NCDA&CS - North Carolina Forest Service

Stream Restoration Post-Implementation Annual Monitoring Report

Year 4: 2015

Covering the Period of July 2014 through June 2015

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 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 reporting period: September and December 2014, and twice in May 2015. 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 in prior reporting periods, 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)**	**Notes**
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 precipitation is likely higher than reported.
July 2014 - June 2015	54.51	Nearly half of this total precipitation accumulated in 4 months: July (7.35"), Oct.(6.28"), Nov.(5.91") of 2014; and April 2015 (6.01)

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.

Supplemental live stakes were purchased and installed by NCFS staff in May 2015 to help fill in areas immediately along the streambank edge.
Some mortality of tree seedlings were observed this past year, within the protective tree tube shelters.
It is not clear on the cause of mortality. However given the sporadic extent of the dead trees, we do not anticipate needing to plant more. Over the coming winter, we will likely remove some, if not all, of the tree tube shelters now that the seedlings have become established and are emerging from the tubes.

Oak seedling, Sept.2014


Examples of established tree seedlings on the restoration site, Sept.2014

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

Water Quality and Fish Habitat

In early May 2015, the NCFS Forest Hydrologist conducted spot-sampling of the restored reach to assess water temperature, conductivity, and dissolved oxygen, taking samples in both the riffles and pools. The findings indicated complete uniformity in both the temperature and dissolved oxygen readings, with little variability in conductivity.

This indicated that water in both the pools and riffles were well mixed at that time of the year. Conductivity was low but that would be expected given the water is outflowing from the upper strata of the Lake Julia reservoir, which is surrounded by forest, and the outflow water is moving over rather inert rock. Readings taken were as follows:

Temperature: 18.0 º C (64.4 º F)

Dissolved Oxygen: 10.2 mg/L

Conductivity: 18.7-18.9 µs/cm

The NCFS will pursue acquisition of temperature data loggers to better determine the temperature dynamics of the restored stream, building upon prior results from temperature monitoring that was conducted by the N.C. Wildlife Resources Commission at the request of NCFS. 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 during the warmer seasons of the year.

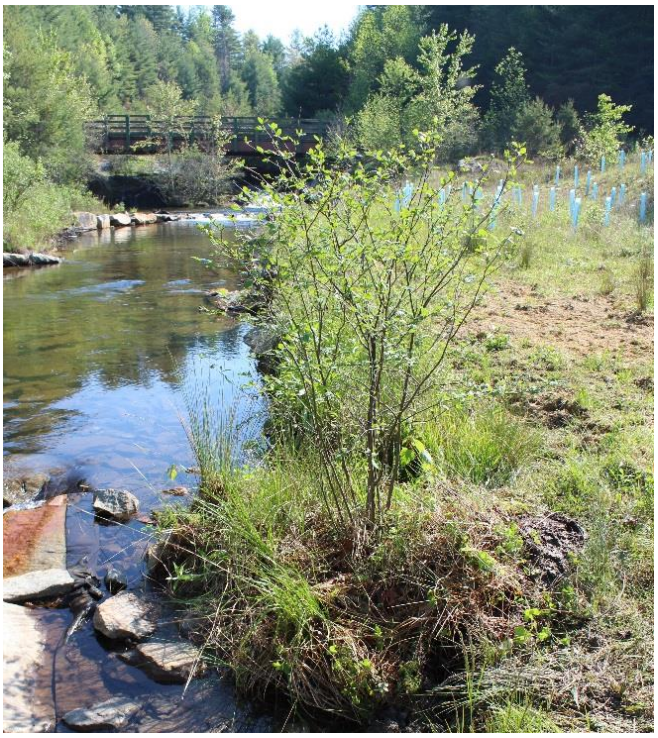
In addition, catch and release fish sampling was conducted in the cool season and warm season, with specimens of rainbow trout captured both times. It is interesting to observe that trout were still present in the restored reach during the May 2015 sampling, as the water temperature was approaching the top of the temperature range for trout tolerance. The assumption is that they move downstream to cooler waters of the Little River during the warmer summer months.

Photo above from December 2014, catch & release sampling of rainbow trout from the restoration reach.

Photo above from May 2015, catch & release sampling of rainbow trout from the restoration reach.

Stream Stability and Function

Minor bank repair work was conducted in May 2015 at a location approximately mid-way down on the left bank of the restored reach. A nearby alder shrub was transplanted from the upland area, into a washed-out spot of the streambank to add stability.



May 2015, immediately after transplanting of an alder shrub and rootball on left-bank.

May 2015, sprouting of a live stake that was installed last year.

A short segment of the left-bank (estimated 10 feet, see photo at left from May 2015) was observed as washing out, at the point where the restored stream reach ties-in to the legacy (un-restored) channel. We will observe this area and if needed consider actions for curtailing or minimizing continued bank erosion.

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 Plan Development

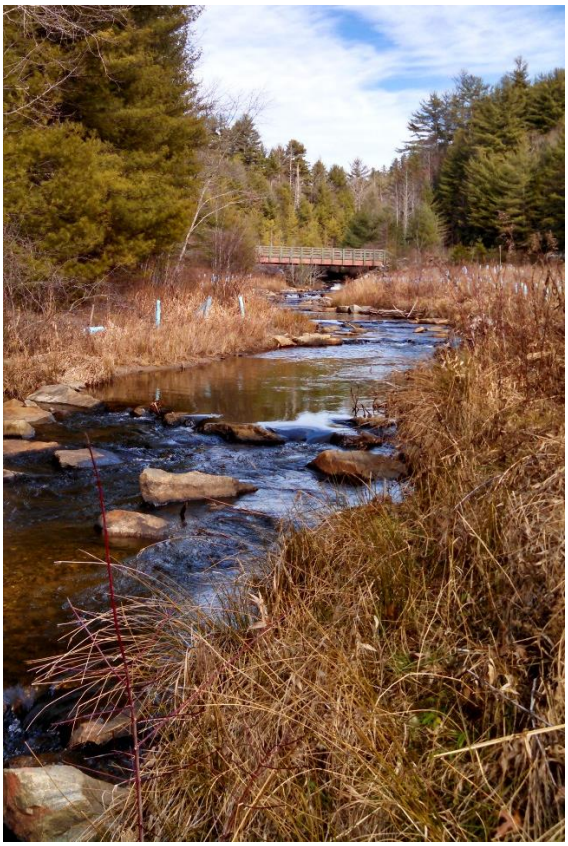
In September 2014, the NCFS was awarded a grant from the NCDENR-DWR Water Resources Development Grant Program to fund the development of an overall watershed assessment and restoration plan for DuPont State Forest. Development of that Plan is ongoing at this time by a contractor. It is anticipated that potential restoration opportunities will be identified within the upper reach of Lake Julia Outfall/Reasonover Creek, immediately upstream of this completed restoration. The Plan will 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 will be similar to a previously-funded plan that was prepared for the NCFS Gill State Forest / Linville River Nursery, 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.
- Remove some or all tree protection tubes.
- Continue to monitor and sample water quality and for fish population.
- Use the site for field study, educational workshops, and training as needed or requested.

Boulder and log vane, May 2015.

Overall project from Conservation Road bridge, Sept.2014.



Overall project from the lower end of the site, Dec.2014

Overall project from the lower end of the site, May 2015.