



# A Summary of the Physical, Chemical, & Biological Assessments of Buffalo Creek and its 5 Tributaries

Lycoming College and  
CWI Interns  
Brad Musser & Katie Swanson

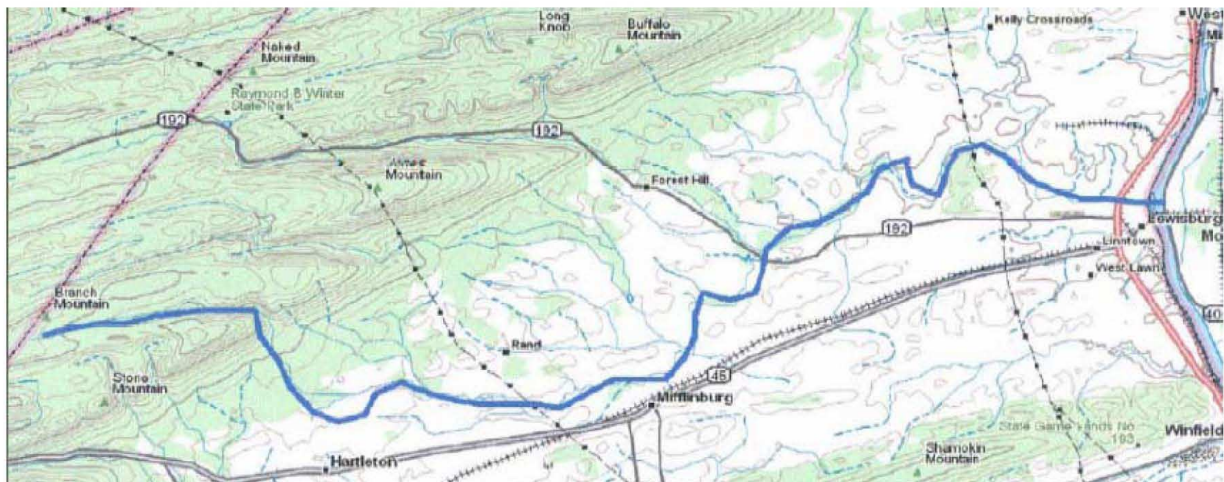
## Overview

- Buffalo Creek and its tributaries
- What does being an intern entail?
- Disturbances
- What we did over the summer
- What we found
- Possible restoration projects
- Acknowledgments

