NCDA&CS - North Carolina Forest Service

Stream Restoration Post-Implementation Annual Monitoring Report:

Year 3 - 2011

For the N.C. Clean Water Management Trust Fund (CWMTF)
Project #2004A-411:
"Rendezvous Mountain Purlear Creek Stream Restoration"

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Project Background

Approximately 2,600 linear feet of Purlear Creek were restored in two phases on Rendezvous Mountain Educational State Forest (ESF) in Wilkes County with funding provided by the N.C. CWMTF. The project was implemented in two phases:

Phase 1: 700 linear feet, UT-Purlear, perennial, Priority 1 restoration.
Phase 2: 1,900 linear feet, mainstem Purlear Creek, perennial, Priority 1 and Priority 2 restoration.

The site was a hay pasture prior to ownership by the N.C. Forest Service (NCFS). The growing and harvesting of fescue for hay production was taking place across the entire pasture and immediately alongside Purlear Creek. This intensive land use along the creek resulted in incised and undercut stream banks. There was no functioning riparian buffer along most of the length of stream within the pasture, except for an occasional large tree.

The outcomes of this restoration project include:

- Align the stream into the natural valley of the site;
- Connect the stream to a functional floodplain;
- Create in-stream structures suitable to manage bankflow events and enhance aquatic habitat;
- Establish a permanent forested riparian buffer.

The long-term goal is to create conditions within Purlear Creek that are suitable for the introduction of trout in partnership with the N.C. Wildlife Resources Commission. More detailed background information about the project's scope of work, the site characteristics and restoration implementation is available in the project's Final Report to the CWMTF dated October 31, 2008.

In addition, a "Phase 3" of this project was accomplished in 2009 with the realignment and restoration of approximately 1,500 feet of Purlear Creek beginning at the downstream ending point of "Phase 2", and extending to the bridge of Mozelles Road over Purlear Creek where the creek leaves State Forest property. This Phase 3 was funded via a grant from the N.C. Division of Water Resources. While this annual monitoring report focuses primarily on Phases 1 & 2 (as these were funded by the CWMTF), occasional discussions regarding Phase 3 may be included in these reports as a means to discuss and depict overall watershed conditions.

Annual Monitoring Narrative

Five (5) individual site visits were made by NCFS personnel to the restoration site during 2011, one each in February, March, August, October, and December. The stream continues to stabilize and is exhibiting excellent hydrologic connectivity with the riparian floodplain. There has been ample sediment deposition and matted vegetation witnessed during multiple site visits, both of which indicate bankfull (or more) stream flows.

The two most notable accomplishments in 2011 were the first herbicide treatment application to control an infestation of kudzu within the riparian zone; and the installation of a stream crossing with portable bridgemats.

Desirable woody vegetation continues to grow well, in spite of the competition from the kudzu and other weedy plants. No supplemental planting of trees should be needed. Short segments of Purlear Creek along Phase-2 are already completely shaded-over during the growing season by the adjacent Alder and Willow shrub thickets which have proliferated after having been salvaged and transplanted during the restoration construction.

During 2011, the NCFS Remote Automated Weather Station situated on the higher elevation portion of Rendezvous Mountain ESF recorded 57.55 inches of total precipitation (data available from the website *www.ncforestservice.gov/fire_control/fc_raws.htm*). Precipitation totals at this location for previous years are included for comparison: 2010: 46.75 inches; 2009: 52.25 inches; 2008: 39 inches; 2007: 33 inches.

Stream Morphology

A stream channel survey will be conducted in early 2012 by NCSU personnel. Observations during 2011 indicated two small areas of stream bank instability along the upper reach of Phase-2, in a location where the old stream channel was retained and in-stream structure was added as part of the restoration. The photos below illustrate these two small areas of instability. Based on our follow-up observation in December 2011, these areas have not gotten any worse. They will be monitored and if needed, hand-work repairs will be made.

Photo at left: February 22, 2011. The stream has washed around this rootwad of alder shrubs along its right bank.

Photo at right: February 22, 2011. This short segment of right bank has been partially undercut.

Photo at left: February 22, 2011. This upper reach of Purlear Creek that was restored in Phase-2 remains stable. The riffles and log vanes that were installed remain intact and functioning. Transplanted alder shrubs (left) have acclimated and put on abundant new stem growth.

Photo at right:
March 7, 2011.
This is a view of the un-named tributary to Purlear Creek, restored during Phase-1 and 2. Note the abundant leaf litter deposited along both stream banks, indicating high water events. Structures remain intact and functioning. Some of the pools are partially filled, as legacy sediment is mobilized downstream through the restored system.

Vegetation

Tree growth remains abundant and there continues to be a diversity of tree species within the riparian corridor. Short segments of Purlear Creek within the Phase-2 are now being heavily shaded during the growing season by abundant thickets of Alder shrubs and Willow trees which were either protected intact during construction, or transplanted from elsewhere on the State Forest during the restoration. As these thickets and individual tree seedlings continue their canopy growth expansion, we are pleased with the prospects of moderating stream water temperature during the spring and summer to the extent that the restored reach of Purlear Creek could once again support cool-water fish habitat.

Both photos taken along Phase-2: February 22, 2011.
Photo above shows clumps of willow on opposite side of stream, and transplanted alder shrubs on near side.
Photo at right shows a short segment which is nearly completely shaded-over by alder during the growing season.

