Prepared in cooperation with

Cornell University Cooperative Extension Ulster County
New York City Department of Environmental Protection
New York State Energy Research and Development Authority

Effect of Flooding from Tropical Storm Irene on Fish Assemblages in the Upper Esopus Creek Basin

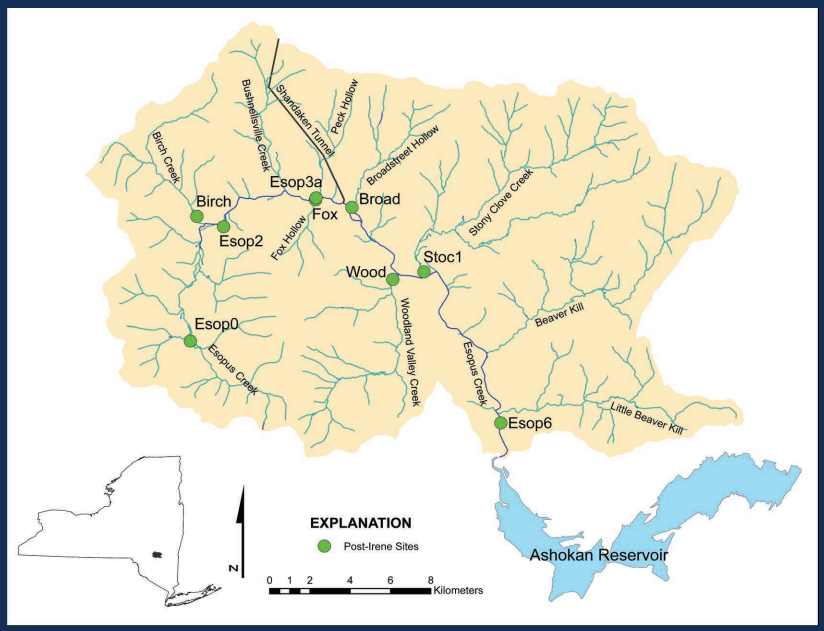
Flooding strongly affected stream habitat and fish populations at several study sites, but had relatively minor effects on the overall fish community basin wide.

Background

The Esopus Creek, a popular trout-fishing and recreational stream in the heart of the Catskill Mountains, received historic flooding from Tropical Storm Irene on August 28, 2011. Streamflows approached or surpassed the 1% annual exceedance probability (>100 year) flood levels at several USGS streamgages in this basin. Short-term flood impacts on biological assemblages have been assessed in several studies, but longer-term effects, recovery, and analysis of factors affecting ecosystem resiliency have rarely been investigated.

The U. S. Geological Survey (USGS), New York City Department of Environmental Protection (NYCDEP), and Cornell Cooperative Extension of Ulster County (CCEUC) collaborated on a study of fish communities at 18 sites from 2009-2011 (prior to the flood). The pre-flood data at these sites provided an opportunity to quantify the impacts of Irene on stream fish assemblages and to assess the relations between landscape and channel features that limit the level of disturbance and hasten recovery.

