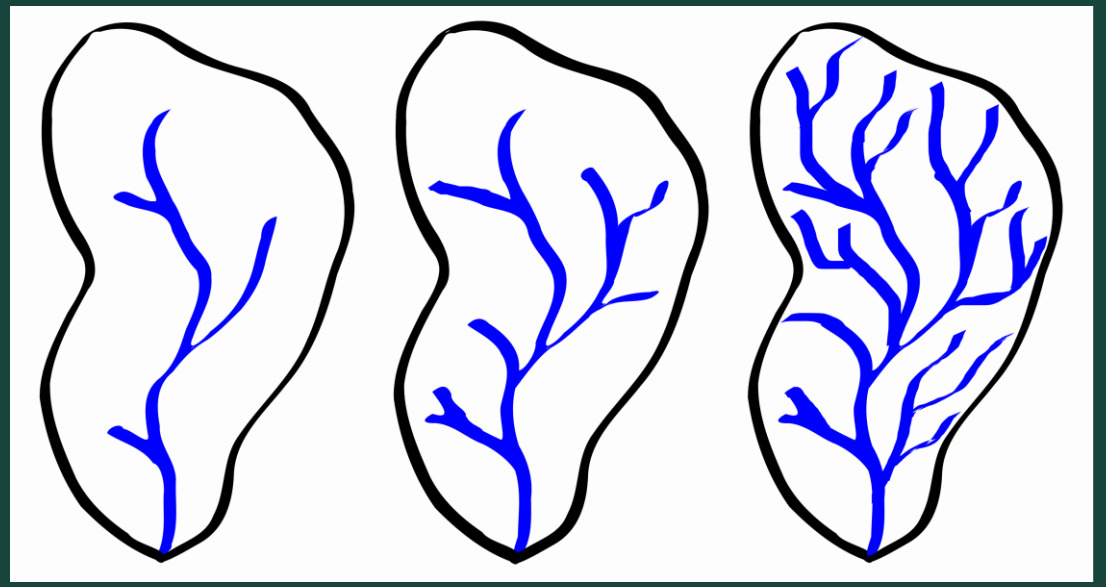
Matrix matters

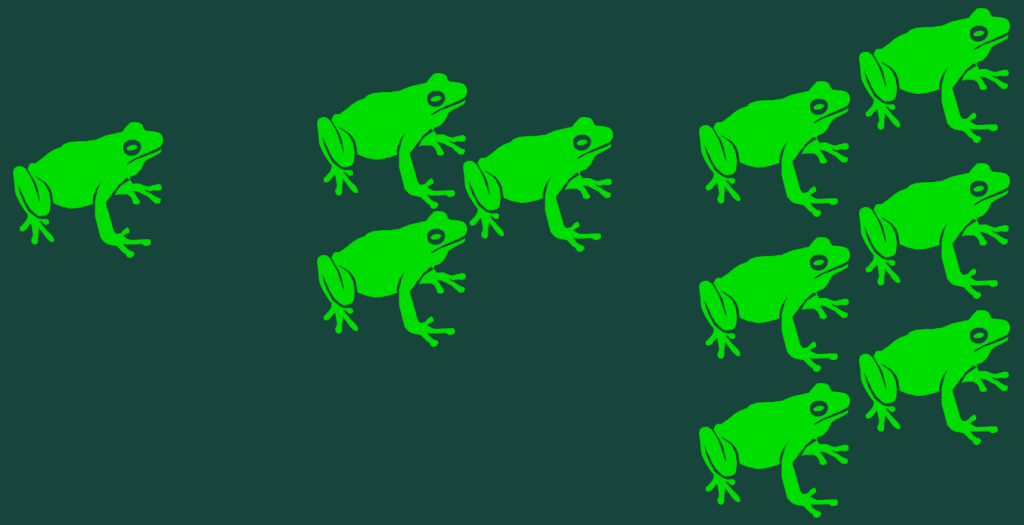
Prevedello and Vieira 2010, Ferrante et al. 2017

Introduction

Stream density

- Proxy for habitat amount
- Increase connectivity between aquatic habitats





Ficetola et al. 2009, 2011

Introduction

Catchment area and Slope

- Physical habitat
  - Substrate type
  - Stream size
- Variation in vegetation

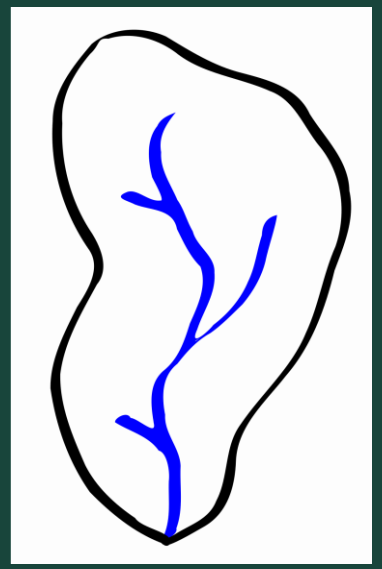
Parris and McCarthy 1999, Eterovick and Barata 2006, Keller et al. 2009, Ribeiro et al. 2012

Introduction

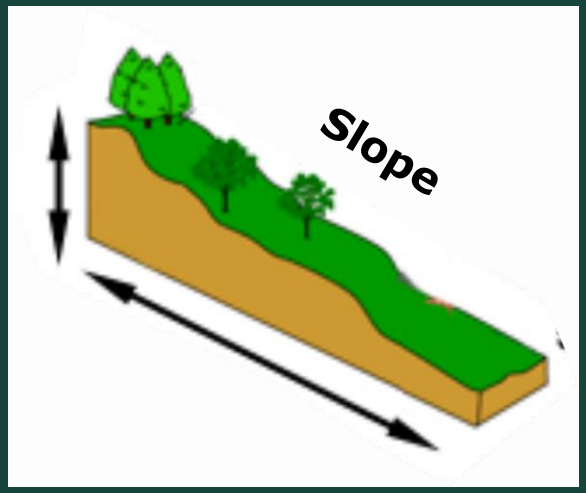
Catchment area and Slope

- **Physical habitat**
  - **Substrate type**
  - **Stream size**
- **Variation in vegetation**

Catchment area



Slope

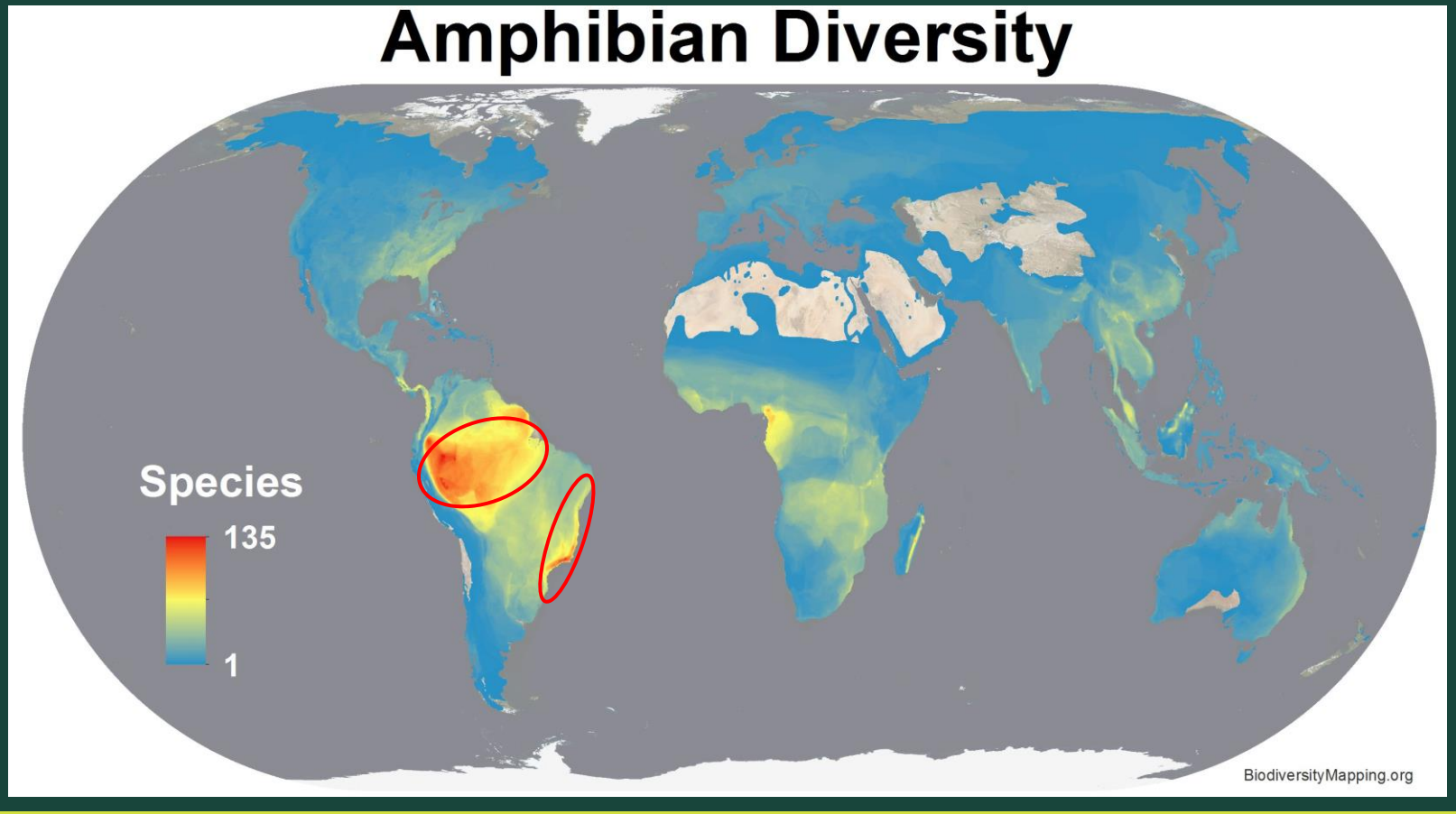


height difference / horizontal distance

Parris and McCarthy 1999, Eterovick and Barata 2006, Keller et al. 2009, Ribeiro et al. 2012

