The Lady-Slipper

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Floracliff's Old Trees: Acorns of Restoration for the Inner Bluegrass Region

By Neil Pederson, Eastern Kentucky University

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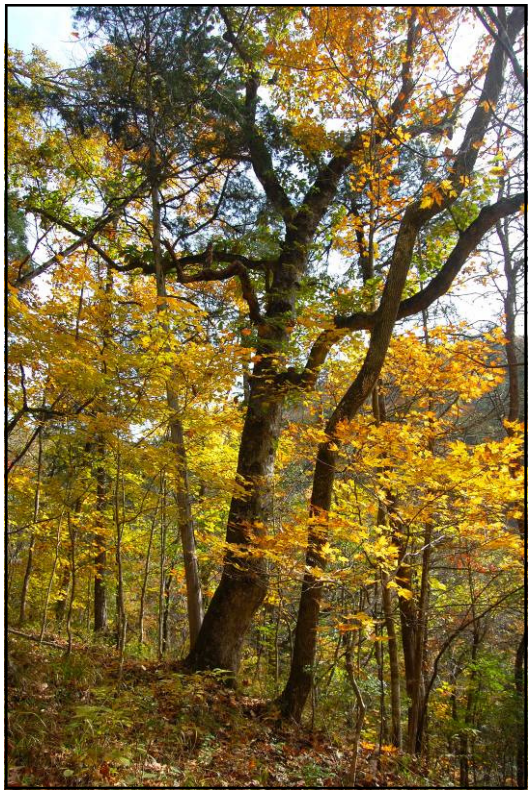

"Woodie C. Guthtree", Kentucky's oldest known living tree at 398 years. Photo by Beverly James.

Old trees are windows into historical events. The science of tree-ring analysis takes advantage of a characteristic common to all trees: no matter how bad things get - an approaching fire, tornado, drought, etc. - trees must stay in place and absorb these abuses. Though each tree is an individual, environmental events like these impact all trees in a similar fashion: events that limit a tree's ability to gain energy reduce the annual ring width. Scientists interpret patterns of ring widths within tree populations to reconstruct environmental history. To date, tree-ring scientists have successfully reconstructed drought history, Northern Hemisphere temperature, fire histories, insect outbreaks, etc. Tree-ring studies have also enriched human history. Scientists have dated logs from ancient structures that, in turn, triggered revisions of human history. Similarly, tree-ring evidence indicates that a severe drought likely contributed to the failure of The Lost Colony in Roanoke, NC and to the outbreak of a highly-contagious disease and subsequent crashes of the human population in ancient Mexico City. Just a few old trees in a small landscape can shed light into long-forgotten or unobserved events.

In late-summer '08, Beverly James, manager of Floracliff Nature Sanctuary, contacted me about sampling some trees in Floracliff to gain insight into the preserve's ecological history. Having been in Floracliff previously, I was skeptical of coring its trees. It is so close to a major corridor (even pre-Daniel Boone), has a series of fields within the sanctuary, is dominated by a second-growth forest being overrun by bush honeysuckle and lies in the vicinity of the oldest European settlements in Kentucky. How and why could old trees survive these conditions? I feared that the coring of any trees here would reveal little beyond the fact that Floracliff was a young forest heavily cut within the last 100 years.

Later that fall, with permission from the Kentucky State Nature Preserves Commission and a great crew, including Dr. Ryan McEwan of University of Dayton, Ciara Lockstadt (a volunteer assistant at Floracliff), and Chris Boyer (undergrad at Eastern Kentucky University), the six of us cored 20 living chinkapin oaks. The first tree we cored came in at 372 years, the oldest documented tree in Kentucky—a record, it turns out, that did not last more than 30 minutes. Our second tree came in at 398 years and is now the oldest-documented tree in Kentucky. Named "Woodie C. Guthtree", he now has his own "Facebook" page.

I teach a course on the ecology of old-growth forests. A reoccurring theme of the course is, "*What is an old-growth forest?*" As our society moves farther and farther away from the 1600s and fully appreciates the value of biological con-

Floracliff Manager Beverly James cores "Old Twisty".

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Kentucky Native Plant Society Membership
801 Schenkel Lane, Frankfort, KY 40601
www.knps.org info@knps.org

For all other business please contact an appropriate officer or board member.

The President's Message

By Alan Nations

Greetings, I hope this finds you all well and enjoying the holiday season. First I must thank all who took part in the fall meeting at Mammoth Cave National Park. Pat Haragan did a great job of putting it all together. Our speakers, Dr. Ronald R. Van Stockum, Jr. and Dr. Larry Alice of WKU, gave superior presentations. Dr. Julian Campbell led a hike to a stand of remnant Eastern Hemlock in a ravine forest. This was a real educational experience and a lot of fun. Our executive board meeting was very productive. The members were prepared and smoothly moved through the agenda, approving proposed changes to the By Laws, which were then passed by membership vote. The changes can now be viewed on the web site. The board approved a proposal to begin publishing the Lady Slipper online, which is less expensive and more environmentally responsible. The board referred proposals to revise the certification and field trip programs to committee for further study. (The 2008 membership survey placed a high priority on certification and field trips.) Visit the web site for updates and information on these and other programs.

Membership is our top priority. Our numbers are stable now and there has been some improvement over the past few months. We are making every effort to improve our programs and communication with our members. Special focus has been given to improving and updating our web site. We now have an interactive membership application for new members and a Pay Pal account for all members to pay annual dues on line. Paying online will substantially reduce the cost of mail and billing. So please renew your membership online if possible before the December 31 due date. If you have other ideas or suggestions for our web site, let our webmaster Dave Luzader know your thoughts.

"It's my hope that each member will feel connected and compelled to actively participate…"

The native plants and ecological systems in Kentucky are facing perilous times because of increasing development, bad land management practices, a growing number of non native invasive species, and weak or non-existent laws that allow the continued importation, sale and planting of these species. We need to step up to our vision of being the "authority on native plants in Kentucky". It's time to unite with other organizations that share our goals, and lead the effort to protect our native flora and ecological systems in Kentucky. In the coming year you will be hearing more about this and other mission related subjects. I encourage you to attend our field trips, outings, and spring and fall meetings, to gain a better understanding and support the efforts of the Kentucky Native Plant Society. It has never been more important than it is today.

It's my hope that each member will feel connected and compelled to actively participate, as an officer, board member, committee chair, on a committee or in some other capacity. I want to remind you of our mission, which is "A citizen/scientist partnership to promote awareness, preservation and the appropriate use of native plants". My point is that you do not have to possess a high level of knowledge or education in native plants to take an active role in KNPS. We need your help and involvement! Please contact me or any of the officers to find out what you can do.

KNPS President Alan Nations addresses the assembled in front of newly planted native trees at the state capitol (see story, page 5).

