



# The Comparison of Herbivory Damage on Red and Green Leaves in a Neotropical Rainforest

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## INTRODUCTION

- “Approximately one-third of plant species in tropical rainforests delay the greening of their leaves” until they are fully mature (Dominy et al.).
- This strategy of delaying the greening of leaves is thought to be a protection mechanism for young leaves from invasive herbivores (Kursar and Coley 1992).
- The plant species that delay leaf greening also contain anthocyanin in their leaves, giving them a red color (Dominy et al.).
- We investigated the proportion of damaged green leaves and proportion of damaged red leaves in a neotropical secondary rain forest. We conducted a comparison of the two proportions.



**Figure 1.** A tree with green and red leaves in a neotropical secondary rain forest in Costa Rica.

## METHODS

**Field Methods:** On March 15-16, 2017, we counted the total number of green leaves, red leaves, damaged green leaves, and damaged red leaves for 15 short trees in a neotropical secondary rain forest. Leaves that appeared to be predated on by herbivores or dead were considered damaged. We measured the circumference of the tree at breast height (5 ft). Of the fifteen trees, twelve trees were at least 5 ft tall and three trees were shorter than 5 ft.

**Data Analysis:** We calculated the proportion of damaged green leaves and damaged red leaves. We calculated the diameter of the tree at breast height.



**Figure 2.** This is a map of the TCU Tropical Research Station Property. The yellow circles indicate secondary forest sites where we collected data.

