Costa Rica River Biodiversity

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Theme/Objectives

- What is the current health of the Abangares River in Costa Rica/ how do different part of the river compare? (water chemistry and macroinvertebrate analysis)
- Important because it shows the biological health of the water in Las Juntas
- Relate to community sustainability because it allows us to test water quality in a sustainable way to preserve the biological health of the community.
- Objective: determine whether the water quality of the Abangares River is healthy or not
- Test whether there is a correlation between water quality perception and willingness to help in advocacy and sustainability initiatives

Urban & Rural Macroinvertebrates

- Type of water going through the site was recorded (riffle, run, pool; fast-, medium-, slow-flowing)

- Weather during trip was recorded because the amount of rain could impact the results

- Map was created so that future students could continue this project

https://maps.app.goo.gl/85SWhWZnXjCttoS36

Macroinvertebrate Biodiversity Results

	Dog Rock	High School Bridge	Boston/ Gongola	Ecomuseo	Aguas Claras
Ephemeroptera *(mayfly)*	19	21	15	23	8
Plecoptera *(stonefly)*			5	2	1
Trichoptera *(caddisfly)*	2	23	2	30	1
Lepidoptera *(moth & butterfly)*		4			2
Fish	3				
Mollusk / *Snail*	2				
Odonata / *Damselfly*	1				
Coleoptera *(water beetle)*	2				1
Watersnipe larvae	1				
Glycera *(bloodworm)*	10				1
Megaloptera / *Dobsonfly*			1		
Chironomidae	5		5		3
Tadpole				1	
Odonata / *Dragonfly*					2

- Relatively high EPT index in most sites, indicates healthy water

- Very little species that indicate poor water health

- Without a microscope, it was hard to find smaller organisms

- Aguas Claras, though where water used to be collected, had the lowest # of macroinvertebrates

Biodiversity results compared to 2008 & 2013

2008

Appendix 1. Number of Insect Orders found at Several River Sites of Abangares River							
	Highschool Bridge	Aguas Calientes	Gloria	Ecomuseo	2nd Crossing	Aguas Claras	Boston
Megaloptera	3	0	1	3	1	0	2
Ephemeroptera	23	0	0	0	0	4	1
Plecoptera	12	0	9	0	0	3	0

Brown 12

Trichoptera	4	0	2	3	0	0	0
Coleoptera	2	0	2	4	2	4	3
Tipulidae	6	0	0	3	6	3	6
Odonata	24	0	2	8	6	8	1
Fish	0	6	0	0	4	0	0
Total Invertebrates (not including fish)	72	0	16	20	15	22	13

2013

Order/Family	2nd Crossing	Mix (Boston & Aguas Claras)	Boston	Aguas Claras	Rickety Bridge	Dog Rock River	Ecomuseo	Highschool Bridge	Aguas Callientes
Epemeroptera/Heptageniidae	1				7			12	
Plecoptera/ Perlidae	1								
Trichoptera/ Hydrobiosidae	5	2	6		7	7	4	7	1
Odonata/ Protoneuridae	7	2	6	3	10	10	8	6	5
Odonata/ Libellulidae					5	2	1	2	
Megaloptera/ Corydalidae		1		1		4	1		
Crustaceans/ Crustacea				1			1		2
Diptera/ Tipulidae				3					1
Hempitera	1	2			1				
Coleoptera/ Hydrophilidae	1		1	11	1	3			
Mollusk					43			1	

2025

	Dog Rock	High School Bridge	Boston/ Gongola	Ecomuseo	Aguas Claras
Ephemeroptera (mayfly)	19	21	15	23	8
Plecoptera (stonefly)			5	2	1
Trichoptera (caddisfly)	2	23	2	30	1
Lepidoptera (moth & butterfly)		4			2
Fish	3				
Mollusk / Snail	2				
Odonata / Damselfly	1				
Coleoptera (water beetle)	2				1
Watersnipe larvae	1				
Glycera (bloodworm)	10				1
Megaloptera / Dobsonfly		1			
Chironomidae	5		5		3
Tadpole				1	
Odonata / Dragonfly				2	

