

ANTS

- Darbhi
Durvasula
and Ciel Fu



How does
deforestation in the
Choco Rainforest
impact biodiversity?



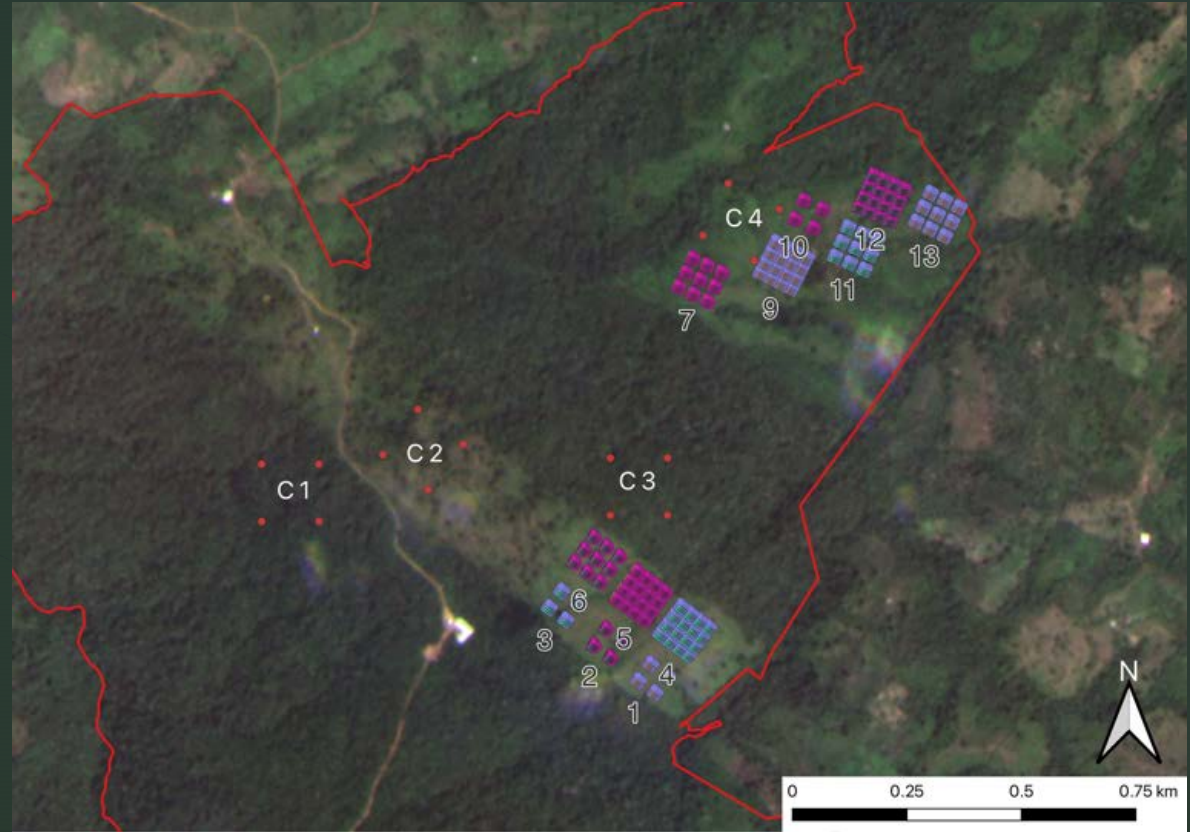
Factors Motivating Deforestation

- Clearing land for pastoral and agricultural use
 - Livelihood of many local people



Environmental Impacts of Deforestation

- Habitat loss
 - Loss of biodiversity
 - Shift in ecosystem composition
- Replacing forest with non-native grasses
- Soil compaction from cattle grazing
 - Reduction in soil quality