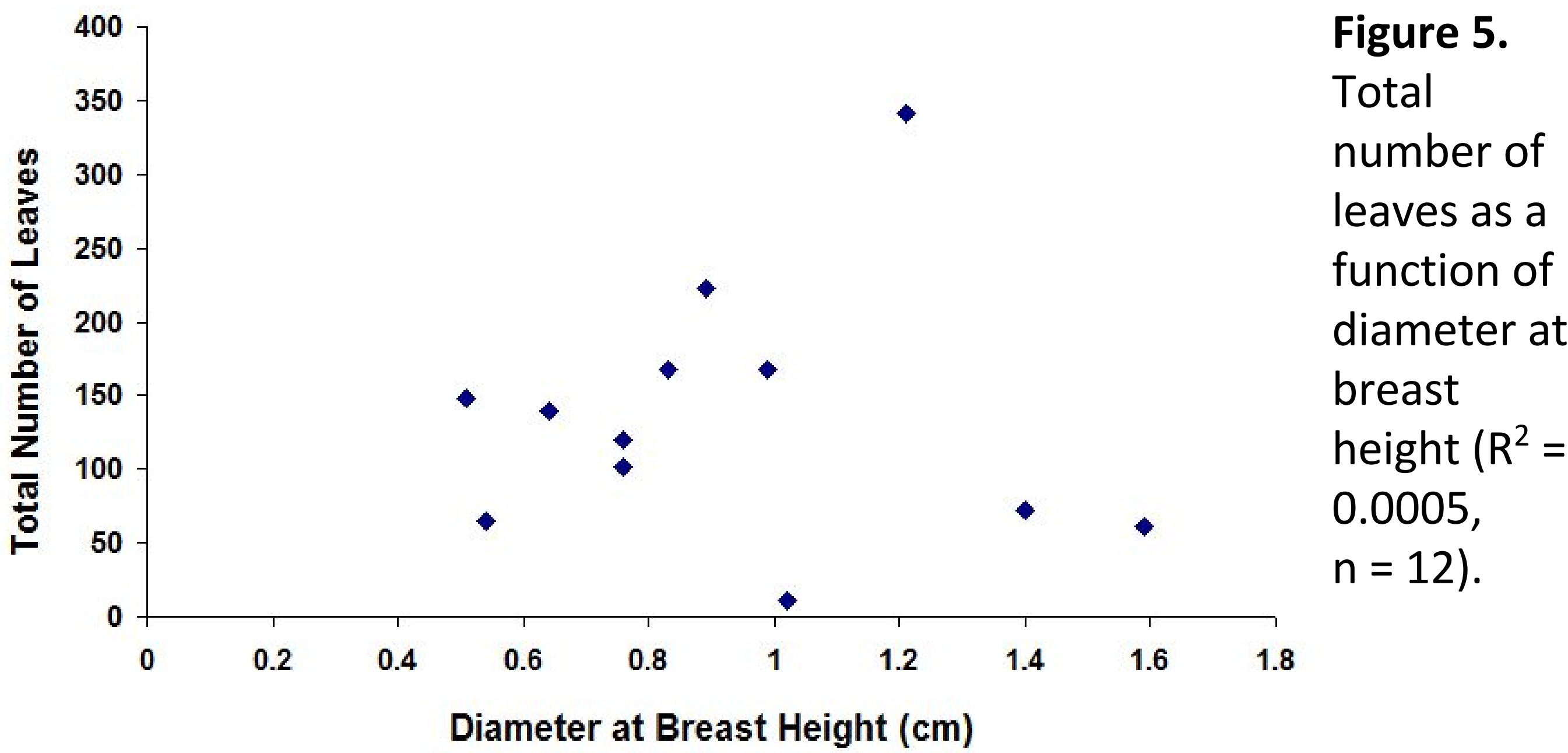


**Figure 4.** We measured the circumference of the tree trunk using a measuring tape.

**Figure 3.** Using counters, we counted the number of leaves (total green leaves, total red leaves, damaged green leaves, damaged red leaves) from our selected trees in the secondary forest sites.



## RESULTS



**Figure 5.** Total number of leaves as a function of diameter at breast height ( $R^2 = 0.0005$ ,  $n = 12$ ).

**Table 1.** Mean, standard deviation, and range of small trees in a neotropical secondary forest.

	Mean ± Standard Deviation	Range
Total No. of Leaves	115.3 ± 86.9	11 - 222.5
Total No. of Green Leaves	91.4 ± 70.2	7 - 274
No. of Damaged Green Leaves	43.1 ± 26.1	6 - 105
Total No. of Red Leaves	23.9 ± 24.2	4 - 59.5
No. of Damaged Red Leaves	4.3 ± 3.8	0 - 12.5

**Figure 6.** Young red leaves from our selected trees in a neotropical secondary rain forest.



**Figure 7.** Two damaged green leaves from our selected trees in a neotropical secondary rain forest. The green leaves appear to be predated on by herbivores.

## RESULTS

- For the twelve trees taller than 5 ft, the mean and standard deviation for diameter at breast height was  $0.86 \pm 0.33$  cm.
- The mean  $\pm$  standard error for the proportion of damaged green leaves and damaged red leaves was  $0.56 \pm 0.05$  and  $0.22 \pm 0.04$ , respectively.
- The mean proportion of damaged green leaves is statistically higher than the mean proportion of damaged red leaves (paired t-test:  $t = 2.14$ ,  $df = 14$ ,  $p = 9.47 \times 10^{-7}$ ).
- The 95% confidence interval for the difference in the mean proportion of damaged green leaves and damaged red leaves falls between 0.25 and 0.43.

## CONCLUSIONS

- The linear regression (Fig. 5) shows no correlation between diameter at breast height (dbh) and total number of leaves most likely due to the small range in dbh of our selected trees.
- Less red leaves were damaged because they have defense and protection mechanisms.
- Young red leaves are full of anthocyanin, which gives the leaves a red color and acts as a signal to herbivores (Coley and Aide 1989).
- Anthocyanin has antifungal activity that can harm ant fungal colonies, reducing fungal herbivory damage (Coley and Aide 1989).
- Red leaves contain low levels of nutrients, including nitrogen (Lee and Gould 2002).
- Anthocyanins aid in protection from UV rays, which secondary forest plant species have high exposure to (Tellez et. al 2016).
- Future studies can determine the levels of anthocyanin and nutrients in red and green leaves in comparison to herbivory damage.

## REFERENCES

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