



NCDA&CS - North Carolina Forest Service

Stream Restoration Post-Implementation Annual Monitoring Report

Year 3: 2014

Covering the Period of July 2013 through June 2014

For the N.C. Division of Water Resources (DWR)

Project #10-0493:

“DuPont State Forest Lake Julia Outfall Stream Restoration”

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Project Background

Approximately 550 linear feet of stream reach flowing out of Lake Julia at DuPont State Forest in Transylvania County was repositioned and restored in May 2011. The outfall stream channel was originally established in its pre-restoration location at the time when Lake Julia was constructed in the mid-20th Century by a previous landowner. Over the ensuing decades, significant erosion and undercutting of an adjoining earthen embankment was contributing sediment loading into the nearby Little River, and resulting in the loss of large, mature trees atop the failing embankment. In addition, the erosion was accelerated during the first decade of the 2000's as a result of successive years of abnormal flood events from tropical-influenced rainfall systems which tracked over the southern Appalachian Mountains of the United States. The accelerated embankment erosion, if left unchecked, would have undermined the footers of a permanent vehicle access bridge located on the State Forest.

After scoping out the nature of the work that might be required, the N.C. Forest Service (NCFS) obtained funding and contracted with the Department of Biological & Agricultural Engineering at N.C. State University (NCSU) for planning, engineering, and construction management restoration services. The project's primary deliverable was to restore a segment of the outfall stream*, beginning at the bridge on the forest access road (known as the Conservation Road), and extending downstream to where the outfall channel joins the old, legacy stream channel, but prior to the stream's junction with the Little River.

Project Goals

- Establish a new stream channel that is positioned away from the collapsing embankment but within the stream's legacy floodplain.
- Improve the hydrological connectivity between the stream and floodplain.
- Improve the stream's substrate and channel configuration in a manner that enhances or improves aquatic habitat, including fishery habitat.
- Partially backfill the embankment to reduce further loss of trees due to soil erosion.
- Plant a diverse mix of appropriate tree species within the floodplain area to re-establish a protected forested riparian corridor.

Site Visits

Four site inspection visits were made during this recent reporting period: August and November of 2013, and March and June of 2014. It should be noted that the Forest Supervisor and other staff at DuPont State Forest pass by this restored stream reach daily as they travel along Conservation Road to/from the Forest Office. The Forest Supervisor frequently visits the project location to check on the status of the seedlings and the overall stream. If notable concerns are observed, the Forest Supervisor will contact the NCFS Forest Hydrologist in Raleigh. This arrangement allows for the Raleigh-based project managers to reduce the need for extensive travel and associated costs for routine site visits.

*In some of this project's documentation, communications, and on some maps, there are instances in which the outfall stream channel may be referred to as Reasonover Creek, since this Creek is a major contributing stream into Lake Julia and would have likely been the major water course through this landscape if the lake had not been constructed. For the sake of clarity, the segment of stream which was restored, and which begins its course at the spillway of Lake Julia, is colloquially referred to as the *Lake Julia Outfall* by the NCFS. The old, legacy stream channel does not have a given name assigned to it by the NCFS.

Precipitation

The years 2013 and 2014 saw multiple intense rain events, requiring multiple issuances of flood warnings across North Carolina's mountains, including the Little River/French Broad River watersheds. Evidence of extreme flow events on the restoration site were evident, with heavily matted vegetation observed well away from the normal stream channel, sometimes for as much as 30 feet out into the floodplain. The NCFS, in partnership with other state and federal agencies, operates [a remote automated weather station](#) at the "Guion Farm" area on DuPont State Forest. Precipitation totals recorded by this weather station are provided in the table below.

Weather Station Location: Latitude: 35.21° Longitude: -82.59°		
Time Interval of Data	Recorded Precipitation (inches)	
July 2011 - June 2012	63.82	
July 2012 - June 2013	66.76	This weather station was inoperable during August 2012, so the actual precipitation is likely higher than the reported amount.
July 2013 - June 2014	59.68	This weather station was inoperable for 52 days during Nov. & Dec. 2013 and Jan. 2014, so actual precip is likely higher than reported

Vegetation

Vegetation of established seedlings continued to show good growth, despite damage to some seedlings observed in August 2013 after an intense high-water flow event that snapped off the tops of seedlings and matted down others due to the force of the floodwaters.



