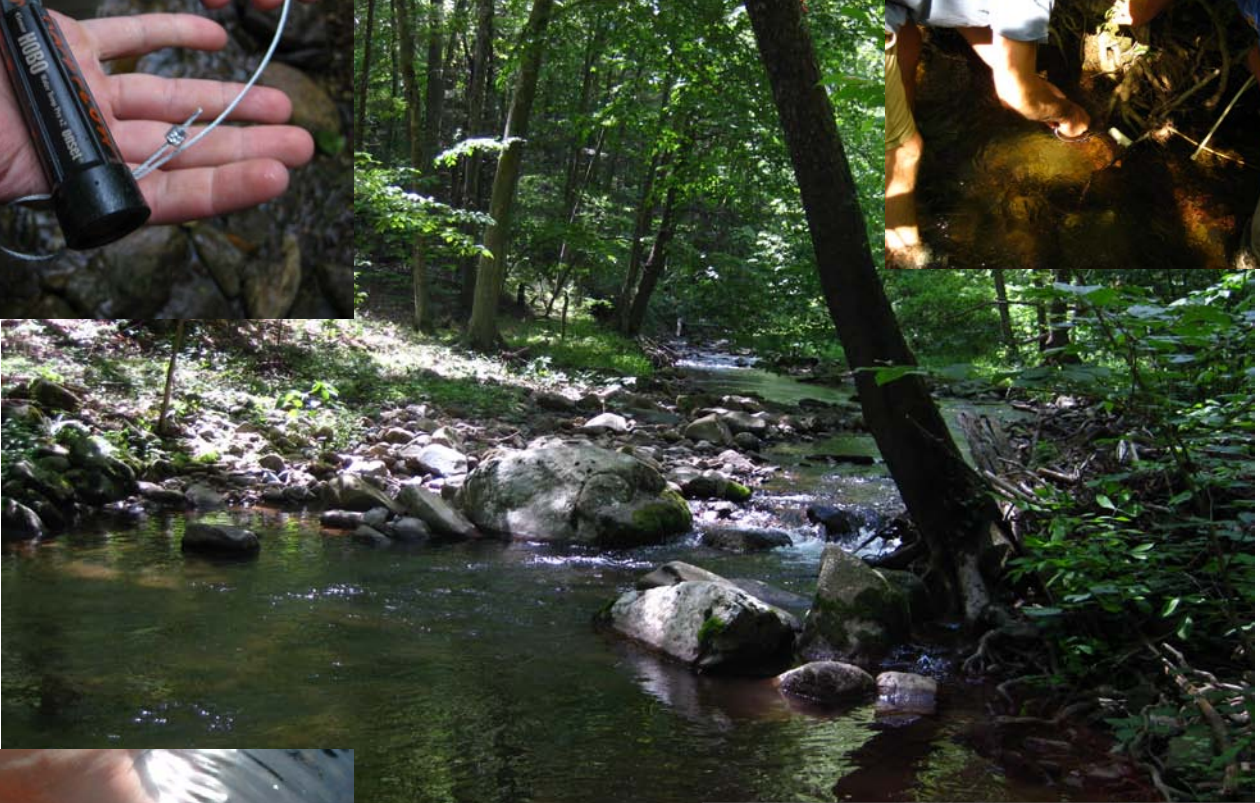
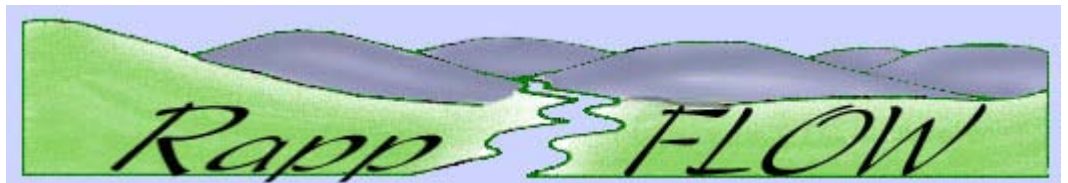


Water Temperature Study 2010: Thornton and Rush Rivers



Prepared by BJ Valentine for Rapp FLOW
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Project Description

