

# Friends of Plant Conservation



## Welcome- Mamie Colburn

September 2018

Volume X, No. 3

Editor: Katherine Schlosser  
kathyschlosser@triad.rr.com

### TABLE OF CONTENTS

President's Message.....	2
Mamie Colburn.....	3
Calendar .....	4
Menace or Marvel .....	5
FOPC Awards .....	7
Winter Indoor Garden.....	9
Pumpkin Time.....	11
Bat Fork Bog Battle.....	13
Seed Collecting.....	16
One Town's Solution.....	17
Annual Meeting Registration..	26
Annual Meeting Details	27



After the death of David Welch his mother, Miriam, wanted to do something for FOPC and NCPCH in his memory. Conversations with Cheryl Gregory, Lesley Starke, Kathy Schlosser, Alvin Braswell, and Kathy Roberts (David's wife) resulted in the decision to establish a Volunteer Coordinator position at FOPC. The Board heartily agreed. David had hoped for a way to increase the ability of NCPCH to accomplish its mission, and this seemed the best method at this time.

Mrs. Welch sent a generous check and we set about the task of writing a job description. Once that was accomplished, Alvin took over as President and put out job announcements for a 20 hour per week position. We have the funds to keep the position for 20 months (includes a computer, travel and phone reimbursement). In the meantime, we need to do some fundraising to keep the position in place.

Sadly, Mrs. Welch did not live to see the position in place nor to meet our new Volunteer Coordinator, Mamie Colburn. Please see page 3 for more about Mamie, what she will be doing, and how you can help.

**Friends of Plant Conservation, Inc.**  
Newsletter  
NEXT DEADLINE:  
December 10, 2018



# President's Message



For the benefit of all people, plants, and animals, I certainly hope that Hurricane Florence did not treat you too badly and recovery will be fast and not too expensive. Natural events, like hurricanes, can have a wide variety of impacts and benefits (on occasion) for our native systems. Stress, in moderation, has made many of our habitats what they are. Both plants and animals are adapted to their environments and the normal environmental conditions. Exceptional events are another matter, and frequently alter the natural features. This can open habitats to new species, some of which may be invasive and cause damage to the native communities. We should be alert to such changes

and make the conservation community aware when damage is observed.

Fall is almost upon us and hunting seasons are starting up. Take care to be safe in the woods by wearing appropriate, colorful clothing, and be observant of and courteous to hunters. Reporting illegal activity to the NC Wildlife Resources Commission can be a good idea (1-800-662-7137). Confronting illegal activity when the perpetrators are armed can be a bad idea!

Remember to get out the vote for officials that understand and appreciate the need to wisely manage our natural resources for the benefit of current and future generations.

Alvin Braswell  
FoPC President

"The beaver is a persistent practitioner of conservation and should not perish from the hills and mountains of our land. Altogether the beaver has so many interesting ways, is so useful, skillful, practical, and picturesque that his life and his deeds deserve a larger place in literature and in our hearts." Enos Mills, *In A Beaver World* 1913



# Meet Mamie Colburn, Volunteer Coordinator

Though Mamie grew up in Wilson, NC, playing in longleaf pine forests, she has been in the Appalachian mountains for a long time and currently lives in Asheville.

After receiving a B.S. in Environmental Studies from UNC Asheville (where she completed research on mountain bogs) Mamie headed to the University of Idaho. While there, she received her M.S. in Environmental Science with an emphasis in plant ecology. Her thesis was *Habitat Requirements of Spalding's catchfly* (*Silene spaldingii*).

For the past two years Mamie has worked for The Nature Conservancy as their stewardship assistant, overseeing projects on their preserves and managing the volunteer program.

Mamie is passionate about connecting people to nature and working in wetland and forest restoration. She even has experience with prescribed burning. She meets new people with ease, which serves her well in her pursuit of her love of teaching, dance, yoga, and tacos!

Mamie's job is to provide community relations and coordination of volunteers and to perform activities related to ecological stewardship on selected North Carolina Plant Conservation Program Preserves.

Primary duties include finding and training volunteers to work onsite at PCP Preserves to accomplish assigned management tasks. Secondary job duties will include applying for grants or conducting fundraising efforts to keep the position funded beyond the initial 20 months.

If you would like to contribute to the Volunteer Coordinator fund to keep Mamie working with us beyond the first 20 months, please send a check to:

Friends of Plant Conservation  
c/o NCDA&CS NC Plant Conservation Program  
1060 Mail Service Center  
Raleigh, NC 27699-1060

*Put Vol. Coordinator on the reference line.*

*All contributions are appreciated and are tax deductible within the guidelines of IRS.*



Mamie at Linville Gorge after a day of *Hudsonia monotana*, Mountain Golden Heather, monitoring.

*You Are Invited*

*To Meet Mamie Colburn*

*At the Annual Meeting*

Saturday, November 10th

Hickory Grove Baptist Church

3717 Hickory Grove Road

Gastonia, NC 28056

*Be the first to sign up as one of her Volunteers!*



## Field Trip/Workday Calendar

**October 8-11 - One-Two Tie Your Boots, Three-Four Sharpen Your Pencil....** Monitoring *Helianthus schweinitzii* (Schweinitz's sun-flowers) populations is conducted annually on several NCPCP Preserves and related areas. Volunteers will be instructed where and how to proceed, and assigned to a team, an area, and a day to work. Some sites can be completed in one-half day, others take a little longer. Any time you can give will be appreciated. Just tell us which day/days you will be available to help. The work is easy and the sites easy to reach.

*PLEASE NOTE: Dates may need to be adjusted depending on weather and bloom times. We will advise you as best we can.*

**TO REGISTER: Send an email to Nancy Stewart ... [Nancy.Stewart@ncagr.gov](mailto:Nancy.Stewart@ncagr.gov) or CALL 919 -707-3755**

Directions and other details will be emailed about a week before the event. Please also leave a telephone/cell number so we can reach you.



**November 10—Menace or Marvel: Beavers on Preserves. Annual Meeting of Members and friends. Gaston County near Redlair. Featured speakers include Cecil Frost. Registration info at end of newsletter.**

Friends of Plant Conservation, Inc. is recognized by the Internal Revenue Service as a 501(c)3 tax exempt organization and is maintains a Charitable Solicitation License with the North Carolina Secretary of State.

Mailing address:  
Friends of Plant Conservation  
c/o NCDA&CS, NC Plant Conservation Program  
1060 Mail Service Center  
Raleigh, North Carolina 27699-1060



# *2018 Annual Meeting of Members*

## **Menace or Marvel: Beavers on Preserves**



**Saturday, November 10, 2018**

**9:30 am—5:00 pm**

Speakers include **Cecil Frost**, Lesley Starke, and Cheryl Gregory.