A Brief Report of the 2009 Botanical Field Season

By Tara Littlefield, KSNPC Botanist

The staff at the Kentucky State Nature Preserves Commission had a busy field season as usual. It seems like just yesterday that we were preparing for the upcoming field season by making maps, looking at aerial photos, and researching elemental occurrences. Every spring we begin a new year of monitoring the nine federally listed plants in Kentucky. We also do general floristic work and rare plant surveys on tracts that are purchased through the HLCF (Heritage Land Conservation Fund). Here are summaries of a few projects have been working on the past few months.

We will be surveying an addition to Kingdom Come State Park and another tract near Kentenia State Forest in the vicinity of Harlan. Our early spring visits to these sites found healthy populations of spotted mandarin (*Prosartes maculata*) and rock harlequin (*Corydalis sempervirens*). On a more somber note, all of the hemlocks we encountered were heavily infested with hemlock woolly adelgid and ATV traffic had been very damaging to one of the areas. The adelgid continues its spread across the Appalachian Plateau and certainly will increase its range in Kentucky this year. Make sure you take a trip to enjoy the imperiled hemlock forest while it still exists.

Corydalis sempervirens; photo by John MacGregor

Among the federally listed plants, those flowering in the spring include Braun's rock cress (*Arabis perstellata*) and Running Buffalo Clover (*Trifolium stoloniferum*). Braun's rock cress is a federally endangered plant that grows along the Kentucky River and its tributaries in Franklin, Owen and Henry Counties. A disjunct population occurs on the Stones River in central Tennessee as well. This unassuming little member of the mustard family grows on steep calcareous slopes and is limited by its habitat niche. Every year we monitor selected sites throughout its range and seek out new sites on private lands for conservation and protection. This spring we located a new population of Braun's rock cress on the Franklin-Henry County border growing with another monitored plant, the Wood's bunchflower (*Veratrum woodii*). It is always an exciting trip when you add two new elemental occurrences from the same site.

The biggest threat to Braun's rock cress is encroachment from non-native garlic mustard (*Alliaria petiolata*). At Tucker Creek Registered Natural Area, we are finishing our second year of a study looking into the affects garlic mustard on seedling recruitment of Braun's rock cress. Both garlic mustard and Braun's rock cress have similar seed dispersal methods and life history. But with a lack of natural predators and allelopathic qualities, garlic mustard is having a competitive advantage in colonizing sites once claimed by Braun's rock cress. As garlic mustard spreads throughout the Kentucky River palisades, it is reducing the available habitat for Braun's rock cress.

Another plant we have been working on lately is the federally threatened Running Buffalo Clover (*Trifolium stoloniferum*). Running buffalo clover is found within the Bluegrass region of Kentucky and in limited portions of Indiana, Ohio, Missouri and West Virginia. Every year we monitor sites that span the range within Kentucky to look at annual fluctuations within the populations. In 2008 we were notified of a new county record in Campbell County and in spring of 2009 a landowner found a patch on her property in Owen County. We are following up on these new populations to figure out if they are more widespread in that area. In addition to our monitoring, we worked with USFWS, EKU and Bernheim Arboretum and Research Forest on a running buffalo clover reintroduction project. This collaborative effort introduced buffalo clover seedlings onto the EKU farm in Madison County. Our goals for this study are to gain a better understanding of the little known life history and introduction potential of this imperiled plant.

This is a summary of just a few of the projects the botanists at KSNPC have been working on over the past year. As always, we look forward to the new occurrences and insights that 2010 will bring. Due to our heavy workload and limited staff, we are planning to institute a volunteer program that will focus on field botany, identification, and mounting of herbarium specimens. If you would like play a part in helping to preserve Kentucky's natural heritage, please contact us at 502-573-2886 or tara.littlefield@ky.gov.

Allelopathy in Trees

By Alan Nations, NativeScapes, Inc

Allelopathy is from the Greek language meaning "to suffer from each other". I often bring up the subject of allelopathy while leading interpretive hikes or speaking to groups about Kentucky's woodlands and natural environments. My audience's common reaction is a puzzled look, an indication to me that I have lost them. It is a rare individual in these very diverse groups, who has any idea of the meaning of the word allelopathy. This is not alarming when you consider the fact that scientific study of allelopathy in tree biology has occurred only during the last thirty years. Pliny the Elder, a Roman natural science author, in 77A.D. first wrote of tree allelopathy in describing his observation of the walnut tree's influence on plants growing beneath them. My intention here, as with my groups, is to help our diverse membership gain a better understanding of the fascinating subject of allelopathy, or serve as an interesting review to those who are more informed on the subject.

Interference is the proper term for individual ecological interactions. Interference, as it pertains to trees and their environment, has two components:

☐ Competition is the control or removal of essential resources from the common environment.

☐ Allelopathy is the addition of materials to the common environment, which alters life functions and biochemically modifies the environment to enhance tree survival and reproduction.

Many of the substances and organisms inside a tree leak out and have no significant impact on the environment. A few chemicals do have an ecological effect and are called allelopathic chemicals or allelo-chemicals. Once leaked into the environment these allelopathy chemicals can produce significant changes in the survival, growth, reproduction and behavior of other organisms. There are four allelopathic classes of chemical reactions.

☐ Antibiotics - microorganism to microorganism

☐ Kolines - plant to plant

☐ Marasmins - microorganism to plant

☐ Phytoncides - plant to microorganism

Allelopathic chemicals from trees can affect seed germination, plant growth, pathological infections, insect injury, and environmental stress impact, in other species as well as the same tree. Once the chemical is conveyed to another plant the plant can be either assisted or impaired. This depends primarily on the dose, too much or too little can change the growth. Normally the longer the species have lived together the less the allelopathy affects their interference. The introduction of new species, succession changes, and introduced exotic species, can generate a large allelopathic effect. When good growing conditions prevail, allelopathy usually represents only five to ten percent of the total interference. Allelopathy increases when a plant is under stress from nitrogen or phosphorus deficiencies, water or temperature extremes and other environmental limitations. Injury and pests can also rapidly increase concentrations of allelopathic chemicals. These concentrations change often in various parts of the tree as the syntheses are enhanced or reduced. Therefore allelopathy should be an important consideration in the overall stress in areas containing trees.

Trees with strong allelopathic properties modify their own rhizosphere and surrounding soils to act as a shield from other allelopathic species. Many allelopathic species can be found growing together because they each control their own interface with the environment while protecting themselves from the allelopathic material of others. An example would be an area where silver maple and black walnut trees coexist.