Introduction

Why Brazilian Atlantic Rainforest Amphibians?

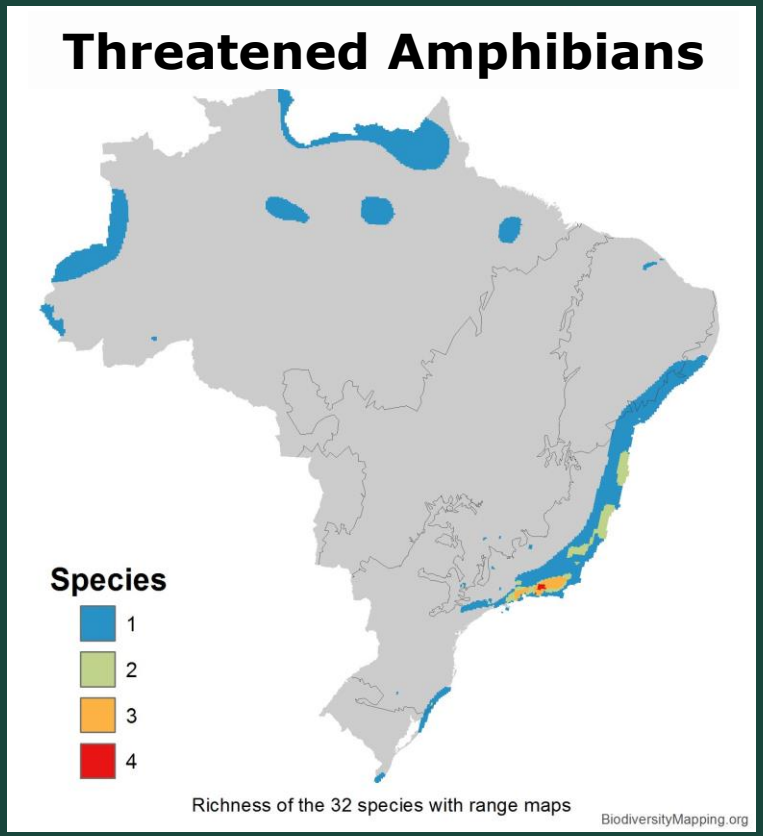


Source: http://biodiversitymapping.org

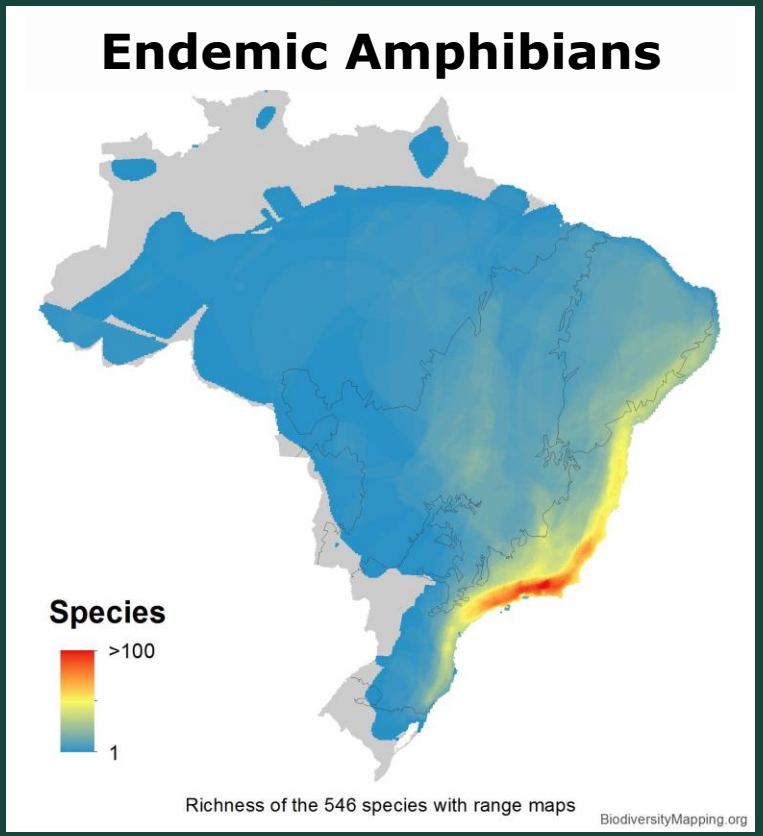
Introduction

Why Brazilian Atlantic Rainforest Amphibians?