In 2009, the Rappahannock Friends and Lovers of Our Watersheds (Rapp FLOW) and Trout Unlimited (TU) started on a project to better understand brook trout in Rappahannock County, VA. A report produced by TU for the Eastern Brook Trout Joint Venture, *Eastern Brook Trout: Status and Threats* gave an assessment of brook trout habitat for each state in the eastern U.S. For Virginia, the greatest threat to brook trout habitat was high water temperatures, followed by poor land management, lack of riparian habitat, grazing, and stream fragmentation (ex: roads). Their assessment shows that brook trout have been extirpated or their habitat has been greatly reduced in Virginia, but for the sub-watersheds on the eastern portion of Shenandoah National Park (SNP) the assessment rated the habitat as being “Intact.” Most of the habitat in Rappahannock County for brook trout is contained in Shenandoah National Park in the head waters of the Rush, Thornton, Hughes and Hazel Rivers due to more ideal water temperatures through thorough overhead vegetation and shading. Eastern brook trout prefer water temperatures below 68°F, while they cannot survive temperatures above 77°F. Rapp FLOW with TU and the Piedmont Environmental Council (PEC) decided to not only try and collect more data on brook trout habitat in Rappahannock County but also work on improving the stream buffer corridor further downstream from the park.

As a starting point we used a digital mapping layer of coldwater streams for Virginia, published by the Virginia Department of Game and Inland Fisheries. This gave us a regional idea of where brook trout distribution possibly may extend outside of SNP in Rappahannock County. In order to assess if the streams extending out of the park may be suitable brook trout habitat, we needed a better understanding of water temperatures during the warmest months of the year. Using the coldwater streams map, and overlaying maps of riparian cover collected by Rapp FLOW, we established monitoring sites as close to the SNP boundary as we could and sites further downstream. For the first year of data collection, we have focused on the north fork and south fork of the Thornton River and the Rush River (8 sites Total). More sites along the Hughes and the Hazel Rivers will be added in the next sampling season. To collect the data we used HOBO Water Temp Pro V2 temperature loggers to take continuous measurements once every hour for 5 months.



Photo by Virginia Valentine

Figure 1. HOBO Water Temp Pro V2 temperature logger with cable.

These loggers were anchored at each monitoring site with a thin diameter cable, and were placed either in a riffle or pool section. Most of the loggers were placed in May of 2010 and were collected in early October. Data was then retrieved using a data shuttle and HOBO software.

Site Locations

Rush River Sites

Upper Rush River: Harris Hollow Road (Utility Easement)



Photo by Virginia Valentine

Figure 2. Temperature logger location on Harris Hollow Rd. The Red oval marks the temperature logger's position in stream. Photo to the right shows the depth of the pool on 5/19/10.

HOBO temperature logger was installed on 5/19/2010 off of Harris Hollow Road in a knee deep pool under a basswood. Both sides of the stream are vegetated with trees and shrubs providing a fairly good canopy for shade. Data logger was removed on 10/13/10. The pool was still knee deep (17-18 inches), but due to the summer's drought conditions it is suspected that during the summer the flow was severely reduced. When retrieving the logger, fish were observed in the pool but they could not be positively identified.

Middle Rush River: Above the U.S. 211 Bridge



Photo by Virginia Valentine

Figure 3. Rapp FLOW volunteer placing temperature logger between Old Mill Rd bridge and the US 211 bridge. The photo to the right shows the water depth on 5/19/10.

Temperature logger was established on 5/19/10 between the bridges of Old Mill Rd and US 211. The probe was attached to the root mass of a sycamore and placed in a riffle section just before going into a deep pool. Water was only about a foot deep on 5/19/10. Probe was collected on 10/13/10. Water levels were about three to four inches shallower than when the probe was installed, but water levels were extremely low during the summer months. Even though the site has large mature sycamores, the canopy is fairly open compared to most sites in the study. The edges along the stream are well established. On 10/13/10 volunteers observed about 8 tires that have been dumped downstream of the Old Mill Rd bridge.

Upper Rush River: Old Ski Lodge Bridge and Clarke Property (Rush Top Bridge)

Instream habitat and Riparian cover are quite good from Old Ski Lodge Lane area up to the Harris Hollow Bridge. Water quality parameters were normal that day for pH and Total Alkalinity. The upstream site, below the most upstream Harris Hollow Bridge, has

some moderate sediment/silt impacts. The fish assemblage suggests that water temperatures reach warm levels in the summer that exceed the threshold for brook trout. The lack of an juvenile brook trout suggest that the warm water temperatures and possibly silt loading is prohibiting brook trout reproduction in this section. The finding of two good sized brook trout demonstrate that the physical habitat and water quality can support brook trout. Although a full macroinvertebrate sampling is needed to really get a true picture of the water quality and issues of nutrient pollution, the observation of numerous Perlidae stoneflies (Golden Stonefly Order Plecoptera) and various other mayfly and caddisfly specimens suggest water quality is good. Efforts to restore riparian vegetation and tree cover to the Rush River upstream of the project sites, and reduce some of the sediment input, would likely improve brook trout habitat in this section of the river.