The main sources of allelopathic effects are tree leaves, roots, stems and microorganisms. Rain washes allelopathic materials from the plant hairs, cracks and oil glands of leaves. Young leaves are less susceptible to leaching than older leaves or leaves with smooth waxy surfaces. Their surfaces are not easily wetted and are less likely to be leached. Acid rain can significantly increase leaching by damaging leaf surfaces. Allelo-chemicals leached from leaves can be reabsorbed by the roots, stems, or foliage of the same tree or other trees and plants in the area. The highest concentration of allelopathic chemicals is found directly beneath a tree. Leaching increases as leaves decompose and microorganisms convert immobilized allelo-chemicals into active forms. The leaves and fruit litter can contain large amounts of allelochemicals that are slowly released as the material decomposes over several years. As a result, species modification can go on for many years after the allelopathic conveyor is dead. The stems of trees leach allelo-chemicals in much the same way as leaves. Water flows over twigs, branches, and stems, leaching chemicals and depositing them in a small circle around the base of the tree. The root exudates are substances released into the soil by healthy root systems. Exudation primarily takes place in young non woody roots, behind primary absorbing root tips, and root hair zones, all of which have high concentrations of allelopathic chemicals.

Microorganisms play a large and very complicated role. Both bacteria and fungi can change exudates

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A Capitol Idea: KNPS Helps Frankfort Go Native

By Zeb Weese, KSNPC Manager

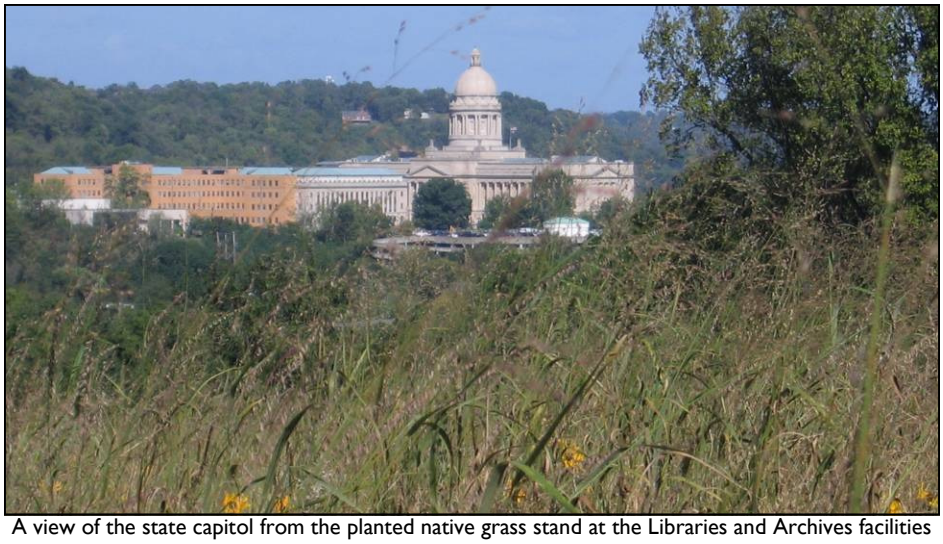
The threat of invasive plants is well known to Kentucky Native Plant society members. Unfortunately, the general public does not always share our awareness of the issue, and many continue to landscape with some of the very same weeds that are overtaking our natural areas and crowding out our native plants. In an effort to increase general awareness of the problem, September 2009 was declared "Invasive Plant Awareness Month" by Governor Beshear at the request of the Kentucky Exotic Pest Plant Council (KY-EPPC) and the Kentucky Garden Club. Educational events focusing on the problems of invasive weeds were held throughout the Commonwealth. As part of this effort, the KNPS worked with the Kentucky Finance Cabinet's Department of Facilities and Support Services to replace several large bush honeysuckles from the State Capitol grounds with native fringe trees (*Chionanthus virginicus*) donated by the KNPS.

The bushes in question were located just a few feet from the Capitol building itself, along Capitol Avenue near the Governor's mansion. According to landscape supervisor Mark Nichols, these shrubs were likely invaders themselves. "I imagine that some other plants were put here many years ago and these just came in and shaded them out, then they were maintained as if they were plantings," said Nichols the day of the removal. The shrubs were well over 20 feet tall and the stems measured over 24 inches at the ground. Chainsaws were used to limb each shrub, and then heavy equipment was used to remove the root systems. The holes created were then used for the fringe trees. Division landscape consultant Tim Depenbrock counted the growth rings on the largest shrub and estimated its age at 35 years. Undoubtedly this specimen has produced thousands of berries and countless seedlings in its lifetime.

In a ceremony held the next day to plant the natives, KNPS President Alan Nations presented a pen and pencil set made by KNPS member Carl Suk out of bush honeysuckle wood to Steve Meredith, an official from the Finance Cabinet. Nations asked that it be presented to the governor to thank him for declaring the month for invasive plant awareness. "Our organization wanted to support Invasive Plant Awareness Month in a way that will last beyond September," said Nations. "Kentucky has so many native plants that work well in landscapes, what better place to start than planting on the Capitol grounds to remind everyone that they can have beauty and benefit our environment at the same time. Urban efforts such as this are instrumental in stopping the spread of invasive plants to Kentucky's diverse and beautiful natural areas."

Peggy Dungan, local member of the Frankfort Garden Club, commented about the project. "The Capitol grounds were my playground as a child," said Dungan. "They have been my front yard all my life. I feel very strongly about preserving their beauty for all Kentuckians to enjoy and to be a source of pride. I also feel very strongly that these grounds should set the example for all gardeners in Kentucky by utilizing native plants and removing invasives. I hope we can continue to remove the plants up there that are overwhelming our beautiful native flora and making it hard on the wildlife to find food."

> ***"I also feel very strongly that these grounds should set the example for all gardeners in Kentucky by utilizing native plants and removing invasives."***
>
> Peggy Dungan, Frankfort Garden Club



A view of the state capitol from the planted native grass stand at the Libraries and Archives facilities in Frankfort.

Fortunately Garth Vinson, the manager of the Capitol grounds, agrees. In addition to removing the honeysuckle, Vinson had his crew remove nearby burning bush and privet and said he intends to continue removing invasives and replacing them with native plants. This project will complement the Depart-

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Charles J. Lapham (1934—2009)

By Ronald L. Jones, Eastern Kentucky University

Over the past decade Charles J. Lapham has been one of the most important figures in the Kentucky Native Plant Society, in Kentucky botany, and in the botany of the southeastern United States. Charlie, as he preferred to be called, passed away on October 26, 2009, of non-Hodgkins lymphoma. He had been in poor health for several years, mostly related to heart disease and diabetes, and was only recently diagnosed with lymphoma. In recent emails he informed his close acquaintances of his situation, and was characteristically matter-of-fact in describing his time remaining. He expected to have a few more months, or maybe a few years, but he suffered a major setback on Wednesday, the 21st, and never recovered. He was 75 years old.