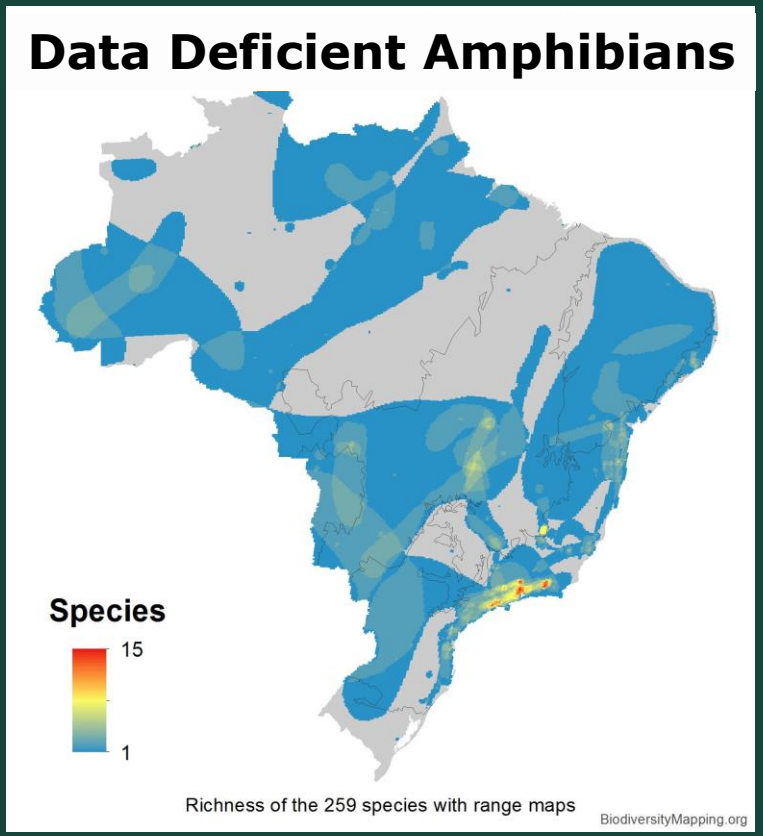
Threatened Amphibians



Endemic Amphibians



Data Deficient Amphibians

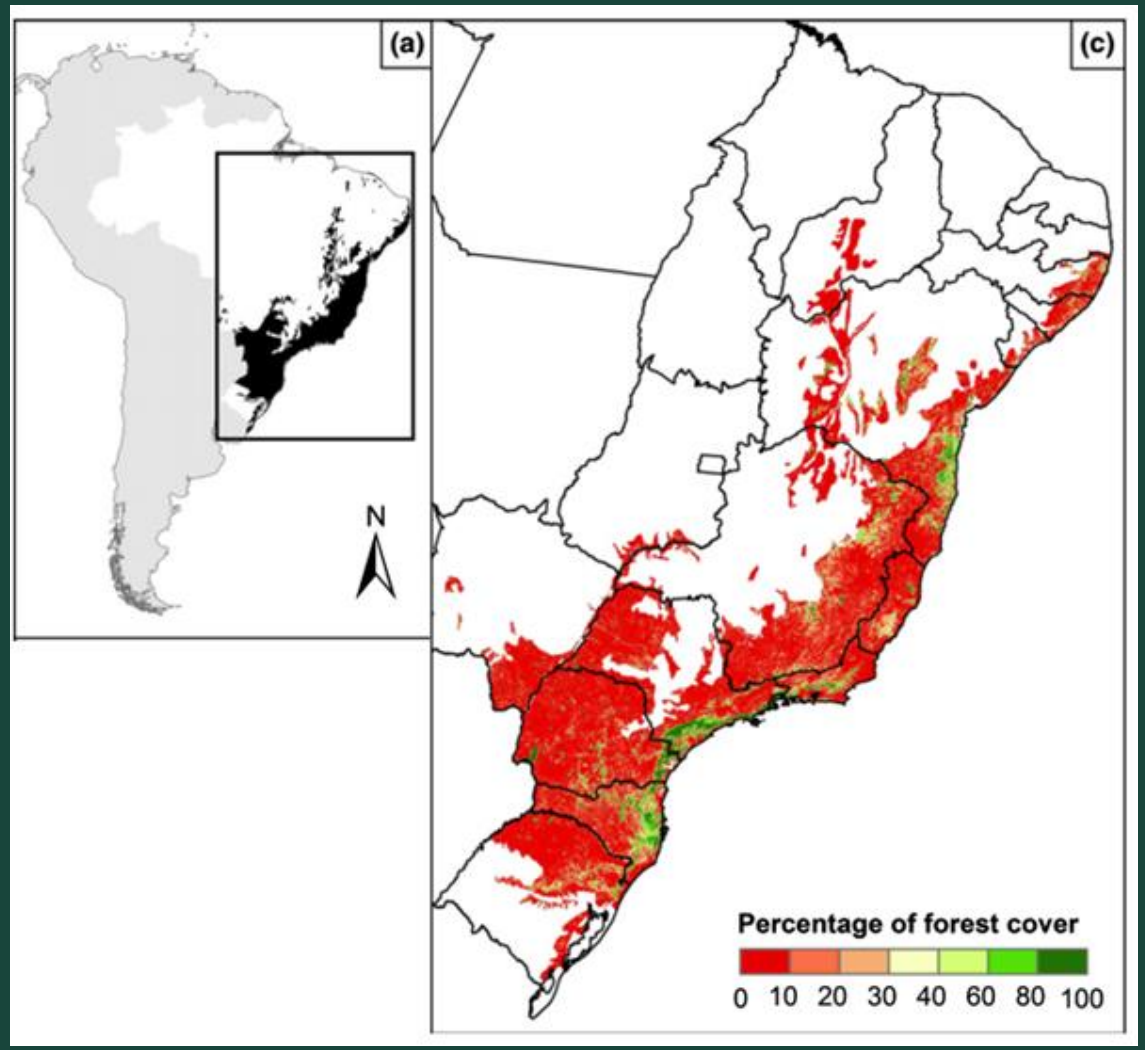


Source: http://biodiversitymapping.org

Introduction

Brazilian Atlantic Forest

- Atlantic Forest originally covered >1,450,000 km²
- ~15% of forest remains
  - 14% is protected by nature reserve



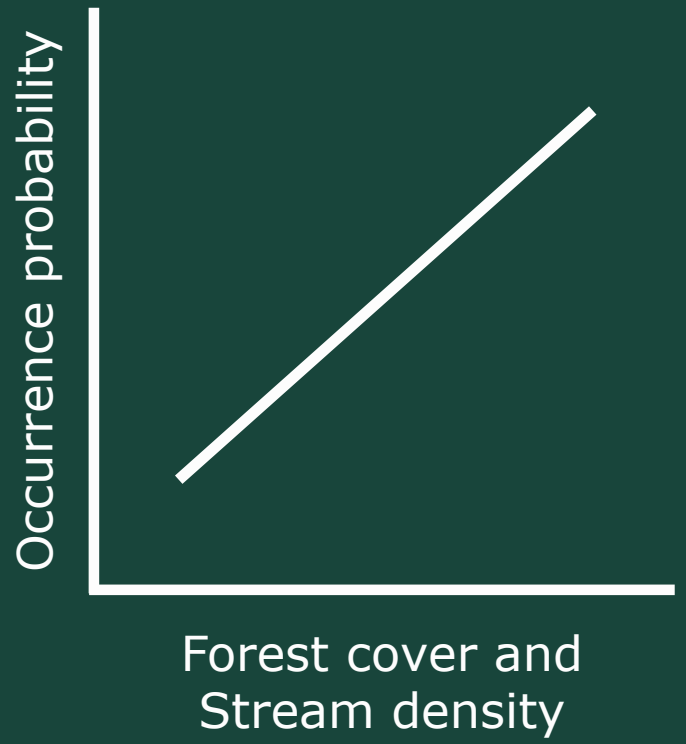
Ribeiro et al. 2009, Joly et al. 2014

Goal

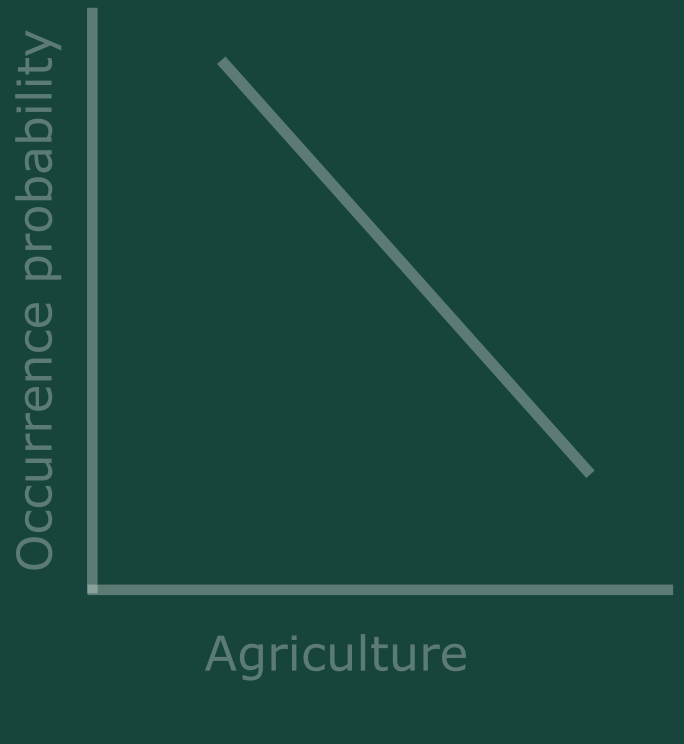
Investigate the influence of landscape characteristics on amphibian occurrence probabilities in Brazilian Atlantic Forest streams

