Wild Flower

journal of the
North Carolina Native Plant Society

"Under the spreading chestnut tree,
the village smithy stands."
Henry Wadsworth Longfellow

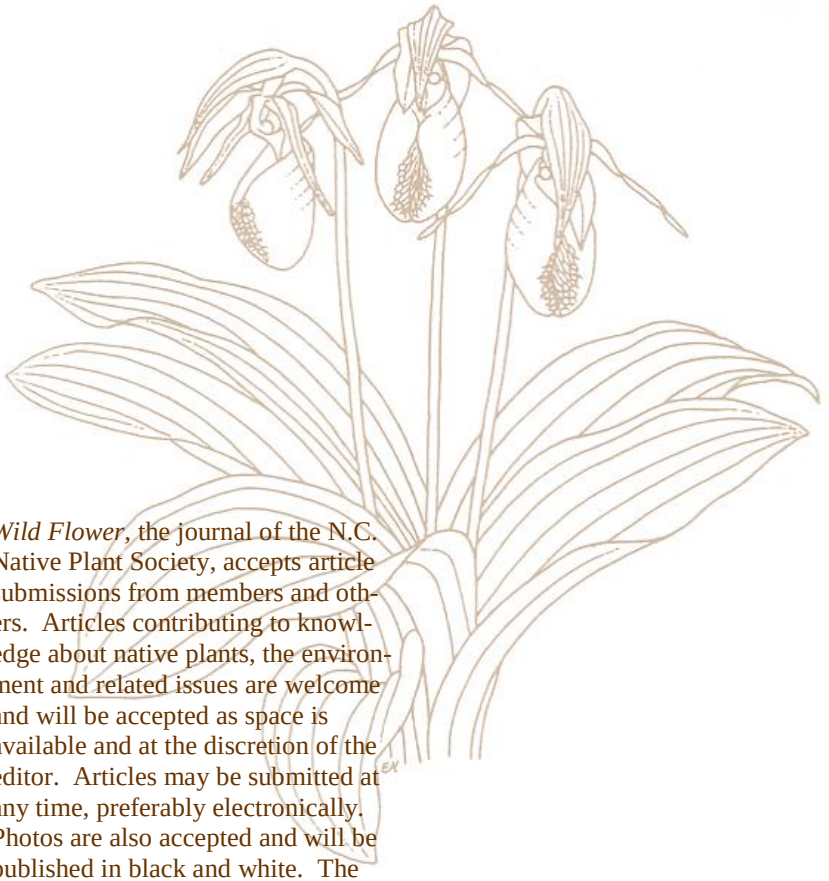
Winter 2007
Volume XIX

Cover illustration:

This drawing, by Henry Wadsworth Longfellow, of the American chestnut tree and blacksmith shop inspired his poem that begins,

"Under the spreading chestnut tree, the village smithy stands."

U.S. Department of the Interior, www.doe.gov/issues/chestnut.html



Wild Flower, the journal of the N.C. Native Plant Society, accepts article submissions from members and others. Articles contributing to knowledge about native plants, the environment and related issues are welcome and will be accepted as space is available and at the discretion of the editor. Articles may be submitted at any time, preferably electronically. Photos are also accepted and will be published in black and white. The journal is published in December of each year.

For additional details, contact the editor at:
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Kindly Note

The NCNPS newsletter is available by email, an environmentally responsible method of transmission.

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Progress Report from NCNPS Grant Recipient Rachel Spigler

The following is a summary of my dissertation research on the native biennial Sabatia angularis*, commonly known as "rose pink", which was supported, in part, by the NCNPS 2005 Tom & Bruce Shinn Grant Program. I completed my dissertation and received by PhD in Plant Biology from the University of Georgia in August 2007.* Sabatia angularis *is truly a beautiful species, and my research has left me wanting to learn more about its natural history and biology.*

I currently live in Pittsburgh, Pennsylvania where I have been working as a Postdoctoral Associate in the Department of Biological Sciences at the University of Pittsburgh since September 2007. I am also working on manuscripts of my dissertation research for publication in peer-reviewed, scientific journals. More detail on the studies described below can be found in my dissertation (Spigler 2007) and in a forthcoming paper in Journal of Ecology (Spigler & Chang, in press).

Reproduction in rose-pink (*Sabatia angularis*, Gentianaceae): the consequences of small population size

Small plant populations may be vulnerable to a number of factors that increase the risk of local extinction. Frequently, reductions in pollination services in small populations underlie these factors. For instance, pollinators are often less attracted to small populations (e.g., Levin & Anderson 1970; Sih & Baltus 1987; Waites & Ågren 2004). Consequently, reproduction in small populations becomes pollen-limited and fruit and seed production are diminished (e.g., Jennersten 1988; Ågren 1996; Groom 1998). If chronic, reproductive declines might translate into lower recruitment, effecting declines in population growth over time as well as retarding colonization or population recovery (Lennartsson 2002; Waser et al. 2000; Ackerman et al. 1996). Reductions in pollinator visitation could also inadvertently lead to increased inbreeding in small populations. This situation is most pertinent to self-compatible species that are able to compensate for reduced outcross pollen receipt through autonomous self-pollination (Karoly 1992; Kalisz *et al.* 2004); such increases in self-pollen deposition can lead to increases in the rate of self-fertilization, the most extreme form of inbreeding. Even in other species,

Sabatia angularis. ©Robert H. Mohlenbrock. USDA SCS. 1989. Midwest wetland flora: Field office illustrated guide to plant species. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science

however, changes in pollinator behavior can lead to changes in the mating system (i.e. the amount of selfing versus outcrossing) (Heinrich 1979; Antonovics & Levin 1980; Ghazoul *et al.* 1998). Through the expression of inbreeding depression—the reduction in quality of offspring produced by inbreeding events compared to outcrossing events—inbreeding could reduce average reproduction and survival in small populations, reducing growth rates and even increasing extinction risks (e.g., Oostermeijer 2000; Brook *et al.* 2002). Furthermore, inbreeding can lead to decreases in genetic diversity (Ellstrand & Elam 1993), which may also translate into reduced plant performance (e.g., Bush *et al.* 1987; Fischer & Matthies 1998; Reed & Frankham 2003). Decreases in genetic diversity, however, may also arise through random losses of gene variants (a process known as "genetic drift"). The severity of the consequences of reduced population size, however, will depend on the amount of time a population has remained small, for one, and may be ameliorated by gene flow (Richards 2000) or the purging of deleterious alleles causing inbreeding depression via natural selection (Lande & Schemske 1985; Lande 1988).

For my dissertation research, I sought to determine whether small populations of a native biennial, *Sabatia angularis* L. Pursh (Gentianaceae), commonly known as "rose-pink", are vulnerable to such reproductive consequences. Specifically, I asked three main questions: (1) Are mean fruit and seed set reduced in small populations of *S. angularis*? (2) Do small populations have increased inbreeding and reduced genetic diversity? (3) What are the potential consequences of increased inbreeding for population viability? The answers to these questions can help improve our understanding of the consequences of reduced population size and can provide insight into factors affecting fundamental population dynamics such as population establishment and local extinction.