Upper Esopus Creek Watershed



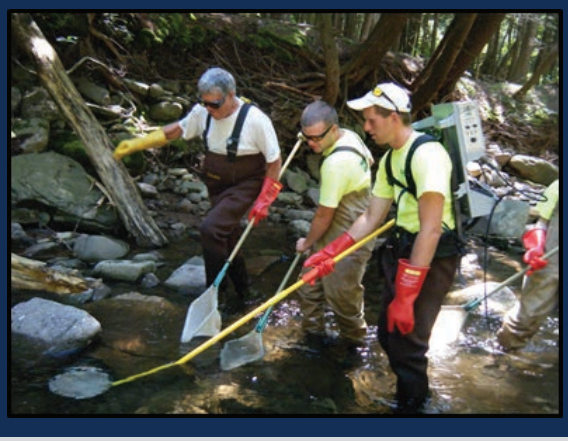
Upper Esopus Creek before Irene

Upper Esopus Creek after Irene

U.S. Department of the Interior
U.S. Geological Survey

April 2013

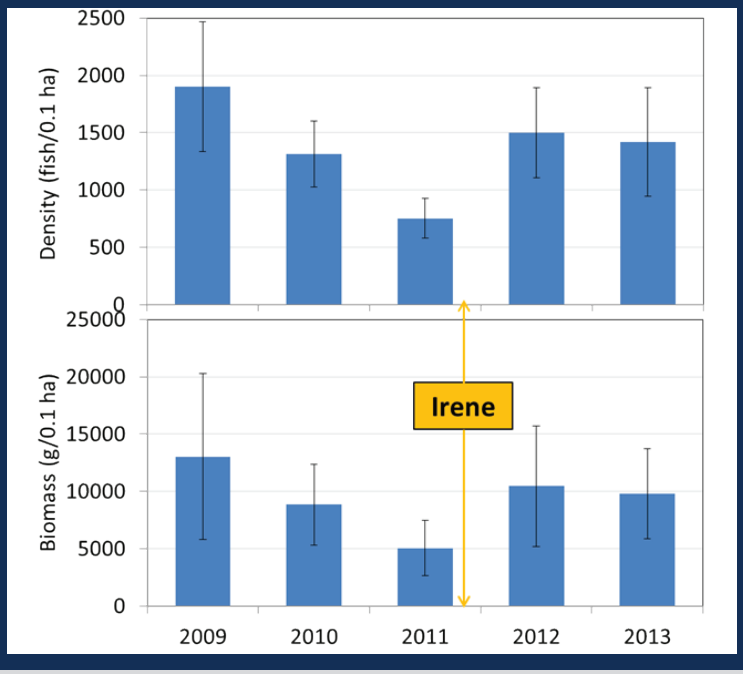
Field crew sampling fish assemblages



Objectives

The main objective of this study is to increase our understanding of the response (short- and long-term impacts) and recovery of fish assemblages to extreme hydrologic events and to determine how landscape and channel features affect this process. More specific goals are to document the impacts, recovery, and apparent resilience of brown and rainbow trout populations and entire fish communities in the Upper Esopus Creek basin.

Average Community Density and Biomass, 2009-13



Approach

Additional funding by CCEUC, New York State Energy Research and Development Authority (NYSERDA) and the USGS allowed for resampling fish assemblages at 9 of the original sites during both 2012 and 2013. Data was complied, verified, and analyzed to test hypotheses that the floods would cause:

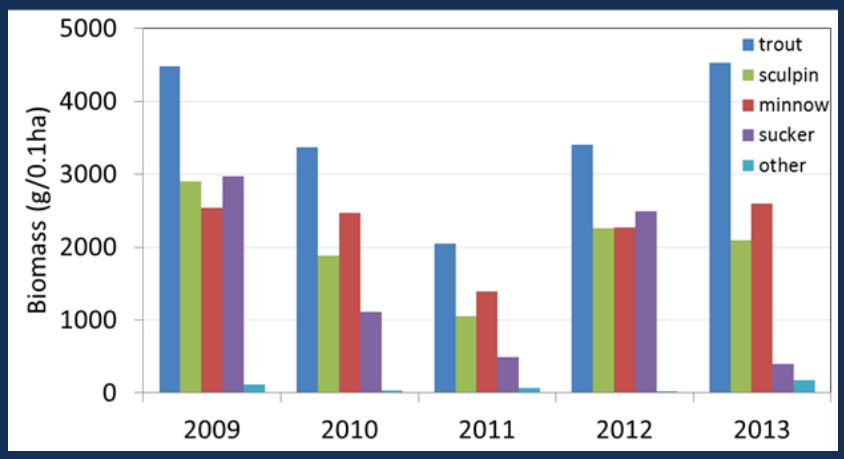
- decreases in density and biomass of fish communities,
- shifts in community structure, and
- more severe impacts on species of small fish and early life stages of large species, especially young-of-the-year trout.

Preliminary Results

Analyses conducted to date indicate that:

- the overall fish community across the basin was minimally affected by the flooding.
- fish assemblages at individual sites responded differently, and
- the impact and recovery of brown, and rainbow trout populations differed,
- brown trout had an enormous 2012 year class following the flood and population age structure shifted toward younger (age 0+ and 1+) fish,
- rainbow trout populations, already declining from 2009-2011, continued to decline in 2012 and 2013

