



N.C. Division of Forest Resources

Stream Restoration Post-Implementation Annual Monitoring Report: Year 2 - 2010

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 in Wilkes County, with funding provided by the N.C. CWMTF. The project was implemented in two phases as outlined below:

- 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 cattle pasture prior to ownership by the N.C. Division of Forest Resources (DFR). Access to Purlear Creek by the cattle had deteriorated the stream banks and allowed the stream to incise and undercut its banks. There was no functioning riparian buffer along most of the length of stream within the pasture area.

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 situated from the downstream ending point of "Phase 2", 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

Four individual monitoring site visits were made by DFR personnel to the restoration site during 2010, one each in March, April, June, and August. A site visit by personnel from our project partners at North Carolina State University (NCSU) was made in May. Overall the stream remains intact and functional. Woody vegetation along each phase is well-established and is beginning to create sections of shade over the stream channel. The Phase 1 and Phase 2 components of the restoration have largely stabilized and are beginning to exhibit signs of 'naturalizing'. Sediment deposition and mobilization is occurring as intended.

Reconstruction of a meander in the restored reach of the stream was conducted in April, along the transition area between the end of Phase 2 and the beginning of Phase 3. This work is further explained later in this report.

A new, but relatively minor infestation of invasive species (kudzu, *Pueraria montana*) was identified along sections of Phase 2 and Phase 3. Control work will begin in the winter of 2011 with attempted removal of the invasive plant matter. The source of this invasive species has not been identified, as this species was not present on the site prior to the restoration work.

During 2010, the DFR Remote Automated Weather Station situated on Rendezvous Mountain recorded a total precipitation of slightly more than 46.75 inches. (http://dfr.nc.gov/fire_control/fc_raws.htm). Precipitation totals for previous years are included for comparison: 2009: 52.25 inches; 2008: 39 inches; 2007: 33 inches.

Stream Morphology

Overall morphology appears intact. No channel surveys were conducted in 2010, but are planned for 2011. Minor reconstruction of a meander bend within the restored stream was completed in April. The inside of the meander had been scoured away from high water flows, and a portion of the outer meander stream bank had also been scoured and partially undercut. Reconstruction work lowered the inside meander bench and deepened the pool within the bend. Erosion control (coir) matting was installed on the newly exposed soil and the area was successfully seeded with erosion control grass. Seed sources from nearby native mature hardwood trees are anticipated to provide woody vegetation regeneration.



Photo 1 above & Photo 2 below were taken in February 2010. They both show the partially scoured stream bank which required reconstruction. Photo 1 is looking upstream; Photo 2 was taken while standing on right bank.





Photo 3: Reconfiguration of the stream's left bank is shown above, April 2010.



Photo 4: Stream left bank has been reconfigured, with the toe of the bank lowered in elevation and the slope reduced, allowing easier floodplain access by high water flow. Final grading and erosion control work is shown above, April 2010.



Photo 5: Overview of the stream repair work, April 2010.



Photo 6: Repaired stream meander shown in August 2010.

Vegetation

Woody vegetation is well-established within the riparian corridor of Phase 1 and Phase 2. The clumps of alder (*Alnus serrulata*) and black willow (*Salix nigra*) that were retained and/or transplanted immediately upon the streambank during the restoration are producing abundant sprouts which are creating short stretches of shade within the restored stream. In addition, growth of naturally-germinated tree seedlings (“volunteers”) from the nearby forested area have contributed to the overall tree seedling diversity and density in the planted area.



Photo 7: Phase 2, shown August 2007 during restoration.



Photo 8: Same location, shown March 2010.



Photo 9: Same location, shown August 2010. Note the abundance of vegetation providing shade alongside the stream, including alder and black willow that were retained during restoration.

In August a regeneration tree seedling tally* was conducted for the first time along Phase 2 and Phase 3:

- The average tree tally along the Phase 2 portion of the Purlear Creek mainstem was found to be 470 trees per acre. This area was planted February 2008.
- The average tree tally along the Phase 3 portion of the stream was found to be 373 trees per acre. This average figure varies widely across the entire Phase 3 area. This area was planted March 2010.

There were 9 predominant species of trees that were observed within the tally plots: alder; black cherry; black walnut; black willow; northern red oak; river birch; swamp chestnut oak; sycamore; and yellow-poplar.