A river birch seedling snapped off due to floodwater flows. August 2013.

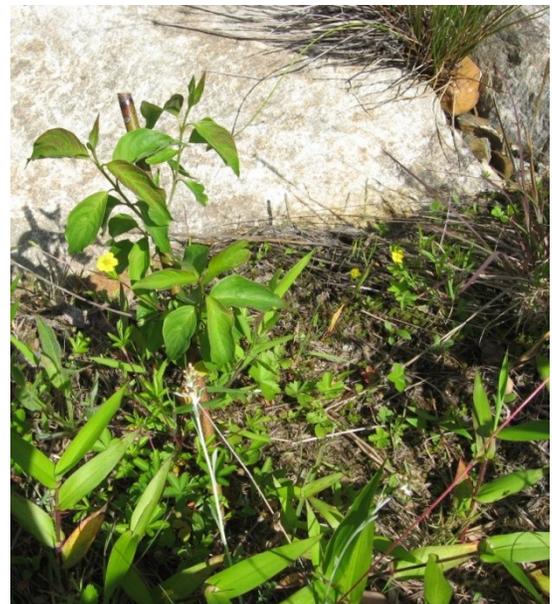


Heavily matted vegetation in the left-bank floodplain. Tree tubes were ripped open by the floodwaters. August 2013.



Seedlings continue to grow well, with many of them reaching heights beyond the protective tree shelter tubes. We will evaluate the need to either retain or remove the tubes in 2014-2015. Both photos taken June 2014.

Additional live stake installation was conducted by NCFS staff in March 2014 to help fill in areas which were lacking vegetation immediately along the streambank. Initial follow-up observations made in June 2014 showed that nearly all of the live stakes had successfully sprouted.



Photos above and right from June 2014, showing sprouting growth of new live stakes that were installed in March 2014.

Monitoring of the site will include routine observations for any nuisance invasive plants which may warrant control effort. There were observations of active tree stem damage from beavers. Action may be needed to control beaver populations so as to assure long term growth of the trees.

Aquatic Biology and Fish Habitat

In May 2013, a fisheries biologist from the NC Wildlife Resources Commission deployed several in-stream monitors to track diurnal temperature fluctuations within the upstream (un-restored) reach of the Lake Julia Outfall, and within the downstream (restored) reach, as well as the receiving waters of the Little River. The Commission wanted to investigate the effects of impoundments on downstream water temperatures, and the NCFS is interested to determine the effectiveness of the restoration to support viable trout fishery habitat. In conjunction with this effort, the NCFS documented, via catch and release, the existence of two species of trout (brown and rainbow) within the restored reach. The presumption is the trout migrated upstream from the Little River, after that waterway had been stocked. But the fact that trout was observed and validated within the restored stream would lead us to conclude that the work to improve the overall habitat conditions, when compared with pre-restoration conditions, has proven successful thus far.

The results of the temperature study indicate that the influence of warmer waters that are constantly released from Lake Julia over the spillway of its dam results in water temperatures being increased by 1° to 2° C within the Lake Julia Outfall channel above the restored section of stream, exceeding the threshold for supporting year-round trout habitat. The temperature monitors that were installed within the restored section of stream could not be located and retrieved due to being washed away.

The NCFS will pursue acquisition of temperatures data loggers for reinstallation in the restored stream segment, to better determine the temperature fluctuations of the restored stream. We wish to determine if the deep pools created as part of the restoration, along with cooler groundwater influx, will moderate the water temperature of the restored stream. The raw data, summary, and graphs provided by the NCWRC are provided in the Appendix of this report.

Casual observations indicate that fish may be using the restored reach for spawning. The photo at right was taken in June 2014, showing a nesting pile of small rocks in the channel.



Stream Stability and Function

Observed in August 2013, there was a small area of left-bank that had scoured away and was beginning to partially undercut the stream bank. This was likely in response to strong flood flows that occurred on the site during 2013. The larger structures, including rock and log vanes, appeared intact and functioning.



Sediment deposition is occurring across the floodplain area, demonstrating connectivity between the stream and its new floodplain. Photo below is from August 2013.