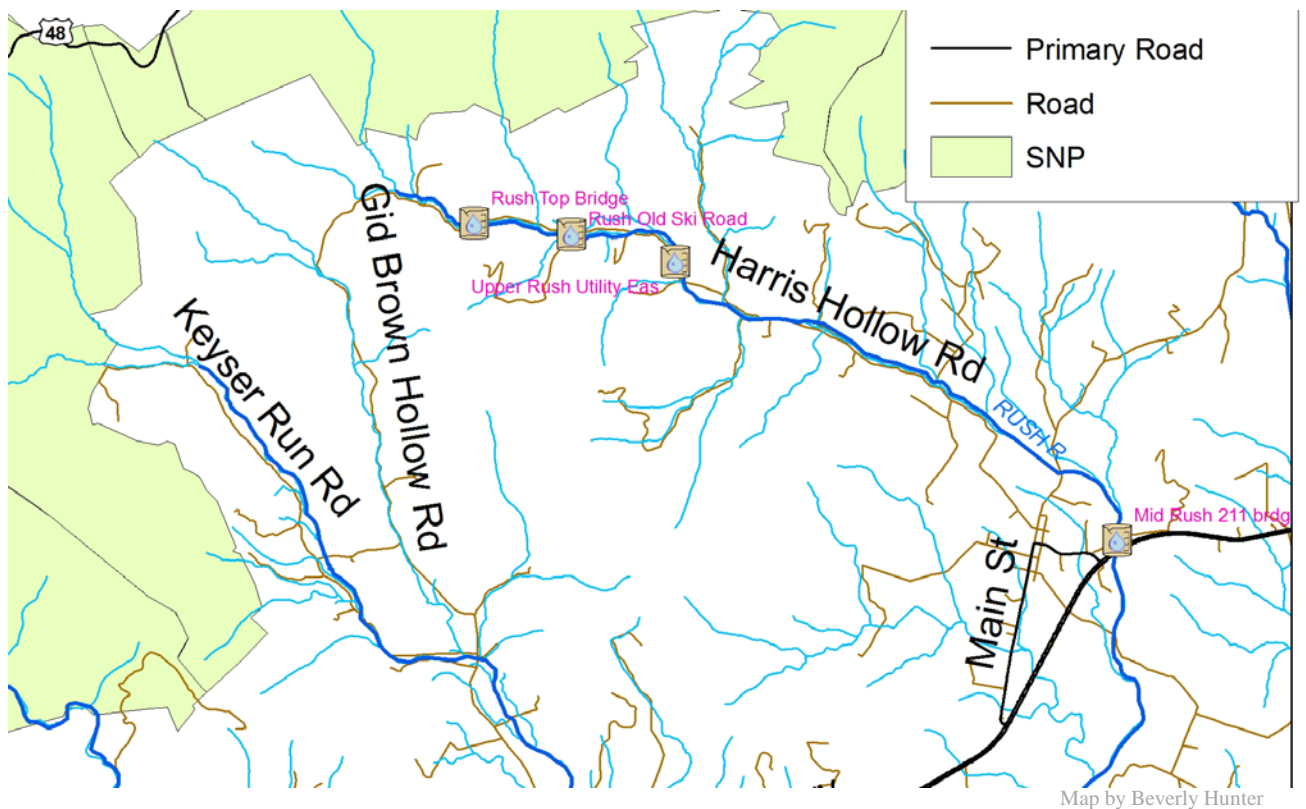


Figure 4. Temperature monitoring sites in the Rush River Watershed.

