Restoration of a Southern Appalachian Mountain Bog Phase II-Hydrology

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Steward's Circle

Restoration of a Southern Appalachian Mountain Bog Phase II-Hydrology

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ABSTRACT: Bat Fork Bog Plant Conservation Preserve, located in Henderson County, North Carolina, is considered an example of a Southern Appalachian Mountain Bog. Across North Carolina this broadly defined habitat has high conservation significance due to the presence of a number of rare flora. However, very few examples of this wetland habitat remain intact, even those that are protected. In this paper, we describe the hydrology of Bat Fork Bog and efforts to restore this unique site.

Index terms: Bat Fork Bog, conservation, hydrology, mountain bog, plant conservation preserve, restoration, Southern Appalachian Mountain

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INTRODUCTION

The 6.8 hectare Bat Fork Bog Plant Conservation Preserve (Preserve) was purchased by the State of North Carolina in 1996, with funds from the Natural Heritage Trust Fund, in order to protect several rare and imperiled plant species. The Preserve is a remnant Southern Appalachian Bog (Southern subtype) (Gaddy 1994). Schafale and Weakley (1990) describe these bogs as palustrine systems with permanently saturated to intermittently dry places often fed by seepage water in relatively flat areas with acidic, wet organic or mucky mineral soils (Figure 1). The soil in the Preserve is Hatboro loam while that of the surrounding slopes outside of the Preserve is Hayesville loam (United States Department of Agriculture, Soil Conservation Service and Forest Service 1980). Existing examples of this habitat are typically small but support a disproportionate number of rare species of plants and animals relative to their size (North Carolina Natural Heritage Program 2006). For this reason, protection of the remaining bogs is a priority for the conservation agencies of North Carolina. At the time of acquisition, the species of primary concern was the bunched arrowhead (*Sagittaria fasiculata*), a federally endangered species endemic to a two county area of North and South Carolina. The site was also known to support the federally listed swamp pink (*Helonias bullata*) and to have historically supported the federally and state endangered mountain sweet pitcher plant (*Sarracenia jonesii*) and the white fringeless orchid (*Platanthera integrilabia*). Since acquisition, at least three additional rare plants have been documented at the site including the State endangered red Canada lily (*Lilium canadense* ssp. *Editorum*), the bog jack-in-the pulpit (*Arisaema triphyllum* ssp. *Stewardsonii*), and the small-leaved meadowrue (*Thalictrum macrostylum*), both species classified Significantly Rare in North Carolina.

Until recently, with the initiation of the Preserve Steward Program, few resources have been available to manage the Preserve. Phase I of the restoration effort, begun in January 2010, was the removal and control of the reed canary grass (*Phalaris arundinacea*) from about half of the Preserve. Much progress has been made and it is now possible to see the bog through the dying remnants of this highly invasive, often 2.5 m tall grass (Baugh et al. 2011).

Hydrology

Phase II involves a description of the hydrological regime of the Preserve and the development of approaches to restore the current highly modified system. As with most of the wetlands in Henderson County, Bat Fork Bog Plant Conservation Preserve was modified for agricultural purposes. The soils map for Henderson County for 1907 (USGPO) shows an intact drainage pattern. Apparently, ditching in Henderson County began after 1907, the result being more than 60 km of straight, deep drainage ditches and channelized creeks, including the adjacent Bat Fork.

The Preserve is composed of a swamp-forest-bog complex across its northern part with an open wet meadow between the complex and Bat Fork and an area of relatively open water ditches in the southeast corner (Figure 2). The Preserve is located entirely in a depression created by higher, sloping ground to the north and east and levees on the south and west. The levee to the south divides the Preserve from Bat Fork while the levee to the west marks the boundary to adjacent pasture land. Water enters the Preserve from precipitation, overland flow, and, on the north and east, from springs and seeps. The North Carolina State Hydrologist has a weather station in Hendersonville about 3.2 kilometers from the Preserve. Data on total precipitation at the weather station shows seasonal lows in June over the period from 2006 – 2010 of 5.5 cm with the highest average precipitation of 18.18 cm in December. Occasional flooding of the Preserve, over the levees