Based upon these findings, the stocking density of trees along the restored Purlear Creek should be adequate to regenerate a diverse riparian forest which can provide adequate shade upon the waters within Purlear Creek for supporting trout fisheries, as well as a viable source of hard and soft mast for wildlife. No supplemental planting of trees is planned or anticipated.

No tree tally plots were conducted along Phase 1 (UT) of the project. However visual monitoring of this restored stream indicates an abundance of tree regeneration due in part to the close proximity and large number of mature trees alongside much of the tributary's length, in addition to the adequate survival of planted seedlings and shrubs.



Photo 10: A swamp chestnut oak (*Quercus michauxii*) along Phase 2 shown in August 2010, 2½ years after planting.

Encroachment of kudzu (*Pueraria montana*) into areas of Phase 2 and Phase 3 is disheartening, as this invasive species was not existent on the site prior to the restoration or reconstruction work. The source of the kudzu has not been identified. During the winter of 2011 attempts will be made to physically remove as much of the kudzu as possible via hand-digging. Follow-up herbicide treatments will be made as needed to keep the invasive plant in check. Additional nearby infestations of other invasive plants (*Ailanthus altissima*, Tree of Heaven and *Microstegium vimineum*, Japanese stiltgrass) will require monitoring to assure they do not impede upon the restoration site. Invasive species control should prove an ongoing challenge.

* The tree tally was conducted by use of 1/100th-acre circular plots along a random course within the riparian zone. Most of the plots were approximately 2-chains apart while other plots were sampled approximately 1-chain apart depending upon proximity to the riparian/upland edge or a property line. This type of circular plot and sampling technique is standard for use in the profession of forestry when conducting seedling survival tally. Plots were largely within the riparian zone, usually within 20 to 25 feet of the stream, and no further than 50 feet from the stream. One (1) chain = 66 feet. This is a standard measuring distance in the forestry profession. Chain distances between plots were estimated by pacing. A 1/100th-acre circular plot equals a circle that has a radius of 11.78 feet.



Photo 11: Kudzu (circled) along a section of Phase 2 on the right bank, shown in August 2010.

Aquatic Insects

An assessment of benthic macroinvertebrates was performed in the spring of 2010 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. Some key findings of this year's survey are included here:

- For Phase 1 un-named tributary (UT), total taxa richness increased following restoration work, and EPT richness has also increased above background conditions during surveys at this site in 2009 and 2010. In addition, dominant in common values (69% in 2010) and the number of indicator taxa have also increased during the most recent investigations. However many taxa that were common or abundant at the reference site were either not collected or were collected at reduced numbers at the restored site.
- For Phase 2 mainstem of Purlear Creek, taxa richness and the presence of indicator taxa remained high during the most recent investigation. However, EPT abundance has not recovered to pre-restoration conditions (average = 159 for 2005-2007; average = 115 for 2008-2010) and the dominant in common value declined to 45% in 2010. The initial positive bump following restoration has been shown to be fairly common, followed by a reduction in this comparison the following year.
- For Phase 3 of the project, the sampling data illustrate a steady decline in taxa richness, EPT abundance, and dominant in common values from the initial survey in 2005 through the 2008 investigation. Once again there appeared to be a positive bump in summary statistics the first year following restoration followed by a decline of the dominant in common evaluation (although taxa richness values remained high in 2010). Interestingly, several EPT taxa were only collected from this most downstream location. Their presence here may represent a change in stream size and habitat complexity or a result of watershed management.

Outreach/Education/Training

The Purlear Creek restoration project was highlighted in a presentation by Dr. Greg Jennings of NCSU at the 2010 Southeastern Stream Restoration Conference. A printed copy of this presentation is included in the Appendix with this Annual Report, and the presentation is available on the internet at the link:

http://www.bae.ncsu.edu/programs/extension/wqg/srp/2010conference/pdfs/jennings_wed4c.pdf

Goals for Continuing Management

In addition to routine monitoring, other project goals for 2011 and beyond include:

- Controlling kudzu infestation and other invasive plant species as needed.
- Conduct a survey of stream morphology.
- Determine feasibility of continuing upstream sediment removal via “Sand Wand” equipment.
- Identify and control sources of sediment from the upstream reach beyond the Phase 1-UT.
- Develop interpretive materials including possible on-site signage.
- Seek guidance from NC Wildlife Resources Commission on stream temperature within restored reach.