- Results vary since the last research project was 12 years ago
- Amount of macroinvertebrates per sample is roughly the same, but more EPT are found today
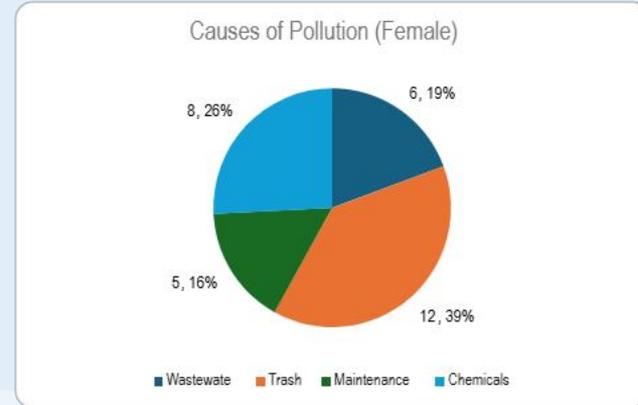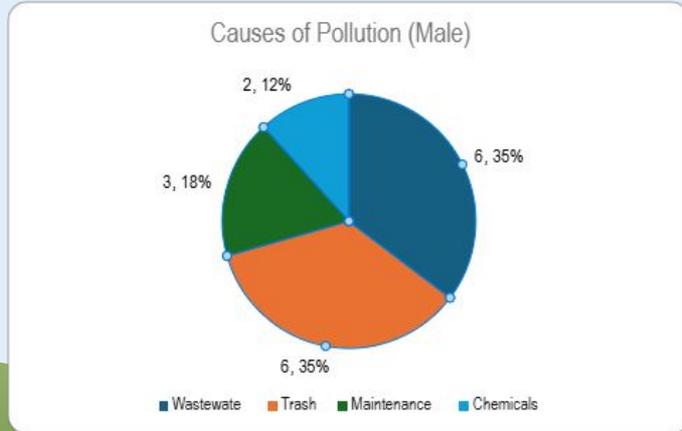- Water seems to be in good health

Major Takeaways

- The watershed is not polluted even with the visible trash around some of the sites

    - The heavy rain might contribute to the high biodiversity within both the urban and rural sites

    - There doesn't seem to be a statistical difference between the health of the urban and rural streams

-We found from interviews that one of the most important ways to improve water health was to educate and promote the importance of biological health in Las Juntas

Major Takeaways from Survey

- Causes of Poor Water Quality by Gender

- Largest causes of poor water quality overall was trash for both genders.

- Men also felt that a lack of maintenance was another equally important issue.

Causes of Pollution (Male)

- Wastewate
- Trash
- Maintenance
- Chemicals

2, 12%
6, 35%
3, 18%
6, 35%

Causes of Pollution (Female)

- Wastewate
- Trash
- Maintenance
- Chemicals

8, 26%
6, 19%
5, 16%
12, 39%

Major Takeaways from Survey

PERCEPTION VS Willingness to Help With Water Quality Improvement Programs

As perception of water quality decreases, willingness to help increases

56% of people's willingness to help is explained by their perception of water quality (more than half)

There is a moderately strong correlation between perception and conservation willingness

Water Chemistry Results

	Dog Rock	High School Bridge	Aguas Claras	Gongola /Boston	Ecomuseo
Dissolved Oxygen	8 ppm	8 ppm	6 ppm	6 ppm	4 ppm
Nitrate	5 ppm	5 ppm	5 ppm	5 ppm	5 ppm
pH	8	7	8	7.5	7
Phosphate	4 ppm	2 ppm	4 ppm	3 ppm	3 ppm
Turbidity	0 JTU	0 JTU	0 JTU	40 JTU	0 JTU
Temp	30°C	30°C	26°C	27°C	28°C

-Most sites contain a healthy amount of dissolved oxygen, Dog Rock and High School Bridge being the best, Ecomuseo being a bit low.
-Nitrate level and pH healthy throughout
-Most phosphate levels healthy, Dog Rock and Aguas Claras being a bit high perhaps because these two sites were the closest to homes

Water Chemistry Compared to 2013

Table 1: Dissolved Oxygen Concentration for All Tested Sites

Site Number	Dissolved Oxygen Concentration
1	8 ppm
2	8 ppm
3	7 ppm
4	6 ppm
5	7 ppm
6	6 ppm
7	7 ppm
8	7 ppm
9	7 ppm
10	7 ppm
11	8 ppm

Table 4: pH for All Tested Sites

Site Number	pH
1	8.5
2	8.5
3	7.0
4	8.0
5	9.0
6	9.0
7	9.0
8	9.0
9	9.0
10	9.0
11	9.0

-Dissolved oxygen was a bit higher in all of the sites compared to our data, which could be due to higher temperatures?