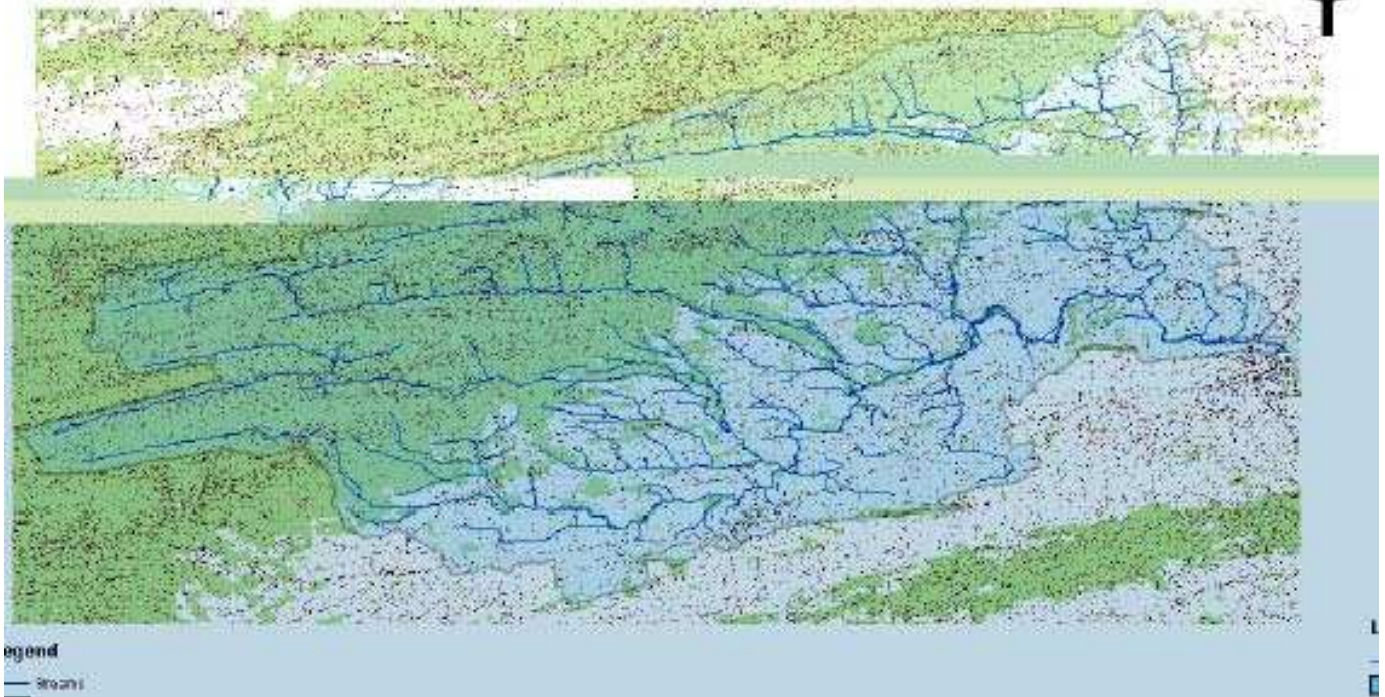


## Buffalo Creek

- 28 miles long
- Has 5 major tributaries
- Begins in heart of Bald Eagle State Forest
- Converges with Susquehanna in Lewisburg
- Second year of a 2 year project



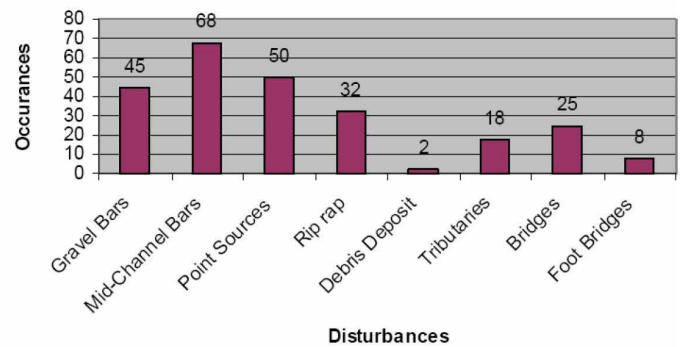
**Buffalo Creek Watershed**  
Union County, Pa



Data From Summer 2004 on Buffalo Creek

# Data From Summer 2004 on Buffalo Creek

Summary of Disturbances along Buffalo Creek



Disturbances

## Buffalo Creek Chemistry Data

June 16, 2004

Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
pH	4.378	6.448	7.91	8.913	8.978	8.723
Alkalinity (ppm)	0	10	89	61.8	69.8	83.8
Orthophosphate (ppm)	0.083	0.135	0.145	0.168	0.14	0.11
Phosphorous (ppm)	0.328	0.333	0.42	0.408	0.384	0.308
Nitrate (ppm)	0.55	1.13	2.8	1.88	2.08	2.23
Nitrite (ppm)	0.0055	0.0053	0.0115	0.0138	0.0085	0.0203
DO (mg/L)	9.6	9.37	9.11	12.19	12.81	11.57
Temperature (°C)	14.4	16.2	19	20.2	21.1	22.2
Width (m)	3.023	7.087	9.22	32.92	27.89	25.3
Depth (cm)	11.33	11.67	31.67	20	51	243.84
Velocity (m/s)	0.17	0.23	0.19	0.6	0.18	0.08
Volume of Flow (m <sup>3</sup> )	0.1543	0.4989	1.4236	9.6179	6.0979	11.8448

Table 1: Summary of Disturbances along Buffalo Creek

Structure	Amount	Percentage of 614
Gravel Bars	45	7.33%
Mid-Channel Bars	68	11.1%
Point Sources	50	8.14%
Rip rap	32	5.21%
Debris Deposit	2	0.33%
Tributaries	18	2.93%
Bridges	25	4.07%
Foot Bridges	8	1.30%
Total Erosion Sites	366	59.6%
Left Bank Erosion Sites	170	46.4%
Right Bank Erosion Sites	196	53.6%

What Does a CWI Intern Do?





## Documenting Disturbances

What counts as a disturbance?

- Gravel Bars



- Mid-Channel Bars
- Point Sources
- Rip Rap
- Debris Deposit
- Tributaries \*
- Bridges
- Foot Bridges
- Dams
- Total Erosion Sites

\* GPS recorded, but not an actual disturbance.