Appendix

1. Summary report of benthic macroinvertebrate survey, April 2010.
2. Presentation entitled “Purlear Creek Habitat Restoration Case Study” for the 2010 Southeastern Stream Restoration Conference.

Photographs (example shown below) from a May 2010 site visit by NCSU personnel are available at:

<http://picasaweb.google.com/stream.restore/RMESF2010May#>

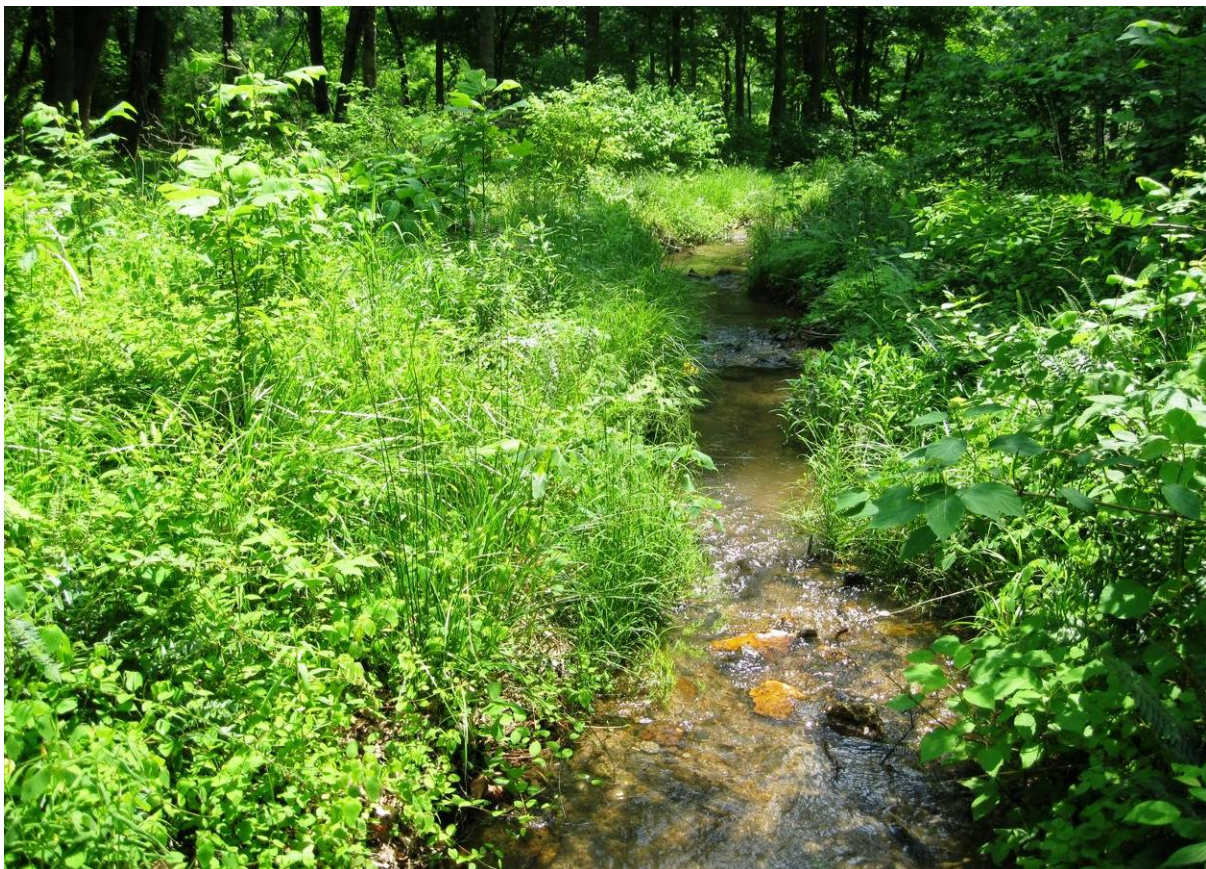


Photo 12: Phase 1 (UT) looking downstream in May 2010. Note abundant woody vegetation growth.