This will be a special day

to **CELEBRATE**

**the 10th Anniversary of FOPC.**

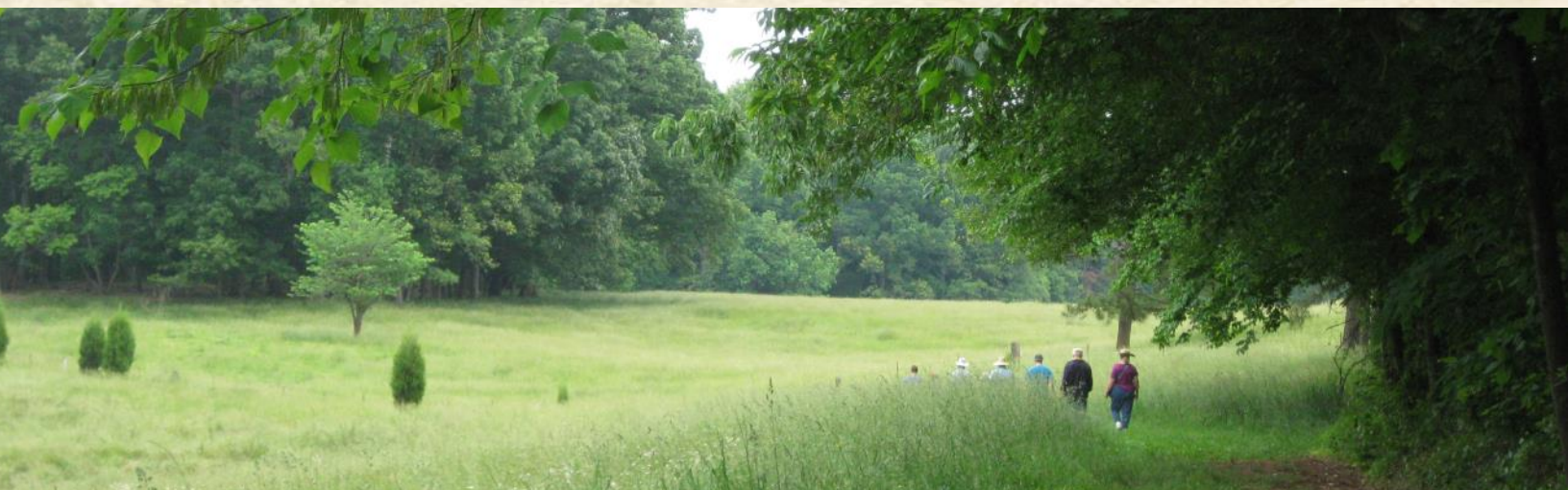
**Hickory Grove Baptist Church**

**3717 Hickory Grove Road**

**Gastonia, NC 28056 AND Redlair Preserve**

**REGISTRATION FORMS AT END OF NEWSLETTER AND ONLINE**

[www.ncplantfriends.org](http://www.ncplantfriends.org)



*You would have to be a little tipsy to try this....*



Maine has its lobsters.

Vermont has its maple syrup.

And New Hampshire has its ... beaver musk.

A specialty Granite State distillery launched its latest craft spirit — Eau De Musc, a high-end, 88-proof bourbon flavored in part by the scent oils found in the castor sacs of New Hampshire beavers.

The beaver booze is distilled by Tamworth Distilling and Mercantile, which with products such as a spruce-tip gin and a tumeric cordial, is always looking for unique means to accent its spirits.

“It’s aromatic, very distinct. It’s leathery, rich, slightly fruity in a non-traditional sense. With the whiskey, it really works in quite well,” said Matt Power, one of the two distillers at Tamworth.

The substance is castoreum, the beaver-specific scent that has ended up in everything from natural foods to fruit flavorings to cigarettes, said Anton Kaska, the New Hampshire trapper who supplied the dried castoreum to the distillery.

The Food and Drug Administration lists castoreum as a “generally recognized as safe” food additive, and manufacturers refer to it as a “natural flavor” when it is used to extend and enhance flavors in foods, Kaska said.

“I’m sure you’ve had castoreum, you just didn’t know it. When you eat something good and you see ‘natural flavors,’ a lot of time you can thank a trapper,” he said.

From New Hampshire Union Leader , June 11. 2018. By Mark Hayward.

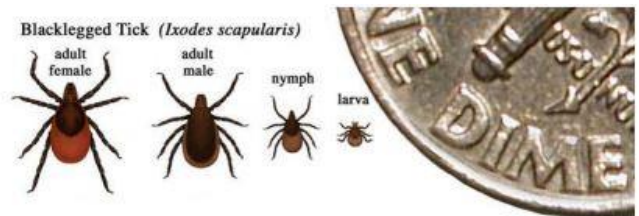
---

## Ticks & Fire

### Linking Ecosystem Health and Human Health

Prescribed fire is an integral tool in the management of most southeastern forests. While the benefits of fire as it relates to ecosystem health are well documented, prescribed fire has more recently gained attention specifically as a potential means to control tick populations. Over the past several decades, the incidence of human tick-borne diseases has increased dramatically. Thus, reduction of tick populations is considered a critical strategy for minimizing the risk of disease in humans.

Elizabeth Gleim, PhD  
Hollins University  
Roanoke, VA



Incidence of Lyme Disease (CDC Data)



# *Voice your Opinion*

It has been our tradition, most years, to recognize members who have contributed in extraordinary ways to the development and functioning of the Friends of Plant Conservation. **We are asking for your suggestions for the following awards:**

## **PLANT CONSERVATION LEADERSHIP AWARD**

The Plant Conservation Leadership Award honors an individual who has made significant contributions to public awareness and/or behavioral changes in public attitudes related to botanical diversity in North Carolina. This award celebrates the tangible achievements of a person who promotes plant conservation and a sustainable environment in North Carolina. Membership in FOPC is not required.

## **DISTINGUISHED MEMBER OF THE YEAR AWARD**

The Distinguished Member of the Year Award honors members who have made exemplary contributions to the Friends of Plant Conservation.

## **PLANT CONSERVATION EDUCATOR OF THE YEAR AWARD**

Recognizing that the future of plant conservation in North Carolina depends on a well-educated public, the Educator of the Year Award honors elementary, middle and high school teachers, college and university faculty, and other public educators for outstanding contributions to the education of North Carolina citizens. Membership in FoPC is not required.

## **HONORARY MEMBER**

Description: For on-going exemplary service to the Friends of Plant Conservation and to the mission of plant conservation.

Criteria: A nominee demonstrates selfless commitment to FoPC in areas including but not limited to education, communication, membership, administrative responsibilities, or service to the board and members. Only five Honorary Members shall be maintained on the membership roll at a given time.

## **OUTSTANDING SERVICE AWARD**

The Outstanding Service Award honors a FoPC member who has made exemplary contributions to the organization. Regularly participates in organization activities, workdays, and promotes plant conservation in his/her community.

Criteria: A nominee will demonstrate dedication to FoPC in areas including, but not limited to education, communication, membership or community service. The nominee demonstrates the ability to mentor, develop and impassion new leaders.

**Presentations will be made at the Annual Meeting of Members on November 19, 2018.**

**Only one nominee will be selected for these awards annually. Not all awards will necessarily be awarded each year.**

**For more information or to submit a nomination, contact the Awards Chair,**

**Carrie DeJaco**  
**704-688-2842**  
**carrie.dejaco@gmail.com**



# *Award Nomination Form*

**Please print legibly or type:**

Your Name: \_\_\_\_\_

Your Contact Information: Phone \_\_\_\_\_

Email \_\_\_\_\_

PERSON NOMINATED: \_\_\_\_\_

NOMINEE'S CONTACT INFO: Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

AWARD : \_\_\_\_\_

**Description of reasons for nomination (please be specific; use additional page if needed). Remember that your nominee may be in competition with others, so respond as fully as you can:**

If your nominee is not a member of FOPC, please give his/her organization/agency:

If desired, you may attach letters of support or other information.

**Mail or Email your nomination to: Carrie DeJaco**

**506 Dawn Street**

**Kannapolis, NC 28081**



# *A Gardener Prepares for Winter*

## **Overwintering Aquatic Plants**

*I*t gets cold on the Blue Ridge Escarpment of the Appalachian Mountains in Western North Carolina. As winter deepens hard freezes set-in. And, year after year the water in what we call the Studio Pond, a water feature in the native plant garden outside my wife Penny's studio, freezes time and again and slowly evaporates. I keep the water flowing from the small upper pool into the larger lower pond as long as I can (Figure 1). The birds love it and flock to the overflow to drink as long as it is free of ice. But, eventually, I'm forced to shut-down the recirculating pump and pull it from the lower tank for cleaning and maintenance.