Charlie and his wife Arlene had lived for the past 20 years in Glasgow, Kentucky. He was born in Fort Edward, NY, grew up in Glens Falls, NY, and lived many years in Lincoln Park, NJ. Charlie graduated from Clarkson University in Potsdam, NY, with a degree in electrical engineering, and worked many years for Standard Motor Products in Long Island City, NY, before he was transferred to Kentucky. Charlie had a life-long interest in science, especially botany, and he began to explore this interest with great enthusiasm after he retired.

Both Charlie and Arlene became active in the Kentucky Native Plant Society in the mid-1990s, and both began taking classes in the KNPS Native Plant Certification program, and were among the first group to receive certification in 1997. In those days the participants had to complete a research project, and Charlie's project was to set up a basic database program for herbarium data management. Charlie and I had discussed databases on a couple of occasions, and he became very interested. This was at a time when university herbaria across the nation were considering the pros and cons of investing in database programs for keeping track of all their dried plant specimens (often numbering in the thousands or even millions), and also to improve capabilities of generating labels and of making maps. Most software at that time was expensive, hard to learn, and difficult to maintain. In Kentucky, several herbaria were investigating the possibilities. We had about 40,000 specimens in the EKU Herbarium at that time, and I suggested to Charlie that he help me set up a database using Microsoft Access. He jumped at the idea, got a manual, taught himself Access, and began working on the program. He later told me that his job in New York had required him to construct similar databases to keep track of auto parts, and that keeping track of herbarium specimens was not that different.

Soon he had a workable system. It was named *Index Kentuckiensis* (IK), and it would allow the inputting of all the data from a herbarium label, sort it in various ways, construct labels, and make maps of the specimen locations using a free online mapping program called MicroCam. This IK system has undergone numerous revisions over the past decade, with Charlie making it more and more sophisticated. Charlie and I began going to meetings of the Association of Southeastern Biologists and giving talks about the capabilities of the software. Other universities were interested, and soon IK was being used at several institutions around the south, and eventually at several institutions across the nation. We were offering it free, and Charlie usually ended up traveling to the institutions to help them set it up. Charlie worked on IK tirelessly, for many years, kept attending meetings and demonstrating the capabilities of IK, and through his efforts many institutions got their first exposures to herbarium databases. Charlie was very sensitive to the "philosophical" differences among taxonomic botanists, especially in how they chose names for their specimens, and worked hard to provide a program that would allow individual flexibility. He was also among the first to use dropdown menus that allowed the user to pick from lists of scientific names, collectors, and other items from a list, which cuts down on typographic errors tremendously. He developed such a high degree of databasing expertise that he was able to converse at the highest levels with other databasing specialists across the country, and in some cases he was the one providing the instruction. As one of the first developers and promoters, Charlie deserves great credit for his services to the botanical community.

Charlie in the field.

Charlie also took a very active part in the Kentucky Native Plant Society, serving both as a board member beginning in 1994 and as Vice-President in 1997. He helped organize field trips, wrote articles for the newsletter, and in many ways contributed to the continued success of KNPS. Charlie also came up with a database for keeping track of KNPS members and for generating mailing labels, and it is still used today. Charlie and Arlene were active in attending field trips and workshops, and Charlie was especially interested in Eggert's sunflower, which grew in the nearby Mammoth Cave area. In one big project, Charlie took a major role in organizing a KNPS activity to rescue a roadside population of the sunflowers that was in jeopardy from highway construction. Charlie helped dig up and transplant the whole population of sunflowers to a protected site within the national park. Charlie and Arlene regularly attended the spring and fall meetings of the KNPS, and Charlie especially

loved the spring wildflower meetings at Natural Bridge State Park. He often participated in rigorous hikes, like walking up to Natural Bridge, which I thought might be too much for him, but he always seemed to keep up with the group and enjoy the outings immensely. Only in the last couple of years, with his health problems increasing, has he failed to attend the annual meetings.

Charles J. Lapham is listed on the title page of *Plant Life of Kentucky, An Illustrated Guide to the Vascular Flora,* as Technical Associate. He is listed because it was through his efforts that about 4,000 images of line drawings were obtained from the 1913 edition of Britton & Brown's classic book on the flora of the northern United States and Canada. These images were in the public domain, but were not easily accessible. Through his connections to a data services company in California, Charlie arranged to send a copy of the 3-volume set to India, to have the black and white illustrations scanned, and then processed into a searchable format. These images were copyrighted as part of the *Index Kentuckiensis* application, and eventually nearly 2,000 of these images were used to illustrate *Plant Life of Kentucky*. So it was through Charlie's expertise and his business associations, that these illustrations were obtained, and without his help, it would not have been possible to gather so many illustrations together so fast. It is the illustrations that help to make the *Plant Life of Kentucky* so useful for so many people, and I am forever indebted to Charlie for his tremendous assistance.

Once word got out that we had a CD with about 4,000 illustrations, a number of people and institutions expressed interest in obtaining a copy. The PLANTS database web site, (http://plants.usda.gov/) which is today the major web site for botanists to check for information on nomenclature and distributions of North American plants, agreed to pay a fee to use the IK/B & B digital images. This was arranged in the name of the Kentucky Native Plant Society, and today, when a species from eastern North America is selected for viewing, in most cases there is an illustration that states "Courtesy of the Kentucky Native Plant Society." The substantial check that was received from the PLANTS database site was donated to KNPS, helping to fortify the savings account, and providing much-needed funding for a number of ongoing activities.

Charlie's legacy is thus far-reaching, from his local work on saving endangered species, to his state-wide efforts with KNPS, to his regional and national influence on herbaria and botanical science. His involvement in regional botany was fortuitous in many ways for me personally, not only from the standpoint of my book, but for all his efforts with building databases. We still use his IK database at EKU, and now have entered over 50,000 records. We plan to have all our 75,000 specimens databased in the next few months. When finishing up the historical section of *Plant Life of Kentucky*, I devoted a section to private citizens, and Charlie was one of two individuals that I selected as having made the greatest contributions over the last 50 years to botanical science in Kentucky. The book contains a description of his accomplishments and a photo of Charlie, and is indicative of the high regard that I, as well as many other botanists across the nation, held for Charlie.

Charlie received an award for service to the KNPS by Dr. Ron Jones and then-president Dr. Dave Eakin.

Charlie is survived by his devoted wife of 54 years, Arlene, his brother, Jerome , his five children, Peter in Glasgow, Suzanne in NY, Thomas in Glasgow, Benjamin in NY, and Jonathan in Glasgow, and their families, including four grandchildren. His was a loving, closeknit family, and it is apparent that his passing touched many; a series of memorial gatherings were held on October 29 by his family and many friends from across the country. In an internet obituary, his family writes "Charlie valued honesty, integrity, hard work, and was at times a self-described connoisseur of silliness. He was never without a project."