Average Group Biomass, 2009-13



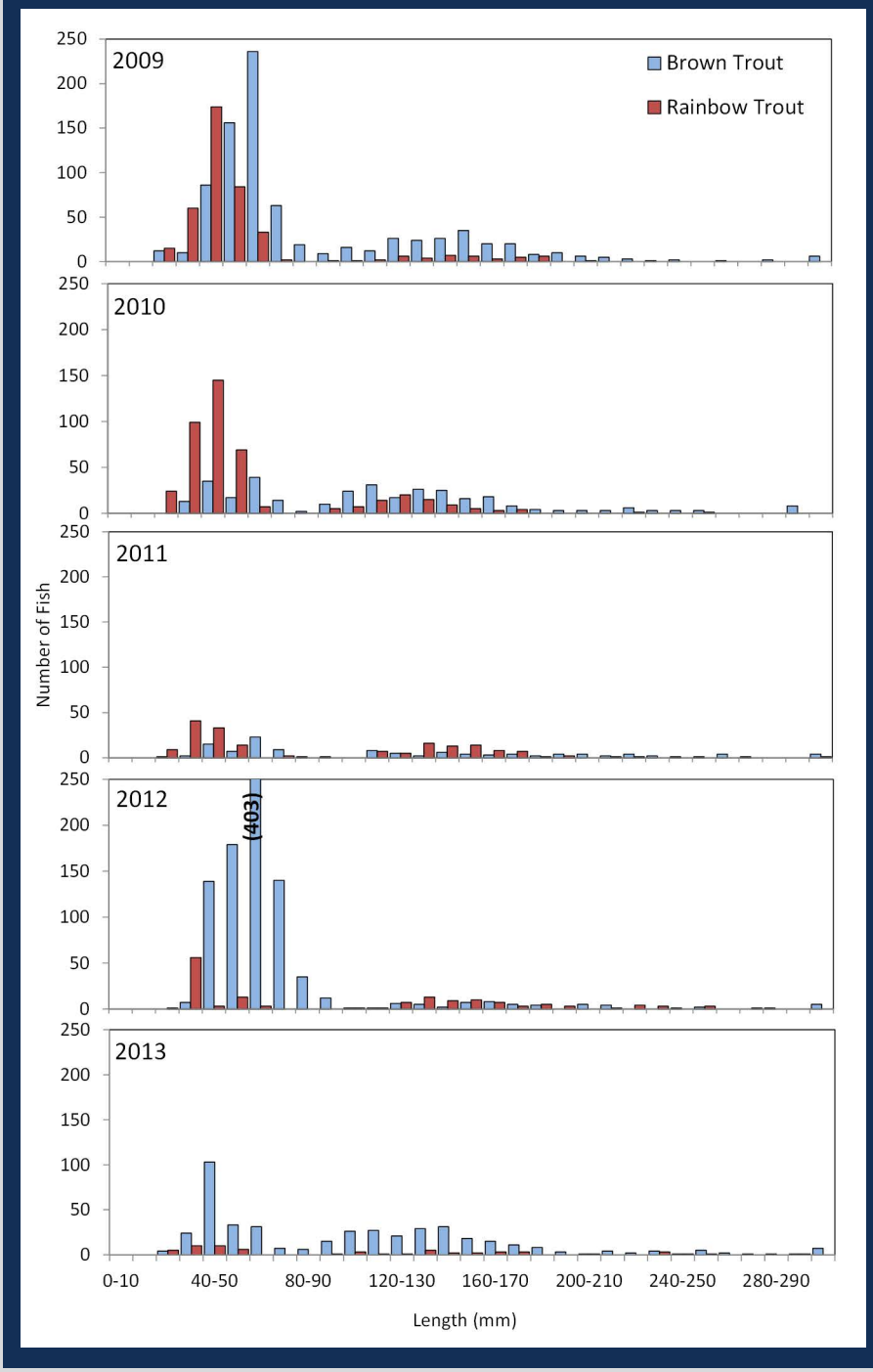
Wild Esopus Creek Rainbow Trout

Conclusions

- local fish communities are fairly resilient to extreme hydrologic disturbance,
- individual species and sites were affected to different degrees by the flooding
- the sampling interval was critical to correct interpretation of species and community impacts
- the increase in some fish community metrics during the post flood years (2012, 2013) may be attributed more to the poor pre-flood (2011) condition of the fish community than to direct effects of the flood, and
- continued surveys at these 9 sites in 2014 will help assess and interpret longer-term impacts and recovery from extreme hydrologic events

Retired DEC Region 4 fisheries manager Walt Keller holding a large Esopus brown trout captured during a 2009 survey

Length-Frequency Distribution for Brown and Rainbow Trout



Publications

George, S.D., B.P. Baldigo, A.J. Smith, and G.R. Robinson. In review. Effects of extreme hydrologic events on trout populations and fish communities in a Catskill Mountain river. Freshwater Biology.

For Additional Information

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