

# A Preliminary Study of Stream Chemistry on the Rio Chirripo Pacifico from Chirripo National Park to Canaan, Costa Rica

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## Abstract

## Acknowledgements

I want to give my greatest appreciation to Ian and Genevieve Giddy, owners of the reserve, for enabling such an incredible opportunity to contribute to the Cloudbridge initiative of preserving and reforesting “an important gap in the cloud forest adjoining the Chirripo Pacifico River on the slopes of Mt. Chirripo, the highest mountain in Costa Rica.” Not only is it their wish to allow research for further understanding this fragile ecosystem, they wish to extend that education to the community through local programs to encourage involvement in local conservation efforts. Eric Kang, the forest manager, and my faithful guide, was an intrinsic part of this project, without his help and expertise, none of this could have happened on it’s own. I want to thank Gram and Jacob, the other Cloudbridge volunteers, for their assistance, which they made available at anytime and anyway they could. Your generosity and good company was always appreciated. Left for last, but never to be forgotten, are all of the workers at Cloudbridge, Mauricio, Victor, Marcus... who are all so involved in the reserve that it would not be the same without them.

## Introduction

This preliminary study on the stream chemistry of the Rio Chirripo Pacifico is aimed at improving the understanding of anthropogenic effects on the chemical and biological composition of the water in order to establish and educational “Adopt-a-Stream” program for San Gerardo de Rivas and other communities located along the Rio Chirripo Pacifico. The “Adopt-a-Stream” program would be introduced as “a community-based educational program designed to encourage people to learn about the physical, chemical, and biological and environmental conditions of the watershed in which they live.” The hope is that this program will help “to prevent detrimental industrial, agricultural practices, land clearing and domestic pollution” that threatens healthy waters.

## Background

### Site Description

The Cloudbridge Private Nature Reserve is located just north of San Gerardo de Rivas, Costa Rica, at an altitude of 1500 to 3819 meters. It shares borders with the Chirripo National Park, La Amistad International Park and adjacent reserves of the Talamanca Mountain Range. The Talamanca Mountains were formed from tectonic movements and igneous activity. This geographical area has been designated a

“biological hot spot” as part of the American Biological Corridor. Within Cloudbridge alone you can find various flora and fauna that are characteristic of a low mountainous rain forest of mid-altitude. Vegetation including the “poor man’s umbrella” (*Gunnera talamanca*), various species of bamboo, oaks, cedar, elms, magnolia, figs, aguacatillo, mosses, ferns, heleconias, orchids, and cecropia that make this reserve so biologically diverse and unique to harbor all of the rare fauna including the resplended quetzal (*Pharomachrus mocino*), the mountain robin (*Tudus plebejus*), the collared redstart (*Myioborus torouatus*), the black guan (*Chamaepetes unicolor*), peccaries, tapirs, spider monkeys, squirrels, tayras, a variety of snakes and lizards and a plethora of insects. As a threat to these rare species adjacent unprotected lands have been deforested and developed for cattle pastures and coffee plantations. Running through the reserve and these deforested properties is the Rio Chirripo Pacifico that flows from the Talamanca Mountains and feeds into the Pacific Ocean.

## Results

## Discussion

Coliform, dissolved oxygen, biochemical oxygen demand, nitrate, pH, phosphate, temperature, and turbidity.

## Conclusion

## Works Cited

## Appendix

Site	Location (°N)	Location (°W)	Altitude (ft)	GPS Accuracy (ft)	Downward Slope	Bank Slope	Land Use
1	9°28.476	83°34.048	5573	35	0°	45°	Primary forest
2	9°28.526	83°34.174	5571	26	25°	35°	Disturbed forest
3	9°28.357	83°34.707	5042	31	10°	45°	Developed
4	9°28.059	83°35.495	4594	29	5°	15°	Developed
5	9°27.885	83°35.962	4372	51	5°	35°	Developed
6	9°27.587	83°36.232			0°	25°	Developed
7	9°26.769	83°36.952			10°	30°	Developed
8	9°26.851	83°36.952	3679	23	5°	5°	Developed
9	9°26.271	83°37.498	3421	29	3°	15°	Developed

Table 1.1 Site descriptions and locations (given by GPS reading), Costa Rica 2004.

Sample	Date	Time	Temperature (°C)	pH	Phosphates (ppm)	Nitrates (ppm)	D.O. (% saturation)	B.O.D.	Coliforms	Turbidity (JTU)
1A	7/7/04	8:23 am	12	8.5	0.0	0.0	37.0	0	Positive	0
2A	7/7/04	9:55 am	12	8.0	0.5	0.0	No data	No data	No data	0
3A	7/9/04	1:33 pm	16	8.2	0.5	0.0	No data	No data	No data	0
4A	7/8/04	12:30	16	8.2	1.0	0.0	No data	No data	No data	0

		pm								
5A	7/8/04	10:27 am	16	9.0	1.0	0.0	No data	No data	No data	0
6A	7/8/04	8:54 am	17	9.0	1.0	0.0	41.5	0	Positive	40
7A	7/8/04	9:33 am	18	8.0	1.5	0.0	No data	No data	No data	40
8A	7/9/04	8:27 am	18	8.5	1.5	0.0	42.0	0	No data	40
9A	7/9/04	9:25 am	19	9.5	2.0	0.0	No data	No data	No data	40

Table 1.2 Trial 1 data for each site including date and time when the sample was taken. “No data” indicates that the site was not tested for this parameter at the specified time and date the sample was taken, Costa Rica, 2004.