### Gravel Bar

- The water table was so low this year and the drought was so severe that there were few gravel bars





Mid-Channel Bar



Point Source





Rip Rap





Debris Deposit







## Evaluating Erosion Potential

Stream Name: _____		Stream Reach: _____	
Watershed: _____		County: _____	
Assessors: _____		Date Assessed: _____	
Form adapted by Jw, Inc. 2001			

BANK EROSION POTENTIAL <b>LOW</b> <b>MODERATE</b> <b>HIGH</b>	<p>0-6 ft.</p>		<p>Well Vegetated &gt;60% Cover</p>	<p>Bedrock/Boulders</p>
	<p>6-9 ft.</p>		<p>Moderate 30-60%</p>	<p>Pit-Sized Rocks</p>
	<p>9+ ft.</p>		<p>Sparse 0-30%</p>	<p>Sand/Clay</p>
	BANK HEIGHT	BANK ANGLE	DENSITY of ROOTS % of TOTAL BANK HEIGHT WITH ROOTS	PARTICLE SIZE

## Erosion Data Sheet



Site #:	Bank Height				Bank Angle			Density of Roots			Particle Size			
	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 ___														
Side	Right Bank						Left Bank							
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:														

Site #:	Bank Height				Bank Angle			Density of Roots			Particle Size			
	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+ ___														
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Slope														
Slope Depo Bar														
Position of Erosion Feature	Lat:						Lon:							
Picture #'s Taken:														

High Erosion  
Potential



# High Erosion Potential



Moderate  
Erosion  
Potential



erate  
sion  
ential



Low Erosion Potential



## In-Stream Habitat and Riparian Buffer Evaluations

- Performed every 1 to 1.5 miles (depending on stream length)
- Used standardized forms and parameter guidelines
- Photographed each site
- Compiled numerical scores to estimate overall condition of stream habitat

We also...

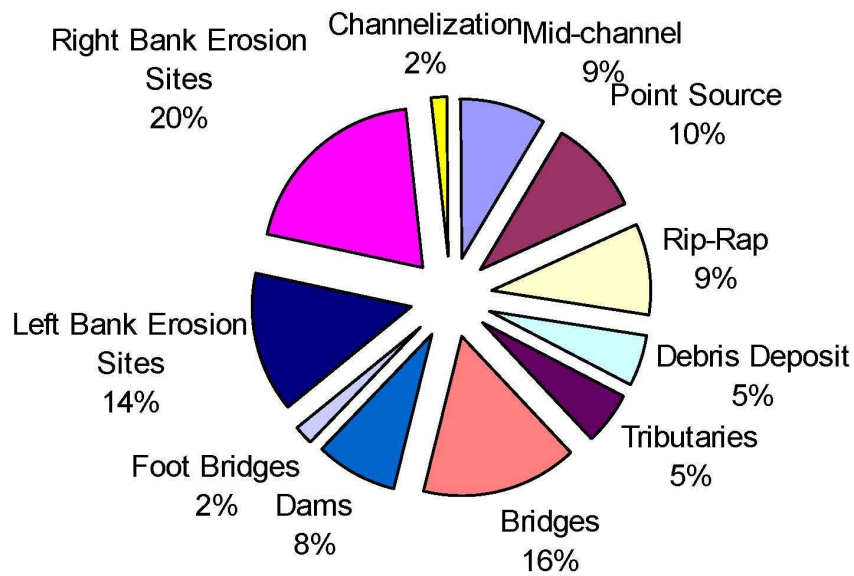
- Performed chemical analysis at multiple sites along the main branch and its tributaries
- Gathered macroinvertebrate kick samples at each chemical sampling site

## Total Tributary Disturbances

\* Note that tributaries aren't actually a disturbance, but their GPS coordinates are recorded.