His family also noted that "In keeping with his love for science, he has donated his body for medical study at the University of Louisville." His family asks that donations be made to the Nature Conservancy in his memory.

In one of his last emails, Charlie lamented the fact that botanists cannot seem to make up their minds what they want—do they want to finally get their data into consistent formats, or endlessly discuss alternatives. He closed by saying "what we need to do is to put botanists together to discuss this and wait for smoke to come out of the chimney."

And that is what Charlie was about, and that is his legacy—when facing a complicated problem, decide what you want, and attack the problem with intelligence and hard work and good humor. Then nearly anything can be accomplished. That is what I will remember about the effect that Charlie had on our botanical community, how he more or less just appeared from nowhere, just plopped down here amongst us botanists, looked around and figured out what kinds of problems we faced, took up the reins, and showed us all how it should be done.

Charlie was funny, brilliant, and sometimes cantankerous. He was unique, and irreplaceable, and will be missed by all.

Hemlock (*Tsuga canadensis*) Genetic Research

By Ronald R. Van Stockum, Jr. , PhD

There are at least 10 species of the genus *Tsuga* worldwide, although up to 25 extant species have been described. In addition to six species in Japan, China, Taiwan and the Himalayas (and fossils in Europe), there are four species in North America. The two western United States species, *T. heterophylla* and *T. mertensiana*, appear to be phylogenetically related while the two eastern species, *T. canadensis* and *T. caroliniana*, are dissimilar. Recent molecular research indicates that *T. caroliniana* is related to the Asian species. Both of the eastern United States species are threatened by the Hemlock woolly adelgid, *Adelges tsugae*, an aphid like hemipteran insect from East Asia, the larvae of which feed on the phloem of the trees. The pest first appeared in Virginia in 1951. It has spread from Georgia to Maine and has now entered eastern Kentucky and Tennessee. Blanton Forest on Pine Mountain in eastern Kentucky has become completely infested. The Kentucky Natural Lands Trust, the Kentucky State Nature Preserves Commission, Pine Mountain Settlement School, and the Nature Conservancy have treated 16,000 trees there in an attempt to preserve Hemlocks on Pine Mountain.

Hemlock provides a significant and unique environment to the forest within which it grows. In addition to shade tolerance, the Hemlock duff produces a slightly acidic soil within which grows a specialized flora. *T. canadensis* often grows on cliff sides and rocky outcroppings rooting into cracks or fissures in the stone. The loss of this species will greatly alter the flora and habitat in which it once grew.

Tsuga canadensis is a species of the Mixed Mesophytic Forest described by Lucy Braun in eastern Kentucky. Braun believed that this forest association represented a mature ecology developed prior to the glacial ages that could be representative of the diversity in the earlier, mild Tertiary forest. Braun postulated that during the glacial ages this Mixed Mesophytic Forest in Eastern North America survived climatic change in isolated refugia within unique cold draining environments in mountainous regions such as eastern Kentucky. After the glaciers retreated, according to Braun, elements from this forest (association segregates) spread north to colonize the denuded land left exposed by the retreating glaciers. Palynological analysis of bogs, lakes and sediments has, however, revealed little evidence of the survival of the Mixed Mesophytic Forest south of the glacial face during the glacial ages. Instead, pollen evidence indicates displacement of the forests of eastern North America during the glacial ages to areas such as the exposed land in the Gulf of Mexico or the highlands of Mexico. Accordingly, the Mixed Mesophytic Forests of eastern Kentucky would be considered recent constructions, elements

A KNPS field trip to one of Mammoth Cave National Park's hemlock stands was part of the 2009 Fall Meeting.

of which have migrated north to present positions within the last 20,000 years after the most recent glaciers retreated.

"...such lack of variability would reduce the likelihood that individuals of the species might harbor resistance to the woolly adelgid."

Hemlock, as part of the Hemlock – White Pine - Northern Hardwoods Association of the Mixed Mesophytic Forest, is potentially a good genetic base from which to explore Braun's thesis as well as describe the migratory history of the species. Our studies seek to look further into these issues by seeking to identify patterns in the genetic diversity of *T. canadensis* within its entire range, above and below the glacial boundary and in adjunct populations.

The ontogeny of these investigations began at the University of Louisville in 1972 when I began my graduate studies. I had the good fortune of working with Dr. Arland Hotchkiss, an expert on charaphytes, including stoneworts. As a Masters' level student, I discovered his interest in outlier populations of Hemlock in southern Indiana and western Kentucky. As a primary botanist, he was intrigued in the assemblage of plants associated with these Hemlock outliers and the possibility of their relationship to the Mixed Mesophytic Forest of the Cumberland Plateau as described by Lucy Braun.

As a result, I completed a floristic study of those populations in Southern Indiana as part of my Masters degree with my thesis entitled "Relic Populations of *Tsuga Canadensis* in Southern Indiana: Ecological Studies Relating to Their Origin." I continued on with my doctoral studies in this intriguing area under Dr. Hotchkiss's guidance with the additional members of my committee being the limnologist Stuart Neff, botanist William Davis, geologist James E. Conkin, and ornithologist and chair of the Biology Department, Burt L. Monroe. I received my Doctorial degree in 1979 and produced my dissertation entitled "Hemlock Mixed Mesophysic Communities in Southern Indiana, Western Kentucky and Highlands North Carolina."

Deam described *T. canadensis* in 11 Indiana counties as "…erratic and in all of its stations it seems to be a relict… and is usually in very small colonies. The reproduction apparently is not sufficient to maintain the colony." Friesner and Potzger described these populations as "…rear guards or relics of a retreating species which was pushed from the northeast during the Glacial Period." Hotchkiss and I surveyed all of the Indiana population, added a county record (Harrison), and found evidence of extensive reproduction.

At Hemlock Cliffs along Otter Creek in Crawford County, Indiana, *T. canadensis* grows on massive Chester sandstones of the Pennsylvanian Period. An assortment of interesting plants are found along with Hemlock in this interesting habitat. They include *Juglans cinerea, Fagus grandifolia, Nyssa sylvatica, Kalma latifolia, Lindera benzoin, Mitchella repens, Heuchera parviflora, Antennaria solitaria, Tipularia discolor, Dodecatheon meadia, Goodyera pubescens, Luzula echinata, Lycopodium porophilum, Asplenium pinnatifidum,* and *Dryopteris spinulosa* var. *intermedia*. Of note, disjunctive populations of *Magnolia tripetala* and *Betula alleghaniensis* occur elsewhere in this unglaciated county (Crawford) of southern Indiana.

