KNPS

The Lady-Slipper

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Highlights from the 2009 botanical field season

By Tara Littlefield, KSNPC botanist

Inside this issue:

As I write this it's nearing the end of 2009, a great year for many plants in general due to the abundance of rain seen throughout the state. However, for plants like the white fringeless orchid, which actually grow this year's main tuber the year before, there were decreases still seen caused by the previous droughts. The previous year's drought may also have caused some die back in older perennial plants (as seen in white haired goldenrod), trees and shrubs. However, the increased rainfall this year promoted many seedlings to sprout. It was much more difficult to hike around doing inventories in many parts of the state because of fallen trees from the ice storm. This definitely slowed all the field biologists throughout the state, especially when surveying near cliff lines and streams that may have been more affected by the ice. Here are some interesting botanical discoveries and observations for the 2009 field season:

A rare mint, the Rock Scullcap (Scutellaria saxatilis), found on Pine Mountain

rock skullcap on pine mountain by Tara Littlefield

On a stormy day in July while conducting a flora for the Kentucky Division of Parks near Kentenia State Forest in Bell County, an interesting mint was discovered in a steep, rocky east-facing mixed mesophytic forest. Its stems were weak and crawling onto the small boulders, with the racemes of purple flowers pointing straight up. The leaves were opposite and heart shaped. There were several small scattered patches of plants over a 40 m^2 area, but it is uncertain whether number of stems is indicative of number of individuals in the population. It has been reported to spread asexually through runners. The main herbaceous associate was poison ivy that was nearly 3-4 ft tall in some areas, which made it difficult to walk about when added to the numerous rocks that were littering the forest floor. Two white walnuts (*Juglans cinerea*, KSNPC-SC) filtered the light, along with basswood, northern red oak, sugar maple, and yellow buckeye.

Rock skullcap is listed as a G3 species. This means that it is vulnerable to extirpation or extinction (Natureserve 2009). It is found mainly in the Appalachian Mountains in several states. It had never been reported from Pine Mountain, so it is always exciting to find a rare plant in a new area in Kentucky. Rock scullcap has been reported from a few scattered places in eastern Kentucky: a tributary to Cumberland River near Cumberland Falls, a stream in Pike County that was turned into a strip mine, and a few scattered locations in the northern Cumberland plateau area in Lewis, Rowan, Elliot, Menifee and Montgomery Counties. Many of these reported locations have not been visited in over 20 years. The fate of rock skullcap on Pine Mountain is questionable. The poison ivy does seem to be competing directly with the population and nearby an upturned tree probably damaged by a storm, created disturbance for the opportunistic non-native tree-of-heaven. Dozens of these sprouts were spreading fast. To find more about rock scullcap, please visit KSNPC's rare plant database at: http://eppcapp.ky.gov/nprareplants/details.aspx?species=Scutellaria+saxatilis

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The Lady-Slipper is intended to be published by the Kentucky Native Plant Society [IRC 501(c)(3)] in March, June, Sept., and Dec. Deadlines are the 15th of the prior months, but Editorial Committee members welcome article submissions at any time. Send dues and membership status inquiries to:

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

The wind is blowing strong and the snow is passing horizontally by my window as I write the final draft of this message. It is winter in Kentucky and, like all things in nature, the weather is subject to change. The weather – particularly precipitation – was an important element in the formation of our diverse ecological systems. They evolved enduring seasonal droughts, major flooding, ice, and snow storms. Through this evolutionary process all manner of life made the changes necessary to ensure the survival of the species, and collectively form one of the most diverse and beautiful ecological systems on the planet. I have chosen change as subject of this message, and use this illustration of how natural systems are constantly changing to achieve balance and solve many problems that occur naturally.

Someone once said Humans are by nature resistant to change. I generally agree with this broad statement, but there are exceptions to any rule. Speaking specifically about the protection of the biodiversity of Kentucky native plants and ecological systems, there is mounting evidence to support the resistance to change theory. But there are exceptions – a few people working to promote awareness and educate the public about the importance of protecting our native plants and ecological systems. I said in my last message, the native plants and ecological systems in Kentucky are facing perilous times because of increasing development, misguided land management practices, a growing number of non native invasive plants, and weak or nonexistent laws that allow the continued importation and planting of non native invasive plants.

"…what will it take to bring about the changes necessary to alter the present course, and began to adequately protect and restore our treasured ecological systems?"

I talk with many people about non native invasive plants, which is in my opinion presently the worst threat to our natural systems. The average person knows little about the subject. The nursery industry turns a deaf ear to the subject and continues to plant, promote, sell, and ship thousands of invasive plants into the state each year. The state allows this to continue despite the publishing of scientific papers documenting the destructive nature of these plants and their impact on our ecological systems. I cannot help but wonder what will it take to alter our present course, and begin to adequately protect and restore our treasured ecological systems?

Thanks to our membership for supporting many recent changes. Your emails and letters of response were appreciated. Our electronic publishing of The Lady-Slipper was well received, thanks to the layout and design of Zeb Weese, technical expertise of Dave Luzader, and final editing by Ron Jones. Our secretary Sarah Hall and Treasurer Tara Littlefield's loyal support, and "go the extra mile" attitude was super. Thanks to you all!

I hope to see you all at Wildflower Weekend,

Alan

Alan Nations

More Highlights from the 2009 botanical field season

By Tara Littlefield, KSNPC Botanist

Finding new populations of running buffalo clover (Trifolium stoloniferum) on Eagle Creek in Grant County

Running buffalo clover by Deborah White

Over the past few years, new county records of Running Buffalo Clover (*Trifolium stoloniferum*, federally threatened, KSNPC-T) were found in Campbell County (Licking River tributary) and Owen County (tributary to Eagle Creek) by conservation minded landowners. Searching near the vicinity of the Owen County population, we found another new county record in Grant County along the Eagle River on an old road on a flat terrace along the river, dominated by an overstory of walnut (*Juglans nigra*). It seems like there is still a lot of suitable habitat for running buffalo clover throughout the Bluegrass Region, so find out about the habitat and unique characters of running buffalo clover and find a patch near you.

To find more about running buffalo clover, please visit KSNPC's rare plant database at:

http://eppcapp.ky.gov/nprareplants/details.aspx?species=Trifolium+stoloniferum

Life history study of White fringeless orchid

KSNPC has begun a multi-year study into the life history of the white fringeless orchid (*Platanthera integrilabia,* federal candidate) in collaboration with the University of Kentucky forestry department. In Kentucky, this species is found in upland seeps mostly in the southern part of the Cumberland Plateau. It seems to be declining throughout its range, most likely due to human caused habitat modifications. Little is known about its life history, and as a result, there are many questions pertaining to the management of this species. This study addresses vegetative, flowering and fruiting ratios among 3 different seeps along with abiotic factors such as precipitation and light intensity. Questions still exist, such as how long can the orchids survive in dormancy waiting for canopy gaps to develop in the seeps? What are the factors that contribute to successful pollination and formation of viable fruits? What are the population trends and how do these relate to varying levels of precipitation over time? White fringeless orchids produced few flowers in 2009 and the number of fruits formed was very low in ratio to flowers. Poor flower and fruit production may have resulted from the previous 2 years of drought for the region. This year's orchid tuber was actually formed last year, so it is affected by climatic conditions during a two-year period. In addition, the extremely low fruit production may suggest problems with pollination success.

