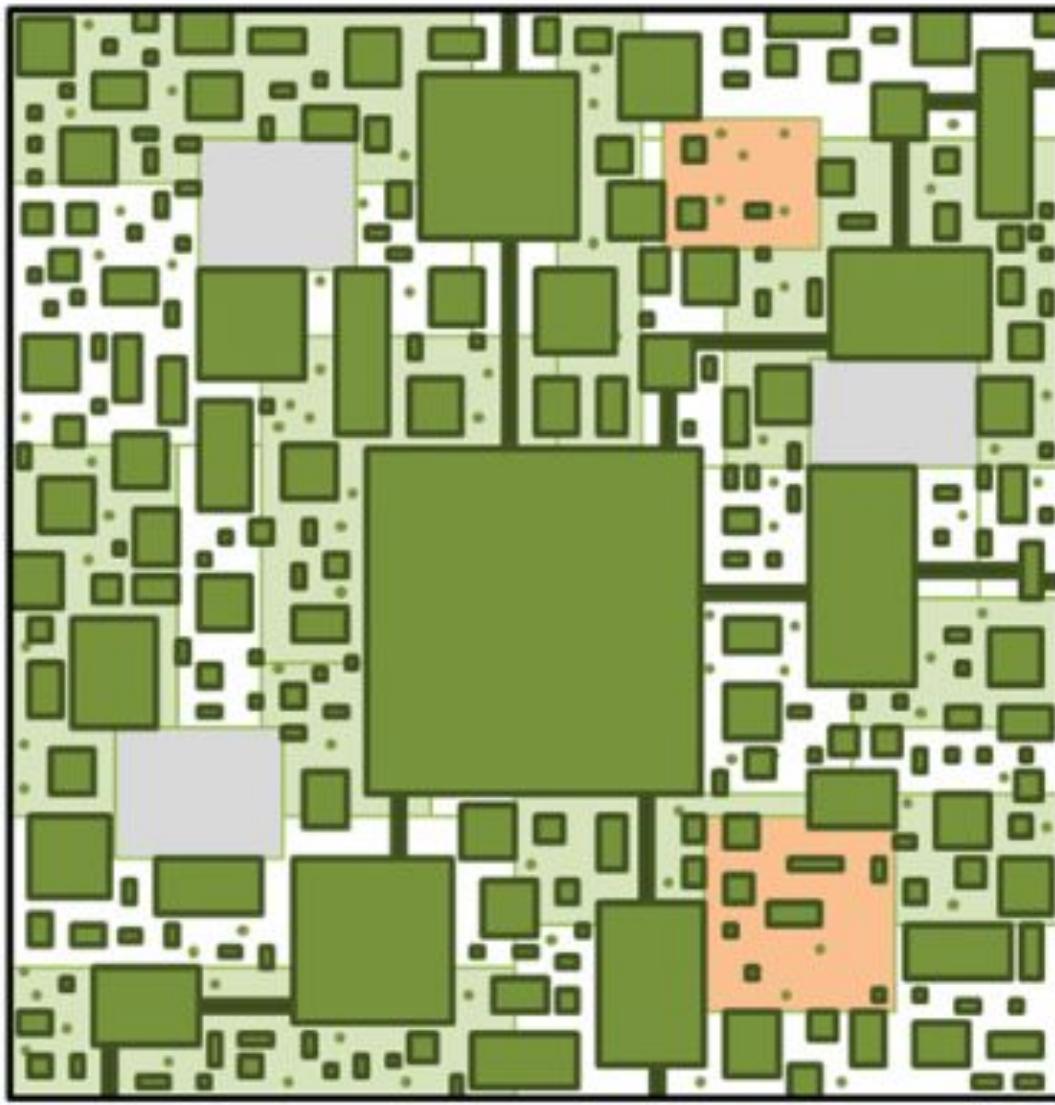




# **Sphere of influence: Investigating how adjacent pasture and plantation affect secondary forest structure and health at the landscape scale in Bahia, Brazil**

Manny R. Flores III, Jacob Peters, Thomas Harris, Daniel Piotto,  
Mark Ashton

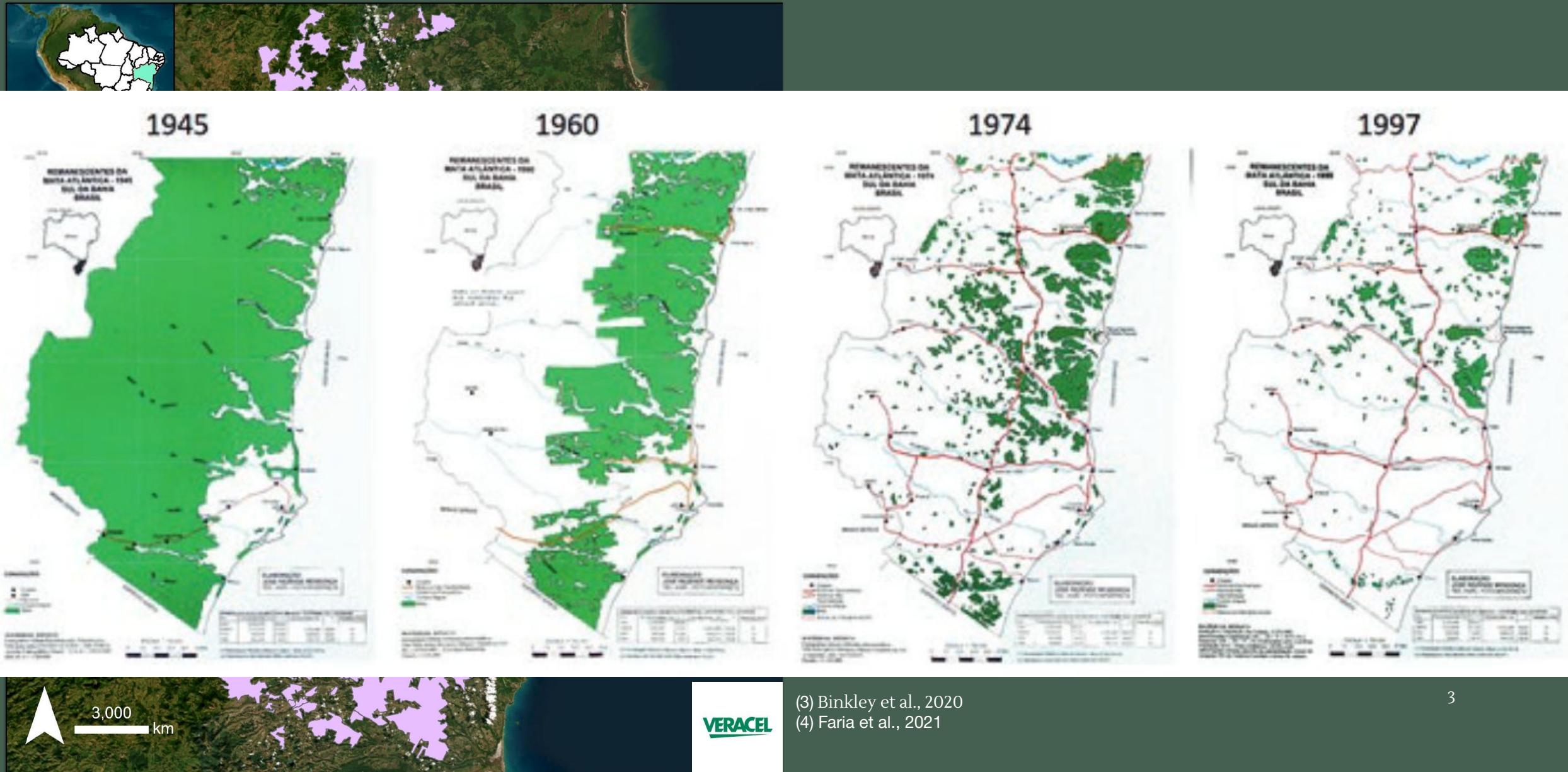
PhD Candidate, Yale School of the Environment  
DecisionES 2025 Talk