Near Highlands, North Carolinia, in a deep ravine formed by Ammons Branch of the Cullasava River is a small virgin remnant of what was considered North Carolina's "Primeval Forest." My dissertation included an examination of this area. The hemlocks (*T. canadensis*) there are enormous, ranging in DBH up to 62 inches. Massive thickets of *Rhododendron maximum*, many 15 feet high choke the streamside and slope floor. Dog hobble (*Leucothoe* sp.) was almost impenetrable in any opening within the rhododendron. The hemlocks were associated with *Betula alleghaniensis, Liriodendron tulipifera, Oxydendron arboreum, Nyssa sylvatica, Acer rubrum, Magnolia fraseri, Halesia carolina, Kalmia latifolia, Ilex ambigua, Amelanchler arborea* and large *Castanea dentata* stumps. Directly above, on a

Cowee Mountain Range hemlock forest in the 1970s (l-r Max Medley, Fred Straub, Reggie Van Stockum, Hugo Hamilton)

ridge of the Cowee Mountain Range (part of the Southern Blue Ridge Mountain) is a stand of virgin Carolina Hemlock (*Tsuga caroliniana*). These trees were associated with *Pinus pungens, Pinus strobus, Nyssa sylvatica, Tsuga canadensis, Amelanchier arborea, Ilex ambigua* and stumps of *Castenea dentata*. They grew just beyond the balds that are so prominently visible on those high mountaintops.

I visited both of these virgin hemlock populations in January 2008. Sadly, I discovered that both populations, *T. canadensis* and *T. caroliniana*, were fully infested with the woolly adelgid. Along the way, I stopped at the Joyce Kilmer Memorial Forest, another famed old growth forest near Robbinsville, North Carolina. All of the hemlocks (*T. canadensis*) that I saw there were dead, already victims of the adelgid.

Although the bulk of my studies have been floristic in nature, towards the end of my doctorial research, I was able to attend the Savanna River Ecology Laboratory (SREL) in Georgia and began to look into the then evolving science of molecular biology as it was being applied to inter- and intra-specific investigations. During these studies, the preliminary results of which are included in my dissertation, I was able to separate out isozymes (peroxidase, PGM and PGI) from the two species *Tsuga canadensis* and *Tsuga caroliniana* in North Carolina and demonstrate the difference in their species through gel electrophoresis. During that time, I also obtained my Juris Doctorate in Law at the Brandeis School of Law at the University of Louisville and have since practiced law as my primary focus. I did, however, continue to pursue the issues raised in my Master thesis and Doctorial dissertation as described below.

In the late 1980s, I was able to fund additional research with Dr. Michael Perlin, a geneticist at the University of Louisville, and his master-level student, Cong Wang, from China. Our initial focus was to isolate chromosomes from Hemlock chloroplasts and cleave them with site-specific restriction enzymes, separating the radioactively-tagged chromosomal segments on an electrically charged gel. We looked to see if we could determine gross differences in the genetic-based sequence of these chromosome sections. Our work proved productive and we associated Dr. David Wagner, a forest geneticist at the University of Kentucky, and a student under his direction, Hugo Hamilton. With the research method developed, we determined to travel the full range of the Eastern Hemlock in North America and collect samples to be brought back to Dr. Wagner's laboratory. There, DNA would be isolated from needle preparations allowing us to run chloroplast chromosome section comparisons over the entire range of the species, both north and south of the glacial face.

Accordingly, we assembled a team of researchers and collectors to travel to different locations in eastern North America to obtain samples. This group included Max Medley, one of the premier botanists in the state of Kentucky; Kostya Krutovsky, a Russian Ph.D. student working with Dr. Wagner; Hugo Hamilton; and our intrepid driver, businessman Fred Straub. Collections were made in the 1991 and 1992 seasons.

Umbrella magnolias at Mammoth Cave at the 2009 Fall Meeting.

In 1997, the first results of our study were published in the Canadian Journal of Forest Research. The abstract for that paper describes the results of that work as follows:

> "We have surveyed chloroplast DNA restriction fragment length polymorphisms in natural populations across the range of *Tsuga canadensis* (L.) Carr. and in one natural population of *Tsuga caroliniana*-Engelm. The survey included 179 *T. canadensis* individuals from seven main-range populations, three glaciated outlier populations, and five unglaciated outlier populations, as well as 11 individuals of *T. caroliniana*. Molecular hybridizations with approximately 13 kilobase pairs from the *Pinus contorta* var. *latifolia* Engelm. chloroplast genome detected five PstI variants and four XhoI variants in *T. canadensis*, with as many as three PstI and four XhoI variants per population. Unbiased variant diversity estimates were as high as 0.73 within single populations. Frequency differentiation of these variants among the *T. canadensis* populations was modest at best, even between main-range populations and unglaciated outliers. The low level of population subdivision may be due to chloroplast gene flow through pollen and (or) generation of convergent variants by a mutation hot spot. The sampled *T. caroliniana* population's XhoI variant frequencies differed substantially from those of its neighboring *T. canadensis* population. This difference is consistent with the lack of literature evidence for hybridization between the two species. The chloroplast variants reported here may be useful for microevolutionary investigations."

Generally the results indicated that, at least within the chloroplast genome, there was variation across the distribution of Hemlock populations. Surprisingly, there was also evidence of variation between individuals within the same populations. The results were, therefore, of interest but insufficient to draw specific conclusions regarding migratory patterns or the relative age of isolated populations.

According to Lucy Braun's hypothesis, outlier populations of Hemlock such as those found in southern Indiana and in western Kentucky, as well as in the main body of the Mixed Mesophytic Forest in the Cumberland Plateau, could have provided associate-segregates which would have expanded onto the newly denuded geography of the land left after the glaciers retreated. If these glacial refugia existed, especially in southern Indiana or western Kentucky, their likely isolation during the glacial epochs could have resulted in selectively neutral mutations accumulating in their genomes. Accordingly, we were hoping to find a range of genetic markers by which we could trace the migration of

Hemlock onto the glacial face and into its current geographic extent.

In early 2000, Dr. Perlin was able to take some of our preserved collection samples and pursue DNA sequence comparisons of selected gene regions. The science and equipment capable of producing genetic readouts were now within our reach and we began to investigate the possibility of looking directly at the genetic code for these samples. In 2005, we were fortunate to attract the assistance of a population geneticist in the University of Louisville's Department of Anthropology, Dr. Christopher Tillquist, and his student, Lee Young. Although Dr. Tillquist worked primarily with the phylogeography of human populations, he was willing to join us in further examining the samples that we had collected in the early 1990s to see whether or not they were still of sufficient quality on which to run genetic sequencing. Of the approximately 200 samples that were frozen during this period of time, only 30 remained with sufficient quality to be utilized for the purposes of genetic sequencing.

