E. *coli* and Water Quality in the San Luis River and Tributaries in Monteverde, Costa Rica

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Introduction

- Less than 4% of Costa Rica's waste water is treated properly, putting streams at risk of eutrophication and pathogenic contamination like E. *coli*[1]
- E. *coli* is often introduced into streams by agricultural runoff and septic tank leaks, and concentrations are significantly higher in the wet season[3]
- 125 cfu/L is the accepted safety limit for E. *coli* in water for recreational and domestic use. Total suspended solids, BOD5, and ammonium typically have positive correlations with increasing E. *coli* concentrations[3]

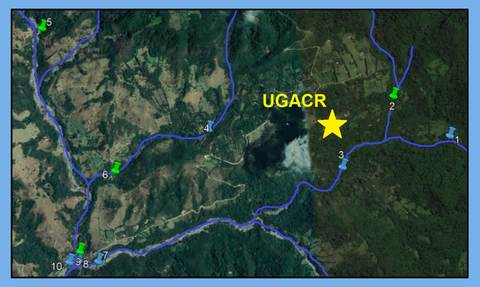
Bellbird Biological Corridor in Costa Rica

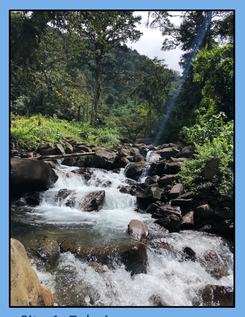
Objectives and Hypothesis

- Quantify how E. *coli* concentrations change from a forested upstream region to downstream where there are increases in human activity and agriculture.
- Examine how E. *coli* concentrations relate to total suspended solids, ammonium concentrations, and BOD5
- We hypothesized that E. *coli* and TSS would increase the further downstream we sampled due to runoff from the communities and agriculture in the area and that E. *coli* and TSS would have a positive correlation.

Study Sites

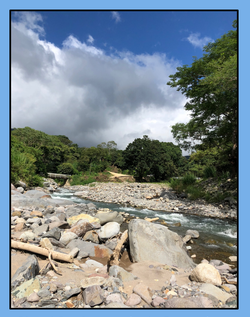
- All sites were located in the northern region of the Bellbird Biological Corridor, near the UGA Costa Rica Campus
- Ten study sites, including five along the San Luis River and five from tributary streams





Site 1: Zelmis

Site 3: Buen Amigo



Site 10: Antes de J. Gonzales

Methods

In the Field

- Used a multiprobe to measure dissolved oxygen, ammonium, and other environmental characteristics.
- Collected two unfiltered water samples from each site

Collecting water at a site.

In the Lab

Quanti-tray

- **E. coli**: Counted E. *coli* colonies after 24 hours in Quanti-tray.
- **Biological oxygen demand (BOD5):** Measured change in dissolved oxygen between day 1 and day 5.
- **Total Suspended solids (TSS):** Filtered stream water through filters, then dried for 24h and re-weighed.

Results

E. *coli*

- E. *coli* concentrations at each site (Figure 1) remained below the 125 cfu/L limit for water used domestically and recreationally, except for Lindora.
- Lindora's E. *coli* content was 290.9 cfu/L, more than twice as high as the limit

Figure 1. E. *coli* concentrations (cfu/L) of each 100 mL sample from each site. Blue represents tributaries to the Rio San Luis and green the main stem of Rio San Luis.

- There is a general positive trend in E. *coli* concentrations (Figure 2) from upstream to downstream in Rio San Luis.

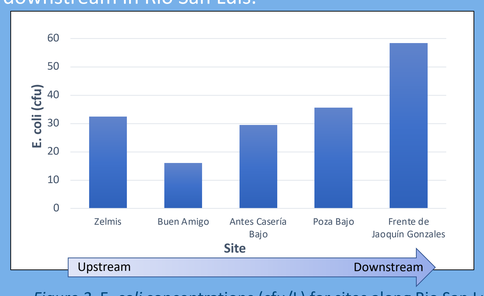


Figure 2. E. *coli* concentrations (cfu/L) for sites along Rio San Luis.

Ammonium and BOD5

- There was no correlation between E. *coli* and Ammonium and E. *coli* and BOD5.
- BOD5 measurements ranged from 0.14 to 8.09 with an average of 4.71

Total Suspended Solids

- There is a significant positive correlation (p = 0.03) between TSS and E. *coli* concentrations (Figure 3, 4) (outlier Lindora was removed from analysis)

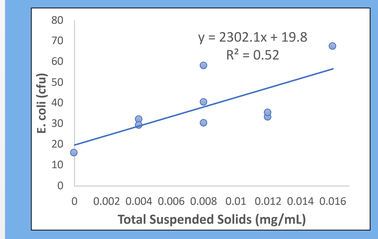


Figure 3. There a positive correlation between TSS and E. *coli* concentrations.

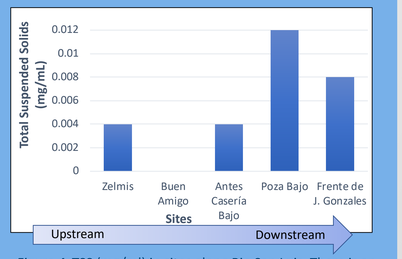


Figure 4. TSS (mg/ml) in sites along Rio San Luis. There is an increase in TSS between Antes Casería Bajo to Poza Bajo.

Discussion

Waste water leaking from the small neighborhood into the river

- No sample except Lindora exceeded 125 cfu/L, indicating the water is safe for recreational and domestic use.
- The general positive trend in TSS and E. *coli* down Rio San Luis is consistent with our hypothesis, indicating exposure to runoff from human activity may be a cause of this trend (Figure 2, 4).
- Between sites 7 and 8, domestic runoff was spotted seeping from the neighborhood into the stream. High algal biomass was only documented here, indicating potential eutrophication [2]
- A large cattle and pig farm is located near Lindora, whose runoff may contribute to the high E. *coli amounts*.

Location of cattle/pig farm relative to Lindora

Conclusion and Future Implications

In conclusion, the quantity of E. *coli* did show an increasing trend from upstream to downstream, supporting our hypothesis. We should further examine Lindora to see how animal agriculture runoff may impact stream health and focus on the importance of forested regions for preventing eutrophication in stream water. For the future, it would be beneficial to compare the wet and dry season, increase sample size and replication, and survey community members for how stream water is used to better understand the public health implications of contaminated water in San Luis.

Acknowledgements

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