Assessment of the Lycoming Creek Watershed

by Brandon Ford

Overview

- Previous studies
  - Erosion Potential
  - Sediment Load
- My work
  - Water Chemistry
  - Macroinvertebrate study

Erosion Evaluation

- During the summer 2002, Lycoming college interns (Theresa Black and Amy Curry) walked or floated the entire stretch of Lycoming Creek between

  Roaring Branch (N 41° 34,294, W 76° 57.891)

  And lower Heshbon Road (N 41° 16.127, W 77° 03.036).

- Total of 28 miles

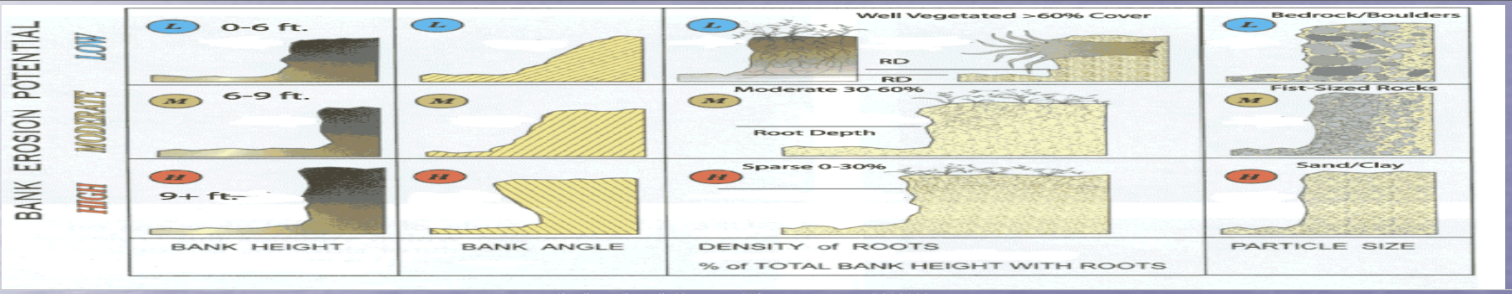
Erosion Evaluation Form

Stream Name: _____ Stream Reach: _____

Watershed: _____ County: _____

Assessors: _____ Date Assessed: _____

Form adapted by jlw , tccd, 2001



Adapted from Rosgen, 1996

		Bank Height			Bank Angle			Density of Roots			Particle Size		
Site #:	RB	L	M	H	L	M	H	L	M	H	L	M	H
Site Type:	LB	L	M	H	L	M	H	L	M	H	L	M	H

Width of Stream (Feet) 10-25 ____ 26-50 ____ 51-100 ____ 101-150 ____ 150+ ____

Length of Site (Feet) 0-50 ____ 50-100 ____ 101-250 ____ 251-500 ____ 501-1000 ____ 1000+ ____

RB Dist. Erosion to Structure (Feet) 0-25 ____ 26-50 ____ 51-100 ____ 100+ ____

RB Structure Type - House ____ Garage ____ Bridge ____ Culvert ____ Road ____ Other ____

LB Dist. Erosion to Structure (Feet) 0-25 ____ 26-50 ____ 51-100 ____ 100+ ____

LB Structure Type - House ____ Garage ____ Bridge ____ Culvert ____ Road ____ Other ____

	Right Bank	Left Bank
Side		
Length Bank		
Height Bank		
Adjacent Land Use		
Pasture/Fenced/ Machine Accessible		
Soil Texture		
Stream Alignment		
Vegetation		
Stream Gradient		
Slope		
Slope Depo Bar		
Position of Erosion Feature	Lat:	Lon:

Picture #'s Taken:

Comments:

		Bank Height			Bank Angle			Density of Roots			Particle Size		
Site #:	RB	L	M	H	L	M	H	L	M	H	L	M	H
Site Type:	LB	L	M	H	L	M	H	L	M	H	L	M	H

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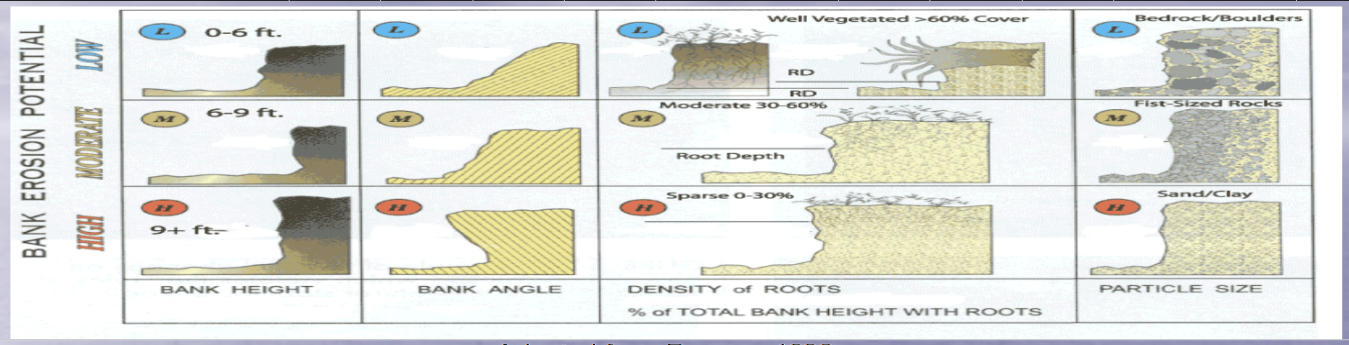