White fringeless orchid by Tara Littlefield

Photo by Tara Littlefield

For more information on the white fringeless orchid, visit KSNPC's rare plant database at: http://eppcapp.ky.gov/nprareplants/details.aspx?species=Platanthera+integrilabia.

WANTED: YOUR CONTRIBUTION!

The KNPS *Ladyslipper* is fortunate to have articles written by many of Kentucky's leading botanists, but we want all of our members to have a voice. Send us any thoughts you may have on the articles in this issue, or anything else KNPS related, by e-mailing info@knps.org with the subject "Letter to the Ladyslipper". Have an idea for an article or know about a native plant event in your area? We'd like to hear about them as well!

Tall fescue and eastern red-cedar alter fire intensity in grassland

By Sarah Hall, Kentucky State University

Prescribed fire is an important management tool for native Kentucky grassland habitats. Fire serves a number of functions, including knocking back woody species that become established and clearing senesced plant litter, both of which allow the plant shoots of grasses and forbs to grow better. The use of prescribed fire is believed to have been essential in maintenance of grasslands in Kentucky by Native Americans. Without frequent disturbances such as burning, mowing, or grazing the vast majority of grasslands in Kentucky quickly undergo natural succession to forests. Eastern red-cedar is the most widespread early invader at grassland sites, but others vary and can include sumacs, hawthorn, rusty blackhaw, and a number of oaks. Fire does not typically kill all individuals of these species, but simply keeps their cover "in check," allowing the native grasses and forbs to flourish. Tall fescue was planted widely across Kentucky in the 1940's and 50's as a forage, creating fescue monoculture over 20% of the state's surface area. The long-term impacts of repeated prescribed burning on fescue is unclear, although we know it remains established following some burns, and can even be improved by a single burn. Herbicides are often combined with prescribed burning to manage grasslands in which tall fescue exists.

I joined land managers from the Kentucky State Nature Preserves Commission for a prescribed burn at Crooked Creek State Nature Preserve on March 20th, 2009. The burn was conducted for restoration purposes in an 8-acre field adjacent to higher quality remnant grassland habitat. Management within this area began in 1999, and has included prescribed burns and use of herbicides to control tall fescue (see Fig. 1 for unit map and management descriptions). The most recent prescribed burn was in 2004. Vegetation surveys were conducted in Fall 2008 to determine if there were differences in species composition, diversity, or abundance of nonnative species corresponding with different management histories. The significant results included: 1) Unit C had higher tall fescue cover and lower species richness than all others, 2) Unit E (control) had the highest species diversity, but composition was different than the others (based on ordination analysis), and 3) Unit A had more Japanese honeysuckle than the others.

Prescribed fire on March 20, 2009 at Crooked Creek State Nature Preserve.

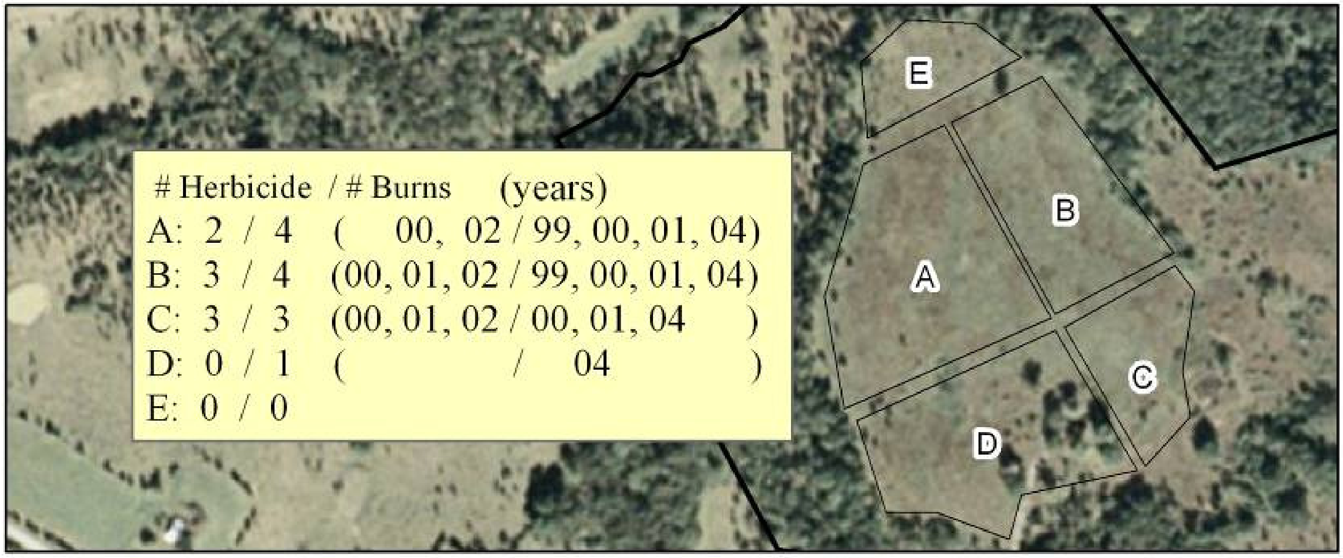


Fig 1. Management history of 8-acre restoration site at Crooked Creek State Nature Preserve (all sections were burned in 2009 prescribed fire).

Fire exhibits very patchy effects on the landscape, influenced by type of vegetation (fuels), wind and relative humidity, fuel and soil moisture, etc. Vegetation cover at the localized scale can have impacts on a number of these factors, thus altering fire behavior. I placed aluminum tags with heat-sensitive paints (Fig. 2) in each of the units in order to detect variation in fire temperature at the ground level within the site. In addition, one tag was placed under a shrub thicket (all others were in grass). Following the burn, tags were removed and examined for melted paints. All tags except those from units E and C exhibited melting of all paints, indicating temperature exceeding 510°C. Tags from E and C had three of the six paints melted, indicating temperatures greater than 246°C but less than 316°C. Unit E was the control which had not been burned before. It had many more cedars, and also a thick moss layer and the second highest tall fescue abundance (7%). During vegetation surveys in Fall 2008, the groundcover was noticeably more moist in this unit than the others. Unit C had significantly more tall fescue cover than the others, at 18% versus 1-2% for A, B, and D.

These results suggest that when fire is not used as a management tool (as in unit E), conditions at the surface become more moist, which allows different plant species to grow, which in turn influences fire intensity. The reduced fire intensity from unit C was likely linked to the higher tall fescue cover in this unit. Tall fescue, a cool-season grass, was green and had begun actively growing when the prescribed fire occurred. Both of these units demonstrate difficulties with managing grasslands, and the importance of repeated prescribed fires to encourage native grasses and forbs. Once tall fescue or eastern redcedar become well established, fire behavior can be dramatically altered (temperatures decreased by half), decreasing restoration success. Clearly, fire continues to be an important tool for managers of grasslands in Kentucky.