North Fork of the Thornton River

Upper North Fork Thornton (Fitzhugh's Property):

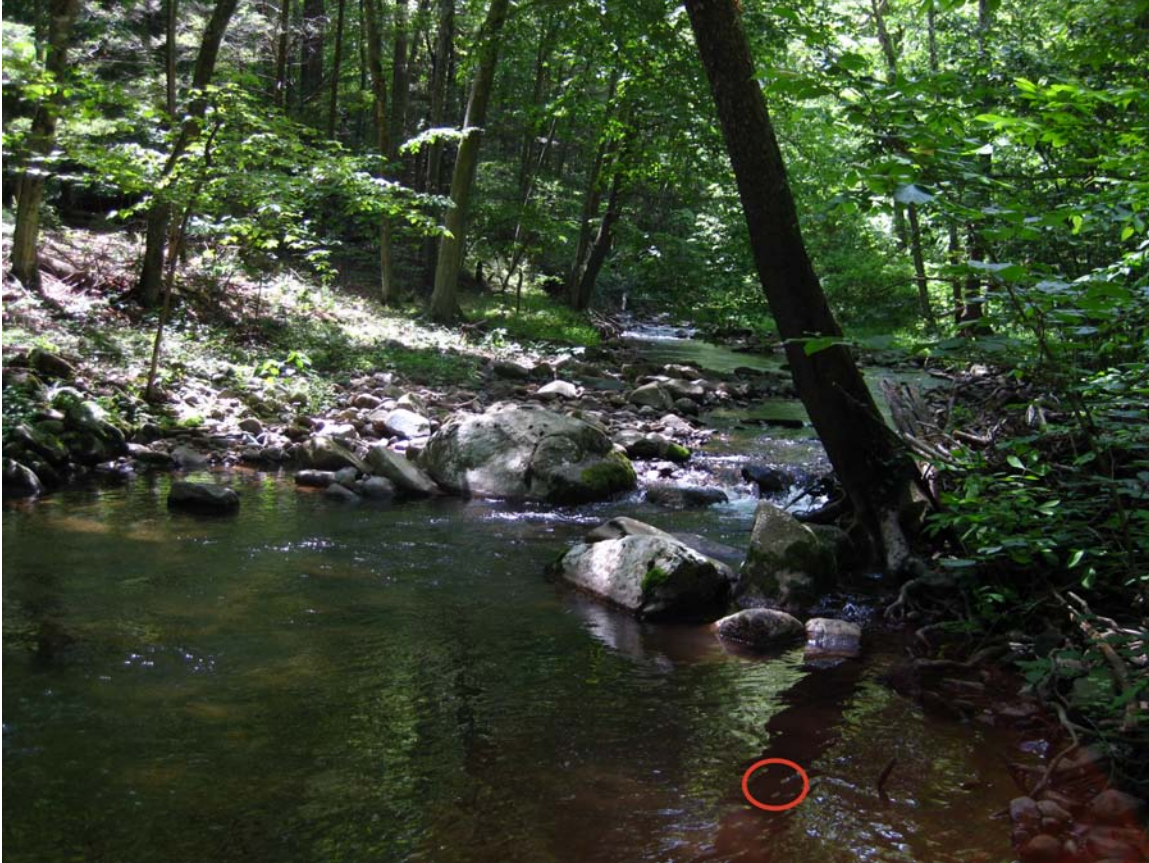


Photo by BJ Valentine

Figure 5. Temperature logger location on the Upper North Fork of the Thornton River on the Fitzhugh's Property. Red oval marks the temperature loggers position in the stream.

Temperature logger was established on 5/20/10 off of Old Hollow Rd, roughly a mile downstream from the Shenandoah National Park boundary. The probe was attached to a root mass and placed in a backwater section of a pool. Water was only about a 6-7 inches deep on 5/20/10. Probe was collected on 10/13/10, with water levels at about 5-6 inches deep. Site is well shaded and protected with mature hardwood trees and understory shrubs.