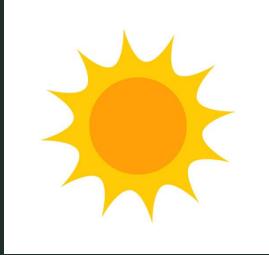
## Designing optimal human-modified landscapes for forest biodiversity conservation

- Native forest (with edges in darker green)
- Riparian corridors
- Wildlife-friendly matrices
- Open areas (e.g. pastures, annual crops)
- Intensive agriculture
- Human settlements
- Hedges, living fences
- ... Isolated native trees

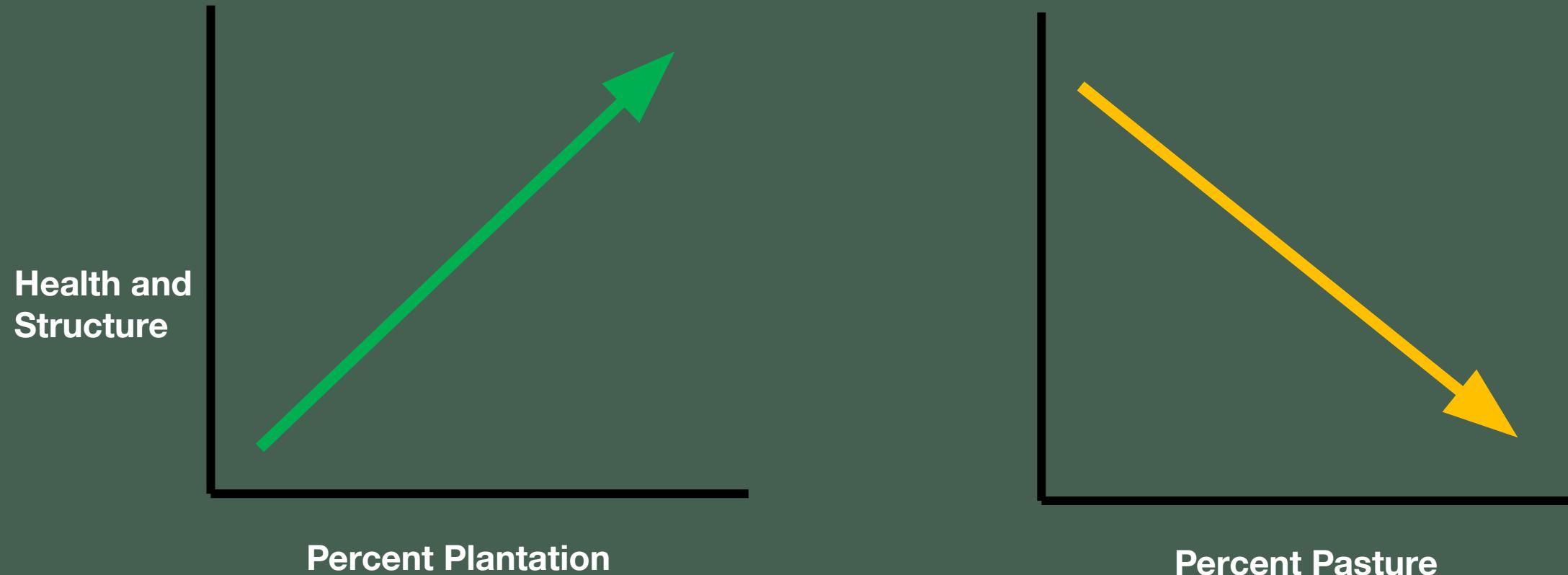
# Study Site







# Key Hypotheses (Chapter 1)



# Methods

## » Response variables for analysis

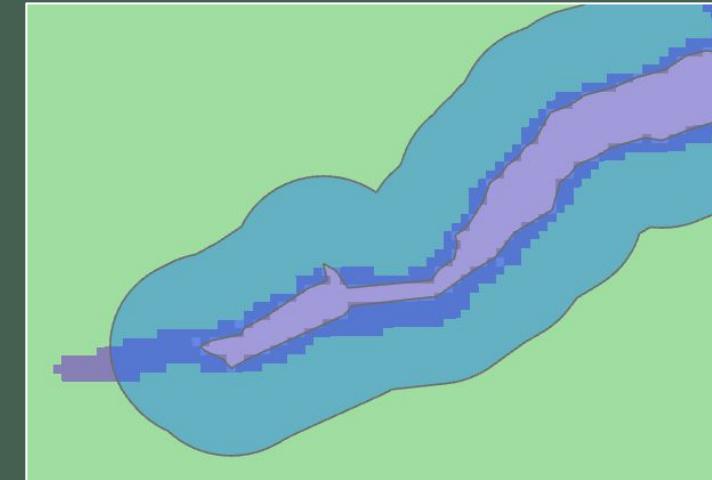
- **Normalized Difference Vegetation Index** – Sentinel 2 (10 m) – Proxy for plant health (canopy greenness reflectance)
- **Normalized Difference Infrared Index** – Sentinel 2 (10 m) – Proxy for canopy water content
- **Canopy Height Model Derived from** – GEDI and Sentinel 2 – Lang et al. (2023)

## » Fixed independent variables

- **Fraction of Plantation** – Derived from Mapbiomas (10 m)
- **Fraction of Pasture** – Derived from Mapbiomas (10 m)
- **Perimeter:Area Ratio** – Calculated in ArcGIS
- **Covariates** – Vapor Pressure Deficit, Nearest Road, Elevation, Mean Age of Secondary Forest in each forest patch