It is a short walk to the foot of our land and there, among the Rhododendrons, springs fill a 'natural' pond of about 5,000 gallons with a production of about 300 gallons a day. Even though the walk is short it is also steep. We are among the fortunate who, approaching our eighth decade, are able to walk, hike, and even climb a bit. All that given, I felt it was to my advantage to have a water feature closer to the house. I was also concerned about introducing native aquatic plants to the spring pool for fear they would escape into the outflow and take hold lower down the watershed. And so, shortly after we moved in, I used a low shelf in the land on the eastern side of our property, purchased a 150 gallon Rubbermaid livestock watering container, dug it into the shelf, surrounded it with a wooden shell and tinkered with it over the succeeding years. I tried a number of configurations until, last year, settling on the present arrangement with a 20 gallon circular container overflowing into the larger, lower container. Most plants are suspended in the water in 5x5x6 deep square pots with slots for plant labels on all four sides of the top through which I use electrical ties attached to hooks that are screwed into the wood frame (Figure 2).

The plants have varied over the years. This year they have been selected and arranged to allow the larvae of Odonata, dragonflies and damselflies to journey from the bottom of the Rubbermaid tank to airborne freedom by crawling up the chara to the hornwort, onto the Vallesneria sp. and finally onto Juncus sp. where they can climb above the water and complete the final stage of metamorphosis into adult Odonata...a vegetative ladder to the skies! Weather, including heavy flooding, and professional and personal

obligations kept me from testing this on any more than five dragonfly larvae collected from an nearby wetland. At least one of the five completed the journey to adulthood and spent the better part of a day zipping around above the water feature. Next year should provide a better opportunity to test the system.

2016 was a difficult year in many ways, not the least of these was a very cold winter. We have noticed that, as we age, we are less tolerant of the cold. My small collection of aquatic vegetation suffers the same problem. Consequently, we purchased small throws for our laps and legs and, inside the garage, I built a one tray wet bench for the plants from 1x2, 1x3, and 1x4 wood. Basically this was a frame supporting an 'Odjob' drywall mud tray 27x20x6-inches deep. It wasn't big enough for the full collection so I lost several more plants over the winter of 2016-2017, including the only remaining specimen of *Sagittaria montevidensis* I had left. Over the past several months I doubled the size of the wet bench by adding a second tray. If you use multiple trays make sure they are both or all of the same make and size. Different stores carry different brands of different sizes. A four foot fluorescent light hangs over the trays and each tray hosts an aquarium airstone to circulate the water (Figure 3). Both the airstones and light are controlled through an inexpensive timer.

Compared to commercial units sold for similar purposes, the project described here cost about \$60, takes very little time to construct, and is simple to build. If you have any questions contact me at [hiddensprings2@gmail.com](mailto:hiddensprings2@gmail.com).

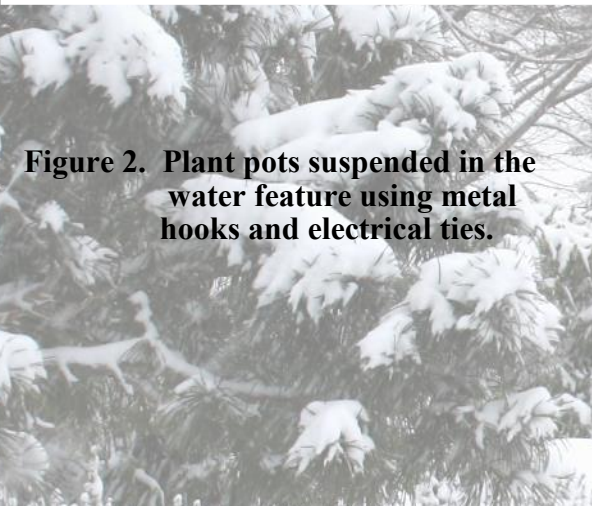
~ Tom Baugh







**Figure 1. A water feature called the Studio Pond.**



**Figure 2. Plant pots suspended in the water feature using metal hooks and electrical ties.**



**Figure 3. Drywall mud trays used to over-winter aquatic plants.**



# Pumpkin Time

If fresh meat be wanting to fill up our dish  
We have carrots and pumpkins and turnips and fish.

*Anonymous from a 1630 ballad,  
Forefather's Song*

Pumpkins have been a part of our cultural history since Europeans first landed on the shores of North America. We learned about the foods and medicines provided by our new land from nearby American Indians who generously shared information and seed with our forefathers. The great orange orbs were adopted into our diets, household ornament, and holiday celebrations.

From the Cherokee (southeast), Shawnee (Ohio Valley), Algonquin (Northeast), and Seminole (Florida, who had their own native pumpkin species), to the Blackfeet, Sioux, and Apache of the Great Plains and beyond, many tribes grew pumpkins. A dish known as Three Sisters which includes corn, beans, and squash/pumpkin was common with a great many of these tribes and remains so today.

Pumpkins originated in northeastern Mexico and were valuable in part because the thick rind and dense flesh made long storage of this nutritious food possible. Seed and peduncle (stem) remnants of pumpkins (*Cucurbita pepo*) found in dwellings have been dated to at least 7,500BC.

By 1500 BC the Hohokam (possible ancestors of Anasazi) had traveled north into what is now New Mexico, bringing maize and pumpkin (*Cucurbita pepo*) with them. Remnants of pumpkins were found at Tularosa Cave and Cordova Cave in New Mexico and dated to 300 B.C. The Hohokam were mostly hunter-gatherers who grew foods when game was scarce. They, and the Anasazi to follow, were migratory, following food and water sources, often walking great distances.

As Ancient Puebloans, or Anasazi, moved further north into the Colorado Plateau area, the ability to grow their own food became more important. Frequent drought, and the accompanying decline in the availability of game, made growing and storing crops more important.



From *The Cucurbit Images* (1515–1518) of the Villa Farnesina, Rome

Though the rind of pumpkins is thick, it is not lignified (woody) as in the gourds used ornamentally or for bowls and such. Pumpkins were good for both immediate use and for storage. Pumpkin fragments from around Pueblo Bonito in northeastern New Mexico are dated to 1000 AD, found in pottery jars and storage rooms. Several cultivars had developed by this time, indicating advancements in agriculture through selection for size, flavor, and storage quality.

If sedentary agriculture is an indication of developing civilization, then this area was probably agriculturally advanced before the Old World, since there is evidence that maize, beans, and pumpkins were all cultivated before plants of the Old World.

In times of prosperity abundant water and game) it was less important to migrate in search of food. As agriculture improved people settled on the land, building strong, secure homes, villages, and roads. They adapted to the environment, planting corn nearly 12 inches deep, allowing roots to reach the shallow water table and avoid the scorching sun as it germinated. Such sophisticated agricultural techniques produced surplus food allowing the Anasazi to shift attention to creating better housing, cultural community activities, and trade with neighboring villages.

Trade is well-documented among American Indians, evidenced by the profusion of shells in the jewelry and ornamental work of Anasazi, who lived far from any ocean.





Brightly colored macaw feathers from Mexico were another sought-after item of trade. Seed was an important commodity and pumpkin seeds found their way across North America reaching north toward Canada and northeast to Maine.

On the arrival of Europeans, pumpkins quickly moved into the agriculture of colonists and soon crossed the ocean. An early illustration of a pumpkin appeared in the 1508 book *Horae ad usum romanum*, drawn by the French artist Jean Bourdichon. There were pumpkins cultivated by Romans in the middle ages, but those were apparently *Cucurbita maxima*, a different species from what we have in North America.