Lower North Fork Thornton: Mount Vernon Farm

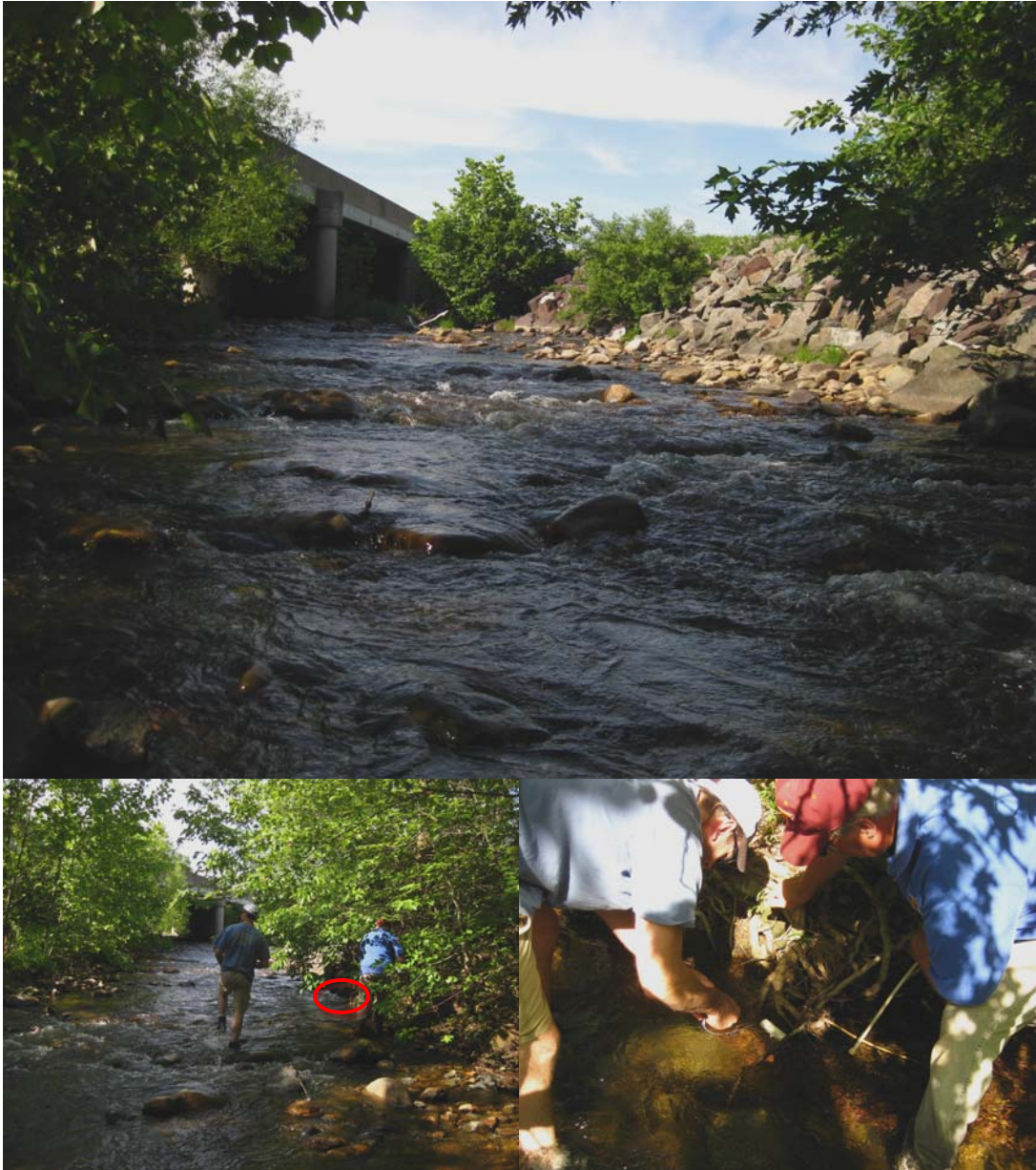


Photo by BJ Valentine

Figure 6. Temperature logger location on the lower north fork of the Thornton River at Mount Vernon Farm. The temperature logger was established by Trout Unlimited. The red oval marks the location of the temperature logger. The image to the lower right show how the temperature logger cable is attached to a root mass. Once fixed to the root mass, the logger is covered with river cobbles and stones.

Temperature logger was established on 5/16/10 just downstream from the US 211 bridge at Mount Vernon Farm. The probe was attached to a root mass and placed in a riffle section. Water was only about a 5-6 inches deep on 5/16/2010. Probe was collected on 10/5/10, with water levels at about 4-5 inches deep. Site is shaded on both sides of the stream with mature sycamores and shrubs, but approximately thirty-five feet upstream the channel on one side of the stream bank is rip-rapped with rock and has little to no

vegetation. The data logger at this site was established by the Rapidan Chapter of Trout Unlimited.

South Fork of the Thornton River

Upper South Fork Thornton: Hearthstone

Temperature logger was established late in the season on 7/19/10 at the Hearthstone School about 0.25 mile downstream from the SNP boundary. The probe was attached to a root mass and placed in a pool. Water was only about a 5-6 inches deep on 7/19/2010. Probe was collected on 10/5/10, with water levels at about 18-20 inches deep. Site is shaded on both side of the streams with mature sycamores and other hardwoods with a shrub understory. Buffers on both sides of the stream are only about 25-30 feet in width.