-pH was also a bit higher in all the sites as well compared to our data which may be because there was possibly more fertilizer runoff?

-Differing results could also be due to the fact that tests were done with different test kits

Riparian Buffer Connection?

-<u>Dog Rock:</u> steep rocky hill, very large rocks, several large trees (before rocks), mud/algae, some trash around base

-<u>High School Bridge:</u> Steep forested hill leading, woody with fewer rocks, tall trees with lots of foliage, visible trash around buffer

-<u>Aguas Claras:</u> very rocky, forested area, various size rocks with lots of foliage/mushrooms, tall old growth trees, algae, and ferns

-<u>Gongola/Boston:</u> (rocky water by sample) very large rocks/old growth, trees/algae, muddy long pipe

-<u>Ecomuseo:</u> lots of rocks of different sizes, a bit smaller than other sites, smaller riparian buffer compared to other sites, shallow

**not any significant connections
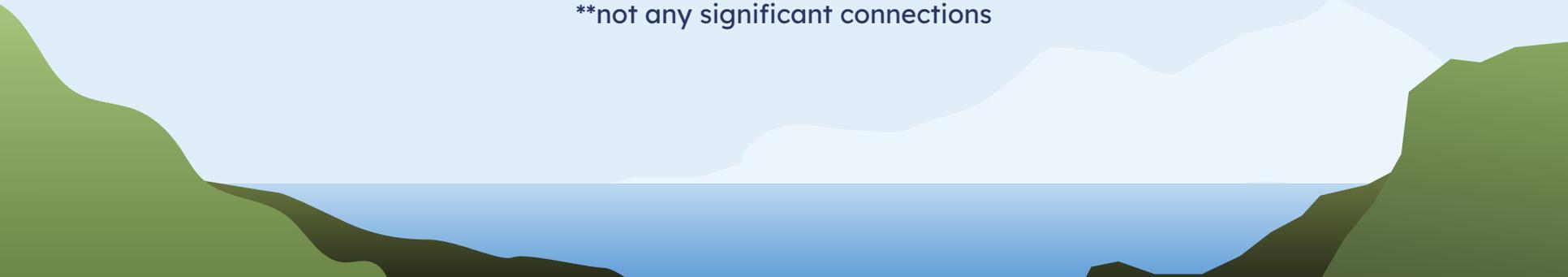
Surprises or unexpected findings

-Water Chemistry is all very healthy
-Benthic macroinvertebrate analysis also indicated that all of the sites were relatively healthy
-Interviews as well as the trip to the water treatment plant shared that there is a very sophisticated process in the treatment of their water and it is very well regulates
-Found that there are many connections with researchers and schools like the University of Costa Rica who do monitoring of the water quality on the Abangares River every year

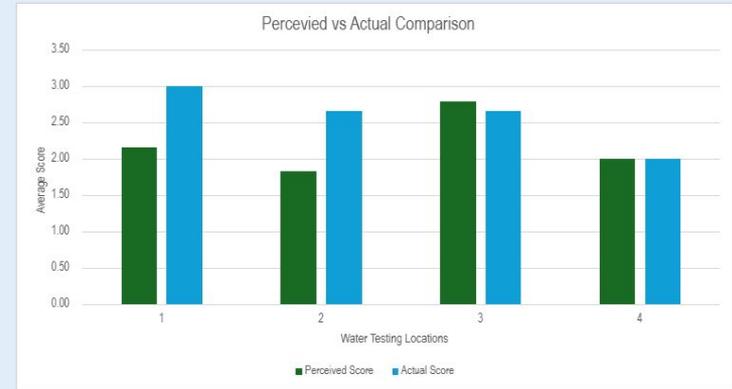# Surprises or unexpected findings from survey