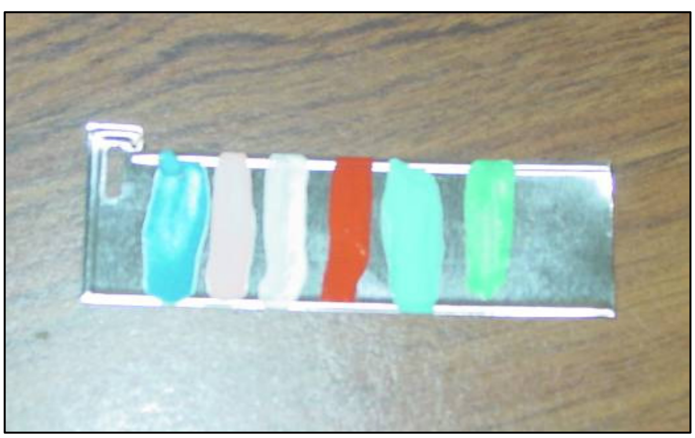


Fig 2. left: Aluminum tag with heat-sensitive paints, melting at 79, 163, 246, 316, 399, and 510°C respectively (from left to right).

right: Tag wrapped in foil placed at soil surface prior to burn.

Rebuilding the Concept of Bluegrass Woodland

By Dr. Julian Campbell

Given the challenges presented for research and restoration in Bluegrass Woodlands, it is important to base our efforts on sound principles among partners: supporting each other, sharing information, and resolving differences. If we try to understand scientific differences in terms of testable hypotheses, this can lead directly into valuable research that is critical for designing good restoration. If we have reasonable differences in approach to management, this can lead to good comparative trials on lands where results are recorded. The following notes attempt to lay the ground for understanding differences in concepts of the original woodland. It is important to delve into such understanding, so that useful trials and experiments can proceed, especially basic comparisons between effects of browsing, burning and other disturbances, and how to integrate recovery of native species with reduction of aliens.

During the first century after settlement in the central Bluegrass Region of Kentucky in 1770-1800, there were few resident botanists to chronicle the disappearance of wilder lands where native plants abounded. Less rugged lands, and even many of the surrounding hillsides, were rapidly converted to farms. Were it not for Constantine Samuel Rafinesque, Charles Wilkins Short, Robert Peter and David Dale Owen, we would have almost no details of the situation before the Civil War. Their work was partly associated with the early scientific institutions of Kentucky, especially Transylvania University and the First Geological Survey. Interrupted by the war, this initial burst of natural history was not followed by a strong tradition during early decades at the University of Kentucky. However, in 1890-1910, Peter's son (A.M.) did help found the herbarium at the Agricultural Experiment Station, where Harrison Garman published some useful botanical notes in the Bulletins.

> ***"...diversity is maintained across eutrophic landscapes: a veritable "Kreb's Cycle" of ecological metabolism."***

In the 20th Century, almost nothing scientific was published about the woodlands until Lucy Braun's brief notes in her 1950 book about the Deciduous Forests of eastern North America. She puzzled about what the original woodland in this "most anomalous" region must have been like, based on the scattered groves of ancient trees and a few historical sources (especially Owen). In the same year, Ursula Davidson produced a master's thesis at the University, where she reviewed additional historical sources. She focused on the ancient bur oaks, which need sun to regenerate from seed, as evidence that some significant degree of opening must have occur in the past for these huge trees to be so characteristic of the region. That theme was later developed by Bill Bryant, Mary Wharton and others in their concept of "blue ash-oak savannah woodland." The initial paper by Bryant et al. in 1980 included an accurate description of the ancient woodland remnants, as well as a relatively broad flexible interpretation of these remnants within the context of rather thin historical information.

Wharton elaborated on the "savannah-woodland" hypothesis in her 1991 book with Roger Barbour: "Bluegrass Land and Life." However, she exaggerated the concept with rather selective citing of particular pieces of evidence, without a critical evaluation of all the evidence, and without a realistic ecological model of how the woodland was opened up. To quote: "The survivors of the presettlement Bluegrass are notably wide-spreading trees with low branches (with the exception of the blue ash, which rarely develops such a silhouette), indicating that they were well spaced even in their youth and did not develop in a dense forest... The occurrence of bur oak, a savanna species, in Kentucky is anomalous... Wherever we find bur oaks in the Bluegrass Region, they tell us that in those places the original "forest" was open... To explain the origin of savanna in this area, we must go back several thousand years to a "xerothermic interval"..." Wharton's concept has been rather widely adopted, and it is often assumed that the original vegetation was a somewhat open woodland or "savanna" dominated by blue ash and oaks. In some cases, it has been proposed that fires set by native people maintained much of the openness, rather than droughts. The potential role of large herbivores has often been noted, but it has been difficult to understand how their effects varied in space and time.

There are several flaws in the concept of a blue ash-oak savanna-woodland, as can be detailed below. The earliest historical evidence actually indicates a more shady woodland, with much sugar maple in places. Wharton overestimated the general age of our ancient trees, and assumed in error that the open-grown form of the oaks reflected open conditions before settlement. Wharton did not mention the several references to "woodland-pasture" during the 19th Century, which was created on larger farms with sufficient slave labor. In original woodland, the generally "dense herbage" and the locally extensive "canebrakes" that were often noted by pioneers may well have been enhanced by relatively open conditions in some areas, but dense grassy ground vegetation can also occur in areas with considerable summer shade under trees like walnuts, hackberry, elms, ashes, oaks and hickories. Indeed, on the moist fertile soils that are typical in this region, such vegetation is the typical condition where regular grazing or mowing is relaxed. Canebrakes were impressive features, often with relatively thin tree cover, but there is no evidence that they covered more than a tenth of the landscape.

In natural history, as in human history, it is often wise to seek original observations rather than depend on the interpretations and reinterpretations of others. For a fresh approach to this problem of the Bluegrass Woodlands, it is even useful to put aside evidence from the remaining groves of ancient trees, which do—after all—cover just a very small proportion of the landscape: generally less than 1% and concentrated in more affluent estates. In brief, a broad new approach can include the following types of evidence.

(1) Archaeology. In her excellent dissertation, Gwynn Henderson (1998) summarized data from villages of the Fort Ancient culture across the region, ca. 900-1700 A.D. Wood fragments at these sites come from a wide variety of tree species, usually with much hickory and not indicating any dominance by ashes or oaks.

(2) Narrative History. I have tried to search all potential sources (see my 1989 paper and transcriptions at http://moondancerfarm.com/julian/Technotes.asp). There is overwhelming evidence from the accounts of pioneers and early travelers that a fairly diverse woodland existed, ranging from deeply shady woods with "sugar tree" to more open areas with much cane; ashes and oaks did not appear generally dominant.