EXPECTATIONS

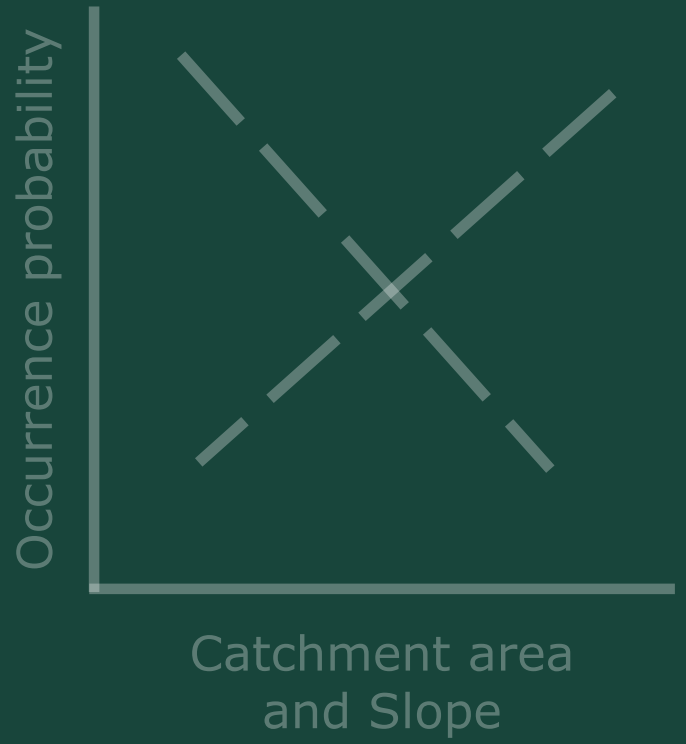
Forest cover and Stream density



Agriculture



Catchment area and Slope



EXPECTATIONS

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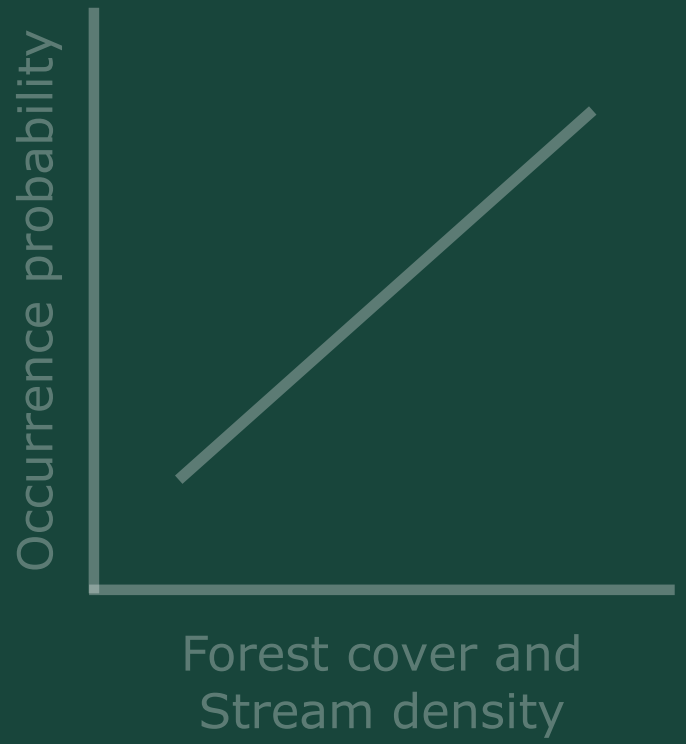
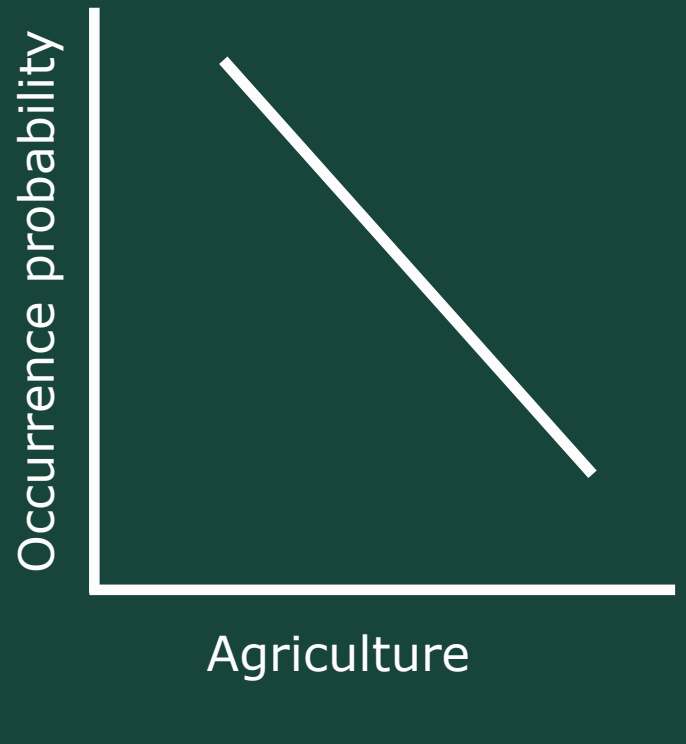
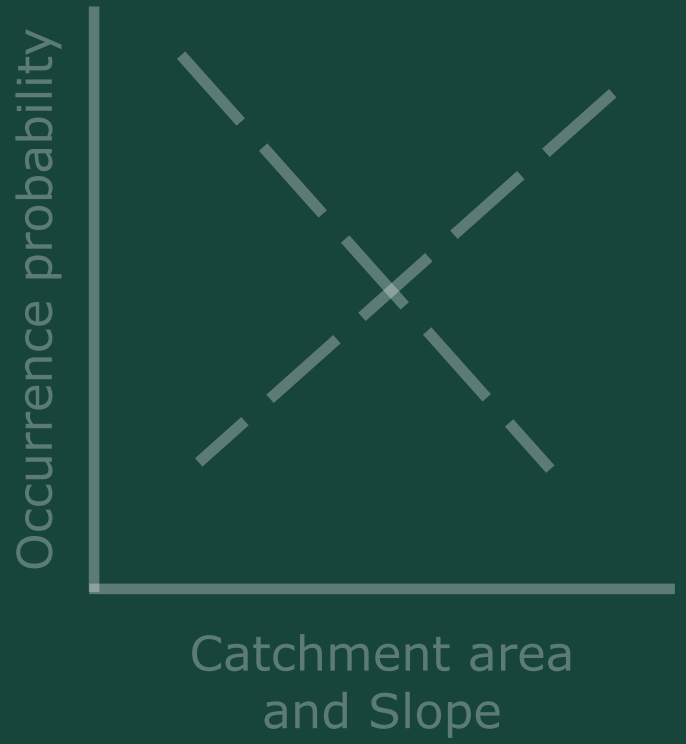


Agriculture



Catchment area and Slope



EXPECTATIONS

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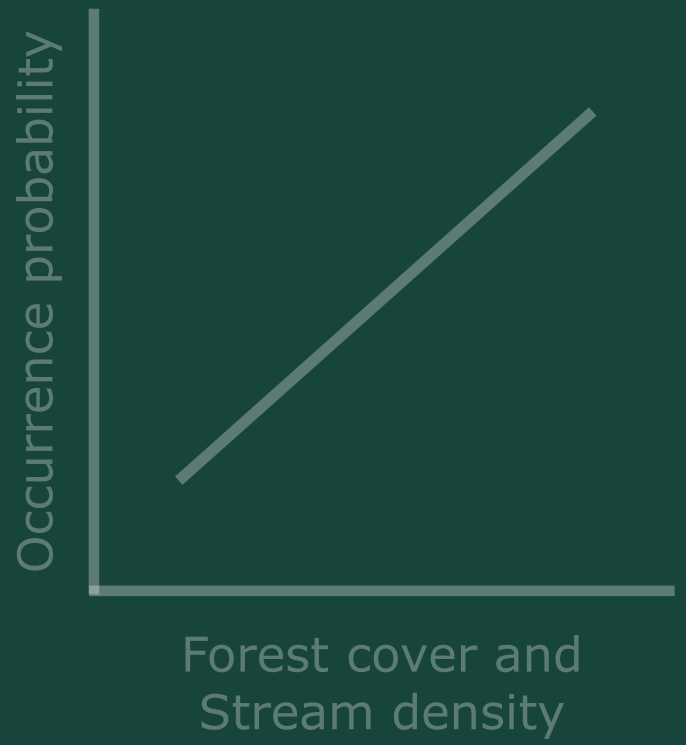