Changes in Water Quality in Recent Years Perception VS Actual Water Quality Variation
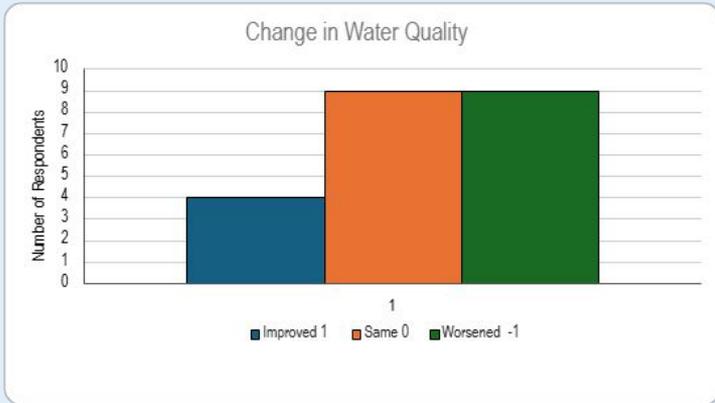
41% said water quality had worsened or stayed the same

QUALITY HAS IMPROVED BUT PERCEPTION HASN'T

Surprising because the water quality is higher than what most perceive it to be at most locations.

Perception was lower than or equal to the actual quality of the water at most site locations

Assets and Challenges

-It was difficult to count every single macroinvertebrate that we found, and because we did not have access to a microscope, so it is likely that we missed some of the smaller organisms in our counts
- We may have had some bias going into the project, thinking the water was not going to be as healthy as it was
-May not have had enough samples or sites for significant data

Assets and Challenges from Survey

According to my interview with Jose who runs the water operations in Las Juntas

What's Working Well (Asset)
• Challenging filters (holding ponds) are being used to clean water.
• They filter water and hold it long enough for sediment to settle, so the water is clean when used.
• There is an existing water treatment system helping to protect water quality.

River Use

23%
14%
9%
55%

■ Often ■ Sometimes ■ Rarely ■ Never
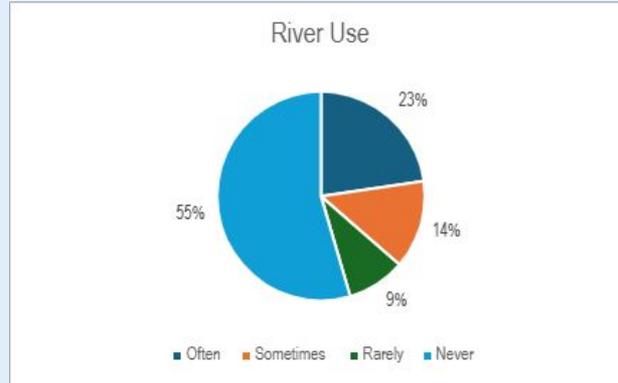
Barriers to Sustainability:
• 55% of survey respondents never use the river, which may mean low public involvement in river improvement efforts or lack of care/concern.

• Lack of participation makes it harder to mobilize the community to help change or protect the river.

• People may be misinformed or not receiving accurate information about the water quality.

• This misinformation leads to negative perceptions of the river, even when the water may not actually be bad.

What's Next?

- Students in future years could continue our project since it is a long-term project

- If we were to come back for 6 months, we would sample the same site multiple times and have a more organized sampling schedule

- See how the same sites may differ in results during different times of the year (wet vs dry)

What's Next from Survey

Project Focus:
• Community-driven river restoration

Main Actions:
• Launch a community clean-up and waste reduction campaign
• Address the issue that **82%** of surveyed people identified trash as the most common source of pollution

Monthly Activities:
• Organize monthly clean-up events
• Involve local schools
• Partner with businesses and community leaders

Education and Outreach:
• Promote Reduce–Reuse–Recycle education
• Implement environmental education programs in schools across Las Juntas
Notify residence of water quality and show improvement trends to help perception match actual quality

Overall Goals:
• Encourage the community to take care of the river
• Help build lifelong environmental habits
• Build perceptions of ownership in the restoration efforts and pride in the actual quality of the water

Overall Causes of Pollution

45%   55%

36%

82%

■ Wastewater%   ■ Trash%   ■ Maintenance%   ■ Toxins%