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Side	Right Bank	Left Bank
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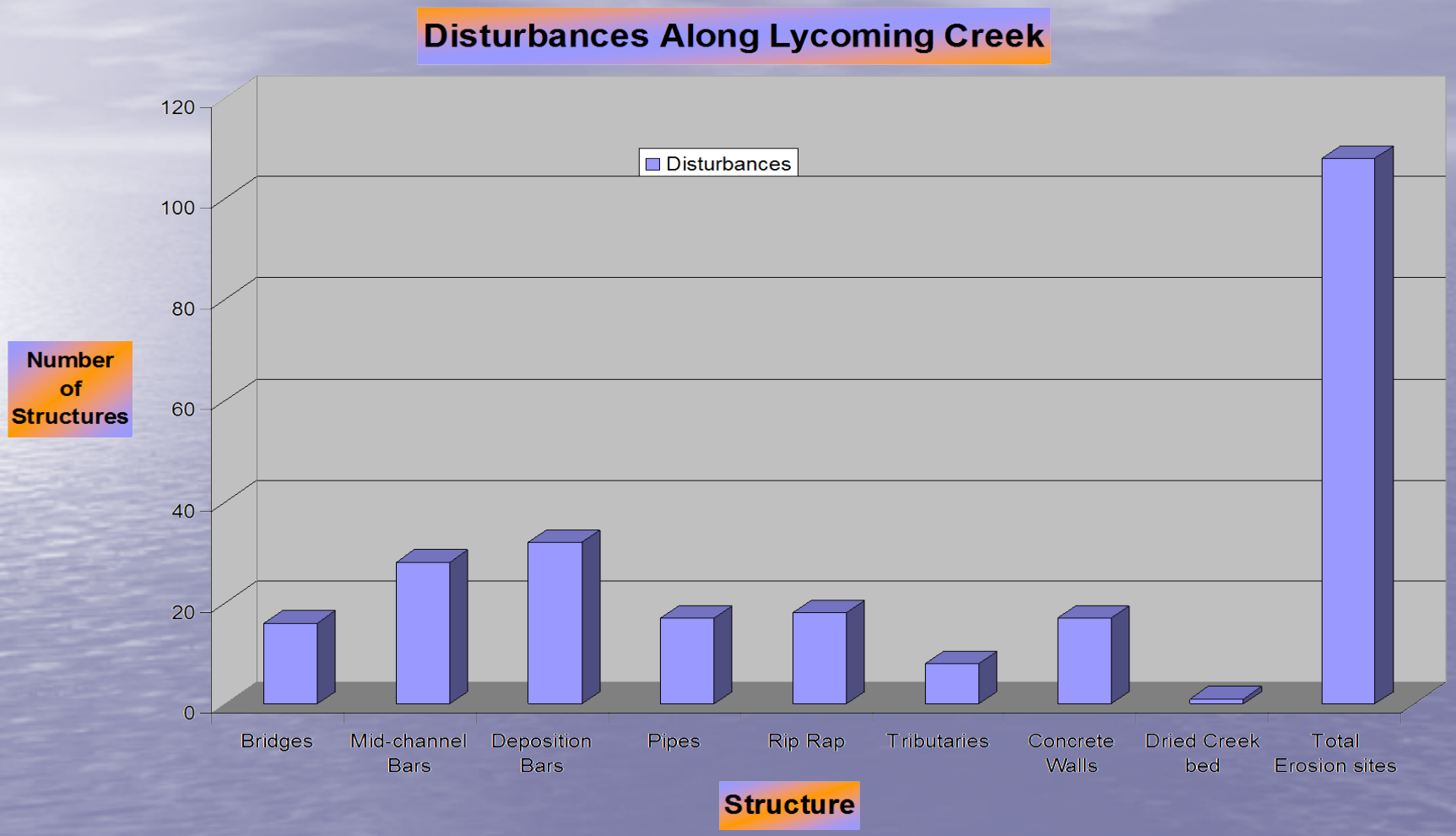
What they found

Structure	Amount	Percentage out of 245
Bridges	16	6.53%
Mid-channel Bars	28	11.42%
Deposition Bars	32	13.06%
Pipes	17	6.94%
Rip Rap	18	7.35%
Tributaries	8	3.27%
Concrete Walls	17	6.94%
Dried Creek bed	1	0.41%
Total Erosion sites	108	44.08%
Right banks	58	23.67%
Left banks	50	46.30%

** Study area between Roaring Branch and Lower Heshbon Road*

***Completed by Lycoming College Clean Water Institute Interns*


Disturbances Along Lycoming Creek
Disturbances
Number of Structures
120
100
80
60
40
20
0
Bridges
Mid-channel Bars
Deposition Bars
Pipes
Rip Rap
Tributaries
Concrete Walls
Dried Creek bed
Total Erosion sites
Structure

LYCOMING CREEK WATERSHED GEOMORPHIC ASSESSMENT

- Rob Parker of Endless Mountains RC & D
- Walked all tributaries of Lycoming Creek with the help of Lycoming College Interns
- Surveyed all possible sites off erosion and took GPS location

PURPOSE

- Physically inspect the tributaries and main stem
- Determine **sources** of instability
  - i.e. watershed wide
- Development and prioritization of appropriate remediation strategies for each of the identified sites/reaches

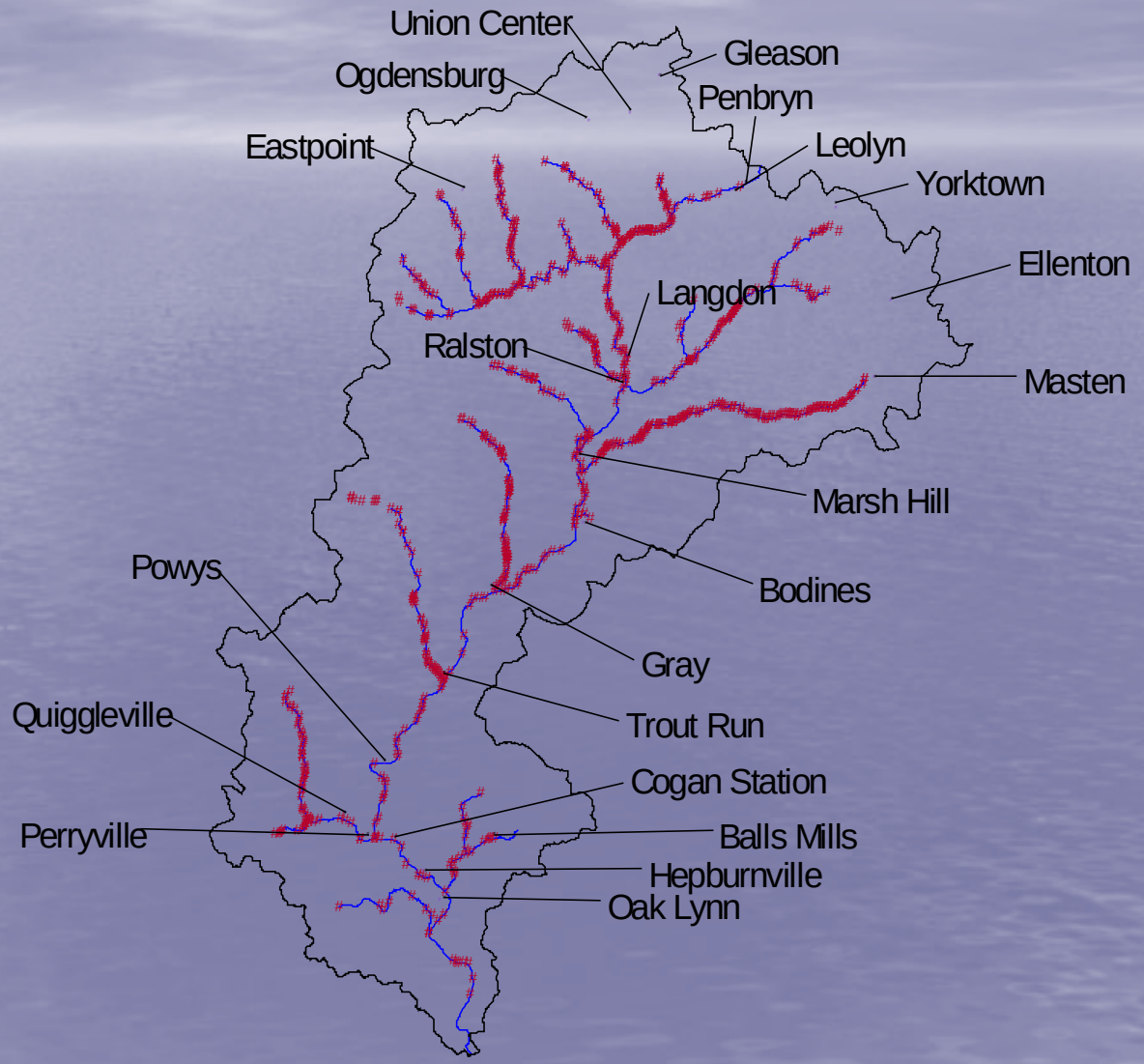
Equipment

- All waypoints were recorded using a 3D Differential GPS unit (accuracy typically @6 ft.)