S. angularis is a common wildflower of the eastern United States and occurs in a wide variety of habitats including wetlands, old fields, rocky outcrops, and prairies. Several aspects of this species' biology made it appropriate for this study. Although considered common, natural populations vary greatly in size. Most populations range from approximately 1 to almost 400 plants, but if maintained, populations can reach over 7,000 (Spigler, unpublished data). On the other hand, populations that are not maintained face real extinction risks; *S. angularis* is listed as threatened in Michigan and as endangered in New York (USDA 2002). Furthermore, previous research determined that *S. angularis* is fully self-compatible (Dudash 1987, 1990) and there are many opportunities for self-pollination in natural populations. Despite being protandrous (flowers enter male phase prior to female phase), autonomous self-pollination can occur when these phases overlap within a flower (Spigler, unpublished data). In addition, flowers in different phases are typically open at the same time within an individual (Spigler, personal observation). Given that a medium sized plant can have upwards of 50 open flowers at a time, individuals may also experience high levels of self-pollination when pollinators move between flowers of the same plant. Furthermore, inbreeding depression has also been found to occur in at least one *S. angularis* population (Dudash 1990).

I addressed my research questions using 20 natural *S. angularis* populations that were located in North Carolina, South Carolina, and Georgia and ranged in size as described above (see Spigler 2007 for details). To answer the first question concerning reproduction and population size, I randomly selected up to 35 individuals per population and estimated their fruit and seed set. I measured fruit set as the ratio of the total number of fruits to the total number of buds produced per plant. Seed set is typically measured as the mean number of seeds per fruit. Since seeds of this species are so small, I measured seed set as total seed mass per fruit, which I previously determined to be significantly correlated with seed number (Spigler, unpublished data). Because these measures are relative, they are useful for comparing reproduction between individuals and populations. I then evaluated the effect of population size on fruit and seed set using regression analysis.

To address the second question concerning the effect of population size on inbreeding and genetic diversity, I genotyped 12 progeny for each of 20 maternal plants in eight populations across eight polymorphic allozyme loci, yielding a total of 1,920 plants. These eight populations were a subset of the original 20 and ranged in size from 15 to 355 individuals. I used the genetic data to estimate outcrossing rate and standard measures of genetic diversity for each population. I then used correlation analysis to examine how these parameters varied with population size.

To address the potential consequences of increased inbreeding for population viability, I performed an experiment examining the prevalence and

Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. Vol. 3: 5. Courtesy Kentucky Native Plant

magnitude of inbreeding depression across six of the above eight populations. For this experiment, I hand pollinated flowers on approximately 15 plants per population *in situ*. Each flower received either self-pollen or outcross pollen. I subsequently measured fruit and seed set in the field, germination in the greenhouse, and survival in a common garden and in the original field sites. I used this data to examine whether outcrossed progeny performed significantly better than selfed progeny.

My results showed that small *S. angularis* populations have significantly reduced mean fruit set (i.e. proportion of flowers that matured into fruit) (Spigler & Chang, *in press*). Interestingly, fruit set was relatively constant among populations with greater than 15 individuals, but below this number, dropped precipitously. This suggests that there is a "threshold" population size, below which *S. angularis* populations may be in reproductive danger. Mean fruit set in such populations can reach as low as 45% and, on average, is about 20% less than that in larger populations. The cause of these reductions was not clear. There was some suggestion that these results may be due, in part, to reduced pollen loads in the smallest populations, but experimental studies are needed to further elucidate the underlying mechanism. Despite changes in fruit set with population size, however, the average number of seeds produced per fruit did not vary with population size. As a result, average total reproductive output per plant did not vary predictably with population size. Instead, average reproductive output per plant was highly variable among small populations. These results suggest that small populations of *S. angularis* can suffer reproductive disadvantages through reduced fruit set, but that total seed production per plant is not always compromised. Detailed results from this study may be found in Spigler and Chang (*in press*).

Results from my mating system analyses revealed that *S. angularis* is predominantly outcrossing; on average, the outcrossing rate is approximately 78% across populations (Spigler 2007). Since the rate of selfing and outcrossing sum to 100%, this result may be stated in terms of self-fertilization, with the average selfing rate across populations approximately 12%. This estimate

agrees well with earlier work by Dudash (1990), which was not based on genetic data. The selfing rate varied among populations, however, and increased significantly with population size (Spigler 2007). Mean estimates of selfing rates in small populations were as much as 6 times higher than those from larger populations. This indicates that seeds produced in small populations are more likely to be a product of self-pollination events, rather than outcross pollination events. As I discuss below, this difference may be important because self-pollination events lead to the production of poor quality offspring. I did not see a relationship between genetic diversity and population size, which indicates that small populations are not genetically depauperate. Caution should be taken in interpreting this latter result to mean that small populations of this species are immune to genetic loss. For instance, populations may not have been small long enough for the effects of genetic erosion to have manifest or the high rates of selfing seen in the study may not be typical of historical rates. Alternatively, natural selection between the seedling stage, from which we obtained our population level outcrossing rates, and the adult stage might favor heterozygous genotypes, thus preserving genetic diversity. Data collected from my final study suggest that selection may indeed be responsible for these patterns.

Lastly, I demonstrated that selfed *S. angularis* offspring have significantly reduced germination and survival than outcrossed progeny (Spigler 2007). On average, selfing resulted in a 33-43% reduction in the number of offspring surviving up to one year, depending on the environment. The relatively poor performance of selfed offspring could result in lower population growth or viability for small populations, given that those populations have significantly higher selfing rates and thus a greater percentage of offspring produced through selfing. Fortunately, however, natural selection may be able to offset these losses by removing inbred offspring from natural populations and maintain genetic diversity in small populations.

In conclusion, small populations of *S. angularis* tend to have reduced fruit set, although total reproductive output per plant is highly variable. In addition, plants in small populations have increased selfing rates, on average, and the offspring of selfing events are of poorer quality. The long-term consequences of these reproductive disadvantages will depend, in part, on the ability and effectiveness of natural selection to purge unfit, selfed offspring from populations. In addition, migration of genes via pollen or seeds between populations, as previously mentioned, may help to mitigate the long-term consequences. Future studies might consider following natural populations through time to examine differences in population growth rates among populations of varying size and to determine whether these reproductive disadvantages play a role.

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Lichen Biodiversity in North Carolina

Gary Perlmutter

Lichens are symbiotic organisms that consist of a fungus (mycobiont) and a photosynthezising partner (a green alga or cyanobacterium, known as the photobiont), growing intimately together as one. These distinctive and varied organisms are found on most surfaces in our forests and cities, but are largely neglected by both scientists and lay people alike. They are what I consider "the forgotten flora."

My interest in lichens began over ten years ago while I lived in the small community of Meiners Oaks in the shrubby chaparral of southern California. "Back West," as I like to say, lichens are far rarer due to habitat loss and their sensitivity to air pollution. When I moved to Raleigh in 2003 I was amazed by the richness & diversity of the Southeastern forests, and I was eager to learn if the lichen biota was just as rich.

I began taking seasonal flora classes at the North Carolina Botanical Garden (NCBG), then enrolled in the Garden's Native Plant Studies Certificate program in July 2004. Having caught the biodiversity bug from attending the First Lichen Bio-Quest with the All Taxa Biodiversity Inventory (ATBI) in the Great Smoky Mountains National Park just one month earlier, I decided to conduct an inventory here in the Piedmont. This inventory would become my Final Project in the Certificate Program.

My inventory project has three components: (1) a state-wide checklist built from pre-existing literature; (2) a survey of the regional herbaria for specimens previously collected in the Piedmont; and (3) intensive field surveys of lichens in protected forests of the Piedmont. Any scientific endeavor requires background research before hitting the field. It became immediately clear to me that the bulk of lichen research conducted in North Carolina has been done in the mountains, and that relatively little is known about the Piedmont lichens. My initial research also revealed that most previous work had focused on the larger, more conspicuous cladonias and foliose lichens1.