*Cucurbita pepo* includes eight groups of edible cultivars—pumpkins, scallops, acorns, crookneck, straightneck, vegetable marrow, summer squash, and zucchini. Crooknecks developed through cultivation from wild forms from northeastern Mexico and Texas. Many ornamental gourds are also varieties of *C. pepo*.

Domestication led to larger fruits, sweeter flesh, and larger seeds (also a significant part of diets). Fuchs' *Herbal* of 1542 contains an illustration of a pumpkin that looks like the one we call 'Small Sugar,' used for pie making. It is still available for those who make their own pumpkin puree, weighing up to 7 pounds with thick flesh of rich orange color and a fine flavor.

Pumpkins are consumed when mature, squashes before maturity. Pumpkin flesh can be cut into strips and dried for storage, but they will also store over much of the winter if kept cool and dry. Hence their great value to the native people of the desert southwest.

Autumn Equinox is upon us and pumpkins will soon be visible in fields and markets. This year consider using one following the example of our ancestors: as a vegetable. John Josselyn included a recipe in his 1674 'Account of the Voyages to New England' which is adapted here.

### Standing Dish Pumpkin

4 cups of cooked (boiled or baked) pumpkin, mashed  
 3 tablespoons butter  
 3 teaspoons cider vinegar  
 1 teaspoon ground ginger  
 1 teaspoon ground cumin  
 ½ teaspoon salt  
 Optional: stir in some toasted chopped hazelnuts or pecans

In a saucepan over medium heat, stir and heat all the ingredients together. Serve hot to accompany meat or fish dishes.

Though the Forefather's Song, above and here, may have poked fun at the uses of pumpkin, it is an iconic American fruit that inspires creativity. Enjoy.

If barley be wanting to make into malt,  
 We must be contented, and think it no fault;  
 For we make liquor to sweeten our lips,  
 Of pumpkins and parsnips and walnut-tree chips.  
*Forefather's Song*

Katherine Schlosser

Brand, David D. The Origin and Early Distribution of New World Cultivated Plants, *Agricultural History*, Vol. 13, No. 2 Apr. 1939. pp 109-117.

Chamberlain, Lucia Sarah. Plants Used by the Indians of Eastern North America, *The American Naturalist*, Vol. 35, No. 409, Jan. 1901.

Drake, Benjamin. Life and Adventures of Black Hawk with Sketches of Keokuk, the Sac and Fox Indians. Cincinnati, 1840.

Gremillion, K. J. Changing Roles of Wild and Cultivated Plant Resources Among Early Farmers of Eastern Kentucky, *Southeastern Archaeology*, Vol 17, No. 2, Winter 1998.

Hastorf, Christine A. Recent Research in Paleoethnobotany, *Journal of Archaeological Research*, Vol. 7, No. 1, March 1999. pp55-103.

Huckell, Lisa W. Plant Remains from the Pinaleno Cotton Cache, Arizona. *Kiva*, Vol. 59, No. 2, Winter, 1993. pp. 147-203.

Hunter, John D. Manners and Customs of Several Indian Tribes Located West of the Mississippi. Philadelphia, 1823.

Paris, Harry S. *et al.* First Known Image of *Cucurbita* in Europe, *Annals of Botany*, Vol. 98, No. 1, July 2006, pp 41-47.

Paris, Harry S. Historical Origin and Development of the Edible Cultivar Groups of *Cucurbita pepo*, *Economic botany*, Vol. 43, No. 4, Oct.-Dec. 1989, pp. 423-443.

Scarry, C. M. and J. F. Scarry, Native American 'Garden Agriculture' in Southeastern North America, *World Archaeology*, No. 37, No. 2, Garden Agriculture, June 2005, pp. 259-274.

Scull, Gideon D. *Voyages of Peter Esprit Radisson*. Boston, 1885.





June 2017



August 2018

## Bat Fork Bog Battle

Bat Fork Bog Preserve is in Henderson County and has a 4 acre field that is essentially a monoculture of *Phalaris arundinacea* (reed canary grass). PCP staff have attacked



this invasive grass using a variety of chemicals and application methods in 2017 and 2018. We've used ATVs outfitted with tanks and spray guns, backpack sprayers and also drones.

### June 2017:

Staff began treatments with 2 ATV tank sprayers and treated the field with a mix of 1% Imazamox (Clearcast) and 1% Glyphosate (RoundUp Custom) and 0.25% Non-Ionic Surfactant NIS (Surfac 820). We hand pulled Phalaris near sensitive rare species. This trip we used 100 gallons of mix.

### July 2017:

Same tank mix as before, we didn't need to respray any areas already hit from the June application. The chemical is very effective and no regrowth was observed so we just sprayed missed areas. This trip we used 60 gallons of mix.

### October 2017:

I was speaking with a colleague at N.C. Department of Transportation about the complications of PCP's herbicide applications here because it is a wet boggy area that is hard to navigate. As a result of this conversation, I arranged for PCP to be selected for a free demo project involving herbicide application by drone. Turns out, they were just starting a pilot program of their own to use a drone to apply herbicide to another invasive wetland species and they were asking if PCP had any sites that they could get some hours and practice? I thought the Bat Fork Bog site was ideal as there were no rare species in the target area, no tree canopy coverage and it is fairly inaccessible by foot (deep freshwater marsh habitat).

Christopher Dustin with North State Engineering is the pilot of the DJI Agras drone certified by NCDA&CS. The company is under contract with our partner agency NCDOT to use the drone to spray Phragmites on Bodie Island in Dare County. According to Dustin, "The drone offers an ultra-low spraying volume...it is essentially like spraying through a backpack sprayer, but the drone can get to areas that a person or ATV vehicle might not be able to get."





## MORE BAT FORK BOG PHOTOS.....

Pond Area south of berm

June 2018 (pic P6120003)



August 2018 (pic 3090)



JUNE 2018



AUGUST 2018



Over the winter, North State obtained the required FAA/ Dept Agriculture licenses and certifications and they received their final FAA approval in May of this year. They completed their check off flight in June 2018. This is so exciting and we consider Plant Protection lucky to be involved at the first stage of this newly emerging drone technology!



Drone photo prior to June 2018 treatment

#### **June 2018:**

We planned the first drone flight herbicide application at a PCP Preserve and one of the first flights of its kind in NC! This is the first drone to have been issued a NCDA pesticides contractor's license in NC. We started off with the same chemical mix as before, again, using the 2 ATV tank sprayers to treat the field areas that were accessible. The next day we used backpack sprayers to get areas missed under the trees last year and field edges where we knew the drone couldn't reach because of canopy overhang. The last day the drone was used on flooded areas difficult to get to on foot or ATV. This trip we used approximately 80 gallons of mix.



#### **August 2018:**

It was way too wet to get an ATV in the field so we filled the backpack sprayers and strapped on our waders to get areas missed during the last treatment. This trip we used approximately 44 gallons of mix.



#### **September 2018:**

We have one more trip planned for this year to spot treat areas missed in August, this will likely be late September and we don't anticipate it will be very much to treat at all. If the gallon amounts used are any indication of success, we have decreased chemical use by approximately 50% over two years of treatment. A couple more years of effort like this will make for a triumphant story!!

Cheryl Gregory  
Lesley Starke  
Jenny Stanley





# Seed Collecting



The first NCPCP seed collection effort associated with the pending USFWS grant *"Rare Species Management to Support Recovery & Potential Downlisting"* was held on September 5th. Lesley Starke organized the event; the volunteer team included David Schnake (Forestry & Natural Resources, NCDA&CS), Michael Kunz (NCBG), Dale Suiter (USFWS), John Eaton (NCPCP), Laura Daly (Duke Gardens), Annabel Renwick (Duke Gardens).