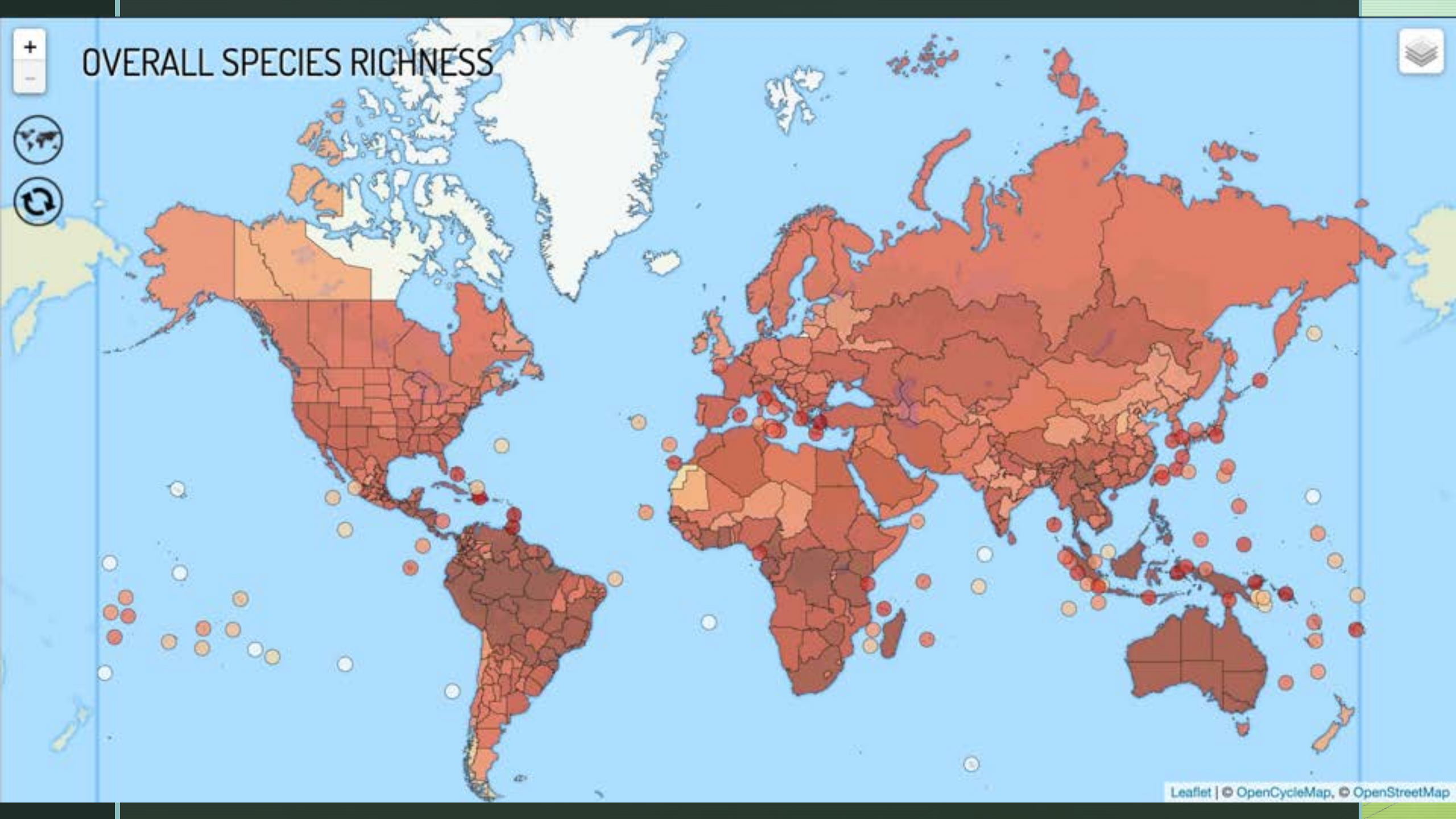


Why Ants?

- Globally dominant species
 - “Ants are a globally dominant faunal group, contributing a large proportion of terrestrial faunal biomass and playing key ecological roles as soil engineers, predators, nutrient cyclers and regulators of plant growth and reproduction” (Andersen 2019)



OVERALL SPECIES RICHNESS



Why Ants?

- **Bioindicator**
 - Provides insight to the health of an ecosystem
 - Ecological impacts of disturbance events



Research Questions

1. How does deforestation in the Choco rainforest impact the composition of ant species?

■ Hypothesis:

The composition of ants species in the reforestation area is the subset of the composition of ants species in the forest.

Deforestation's impact: It only reduces the number of species of ants.



Research Questions

2. How does deforestation in the Choco rainforest impact the diversity of ant species?

■ Hypothesis:

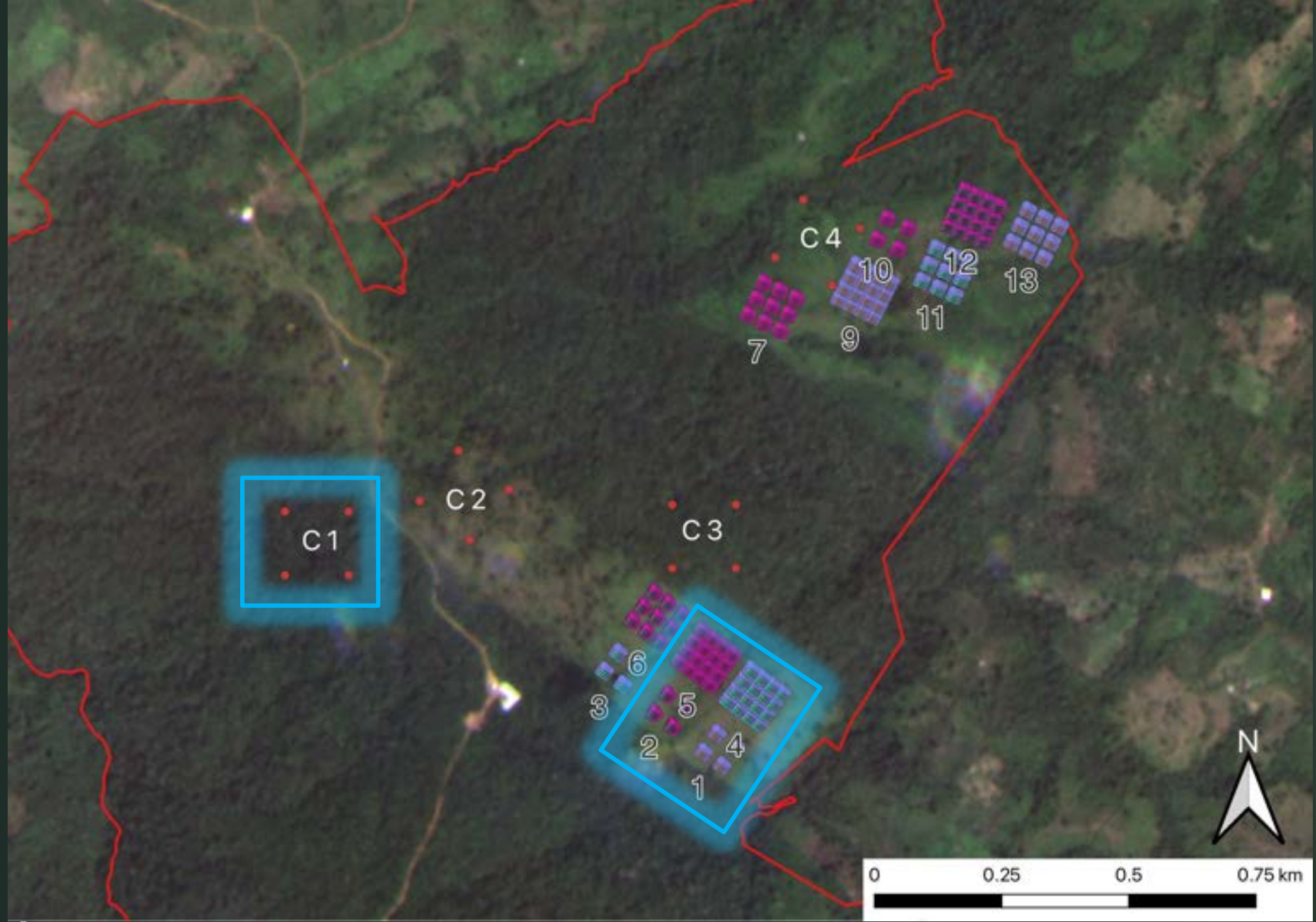
Species diversity will be higher in the primary forest than in the reforestation areas.

- Functional diversity, richness, and evenness are higher in areas with more canopy cover and tree density (Díaz-García et al. 2022)
- Habitat openness (level of vegetation cover) is critical to determining ants' response to disturbance events (Andersen 2019)
- Disturbance events are any event that removes biomass (ex: fires and deforestation)
- Competition is an important structuring force in ant communities (Hölldobler & Wilson 1990, Parr & Gibb 2010)

Methods: collection

- Comparing **primary rainforest** and **pastoral reforestation** sites
- The reforestation area is only 1 year old, thus it is not yet fully reforested
 - more representative of deforestation



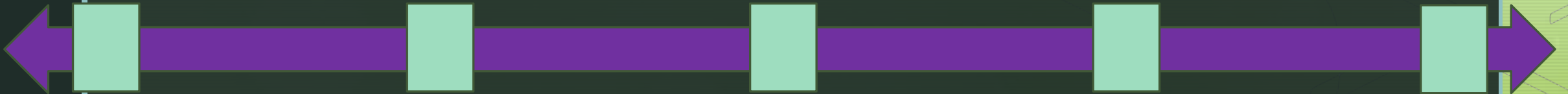


Methods: collection

- **4 sites** surveyed in each area along **transects**
- 2 types of surveying:
 - **Active sample:** 10 minutes of active sampling along the transect line
 - **Bait sample:** Left for 20 minutes, then 2 minutes of sampling at the bait sites