While researching the scientific literature for what is known about North Carolina lichens I found an online global portal to lichen checklist published by the University of Hamburg, Germany2. The checklist for North Carolina contained only 136 lichen species with just five reports evaluated! I got to work, and with the help of other lichenologists, compiled a state checklist of over 700 species 3, 4. I was invited by Dr. Tassilo Feuerer, webmaster for this global

portal, to supervise the checklist for North Carolina, and it now boasts 790 species and over 25 evaluated reports5. I anticipate that there are still many lichen species to be inventoried from The Old North State, and that the list checklist eventually will have over 1,000 species.

The second phase of my project was to survey the lichen collections of two local herbaria: Duke University (DUKE) and the University of North Carolina at Chapel Hill (NCU). A systematic search of these collections and others via their online databases yielded 20 new species for the state's checklist. With the financial assistance of the Shin Grant through the North Carolina Native Plant Society, I was able to publish the results of this herbaria survey6.

Perhaps the most enjoyable aspect of my inventory project is the on-going field work in the State Parks of North Carolina, with particular focus on William B. Umstead State Park, over 5500 acres of Piedmont forest between the cities of Raleigh and Durham and adjacent to the RDU International Airport. My work in Umstead Park began in February 2006 as a series of public walks on lichen biology. When I contacted Umstead Park to obtain a collecting permit, I learned that the North Carolina State Park system is building a database of the natural resources found in each park. However, when Betty Anderson, the Office Assistant at Umstead, queried the database for lichens, there were only three species recorded for the whole state!! I was then given access and was trained to enter my lichen observations into the State Park's Natural Resources Inventory Database7. As word spread, I have been invited to other state parks to investigate their lichen floras. To date, seven additional parks have been inventoried: Fort Macon, Lower Haw River, Occoneechee Mtn, Morrow Mtn, Pilot Mtn, Raven Rock, and Theodore Roosevelt State Natural Area. Check-lists for two, Fort Macon State Park and Theodore Roosevelt State Natural Area, have recently been published 8,9.

I have formed a close collaboration with lichenologist James C. Lendemer, formerly at the Academy of Natural Sciences in Philadelphia (PH), and currently at the New York Botanical Garden (NY). Lendemer has been generous with his time and expertise, and has examined many of my more difficult-to-identify specimens. In January 2007 we conducted a joint foray into Umstead Park. Our collections, deposited in PH and NCU herbaria, number over 300, and our checklist now stands at 140 species, including a few possibly new to science.

The species list for Umstead Park is unusually rich in crustose species, with over half of the flora consisting of crusts (Table 1). I think this is not that Umstead Park is unusually endowed with crusts, but that they are often neglected because they are so difficult to identify. While many of the macrolichens can be identified morphologically, many crusts require more technical means such as microscopic examination of fruiting bodies (ascomata) and chemical testing,

Table 1. Comparison of North Carolina Piedmont lichen biotas by habit showing differences in sampling.

	Crustose	Foliose	Fruticose	Total spp
Herbaria holdings (pre-2006)	32%	47%	21%	350
Umstead State Park forays (2006-2007)	61%	23%	13%	140
Mason Farm plot surveys (preliminary data 2007)	56%	28%	16%	100

including Thin Layer Chromatography (TLC). These technical difficulties, combined with the small physical size of crusts, make crustose lichens an especially forgotten part of our flora.

A major part of my Final Project for the NCBG Certificate Program is to inventory lichens in Mason Farm Biological Reserve located on the Durham/ Orange County line. In 1991 Julia Larke and Rick Busing inventoried all the trees, shrubs, vines and wildflowers in plots in MFBR10. However, they did not inventory the lichen flora within these plots. For my inventory I am using four plots in the Shagbark Hickory Slope Natural Area (in an oak-hickory forest over diabase rock) and four other plots in Big Oak Woods Natural Area (a seasonally flooded Piedmont swamp forest over Triassic sediments). Although there is much overlap of the lichen floras of the two areas, there are distinctions, notably that few lichens occupy the forest floor in Big Oak Woods. As I discovered in Umstead Park, Mason Farm Biological Reserve has a rich lichen flora (with possibly new species!) and a predominance of crusts (Table 1). One interesting collaborative project involves some of my more recently collected specimens of Shield Lichens (Parmeliaceae). There are over 175 species in 35 genera of Shield Lichens in North Carolina – a whopping 23% of the state's lichen biota! I am providing Dr. Tassilo Feuerer, a lichenologist at the University of Hamburg, Germany, with specimens for his molecular studies to discern the relationships between the various species within the Shield Lichen family.

All the lichen specimens that I collect are being deposited at the University of North Carolina Herbarium (NCU), so that future lichenologists can benefit from my work. I have also assumed curatorial responsibilities for this collec-

tion in collaboration with Curator Dr. Alan Weakley. Since both the NCU Herbarium and Mason Farm Biological Reserve are parts of the North Carolina Botanical Garden, this seemed the most appropriate place for my voucher specimens. Surveying NCU's small lichen collection in 2005, I was surprised to find that most specimens were collected between 1920-1940. After this period, lichen research in North Carolina shifted to DUKE with the arrival of Drs. William and Chicita Culberson in the 1950's. Over the next fifty years the Culbersons and their students built one of the largest lichen collections in the United States. Another shift occurred at DUKE in the early 2000's with the arrival of Francois Lutzoni and his team of molecular phylogeneticists. After completing the Mason Farm Biological Reserve lichen inventory and graduating from the North Carolina Botanical Garden's Native Plant Certificate Program, I plan to continue forays into North Carolina's State Parks. I hope that my work on the lichen flora of North Carolina, with my particular focus on the Piedmont and my devotion to the collection and identification of crust lichens will greatly add to our knowledge of this forgotten flora.

Figure 2. Myelochroa aurulenta, a member of the Parmeliaceae being studied in Hamburg, Germany. Image taken in a plot at Mason Farm Biological Reserve.

Acknowledgement

I would like to thank Carol Ann McCormick, Assistant Curator of the UNC Herbarium, for making improvements on an earlier draft of this article.

Gary Perlmutter

Footnotes and References:

1. The three major habits of lichens are: crustose (crust-like), foliose (leafy), and Fruticose (shrubby or otherwise three-dimensional). Cladonia cristatella, British Soldier Lichen, is a common lichen whose red spore-producing reproductive structures are clearly visible.

2. www.checklists.de

3. Perlmutter, G. B. (2005) Lichen checklist for North Carolina, USA. Evansia 22 (2): 51-77.

4. --- & D. N. Greene (2005) Corrections and additions to the North Carolina, USA lichen checklist. Evansia 22(4): 126-137.

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9. --- (2007) A supplemental checklist of lichens in Theodore Roosevelt State Natural Area, North Carolina, USA with a note on the rare Teloschistes flavicans. Evansia 24 (4): in press.

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Figure 1. Piedmont lichens showing characteristic lichen habits: A) *Pyrenula punctella*, a common crust on beech; B) *Candelaria concolor*, a foliose lichen common on urban trees, and C) *Cladonia didyma*, a fruticose species on wood.

A.

B.

C.

Recovering North Carolina's Native Treasures

Jo Meyerkord

The Center for Plant Conservation salutes the North Carolina Native Plant Society, because we know you appreciate your native plants! Native plants are the hallmark of home, the tapestry of the familiar landscapes we hold dear. They are also incredible resources for food, fiber, medicines and unknown future needs of man. They deserve attention and good stewardship, yet today 15% of our native flora is documented to be in steep decline or considered at risk.