Cheryl Gregory

## The Return of Beavers to Southern Piedmont Streams: Stream Restoration or Disruption?

Michael E. Lewis and Tom Tricot

Department of Geography  
University of North Carolina at Greensboro

The return of beaver to streams in Guilford County, North Carolina has encountered widely different responses in rural and urban landscape contexts. We found that beaver were viewed as positive agents of stream restoration in a project intended to rank potential riparian conservation easements in rural Guilford County. The response to beaver in two urban neighborhoods was to demand their eradication as a public nuisance. A primary goal of stream restoration in environmental planning is the recreation of natural conditions in streams altered by human action. Successful implementation of that goal will require clear definitions of what constitutes natural form and function, and human accommodations to the changes reintroduced species may bring to local environments.

### Introduction

After being gone for over a century, beaver (*Castor canadensis*) have returned to the North Carolina Piedmont, a landscape significantly altered by human actions during their absence. Opportunistic by nature, the beaver are reoccupying both rural and urban riparian settings, transforming and restoring stream valleys to conditions more like those prior to European contact. The transformation is meeting with a mixed reaction from people living in the affected areas. While some welcome the beaver's work as a low-cost means of restoring natural functions and spatial forms to degraded riparian landscapes, others see the animals as a disruptive nuisance and are calling for their eradication. The purpose of this paper is to examine those conflicting responses in the rural and urban contexts of Guilford County, North Carolina, and discuss their implications for environmental restoration efforts in human altered landscapes.

Beaver were common throughout North Carolina before European contact, but their numbers declined rapidly throughout the 18<sup>th</sup> century because of heavy trapping for the fur trade with Europe. Trapping was following by extensive land conversion, wetland drainage, and stream alteration to accommodate agricultural and urban

land uses, until the animal was extirpated from the state sometime around the end of the 19<sup>th</sup> century. In 1939, the North Carolina Department of Conservation re-introduced 29 beaver from Pennsylvania into the North Carolina Coastal Plain (Woodward and Hazel 1991). The animals quickly took hold in their old niche and since then have spread westward across the state, following the rivers and stream corridors upstream to the Piedmont.

### Geomorphic and Ecologic Influences

Beaver obviously alter the geomorphic and ecologic character of landscapes. Butler (1995) asserted that humans are the only animals that have done more to alter the landscape characteristics and functions of North American streams, and Shepard (1986) referred to the beaver as the original Soil Conservation Service because of the sediment detainment functions of their dams and ponds. Large woody debris dams, mud-and-stick lodges, bank burrows, excavated canals, and food caches are some of the more common structures placed in, across, or along stream channels by the work of active beaver. Such activity alters the hydrology of affected streams and produces a variety of geomorphic changes, particularly in upland Piedmont streams impacted by erosional incision



accelerated by agricultural and construction practices of the past and present. Other effects of beaver impoundments include modification of bank erosion and mass wasting processes, and altered temporal and spatial stormwater runoff and flooding patterns. Reduced rates of stormwater runoff may also raise local groundwater tables, and expand the transitional wetland zone between the open water channel and adjacent uplands (Gurnell 1998; Butler and Malanson 1994; Naiman and colleagues 1988).

Not all beaver construct large dams or lodges. On smaller streams they may construct shelters by simply burrowing into stream banks. Meetemeyer and his colleagues (1998) reported on the erosional effects of stream bank burrowing and tunneling in a North Carolina Piedmont stream where beaver dams were generally lacking, finding that such activities actually contributed to bank mass wasting and erosion.

In their ecological role, palustrine wetlands formed by the work of beaver may modify the species abundance and diversity of riparian vegetation, setting in motion successional vegetation dynamics as ponds fill with sediment or dams are abandoned (Malanson 1993). Old and abandoned beaver ponds fill to become wet "beaver meadows" in some instances. Similar to other wetland environments, beaver created wetlands function as biogeochemical filters and sinks, which can be important in the environmental management of pollutant loads. They also provide habitat for a variety of wetland plants and animals, including other aquatic mammals, amphibians, fish, and a host of benthic invertebrates.

A common result of urban development or agricultural drainage schemes is the transformation of perennial flow regimes to "flashy" ephemeral flow that can decimate aquatic ecology. Beaver activity can return a measure of stability to stream flow, allowing high order predators such as fish and amphibians to move upstream and feed on insect larvae or other food. During droughts the deep water provided in beaver ponds can also serve as a refuge for fish and amphibians. Contrary to popular belief, such relationships between beaver

and aquatic life may actually serve to reduce mosquito populations (Shepard 1986; Johnston 1994).

The stream altering work of beaver sometimes presents natural hazards to human land use. Dams may function to hold back minor floods for decades or even centuries before finally being silted in. In other cases Southern beaver dams have been known to burst during major storm events, sending flash floods downstream (Butler 1989). Beaver activity in the South has had negative impacts on highway and railroad drainage structures as well (Butler 1991; Federal Interagency Working Group 1998).

What most often puts beaver at odds with people, particularly in urban settings or intensively managed forests, is their ability to take down trees. In wildland landscapes where preservation of natural functions is a stated policy goal, use of trees and shrubs by beaver may be viewed as an element of the natural landscape dynamics of an area, but in urban settings where "urban forestry" has reached the city planning agenda, trees are being promoted as valuable assets. Anything that results in reducing the inventory of trees may be viewed as a negative event requiring interdiction by city officials.

A single adult beaver can chew through a tree 6 inches in diameter in about 15 minutes, and larger trees pose only minor challenges to a determined beaver (Butler 1995). Sharply chiseled stumps adjacent to fallen or missing trees are often noticed before the animals themselves are actually seen in a new area. Beaver prefer to gather food and building material near the water, and favor some tree species over others, but they generally do not discriminate between horticultural trees in a residential yard or native trees in a natural setting. It is particularly in instances where horticultural trees are taken down that the animals quickly run afoul of homeowners and urban foresters (Gray 1990).

### **Beaver as Agents of Rural Landscape Change**

We first encountered North Carolina beavers as agents of landscape change through a riparian land acquisition project. A consortium of non-profit groups interested in restoring streams within

the Upper Cape Fear River basin enlisted our help in assessing the condition of a stream flowing through rural areas of northern Guilford County. Their goal was to identify potential sites for acquisition by the North Carolina Clean Water Trust Fund. The Clean Water Trust Fund was set up to protect and restore riparian areas and wetlands along the state's major rivers as part of efforts to improve water quality. The consortium selected Mears Fork of the Haw River, a 3<sup>rd</sup> order stream near the headwaters of the Cape Fear River, with a drainage area of approximately 18 square miles. They chose Mears Fork because the Guilford County Natural Heritage Inventory listed it as the highest quality stream in the county (Bates 2001). That ranking was based on the critical habitat provided by the mature hardwood forests and wetlands found along the stream. Neotropical migrant birds, river otter, beaver, wild turkey, and deer are just some of the wildlife utilizing the riparian habitat. The diverse and rare riparian plant assemblages in the area are also notable, including the purple fringeless orchid (*Platanthera peramoena*), a species considered significantly rare and peripheral by the North Carolina Natural Heritage Program and discovered along Mears Fork during fieldwork for the inventory (Amoroso 2002, Bates 2001).