Photo from August 2013 showing a combination rock/log vane structure functioning. Note the matted down vegetation on the far bank, indicating the extent of floodplain flow.

Aerial/satellite imagery available from Google Earth now shows the restored stream segment, as compared with its previous condition. The new alignment and boulder vanes are clearly seen.

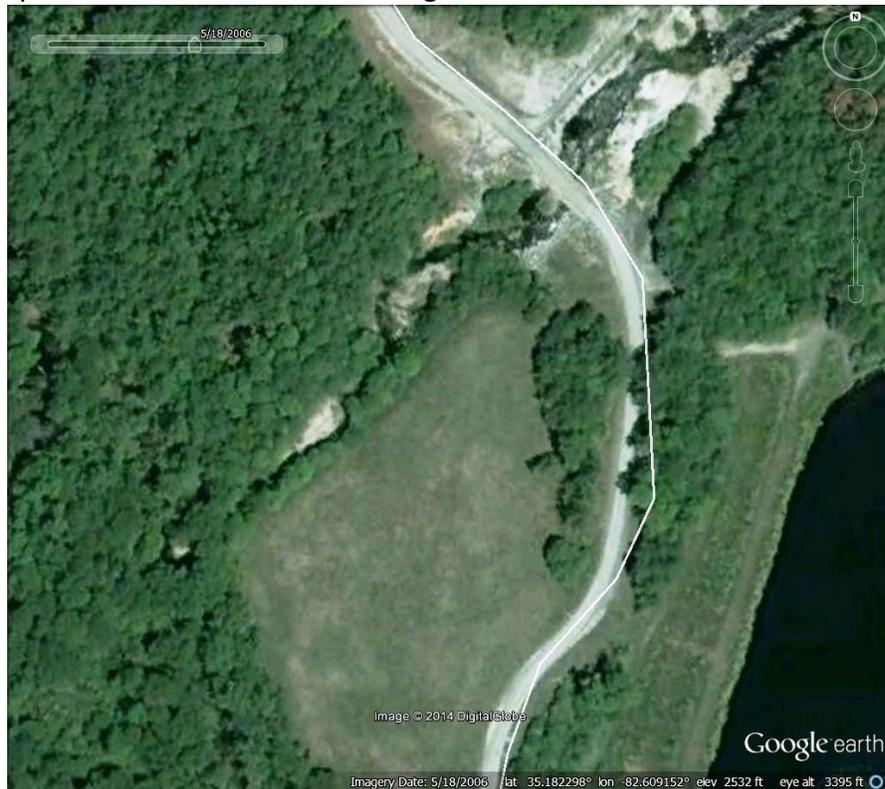


Image above is dated May 2006. Image below is dated February 2012.



Outreach/Education/Training

No coordinated training events were conducted in this reporting period. Installation of the large / overall interpretative exhibit sign remains to be done. Smaller signs that were also produced will be installed at a future time, closer to the stream, once the site vegetation matures, the site fully stabilizes, and a walking trail can be established to allow visitors to navigate through the restoration site safely with minimal disturbance.

Future Restoration Planning

The NCFS is submitting a grant funding proposal to the NCDENR-DWR Water Resources Development Grant Program to fund the development of an overall watershed assessment and restoration plan that would include the upper reach of Lake Julia Outfall/Reasonover Creek, immediately upstream of this completed restoration reach. The watershed plan would also evaluate other bodies of water on the Forest for their needs or potential for restoration; and outline what actions would be appropriate to undertake such a restoration. This plan would be similar to a previously-funded plan that was prepared for the NCFS properties on Gill State Forest / Linville River Nursery, co-located in Avery County.

Continuing Management

- Purchase temperature data loggers and install in the restored stream segment.
- Install the large interpretive sign that provides an overview of the restoration project.
- Monitor stream bank and make adjustments as needed to assure stability.
- Maintain collaborative water temperature study with NCWRC.
- Conduct a survey of vegetation to assess overall survival and growth; monitor for invasives.
- Use the site for field study, educational workshops, and training as needed or requested.

Appendix

Water Temperature Investigation Results Provided by NCWRC:

- Summary of findings with temperature graphs
- Raw data of temperature readings for 1 year