We know you value your North Carolina natives for more than their role in your own identity and sense of place, and you want to preserve these precious assets. The U.S. Fish and Wildlife Service has listed 27 species in North Carolina as endangered or threatened under the Endangered Species Act. Within the state, the Department of Agriculture and Consumer Services administers the state laws protecting plant biodiversity and has listed 134 as endangered or threatened. The state is a leader in plant conservation and has its own Office of Conservation & Community Affairs as part of the North Carolina Department of Environment and Natural Resources. The Center for Plant Conservation's Participating Institutions are currently working with 63 North Carolina native species, securing them against extinction. You can review them by clicking on "National Collection" on our website: www.centerforplantconservation.org, and searching for North Carolina.

Headquartered in St. Louis, CPC is a network of 36 botanical institutions involved in the study, preservation, conservation and restoration of the nation's imperiled native plants. The network of botanists has been working with imperiled plants for more than 20 years. CPC's goal is to build programs to recover all imperiled plants across the country, so that native plants are thriving again.

Unlike popular garden ornamentals, many native plants have had little research attention and little is known about their basic biology propagation, restoration or management needs. Fortunately, scientists at CPC's network institutions the North Carolina Botanical Garden at the University of North Carolina in Chapel Hill and the North Carolina Arboretum in Asheville have a strong commitment to imperiled plants of the state. They've collected and secured seed, learned to grow the species and have a number of monitoring restoration and management projects to benefit North Carolina species.

Securing and restoring vulnerable plant species is challenging and involves

many different scientific specialties. Collaboration is essential to succeed in restoring these species, and CPC is all about partnerships! CPC institutions are working in communities nationwide monitoring, securing seed and working with local and federal agencies to restore habitats and rare populations. Partnerships with the North Carolina Natural Heritage Program and similar organizations make it possible to make a difference on the ground within the state. Find those working to conserve plants in North Carolina on our website, in our conservation directory, which is searchable by state.

Reintroductions of imperiled species are a key part of the mission of the Center for Plant Conservation and their national network of Participating Institutions and North Carolina Botanical Garden is a leader in the field. Working to restore the landscape with the native plants that once flourished is a priority. The North Carolina Botanical Garden (NCBG) has been working with Harperella (*Ptilimnium nodosum*) for many years. Recently, they collaborated with NCBG staff, volunteers, the NC Plant Conservation Program, the Natural Heritage Program and the U.S. Fish and Wildlife Service on a reintroduction. The team outplanted 800 individuals on an historical site on the Deep River in Piedmont, North Carolina.

The team had some challenges. Just one day after the reintroduction, the river waters rose eight feet due to heavy rains. And within that first week, the site flooded three additional times. Another challenge came also by air, Canada geese. Their taste for the species caused the fragile seedlings to struggle.

But, the plants persisted. By the end of the season, over 150 of the plants reached 30 centimeters in length and dozens of the flowering scapes rose to knee-height.

During the following winter and spring the plants were challenged again. They were completely submerged and faced another difficult growing season. Once again the plants won. Under inspection in the summer of 2007, the team counted 125 individuals.

Attrition of the original planting was expected, but the team is already seeing on-site sexual and vegetative reproduction. They will follow the progress of the reintroduction over many years, and continue to be optimistic about the future of Harperella on the Piedmont River. Recently, CPC's newsletter featured an article on North Carolina Botanical Garden's work with Harperella. You can find it at www.centerforplantconservation.org/Assets/Summer2007.pdf

Educating the public on native species is a crucial tool in spreading the word of North Carolina's imperiled natives. Conservation education starts early. In a recent survey, a surprising number of students were unable to identify plants as being alive. Parents and educators may be interested in "Plants in Peril, a guide to exploring biodiversity and rare native plant conservation for middle school educators." This lesson plan was developed by CPC as a means of reaching youth with native plant information and help start a dialogue with kids about native plants. Available at the CPC website by clicking on "Education Tools," the topics include biodiversity, rare native plants, challenges to saving plants in peril, multiple student activities, ideas for action projects, and additional resources.

While CPC's institutions are working everyday with our scientific standards and protocols to make a difference for North Carolina's vulnerable plants, it is a big job. In addition to partnerships with agencies, there is a role in support, education, and volunteerism for everyone who wants to help. You may already be active in helping control invasive species, monitoring rare plant sites, cleaning seed or entering data for a conservation project. If you're just getting started, the conservation directory is a good source of information.

Building support for plant conservation and stewardship is one of CPC's priorities. CPC has established a plant sponsorship program to build sustainable funding for vulnerable plants. For each sponsored species, funds are provided annually to CPC institutions to assist in restoration efforts. These funds have already significantly supported work for Harperella. If you'd like more information about CPC or plant sponsorship for other species visit our website www.centerforplantconservation.org or call 314-577-9450. Let's work together to make sure North Carolina's imperiled plants populations are restored for future generations!

Center for PLANT Conservation

Recovering America's Vanishing Flora

www.centerforplantconservation.org

Jo Meyerkord can be reached at the following address:

Communications Coordinator
Center for Plant Conservation
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St. Louis, MO 63166-0299

Climate Change and Adaptation

Sam Pearsall
Director of Science,
The Nature Conservancy, NC Chapter

One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.

This quotation from Aldo Leopold is such an integral part of the culture of conservation that I suspect I do not have a colleague who cannot recite at least the first sentence verbatim. But ever the optimist, I have never quite believed it. Working in conservation since 1978, I have fancied that we live in a world of scrapes and contusions, a world where the wounds, however painful, are hardly lethal, and more likely over long enough time to leave scars than corpses. My employers for most of my career have been The Nature Conservancy and the Tennessee Natural Heritage Program, organizations utterly committed to another of Aldo Leopold's famous sayings – the one about saving every cog and wheel – convinced that saving the pieces – all the species and natural communities – can save the world. It is, after all, still a beautiful world for the most part, and there is little obvious, direct evidence that it is falling apart.

One hundred and twelve years ago, in 1895, Svante Arrhenius, a Swedish chemist, first described the expected impacts of human consumption of fossil fuels on the extra accumulation of greenhouse gases and the likely increase in the temperature of the atmosphere that would result. His predictions were not far off the current predictions of the very sophisticated global circulation models used by scientists and international agencies today. So global climate change and its scientific foundations are hardly news. Yet today, we have only just begun to acknowledge the enormity

of the problem, our responsibility for it, and its likely consequences for us. Most of those who are engaged with the issue are, quite correctly, trying to devise policies and technologies that will put an end to and then reverse the artificial augmentation of greenhouse gases. That is very good news. The very bad news is that it is too late to prevent global climate change from profoundly and permanently changing the world we live in – the world people like us are trying to conserve.