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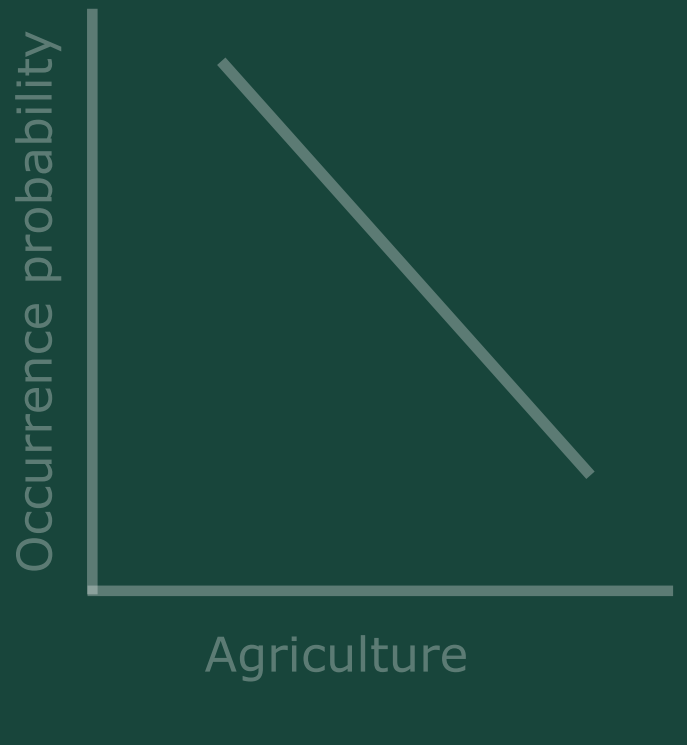
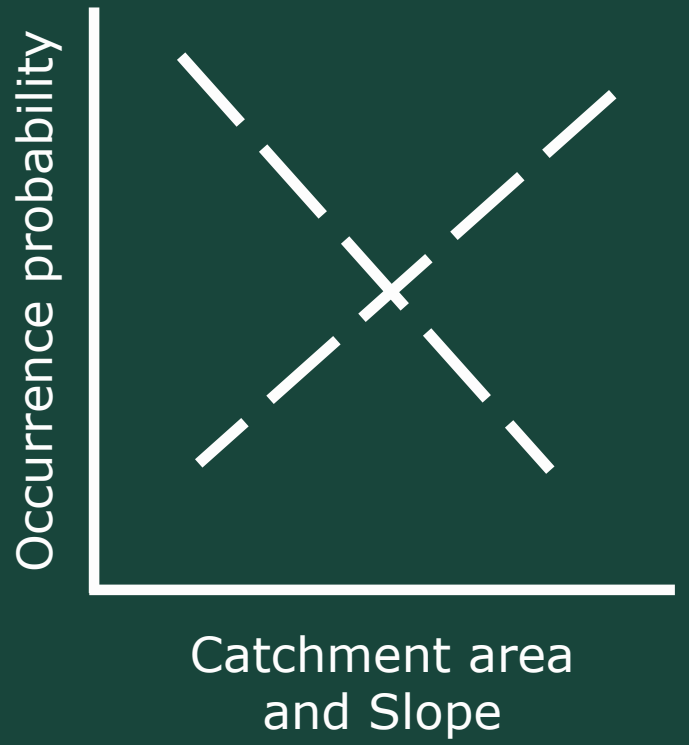
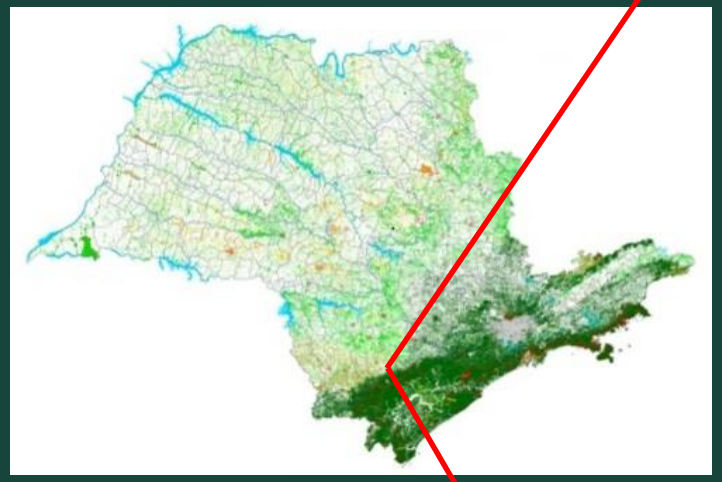
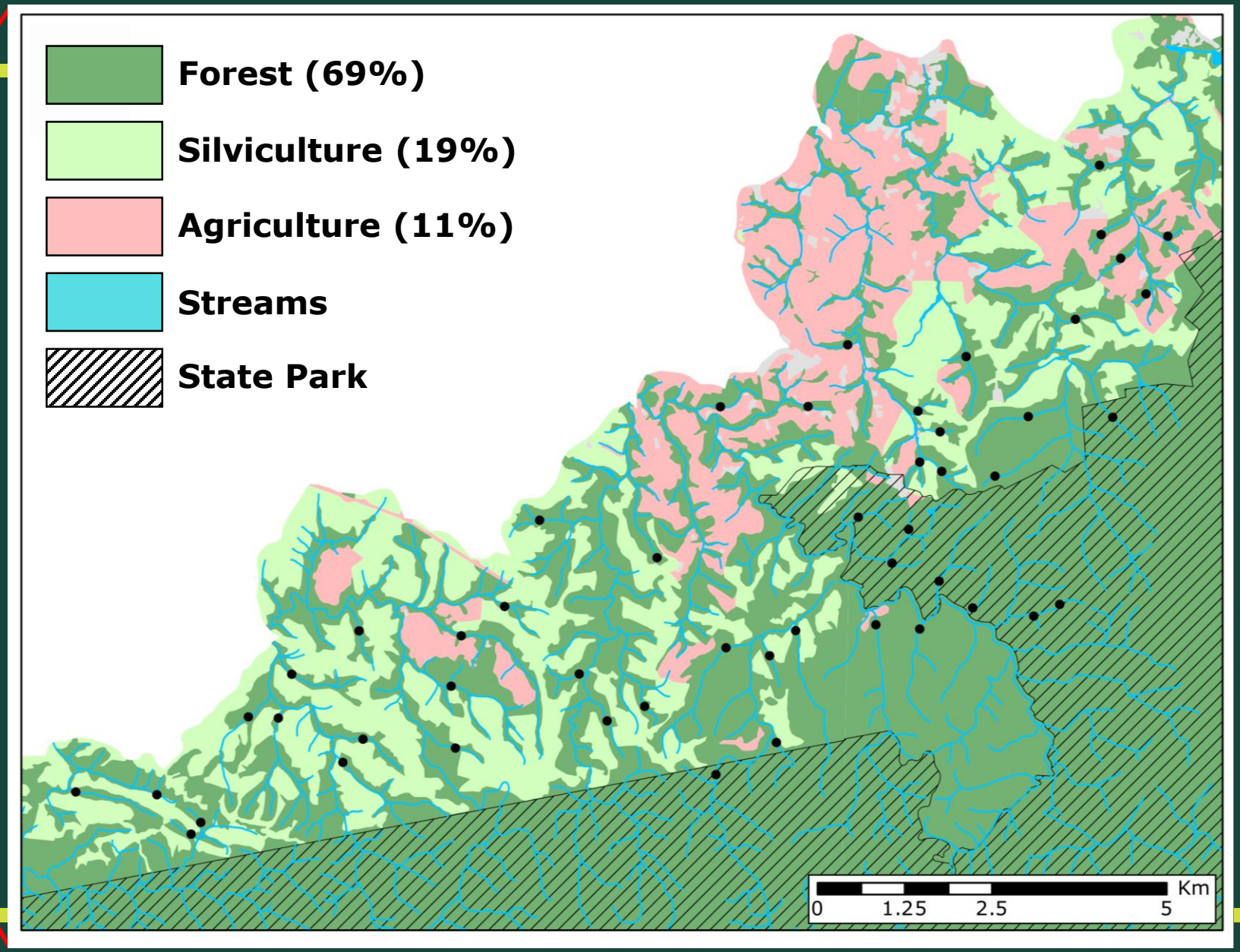


Catchment area and Slope



Study area




Forest (69%)
Silviculture (19%)
Agriculture (11%)
Streams
State Park
Km
0
1.25
2.5
5

Amphibian sampling

Active - Standardized Acoustic and Visual Transect Sampling (SAVTS)

Passive - Automated Acoustic Recorders (AAR)

rainy season (Oct 2015 - Mar 2016)

Amphibian sampling

Active method - SAVTS

- 100 m transect segment
- Stream channel, vegetation, and litter
- Recorded all calling individuals
- Each stream was sampled twice

Parris 2004, Alix et al. 2014, Walls et al. 2014

Amphibian sampling

Passive method - AAR

- Automated Acoustic Recorders
- 1.5 m above the ground
- 5-min periods each hour from 4-11 pm
- During three days