(3) Surveying History. The witness trees noted in early surveys provide ample evidence of the generally "well-wooded" nature of the landscape, with even more deeply shady woodland than indicated by the narrative history. To date, the analysis has focused on broad trends in space and time, by calculating percentages of each species (or genus) for whole counties or watersheds. A lot more detailed pattern can be examined if individual surveyed corners are located on modern maps (see below).

(4) Early Botany. The collections and notes of Short, especially his "Florula Lexingtoniensis" of 1828-29, provide invaluable insight, supporting the general impression of original woodland from previous historical sources and also indicating the general decline of some native species and the increase of some weeds. Most of the native species noted by botanists as relatively common during early decades after settlement are typical of more or less shady woodland, although a significant minority are typical of more open areas. A few sun-loving species have now virtually disappeared; curiously, these are mostly northern or western species typical of relatively damp sites or lowlands (*Caltha palustris, Anemone canadensis, Thalictrum dasycarpum, Desmanthus illinoensis, Lysimachia hybrida, Stenanthium gramineum, Carex vesicaria*—note also tentative records of *Fraxinus nigra*).

(5) Modern Botany. Building on the initial efforts of Willem Meijer, I have kept notes on less common native species found in woodlots, fencerows and fields around the central Bluegrass. Some of these species are relatively 'conservative' indicators of original conditions, often with little survival in artificial landscapes and with little or no unaided dispersal back into areas that are abandoned, replanted or restored (e.g. wild ginger, mayapple, trout-lilies). It is significant that most of the more conservative species are typical or more or less shady woodland. Other than cane and others in brushy transitions to deeper shade, few conservative species are typical of truly open conditions and these mostly in more rocky sites near the river or transitions to the Eden Shale hills.

(6) Dendrochronology. Ryan McEwan's 2008 paper (with Brian McCarthy in Journal of Biogeography) showed that the ancient trees of woodland-pastures started to grow much faster after settlement, with doubling or tripling of radial growth and initiation of their massive spreading limbs. He found no fire-scars dating before settlement. Although bur oak, in particular, does require sun to regenerate from seed, small trees can survive for decades in suppressed condition, and large trees can put on rapid growth into old age. Further sampling is continuing, including from old log cabins, in order to extend the record back in time. It is possible that severe droughts in the 17th Century did then promote oaks and ashes relative to more mesophytic species like sugar maple. Before that of course, much larger native human populations would have created significant openings around seasonal camps and more permanent villages.

(7) Land-use History. Several writers ca. 1800-1840 noted how woodland-pastures were formed in early decades after settlement. The "Anonymous" account of 1834 provides good insight (reprinted in the 1973 volumes of "Travels in the Old South"): "The woodland pastures, which are peculiar to this section of country, are remarkable beautiful... This pleasing effect is produced by a simple procedure. The woodlands are all inclosed [sic]; the underwood and the useless trees are removed, and the valuable timber trees are left, standing sufficiently wide apart to admit the rays of the sun and the free circulation of the air between them. The ground is sown with grass, and extensive tracts, which would otherwise have been mere forest, are thus converted into spacious lawns, studded with noble trees. These are so numerous, and of such extent, as to form a prominent feature in the scenery, and it is impossible to imagine any thing of this kind more beautiful than the alternations of woodland and meadow, with hemp and corn fields, and orchards, which the eye here meets in every direction... Within the memory of living witnesses, the region which is now so splendidly embellished, and which support a numerous and highly refined population, was covered with savage forests and vast cane-breaks..."

I have recently completed an initial foray into the mapping of individual corners described for early land-surveys during 1774-86 in the upper watershed of South Elkhorn Creek (see attached maps). This continuing effort will benefit greatly from the earlier mapping of Carolyn Wooley (in her 1973 book on the founding of Lexington), Nancy O'Malley (her report on early stations; Dept. of Archaeology, Univ. of Ky.) and especially Neal Hammon (in several books). These people have located many surveys on modern maps, and it has proven relatively straightforward to extend their results and to accumulate fairly accurate geo-referenced data on the witness trees. It is also encouraging that Paul Bradway, a new graduate student at the University's Dept. of Geography, is taking on such work with a special focus on Woodford County.

Pattern in the degree of openness in the woodland may be indicated by coding trees to reflect their overall tolerance of shade.

(1) Tolerant of deep shade: sugar tree, buckeye; these are shade tolerant and potentially dominant in deeper woods.

(2) Intermediate/transitional: ashes, elms, hackberry, mulberry, hickories; these are mostly somewhat shade-tolerant but tend to be less competitive in deeper woods.

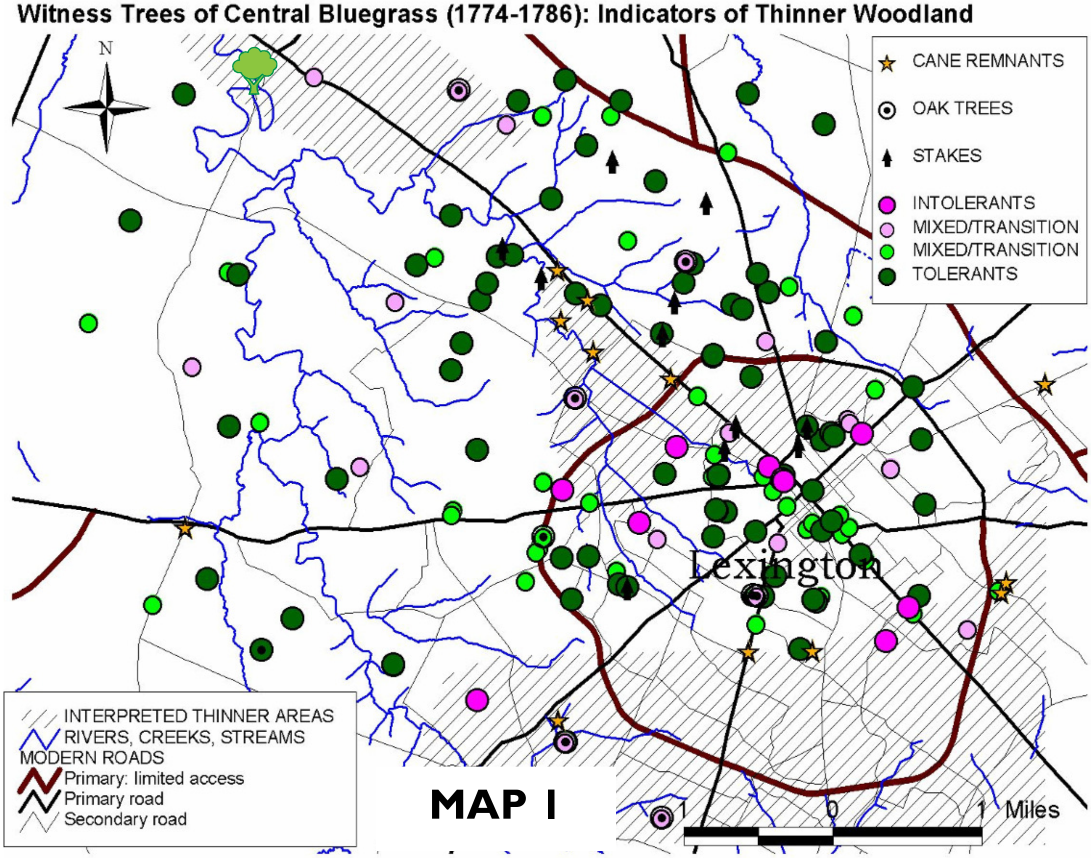
(3) Intermediate/transitional: oaks, walnuts; these need sun to regenerate but can be relatively long-lived within denser woods.