At Oak Ridge National Laboratory, scientists have engaged in a fascinating process in which they use a warehouse full of computers in a massive parallel array and Principal Components Analysis, a statistical technique, to classify the earth's surface into unique, self-similar ecological domains based on characteristics of soil, topography, and climate. Each domain represents a unique opportunity for a suite of ecosystems. In 2004, scientists from The Nature Conservancy began to work with the Oak Ridge team to see what would happen if climate were decoupled from the other variables for the 48 contiguous states. They tried out a couple of the scenarios developed by the UN Intergovernmental Panel on Climate Change (IGCC), and they found cause for both hope and grave worry. In the best case scenario, a scenario in which current emissions are quickly and drastically reduced, about 15% of the domains disappear entirely, and over half the land surface is occupied by domains that do not exist today. In the modest, gradual improvement scenario, the scenario that fits most of the negotiated solutions being proposed in Congress and on the international front, more than 60% of the domains disappear entirely, and more than 60% of the land surface is occupied by entirely new domains. Simply put,

I have come to believe that the role of conservation from now on is not just to save all the pieces we can save; we must also positively influence what all those new ecosystems turn out to be.

in the best case scenario, more than half of the ecosystem occurrences and about 15% of the types will disappear, while in the most likely scenario, well over half of both types and occurrences will disappear. In a sense, the world really is falling apart. Without benefit of these statistics, Bill McKibben concluded the same thing in 1989 when he wrote a book about climate change and the dominance of human influence in all of the world's ecosystems.

But there is good news if we can find it. Every ecosystem occurrence and type that is lost will be replaced by something. As local ecosystems disassemble, and as some of their component species become extirpated or extinct, new ecosystems will assemble in their places. I have come to believe that the role of conservation from now on is not just to save all the pieces we can save; we must also positively influence what all those new ecosystems turn out to be. After all, the goal of intelligent

tinkering and saving every cog and wheel is not an outstanding cog and wheel collection. The goal is to keep the clock running. I believe that the science of ecology provides some basic principles for carrying on with our assignment of hope.

Ecosystem Resilience and Ecological Catastrophes

The literature of ecology is full of references to the notion of ecosystem resilience, and the diversity of definitions for this concept is bewildering. I have come to use a metaphorical definition involving a ball in a bowl. Imagine that the ball represents the current state of an ecosystem, and the bowl represents all the possible states of that ecosystem, its normal range of variability. Various environmental perturbations will cause the ball to move around in the bowl. The center of the bowl, the point at which the ball rests if there are no perturbations, is the hypothetical equilibrium point for the ecosystem. But of course, many ecosystems seldom or never come to rest here. For example, a fire-maintained system may never even cross this point in its travels around its bowl. Measures of the shape and size of the bowl can represent measures of the ecosystem's resilience. The steepness of the bowl's sides accounts for the amount of energy it takes to move or keep the ball away from the center. The diameter, and thus the area, of the bowl represent the range of possible states from which the ball can return to the center. A very large, very deep bowl represents a very large degree of resilience. Even in the face of major perturbations, the ball is more likely to be able to remain in the bowl if it is large and deep than if it is small and shallow. In systems science, we define the departure of the ball from the bowl as a "catastrophe." A catastrophe is not necessarily a bad thing, but it is a transformation of the system from which there is no return to any previous state. So if our ecosystem is so jostled that it is changed beyond its ability to return to any point in its normal range of variability, it is permanently a new ecosystem. The ball is out of the bowl forever.

Ecologists talk about three dominant characteristics of ecosystems: composition, structure (pattern), and function (process). It turns out that diversity within these three measures often correlates with the size of the bowl. In particular, redundancy of function turns out to be a very good predictor of resilience. The more different ways a critical function can happen, the more likely it will happen in the context of environmental stresses. Diversity of composition and structure are major contributors to redundancy of function. For example, the more species capable of fixing nitrogen, the less likely any given disturbance will disrupt nitrogen fixation. Conservation managers generally take it as given that our job is to conserve the diversity of composition, structure, and function across the full range of an ecosystem's potential states. We think this will enhance resilience and contribute to the persistence of the ecosystem within its natural range of variability. We think we can avoid catastrophe and keep the ball in the bowl by preventing simplification. Sometimes we can.

But the bowl is moving! In the context of geological or evolutionary time, it is easy to recognize that the bowl itself is moving along some trajectory. The range of variability for an ecosystem is shrinking in some directions and expanding in some others over time. The ecosystems of the late Pleistocene have morphed into the ecosystems of today, and their new ranges of variability sometimes do not overlap their old ranges at all. Normally this process happens very gradually. Sometimes it happens extremely rapidly, as it appears to have on those occasions in geological history when, against all short-term odds, an asteroid or comet collided with us. When these shocks occurred, rapid simplification quickly shrunk the bowl to the equivalent of the dimple on a golf tee, and the ball fell out (off), and the process of diversification and resilience building started over. New species evolved, new niches were defined, and new ecosystems became established. Over geological time, these shocks have happened rarely enough that they have not, in aggregate, prevented the development of an extremely complex, diverse, and resilient global ecosystem. Earth's biosphere is the survivor of many simplification episodes. There is much hope in that fact.

Mission Impossible?

Climate change has been accelerated by human consumption of fossil fuels, and incidentally, also by human agricultural practices and many other human activities not taken into consideration by Arrhenius. This situation looks to Bill McKibben and many others, including me, like a probable, global catastrophe. We've kicked the bowl, and although the ball is still in it, the whole system looks poised to rapidly and drastically simplify. The bowl is getting smaller, the ball is moving faster, and the trajectory of the bowl is not reliably predictable from where we stand.

The conservation mission requires revision. While we continue to struggle to save all the cogs and wheels, all the species and communities, we must pay much more attention to the mechanism of the clock itself. What do all of those cogs and wheels do? When some of them inevitably disappear, what can take their place to keep the clock running? Is it possible for conservationists to help today's ecosystems change and adapt to an unknowable future by turning our attention more toward conserving and building resilience? I have no idea at all if this is possible at the global scale. At that scale, we are riding the bowl wherever it is going, and attempts to slow its velocity by rapidly reducing new and sequestering old greenhouse gas emissions are our only real hope. Meanwhile, at every scale, from the biosphere to the coastal salt marsh, we can try to keep the balls in their bowls. We can try to manage ecosystems to adapt to climate change in ways that avoid rapid simplification.

When I started thinking this way about conservation, my first reaction was hopelessness. I thought the new mission was impossible. It seemed too complicated to understand and too big to accomplish. But eventually a few basic

principles began to emerge from my worried wondering, and I am now very hopeful that we still have time to succeed. These principles all require a lot of refinement, especially in the context of their local application.

We can try to manage ecosystems to adapt to climate change in ways that avoid rapid simplification.

Lose the Glue

When I first became a professional conservationist, the operational paradigm was to glue the ball to the center of the bowl. We sought to find and preserve the pristine example(s) of each ecosystem type in its Platonic ideal. I don't know any conservationist who thinks that way now. All of us seem to be on board with the idea that an ecosystem has a range of states, and that not only do we need to recognize the range, sometimes we have to help the ecosystem move around within its range if the natural order of perturbations has been suppressed by other human actions. The use of prescribed fire is an outstanding example of this intent. The system needs jostling, and we do the jostling.

However, not all of us have accepted that the bowl has its own natural motion that we should not attempt to counter. I know of many cases where conservation practice is aimed at conserving a late Pleistocene or a pre-European bowl, a range of variability that can only be maintained by high energy, high cost human investments.

This situation is made much more complex by the fact of the bowl's new, erratic motion in the context of human actions, especially those contributing to climate change. The ecosystems we used to have are often either going or gone. We must become futurists, trying to imagine what the ecosystems of the future are likely to be, and how we can help them be more resilient. In many cases, we may have to abandon preservation and focus on abetting the transition, selecting one among many possible futures because we think it will be the most diverse and thus the most resilient.

For example, coastal freshwater wetlands once existed in a range of states that included different kinds of wetlands from open water (lakes and ponds) to marshes, pocosins, and littoral forests. Peat soils accumulated during the normal progression of ecosystem types, and then during catastrophic fires, the peat soils would be partially consumed, and the process would begin again. This cycle was long enough that it may not have happened more than once or twice anywhere, and there are some places where it may have never completed its first round.