Sample	Date	Time	Temperature (°C)	pH	Phosphates (ppm)	Nitrates (ppm)	D.O.(% saturation)	B.O.D.	Coli-forms	Turbidity (JTU)
1B	7/16/04	10:42 am	12	8.5	0.0	0.0	No data	No data	Positive	0
2B	7/16/04	11:05 am	12	8.0	0.5	0.0	37.0	0	No Data	0
3B	7/16/04	7:35 am	16	8.2	0.5	0.0	41.0	0	No Data	0
4B	7/20/04	9:45 am	16	8.2	1.0	0.0	41.0	0	No Data	0
5B	7/20/04	10:50 am	16	8.5	1.0	0.0	41.0	0	No Data	0
6B	7/21/04	12:20 pm	18	8.5	1.5	0.0	42.0	0	No Data	0
7B	7/21/04	12:05 pm	18	8.2	1.5	0.0	42.0	0	No Data	0
8B	7/21/04	11:45 am	19	8.3	2.0	0.0	No Data	No Data	No Data	0
9B	7/21/04	11:26 am	20	8.5	2.5	0.0	44.0	0		0

Table 1.3 Trial 2 data for each site including date and time when the sample was taken. “No data” indicates that the site was not tested for this parameter at the specified time and date the sample was taken, Costa Rica, 2004.

Sample	Date	Temperature (°C)	pH	Phosphates (ppm)	Nitrates (ppm)	D.O. (% saturation)	B.O.D.	Coliforms	Description
C1	7/16/04	21	9.0	0.0	0.0			Positive	Rainwater
C2	7/16/04	22	9.0	0.5	0.0	92.0	0	Negative	Boiled tap water

Table 1.4 Rainwater and boiled water controls for each parameter. Rainwater was collected in a sterile container from the Cloudbridge Weather Station. Boiled water was boiled for fifteen minutes and cooled in a sterile container before testing, Costa Rica 2004.

Date	High (C)	Low (C)	Rainfall (mm)	Date	High (C)	Low (C)	Rainfall (mm)
7/1/04	23.7	14.0	0	7/16/04	28.9	13.0	0
7/2/04	34.1	13.0	4	7/17/04	27.1	13.0	0
7/3/04	34.1	11.0	0	7/18/04	25.9	14.0	8
7/4/04	30.5	11.0	12	7/19/04			
7/5/04	29.9	13.0	48	7/20/04			
7/6/04	27.0	13.0	10	7/21/04			
7/7/04	32.9	14.0	43	7/22/04			
7/8/04	21.1	12.0	3	7/23/04			
7/9/04	31.5	13.0	0	7/24/04			
7/10/04	21.1	13.0	0	7/25/04			
7/11/04	21.9	14.0	10	7/26/04			
7/12/04	21.9	13.0	28	7/27/04			
7/13/04	29.1	13.0	46	7/28/04			
7/14/04	28.6	13.0	5	7/29/04			
7/15/04	24.4	13.0	5	7/30/04			

Table 1.5 Weather data was recorded daily from the Cloudbridge Weather Station using the AcuRite © temperature gauge and the Taylor graduated rain gauge to measure daily rainfall, Costa Rica 2004.

Test Factor	Result	Rank
Dissolved oxygen	91-110% Sat	4(excellent)
	71-90% Sat	3(good)
	51-70% Sat	2(fair)
	<50% Sat	1(poor)
BOD	0 ppm	4(excellent)
	4 ppm	3(good)
	8 ppm	2(fair)
Coliform bacteria	negative	3(good)
	positive	1(poor)
pH	4	1(poor)
	5	1(poor)
	6	3(good)
	7	4(excellent)
	8	3(good)
	9	1(poor)
	10	1(poor)
Temperature change	0-2 °C	4(excellent)
	0-5 °C	3(good)
	6-10 °C	2(fair)
	>10 °C	1(poor)
Nitrate	5 ppm	2(fair)
	20 ppm	1(poor)
	40 ppm	1(poor)

Phosphate	1 ppm	4(excellent)
	2 ppm	3(good)
	4 ppm	2(fair)
Turbidity	0 JTU	4(excellent)
	>0 to 40 JTU	3(good)
	>40 to 100 JTU	2(fair)
	>100 JTU	1(poor)

Table 1.6 “Ranking Test Results” from the LaMotte “Low Cost Water Monitoring Kit” handbook, Costa Rica 2004.