Of those 30, we recently ran populations from Maine, Michigan, Turkey Run State Park in central Indiana (north of the glacial face) and Hemlock Cliffs in southern Indiana (south of the glacial face). We have looked at three genes in both nuclear (4CL) and mitochondrial (Nad7 and Nad1) chromosome material. In this preliminary, direct examination of the genetic sequence in our Tsuga collected population, we are able to report that for two gene regions, Nad7 and 4CL, the results indicate that the populations, both above and below the glacial face, are identical in the sequences analyzed. We are still awaiting results for the gene for Nad1. Were these results to be indicative of the general genetic variability within the distribution, Lucy Braun's thesis would not be supported. In addition, such lack of variability would reduce the likelihood that individuals of the species might harbor resistance to the woolly adelgid.

We are encouraged in our endeavors by the successful utilization of gene sequencing in the investigation of this biogeographic question. Our plans are to do further analysis of the samples that we still have in our possession and then put together a new set of teams, both collecting and analytical, to again examine the full geographic range of this threatened species.

I was pleased and honored to review this ongoing effort with members of the Kentucky Native Plant Society at their October, 2009 Fall Meeting in Mammoth Cave, Kentucky.

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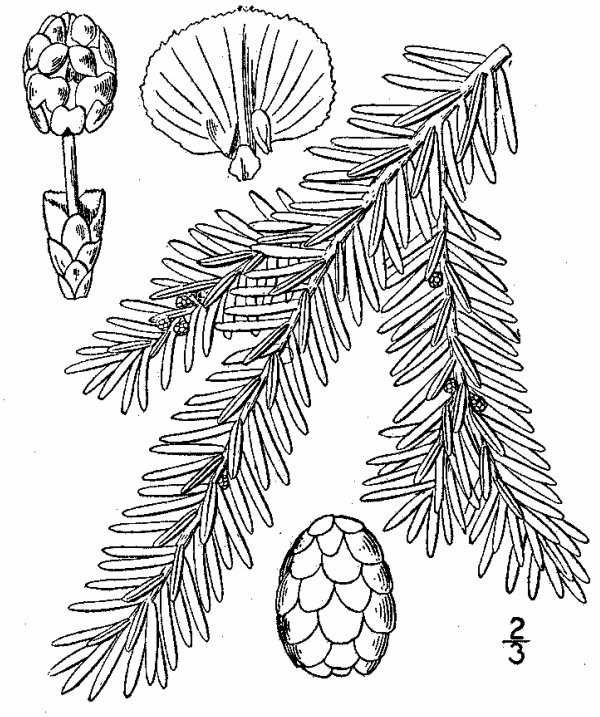


Tsuga canadiensis

Old Trees (cont from page 1)

Floracliff's old growth "epicenter" by Beverly James.

servation, this question becomes pertinent. If the definition of an old-growth forest is simply a forest untouched by people of European descent, then there are no old-growth forests and little incentive to protect once, twice or thrice disturbed forests. However, if we define old-growth forests using the philosophy of Michael Pollan, who states that old-growth forests (or anything natural) will only persist because of human will, then it makes sense to allow the influence of humans into the old-growth forest definition. Making this allowance then allows for future creation and restoration of old-growth forests, a concept that the former definition makes impossible.

To be clear, these old trees are cull trees in a second-growth forest – these trees were left behind by loggers because they were seen as "inferior". They did not grow to be prime, sawboard-producing trees. Their value, in my mind, is great. Not only have they been witnessing changes in the environment since well before Daniel Boone stepped foot into Kentucky, they are an important link to the past in an area that has more legend right now than facts. Floracliff and its Original Individuals can be a core for the recovery of the Inner Bluegrass landscape. See, while these trees were not considered "superior" when the Floracliff was cut, they contain genetic structure that is *directly tied to pre-European forests*. There was likely a loss of genetic diversity with logging. Yet, the architecture of the Original Individuals, which is what allowed them to live through the pre-sanctuary era, was likely shaped by what they struggled against to survive - direct competition, rather than weak genes. Plants seem to carry multiple copies of their genes. And, if the new discipline/area of study epigentics is any indication, genes are dynamic; a tree's DNA system might be more dynamic than previously thought. Hope might genetically spring anew from these old chinkapin oaks.

As this chapter of environmental investigation closes, I look forward to the future of Floracliff and discoveries of the environmental history of the Inner Bluegrass Region. Floracliff is an emerald of the Inner Bluegrass; it can seed restoration of future old-growth forests while providing hope for the discovery of more forests with similar connections to ancient times. Floracliff will also be the lead forest in the reconstruction of regional environmental and human history. Its trees can help us answer questions such as, "*What was the climate like during the settlement of Fort Boonesborough, Harrodsburg and Danville*?" and "*Were there any large-scale disturbances in the forests of the Inner Bluegrass region during the last 300 years*?" The rare old trees of Floracliff will reveal important slivers of historical Fayette County ecology – slivers which will allow us to ponder and construct plans for a more sensible and hopeful future environment.

Neil Pederson with "Woodie."

Allelopathy in Trees (cont from page 4)

into inactive material or allelopathic agents. Microorganisms also generate their own allelopathic chemical that affects other organisms and tree roots. Microorganisms are responsible for the release of allelopathic agents from materials as they decay. During this process all parts of the tree are consumed, transformed, or released. Residuals of lignin and humic acid can be detected for decades after a tree has decomposed. Allelopathic chemicals exist in almost all environments. Seeds and fruits can contain a strong concentration of allelopathic chemicals in their reproductive material, which are released as the seed covering breaks down, modifying the micro site around

the seed. Allelochemicals produced by trees are generally classified as Terpenes, Phenolics, Alkaloids and Nitriles.

☐ Terpenes are found in the oil of many trees and to a lesser degree in resin. The scent of trees is also associated with the presence of Terpenes. The primary form of release is vaporization, but small amounts also leach into water. Terpenes cause poor growth rates and contribute to other problems.

☐ Phenolics are also found in the oil of trees and provide scent in some trees. Phenolics are a large group of compounds, some of which protect trees from infections, microorganisms, and injury from animals. Some elements of Phenolics have been found to be allelopathic. Tannins are Phenolics which affect the palatability of some trees, protecting them from grazing animals.

☐ Alkaloids and Nitriles - Alkaloids are commonly found in toxins. Nitriles, a group of organic cyanides, are associated with the same toxins. Because of their nitrogen content these compounds dissipate rapidly when released into the environment. However, prolonged leakage even in small amounts can greatly change the plant, animal and microbial presence in an area.