The natural trajectory of this system included rising seas. When seawater comes into contact with peat, the latter decomposes more rapidly. We don't know what the pre-industrial rate for sea level rise was in North Carolina, nor do we know how often catastrophic fires resulted in ground ignition, but we do know that these processes were gradual enough or rare enough that significant peat deposits are now physically sequestered under accumulated silts and salt marshes along the sound shores.

A rational approach to managing this suite of ecosystems today, in the context of rapidly rising seas would include proscription of ground fire, even in wild-fires, prevention of shoreline armoring to allow the inundation to be as gradual and natural as possible, closing old drainage ditches that now facilitate salt water penetration into peat lands, and the installation of structures such as sills or elevated oyster reefs along the shore to reduce the energy in the system as it goes under water. None of these options is terribly expensive, nor are any of them untested. And if the sea rises far enough, fast enough, they may not work. But they seem to represent viable options for making the system more resilient, and thus less likely to rapidly simplify (e.g. to a colloidal mud bottom supporting mainly bacteria) in the context of rapid climate change. As a bo-nus, these strategies may also prevent a lot of peat from becoming greenhouse gases

. . . .we may have to abandon preservation and focus on abetting the transition, selecting one among many possible futures because we think it will be the most diverse and thus the most resilient.

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More Contiguous, More Connected, and More Protected Are Probably Better

Some of the most important things we can do to build resilience into future systems are already part of our rhetoric and typically our practice. The three ideas that follow will not be new to anyone in the conservation business.

Once upon a time, scientists argued all night about whether a single large or several small preserves of the same area would capture more diversity. If cap-turing diversity (the cog and wheel collection) is not the goal, and building in resilience in the face of climate change (keeping the clock running) is the goal, then bigger, more contiguous conservation lands are almost certainly better.

If organisms have any chance at all of moving ahead of climate change related stress, then connectivity among protected areas becomes very important. Cor-ridors should begin with lack of obstructions (no hard armoring of the coast, no un-bridged wetland road crossings, no major highways without bigger under-

passes than we have managed so far). Corridors should, when it's possible, follow ridges, river valleys, and soil types. However, we should not have high expectations that many species will be able to shift their ranges as rapidly as their home ranges are changing. Whole ecosystems will not change ranges intact.

Finally, during the Pleistocene, many species were able to take refuge in sheltered places that served as refugia. The move into these refugia took thousands of years, and the move back out, when it was successful, took about the same. We should protect the most sheltered places, e.g., coastal coves and montane valleys, in hopes that some species may find long term refuge there.

Manage the Guest List

The ideas listed in the previous two sections are directed mainly at conserving appropriately managed, adequately large, adequately connected and protected opportunities for the ecosystems of the future. Imagine that we are in the process of preparing a city for an expected influx of refugees, many of whom are expected to stay a long time. We also know that many of the current residents, including some whole neighborhoods, have already left or will leave. We have many things to do to make the environment more hospitable for the new residents, and we have many things to do to avoid displacing as many as possible of the established residents. We also need to develop strategies for prediction, and that failing, early detection of the invaders, the weeds. As species move into the places where old ecosystems have disassembled, some will be relatively well behaved, adding to diversity of composition, structure, and function. Others will be simplifiers, taking over many niches, tending to simplify the system. And some of the old residents, detecting opportunity and succumbing to temptation, may become simplifiers themselves. I suggest that developing comprehensive, reliable strategies for predicting which species will become simplifiers may be the most important bit of research that adaptation practitioners need today.

M*A*S*H

We do live in a world of wounds, and some of them are certainly lethal. I'm over my illusion about scrapes and contusions. Like the good doctors in the TV series, and like their models in the real Korean conflict, we are in the business of triage first, and then in the business of keeping things alive. Like them, our best hope is that the presidents and generals will solve the root problem quickly. Meanwhile, we've got a lot of work to do under pretty rotten conditions, and we've got hope.

Sam Pearsall

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Castanea dentata: Tree with a past

Jim Drake

Grandma was born in 1881 and spent her formative years in the nineteenth century. No one during that time enjoyed the conveniences we now consider essential to modern life. Fortunately, she survived well into the twentieth century. Some of my fondest youthful memories involve her descriptions of life in the North Carolina mountains when she was growing up.

Ground covered with nuts under a giant tree

Bounty from *Castanea dentata*, the American chestnut, had been a valuable sustenance for Native Americans and European settlers for generations. One of my favorites from Grandma's stories concerned the harvesting of chestnuts. During late fall, people would place bed sheets or other broadcloths under some of the larger trees to collect fruit which would fall from higher branches. Later, after the tree had completed its generous yield, residents would remove the encompassing burs and place the thin shelled nuts into horse-drawn wagons to be hauled away for later use as food and animal feed or sold for cash.

Plenty remained in the forest for feasting by deer, squirrels, wild turkeys and other wildlife. A typical eastern hardwood forest was comprised of about twenty-five percent chestnut trees. In addition to nutritional benefits from nuts, lumber produced from the logs was durable, strong and easily worked. Shade found beneath widely spreading branches provided welcomed relief from summer heat. *Castanea dentata* seemed the perfect tree.

A squirrel in Cadillac, Michigan enjoys the bounty

Shortly after the turn of the twentieth century, an introduced fungus caused an insidious blight that quickly spread from New York throughout the chestnut's native range destroying practically every tree by effectively girdling the trunk. Now about all that remain of this great hardwood are viable roots that continue to send up new shoots, doomed for re-infection. As I walk through the woods and frequently encounter these valiant survivors, I can only imagine the majesty of a bygone forest.

Fortunately, rather than lamenting the past, biologists, foresters and other scientists from many states are involved in massive efforts to restore the tree to past splendor. For example, The American Chestnut Foundation (TACF), http://www.acf.org/, a not-for-profit group headquartered in Bennington, Vermont coordinates 15 state chapters in helping with their efforts to produce blight resistant trees.

Male catkins in Georgia, June 2007.

Hal Massie and other volunteer members of TACF have worked with a few surviving fertile trees in Georgia. Their recent activities involved cross pollination efforts hoping to produce a blight-resistant chestnut strain. This year, Hal's group was able to collect pollen from Georgia, which was used to fertilize chestnut trees at TACF's orchard in Meadowview, Virginia. When the seeds are collected from those trees, they will be planted in containers and the resulting seedlings will eventually be planted in their native habitat.

The Southern Appalachian Regional Office of TACF, http://www.acf.org/saro.php, located in Asheville, is headed by Dr. Paul Sisco, Regional Science Coordinator and Meghan Jordan, Director of Communications. In a recent interview, Paul provided several interesting facts concerning North Carolina's activities. Using approximately fifty fertile American chestnut trees located in the western part of the state, a complex cross pollination project has been underway for about seven years. American chestnut trees are first cross-bred with Chinese chestnuts. These offspring are then backcrossed three more times with other American chestnuts. Finally, pairs of offspring from these trees are then intercrossed to form a blight resistant species comprised mostly of American chestnut but with a small fraction of Chinese chestnut genes to provide blight resistance. This project should be completed in about ten years at which time

NC Forest Service personnel and others will begin reforestation efforts. In the meantime, there are several locations at turnouts along the Blue Ridge Parkway where nut-producing American chestnut trees can be viewed. Also, two rest areas off I-26 – one in Polk County and one in Madison County – have informational exhibits on chestnuts. The one in Polk County includes directions on where to view live surviving trees.