Way Points

Including

- Bridges
- Debris jams
- Sites of existing bank protection
- Erosion sites

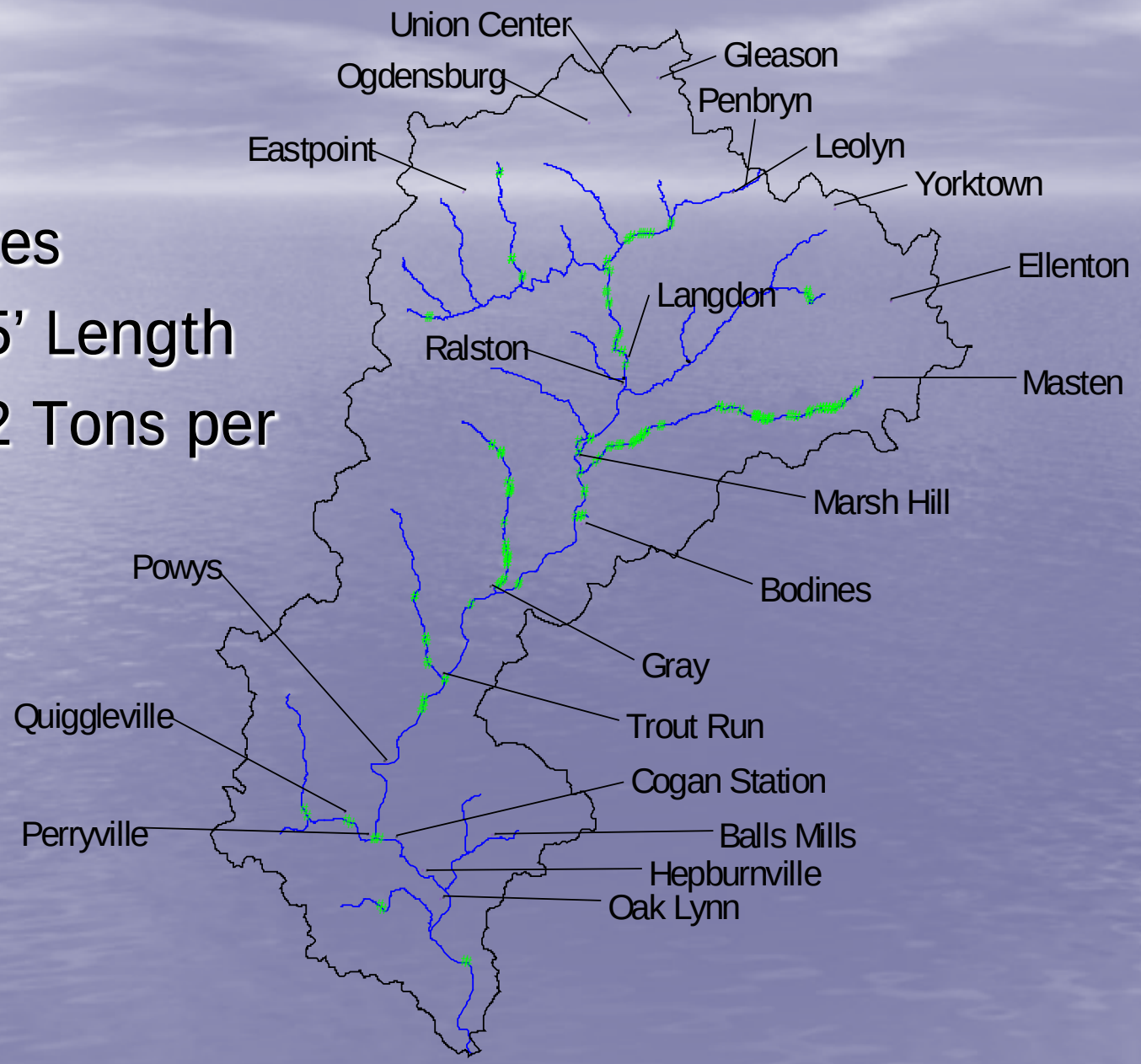


Sediment Loads

- Determined by inserting erosion site lengths and stream discharge into a computer program (BEHI) that models sediment loads lost from erosion (tons/year)

EROSION SITES

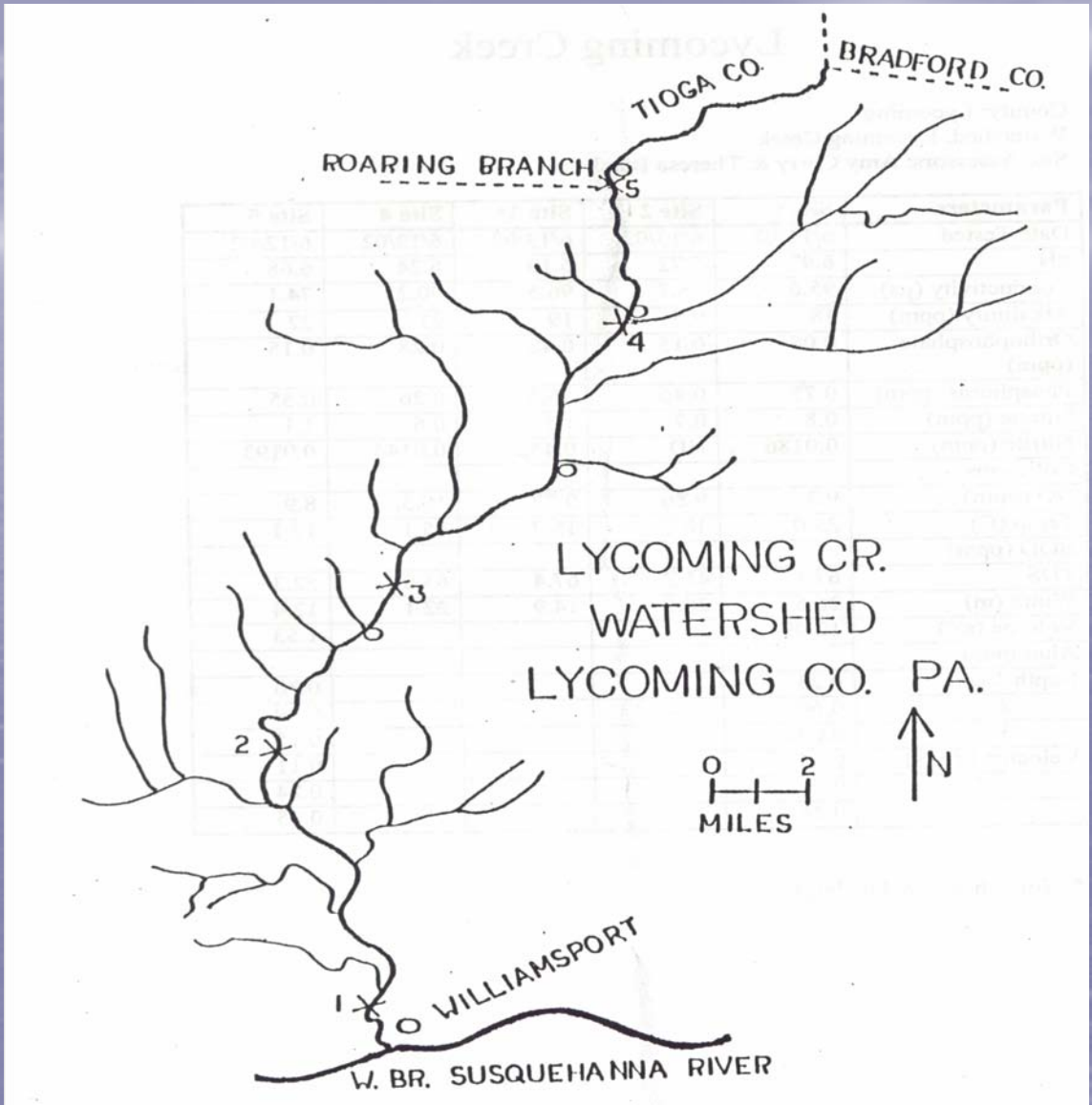
- 86 Sites
- 31555’ Length
- 12862 Tons per year