Our task was to assemble a spatial database of the Mears Fork drainage basin that could be used to analyze and prioritize land parcels for potential acquisition of conservation easements or fee simple title by the state. We utilized digital orthophotography and hydrologic data sets, in addition to color infra-red (CIR) aerial photography, zoning maps, and property tax maps obtained from Guilford County to create a digital spatial database of land use, land cover, and property divisions. A variety of habitat quality indices are available for stream classification, but we limited our project to illustrating how the database could be queried to identify potential parcels based on criteria specified by the Clean Water Management Trust Fund (Tricot 2001). McQuaid and Norfleet (1999) provide a review and assessment of other stream

habitat quality indices that have been applied in North Carolina.

Two criteria we examined were related to the activity of beaver: 1) the proportion of an ownership parcel within a forested riparian buffer, and 2) the presence of open bodies of water in a parcel. The forested riparian buffer was defined as the proportion of the land extending 300 feet from the centerline of the stream. It was estimated using aerial photographs. The buffer was found to be consistently wider wherever beaver were active.

Open bodies of water were shown without regards to origin in the spatial hydrology data set we obtained from the county, but field observations indicated we were dealing with two very different forms of detained water. The first was sediment detention ponds located on the upper tributaries of the Mears Fork drainage network. Many of the ponds were constructed several decades ago as cooperative erosion control efforts between agricultural landowners and the federal Natural Resource Conservation Service (then known as the Soil Conservation Service). The ponds were typically accessible to livestock, vegetative buffers were minimal, and signs of life in the water were scarce. Trampling and bank erosion, as well as pollutant loading by livestock were evident. Ponds managed specifically for private recreational fishing were an exception.

The work of beaver was the principle origin of open water bodies and wetlands within the narrow floodplain of Mears Fork. Outside of reaches with beaver, much of Mears Fork resembles other Piedmont streams in that the channel is deeply incised with undercut banks subject to mass wasting. There is a narrow transition from channel to upland vegetation and the floodway is poorly developed. Stream reaches where beaver are present are distinctly different. They include a wider and wetter transition from channel to upland, with standing dead tree snags being used by cavity nesting birds, or as roosts for wading water birds. Emergent wetland vegetation, woody shrubs, and bottomland hardwood trees are found on the wider sediment-rich floodway. Fish and other vertebrates,

as well as macro-invertebrates, are readily observed in the shallows and muds of the impounded water.

Local naturalists commonly observe beaver and other wildlife along the wider sections of the floodway during evening hours (Bates 2001). Indirect signs of active beaver are further indicated by felled trees and sharp woody stakes, dam sites and food caches, bank dens, canals cut through wet meadows, and trampled runs through the marshy areas. Wet meadows formed by the siltation of former beaver ponds were of particular interest in our assessment. Such wetlands are uncommon on the Piedmont and are habitat for many of the rare or endangered plant species of Guilford County, including the purple fringeless orchid. Because of their role in restoring the habitat of the orchid and in adding to the limited stock of wetland environments on the Piedmont, we recommended that areas with active beaver be considered for higher ranking than those with sediment detention ponds constructed by landowners. Our recommendations were favorably received by the consortium and contributed to acquisition of three conservation easements totaling 51 acres of riparian land.

In summary, our work in rural Guilford County showed that beaver can be viewed as agents of stream restoration. Their work contributed to increased landscape diversity and species richness along Mears Fork, and met the criteria for funding by the Clean Water Management Trust Fund.

### **Beaver as a Public Nuisance**

Observations and interviews with urban residents and city foresters in Pinecroft Lakes and Hamilton Lakes, two urban Greensboro neighborhoods, reveal a different reaction to stream environments modified by beaver. Both neighborhoods are outside the Mears Fork drainage and were not part of that study. However, similar to the case of Mears Fork, beaver moved into each area by natural dispersal and modified the pre-existing stream conditions. Here we review the neighborhood reactions to those modifications.

Pinecroft Lakes began as a private hunting and fishing club set up outside of the city's limits in the 1920s. The neighborhood takes its name from three dams constructed across a stream running through the property in the 1930s. Sedimentation associated with urban construction and assimilation of the neighborhood into the city of Greensboro has altered the three lakes. The one furthest downstream remains an open lake, siltation of the middle lake has created a shallow wetland, and the upper most lake is silted in completely and grown up in bottomland hardwoods.

The area was annexed into the city following sale of the land to a developer in 1953. A residential neighborhood was built and the hunting lodge and outlying cabins were converted into year-round residences. Most of the older homes were constructed on large lots far back from the water's edge, but more recent construction on subdivided lots has reached into the wet margins of the middle lake.

In the early 1990s the City of Greensboro and the T. Gilbert Pearson Chapter of the Audubon Society cooperated with the neighborhood in the establishment of an educational boardwalk with interpretive signs describing the wetland functions and character of the middle lake, as well as the dynamic history of siltation in the area. Audubon hoped to highlight the wildlife habitat values of urban wetlands, including the role of an active beaver colony that had been using the area for some time. In addition, the City of Greensboro Stormwater Services Division wanted to increase public acceptance of created wetlands as an effective management practice for reducing stormwater sediment and pollutant loadings into the city's streams.

Trouble started when new homeowners on the lots reaching back into the wetland discovered that beaver were in the area. The newcomers called the city expressing alarm and complaining that their trees were at risk. Some property owners responded by placing wire fencing around their most valued trees to discourage the beaver, just as



homeowners on older properties had been doing for years with good results. Others demanded the city get rid of the beavers, citing a fear of more mosquitoes and the potential for flooded streets if the beaver were allowed to remain in the area.

The Stormwater Management Division of the Greensboro Environmental Services Department conducted a survey of neighborhood residents and found them about evenly split between those who were accustomed to the presence of beaver and willing to work towards an accommodation of the animals, and those who wanted the city to do something more decisive about the perceived beaver problem. Finally, under pressure from the most vocal neighbors, the city hired a trapper to capture and kill the beavers. He then blew out their dams to lower the water in the wetland to a level acceptable to homeowners with backyards reaching to the water's edge (Phlegar 2001).

Recent field observations at the site show signs of renewed beaver activity in the form of fresh mud and stick placement in dams blown out by the trapper. The last several years have been a period of marked dryness and low stream flows in Greensboro, however, so water levels at Pincroft Lakes have remained low. The returning beaver are also being more discrete about taking down trees and the city has not received any recent complaints. What will happen when normal rainfall runoff patterns return, or if a nocturnal beaver is discovered gnawing on a backyard tree late one night, remains to be seen.

A similar story is playing out across town at Hamilton Lakes. That neighborhood was formed when a dam was constructed in 1920 across a wooded stream corridor. The resulting lake became the focal point of a private, upscale neighborhood noted for its leafy character and lots with views of the lake. Beaver recently moved into the area after an extensive area of wooded rural land upstream from Hamilton Lake was cleared for development. The newly arrived beaver felled several trees along the stream, including a prized cherry tree in a homeowner's yard. They also placed a low dam above the

stream's inlet to Hamilton Lake and backed up a shallow pool.

Meetings of the local neighborhood association were called to discuss the "beaver problem." As in the case of Pincroft Lakes, battle lines were drawn between opponents and proponents of the beaver. The governing board of the neighborhood association hired a man who described himself as an animal control consultant who had given up trapping beaver for their pelts because of the low price, finding a better income could be made trapping nuisance animals. During one heated meeting of the neighborhood association he declared, "if the beaver population is left alone, they'll cut down all the trees, I'll promise you that." He added that beaver would expose residents to rabies and to an intestinal parasite that causes extreme diarrhea in humans, claiming that merely touching the water a beaver inhabits can spread the disease (Perkins 2001a)<sup>1</sup>.