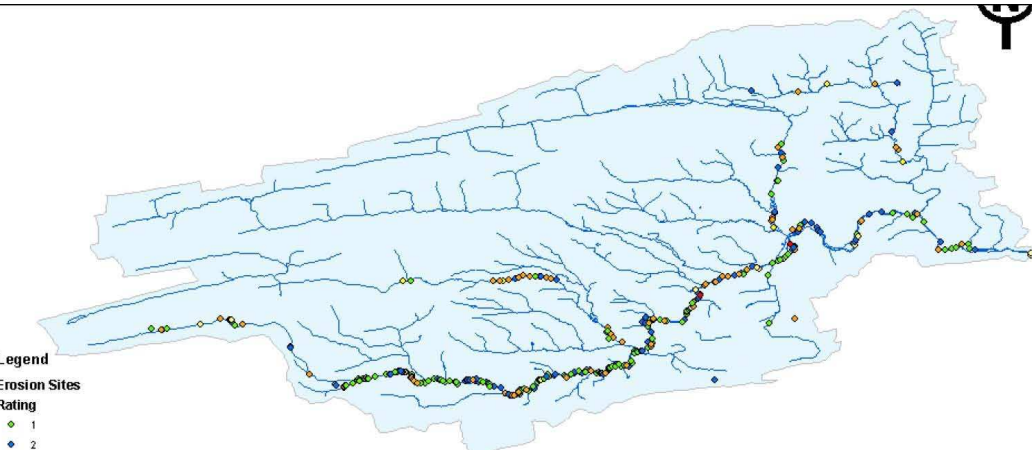
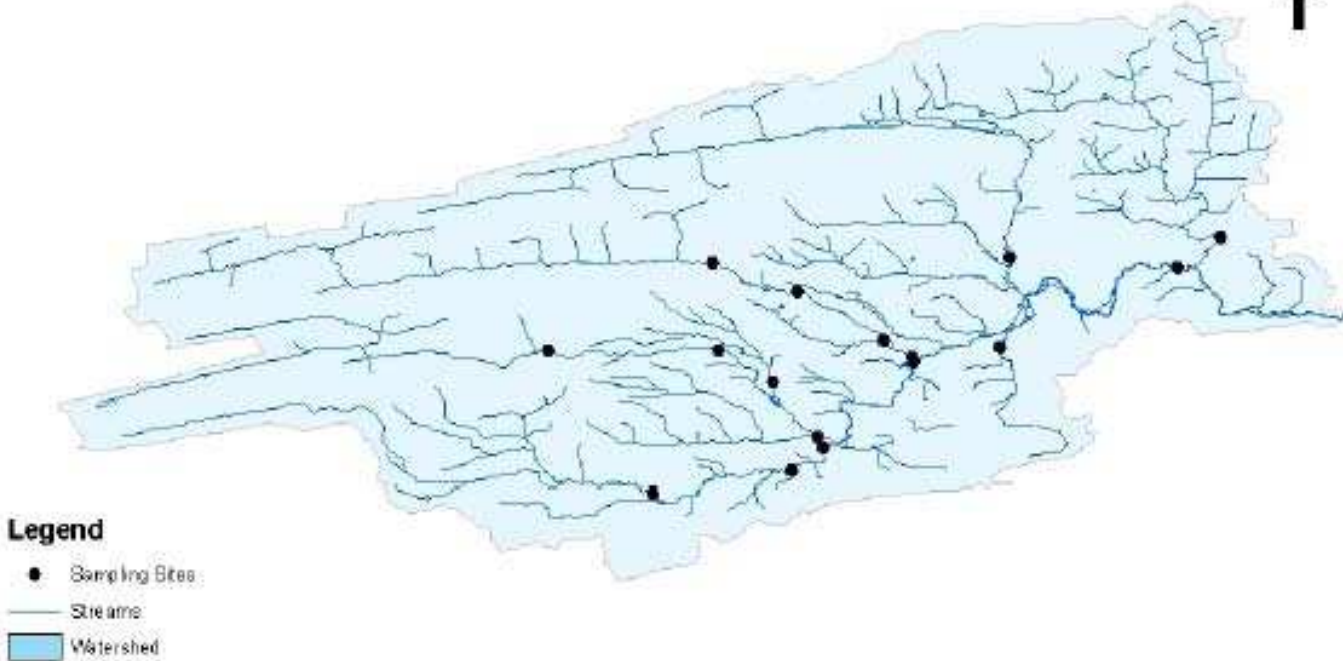