My Work

- During Summer of 2004
- Collected water samples and macroinvertebrate samples from fives sites on Lycoming Creek and from sites on 14 of its tribs.
- Samples were also taken from 3 control sites; Grays Run, Rock Run, and Pleasant Stream

Water Chemistry and Biological Sampling Sites



Water Chemistry

- Samples were collected in plastic containers
  - Each container was rinsed twice before filling
- Several biological and metal tests were run on water samples including:
  - pH level
  - Aluminum

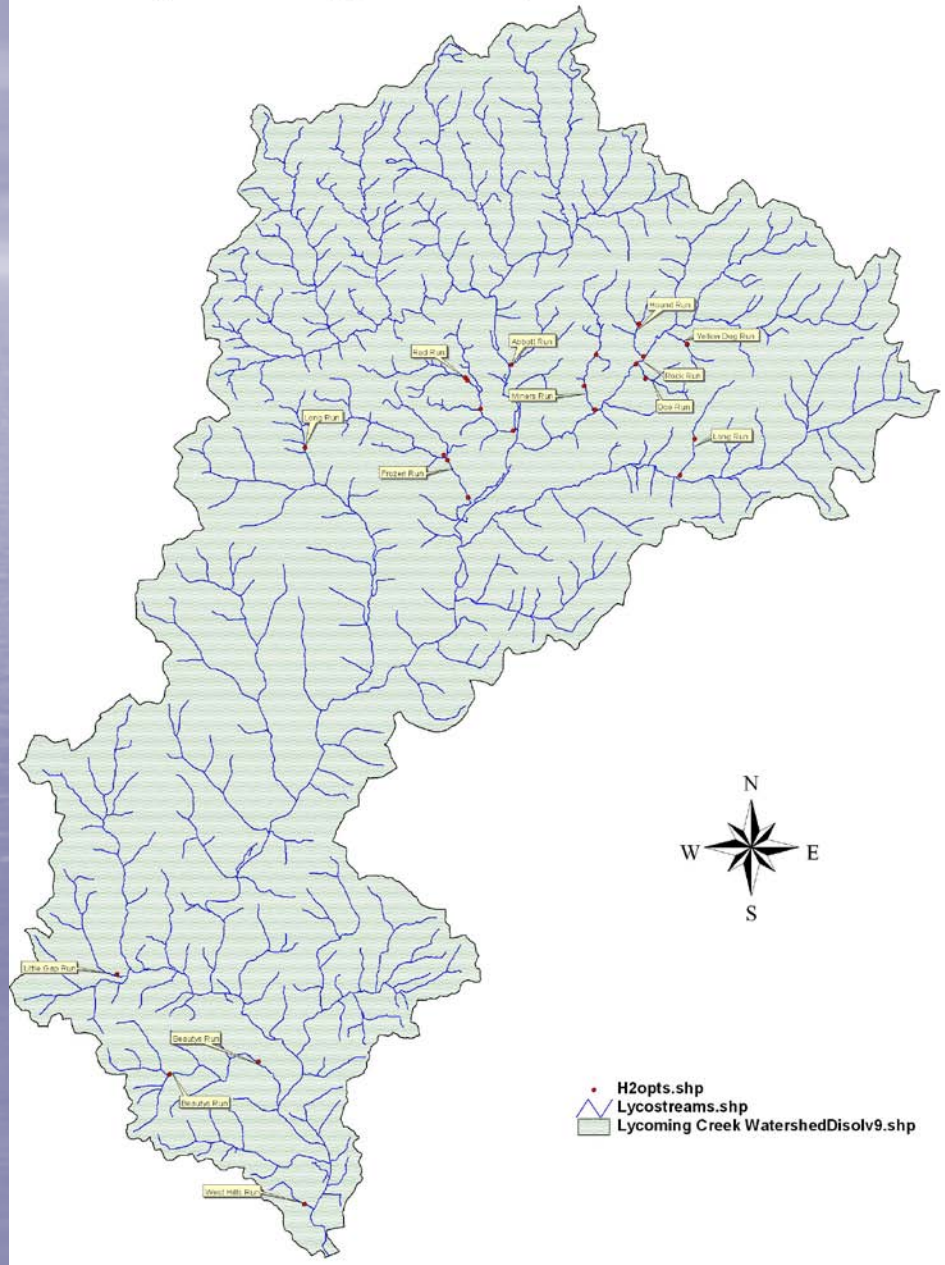
Lycoming Creek

- My data along with Amy and Theresa's
  - Summer pH was generally higher than Spring pH
  - Large decrease in alkalinity between Summer and Spring sampling
  - Slight increase in pH from Summer '02 to Summer '04

Averaged #'s for Water Chem.

