

## Introduction:

Within Pennsylvania, there exists a variety of threats to stream ecosystems. Agricultural activities, urbanization, and natural gas exploration are a few examples of anthropogenic threats. However, impacts of 100 and 500 year flood events can also significantly alter stream habitat and biota. By all accounts, the flood of September 2011 due to Hurricane Irene and Tropical Storm Lee was a 500 year flood event in the Loyalsock Creek watershed. This project, compares pre and post data collected by CWI interns, starting in 1999, on two Loyalsock Creek watershed streams: Big Bear Creek and Ogdonia Creek. Habitat, macroinvertebrates, and fish were sampled 8-9 months after the flood.

## Study Area-

### Big Bear Creek:

Big Bear Creek, tributary to Loyalsock Creek, is a third order stream nestled in a 17<sup>m</sup> watershed. The stream runs approximately 5.2 miles, and has been on the property of the Dunwoody Sportsmen's Club since 1884. Due to the stream suffering from severe bank erosion, sediment deposition, and channel widening in 1999, the U.S. Fish and Wildlife Service in cooperation with the Dunwoody Sportsmen's Club decided to use the stream as a pilot project for Natural Stream Channel Design (NSCD). The purpose of the NSCD was to restore the stream to its natural condition and achieve even distribution of riffle, run, pool areas through the use of habitat restoration structures. The final project implemented 127 structures over four miles of the stream and took approximately four years to finish. The flood of September 2011 greatly altered the streams restored condition after the NSCD restoration project took place.

#### Pre-Flood Structures



#### Post-Flood Structures



### Ogdonia Creek:

Ogdonia Creek, also a tributary to Loyalsock Creek, is similar to Big Bear Creek in several ways. This third order stream is located approximately 8 miles north of Big Bear Creek. Unlike Big Bear Creek, Ogdonia Creek did not undergo stream restoration and does not have structures to help restore its natural condition and even distribution of riffle, run, pool areas. The stream remains a natural, non-restored stream.

# Biological Response of Two North Central PA Streams After Flood of September 2011



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## Analysis of Structures after the September 2011 Flood:

Before the flood there was 127 functioning structures in place to help restore the streams natural condition. The flood has impacted the structures by completely removing structures (52%), making them partially intact which alters the function of the structures (35%), and few remain intact and appropriately functional (13%). A walking survey was done in 2012 and a total of 62 structures were found compared to the total of 127 structures in place in 2004. Only 48% of the structures could be accounted for post-flood. The table below shows the type of structures that were accounted for on the 2012 walking survey and their relative condition.

The Type and Condition of Structures Accounted for			
Structure Type	Partially Intact	Fully Intact	Total
Rock	31	12	43
Log	11	4	15
Mixed	4	0	4
Totals	46	16	62

Although some remained intact or partially intact their ability to function may have been altered because the channel of the stream shifted due to the water flow from the flood.



Rock and settlement deposits from the flood have made this j-hook a non-functioning structure.

Working on the 2012 walk structure survey for the aftermath effect of the September 2011 flood.

## Comparison of Water Chemistry Before and After the Flood:

Between June and July 2012 water samples were collected to determine the water quality of the streams. The water samples collected demonstrated good water quality conditions for both streams in 2012.

Ogdonia Creek Water Chemistry Average of all Sites		
Parameters	August-10	June-12
pH (Lab)	6.88	6.57
Conductivity (Us)	61.6	54.3
Alkalinity (ppm)	20	13
DO (ppm)	8.45	8.05
Temperature (°C)	19.8	15.0
TDS (ppm)	24.95	27.2

Big Bear Creek Water Chemistry Average of All Sites		
Parameters	August-10	July-12
pH (Lab)	6.97	6.50
Conductivity (Us)	33.2	43.8
Alkalinity (ppm)	6.7	12.3
DO (ppm)	8.48	8.28
Temperature (°C)	15.9	17.1
TDS (ppm)	16.6	22.0

## Water Quality based on Macroinvertebrates and Fish Population Estimates:

Macroinvertebrates were collected between June and July at all of the Big Bear Creek sites as well as all the Ogdonia Creek sites. According to the Hilsenhoff Family Biotic Index, both streams indicated very good overall water quality with the possibility of some organic pollution. Family Biotic Index average score for Big Bear Creek was 4.63 in 2012 after the flood, which is slightly higher than before the flood in 2010 (4.0). Ogdonia Creek however, showed a Family Biotic Index of 3.8 in 2012, which is exactly the same as in 2010 (3.8). In 2012, the EPT taxa percent of all macroinvertebrates for Big Bear Creek was 61.9% and for Ogdonia 53.6%. The relatively high EPT taxa's being present signifies that the water quality is good because the EPT taxa's tend to be more intolerant to pollution than other taxa's. Although the macroinvertebrates are present and the water quality seems to be very good, the amount of macroinvertebrates colonizing are fewer after the flood then before the flood but are rapidly increasing.

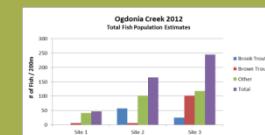
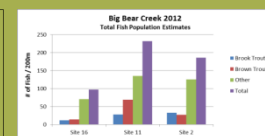
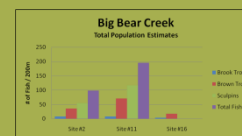
Fish population estimates were completed between June and July 2012. Mean trout density per 200m was 61 at Big Bear and 65.3 at Ogdonia Creek. For Big Bear Creek and Ogdonia Creek the presence of brown trout was higher than the presence of brook trout.



2010



2012



The tables above demonstrate that there are no real significant effects on the water quality based on the parameters of pH, conductivity, alkalinity, DO, temperature, and TDS from the September 2011 flood.

Four species of fish were found at Big Bear (Brook trout, Brown trout, slimy sculpin, and longnose dace). Longnose dace were not present before the September 2011 flood and could be a result of them migrating up due to the lower dam blowing out during the flood. Whereas, at Ogdonia Creek blacknose dace, tessellated darter, and creek chubs were found in addition to the same species found at Big Bear Creek.