# Total Tributary Disturbances

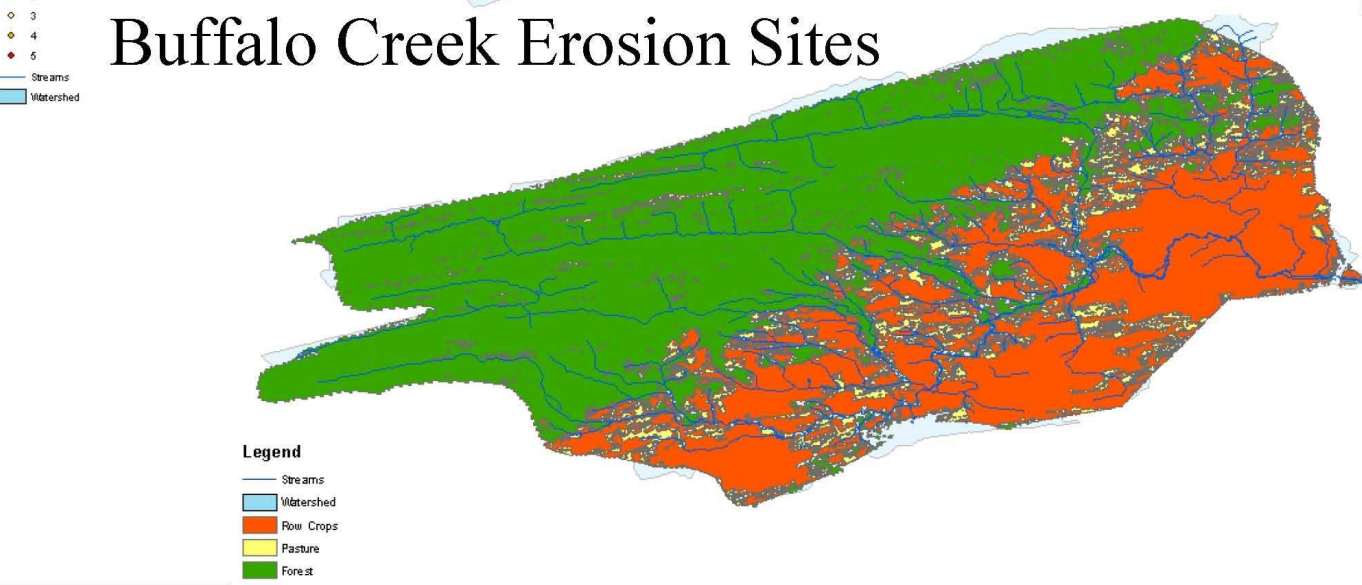


\* Note that tributaries aren't actually a disturbance, but their GPS coordinates are recorded.

Buffalo Creek Watershed Sampling Sites  
Union County, Pa



Buffalo Creek Erosion Sites



Buffalo Creek Watershed  
Soil Loss (tons/acre/year)

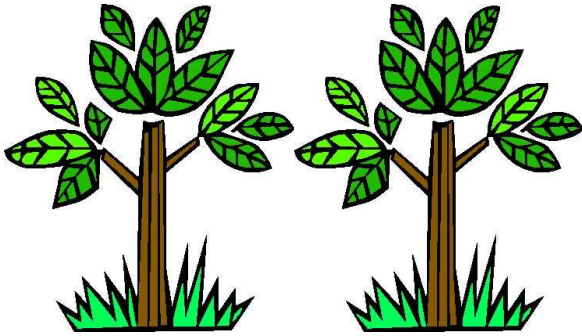


Forest 0.000167

Pasture 0.012498

Rowcrops 8.33187

This data is based on a model that incorporates the erosion potential, the average monthly stream flow (taken at 12 gauge stations), and the land cover type.



### Spruce Run Disturbances

<u>Structure</u>	<u>Amount</u>	<u>Percentages</u>
Mid-Channel Bars	4	10.53%
Point Sources	2	5.26%
Rip rap	6	15.79%
Debris Deposit	0	0.00%
Tributaries	3	7.89%
Bridges	4	10.53%
Dams	1	2.63%
Foot Bridges	1	2.63%
Left Bank Erosion Sites	5	13.16%
Right Bank Erosion Sites	12	31.58%
Channelization	0	0.00%
<b>Total</b>	<b>38</b>	<b>100.00%</b>
Total Erosion Sites	17	