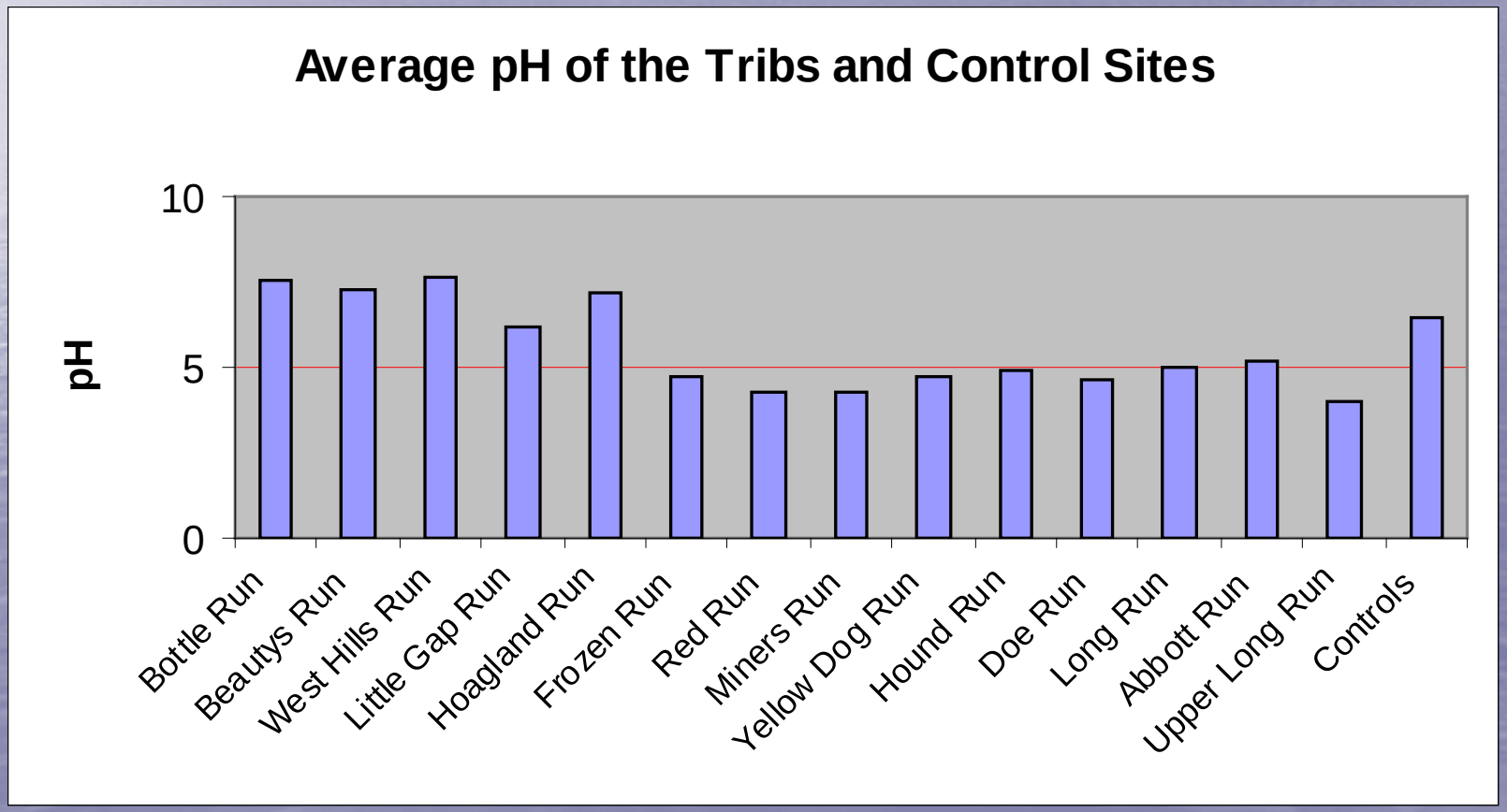
Stream Name (Site Number)	Roaring Branch	Ralston	Camp Susque	Powys	Bowmans Field
pH lab	7.03	6.60	6.66	6.77	7.00
Conductivity (us)	102.47	80.73	51.50	82.97	84.50
Alkalinity (ppm)	15.12	10.90	4.35	14.17	14.20
Orthophosphate	1.26	1.50	1.94	0.19	0.22
Phosphorous	0.31	0.27	0.84	2.05	0.33
Nitrate	9.62	9.95	8.01	7.67	6.38
Nitrite	0.02	0.02	3.29	0.02	0.02
DO (ppm)	8.97	10.72	10.62	10.88	10.48
Temp (C)	79.83	12.27	12.00	12.25	13.63
TDS (ppm)	57.40	43.63	45.23	47.03	47.53

