Stream Dynamics of an Amazonian Lowland Floodplain Forest

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Introduction:

The Amazon River drains over 40% of South America and comprises the largest watershed in the world. The water quality characteristics of the over 200 tributaries that contribute to the Amazon River are largely determined by the soil and forest ecology of the floodplains they drain[1]. These tributaries all undergo annual flooding and subsequent water-level fluctuations, resulting in inundation of the surrounding forest floodplains for a period of up to 5 months. The characteristics of the flooded soil, then, directly affect attributes of the of the river.

White water tributaries originate in the high-elevation Andes, transporting large amounts of nutrient rich-sediments and dissolved solids, including alkali-earth metals and carbonates. These waters have a near neutral pH and are rich with silt from the varzea forests that they drain [2]. Studies of white water streams in the Peruvian Andes have shown high conductivity and turbidity readings coupled with high macro-invertebrate species diversity [2,3]. However, little data exists on the water ecology of non white water tributaries.

Our study focused, then, on the black water streams that drain the lowland igapo forests of the lowland Amazonian floodplain. These waters are characterized by little suspended matter and electrical conductivity, with estimates of less than 20 microsiemens/cm [2]. This water is unique largely due to its acidic quality, pH 4-5. The low pH is a result of the acidic tannins released from rotting vegetation [2]. The study site was located in the Peruvian Tamshiyacu Preserve along the banks of the black water Tahuayo River. A 2-km by 2-km gridded forest area mapped according to igapo forest sub-ecotypes was selected and water quality was taken from a small stream within the forest grid at three different locations (L-0, G-9, U-4). In addition, macroinvertebrate sampling was done at a single stream location in order to gain a better understanding of stream health and aquatic macro-invertebrate diversity. Lastly, water quality assessment was also done at Cranberry Bog Nature Preserve to look at the possibility of a comparison study between the characteristics of acidic water in temperate environments versus those in tropical environments.

An increased knowledge of watershed dynamics that contribute to the character of black water tributaries is necessary to understand the interrelation between terrestrial and aquatic ecosystems, subsequently aiding in the conservation of these critically diverse environments.

(A) (B) (C) (D)

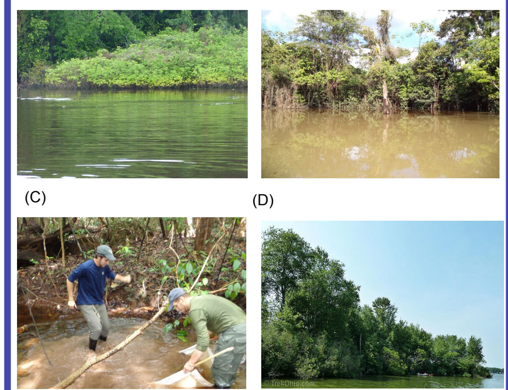

Figure 1 (A) Tahuayo River blackwater and surrounding igapo forest. (B) A whitewater tributary and surrounding varzea forest. (C) Small stream in the igapo floodplain forest which drains into the Tahuayo River (D) Cranberry Bog Nature Preserve in Buckeye Lake, Ohio.

Materials and Methods:

Study Sites:
1. Tahuayo River Amazon floodplain, tributary forest streams, TRARC, Peru
2. Cranberry Bog Nature Preserve, Buckeye Lake, Ohio

Macroinvertebrate Sampling: Sampling was done at a riffle, pool, and run for the small stream site and collected by kick-seine. Sampling was also done along the stream bank and collected in nets. Macroinvertebrates were preserved individually in vials with alcohol gel, photographed, and sorted by order.

Water Quality Testing
Each site was tested for pH, temperature, conductivity, turbidity, and nitrate levels. Humidity damage to equipment limited testing.

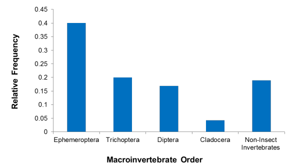

Figure 2. Relative frequencies of macroinvertebrate orders found in the igapo forest stream site G-9.

Results and Discussion:

Table 1.
The temperature and turbidity amongst the different sites within the igapo forest remained relatively constant. The conductivity and phosphorous levels varied significantly from site to site, suggesting a large amount of variability within any particular stream.

Table 2.
Cranberry Bog was warmer across the board, though, not by very many degrees. The large variation between the Amazonian river and the Cranberry Bog was observed in the chemical makeup of the two. The conductivity, turbidity and phosphorous levels of the bog varied largely from those of the igapo forest stream, suggesting that even though the pH at G-9 and inside the bog were close to one another, perhaps the chemical dynamics of the ecosystems are more different than originally thought.

Graph 1.
Ephemeroptera (mayflies) and Tricoptera (caddisflies) were found in abundance, along with a large diversity and abundance of annelids. The very minimal sampling of the G-9 site suggests a relatively high diversity of aquatic macroinvertebrate life that could yield insight into the dynamics of acidic environments.

Test Site	L-0	G-9	U-4
Temperature (°C)	24.3	25.6	24.4
Conductivity (µS)	5	21	10
Turbidity (FAU)	24	18	17
Nitrate (mg/L)	N/A	N/A	0.03
Phosphorous (mg/L)	0.2	1.45	1
pH	N/A	5.60	N/A

Table 1. Water quality readings for three different streams in the igapo forest research site along the banks of the Tahuayo River.

Test Site	Bog	Swamp	Lake
Temperature (°C)	26.2	27.5	31
Conductivity (µS)	75	344	372
Turbidity (FAU)	857	161	42
Nitrate (mg/L)	0	1.37	0.002
Phosphorous (mg/L)	0	0.01	0.26
pH	5	6.46	8.8

Table 2. Water quality readings for Cranberry Bog Nature Preserve at the innermost point of the bog, boundary swamp, and the surrounding lake.

Future Research:

The goal of this project is to establish a basis for a longitudinal study of this research site. In the future, macroinvertebrate sampling and water quality testing will continue to take place in established sampling sites to examine how data changes overtime and in relation to other environmental parameters. In addition, more study sites will be established in different regions of the grid and in the distinct igapo sub-ecotypes palm swamp and bajial. More sampling will also be done along the Tahuayo River and nearby whitewater rivers. In addition, the data will look to relate overall stream ecology with arthropod diversity and forest ecology from companion studies.

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References:

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