Chestnuts are an important agricultural product of portions of northwest Michigan, and several varieties of chestnuts, including the legendary American chestnut, are grown locally. This part of the country was not in the original native range of *Castanea dentata* and the blight is not yet as prevalent there. Some of the American chestnut trees growing here were brought in and planted by early settlers and have survived to maturity.

This tree in Cadillac, Michigan was 50 feet tall with a trunk diameter of more than 5 five.

This past October 13, Cadillac, Michigan hosted its seventh annual Chestnut Festival, attended by hundreds including this writer. (See http://www.cadillacmichigan.com/chestnuts/) While in the area, I witnessed a sight I never expected to see in this life. Beside a country road, stood a huge American chestnut tree of at least five feet diameter and soaring to a height of fifty

feet or more. Underneath the crown of green leaves, the ground was literally covered with burs and nuts. Was that Grandma's whispered voice I heard, or just the rustling leaves?

Jim Drake

Burs on a giant chestnut in Cadillac, Michigan

Trunk of the giant tree in Michigan.

Note: Anticipating interest, Jim sent along information on places to see chestnut trees in North Carolina:

Following are some Blue Ridge Parkway sites where trees can be seen:

Mile Post #	**Name of Overlook or site**
413	Pounding Mill Overlook
412	Wagon Road Gap Parking Area
404	Hominy Valley Overlook
408.7	Pisgah Inn Deck
236	Devil's Garden Overlook near Virginia Borger (not Devil's Courthouse)

Following are directions to the I-26 sites where trees can be seen:

Polk County rest stop exhibit. If traveling north on I 26 from South Carolina heading into North Carolina, the rest stop is the first turn out on I 26 almost immediately upon entering North Carolina. If traveling south on I 26 from North Carolina, proceed on into South Carolina, take the first SC exit, turn left over the bridge and left again onto I 26 heading north back into North Carolina and take the first turn out into the rest stop. There is only one rest stop and it is on the north bound lane of I 26.

Madison County exhibit. The rest stop is located on I 26 south bound just past exit 3. There is only one rest stop and it is the one on the south bound lane. There is no rest stop on the north bound lane here.

NCNPS Fair Garden

Margaret Partridge

Surprisingly, our demonstration garden at the NC State Fairgrounds fared pretty well despite the record heat and drought of the summer. Although it did receive some sporadic irrigation (less than an inch per week), it is reputed to be located in the driest spot in the Flower Show area. I was very pleased with how our garden held up.

Just before the Fair, Stefan Bloodworth, Horticulturalist for the Blomquist Native Garden at Duke, Michael Patrick, (another Duke volunteer), and Reid Chapter members Tom Harville, Jeff Prather, and Margaret Partridge help spruce up the garden by replacing a few woodies, cleaning out the water feature, and pruning the desiccated foliage on the some of the perennials. One object was to replace several of the garden-worthy plants that are southeastern natives with North Carolina natives. These included a couple of deciduous azaleas and a bottlebrush buckeye. Several of the woodland plants we recorded as having been planted last year were not in evidence. It remains to be seen if they are just dormant or couldn't take the extremes of this past summer. As the young trees we planted mature, it will be easier on our native garden.

This year's showstoppers were the *Helianthus angustifolius* (Narrow-leaf Sunflower) and the *Euonymous americanus* (Hearts-a-burstin). The Healianthus was a blaze of vibrant yellow at the back of the "stream" and the Euonymous fruits always attract folks. I plan to add a *Callicarpa americana* (Beautyberry) for its attention getting purple berries.

I was pleased that the Reid Chapter came through better than ever with staffing the garden during the Fair. Every time I volunteered, there was a meaningful interaction with the public that may very well lead to new members for the Society and new interest in our activities, and I am sure that was true for all our volunteers. Many thanks to Charlie Kidder, Marlene Kinney, Sarah Palmer, Monika Coleman, Jan Stratton, AJ Bullard, Ken Moore, Kathy Buck, Maureen Buck, Morgan and Susan Waugh, Catherine and Steve Stokes, Dale Batchelor, Marilyn Miller, Ed and Janice Swab, Robert and Julia Mackintosh, Margaret Partridge, Tom Harville, Jeff and Cheryl Prather, Alice Zawadzki, and Pam Causey for giving so generously of their time.

Margaret Partridge
Reid (Triangle) Chapter Chair

North Carolina Native Plant Society

The Year In Review

Obituary

Robert W. Conner

HIGH POINT — Architect and environmentalist Robert W. Conner, 93, of River Landing, died on Friday, December 7, 2007, at the Presbyterian Home.

Bob was born in Wilkes-Barre, Pa., on September 8, 1914, the son of Floyd and Helen Bertels Conner. They moved to Utica, New York, where he grew up. He attended Duke University and studied architecture at N.C. State [then] College, working for Voorhees and Everhart Architects for some years before opening his own office.

He served in the 93rd Seabee (Construction) Battalion in World War II, in the Russell, Green, and Philippine Islands. His daily diary and letters have become the foundation of a website, www.seabees93.net. He was a member of the American Institute of Architects, local, state, and national (emeritus), Construction Specifications Institute, GTCC Architectural Advisory Board, HP Planning & Zoning Board for 14 years, the Piedmont Health Systems Agency, Toastmasters, Friends of the Library, and Friends of the Theater. He was a director and vice-president of the Jaycees.

Well-known in North Carolina environmental circles, he was a founder of the Conservation Council of N.C. and the Conservation Foundation of N.C., both of which he served as first President. He also served on the Guilford County Advisory Board for Environmental Quality for 15 years and the North West Preservation Committee. He served as President of the Catesby Bird Club, Piedmont Appalachian Trail Hikers and Friends of State Parks, and on the Board of the Piedmont Environmental Center. The last two, he was instrumental in founding. A member of Wesley Memorial United Methodist Church, Bob worked with the youth Kerygma program and the Marthas & Stevens.

On August 24, 1940, he married Elizabeth Hatcher, who survives of the home. Also surviving are a son, William H. Conner of Greensboro; two daughters, Sister Susannah Conner of La Plata, Md., and Christine Levin and husband, Dr. Steve Levin of Philadelphia, Pa.; a sister, Marion Sedlar of Salt Lake City; three grandsons, Daniel, Sam, and Matthew Levin, also of Philadelphia.

Actions and Decision of the Board of Directors for 2007

Funds dispersed as follows:

- Conservation Council $350
- NC Museum of Natural Science $100
- NC Botanical Garden $200
- NC Botanical Garden Building Fund $1,000
- BW Wells $100
- $500 for native plant seeds for the Meadowlark Sanctuary/ Piedmont Prairie
- $700 for two scholarships to Cullowhee conference
- $500 Shinn Grant award
- $100 Friends of Plant Conservation

Installation of permanent native plant garden at the NC State fairgrounds.

Became an affiliate of the Lady Bird Johnson Wildflower Center.

"Plants without Borders" May symposium in conjunction with SCNPS

Prairie Workshop in conjunction with SCNPS

Propagation Classes

Certification of 12 native plant habitats

Programs presented to the gardening public by NCNPS members

Website upgrade approved: on-line in January, 2008

June picnic in Winston-Salem

October trip to Bird Island.

Participation in Earth Day events around the state; Cabarrus Home and Garden Show.

Plants rescues and removal of invasives efforts.

New chapters established in Wilmington and Asheville.

Participation in the Food Lion program to receive monies as a non-profit.