Water Chemistry Points
Lycoming Creek, Pa



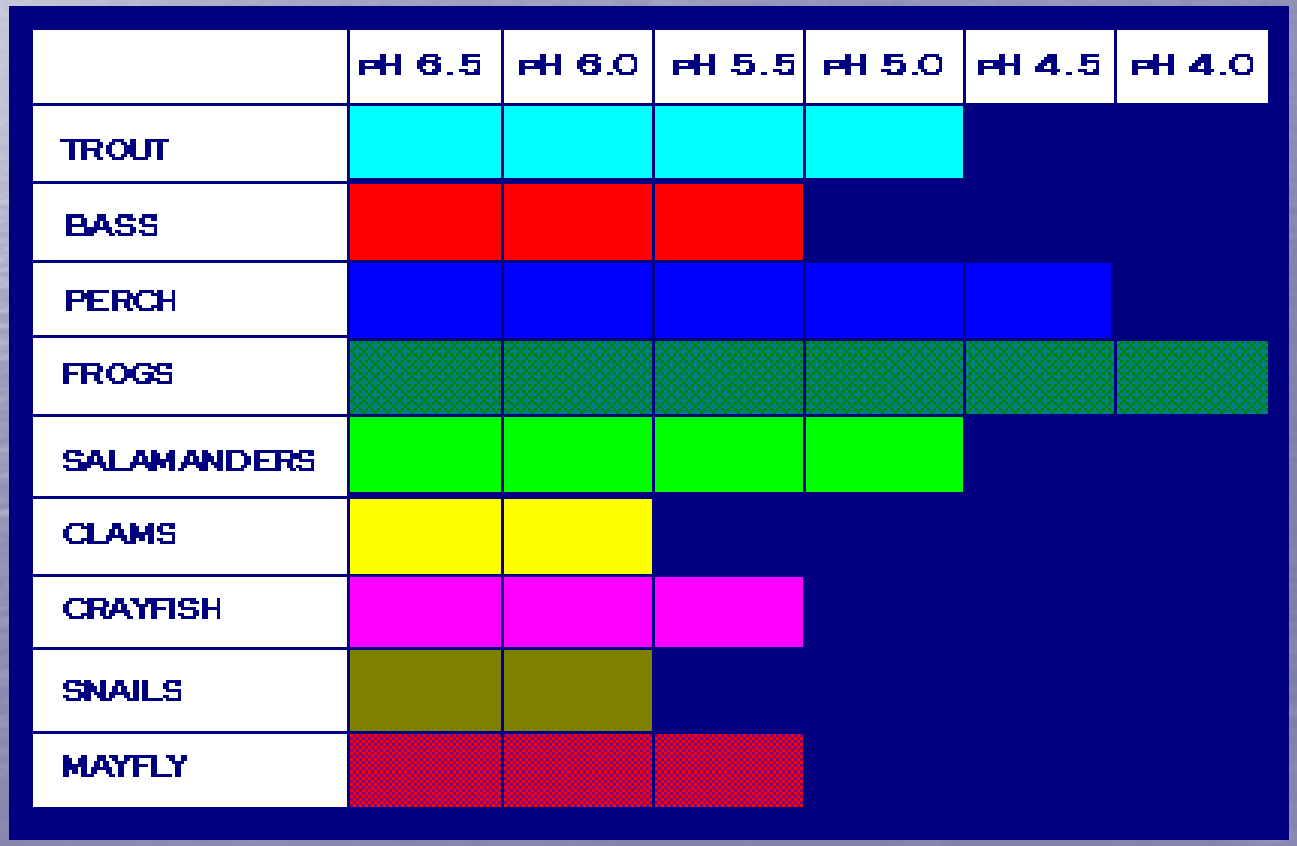
Average pH levels

- Average pH level of Pa streams 6.5 – 8.5



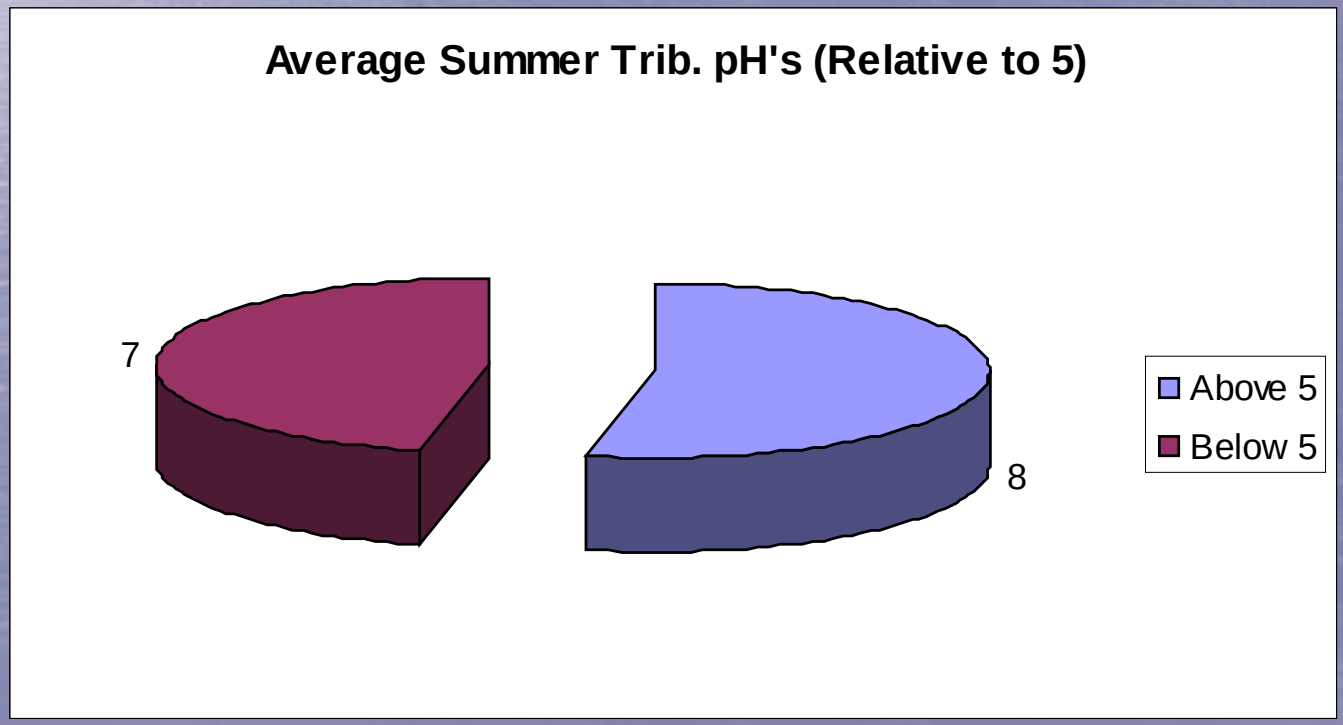
How pH Effects Stream Life

- Acidic water allows leaching of many toxic chemicals
- pH levels around 4 or below may destroy larva and eggs, result in fish kills, and/or cause mutations.



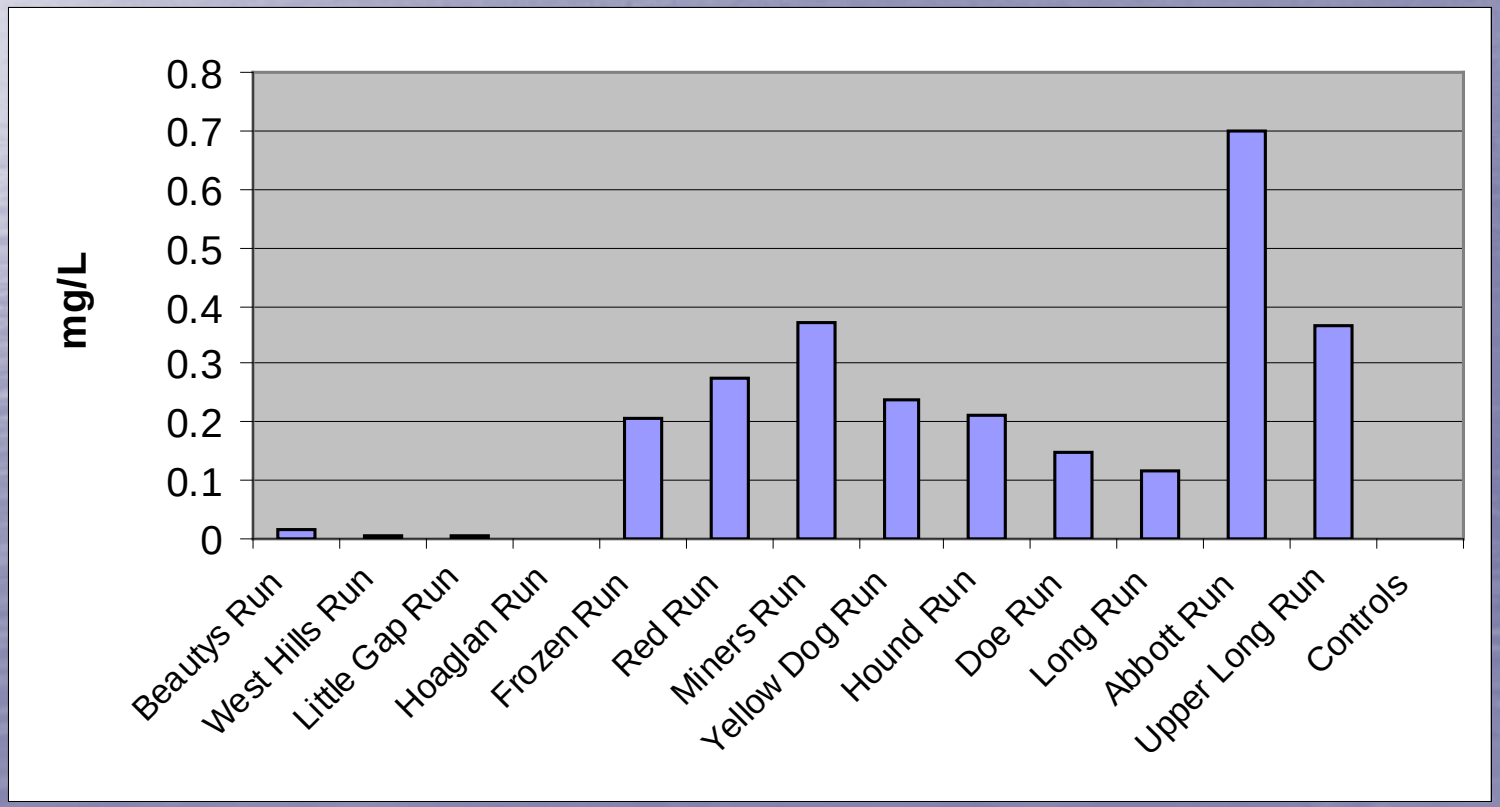
Tributaries with High pH Levels

- Many streams had a pH level under 5.0
  - Frozen Run, Red Run, Miners Run, Yellow Dog Run, Hound Run, Doe Run, and Upper Long Run