As debate continued, a sort of guerilla war was staged in the woods around Hamilton Lake by defenders of the beaver who viewed killing the animals as inhumane. At one point a dead beaver was found hung from a tree with a sign around its neck (reports of what was written on the sign conflicted and could not be verified). Defenders of the beaver responded by vandalizing traps set to capture the animals. Finally, after months of claims and counter-claims, the owner of a private wildlife preserve in rural Rockingham County offered to accept the beaver if they were live trapped and brought to his property for release. This solution seemed to appease all parties to the issue and the beaver were trapped and moved (Perkins 2001b).

Field reconnaissance in the area soon after the beaver were removed showed that they had in fact felled some wild tulip poplars and a good number of smaller alders, willows, and mulberries. Their overall affect on the wooded character of the neighborhood was minimal, however, and none of the felled trees or shrubs could be seen from the streets of the neighborhood. The tree canopy remained mostly closed along the stream corridor. The greatest damage to canopy trees resulted from

wind and ice storms, rather than beaver activity. Stumps and woody spikes left by the beaver were vigorously sprouting new stems, creating a denser understory and more potential food for the absent beavers in the form of abundant tender bark.

Within a few months of the removal of the beaver, I returned to the site and found fresh tracks in the mud, confirming that either all the beaver had not been trapped or a new group of beaver had noticed the vacant habitat and food supply and were moving in to take the place of the former occupants. As in the case of Pinecroft Lakes, trapping and removal of the animals proved to be a temporary measure that satisfied local residents in the short term, but did not eradicate the animals in the long term.

## Discussion

Environmental restoration has been defined as the holistic reestablishment of natural landscape functions made nonviable by human disruption (National Research Council 1992). Restoration ecologists recognize that no restoration is likely to be perfect, and all will be exercises in approximation. The principal goal is to recreate naturalistic functions as well as spatial forms. Specifically, the National Research Council Committee on Restoration of Aquatic Ecosystems stated (1992, pgs 17-18):

Merely recreating a form without the functions, or the functions in an artificial configuration bearing little resemblance to a natural form, does not constitute restoration. The objective is to emulate a natural, self-regulating system that is integrated ecologically with the landscape in which it occurs. Often, restoration requires one of more of the following processes: reconstruction of antecedent physical conditions, chemical adjustment of the soil and water; and biological manipulation, including the reintroduction of native flora and fauna, or of those made nonviable by ecological disturbances.

Our observations in rural Guilford County and urban Greensboro suggest that a fundamental obstacle to the ideal described by the committee may be variations in public perception of what constitutes natural form and function from one landscape context to another. No reference streams remain to serve as models for what North Carolina's Piedmont streams looked like during the period when beaver were a common component of the landscape and Native Americans were the only human residents of the region. Instead, several generations of people have never known a stream that was not heavily impacted by agricultural and urban development practices. What is experienced over the long term may subsequently be considered natural when no other point of reference exists. And when animals that are part of the dynamic functions and forms that were once truly natural begin to reassert themselves they are labeled as disruptive and a "nuisance" under the pretext of protecting a degraded natural landscape.

We found less public resistance to the reestablishment of beaver in rural Guilford County, though the question remains open for further study. Shepard (1986) reported that farmers in Virginia were experiencing conflicts with beavers because of loss of land for grazing and crop depredations. Along the Mears Fork, the activity of beaver is generally limited to a narrow riparian corridor whose restoration rural residents appear willing to accept, given that the dynamics of beaver activity do not directly infringe on agricultural production. Urban residents live in closer spatial contact with the landscape changes brought about by the work of beaver, particularly when homes are situated in or near streams and wetlands, and that may contribute to the greater opposition to beaver we experienced in Greensboro.

Rural and urban landowners may also differ in fundamental attitudes of mind and human perceptions of natural landscapes. In the anecdotal cases reviewed here, urban property owners appear to consider natural form to imply trees undisturbed or unmodified by the actions



of animals. Urban forestry in its most spatially static silvicultural form is the goal. Streams that have been straightened, dredged, and cleared of woody debris are considered restored to their natural function simply by allowing vegetation to grow up along the banks. Benign wildlife, such as songbirds, are acceptable and even desirable, so long as their natural history does not interfere with the perceived naturalness of the trees. But when an animal such as the beaver introduces change to the stream form, and dynamics to the vegetative composition and structure, the action is considered destructive and unacceptable. People who view themselves as protecting the trees see removal of the animals as the only viable solution. Where there was urban opposition to removal of the beaver it was grounded more in a moralistic objection to killing animals than a desire to include beaver in a policy of restoring natural functions. Removal by live trapping was an acceptable compromise for such people.

A political dimension may increasingly affect the issue as cities continue to refine the set of best management practices implemented in stormwater management plans mandated by the National Pollution Discharge Elimination System (NPDES). NPDES is a series of federal mandates requiring cities to reduce pollutant loading of streams by runoff from dispersed sources. Phase I of NPDES was first implemented in the 1990s in larger cities, and is now entering Phase II, which will include smaller towns and municipalities. Constructing stormwater detention ponds has been among the most common best management practice required of new property developments in many plans, and urban ponds now dot the Piedmont landscape in much the same way sediment detention ponds were constructed to control rural agricultural runoff in a previous generation. The ponds can be expensive to install and carry ongoing maintenance costs, leading stormwater planners to search for alternate practices, including those which incorporate natural processes and functions (Broughton and Apfelbaum 1999; Lewis and colleagues 1994).

One approach has been to encourage developers to set aside riparian corridors in

development plans and receive credit for stormwater mitigation without the need for building detention ponds. That approach most often involves considering topography and natural drainage in the clustering of building lots. A common example is the case of naturally vegetated buffers along stream corridors being set aside as common property of planned unit developments. Another variation includes preservation or construction of wetland basins rather than open water ponds.

Either scenario creates a setting that invites the work of beaver in their roles of natural stormwater detention engineers, soil conservationists, and restoration ecologists. The major difference is that the fees charged by the beaver are much less than their human counterparts. If water levels rise too high, or interfere with roads or local infrastructure, human engineering can be selectively utilized to alter the situation. For example, perforated pipes inserted through a beaver dam well below water level have been used to lower water levels without eliminating the pond or the beaver (Federal Interagency Stream Working Group 1998; Shepard 1986). Desirable trees can likewise be protected with various armoring devices, or by manipulating plantings to provide more favorable food species to decoy the beaver away from trees designated for protection.

## Conclusions

Beaver are dispersing throughout both rural and urban landscapes of the North Carolina Piedmont, returning streams to conditions more like those before European contact. Natural predation is light and human trapping for furs or food lacks economic incentive, so as suitable habitat becomes available it appears likely that the beaver will continue to expand their range. Adaptable and opportunistic by nature, beaver often return to areas to rebuild when previous animals are removed or killed.

The question of when and whether beaver activity is a public nuisance or beneficial ecological restoration has much to do with attitudes of mind and the social goals of environmental restoration. The abundant geomorphic and ecologic literature on the natural functions of beaver activity seem to have been generally overlooked in the formulation

of public policy. Stormwater management planning may provide an avenue for changes in the public perception of beaver activity, but for now urban homeowners in Greensboro have generally shown themselves to view beavers as nuisance animals requiring removal rather than accommodation. Rural landowners in Guilford County appear to be less strident in opposition to the impact of beaver on streams, but their specific attitudes and perceptions remain open to further study.

#### End Notes

<sup>1</sup>According to the U.S. Center for Disease Control *Giardia* is found worldwide and infects both domestic and wild animals, including dogs, cats, deer, and beaver. *Giardiasis*, the illness caused by *Giardia*, occurs when cysts of the parasite are ingested through person-to-person transmission or ingestion of fecally contaminated food or water. Waterborne outbreaks are caused by drinking water contaminated by *Giardia* cysts. North Carolina law does not require reporting of cases of *Giardiasis* to the CDC so the prevalence of the illness could not be determined. Hamilton Lake is closed to all recreational use and does not serve as a drinking water supply. (<http://www.ede.gov/eпо/mmwr/preview/mmwrhtml/ss4907al>).