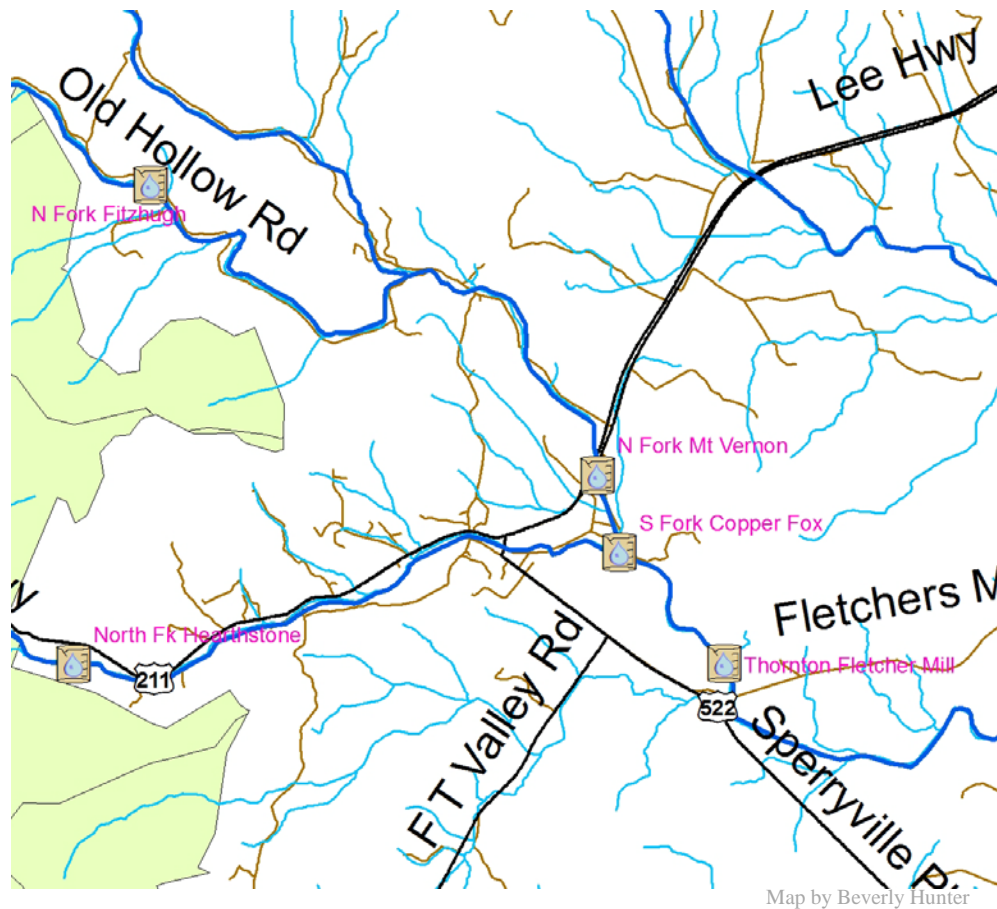


Figure 7. Temperature logger location in the Upper Thornton River Watershed.