Average Aluminum Levels

- Levels increase due to low pH levels
- Pa State Drinking Limit is 0.2 mg/L

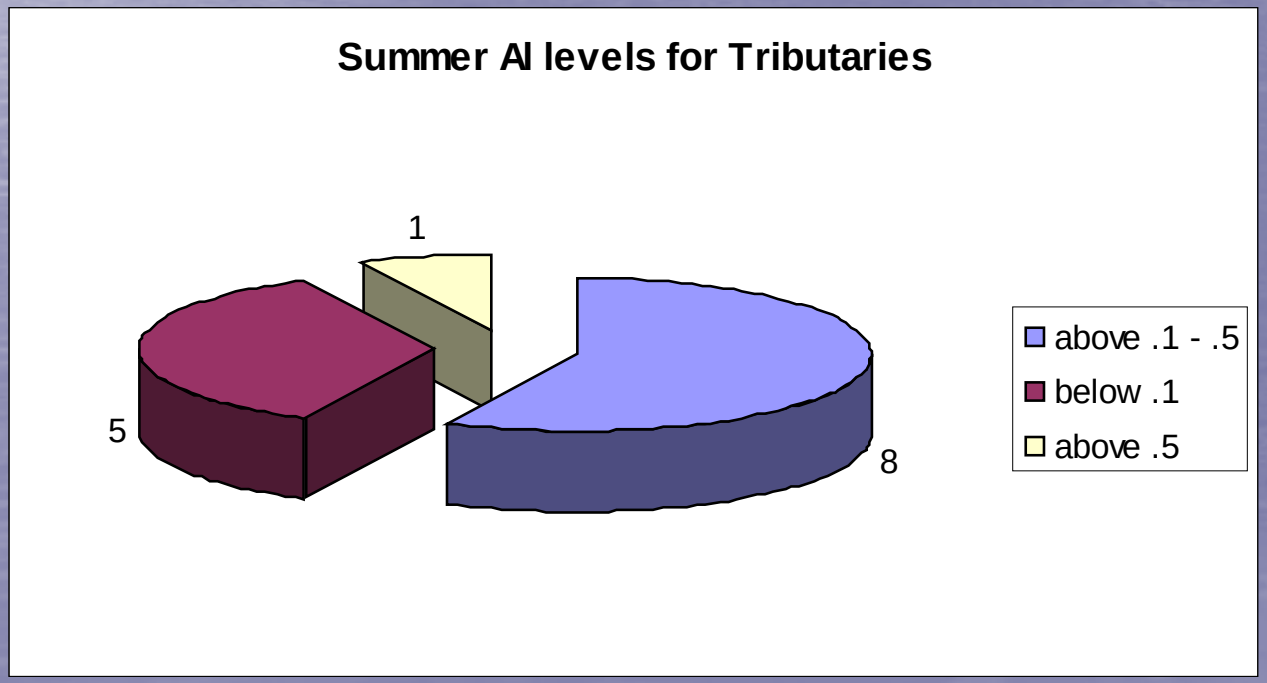


How Does Aluminum Effect Stream Life

- Accumulates on gills restricting breathing
- Al levels of 0.5 mg/L combined with pH levels under 5.5 are lethal to most fish and aquatic macroinvertebrates
- A level of 0.1 mg/L Al, independent of pH, has been set as a “stress level” for aquatic organisms

Tributaries with High Levels (>0.1mg/l) of Al

- Several tribs had pH levels over 0.1 mg/l
  - Frozen Run, Red Run, Miners Run, Yellow Dog Run, Hound Run, Doe Run, Long Run, Abbott Run, and Upper Long Run
  - Abbott Run was above .5 mg/l



What do these measurements tells us?

- High levels of any of these measurements indicate some type of acid impact
  - Acid precipitation
  - Acid mine drainage
- Many of the sample tribs. lie below abandoned mines

Acid Mine Drainage (AMD)

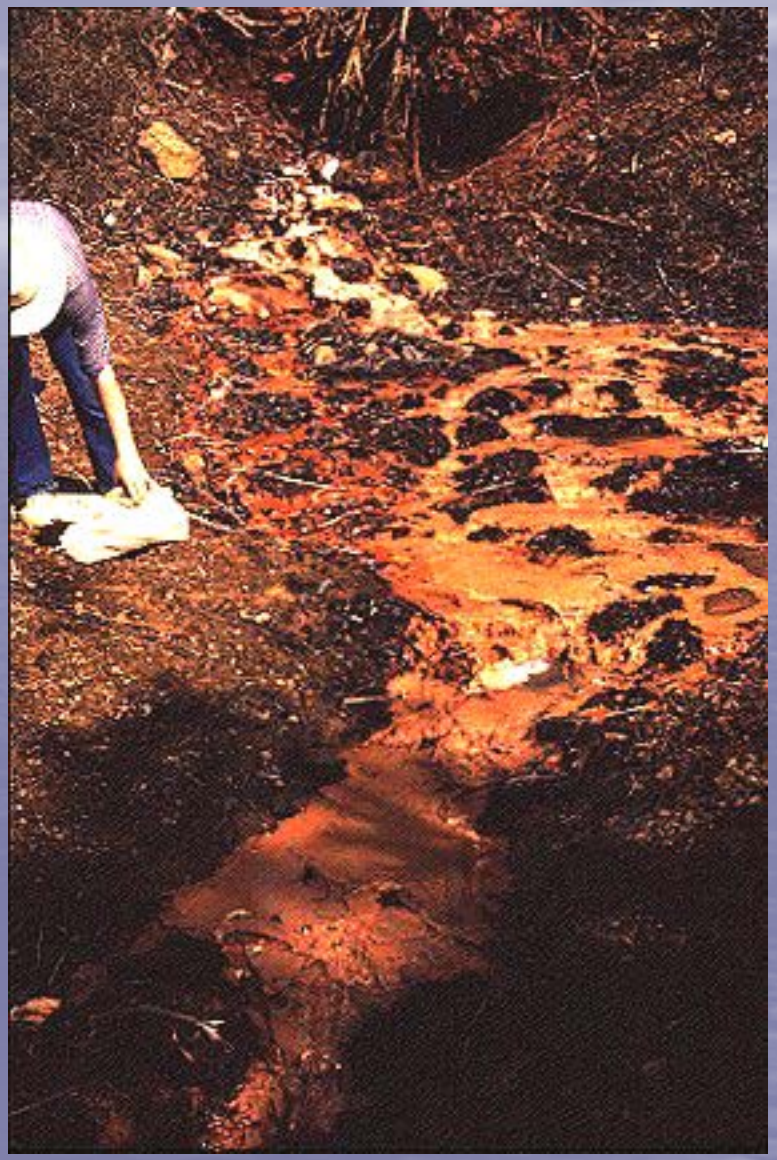
- Occurs in streams below old surface and deep mines
- Pyrite (FeS_2) is present in coal seams and the rock layers between coal seems
- Result of the reaction that occurs when pyrite encounters water and air

