Canopy cover influences arthropod communities in tank-bromeliads in the Monteverde Cloud Forest, Costa Rica

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INTRODUCTION

- Tank-bromeliads (Bromeliacae) have a rosette leaf structure, which allows them to collect water and detrital material creating habitats for arthropods, amphibians and small vertebrates.
- Canopy cover can impact water volume by affecting movements of rainfall.
- Larger bromeliads can hold larger quantities of water than bromeliads that are smaller in size, allowing for higher arthropod populations and, thus, acting as an indicator for carrying capacity.
- Canopy cover can impact algal growth by affecting the quantity of light that reaches the bromeliad habitats.
- Arthropod community structure is dependent on the primary production within the food web.

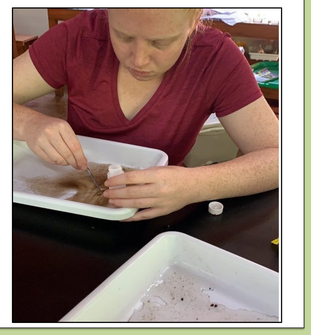
OBJECTIVE & HYPOTHESES

- Our objective was to analyze how differences in canopy cover can influence resources within bromeliads and investigate the relationship between these factors and arthropod community abundance in bromeliads.
- We hypothesized that there would be
  1) higher arthropod abundances in open canopy bromeliads
  2) a positive correlation between bromeliad size and water volume
  3) greater water volume and higher chlorophyll *a* concentrations in open canopy bromeliads
  4) water volume and chlorophyll concentration would both be positively correlated with arthropod abundance

Canopy Cover → Resources → Arthropod Abundances

STUDY SITE & METHODS

- Our study was conducted in the Monteverde Cloud Forest in Costa Rica.
- For each bromeliad, we measured diameter (cm), water volume (mL), and canopy cover (%). All arthropods were collected and identified to the family level.
- We extracted chlorophyll *a* from 5 bromeliads from both open and closed canopy habitats, and we used a spectrophotometer to analyze the chlorophyll *a* concentrations.



RESULTS

Canopy Cover

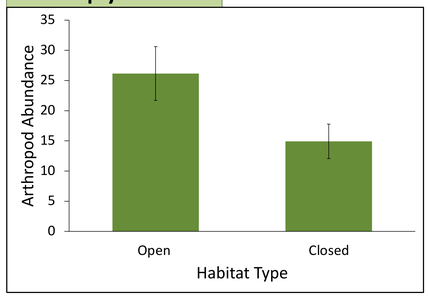


Figure 1. Arthropod abundance between habitat types (P=0.003; error bars ± 1 SE).

- There was significantly higher arthropod abundance in the open canopy habitat compared to the closed canopy (Figure 1).
- There was a positive correlation between bromeliad size and total water volume (Figure 2).
- Total water volume was significantly greater in open canopy compared to the closed canopy habitats (Figure 3).
- As water volume increased, the arthropod abundance also increased (Figure 4).
- Chlorophyll *a* concentrations were significantly higher in open canopy habitats compared to the closed habitats (Figure 5).

Water Volume

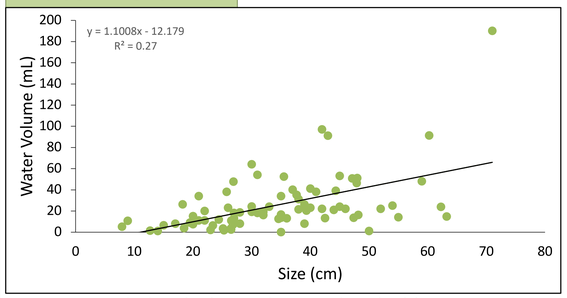


Figure 2. Bromeliad size(cm) vs total water volume(mL) (P<0.001; error bars ±1 SE).

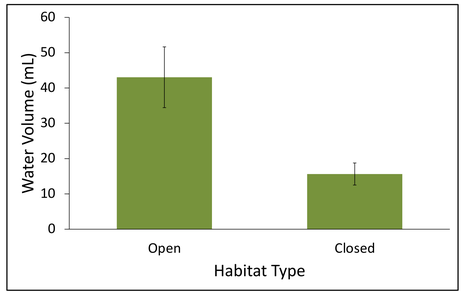


Figure 3. Average total water volume (mL) in bromeliads of open and closed habitats (P=0.039; error bars ±1 SE).

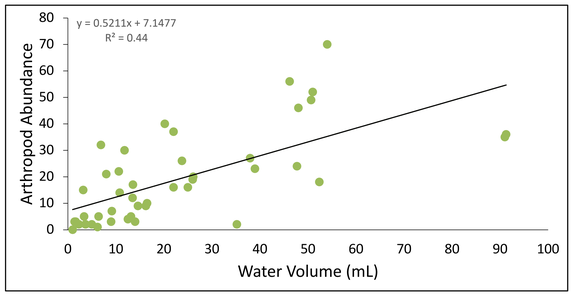


Figure 4. Positive correlation of bromeliad total water volume (mL) and arthropod abundance (P<0.001; error bars ±1 SE).

Chlorophyll *a* Concentration

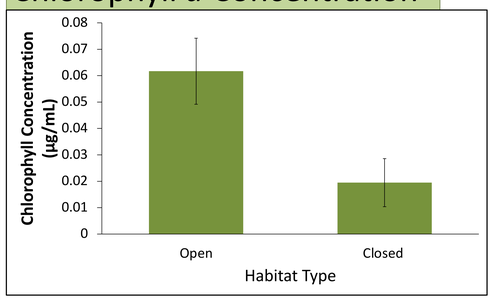


Figure 5. Average chlorophyll *a* concentration (µg/mL) between open and closed habitats (P=0.033; error bars ±1 SE).

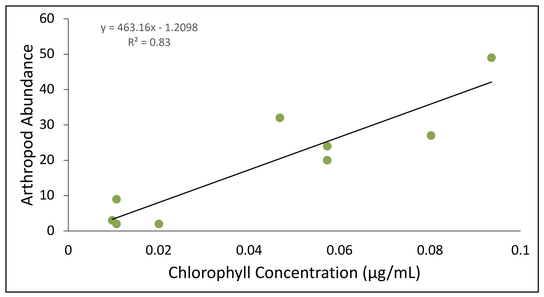
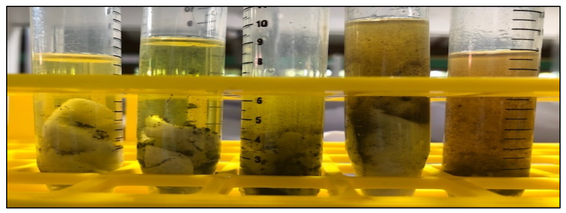


Figure 6. Positive correlation between chlorophyll *a* concentration (µg/mL) and arthropod abundance (P<0.001; error bars ±1 SE).

- Percent canopy cover and light abundance were negatively correlated (P=0.0013).
- Chlorophyll *a* concentration and arthropod abundance have a positive relationship (Figure 6).



CONCLUSIONS & FUTURE DIRECTIONS

- We found that bromeliad size and water volume were positively correlated and influenced arthropod communities. Bromeliads in open habitats contained greater volumes of water, received more sunlight, and had higher algal concentrations and arthropod abundance compared to those in the closed habitat.
- We suggest that future research projects investigate the effects of canopy cover on bromeliad size and further quantify the influence of algal resources on the arthropod communities by gathering a larger range of chlorophyll and light data from bromeliads. Finally, to further investigate the effects of canopy cover on food resources, detrital resources should also be collected from the bromeliads.

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