Macroinvertebrate community composition in tropical streams after a major disturbance event

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Overview

- Climate change is projected to increase the frequency and severity of tropical storms, leading to an increase in disturbance events with less recovery time. (Knutson et al. 2009).
- Extreme flow disturbances can have a noticeable effect on community diversity and determine which species dominate during recovery (Poff et al. 2018).
- In 2016 and 2017 a perennial and intermittent stream were sampled monthly for invertebrates during the wet and dry seasons to quantify high and low flow events on community composition and recolonization patterns among seasons (Hernadez et al. *In revision*).
- In October 2017, tropical storm Nate ripped through the Monteverde region of Costa Rica, causing landslides and debris flows in several watersheds, and providing an opportunity for pre- and post- disturbance comparisons.

Objective and Hypotheses

- To quantify invertebrate community composition in a perennial stream (Alondra) that experienced a debris flow and riparian vegetation loss, and a neighboring intermittent stream (Bruja) that experienced relatively minor disturbance.
- We hypothesized that with a reduced riparian area and an open canopy after the disturbance, there would be a shift in invertebrate community composition to grazers in Alondra. We also hypothesized that Alondra would have a lower density of macroinvertebrates, and that macroinvertebrate density in Bruja would remain more or less the same.

Study Sites and Methods

Study Sites

- Our study took place in two tropical streams in the Monteverde region of Costa Rica within the pre-montane wet forest.
- Alondra, is an perennial stream that experienced a debris flow and loss of canopy cover during Nate.
- Bruja, is an intermittent stream with highly variable water levels during both the dry and wet seasons.
- Monteverde's dry season is from November to April and the wet season spans from May to October.
- The average annual precipitation at our site is ~3m.

Methods

- Macroinvertebrate were collected in October 2018 at 3 sites, both in Bruja and Alondra, using a 250µm Surber net in a 100 m stream reach.
- Invertebrates were identified to the lowest possible taxonomic level (usually genus) and counted and measured to quantify richness, density, and biomass.
- We used a densitometer to take 3 canopy cover measurements in each stream (Figure 1).
- We compared our invertebrate community data to October 2016 before tropical storm Nate

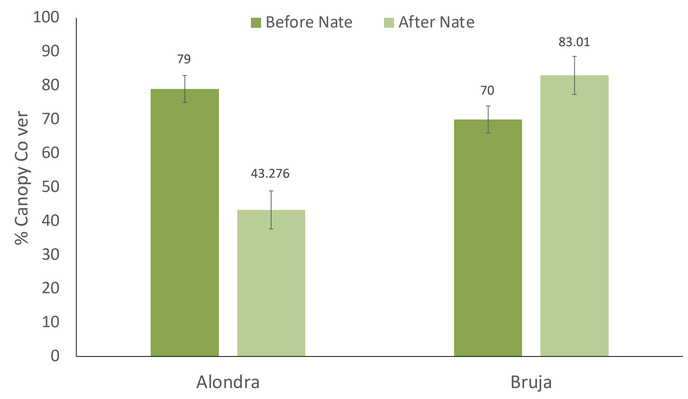

Figure 1: Average canopy cover in both streams before and after Nate. Alondra decreased ~40%, while Bruja showed a slight increase, but remained relatively similar.