Transect

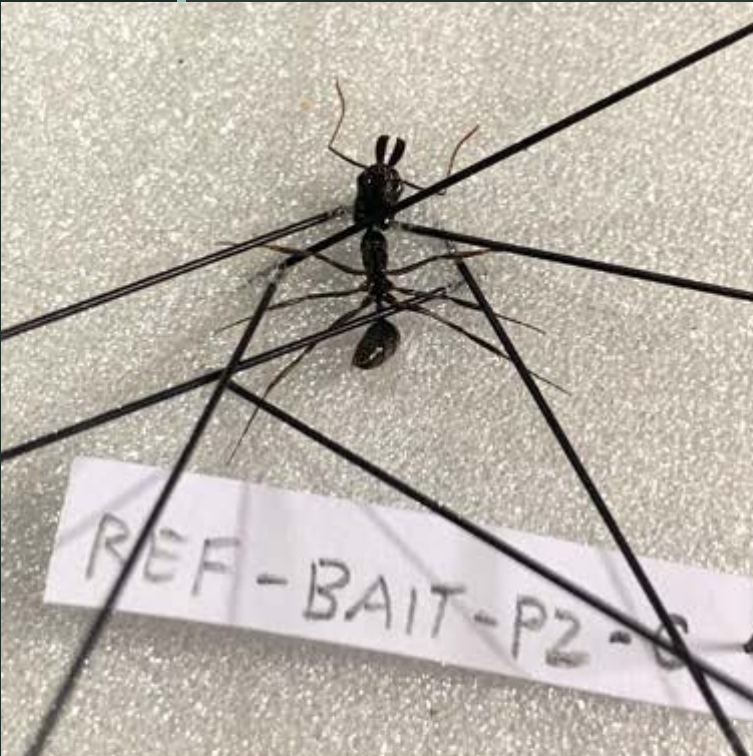
Bait





Methods: processing

- Ants dried, pinned, and identified to create a FCAT collection





Results: composition

The Number of Species found in reforestation area and forest

Reforestation: 12

Forest: 32

Both in Reforestation and Forest: 4

*Nylanderia

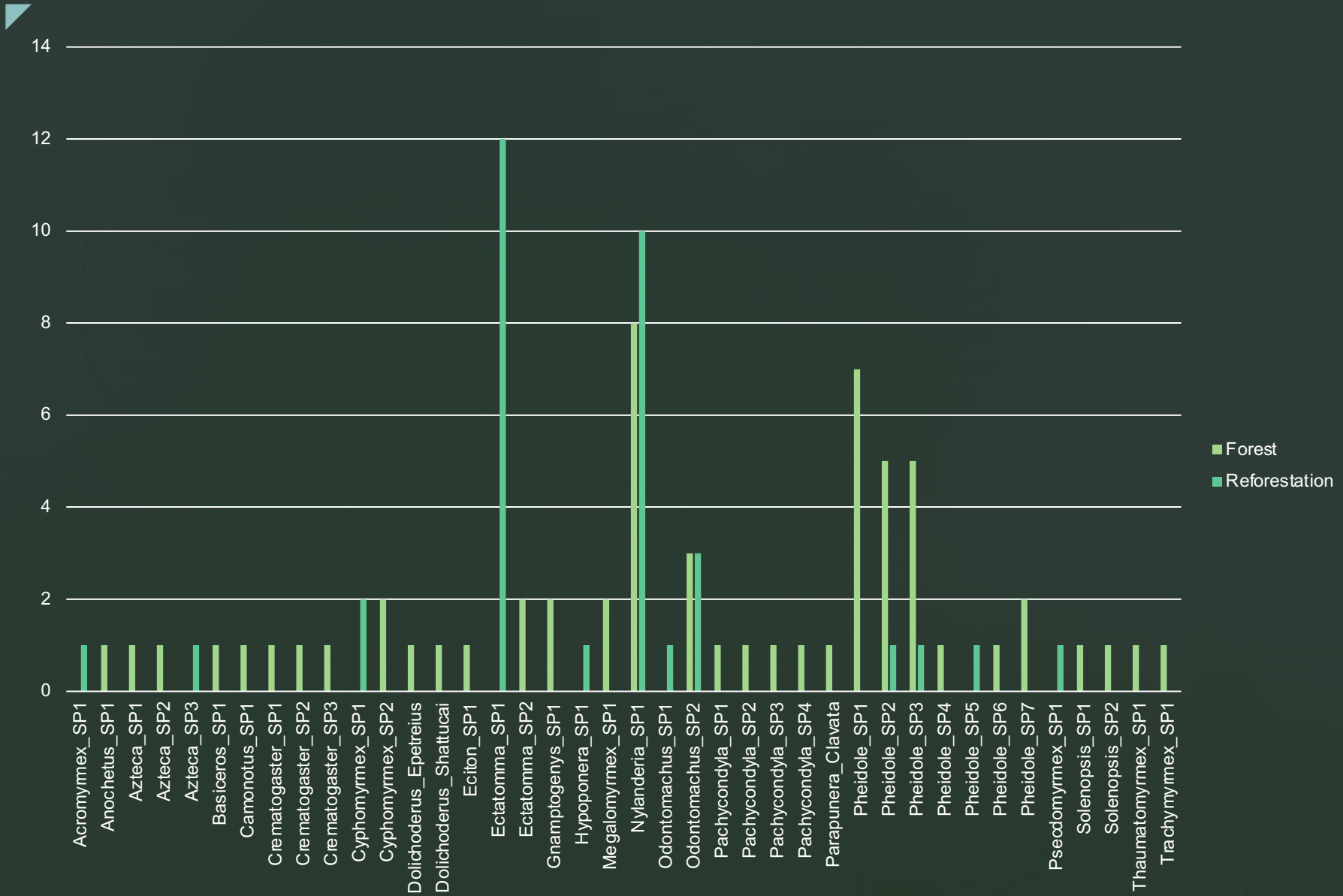
*Odontomachus

*Pheidole_SP2

*Pheidole_SP2

Total: 40 species, 22 genus

Count of Data	Column Labels		
Row Labels	Forest	Reforestation	Grand Total
Acromymex_SP1		1	1
Anochetus_SP1	1		1
Arteca_SP1	1		1
Arteca_SP2	1		1
Arteca_SP3		1	1
Basiconus_SP1	1		1
Camponotus_SP1	1		1
Crematogaster_SP1	1		1
Crematogaster_SP2	1		1
Crematogaster_SP3	1		1
Cyphomyrmex_SP1		2	2