Parris 2004, Alix et al. 2014, Walls et al. 2014

Multi-species model

Occupancy model

Occupancy ~

- Forest cover
- Agriculture
- Catchment area
- Stream density
- Slope

logit link function

Dorazio and Royle 2005, Zipkin et al. 2009, Kéry and Royle 2015

Multi-species model

Detection model

Date - linear

Detection ~ Method type + Date - square

Precpitation

logit link function

Dorazio and Royle 2005, Zipkin et al. 2009, Kéry and Royle 2015

Multi-species model

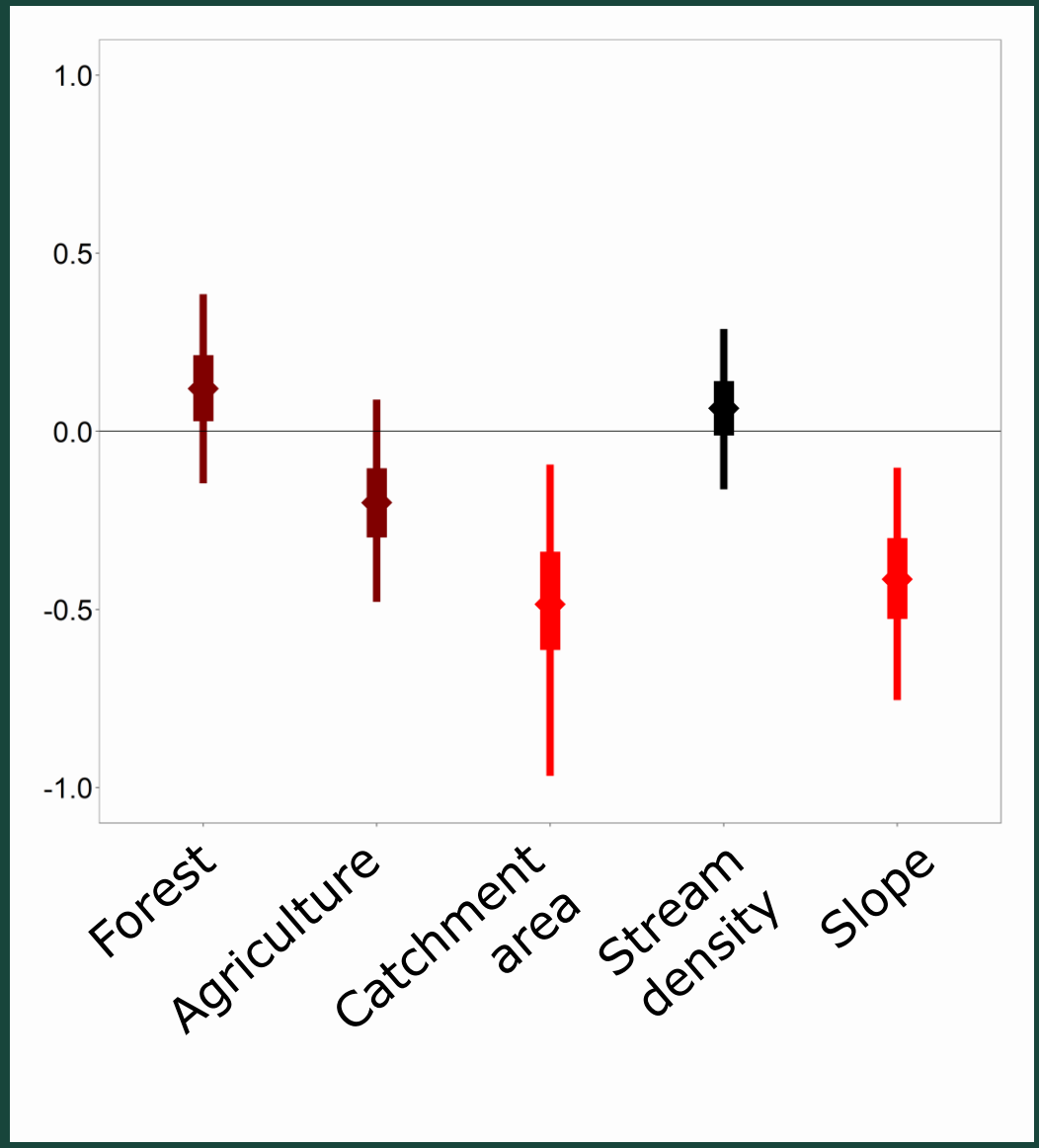
Community-level paramater

- Use a community-level distribution (hyper-distribution)
- Normal distribution

Dorazio and Royle 2005, Zipkin et al. 2009, Iknayan et al. 2014, Kéry and Royle 2015

Results

Community-level occupancy

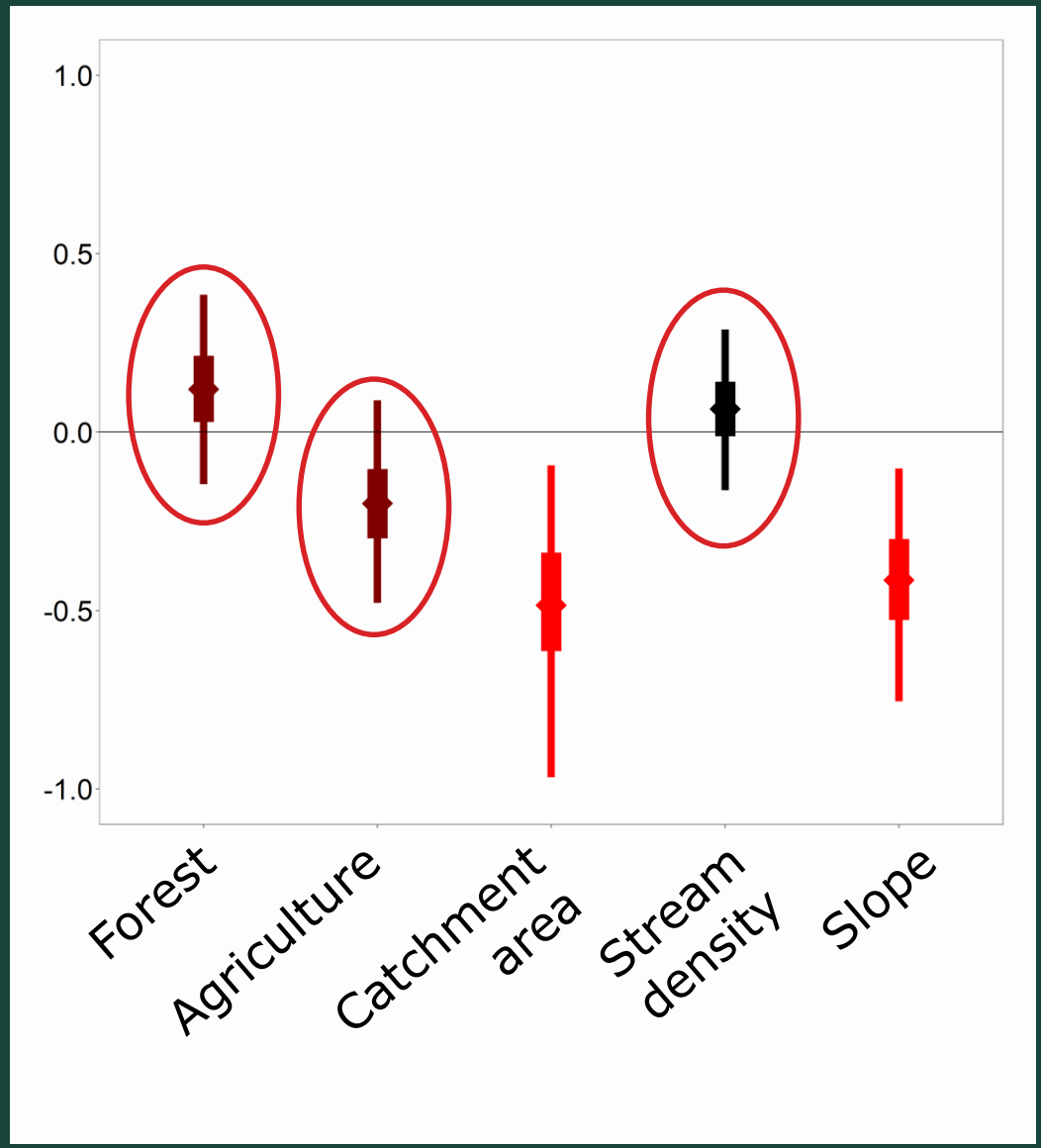


Posterior distribution not overlapping zero

- **< 75%**
- **75 - 95%**
- **> 95%**

Results

Community-level occupancy



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Results

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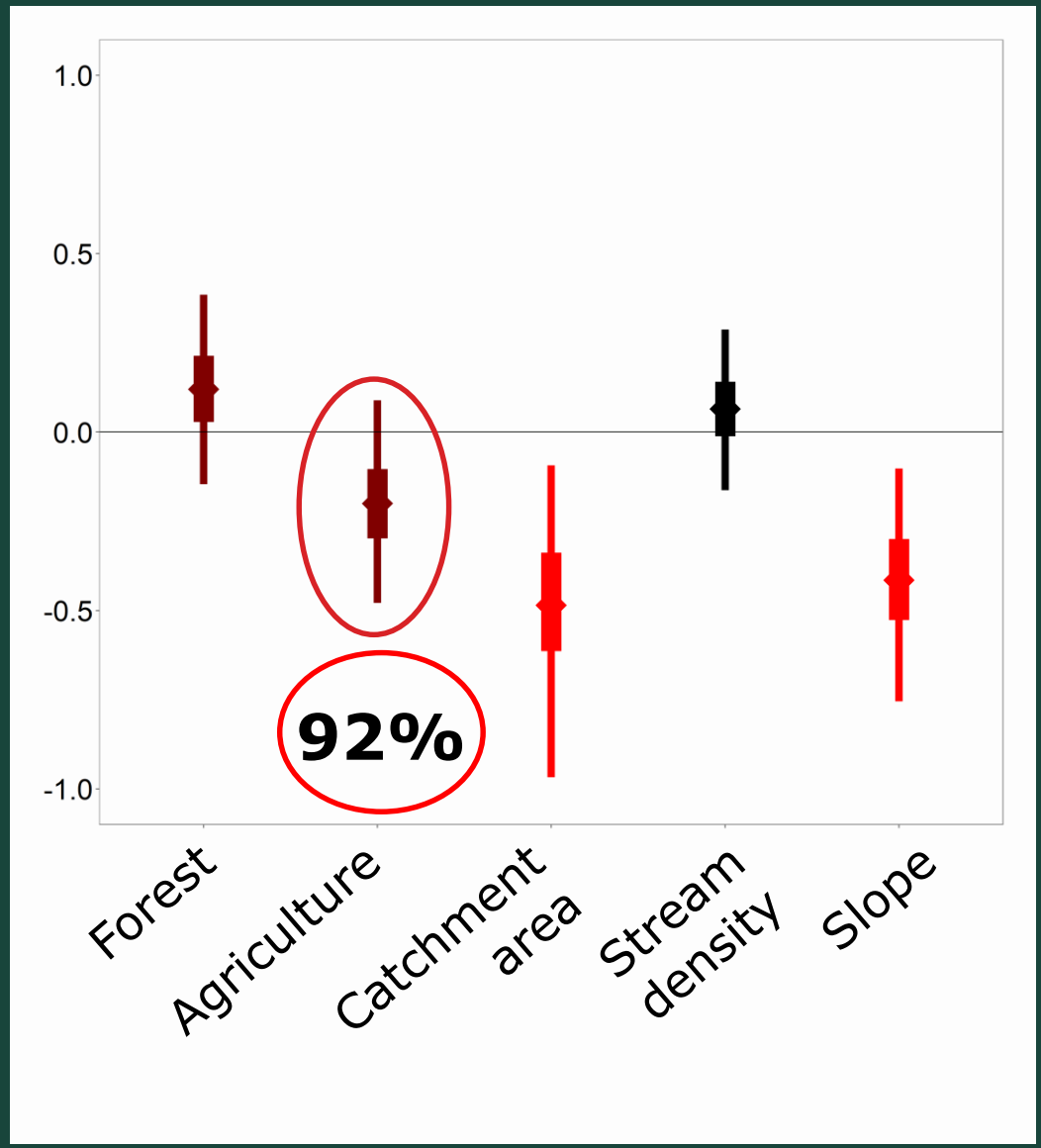