# Methods



Canopy  
Height

MapBiomas Pasture

Canopy  
Height

NDVI

NDII

~

Plantation  
Fraction

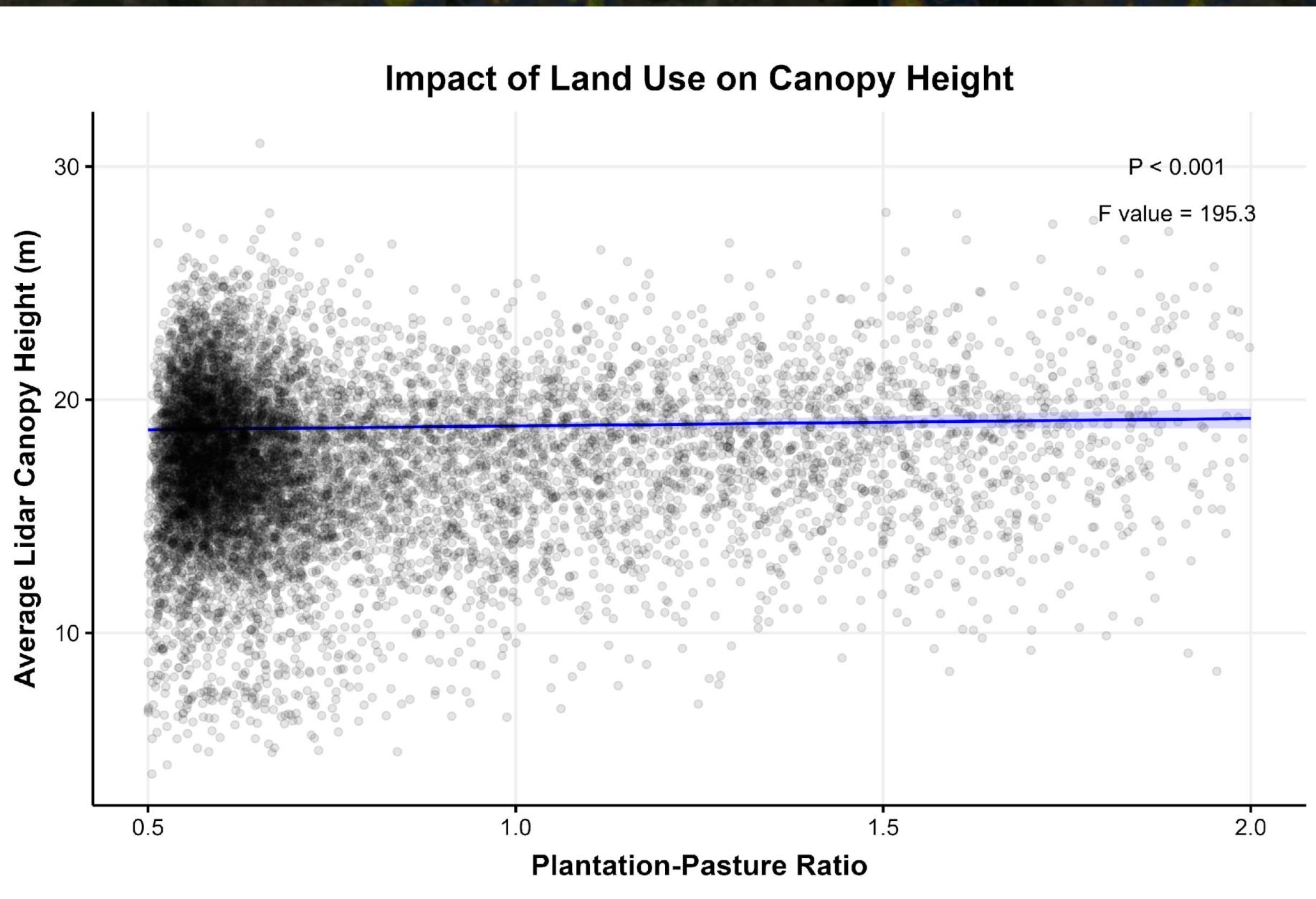
/

Pasture  
Fraction

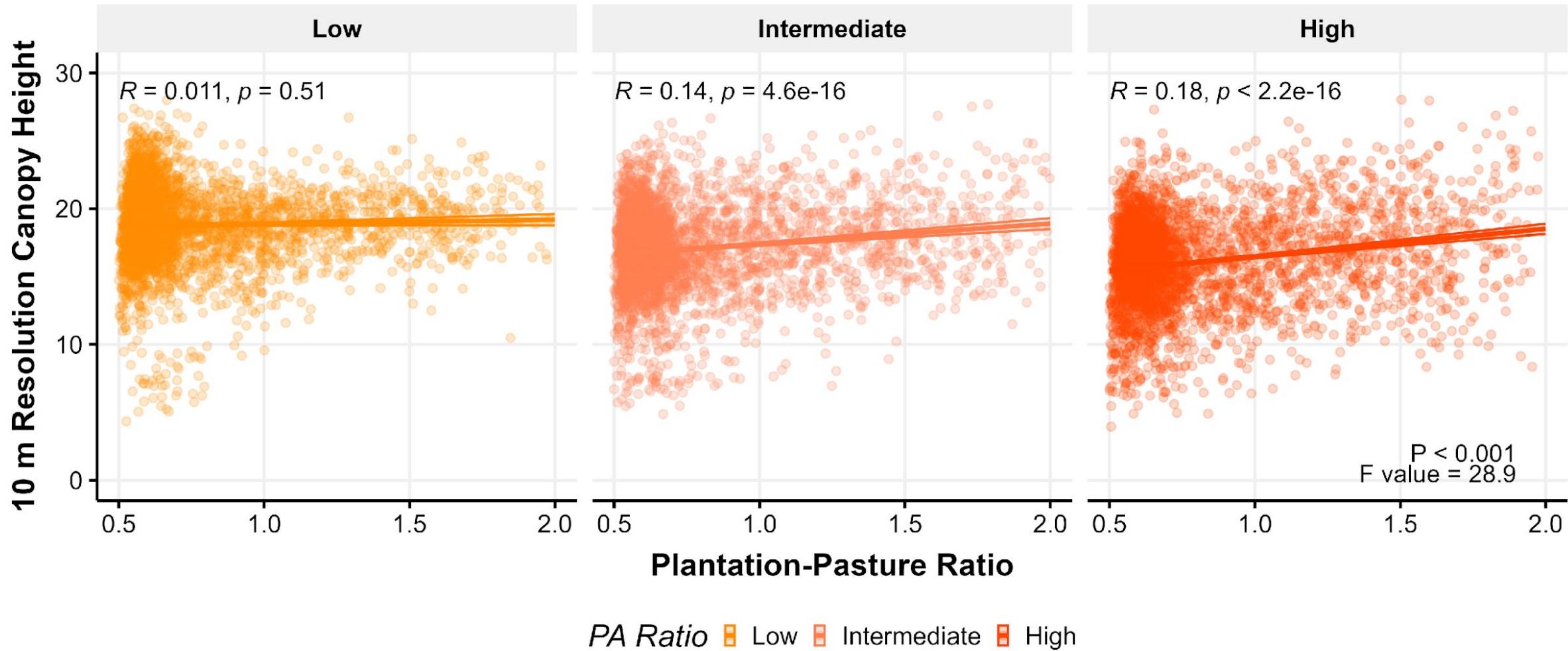
PA Ratio

Env  
Covariates

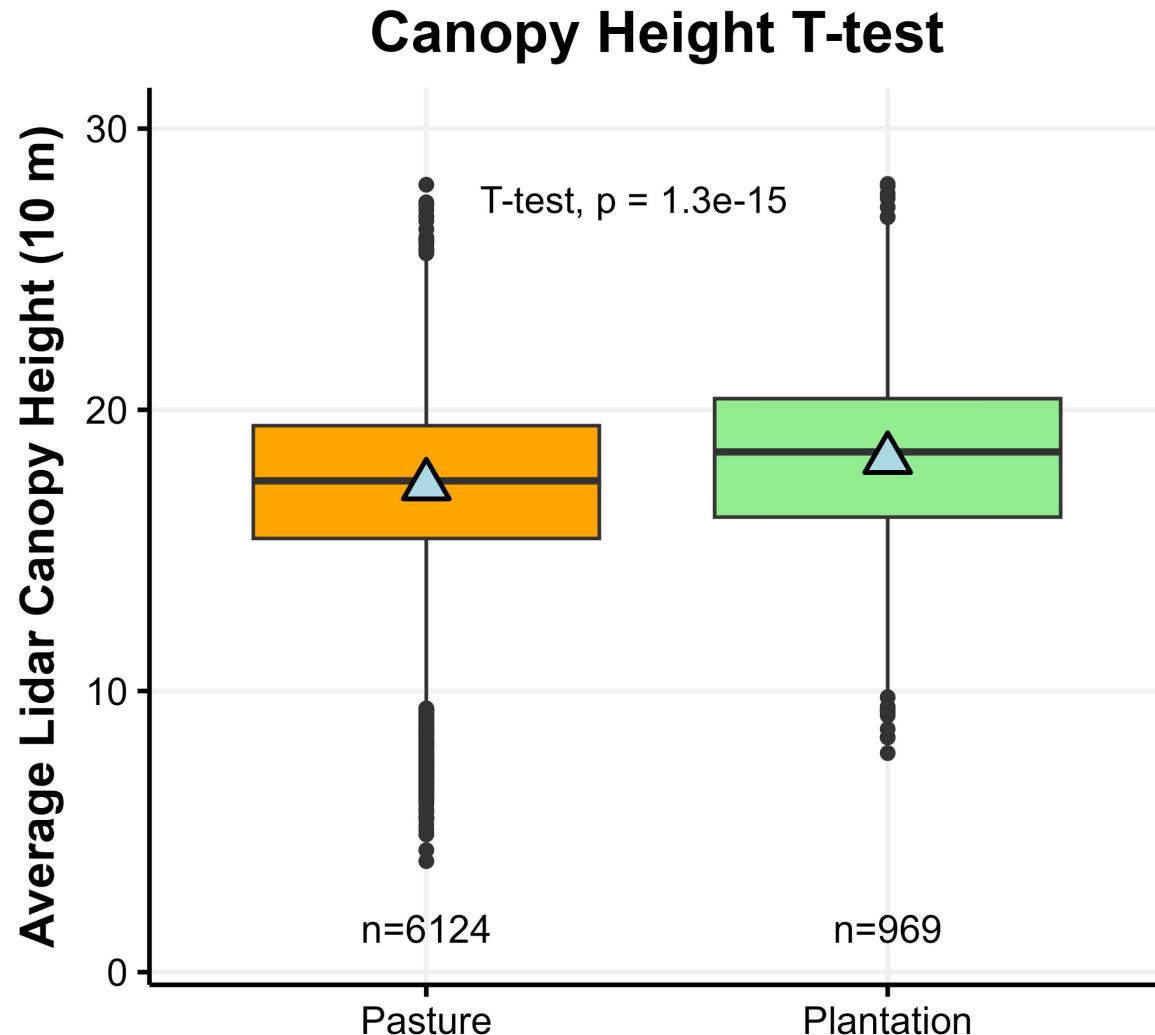
# Results – Canopy Height



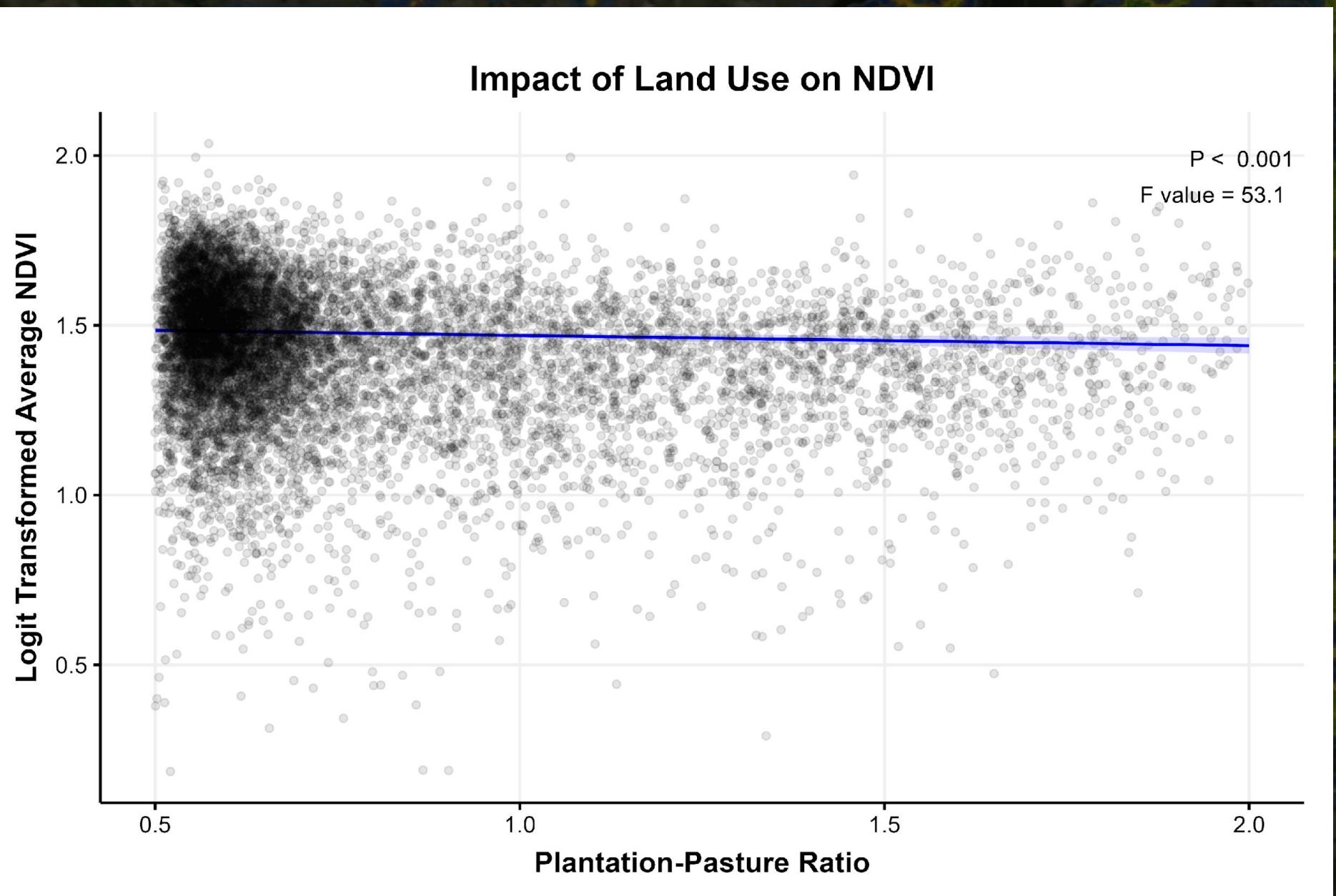
# Results – Canopy Height



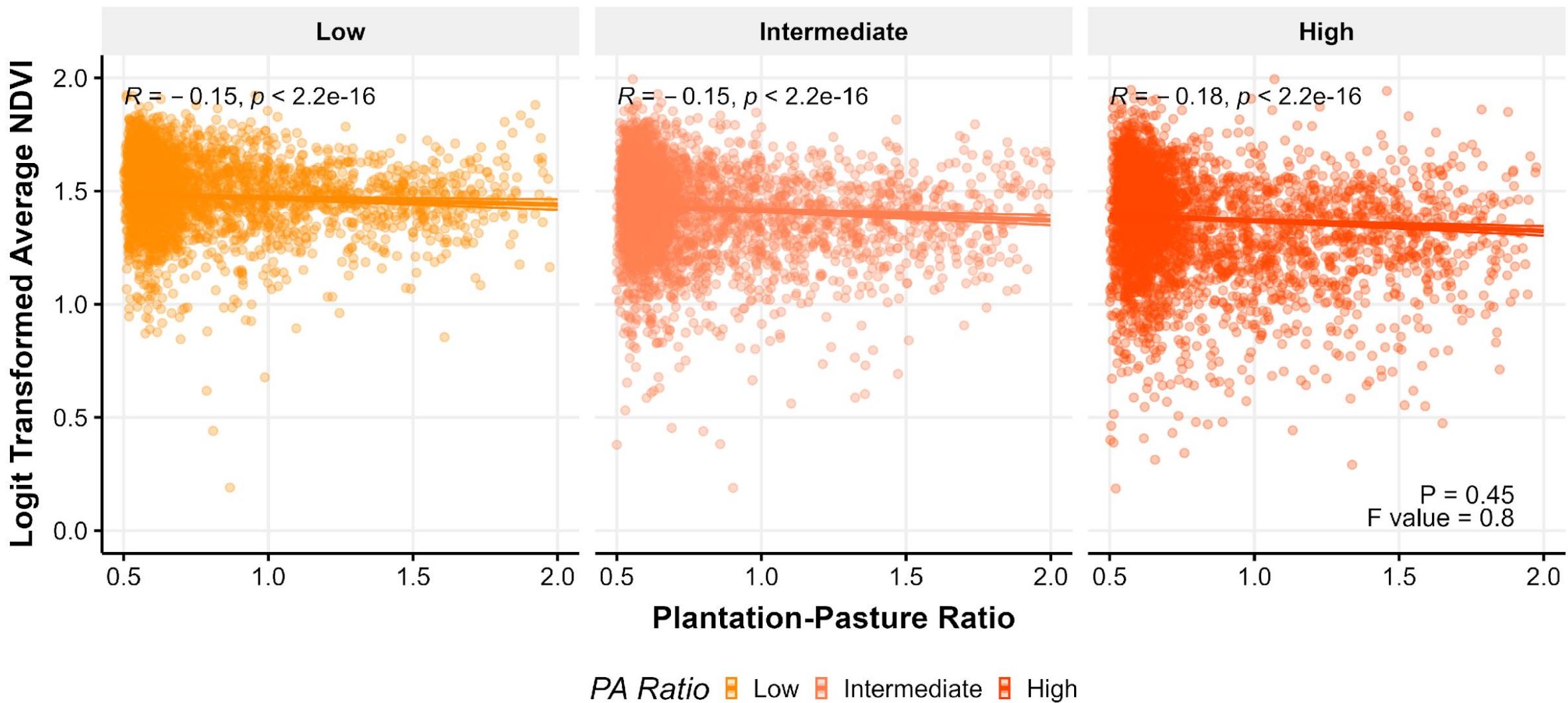