Cyphomyrmex_SP2	2		2
Dolichoderus_Epetreus	1		1
Dolichoderus_Shattucal	1		1
Eciton_SP1	1		1
Ectatomma_SP1		12	12
Ectatomma_SP2	2		2
Gnamptogenys_SP1	2		2
Hypoponera_SP1		1	1
Megalomyrmex_SP1	2		2
Nylanderia_SP1	8	10	18
Odontomachus_SP1		1	1
Odontomachus_SP2	3	3	6
Pachycondyla_SP1	1		1
Pachycondyla_SP2	1		1
Pachycondyla_SP3	1		1
Pachycondyla_SP4	1		1
Paraponera_Clavata	1		1
Pheidole_SP1	7		7
Pheidole_SP2	5	1	6
Pheidole_SP3	5	1	6
Pheidole_SP4	1		1
Pheidole_SP5		1	1
Pheidole_SP6	1		1
Pheidole_SP7	2		2
Pseudomyrmex_SP1		1	1
Solenopsis_SP1	1		1
Solenopsis_SP2	1		1
Thaumatomyrmex_SP1	1		1
Trachymyrmex_SP1	1		1
Grand Total	60	35	95



Diagram

Total: 40

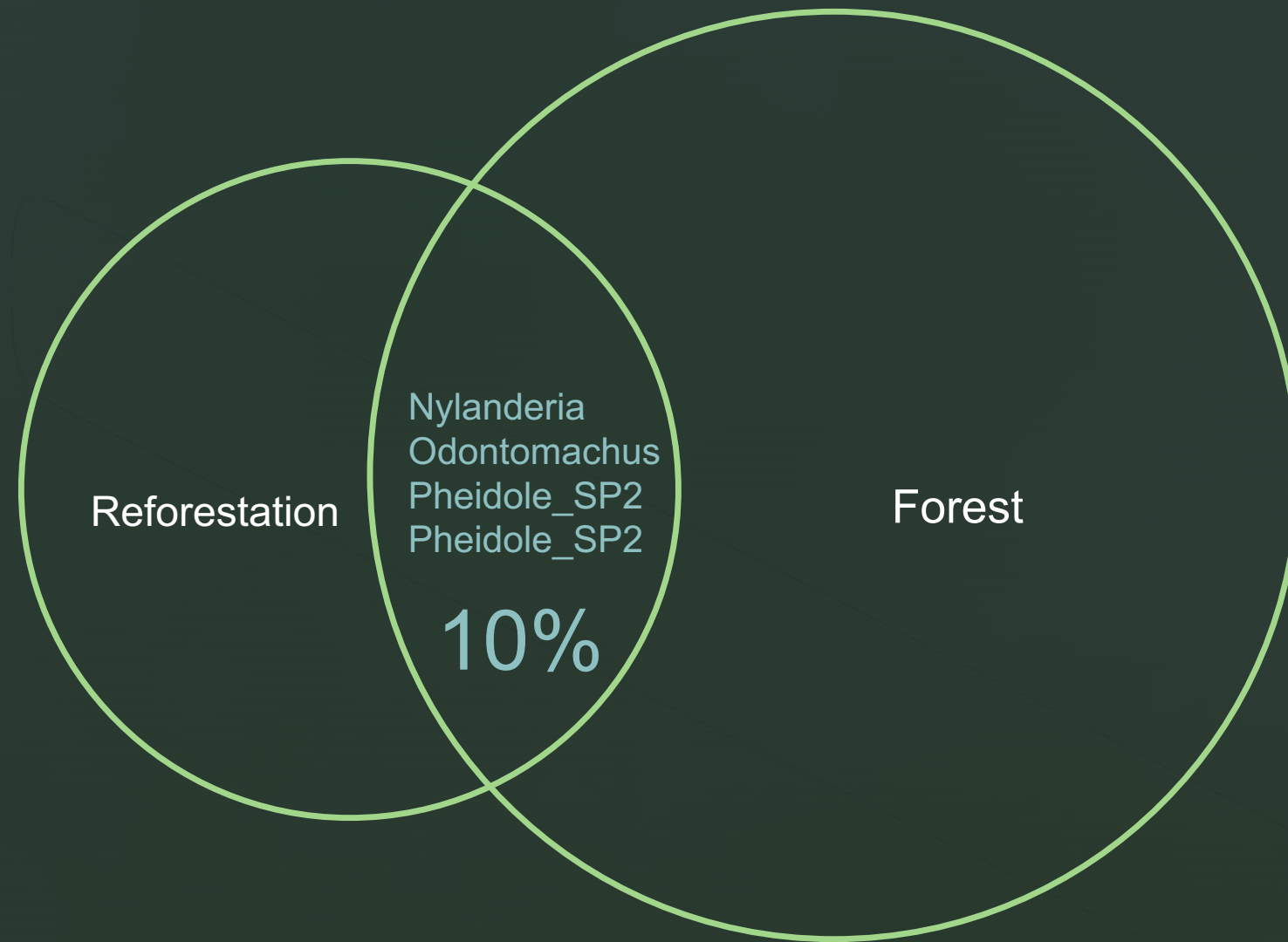


Proportion:

Total: 40

Common subset : $\frac{4}{40} = 10\%$

Changing species (turnover) : $1 - 10\% = 90\%$



▀ Pheidole (Both Areas)



Every place
Cosmopolitan
Construct their nests everywhere:
soil, trees, trunks, and leave litter
Omnivorous
Predator
Forest and open area
Resist deforestation



Acromyrmex_SP1(Only Reforestation)



Leave Cut ants
Open environment
Fungus
No Forests



▀ Dolichoderus Shattucaï (Only Forest)



Endemic
Arbre
Good environment
Nets in the trees



Discussion:

The composition of ants species is so different between reforestation area and forest. They have few overlapping species (Only 10%).

Deforestation has huge impacts on the composition of ants species. It not only decreases the richness of ants species, but also changes ants species almost completely.



Why?

Deforestation may increase vulnerability of native ant communities to ant invasions

Heavy rain in open areas can cause flooding of nests

Survival mechanisms include evacuating nests to higher ground or in trees, and forming rafts, several that are carried by the current to dry ground.

In boreal forests, colony abundance of red wood ants (*Formica rufa* group) declined drastically in deforested areas

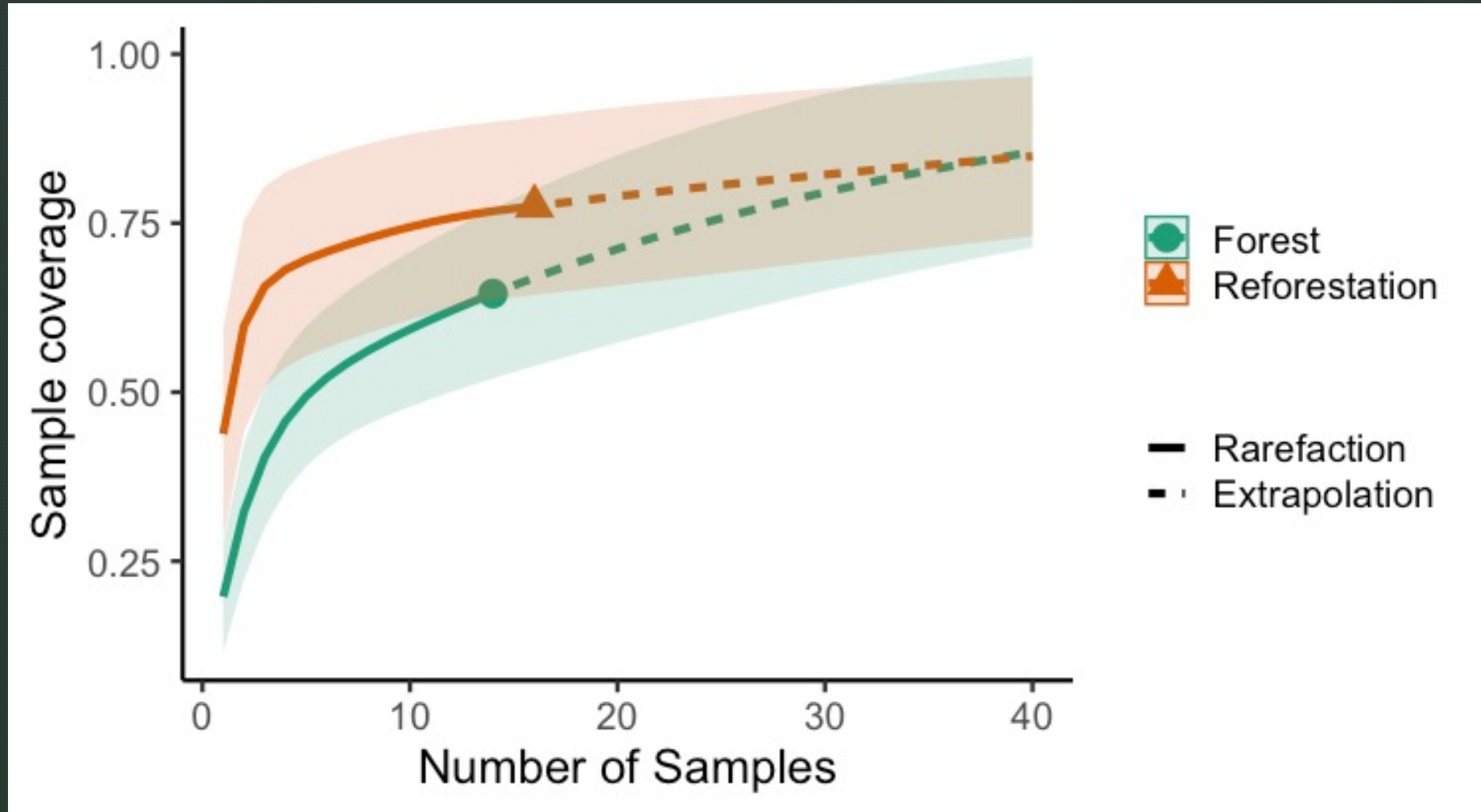
Results: diversity

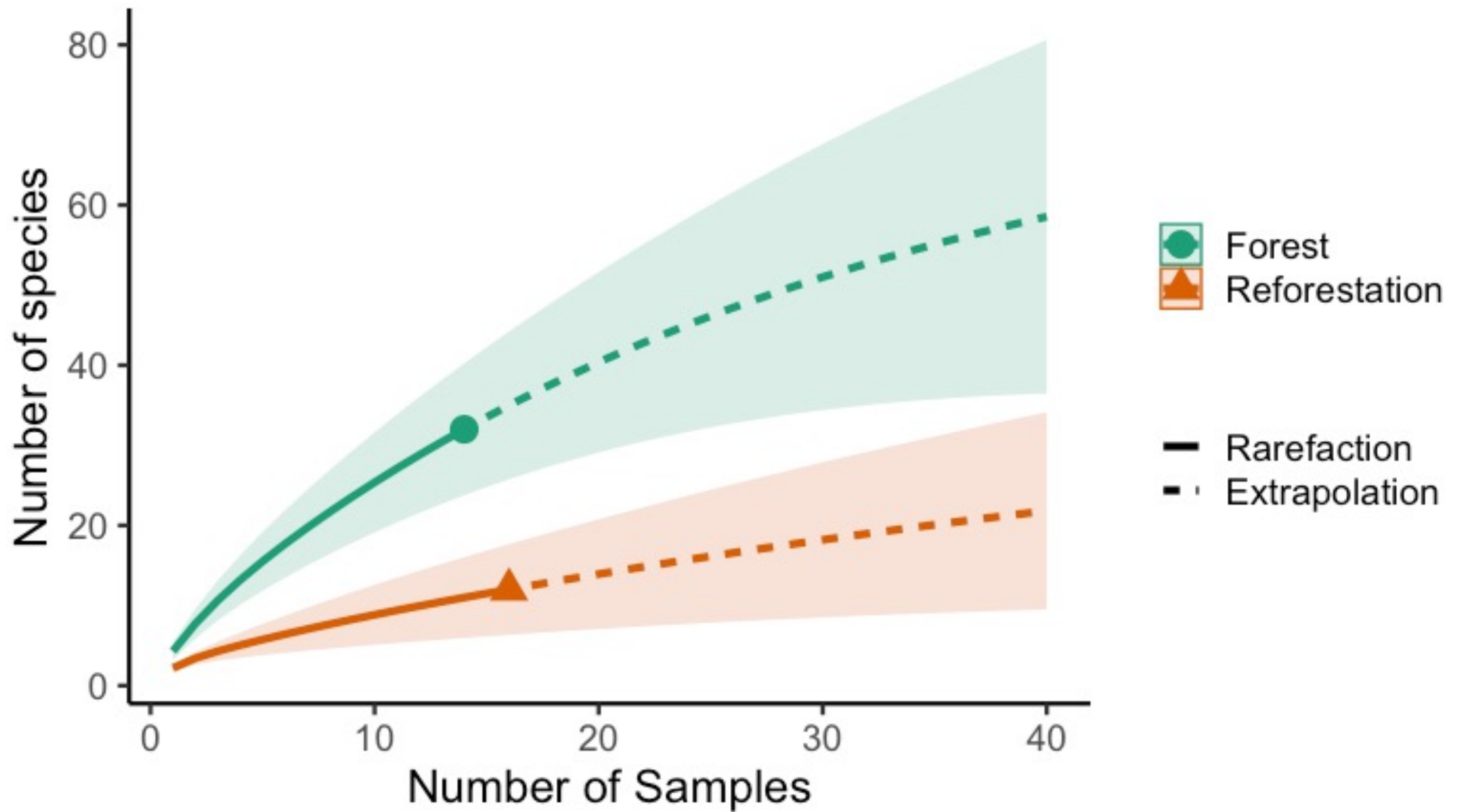
Species diversity was measured in 3 ways:

- Species richness: raw # of species found within a transect
- Shannon Diversity Index: favors common species
 - Measures the probability of a new sample presenting a new species
- Simpson's Diversity Index: favors rarer species
 - Measures of the probability that 2 entities taken from a dataset represent the same type
 - Scale of 0 to 1, closer to 1 means higher diversity because it is a function of the proportional abundance