Twelve page coloring book of natives developed.

Approved P.L.A.N.T. program for use by NCNPS.

Support of the following:

Endorsed the Voluntary Code of Conduct for Gardening Public.
Recommended Dr. Johnny Randall to the NC Pesticide Advisory Committee
Recommended the state purchase of Chimney Rock Park
Supported the Land for Tomorrow proposal
Endorsed letter of concern to Congress concerning invasive species

Opposed

N. Shore Road in Swain County
Sale of national forest lands
Increase of cutbacks for highway billboards

Information compiled by Lynda Waldrep, NCNPS Secretary

2007 Education Events

We have just this year begun compiling this type of information, so our data is incomplete. Still, you can see that NCNPS members have been busy around the state.

Group/Event	**Topic/Event Type (# in attendance)**
Cabarrus Master Gardeners	Threatened and Endangered Plants in the Piedmont (30)
Salisbury Master Gardeners	Landscaping with Native Plants (20)
Cabarrus County	Native Orchids
Margaret Reid Wildflower Garden	Tour
Durham Earth Day	Exhibit
NC State Fair	Exhibit
North Raleigh Regional Library	Native Plants for your Backyard
Sanford Garden Club	Native Plants for your Backyard
Penny Road Elementary School	Native Plants (12)
NC Botanical Garden	Tour
Cabarrus Home and Garden Show	Exhibit
Habitat Stewards Training, Mecklenburg	Native Plants in the Piedmont (30)

Group/Event	Topic/Event Type (# in attendance)
The Sanctuary - home owners	Landscaping with Native Plants `
Gaston County Library - Gastonia	Landscaping with Native Plants (45)
UNCC Bot. Garden tour	Tour
Native Plant Joint Symposium	Weekend Education with SC NPS
EarthFare	Landscaping with Native Plants (14)
Hummingbird Festival, Reedy Creek Park	Exhibit
CPCC - Native Plant Class	Native Plants in the Piedmont (9)
Earth Day—Charlotte	Exhibit
Propagation Class	Class taught at UNCC Greenhouse (12)
Master Gardeners Training, Mecklenburg	Native Plants of North Carolina (18)
Master Gardener conference, Kill Devil Hills	Exhibit
Women's Club - Dare County	Native Plants
Master Gardens Cabarrus County	Native Orchids
Cabarrus master Gardener Herb and Plant Festival	Exhibit
Wachovia Call Center	Native Plants and Wildlife in the Winter (14)
Historical Union Garden Club	Gardening with Native Plants (16)

Thanks to Jean Woods for keeping up with "who goes where" to talk about native plants—and thanks to those NCNPS members who willing give of their time to spread the word.

Outreach via our website

Average number of visits to site per month: 6,050 (range 3,000—9,000)

Most frequently viewed pages:

1. Native plants
2. Invasive plants
3. Native Plant Recommendations
4. Native orchids
5. Scholarships/Wells Fund
6. Native Plant Sources
7. NCNPS schedule
8. Rare plants

Thanks to Jean Woods for sending in the statistics, and to Mary Baumeister, our webmistress,

NCNPS Members

Total Number as of November 2007: 386
Number of Life Members: 64
Number of Complimentary memberships (libraries, native plant societies, botanical gardens, Speaker 'gifts'): 30

NCNPS 2008 Calendar

Society Events

May 9 - 11	Spring walk to Toe River Fishing Club
June 7	Picnic, Hagan-Stone Park, Greensboro
October 10 - 12	Fall walk - TBD

Board Meetings:

February 23
May 3
August 23
November 15

For additional information and events, watch your newsletter and the NCNPS website: www.ncwildflower.org

Board of Directors

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Winter Thoughts

Autumn ends, not by the calendar, but by the season itself. The leaves are gone, save those few parched hangers-on that will cling the Winter through to the twigs of oak and beech and ironwood. The weeds have ripened and their pods are empty. A few jays remain, and the earliest juncos are dropping in; but even they speak softly now.

The quiet days and the silent nights are at hand. One walks abroad in the hushful evening, a quiet so deep that footsteps are exaggerated even in their echo and voices carry on the chill air an amazing distance. So deep the silence that we shall hear the faintest whisper of the first snow.

Gone is the crisp rustle of September leaves. Gone the loud complaint of the katydids, the crickets and all the other insects of early Fall. The frogs and peepers are silent. The chipmunks are resting from their frantic scurrying of the harvest season, and the squirrels go quietly about their business. Winds that rushed through the treetops of six weeks ago now sway the naked branches with a cold swish. Even the streams have ceased their brawling.

Winter creeps in, silent as the stars; only when it is full upon us will it howl around the house corner and rattle its icy knuckles at the door and windows. It is as though time itself were now at rest for a moment, a solemn pause before the season of the nativity and the turning of the year.

Hal Borland
An American Year
Simon & Schuster, New York. 1946. 143-144

Illustration from *Forest Scenes* (W. A. Townsend & Co., Cambridge, 1860)

You're Invited To A CHAPS Educational Event

Water-Wise Plants with Impact

- February 6, 2008, Wednesday
- 6:00 Hors d'oeuvres ~ Cash Bar
- 7:00 Lecture
- Mint Museum of Art ~ 2730 Randolph Road, Charlotte
- Speaker: Mark Weathington

Tough times call for tough plants. This past summer's drought emphasized the need for drought tolerant plants, which depend less on supplemental irrigation than the traditional landscape.

This doesn't mean every garden must look like an Arizona moonscape. There are plenty of plants that can create a visually arresting landscape while still minimizing the reliance on irrigation.

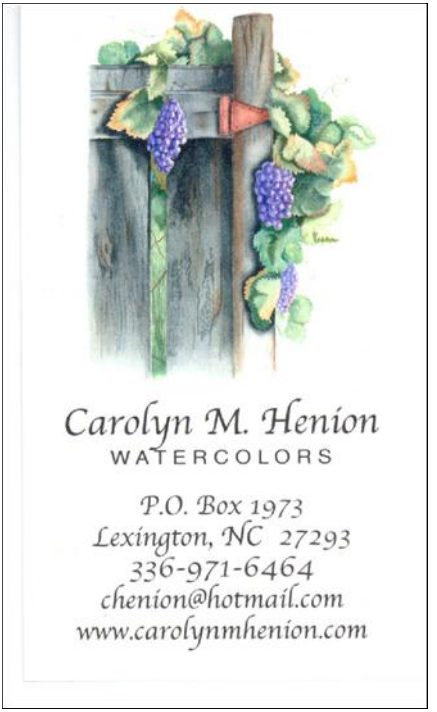
Speaker: Mark Weathington is the Assistant Director and Curator for the JC Raulston Arboretum. His undergraduate degrees in Horticulture and Sociology and his Master's degree in Horticulture were earned at Virginia Tech. He has served as Director of Horticulture for the Norfolk Botanical Garden and as Horticulturist at both the Virginia Aquarium and the Atlanta Botanical Garden. Mark writes and speaks on a variety of topics in horticulture. He has been published in Horticulture, Carolina Gardener, Virginia Gardener and The Mid-Atlantic Gardener's Book of Lists. In addition, he writes two weekly columns for The Virginia-Pilot, Virginia's largest newspaper.

Admission ~ $10.00

CHAPS Members (Central Piedmont Community College Horticulture Alumni Professional Society) ~ Free of Charge

R.S.V.P. Arlene Main at mainkna@bellsouth.net

Appropriate plants and books will be for sale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NCNPS Wild Flower

ISSN # 1048-4582