# North Branch Disturbances

<u>Structure</u>	<u>Amount</u>	<u>Percentages</u>
Mid-Channel Bars	5	7.46%
Point Sources	8	11.94%
Rip rap	5	7.46%
Debris Deposit	6	8.96%
Tributaries	2	2.99%
Bridges	7	10.45%
Dams	8	11.94%
Foot Bridges	2	2.99%
Left Bank Erosion Sites	11	16.42%
Right Bank Erosion Sites	13	19.40%
Channelization	0	0.00%
<b>Total</b>	<b>67</b>	<b>100.00%</b>
Total Erosion Sites	24	

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## Little Buffalo Disturbances



<b><u>Structure</u></b>	<b><u>Amount</u></b>	<b><u>Percentages</u></b>
Mid-Channel Bars	2	6.06%
Point Sources	2	6.06%
Rip rap	1	3.03%
Debris Deposit	2	6.06%
Tributaries	1	3.03%
Bridges	7	21.21%
Dams	2	6.06%
Foot Bridges	1	3.03%
Left Bank Erosion Sites	5	15.15%
Right Bank Erosion Sites	7	21.21%
Channelization	3	9.09%
<b>Total</b>	<b>33</b>	<b>100.00%</b>
Total Erosion Sites	12	

# Beaver Run Disturbances

<u>Structure</u>	<u>Amount</u>	<u>Percentages</u>
Mid-Channel Bars	0	0.00%
Point Sources	0	0.00%
Rip rap	0	0.00%
Debris Deposit	0	0.00%
Tributaries	0	0.00%
Bridges	5	62.50%
Dams	0	0.00%
Foot Bridges	0	0.00%
Left Bank Erosion Sites	2	25.00%
Right Bank Erosion Sites	1	12.50%
Channelization	0	0.00%
<b>Total</b>	<b>8</b>	<b>100.00%</b>
Total Erosion Sites	3	

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# Rapid Run Disturbances

<u>Structure</u>	<u>Amount</u>	<u>Percentages</u>
Mid-Channel Bars	11	7.28%
Point Sources	13	8.61%
Rip rap	12	7.95%
Debris Deposit	5	3.31%
Tributaries	8	5.30%
Bridges	17	11.26%
Dams	10	6.62%
Foot Bridges	1	0.66%
Left Bank Erosion Sites	14	9.27%
Right Bank Erosion Sites	20	13.25%
Channelization	4	2.65%
<b>Total</b>	<b>115</b>	<b>100.00%</b>
Total Erosion Sites	34	

## Erosion Potential Based on Bank Angle

<b>Sites</b>	<b>L</b>	<b>M</b>	<b>H</b>		<b>TOTAL</b>
Rapid Run	7	20	9		<b>36</b>
Little Buffalo	3	7	2		<b>12</b>
Beaver Run	3	0	0		<b>3</b>
North Branch	5	10	11		<b>26</b>
Spruce Run	6	6	6		<b>18</b>
<b>TOTAL</b>	<b>24</b>	<b>43</b>	<b>28</b>	<b>95</b>	
<b>PERCENT</b>	<b>25.26%</b>	<b>45.26%</b>	<b>29.47%</b>		

## Water Chemistry Data of Buffalo Creek's Tributaries

June 2005

Parameters	Little Buffalo #1	Little Buffalo #2	North #1	North #2	Beaver #1	Beaver #2	Rapid #1	Rapid #2	Spruce #1	Spruce #2
pH	7.04	7.48	6.045	7.215	7.465	7.865	6.16	6.76	5.97	7.69
Conductivity	77.8	12.5	11.83	40.465	316	293	11.22	28.95	9.61	83.8
Alkalinity	53.5	94.5	4	23.5	296	248	4.5	15	3	63
Orthophos.	0.1525	0.095	0.09	0.1775	0.3925	0.4525	0.2425	0.1925	0.29	0.305
Phosphorus	0.29	0.1075	0.2175	0.1525	0.2525	0.205	0.13	0.1925	0.3225	0.23
Nitrate	1.5	3.9	1.53	2.13	9.125	8.025	1.5	0.8	0.65	2.4
Nitrite	0.00335	0.01143	0.004	0.0049	0.0145	0.0674	0.0072	0.0091	0.0103	0.0145
DO	6.79	7.22	8.49	7.35	8.05	9.58	6.73	8.42	9.5	8.14
Temp	19.4	22.1	17.2	21.3	13.7	16.4	16.5	19.7	13.5	21.6
TDS	38.45	62.3	5.92	20.05	169	147	5.605	14.6	4.805	41.85
Depth(cm)	5	26	24	40	12	13	25	21	15	20
Velocity	0.42	0.05	0.61	0.07	0.26	0.18	0.07	0.47	0.15	0.2
16-Jun-05										