Invasive Plant (Kudzu) Control

In 2010 we identified an infestation of kudzu within portions of the riparian zone. In late August/early September of 2011, NCFS personnel conducted the first herbicide treatment application on the kudzu in an attempt to eradicate the plant from along Purlear Creek. We used a targeted herbicide which is specific to only certain types of vegetation; thus the desirable woody stems within the riparian zone should not be adversely affected by the use of this herbicide. Application was made using backpack-mounted, manually-pumped sprayers. Once we began application, it become apparent that the extent of kudzu infestation was larger than initially thought. The kudzu had progressed along much of the Purlear Creek corridor, downstream to the Mozelles Road bridge. However, the kudzu has not yet progressed very far upstream, nor had the kudzu progressed very far outward (towards the uplands) from the immediate riparian corridor. Based upon our follow-up observations about two months after treatment, it appears that the treatment was successful. As with any attempt to control kudzu, we will need to make successive annual herbicide treatments until such time that we do not observe any further kudzu growth.

Aquatic Insects

An assessment of benthic macroinvertebrates was performed in the spring of 2011 by Dave Penrose, on behalf of the NCSU Department of Biological & Agricultural Engineering. The complete report of the findings is included in the Appendix to this Annual Report, including a full listing of identified species. Overall, the recovery of aquatic insects appears well on course in spite of some legacy sediment build-up within portions of the restored stream reach, and open canopy in the more recently-restored segments.

Bridgemat Stream Crossing

Since Phase-2 of Purlear Creek was restored in 2007, a portion of the State Forest property has largely been inaccessible to vehicles or equipment, due to the lack of a proper vehicular stream crossing of Purlear Creek. In 2010, the NCFS purchased a set of portable, engineered-lumber bridgemats. The bridgemats are 24 feet long and completely span the stream banks on either side. With the rocky nature of the soil, we do not anticipate any issues with soil compaction or stream bank degradation as a result of this bridgemat crossing. The crossing will serve as a BMP demonstration, as well as provide access for NCFS agency use to patrol the property, conduct forest management work, and allow for wildfire control access. This crossing will not be open for public use. The crossing was installed by the NCFS in December 2011. Additional BMP work will be implemented in 2012 to apply gravel along each approachway to the crossing for sediment & erosion control and improved trafficking.

Crossing location prior to bridgemat installation. Vegetation disturbance was kept to a minimum. Soil erosion was mitigated by installation of silt fence.

Bridgemat crossing installed. The State Forest property on the opposite side of the stream crossing is now accessible.

A side view of the installed bridgemat crossing, looking upstream.

View from underneath the crossing, looking downstream.

Outreach/Education/Training

The Purlear Creek restoration was included in a presentation made by NCFS staff at the 21st annual conference of the Southern Appalachian Man and the Biosphere (SAMAB). The presentation, entitled "Highlights and Lessons Learned: Stream Restoration on Two State Forests in the Mountains of North Carolina", is available from the SAMAB website: http://www.samab.org/site/conference-schedules/2011-fall-conference/

Groundwater Investigation

In August, a small team of faculty and students from UNC-Charlotte conducted a day-long investigation of the near-surface groundwater interaction within the hyporheic zone of the restored stream.

The preliminary investigation was intended to determine if future research on the subject matter is warranted, and if Purlear Creek would be a suitable research site. While there have been no further outcomes from this investigation, this site remains viable for future water-related projects when done in congruence with the NCFS property management goals and our contractual obligations with the CWMTF.

Photo at right: August 3, 2011.
A group of faculty and staff from UNC-Charlotte install a shallow piezometer to evaluate the groundwater level along a portion of Phase-3.

Watershed Management Plan

A management plan for the Purlear Creek restoration watershed was drafted by staff of the NCFS Nonpoint Source Branch at the request of the NCFS area supervisor who oversees the management of Rendezvous Mountain Educational State Forest. This plan includes a summary of the obligations between the NCFS and CWMTF, with regard to protecting and conserving the riparian corridor associated with the Purlear Creek restoration. In addition, the plan includes a proposed schedule of activities regarding ongoing management, assessment, outreach, and maturation of the project site projected for the next 5 years. This draft plan is being reviewed by NCFS personnel, and will serve as a foundation upon which to base our agency's management actions on the State Forest, with respect to activities in the Purlear Creek watershed. The intent to assure that management activities on the State Forest are conducted in accordance and in harmony with the long-term water resource protection goals that are affiliated with the stream restoration project.

Goals for Continuing Management

In addition to routine monitoring, other project goals for 2012 and beyond include:

- Complete bridgemat BMP demonstration work
- Conduct a survey of stream channel morphology
- Finalize the Watershed Management Plan
- Continue annual herbicide treatment to control kudzu infestation
- Locate sources of legacy sediments and identify options for control/containment, where feasible
- Conduct a prescribed burn on the uplands portion of the watershed to foster growth of native warm season grasses, control invasive plants, and improve small game habitat

Appendix

- Report of findings from 2011 benthic macroinvertebrate sampling, by Penrose/NCSU

Both photos from March 7, 2011. Top photo is a view of Phase-2 looking downstream. The bottom photo shows a view of Phase-3 looking upstream. The automated rain gauge on the State Forest recorded 5.5 inches of cumulative rainfall over the prior 11 day period. The stream's structure has held up very well in 2011 in spite of the abundant annual precipitation recorded at the site (most since the project was completed).

Our observations of floodplain sediment deposition, matted vegetation, and wrack piles indicate effective connectivity between the stream and its floodplain during high water events.