#### References

- Amoroso, J. (ed.) 2002. *Natural Heritage Program List of Rare Plants of North Carolina*. Raleigh: North Carolina Natural Heritage Program (<http://www.ncsparks.net/nhp/county.html>)
- Bates, M. 2001. Consulting botanist and principle contributor to the Guilford County Natural Heritage Inventory, 1994. Personal communication.
- Broughton, J. and Apfelbaum, S. 1999. Using ecological systems for alternative stormwater management. *Land and Water* (September/October):10-13.
- Butler, D. R.. 1991. The reintroduction of beaver into the South. *Southeastern Geographer* 31:39-43.
- Butler, D. R. and Malanson, G. P. 1994. Canadian landform examples — Beaver landforms. *Canadian Geographer* 38:76-79.
- Butler, D. R. 1995. *Zoogeomorphology: Animals as Geomorphic Agents*. New York: Cambridge University Press.
- Federal Interagency Stream Working Group. 1998. *Stream Corridor Restoration: Principles, Processes, and Practices*. Washington, D.C.: Government Printing Office.
- Gray, M. 1990. Denver's urban beavers — a gnawing problem. *Colorado Outdoors* 39: 27-29.
- Gurnell, A. M. 1998. The hydrogeomorphological effects of beaver dam building activity. *Progress in Physical Geography* 22:167-189.
- Johnston, C. A. 1994. Ecological engineering of wetlands by beavers. In *Global Wetlands: Old World and New*, W. Mitsch (ed.), New York: Elsevier Press, pp. 379-384.
- Lewis, M. E., Jezorek, J. R. and Rublee, P. 1994. Merging stormwater management with stream habilitation: Greensboro's Lake Daniel pilot project. *The North Carolina Geographer* 3:17-29.
- Malanson, G. P. 1993. *Riparian Landscapes*. Cambridge, U.K.: Cambridge University Press.
- McQuaid, B. F. and Norfleet, L. 1999. Assessment of two Carolina watersheds using land and stream habitat quality indices. *Journal of Soil and Water Conservation*, Fourth Quarter, 657-665.



- Naiman, R. J., Johnston, C., and Kelly, J.C. 1988. Alteration of North American streams by beaver. *BioScience* 38:753-62.
- National Research Council, Committee on Restoration of Aquatic Ecosystems. 1992. *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy*. Washington, D. C.: National Academy Press.
- Perkins, A. 2001a. Neighborhood beavers may be eradicated. *Greensboro News and Record*, January 28.
- Perkins, A. 2001b. Beavers to leave city for country. *Greensboro News and Record*. March 17.
- Phlegar, D. 2001. Water Quality Supervisor, Stormwater Management Division, City of Greensboro. Personal communication.
- Shepard, V. 1986. Beavers-Loved or dammed? *Virginia Wildlife*, 46:22-26.
- Tricot, T. A. 2001. *Using GIS to Prioritize Land Acquisition in a Piedmont North Carolina Watershed*. Applied Master's Project, Department of Geography, University of North Carolina at Greensboro.
- Woodward, D. K. and Hazel, R. B. 1991. *Beavers in North Carolina: Ecology, Utilization, and Management*. Publication No. AG-434. Raleigh, NC: North Carolina Cooperative Extension Service.



# FRIENDS OF PLANT CONSERVATION

## Annual Meeting

### Menace or Marvel: Beavers on Preserves

Saturday, November 10, 2018 9:30—4:30

#### Registration Form

Name(s): \_\_\_\_\_

Address: \_\_\_\_\_

Email: \_\_\_\_\_

Telephone: \_\_\_\_\_

Our Program will begin at 9:30 on Saturday morning at the **Hickory Grove Baptist Church** (3717 Hickory Grove, Rd., Gastonia, NC—just down the road from Redlair Preserve). For your convenience, you may order a lunch or bring your own.

Please send in your lunch orders as soon as possible to the address below. You may pay with your form, at the door, or by Paypal on the website ([www.ncplantfriends.org](http://www.ncplantfriends.org)). *If you order and do not arrive, we will send you a bill.*

#### **LUNCH SELECTIONS:** Please choose one item per person.

Tea and water provided.

# \_\_\_\_\_ SPICED ROASTED VEGETABLE SANDWICH  
squash, sweet peppers, portobello mushrooms, caramelized onion, herb & goat cheese spread, lettuce and sliced tomato, on herb & sea salt Kaiser roll

# \_\_\_\_\_ SMOKED TURKEY, CHEDDAR, AND APPLE SANDWICH  
house roasted shaved turkey, white cheddar cheese, apple chutney, lettuce and sliced tomato, on multigrain bread

# \_\_\_\_\_ CHICKEN SALAD SANDWICH  
roasted chicken breast, parsley, salted pecans, fresh grapes, sliced tomato, leaf lettuce, on fresh baked croissant

# \_\_\_\_\_ ASIAN CHICKEN WRAP  
teriyaki marinated chicken, honey sriracha mayonnaise, romaine, carrots, toasted peanuts

# \_\_\_\_\_ HONEY ROASTED BEET SALAD  
honey roasted beets tossed with fresh spinach, goat cheese, walnuts and dried apples with red wine vinaigrette

# \_\_\_\_\_ SIGNATURE SONOMA SALAD  
house blend lettuce, house roasted turkey, sun-dried cranberry, toasted pecans, gorgonzola cheese, tomato, applewood bacon with red wine vinaigrette

sandwiches include chips, fresh fruit cup, cookie

salads include a fresh fruit cup, cookie

#### **REGISTRATION**

Registration \$25.00 @ x \_\_\_\_\_ people = \$ \_\_\_\_\_

Lunch \$18.00 @ x \_\_\_\_\_ people = \$ \_\_\_\_\_

Total Enclosed \$ \_\_\_\_\_

You may also pay online . Be sure to send in this form so we know you will attend and your lunch preference:

**[www.ncplantfriends.org](http://www.ncplantfriends.org)**

#### **RETURN THIS FORM WITH CHECK TO:**

**Friends of Plant Conservation  
NC Plant Conservation Program  
NCDA&CS, Plant Industry Division  
1060 Mail Service Center  
Raleigh, NC 27699-1060**



**AREA HOTELS – listed by distance from meeting site (approximately)**

**Hampton Inn, Charlotte-Belmont**

820 Cecilia Alexander Dr, Belmont, NC 28012

Phone: (704) 825-6100

**Holiday Inn Express, Charlotte=Belmont**

250 Beatty Dr, Belmont, NC 28012

Phone: (704) 812-2000

**Courtyard by Marriott, Charlotte-Gastonia**

1856 Remount Rd, Gastonia, NC 28054

Phone: (704) 852-4411

**Fairfield Inn by Marriott, Charlotte=Gastonia**

1860 Remount Rd, Gastonia, NC 28054

Phone: (704) 867-5073

**Hickory Grove Baptist Church - meeting and lunch**

3717 Hickory Grove Road

Gastonia, NC.

**Redlair Preserve – Preserve Walks (strenuous and easy options)**

Redlair Lane

Gastonia, NC

You will enter the meeting address in your preferred mapping device, but to give you an idea where it is in relation to Charlotte, Gastonia, Belmont, and Redlair Preserve, we offer this general map of the area. You CAN avoid Charlotte ☀️

Redlair Preserve is just off Hickory Grove Road, about 2 blocks from the church.