## Water Chemistry Data of Buffalo Creek's Tributaries

### July 2005

Parameters	Rapid Run #1	Rapid Run #2	Little Buffalo #1	Little Buffalo #2	Beaver Run #1	Beaver Run #2	North Branch #1	North Branch #2	Spruce Run #1	Spruce Run #2
pH	5.45	6.73	7.32	8.18	7.74	7.97	6.44	7.43	6.10	7.88
Conductivity	13.86	26.90	75.00	126.20	301.00	282.00	17.09	38.55	9.71	79.20
Alkalinity	1.50	11.00	52.50	85.50	295.50	245.00	10.00	23.50	3.50	56.50
Orthophos.	0.25	0.24	0.09	0.15	0.23	0.21	0.16	0.21	0.19	0.04
Phosphorus	0.06	0.22	0.23	0.13	0.18	0.10	0.07	0.19	0.08	0.05
Nitrate	0.80	0.60	0.01	0.01	0.02	0.18	0.01	0.01	0.50	2.00
Nitrite	0.01	0.01	0.73	2.43	9.07	6.83	1.17	0.93	0.01	0.01
DO	8.86	6.82	6.14	5.5	7.54	9.11	6.15	8.44	9.62	6.9
Temp	13.8	18.9	23.4	26.2	17.3	19.1	17.7	22	12.9	21.8
TDS	6.83	13.50	37.35	63.25	151.00	141.00	8.52	38.50	4.85	39.55
Depth	29 15	24 29	12	20	13	13 11	26 14	21 31	10	11 24
Velocity	.30 .25	.43 .70	0.16	0.02	0.25	.22 .11	.53 .75	17 .32	0.5	18 .18

## Buffalo Creek Water Chemistry

### Spring 2005 (03/21/05)

Buffalo Creek Water Chemistry Spring 2005 3/21/05

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
pH	n/a	6.98	8.01	7.58	7.75	7.56
Conductivity	n/a	51.7	181.05	203	192.65	147.45
Alkalinity (ppm)	n/a	1.75	5.5	6.65	6.85	7.05
Orthophosphate (ppm)	n/a	0.395	0.92	5.50(over)	0.395	0.51
Phosphorus (ppm)	n/a	0.22	0.95	0.535	0.155	0.15
Nitrate (ppm)	n/a	1.95	3.4	3.75	3.25	3.85
Nitrite (ppm)	n/a	0.0068	0.01355	0.013	0.0126	0.0105
DO (ppm)	n/a	11.6	11.77	12.5	10.03	9.44
Temp °C	n/a	4.2	5.4	5.7	5.4	5.5
Width (m)	n/a	7	10.5	28	30	40
Velocity (m/s)	n/a	0.71	0.233	0.27	0.237	n/a
Depth (m)	n/a	0.1016	0.4191	0.25	0.584	n/a
Volume (m3/s)	n/a	0.504	1.05	1.89	4.15	n/a

## Buffalo Creek Water Chemistry



May 2005

Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
pH	4.09	6.19	8.005	8.9	8.565	7.915
Conductivity						
Alkalinity	0	11	90	68	72	85.5
Orthophosphate	0.1325	0.11	0.1325	0.16	0.14	0.13
Phosphorus	0.12	0.1425	0.345	0.2725	0.3375	0.2425
Nitrate	1.525	1.825	3.4	2.7	2.825	3.075
Nitrite	0.009	0.0091	0.0152	0.0113	0.0117	0.0136
DO	11.3	10.04	6.98	7.25	5.98	5.39
Temp	12	13.3	15.9	16.7	16.9	18
TDS						
5/18/2005	Buffalo Creek					

## Buffalo Creek Water Chemistry

June 2005

pH	3.870	6.345	7.530	7.890	7.760	7.735
Conductivity	27.35	57.55	263.00	192.00	217.50	230.00
Alkalinity (ppm)	0	11	98	62	74	75.5
Orthophosphate (ppm)	0.9570	0.2030	0.2700	0.2575	0.3075	0.4775
Phosphorus (ppm)	0.0675	0.0725	0.6175	1.3050	1.1925	1.3175
Nitrate (ppm)	0.875	1.525	3.860	2.630	2.400	2.867
Nitrite (ppm)	0.0519	0.0313	0.0141	0.0358	0.0440	0.0524
DO (ppm)	8.08	8.99	7.83	5.11	8.08	7.15
Temp @	15.2	17.3	19.3	21.5	21.6	23.0
TDS	14.15	25.05	132.00	98.00	108.50	115.00
Date	6-Jun					

Possible Restoration Projects:

Engineered J-Hook



Possible Restoration Projects:  
Planting Riparian Buffers...  
Could Turn This...