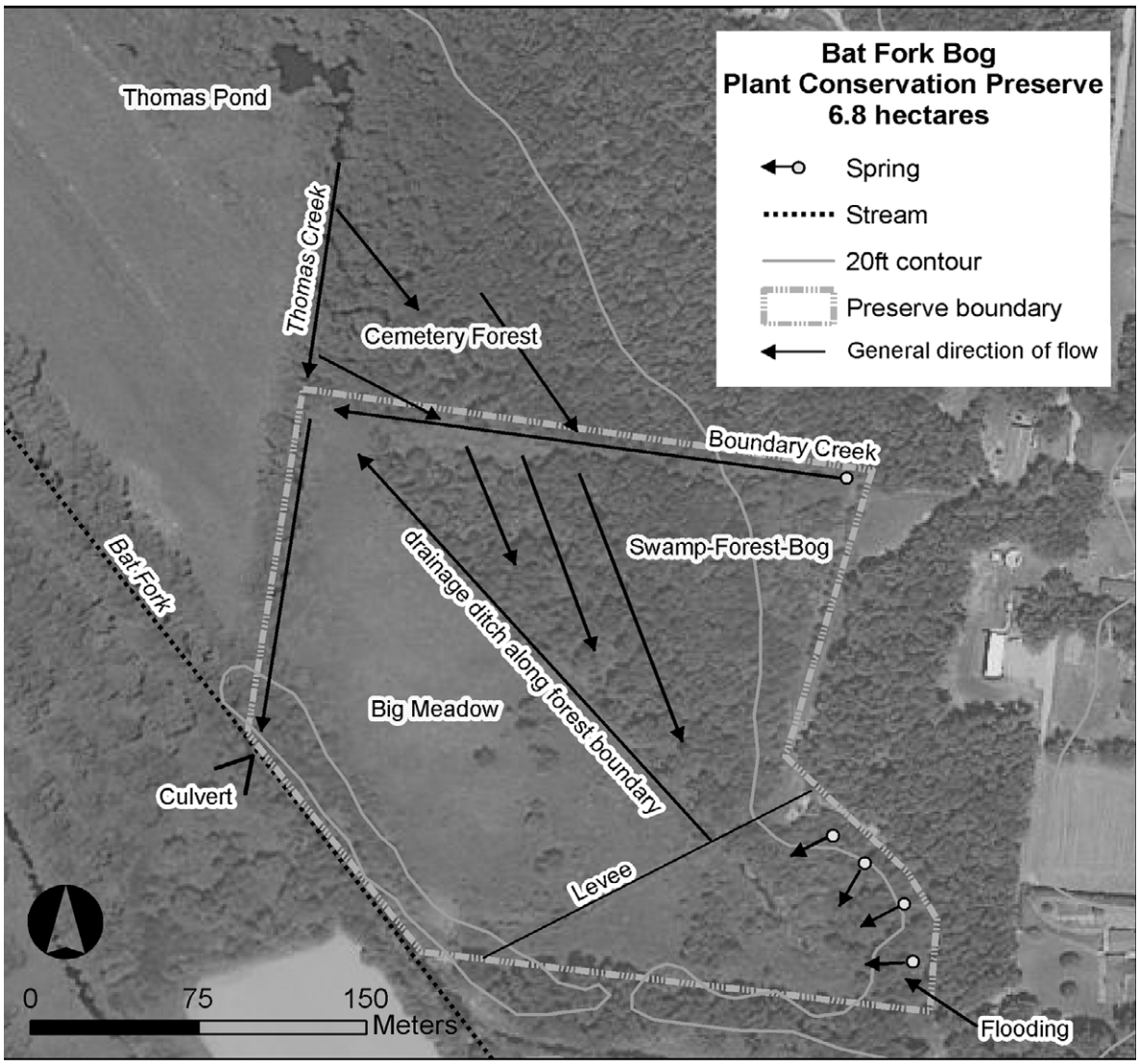

Figure 1. Diagram of Bat Fork Bog Plant Conservation Preserve with features identified.

on the south and southwest, is reported by residents living along the high ground to the east of the Preserve, and was confirmed by the authors on December 2, 2010.

One spring, with seasonally variable flow, has been located on the north boundary of the Preserve along Boundary Creek. These waters flow through an obviously dredged channel before entering a very shallow, possibly natural depression. The depression continues along the northern boundary of the Preserve where it joins with Thomas Creek flowing south from adjacent property. Water from Thomas Creek not only flows into Boundary Creek but also immediately east into a patch of swamp-forest-bog that is part of the adjacent Forest Lawn Cemetery. We call this Cemetery Forest, and it does not hold surface water year round. Thomas Creek holds surface water along its length year round. Boundary Creek holds surface water year round from its spring source west to a point about half way along the northern boundary of the Preserve. Heavy rains in later July and into August 2010, and again in early December, provided enough water to increase the volume in both Thomas Creek and Boundary Creek so that they would join for a day or two and then separate with drier weather.

The importance of precipitation to the Preserve was demonstrated from the last week of August 2010 to the second week of September 2010. Prior to 26 August, the area had received consistently heavy rains. Thomas Creek flowed into Boundary Creek; water from Boundary Creek flowed across the open space between the creek and the northern edge of the Complex. The water level at a shallow (50 cm deep) well in the Complex was 8 cm from the surface mud. There was no measurable precipitation from 26 August to 27 September. By the end of this period, there was no connection between Thomas Creek and Boundary Creek, there was no standing water between Boundary Creek and the edge of the Complex, and the water

Figure 2. Interior of the swamp-forest-bog complex at Bat Fork Bog Plant Conservation Preserve, Henderson County, N.C. (Photo by Tom Baugh)

level in the well dropped 20 cm below the surface mud.