(4) Intolerant of shade: locusts, cherry, coffee-tree, hawthorn, cane; these generally need sun for proper establishment and tend to decline in deeper woods after a few decades.

At corners with two or more trees, I assigned the predominant code, or equal mixtures as follows: 1 and 2 to 1; 1 and 3 to 2; 2 and 4 to 3; 3 and 4 to 4; etc. Almost all corners during this early period had witness trees, but a few just had "stakes"; it is possible that stakes were used where trees were absent.

Map 1 indicates that a zone of relatively thin woods occurred across a northwestern sector of modern Lexington. Intolerant trees (mostly honey locust) were clustered here. Sugar maple was virtually absent. Similar zones may have occurred further to the northwest and to the southeast, but more sampling is needed. Oaks were relatively infrequent among witness trees (ca. 5%), and may have been concentrated in thinner woods. The few remnants of cane in the modern landscape appear to be concentrated in these zones. In the more northwestern zone, we know that much cane occurred along Cane Run but no remnants are known today.

Witness Trees of Central Bluegrass (1774-1786): Indicators of Thinner Woodland



MAP 1

Pattern in browsing history may be indicated by coding trees as follows, based on general observation and review of literature.

(1) Highly intolerant of browsing: ashes, elms, hackberry; these tend to be heavily browsed by cattle or deer.

(2) Less intolerant of browsing, uncertain, intermediate or varied: sugar maple, mulberry, cane.

(3) Less tolerant of browsing, uncertain, intermediate or varied: oaks, hickories, walnuts, cherry.

(4) Highly tolerant of browsing: buckeye, locusts, coffee-tree, hawthorn.

At corners with two or more trees, I assigned the predominant code, or equal mixtures as follows:

1 and 2 to 1; 1 and 3 to 2; 2 and 3 omitted; 1 and 4 omitted; 2 and 4 to 3; 3 and 4 to 4.

Map 2 indicates that zones with more browsing history may have existed in and around Lexington, but with no clear correlation to the zones of indicated openness (Map 1). This result could be used to support the concept that both of these predominant ecological factors were at work in the original woodland. I have developed this concept into a general model by adapting the ideas of Franz Vera (see poster at http://www.moondancerfarm.com/julian/Technotes.asp).

In a broad simple form, this model could be summarized for this region as follows.

(A) Random climatic events or more stable features of the landscape promoted disturbance or interruption of the tree canopy. For example, it is likely that moist fertile productive soils and springs on the northwest side of Lexington caused much attraction for herbivores and humans; it is possible that humans cleared some areas for crops.

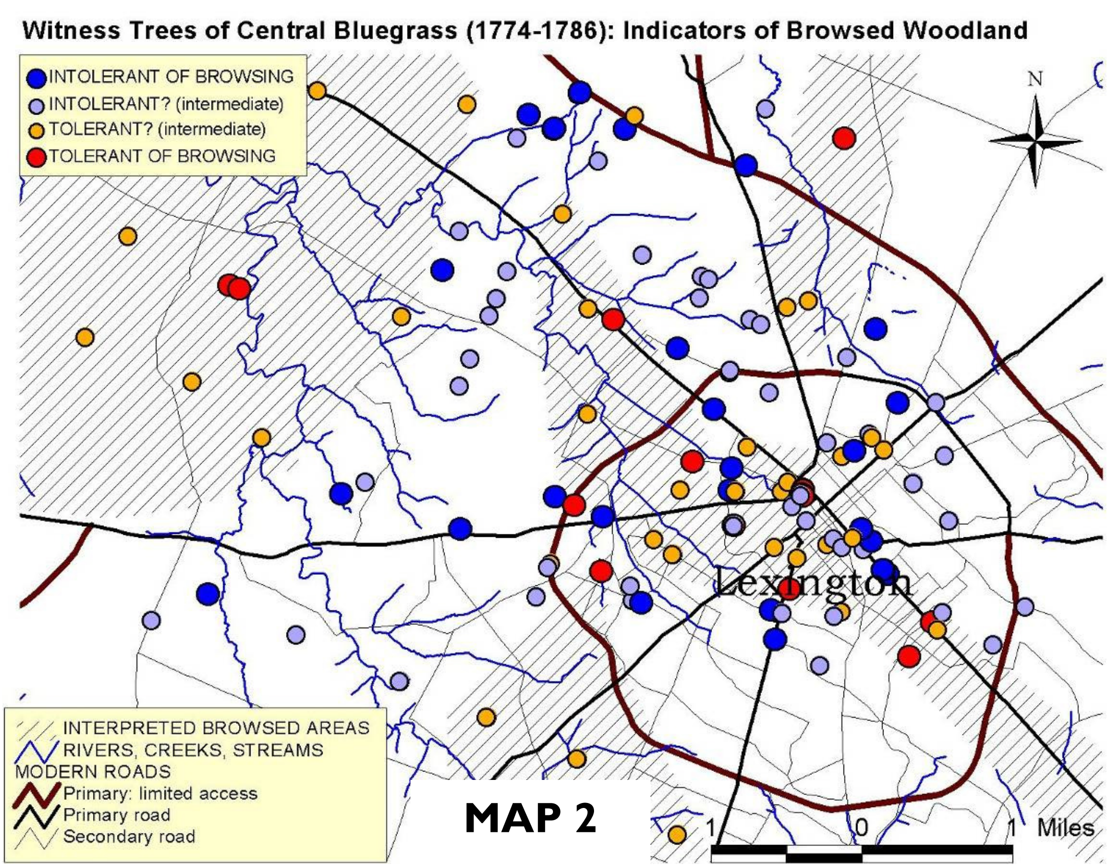
(B) Consumption of vegetation in these relatively thin woods could select locally for more thorny or toxic species; after a period of time (years, decades or centuries), such selection could lead to reduced consumption.

(C) Herbivores and humans could then shift their foci of attention to fresher openings in the woods, where more palatable species would increase rapidly in their growth.

Some degree of cyclical behavior in these ecological trends can be envisaged, but against this there would have been some relatively stable features of the landscape that maintained a more stable pattern in the vegetation. For example, before human interruptions it is possible that some larger herbivores like bison migrated back and forth between northwest and southeast regions across the central Bluegrass. During winters, such animals could have moved south from across the Ohio River, sometimes overwintering in the cane. Major bison trails crossed the Kentucky River at Lees Town (W Franklin Co.) and then again at Clay's Ferry (SE Fayette Co.). Their routes might have been close to the modern Leestown Road (US 421) and Boonesborough Road (US 25), or perhaps they sometimes ranged off the regular courses into variants and side roads within the region.