Lower South Fork Thornton: Copper Fox

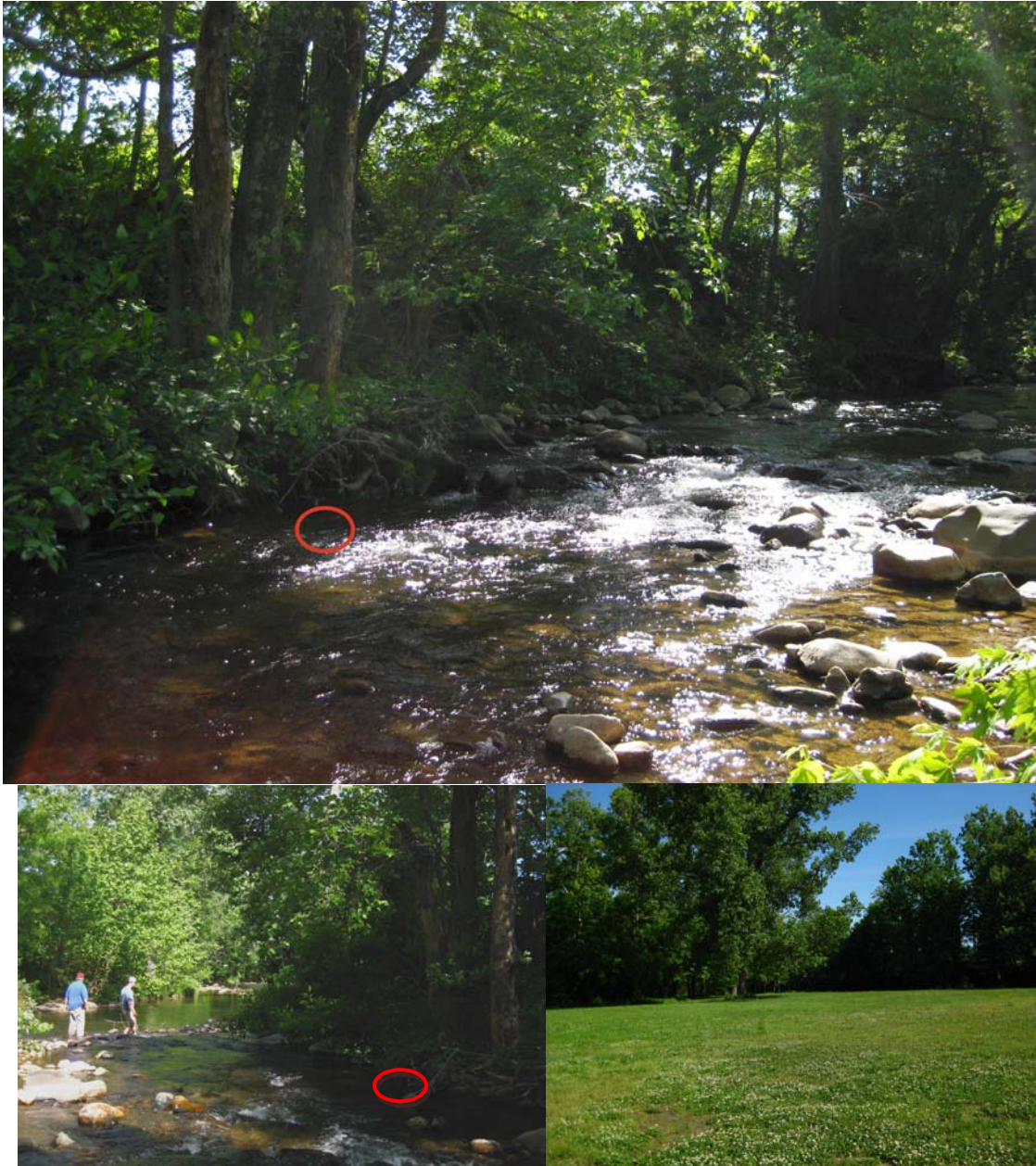


Photo by BJ Valentine

Figure 8. Temperature logger location on the lower south fork of the Thornton River just before the confluence of the forks at Copper Fox Antiques. The red oval marks the location of the temperature logger. The image to the lower left shows the confluence of the north and the south forks. In the lower left hand image, the South fork is at the tree line in the background. Only one wide of the stream is fully vegetated with trees and shrubs.

Temperature logger was established on 5/20/10 just downstream from the US 211 bridge at Mount Vernon Farm. The probe was attached to a root mass of a large sycamore and placed in a pool. Water was only about 16-17 inches deep on 5/20/2010. Probe was collected on 10/13/10, with water levels at about 17-18 inches deep. Site is shaded on

one side by a narrow buffer of mature hardwoods with a shrub understory. The stream bank on the side towards the Copper Fox is grassed and open.

Data Overview

Water temperature data is shown in the attached graphs for both forks of the Thornton River and the Rush River. Also graphed for each stream section are the optimal temperature for brook trout (< 68° F) and the temperature range that brook trout cannot tolerate (> 77° F). Between the range of 68° F and 77° F brook trout can only tolerate the water temperature for a few days.