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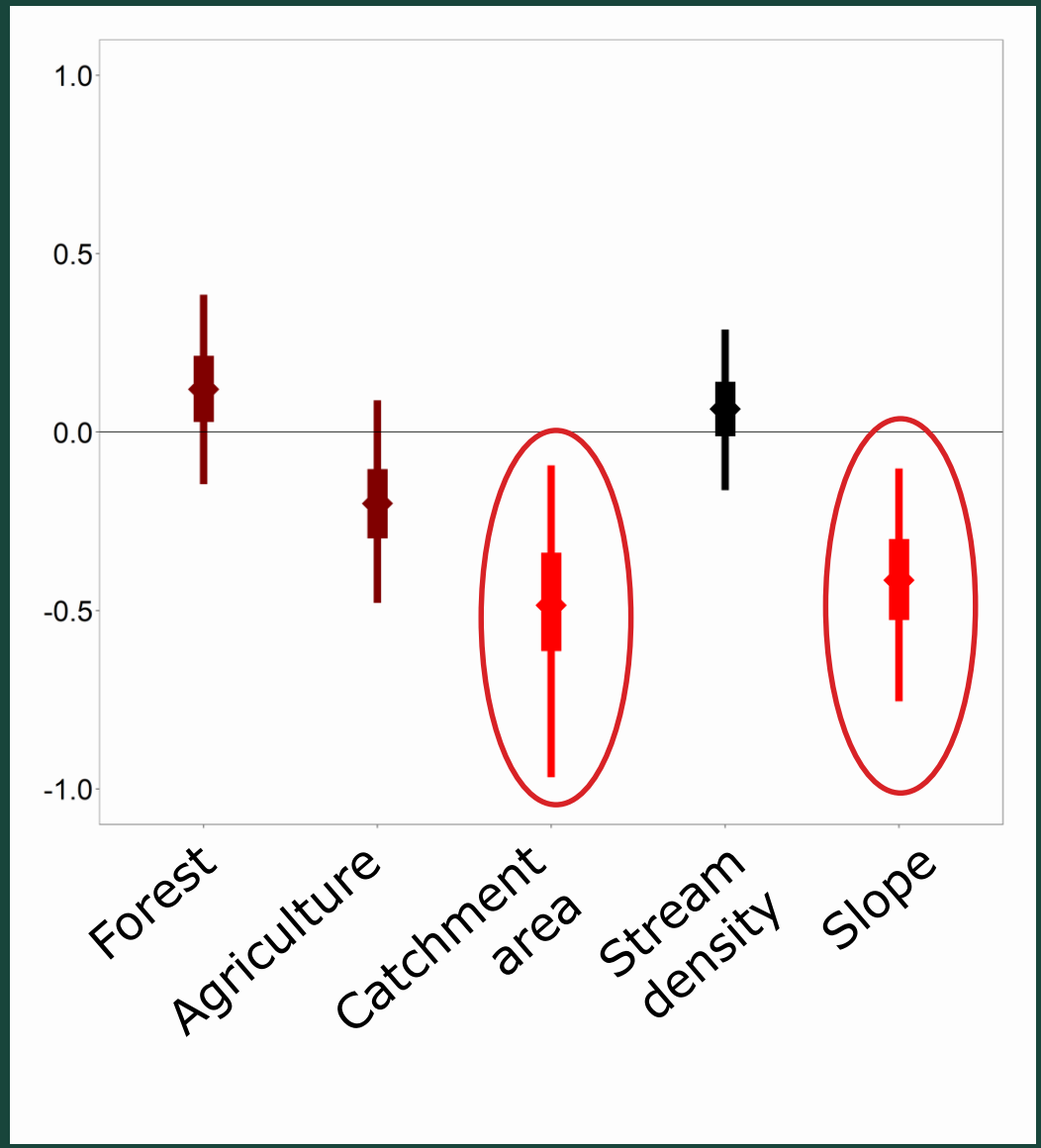

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Results

Species-level occupancy

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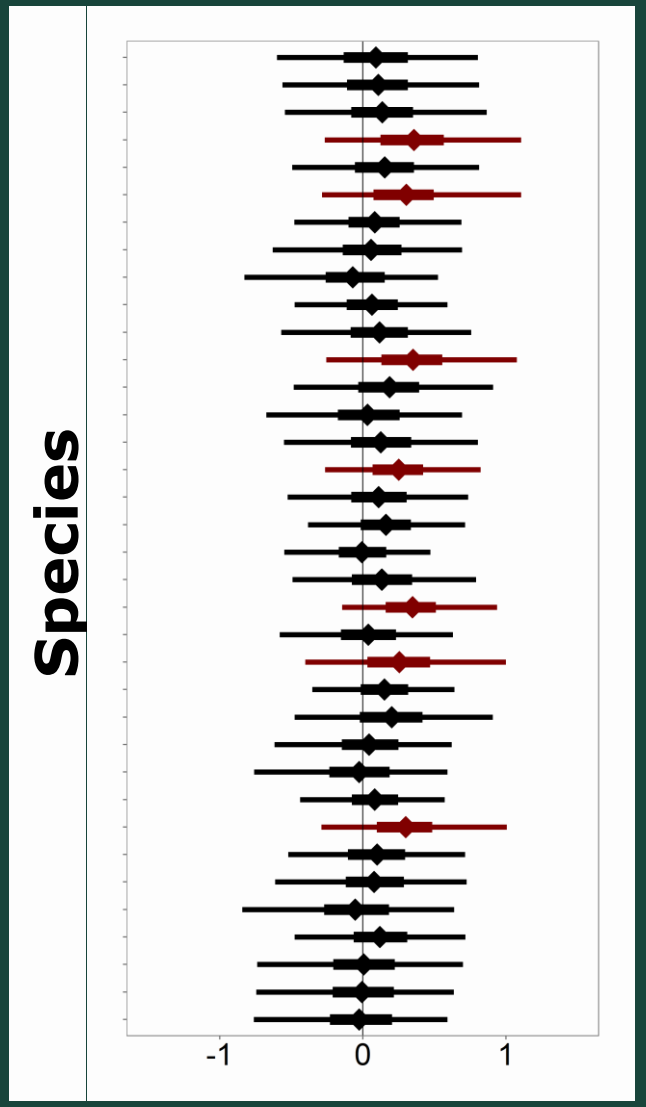
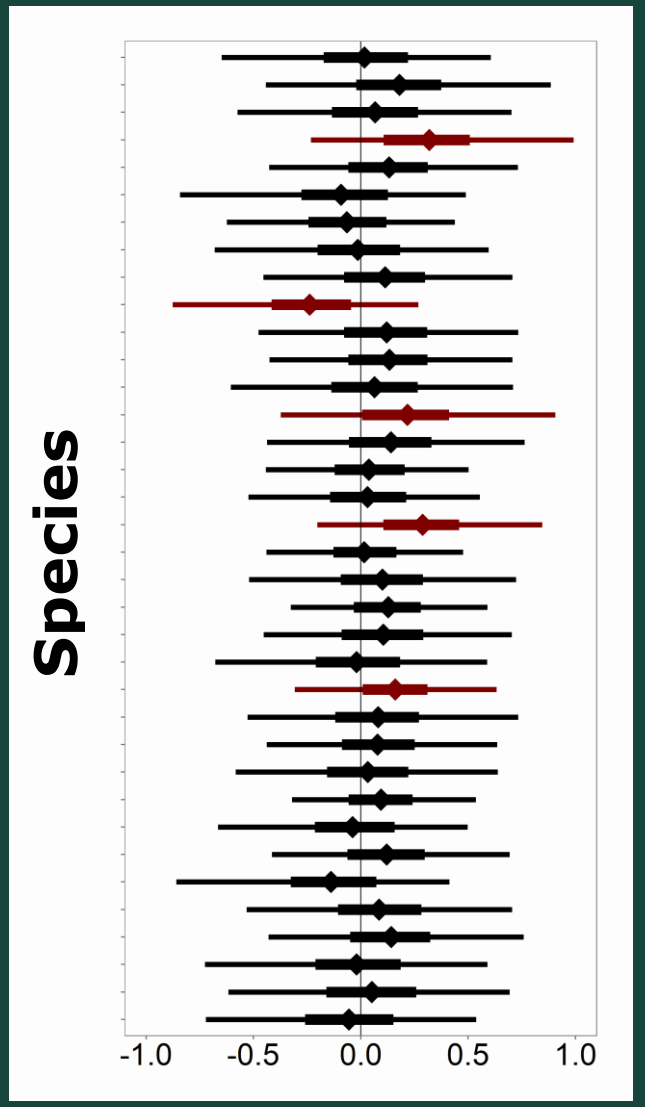
- > 95%