# Results – Canopy Height



# Results – NDVI

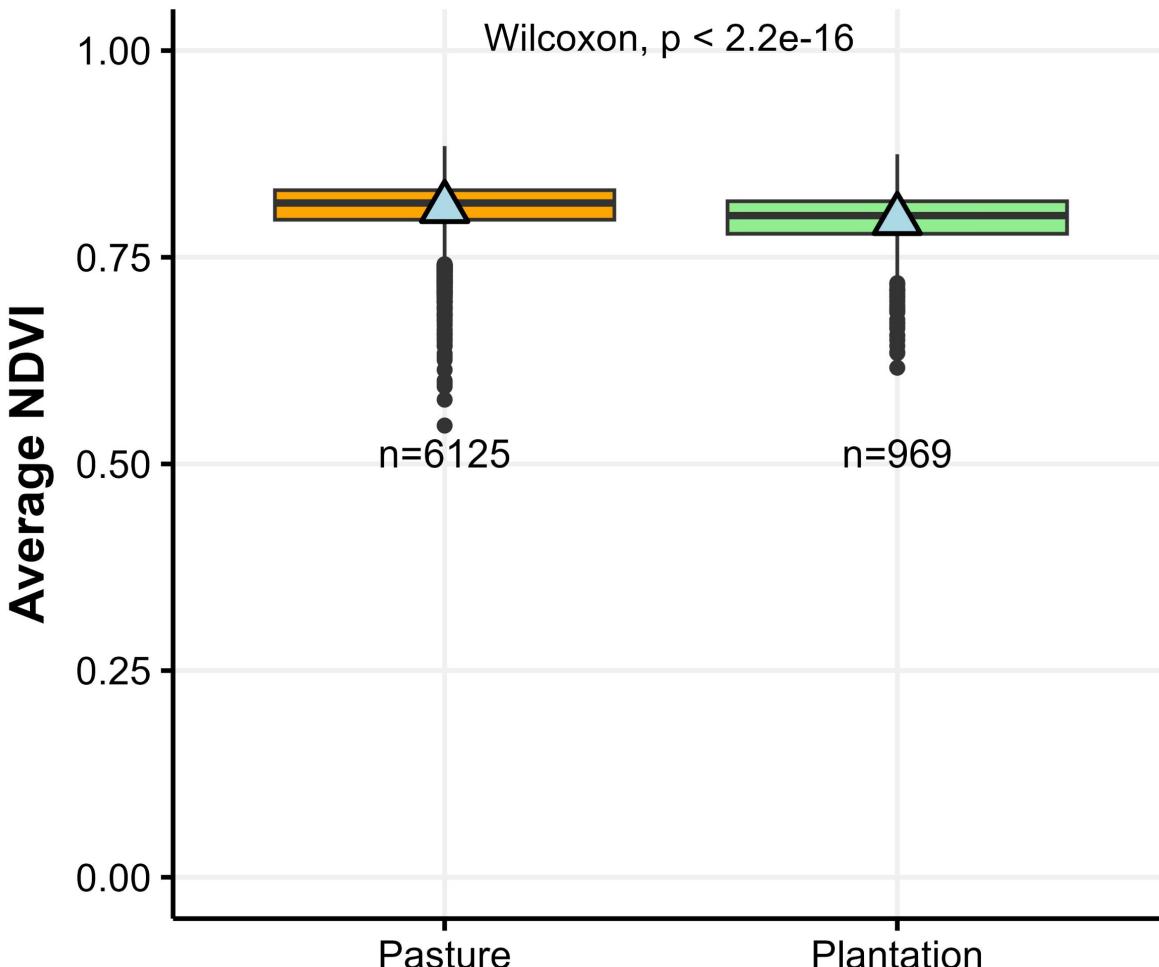


# Results – NDVI



# Results – NDVI

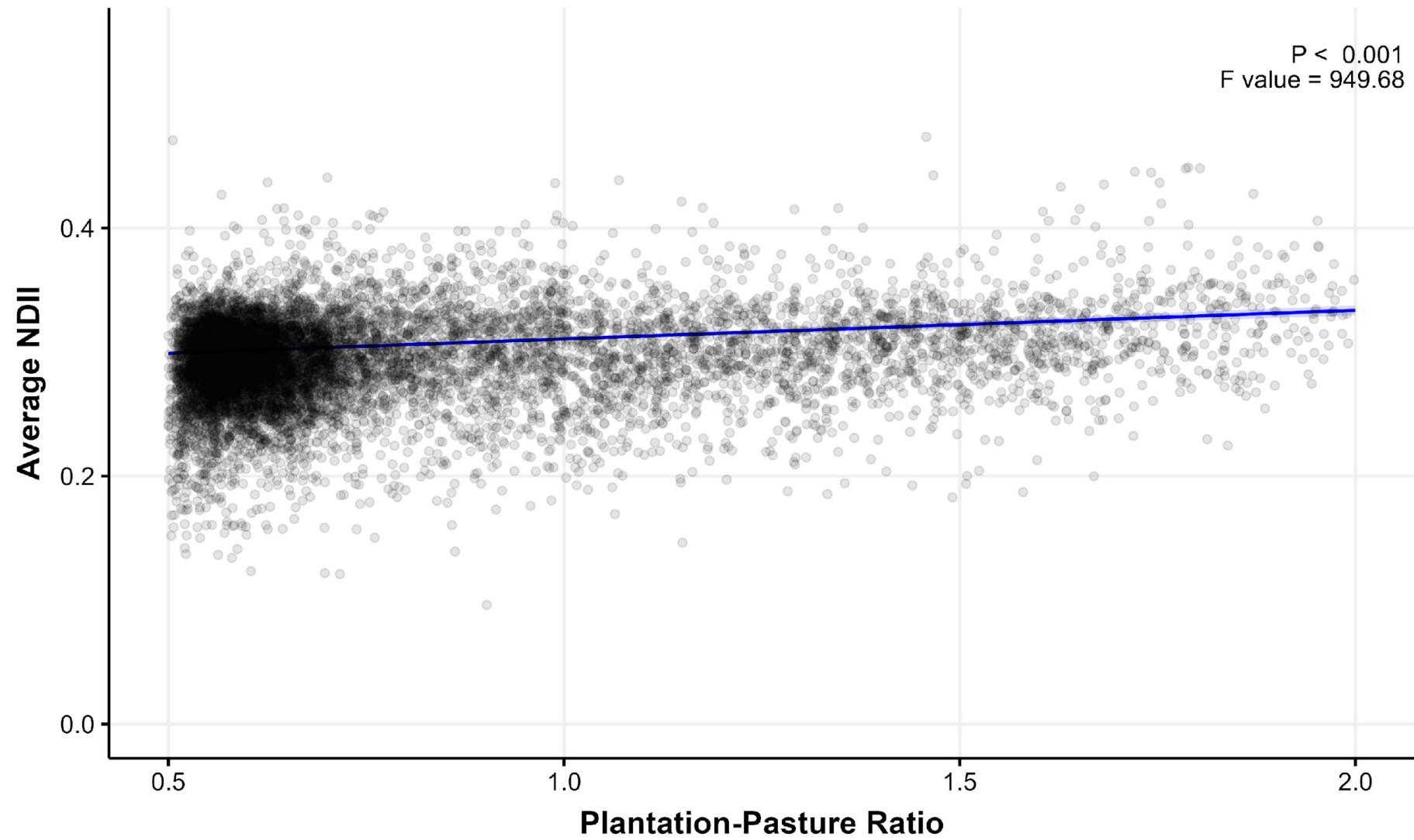
**NDVI Wilcoxon rank sum test**



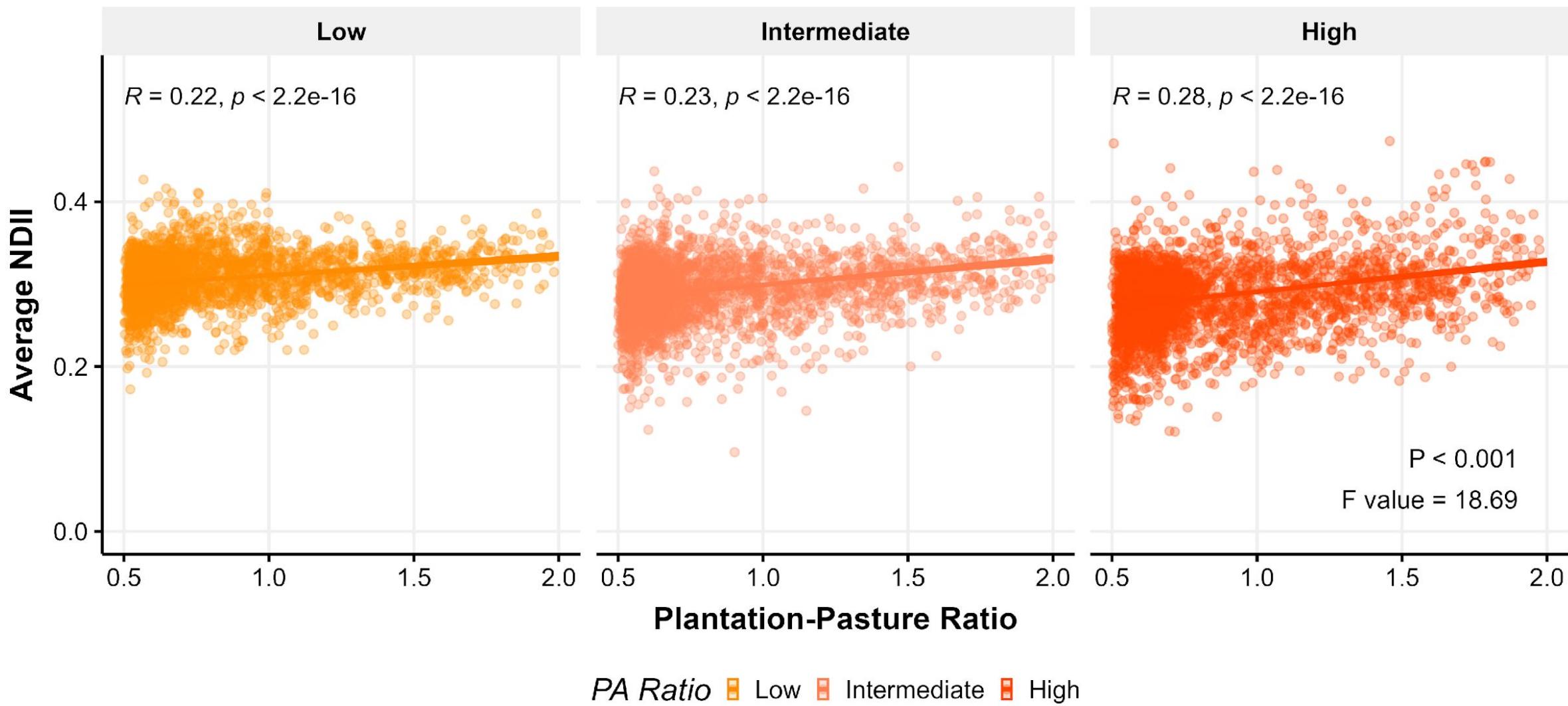
# Results – NDII

Impact of Land Use on NDII

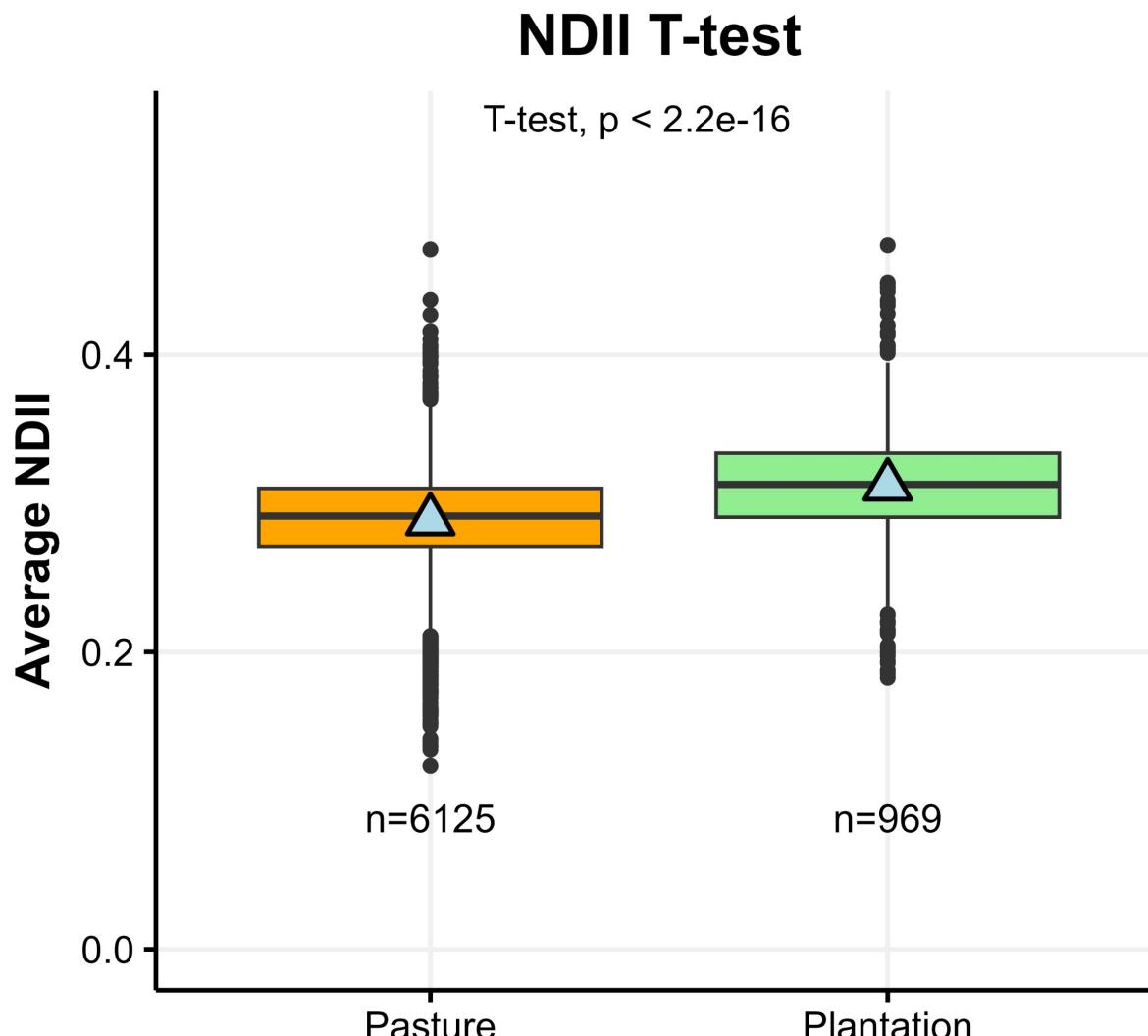
P < 0.001  
F value = 949.68



# Results – NDII



# Results – NDII



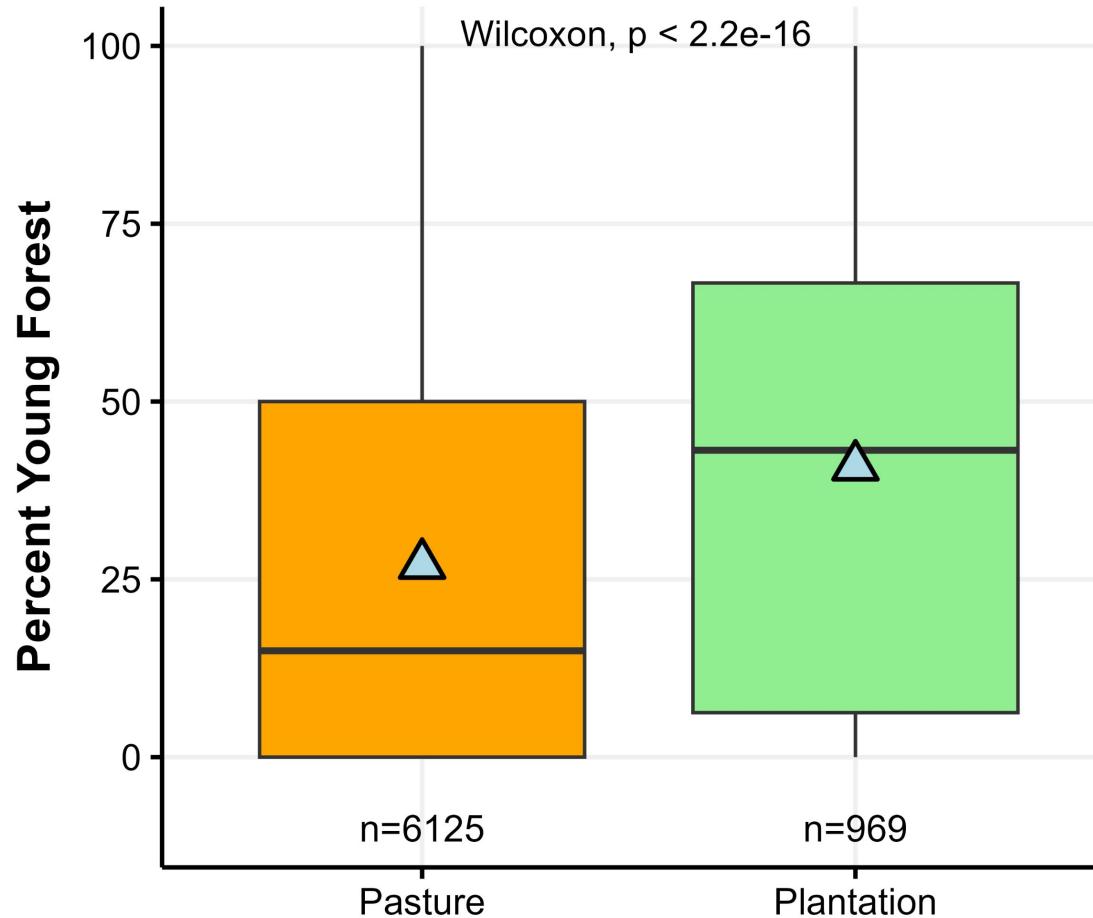