	Temp. Logger	# of measurements	Min. Temp (°F)	Min. Date and Time	Average (°F)	Max. (°F)	Max. Temp. Date and Time	Air Temp. for Max. Water Temp. Days				
								Start Date	End Date	High (°F)	Avg (°F)	Low (°F)
Rush River	Old Ski Lodge Bridge	6/30/2010	9/13/2010	1797	61.4	7/2-3/10 7:00	71.2	89.2	9/3/2010 19:00	90	76	67
	Clarke Property	6/30/2010	9/13/2010	1797	61.6	7/2/10 8:00	71.2	87.6	9/3/2010 19:00	90	76	67
	Harris Hollow Rd	5/19/2010	10/13/2010	3526	54.2	5/20/10 7:00	67.8	78.0	7/16/2010 16:00	94	80	69
	211 Bridge	5/19/2010	10/13/2010	3526	54.5	5/20/10 7:01	71.4	102.6	9/25/2010 13:51	92	78	68
North Fork Thornton River	Fitzhughes Property	5/20/2010	10/13/2010	3506	53.3	10/7/10 8:57	66.0	75.8	7/25/2010 17:00	96	81	74
	Mount Vernon Farm	5/16/2010	10/5/2010	6823	50.4	9/10/10 6:00	70.3	90.0	9/24/2010 16:00	95	80	68
South Fork Thornton River	Hearthstone School	7/19/2010	10/5/2010	1874	54.1	10/5/10 9:00	67.4	78.0	7/24/2010 17:00	98	85	76
	Copper Fox	5/20/2010	10/13/2010	3507	53.6	10/7/2010	69.5	81.0	7/16/2010 17:00	94	80	69

Table 1. Data and general information for each of the water temperature monitoring locations. Air temperature data recorded from <http://www.rappahannockweather.com/>.

All most all of the loggers recorded temperatures that were over the preferable range (< 68° F) starting around the beginning of June and ending in the middle of September. Loggers lower in the watersheds (Rush River at the 211 bridge, N. Fork Thornton River at Mount Vernon, and S. Fork Thornton at the Copper Fox) did exceed >78° F for multiple days in June, July, August.

The temperature data gets very erratic near the beginning of September for a few of the monitoring sites. Some loggers recorded temperatures of 80°-100°F. We believe it is due to the low water flows caused by the lack of precipitation over the summer months. The evidence of this is the fact that every logger placed in a riffle section shows a tremendous increase in temperature while loggers placed in small pools show no spike in temperature values. The logger on the middle Rush River at the US 211 bridge recorded the highest temperature of 102.6° F, which is actually higher than a recorded high air temperature at a local weather station. We believe this is not only caused by being exposed above the water surface but also probably being in direct sunlight due to an open canopy. Also of note is the fact that the high readings from loggers placed in riffles all declined at the same moment in time, even in separate watersheds. There was roughly a 20° F drop in air temperature on 9/26/10 (92° F on 9/25, 70° F on 9/26), that also brought rain to the area. After 9/26 all of the readings from riffles follow similar temperature trends with loggers placed in pools.

Conclusions

Even though sites lower in the watershed exceeded the maximum temperature for brook trout during the warmest months of the year, all of the sites show that in late spring and in early fall water temperatures are adequate for brook trout habitat. This data shows that brook trout may extend further down in the watershed during the cooler times of the year, but further yearly data collection would be needed to make this a fact. We also believe that further improvements to the riparian buffer on these streams would greatly improve the streams ability to maintain cooler temperatures during the warm summer months.

Water temperature is only one piece of the puzzle in determining the quality of brook trout habitat in a stream. Water quality properties (i.e. dissolved oxygen, pH), stream morphology (gravel stream bottoms, adequate pools and riffles) and a healthy aquatic ecosystem (plants, macroinvertebrates, and fish species) all need to be evaluated in order to improve brook trout populations and habitat.

Rapp FLOW and TU will continue to monitor water temperature for the coming years and add other streams in Rappahannock County that contain brook trout higher in their watersheds. Along with PEC we will talk with landowners adjacent to the park and further downstream to fill in the gaps of riparian area that are not forested to improve stream quality. We believe that this effort would help to better protect the already established brook trout populations in the headwaters and allow for better migration of the species outside of the SNP boundary.

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Piedmont Environmental Council – Don Loock

Virginia Dept. of Game and Inland Fisheries – John Odenkirk

References and Other Related Information

Piedmont Environmental Council: <http://www.pecva.org/>

Rappahannock Weather: <http://www.rappahannockweather.com/>

Rapidan Chapter of Trout Unlimited: www.rapidantu.org/

Rapp FLOW: <http://www.rappflow.org/>

Trout Unlimited: <http://www.tu.org/>