It is likely that more extensive mapping like this will allow us to develop such concepts into proper dynamic models. In addition to historical data, more details of ancient trees and other remnants can be included. For example, we should build on Davidson's mapping of bur oaks across Fayette County, Jim Same's mapping of bison trails (check with Bill Penn at Midway, http://midwaymuseumstore.com/), and more extensive mapping of "savanna-woodland" by Kentucky State Nature Preserves Commission and others.

Provisional analysis of functional characteristics for each tree species suggests that development of this model could get to the core of understanding how diversity is maintained across eutrophic landscapes: a veritable "Kreb's Cycle" of ecological metabolism.



MAP 2

Curators' Corner #1: Herbaria going high-tech

By Dr. Maggie Whitson, Northern Kentucky University

As we enter a new decade, Kentucky's herbaria are joining museums around the country (and the world) in a push to modernize and bring themselves into the information era. Botanists are moving out of the field and onto the web.

Herbaria have been around nearly as long as botanists, and aren't known for their use of cutting edge technology. Up until recently, it hasn't been necessary. As reference libraries of plants, herbaria have been able to serve their purpose without technological bells and whistles. Collections of dry, pressed, labeled plants are mounted on acid free paper and filed in metal cabinets. Specimens are organized by the plant family they belong to, then genus within the family, and then species within the genus. Filing is typically alphabetical within groups, though some herbaria arrange their families by relationship, while others simply alphabetize. Individuals within species may also be organized via geography -- usually, local versus non-local specimens. If you have these things, then you have a functional herbarium.

Botanists have a long, rich history of plant collecting, which in a way has lead to an embarrassment of riches. While pre-computer era libraries used card catalogues to guide users through their collections, herbaria never adopted this technique. After all, what should be found in their holdings was self explanatory (examples of local plant life), and it was all neatly alphabetized, anyway. Plant specimens, when handled gently, kept dry, and protected from the ravages of sunlight and bugs, will last almost indefinitely. Many European collections contain specimens from the 1700s, and some older than that.

Herein lies the rub-- with long lasting collections, plenty of time to accrue them, and the ability to pack far more sheets into a cabinet than seems physically possible, even herbaria with limited space can amass large collections of specimens. Sorting through these holdings can become a daunting task, particularly if you want to look at something other than all of the specimens of a particular species. For example, finding all specimens collected by a specific person, or finding all specimens from a certain county of a state, would be Herculean tasks. Sifting through every specimen in the collections is your only option.

With our native flora facing multiple threats -- habitat destruction, climate change, invasive species, and overcollection of medicinal and horticulturally desirable species, to name a few -- understanding the distribution and diversity of native species is becoming ever more critical. We must understand what we have and where it is in order to conserve it. The historical approach has been, "Get out in the field and get more plants!" Collecting is very important for historically under-collected areas, but more collecting in areas already well-combed by botanists may not be the best use of limited resources. In this case, a better understanding of what we already have would be more appropriate. Throughout Kentucky, undiscovered botanical treasures lurk in our herbarium cases, hidden and unused until someone thinks to look for them. The larger the collection, the better the odds of some rarity being lost among countless common specimens.

How do we bring these lost treasures to light? We give in and follow the lead of the libraries. For once, procrastination has been of benefit, because we can skip adopting the card catalog. Like modern libraries, herbaria are creating searchable, electronic databases of their holdings.

A typical databasing method is to attach a unique

An old time specimen joins the digital age: the collecter of this newly databased little composite probably never anticipated this fate for her specimen.

barcode to the specimen as a reference number, and then enter all information from the specimen label. This includes name of the plant, who collected it and when, a description of the fresh specimen and its habitat, and directions to where it was collected. Annotations added by later users of the specimen are also included. The truly wonderful thing about having this information in a database program is that it can be searched and sorted in almost limitless ways. It can also be made available via the web so that people who can't physically visit a herbarium can still virtually browse its holdings.

With a searchable database of specimen information, finding all collections from Nicholas County, Kentucky is no longer a months long project. Just have the program pull the desired county records and sort them by taxon. (This can be invaluable for researchers making county floras.) Similar searches could be done for collections that had flowers in April or collections made by your mother when she was in college. This new flexibility in sorting and searching through large amounts of data will allow a variety of new studies that would have been highly difficult previously. It has the added benefit of reducing wear and tear on specimens. Now you don't have to handle every specimen while you're looking for something specific. You can pick out what you need to see beforehand and then go to exactly what you want to look at.

Some of the fancier databasing systems allow records to be tied to images of the actual specimens and to mapping programs which will show you where the collection came from. Some mapping programs can actually take the records from multiple specimens and generate range maps for you. GeoLocate is a free program created at Tulane University's Museum of Natural History (http://www.museum.tulane.edu/geolocate/). It uses text location information from a specimen label, scans it for mapable components, and then shows you where the specimen came from and what it's GPS coordinates are.

Thanks to Charles Lapham, Kentucky's herbaria actually got a head start in the databasing frenzy (Jones, 2005). He combined an interest in native plants with an interest in databases, and in the mid-1990's, working primarily with Ron Jones, created *Index Kentuckiensis*. This software allows everything from data entry to specimen mapping, and because it was provided free of charge to those with an interest, it is not only still used in Kentucky, but also by herbaria across the country (for example, the Intermountain Herbarium in Utah: http://herbarium.usu.edu/).

Currently, at least half of Kentucky's herbaria are involved in databasing their specimens, and EKU, Murray, and WKU have significant numbers of records available online. Here at NKU's John W. Thieret Herbarium, our databasing project is still in the early stages. We have nearly 3000 specimens databased, and about 35,000 to go. New specimens are being databased as they are added to the collections, so at least all recent collections data will be available electronically.

While databasing does take time away from field activities, here at NKU it will have a wonderful effect on the quality and usability of the collections. It is our opportunity to actually count the specimens (we think we have nearly 40,000 now). We will also provide all of them with unique index numbers and update the nomenclature (and with all the changes resulting from molecular data and Flora of North America work, it sorely needs updating).

Databasing leads to the potential for increased use of herbarium collections, since it can provide electronic access for off-site users. Even before these days of economic trials and tribulations, universities were closing their herbaria at an alarming rate. Anything that can be done to increase herbarium usage and public visibility is helpful. We must demonstrate that herbaria are not low tech, unchanging entities with a focus solely on the past. To make the most of our rich collections, herbaria can (and should) be innovative blends of the traditional and the high tech.

A great way to make a long term contribution to our knowledge of the Kentucky flora is to help out your local herbarium. New, quality plant collections are always desirable. Most herbaria also need help processing the new collections they already have, and any herbarium involved in databasing usually needs help with data entry. Volunteering at your local herbarium provides a unique, behind-the-scenes view of botany in Kentucky, is an educational experience, and improves the botanical resources available to all of us.