The juncture of Thomas Creek and Boundary Creek is very important in maintaining water flow into the Preserve. As stated earlier, during higher flows, waters from Boundary Creek join those of Thomas Creek at the northwest corner of the Preserve, leave the 'banks' of the very shallow Boundary Creek, flow across an area of relatively open land from 5 – 15 meters wide, and enter the Complex. However, several feet south of where the two creeks join in the northwest corner of the Preserve, a ditch begins, well below the level of the intersection and separated from the confluence by a low, heavily vegetated berm. Prior to beginning management in 2010, some water from Thomas Creek would drain into the ditch along the western border of the Preserve and then down the western side of the Preserve into Bat Fork through a meter (+) wide corrugated galvanized steel culvert. We now direct all of the flow from Thomas Creek into Boundary Creek and, thus, into the Preserve.

The southeast section of the Preserve is a salient or bulge to the east that hosts roughly crescent-shaped, spring and seep-fed ditches from several centimeters to a meter in depth. The water in this salient is the largest area of open water on the Preserve, although it has been heavily colonized by *Phalaris arundinacea*. This area is separated from the rest of the Preserve by an old farm road or a low levee that hold the waters in the southeast salient.

Restoration Tasks

The major concern in restoring water to the swamp-forest-bog complex is a ditch that runs roughly diagonally across the Preserve between Big Meadow and the Complex. As was the intent of those who dug the ditch, this ditch drains water from the Complex into the northwest corner of the Preserve and then down the west side ditch into Bat Fork. At present, our plans are to backfill portions of this ditch at about 50 meter intervals, or possibly less, beginning at the northwest corner of the Complex back toward the levee. Soil for the backfilling will be withdrawn from the levee that crosses Big Meadow.

With little except anecdotal information and no data available, it is impossible to monitor the impacts of these restoration activities in terms of comparison with earlier times. We will have precipitation and water level data in the Complex from July 2010 on. We will consider the backfill plugs along the diagonal ditch a success if water ponds between the plugs.

In Phase III we plan to continue to eradicate all invasive species, restore the hydrology as described above, and, as funds are available, progressively plant those areas currently occupied by *Phalaris arundinacea* with overstory and understory species currently found in the Complex.

Summary

We have developed a preliminary understanding of the hydrology of Bat Fork Bog Plant Conservation Preserve, identified backfilling of the diagonal ditch between the Complex and Big Meadow as the primary hydrological restoration task, and identified future actions in the restoration of this bog.

Tom Baugh is a biologist with a focus on ecology and 30+ years experience in various aspects of conservation biology with one university and two US federal agencies. His current work is in the study and management of Southern Appalachian mountain wetlands. Tom is a member of the Natural Areas Association and a number of other professional organizations. He currently serves on the Executive Committee of IUCN's Commission on Ecosystems Management for North America and the Caribbean.

Rob Evans is plant ecologist and program coordinator for the N.C. Plant Conservation Program. In this capacity he is responsible for developing regulations and conservation programs for imperiled plant species in North Carolina. He oversees the establishment and management of Plant Conservation Preserves, and has obtained nearly $16,000,000 in land acquisition grants since 2005, and has also initiated restoration projects on a number of sites. Previously, he worked with The Nature Conservancy (Southern Resource Office), the USDA Forest Service (National Forests & Grasslands in Texas; Apalachicola National Forest), and NatureServe (Ecology South).

LITERATURE CITED

Baugh, T., R.E. Evans, C.J. Stewart, and S. Artebane. 2011. Restoration of a Southern Appalachian Mountain Bog: Phase I – *Phalaris arundinacea* removal. Ecological Restoration: in press.

Gaddy, L.L. 1994. An inventory of significant natural areas of Henderson County, North Carolina. North Carolina Department of Environment and Natural Resources, Raleigh.

North Carolina Natural Heritage Program. 2006. Guide to federally listed endangered and threatened species of North Carolina. North Carolina Department of Environment and Natural Resources, Raleigh.

Schafale, M.P., and A.S. Weakley. 1990. Classification of the natural communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program, Department of Environment and Natural Resources, Raleigh.

United States Department of Agriculture, Soil Conservation Service and Forest Service 1980. Soil Survey of Henderson County, North Carolina. Available online <http://soildatamart.nrcs.usda.gov/manuscripts/NC089/0/henderson.pdf>.

United State Government Printing Office. 1907. Soil map, North Carolina, Henderson County Sheet. United States Department of Agriculture, Bureau of Soils, Washington, D.C. North Carolina State Archives. Available online http://soildatamart.nrcs.usda.gov/manuscripts/NC089/0/henderson.pdf <http://www.lib.unc.edu/dc/ncmaps/interactive/MC_050_1907h.html>