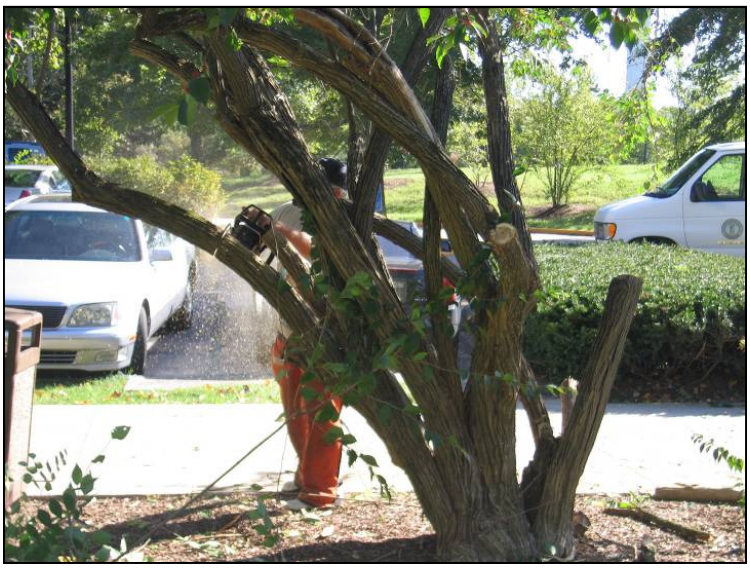
Some trees, native to our region and known to convey strong allelopathic impacts, are listed below.

Species	Source
Acer saccharinum (Silver Maple)	Roots
Quercus falcata (Southern Red Oak)	Leaves
Sassafras albidum (Sassafras)	Roots, Leaves, Stem
Juglans nigra (black walnut)	Roots, Leaves, Stem

There is a lot of research yet to be done in the area of allelopathy. What is known indicates great potential for many beneficial uses, such as effective and safe pesticides and growth regulators. The presence of allelopathic chemicals modifies the relationships between organisms, causing change in the ecology of an area. This can have great impact on trees' survival, future health and productivity. Allelopathy should be a consideration for arborists as well as those involved in tree health care and landscape management. An excellent source for more information can be found at the web site of Professor Kim Coder from the University of Georgia in Athens' School of Forest Resources , http://warnell.forestry.uga.edu/warnell/service/library/. (Search under Community Forestry or Tree Health Care headings.)

State champion sassafras from www.forestry.ky.gov.

A Capitol Idea (cont from page 5)



Mike Nichols cuts down an offending bush honeysuckle

ment's efforts to convert large fescue fields at the nearby State Libraries and Archives complex to native warm season grass mixes. However, he cannot complete this "Capitol Makeover" alone. Vinson asked for KNPS assistance in conducting an inventory of the invasives on the Capitol grounds and a location map. KNPS's Sarah Hall is spearheading this inventory effort, but could use your help. If you live in the Franklin/Fayette County area and would like to work on this project please contact Sarah at sarah.hall@kysu.edu for more information.

Join the KNPS Facebook group!

Join our facebook Group

Just click below!

http://www.facebook.com/group.php?gid=69397006016

2009 Wildflower Weekend Photo Contest Winners

This spring at the annual Wildflower Weekend at Natural Bridge State Park, the KNPS brought back the traditional photo competition, but with a few digital changes. Folks were permitted to e-mail in up to three photos taken that weekend in the Red River Gorge area, which were then posted on the www.KNPS.org website, where members voted for their favorites. We received quite a few great entries, but the following were chosen as the favorites. Congrats to the winners! We invite you to join us at Natural Bridge in 2010 to participate yourself, although we welcome your photos of Kentucky's native plants and natural areas at any time. Just send your photos in to webmaster Dave Luzader, at dluzader@insightbb.com.

1st Place Medora Farmer

2nd Place Diana Williams

3rd Place Jack McKinney

KNPS Hikes and Volunteer Opportunities

Winter Trees and Ecology Hike at Anglin Falls on January 23rd, 2010

Join Kentucky State University research biologist and KNPS Secretary Sarah Hall for a hike around the John B Stephenson State Nature Preserve in Madison County. Limit 12 people, must RSVP by Jan 13th. For more information contact Ms Hall at sarah.hall@kysu.edu

Old Growth Forest Hike at Blanton Forest on February 6th, 2010

Dr. Neil Pederson, biology professor at Eastern Kentucky University, has been researching old growth trees throughout the state. Join him for this hike through the Commonwealth's largest intact old growth forest. Limit 12 people, must RSVP by Jan 28th. For more info contact Dr. Pederson at neil.pederson@eku.edu

Short's Goldenrod Restoration Bonfire at Blue Licks State Park on February 20th, 2010

Each winter the KNPS assists the KSNPC in clearing cedar trees from around populations of the federally endangered plant *Solidago shortii*. Give us a hand in helping this rare plant survive. For details on the project, see "Survival of the Rarest: Short's Goldenrod Recovery Efforts in Kentucky" in *The Lady-Slipper*, Volume 23, Issue 1, Spring 2008, page 4 at www.knps.org. For details contact Zeb Weese at zeb.weese@ky.gov

Invasive Species Removal Days at Floracliff State Nature Preserve

See www.floracliff.org for more information or contact Beverly James at floracliff@aol.com

Kentucky State Capital Invasive Species Inventory

See this issue, page 5 for details; contact Sarah Hall at sarah.hall@kysu.edu.

KSNPC Rare Plant Surveys

See this issue, page 3 for details; contact Tara Littlefield at tara.littlefield@ky.gov.

KNPS Native Plant Studies Course at Northern Kentucky University:

Taxonomic Keys for Identifying Kentucky's Wildflowers on February 13, 2010

The course provides students experience in the use of taxonomic keys to identify Kentucky's native wildflowers, serving as an introduction to the use of taxonomic keys or as a supplement for those students who may have taken either core course on the identification of Kentucky's wildflowers (fall or spring). Ron Jones' "Plant Life of Kentucky: An Illustrated Guide to the Vascular Flora" is the recommended text for this course. However, alternative materials will be provided for those unable to purchase Dr. Jones' text. This course will be completely taught in the lab using prepared herbarium specimens and dissecting scopes. Cost is $65 per person; for details or to register go to www.peopleware.net/0971 and click on "Community Connections" under "Registration, or call 1-859-572-5600. For more information please e-mail connect@nku.edu.

Interested in the KNPS Native Plant Studies Certification Program?

Just go to http://www.knps.org/certification.html for more information!

Kentucky Native Plant Society
801 Schenkel Lane
Frankfort, KY 40601

2010 KNPS Membership Application or Renewal

Detach and send to: Kentucky Native Plant Society / 801 Schenkel Lane / Frankfort, KY 40601

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Questions? E-mail "info@knps.org" for help!

The Kentucky Native Plant Society was founded in 1986 for everyone interested in the native plants, trees, and wildflowers of Kentucky. Plants are essential to both the well-being of our Commonwealth's natural ecosystems and our enjoyment of its unique environment. With members in Kentucky and neighboring states, the Kentucky Native Plant Society is a leader in promoting education about, appreciation for, and conservation of the native flora of our Commonwealth.