Works Cited

Jones, R. L. 2005. *Plant Life of Kentucky*. University Press of Kentucky, Lexington.

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Tall Tree Tales: Characteristics of Old Trees

By Dr. Neil Pederson & Dr. Ryan McEwan

Howdy and welcome to 2010 – time to put a new dot on the tree ring [in future columns, we will explain this – it is kind of a dendrochronologist joke – perhaps not that funny of one, though]. We'd like to formally introduce our new column of the KNPS newsletter. The column in the last newsletter about the documentation of old trees at Floracliff Nature Sanctuary was the informal launch of our column. With the New Year, we'd like to formally column launch "*Tall Tree Tales*", a joint column by forest ecologists and tree fanatics, Ryan McEwan of the University of Dayton and Neil Pederson of Eastern Kentucky University. The aim of our column is to briefly touch upon anything related to trees. Some columns might focus on a single species while other columns might focus on a region or forest type. We might highlight recent discoveries in the world of trees and then discuss what it might mean for Kentucky's forests. We will definitely discuss the threats to Kentucky's forests, but we will try to balance that out with good news. Ryan, a native of Cynthiana [editor's note: *a town that seems to grow plant ecologists by the bushel*], studies how and why forests change. Neil explores changes in environmental history through the 'eyes', 'feelings' and responses of trees and their growth rings. If you have any burning topics on your mind or questions, please contact us at 'the.tsuga@gmail.com' or 'mockernut@gmail.com' [told you we were tree fanatics!]; please put Tall Tree Tales in the subject line.

The subject of our inaugural column is the external characteristics of old trees. Before we can understand environmental history, we need to be able to readily identify old trees. Old trees are a rarity on the landscape for several reasons. First, the biological: like humans, few trees reach near the maximum age for the species. The oldest, well-verified age for a human is 122.5 yrs. Given that the average longevity of humans in developed nations in the upper-70s and lower 80s, statistics suggest that it is likely that few of us will reach 110 yrs old, or 90% of maximum human longevity in the near future. This is also true of trees. Maximum ages are still being worked out for many species, but it is safe to say that in eastern North America 350 yrs is very old for a tree. Even if trees can live longer than that, most don't get the chance. Practically all of Kentucky's forests have been cut over at least once (sad, but true), and even in our few remaining old growth forests, most of the trees are far less than their maximum age due to natural disturbance and mortality rates. In our many investigations, looking carefully in stands thought to contain ancient trees, it is common that we only find a few trees 350 yrs old or older! Truly old trees are a rarity.

If you are searching for old trees, don't get overly focused on searching for big trees. Age and size are not well related! While it can be true that big trees can be old, it is often the case that they are 90-250 years old, not the 400 yrs often inferred from tree size [don't get us started on the ages listed on many placards next to large, beautiful stately trees in many towns and cities. They *could* be old, but…]. Scientific evidence displaying tree diameter with known age often turns out to be an asymptotic relationship. That is, while as size increases, tree age does as well for the first 80-100 years. After this point this relationship becomes very messy. We often find that trees in the same diameter range can be 120, 240 or 360 yrs old; by this we mean that tree age does not increase as diameter increases within a sample collection making the curve of diameter versus age look like a plateau after about 100 or so yrs. The reason that size might not equal age is physiologically, morphologically and ecologically fairly obvious. First, the physiology and morphology: a large tree with a large, full crown likely has a similarly large root system. This individual then is a better competitor with better access to sunlight, water and nutrients. It simply is a better competitor and grows faster than its neighbors. Fast growth, means gaining girth quickly! The perfect example of this can be seen in bur oaks growing on the margins of agricultural fields. These trees can be enormous, but think…they have unlimited access to light, and their root systems is being soaked by fertilizer from the field!! They can attain enormous girth very quickly.

The second reason "large" does not necessarily mean "old" is mostly ecological. It has been shown from studies around the world that the oldest individuals in forests often grew slower during their first 100 yrs of their life compared to younger individuals in the same living forest. The reasons for this are not clear. Often the older trees were suppressed when they were youngins, either because they germinated under a closed canopy, or were beaten to the canopy by compatriots who, while growing faster, are no longer with us today. Perhaps this is a simple matter of exposure? Larger individuals often stick out the top of the forest canopy exposing them to ice storms, heavy snow loads, lashing rain and lightning strikes. Evidence also suggests that the energetic requirements of maintaining large sizes might come at the expense of growth/vigor. Regardless of "why", we have strong evidence that being suppressed (or at least growing slowly) early in a trees life often equates to greater longevity.

So if we should not focus on large trees when seeking old trees, what should we be looking for? What do 250-400+ year old hardwood trees look like in the eastern U.S.? We have distilled some general external characteristics down to six main traits. These characteristics are: 1) smooth or balding bark, 2) low stem taper, 3) high stem sinuosity, 4) crowns comprised of few, heavy and twisting limbs, 5) low crown volume, and 6) a low ratio of leaf area to trunk volume.

Trees with smooth or balding bark on the lower portions of their trunk have been often been found to be older trees (excepting smooth-bark species like American beech, of course). It is unclear why this occurs, whether it is weathering over time or a change in growth patterns. However, an important consideration for many hardwoods in the EDF when considering this characteristic is the high variability in bark patterns within a species. For example, white oak bark ranges from tightly ridged to peeling and flaky bark in young trees, to patchy and balding bark to entirely smooth lower boles in older trees [**FIG 1**] (see G. Symonds, "*The tree identification book: a new method for the practical identification and recognition of trees*", 1958 for a great presentation on bark variation across wide range of species). Similarly, cucumber magnolia naturally has oval areas of smooth bark on young trees, which could be confused with balding patterns associated with age. So, care is needed when trying to interpret age from bark patterns. Despite this, we have observed a general pattern of increased balding with age in many species including: sugar maple, red maple, sweet birch, yellow birch, most oaks, yellow poplar and cucumber magnolia. It is likely a common trait in old individuals of other species.

More reliable traits of old hardwood trees can be seen in their trunks. First, a tree with a low amount of taper from the base of its stem to a few feet below its crown is often an older tree. The base of trees are wider simply because they are older despite that fact that the upper stem puts on wider rings each year that lower portions. So, after as a tree approaches the maximum height for where it is growing, the upper bole begins fill out and reduce stem taper. To us these trunks look like cylinder. Trees with this shape that are often older. In short, it takes many years to grow a cylindrical bole, and to us, this is a good indicator of age.

Perhaps the most reliable stem characteristic of old trees, and perhaps the most interesting, are those with a highly sinuous stem. To us, these trees resemble a snake climbing a tree where its body flows from side-to-side at short intervals, giving it a highly sinuous appearance. Likewise, old hardwood trees often 'snake' side-to-side moving from the bottom of the trunk to the base of its crown, giving it high sinuosity. This is especially true for oaks in the white oak subgenus. However, we have even observed this in tulip-poplar, which suggests this might be a common trait across genera. We interpret this growth as a tree that has experienced a life-time of growth influenced by the appearance, and disappearance of holes in the canopy. This twisting search for light indicates suppression, and, as a result, many years of growth.