# Conclusions

- ❖ **Surrounding land-use significantly alters forest structure**
  - Higher PA ratio forests growing embedded amongst plantations grow taller than forests embedded among pasture
- ❖ **NDII found was both higher in forests surrounded by Eucalyptus and in higher PA ratio forests**
- ❖ **NDVI is negatively influenced by increasing plantation**
  - Plant communities may differ between forests surrounded by either plantations or pastures
  - NDVI is not a perfect proxy for plant health



# Forest Age My Influence Results

Young Forest Wilcox Test



# Next Steps

- ❖ **Refine remote sensing analysis**
  - Conducting structure buffer analysis to investigate how edge effects percolate into forest from forest edge
  - Analyze effects of plantation age on forest structure and health
  - Better assess effects of forest age on response variables

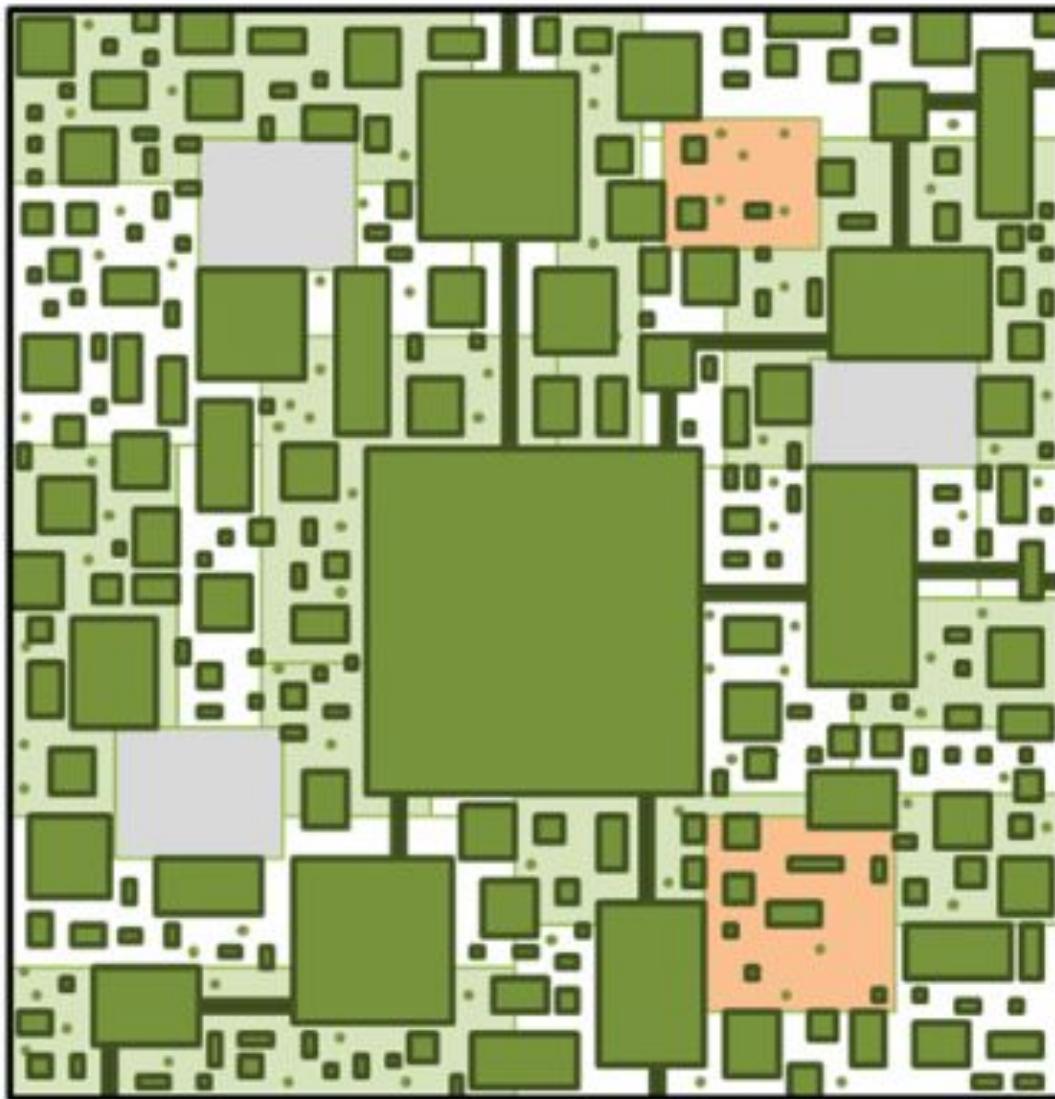


# Next Steps

## ❖ Forest Inventory and Species Diversity Analysis

- Collecting on-the-ground data on Above Ground Biomass and Species Diversity to compare against remote sensing analysis
- Compare species diversity between Eucalyptus and pasture embedded forest
- Assess soil nutrients between Eucalyptus and pasture embedded forest
- Currently completing field work in the summer of 2025





## Designing optimal human-modified landscapes for forest biodiversity conservation

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Photo Credit: Manuel Flores

# Acknowledgements



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# QUESTIONS?

# References

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# Edge Effects

- ◊ Alters microclimate
- ◊ Reduces biodiversity
- ◊ Increases tree mortality
- ◊ Reduces ecosystem services (water cycling and C sequestration)<sup>1,2</sup>

