Investigating the Three-way Interaction of Sunlight Exposure, Soil Quality, and Tree Growth for Spiked Peppers (Piper Aduncum) in Secondary Forest

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Introduction

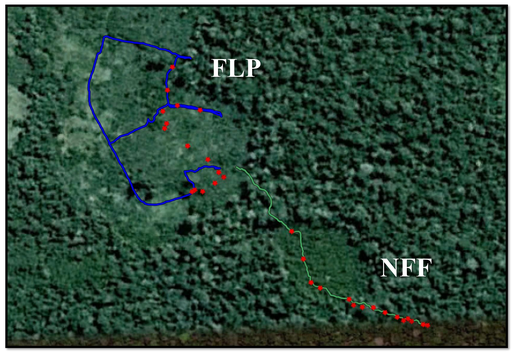
- **Photoreceptors:** Light detectors for nutrients
- **Soil Chemistry:** Nutrient levels influences nutrient transport
- **Luminosity:** Light energy to conduct photosynthesis, germination, cell division, leaf multiplication, and stomata development
- **Community Science Efforts:** Successful tracking of sunlight and soil nutrient levels influenced tree growth
- **Community Demand:** Agricultural effects, Forest Regeneration, Climate Change, Natural Resources, Biodiversity, and Ecosystems
- **Research Aim**: Determine the dynamic feedback loop of sunlight, soil nutrients, and tree growth
- **Research Question:** How do light availability and soil nutrient levels (N, P, K, pH) independently predict tree growth rate in secondary forest plots at Finca Las Piedras and Native Food Forest?
- **Hypothesis:** The forest plot with higher levels of P, K, N, and a pH value close to 7.0 with high luminosity levels allows young Spiked Pepper trees to foster greater growth.

Objectives

- Illustrate organizations, farmers, concessions, and locals the benefits of tracking soil nutrients, sunlight, and growth
- Demonstrate the role of sunlight and soil nutrient availability in driving tree growth to encourage forest regeneration

Methodology

- **Location –** Native Food Forest (NFF in Blue) is a plot designed to grow edible fruits and vegetables and Finca Las Piedras (FLP in Green) is a secondary forest that naturally grows plants after a major disturbance
- **Soil** – Nitrogen, Potassium, Phosphorus, and pH tests with Soil Lamotte Test Kit
- **Sunlight** - Luminosity measurement with Lux meter
- **Measuring Tape** – measured estimated average radius of tree canopy, average length and width of leaves, leaf area, and circumference of tree canopy
- **Statistics** – Multiple Linear Regression, Pearson's Chi-squared, Shapiro-Wilk Test, Wilcoxon Rank Sum Test/U-Mann Whitney Test, Spearman Correlation test, Two-way ANOVA,



Results and Discussion

Spearman Correlation Test: Maximum Height – moderately positive correlation
Multiple Linear Regression Analysis: P=0.029<0.05, the growth of leaf area depends on habitat and sunlight
Wilcoxon Rank Sum Test: Statistically different based upon habitats
Two-way ANOVA: Circumference of tree canopy was statistically different by habitat (p=0.004<0.05)
Pearson's Chi-Squared: Number of leaves were not statistically different

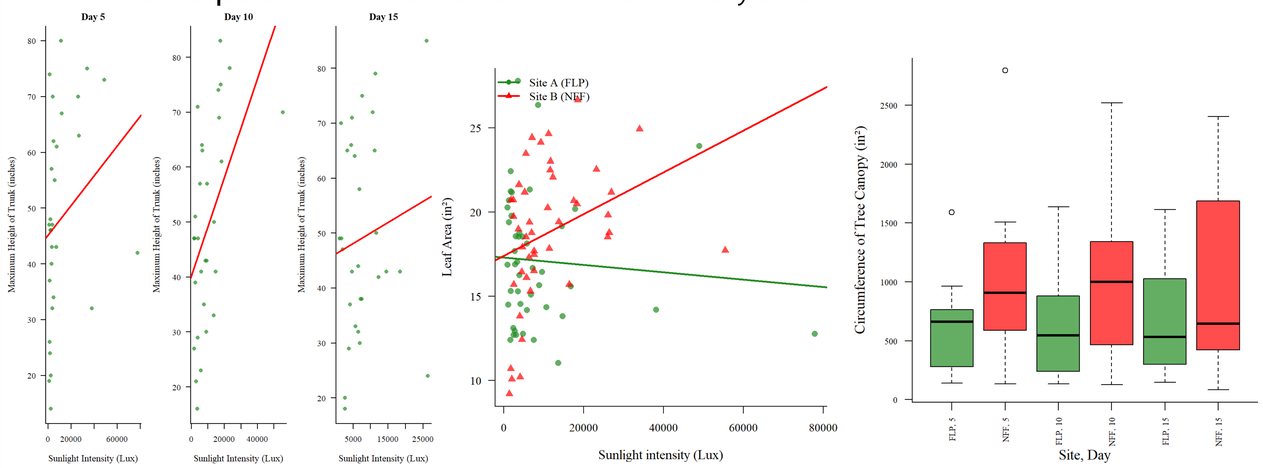


Table 1. Soil Quality in Site A (FLP) and Site B (NFF)

Soil Region	Habitat	Soil Sample Numbers	pH Level	Phosphorus Level	Potassium Level	Nitrogen Level
C	FLP	S3, S4, S5, S6, S7, S8, S9, S10	5.0	Trace	Low	Trace
D	FLP	S1, S2, S11, S12, S13, S14, S15	5.0	Trace	Very Low	Trace
E	NFF	S16, S17, S18, S19, S20, S21, S22	6.0	Low	Medium Low	Low
F	NFF	S23, S24, S25, S26, S27, S28, S29, S30	6.0	Low	Medium Low	Low

Note: The table shows the soil chemistry test differed significantly among different habitats, while some regions in FLP are slightly different.

Conclusion

Effective soil nutrient and sunlight absorption tracking

More sunlight and soil nutrients increases growth

Affordable ways for soil nutrient tests needs further exploration

Increased access to dynamic feedback loop responses in two different plots

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