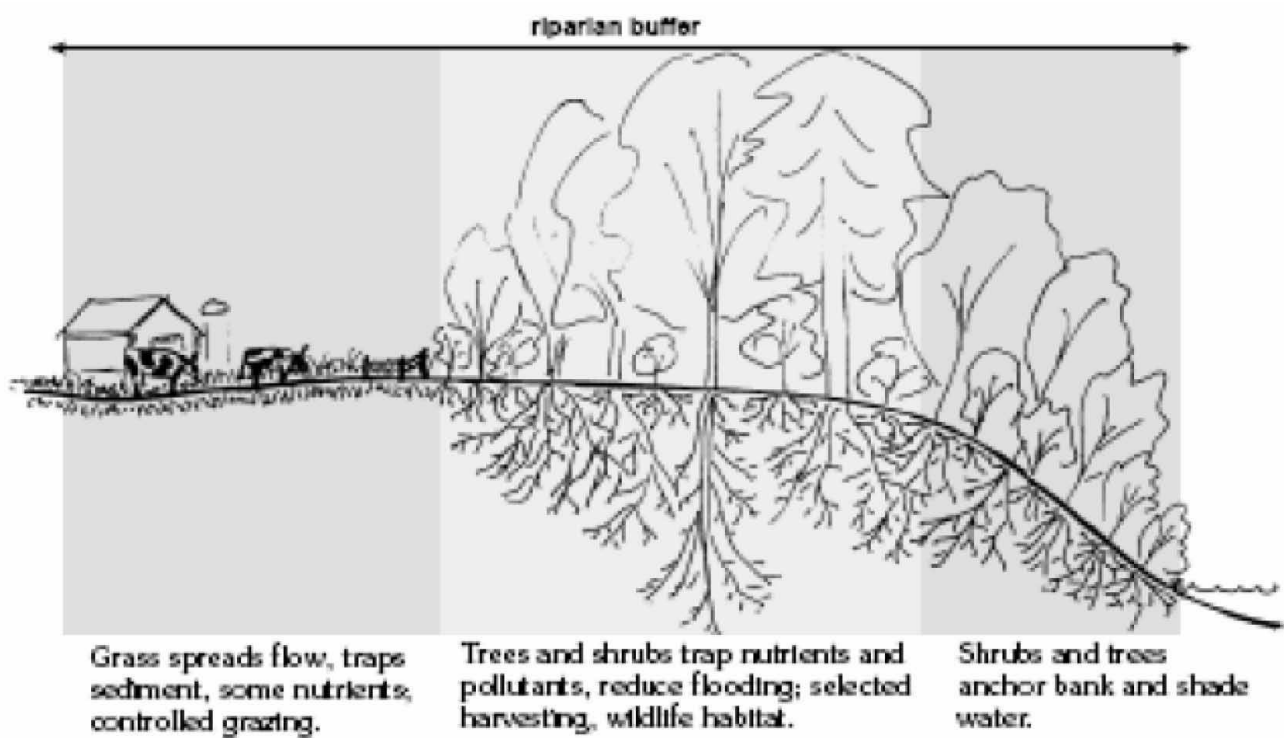
Into This!





[http://www.oh.nrcs.usda.gov/programs/Lake\\_Erie\\_Buffer/riparian.html](http://www.oh.nrcs.usda.gov/programs/Lake_Erie_Buffer/riparian.html)

## Why are Buffers So Important?



<http://www.crjc.org/buffers/Buffers%20for%20Agriculture.pdf>

# Acknowledgements

- Buffalo Creek Watershed Association
- Residents of the PA Watershed
- Dr. Zimmerman
- Our Fellow CWI Interns
- The Biology Department at Lycoming
- Mrs. Musser for Feeding Us Lunch