Forest cover

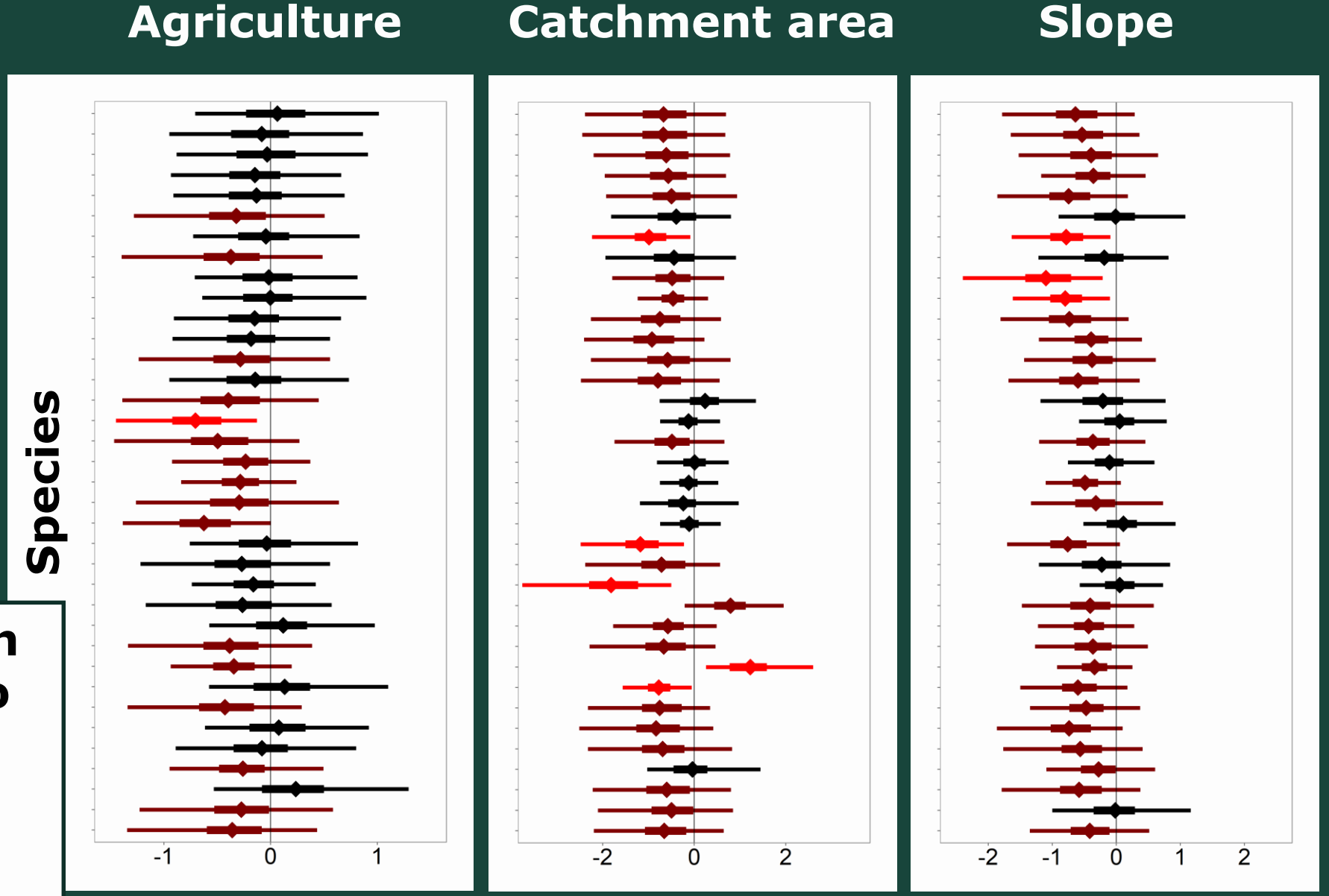


Stream density



Results

Species-level occupancy



Posterior distribution not overlapping zero

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Results

Detection process

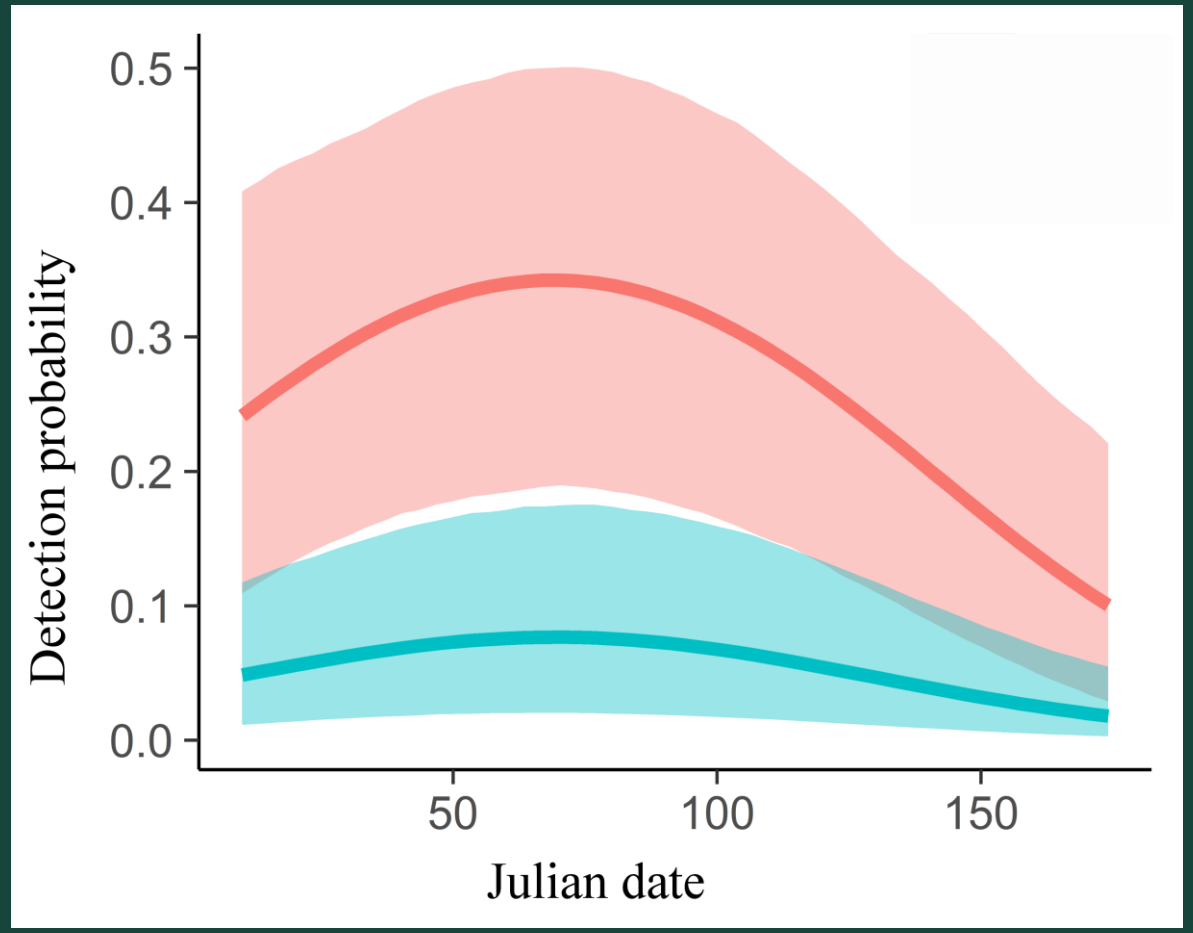
- Average detection varied widely (0.01 – 0.88)
- Influenced by the method
- Peaked middle of the rainy season

Active

Passive

Results

Community-level detection



Conclusions

- On average, small streams and flat topographic areas increase the amphibian occurrence probabilities
- Forest fragments can maintain amphibian diversity in a forested dominated landscape
- Agriculture has a negative impact on amphibians

Acknowledgements

FAPESP

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