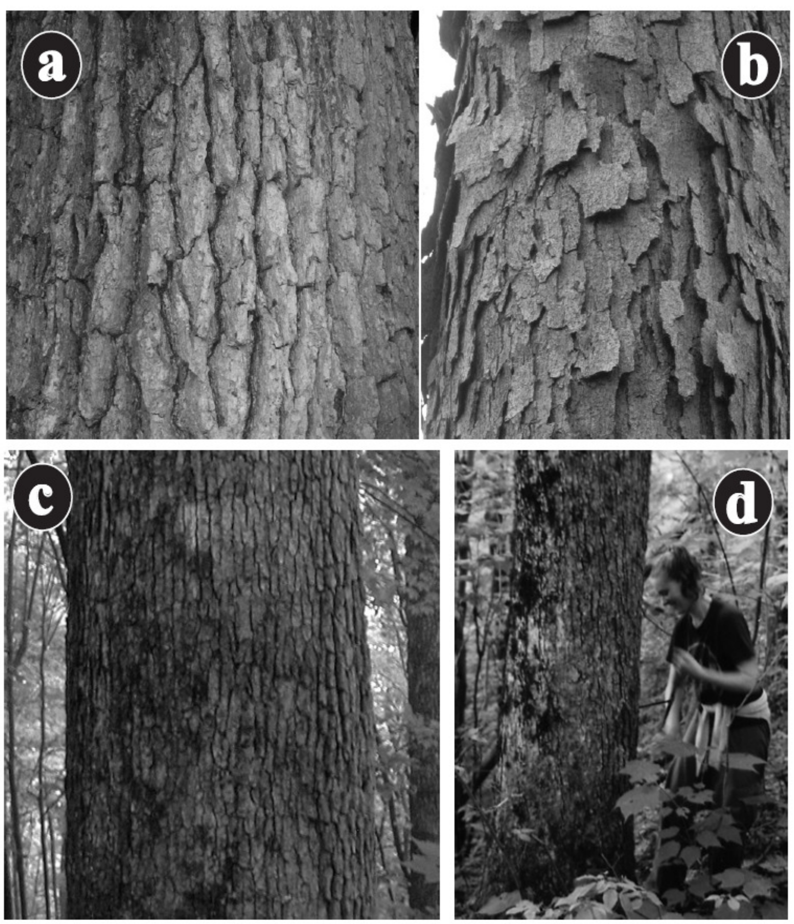

Fig 1 - Examples of variation in *Q. alba* at different ages. a) & b) show the ridged and flaky characteristics of trees les than 150 yrs of age. c) & b) show the variations of low ridging and balding of old or slow growing 250 + yr old trees.

The crowns of trees are some of the best clues of potentially old trees. Thick, somewhat large and gnarly branches have long been known as an indication of older trees. A related characteristic that seems fairly reliable in eastern hardwoods is the size of the trees crown. A smaller crown volume, especially if that is attached to a tree with low stem taper, is a good indication the tree might be old. A small crown can be the result of a shallow crown depth or the presence of a few branches. Regardless of the reason why, a smaller crown means the tree has a relatively small leaf area, and less of an ability to convert less of the Sun's energy for growth. This means the tree has little energy, is probably slow growing, and therefore has likely taken many years to arrive in the canopy. Therefore, when you spot a tree with a small crown volume and a medium to larger diameter, you can have higher confidence that you are in the presence of an old tree. We like to think of these trees as a stalk of grocery store celery (i.e., a stout stem with a few leaves). Trees that resemble celery stalks are of-

FIG 2 . The Rosetta Oak - a 310 yr old *Quercus montana* with all of the featured indicators of old trees. a) The balding and mediocre lower bole (DBH = 41.6 cm) and its b) sinuous, low-tapered upper trunk holding a celery-topped crown.

ten older than their neighbors.

Like a book, one cannot judge the age of a tree by its external characteristics. While it is impossible to know the age of a tree without coring it, the characteristics are common to 250-400+ year old hardwood trees. A recent test of these characteristics was made on a small, partially suppressed chestnut oak in the Daniel Boone National Forest. At the end of a day sampling largish and old trees in an old-growth forest, our group happened on a stunted tree on the border of second and old-growth forest. It had all of the characteristics mentioned above: bald bark for its species, low taper, high sinuosity, the appearance of a celery stalk with thick, gnarly branches and a rather small stem diameter. Could a *Q. montana* survive for 250+ years in the understory? The answer is a resounding yes! The age of this individual at coring height was 310 yrs (**FIG 2**).

It is hoped that the transfer of this knowledge will aid in the identification of the 'hidden' old trees and, perhaps, old-growth forests in the Eastern Deciduous Forest. Though these trees are often in plain sight, their identification is often obscured by commonly held, but often incorrect, conceptions of the external characteristics of old trees. While our set of characteristics generally signals the potential for old trees, there is no guarantee that they represent old ages. Exceptions abound – caveat emptor!

KNPS Wildflower Weekend 2010 at Natural Bridge State Park

KNPS's Wildflower Weekend at Natural Bridge, April 23-25, 2010 is a chance for botanists, gardeners and nature lovers to enjoy the hundreds of species of native plants at Natural Bridge. Field trips leave from the Hemlock Lodge lobby and will be offered at the following times:

Friday – 8:30am, 1:30pm and 4:00pm

Saturday – 8:30am, 9:00am, 1:30pm, 2:00pm Sunday – 9:00am

Special guest speakers will offer their expertise on wildflowers and related topics on Friday and Saturday evening at 7:30 p.m. in the Activities Center. The featured Friday night speaker is Dr. Ross Clark, Retired Professor of Biological Sciences at Eastern Kentucky University. Dr. Clark's presentation is titled "Insights--and a lot more--from plants". Jerry and Carol Baskin, Professors of Biology at the University of Kentucky, will be the features speakers on Saturday night. Their presentation is titled "Cedar glades and xeric limestone prairies of the eastern United States"

Participants will register upon arrival. The registration fee is $10 per adult, $3 (ages 13-17) and is free for ages 12 and under. Registration will be open 30 minutes before each field trip and presentation. A detailed agenda will be available at the time of registration. For more information call Natural Bridge at 1-606-663-2214.

Remember to bring your camera to participate in the Wildflower Weekend Photo Contest!

Jefferson Memorial Forest presents

"Drought-tolerant Gardens"

March 8, 2010 9:00am – 12:00pm, Fee: $10/person

Presented by Margaret Shea, Dropseed Native Plant Nursery

A drought makes it very difficult for many gardeners. Wouldn't it be nice to have a garden that requires less water and maintenance? Discover how you can create your own drought-tolerant garden using native plants. Margaret Shea from Dropseed Native Plant Nursery in Goshen will be presenting.

To register call 502-368-5404

www.memorialforest.com

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

Note: To pay by credit card or PayPal account, please visit the website www.knps.org.

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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.