The Reaction

- $FeS_2 + 3.75\ O_2 + 3.5\ H_2O \Longleftrightarrow Fe(OH)_3 + 2\ H_2SO_4$
  - Yielding iron hydroxide and sulfuric acid
- The acid increases pH which leads to the leaching of Al, Fe, and Mn from soils
- These metals dissolve in stream water but precipitate out when pH levels increase
  - Most of the tribs. with low pH values also had high Al levels

Metal Precipitates

- Fe leads to characteristic Red - Orange or Orange - Yellow color
  - Yellow Boy
- Al is White and Mn is Black



Metal Precipitates

- Precipitates fall to stream beds coating them and the rocks macroinvertebrates live under
- Coating smothers macroinverts and restricts their breathing
- Leads to fish kills as fish feed on the macroinverts

Macroinvertebrate Collection

- Samples collected by means of a kick net
- Placed in plastic container and preserved w/ % ethanol
- Samples were then counted and identified

RBA of Macroinvertebrates

- Samples were analyzed using the EPA's Rapid Bioassessment protocol
- Based on
  - # of taxa
  - # of EPT
  - Hilsenhoff Biotic Index
  - % Tolerant and % Intolerant Taxa
  - Shannon-weiner Diversity

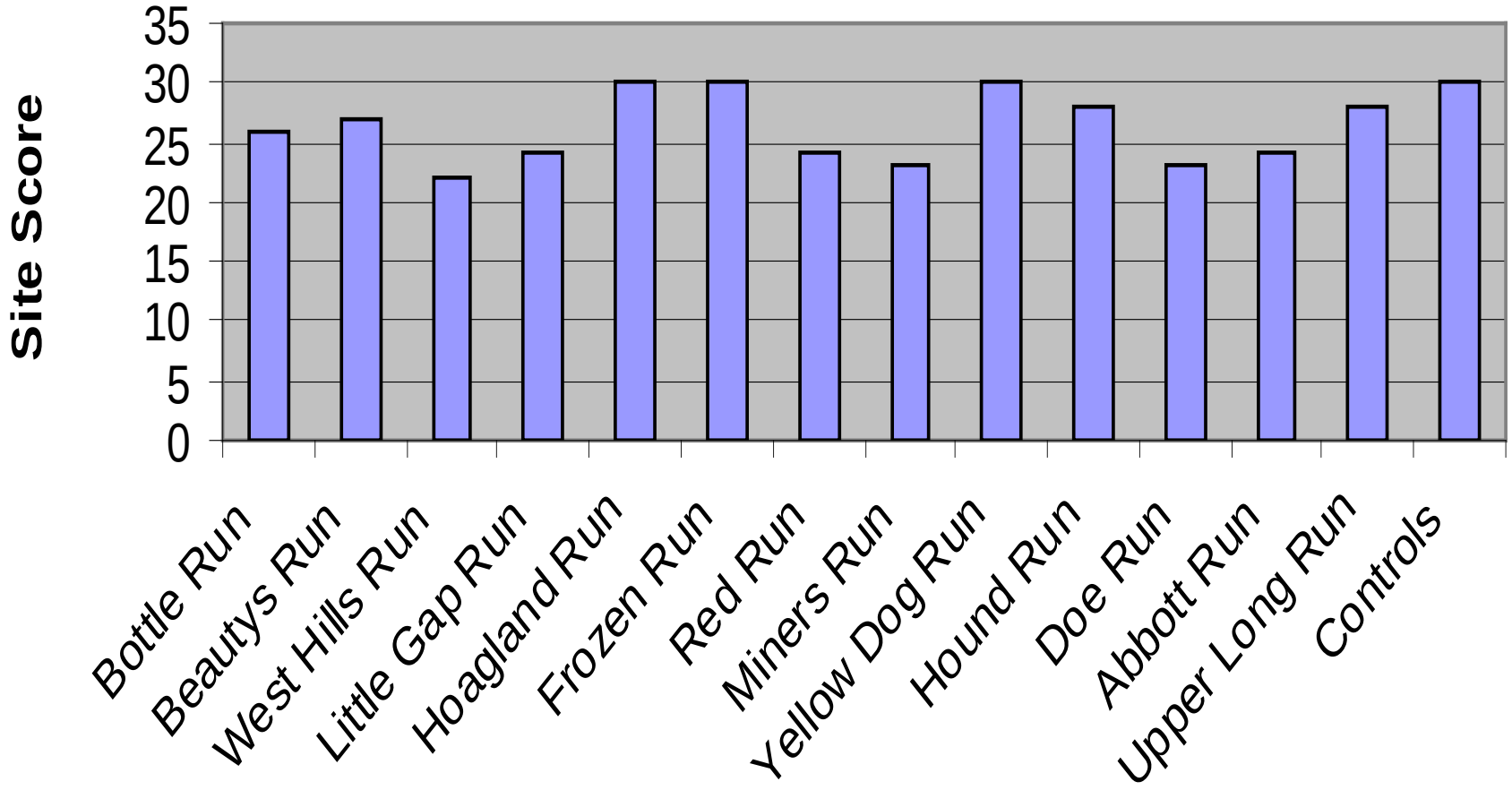
RBA of Macroinvertebrates

- Categories are scored 1-5, 5 being good
- Add up the 6 category scores for a site score (0-30)
  - 6-10 – very poor
  - 11-16 – poor
  - 17-22 – fair
  - 23-30 - good

Metrics for Red Run

	Red Run (S1)*	Red Run (S2)*	Red Run (S3)*	Red Run (S4)*
Total Taxa	11	9	15	5
EPT Taxa	6	4	7	0
Hilsenhoff Biotic Index	2.43	1.76	2.79	5.93
% Intolerant	0.63	0.74	0.56	0
% Tolerant	0	0	0.04	0
Shannon Diversity	2.173	2.201	2.326	0.5237
Metric Scores				
Total Taxa	3	3	5	1
EPT Taxa	5	3	5	1
Hilsenhoff Biotic Index	5	5	5	3
% Intolerant	5	5	5	1
% Tolerant	5	5	5	5
Shannon Diversity	5	5	5	1
Site Score	28	26	30	12
Relative Health	Good	Good	Good	Poor

Average Site Score for Tributaries



Results

- Only one trib. (West Hills Run) had a fair health sore when its site scores where averaged
- However, many individual sites had fair scores and one had a poor score
  - Bottle Run 4, West Hills Run, Miners Run 2 & 3, and Doe Run 1 all had fair scores
  - Red Run 4 had a poor score

Results

- Although many streams appeared to be impaired when there waters are chemically tested, macroinvertebrate communities are relatively unimpaired

Future Work

- More water testing is being performed this Spring
  - More severe pH levels are present in streams during the winter/spring melting/runoff process due to the high acidity of PA precipitation
- More work will also be performed this summer

Hound Run Summer/Spring

- pH dropped in spring and Al levels increased

	Summer pH	Spring pH	Summer Al	Spring Al
Site 1	4.835	2.79	0.192	0.215
Site 2	4.78	3.34	0.275	0.35
Site 3	5.06	3.17	0.163	0.171

Acknowledgements

- Zimm and the rest of the Biology Staff
- Rob Parker
- Drew Zimmerman, Amy Curry, Jim Rodgers, and Heather Edelstein
- Matt