Results and Discussion

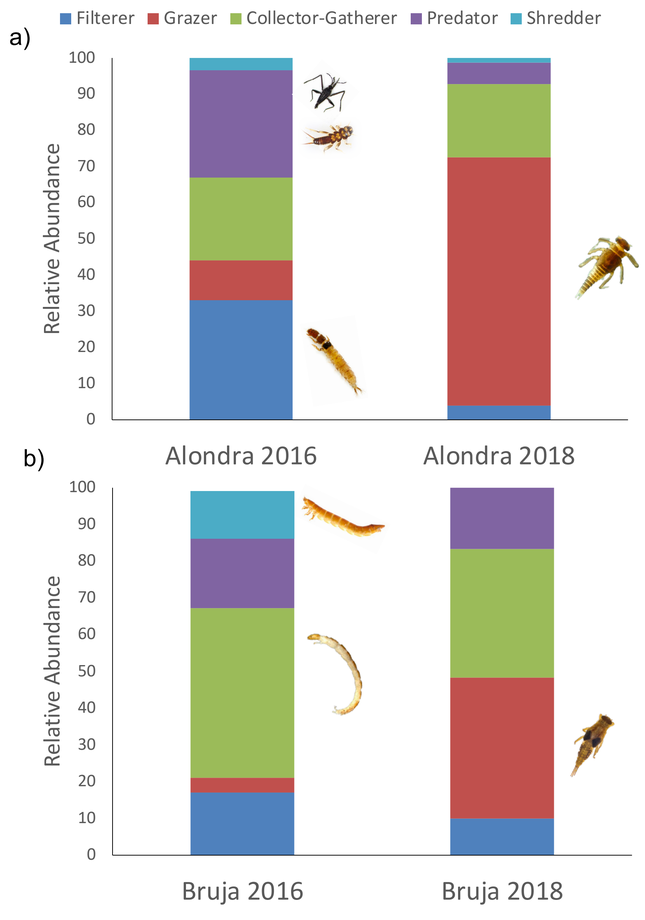

Figure 4: Relative abundance of functional feeding groups in Alondra (a) and Bruja (b) before and after tropical storm Nate.

- Taxa richness decreased ~30% in Alondra and ~50% in Bruja after tropical storm Nate (Figure 2). However, macroinvertebrate density was 5X higher in Alondra after Nate, contrary to our hypothesis. Bruja density remained similar. (Figure 3).
- In both streams, there was a sharp increase in the number of grazers present, and a decrease in the number of filterers and shredders (Figure 4).
- In 2016, *Non-Tanypodinae* (Diptera) was the most abundant family in both streams. In 2018, *Baetodes* (Ephemeroptera) was found to be the most abundant in both streams.
- The increase in grazer abundance from 2016 to 2018 is hypothesized to be due to increased sunlight from canopy loss, while a loss of leaf littler may have caused a decrease shredder and filterer FFGs.
- The Collector-Gatherer *Baetis* (Ephemeroptera) was the second most abundant genus in both streams after the storm.
- Both streams were dominated by disturbance adapted taxa. The perennial stream Alondra, was severely disturbed and was recolonized by *Baetodes* and *Baetis* (Ephemeroptera). Similarly Bruja also saw an increase in these genera, but saw a complete loss of shredders at the time sampling occurred.
- Future monitoring should continue to examine the effects of disturbance and flow on invertebrate community structure, and quantify algal resources and detrital inputs.

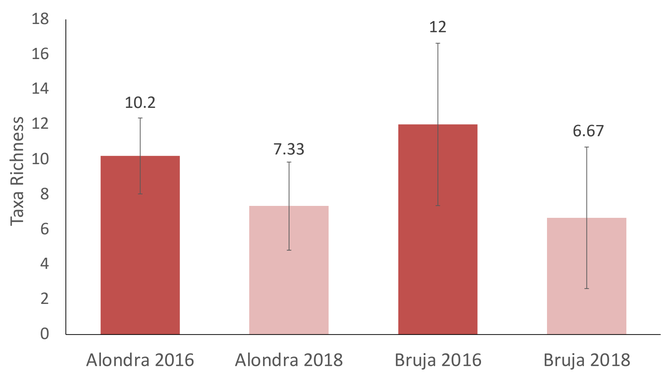

Figure 2: Taxa Richness in Alondra and Bruja before the disturbance (2016) and after (2018) (±1SE)

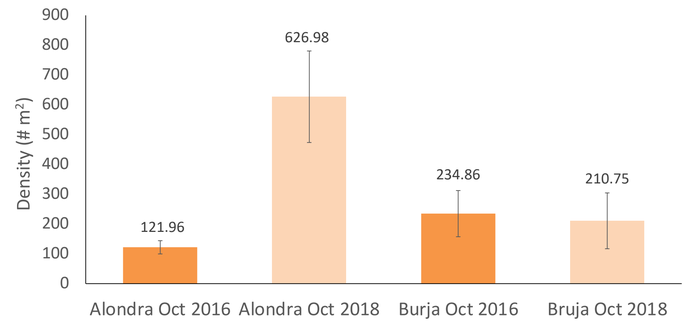

Figure 3: Macroinvertebrate density (# m^2) in Alondra and Bruja before the disturbance (2016) and after (2018) (±1SE)

Acknowledgments and References

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