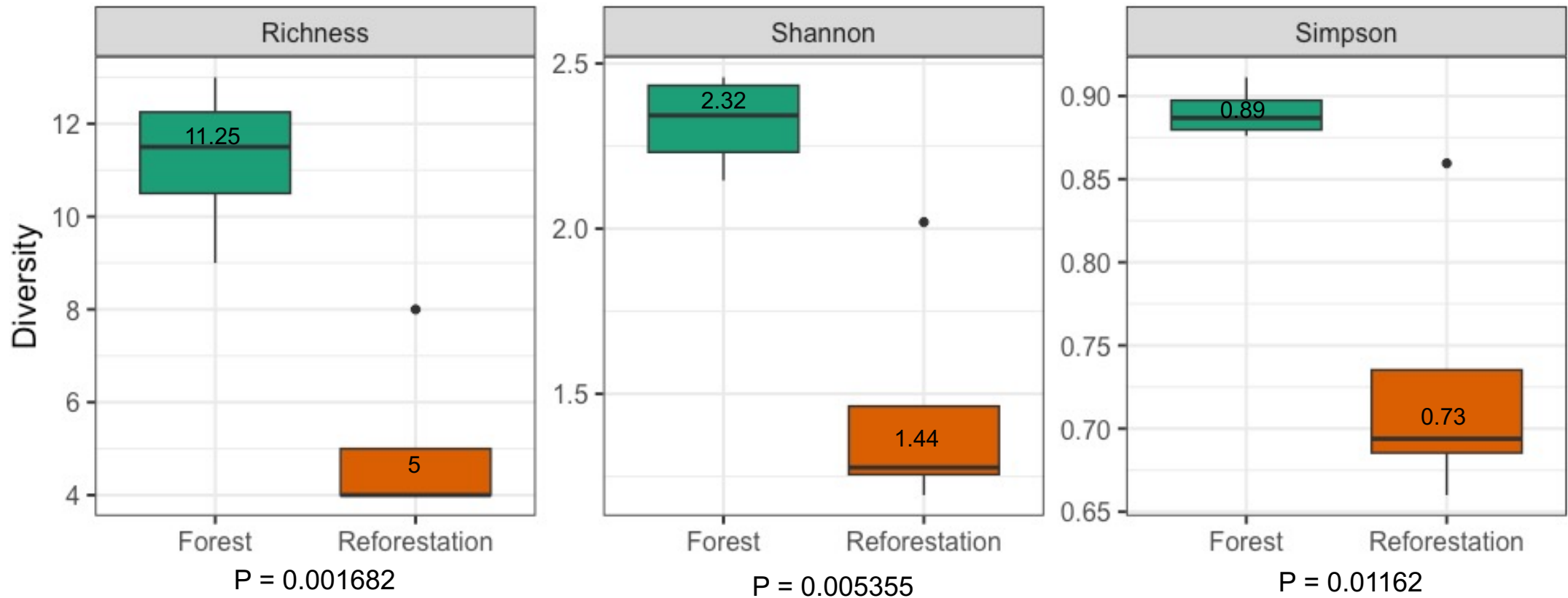
Sample coverage

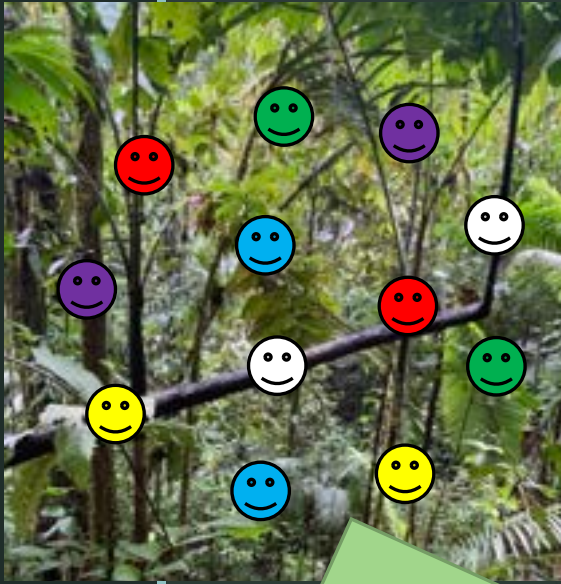
Forest	Reforestation
65%	78%





- **Total species found:**
12 species in reforestation area, 32 species in primary forest





Rainforest: lower frequency of many ant species



Reforestation: higher frequency of fewer ant species



Biological Explanation

Winner-loser dynamics of ants' response to disturbance

- **Winners:** Species that prefer open habitat (hot-climate specialists, opportunists, generalists)
 - Able to colonize the newly deforested open habitat
- **Losers:** Species that prefer closed habitat (cold-climate specialists, specialist predators)
 - Experience reductions in their preferred habitat and die off



Conclusion

- Deforestation causes shifts in species composition and major reduction in ant biodiversity
- Ants of a bioindicator, so these results illustrate the destructive impacts of deforestation on biodiversity overall

Future Implications

- This is the first project looking at impact of deforestation on ant diversity at FCAT
 - Provides a baseline for future ant research to see how reforestation efforts are working to restore biodiversity
- We made an FCAT ant collection
 - Allows for other types of measurements on these ants (functional and genetic diversity) and further research



Merçi
Beaucoup!



Questions?



Acknowledgements



Tiago Fernandes



David Cantos



Darwin Zambrano



Carlos Aulestia



Thalia Dueñas