Burning Issues

Julian Campbell: bluegrasswoodland.com

Burning Issues: restoration of open woodland on deeper soils in the Ohio River watershed with a special focus on restoration of open grassy woodland on the Cumberland Plateau.

Noted assembled in 2016 by Julian Campbell, updated June 2018: julian.campbell@twc.com; phone 859 229 7711. These are mostly general notes, to be developed further with specific examples in the future; see also http://www.bluegrasswoodland.com/Cumberland_Plateau.html.

Current Contents **Pages**

* DBNF = Daniel Boone National Forest; FLN = Fire Learning Network of DBNF & partners; KDFWR = Kentucky Department of Fish and Wildlife Resources; KSNPC = Kentucky State Nature Preserves Commission; NPS = National Park Service; NRRA = National River and Recreation Area; RNA = Research Natural Area; TNC = The Nature Conservancy; WMA = Wildlife Management Area.

Cover: photo from powerline that crosses Marsh Branch Road about 1 mile south of Route 192, in Laurel County; looking north into adjacent woods. The foreground includes little bluestem (*Schizachyrium scoparius*), plume grass (*Erianthus alopecurioides*), oaks (mostly *Quercus falcata, Q. stellata* and *Q. velutina* in the low growth) and scattered seedlings of shortleaf pine (*Pinus echinata*). Pine seedlings are virtually absent in the woods, and most common in brushy transitions; germination also occurs in the most open grassy areas, maintained by disturbance at 1-3 year intervals, but such frequent disturbance generally prevents proper establishment.

We Need to Improve Conservation Planning across the Central Cumberland Plateau (and DBNF). Julian Campbell: 859-229-7711; julian.campbell@twc.com. See the following website for details: http://www.bluegrasswoodland.com/Cumberland_Plateau.html. Problems with the FLN and Greenwood project are part of a larger issue across the central Cumberland Plateau—How can we build consensus in conservation plans among varied interest-groups? Three 'golden rules' (almost religious principles) are essential for success.

1. Teamwork: effective meetings. Rather than DBNF being the primary host for meetings and the primary developer of proposals, it would be better for a somewhat independant collaborative group to do this, representing all interest groups, and working within a process that considers practical limitations of the federal government. We need, at least, an annual meeting for information and ideas to be presented and discussed in a fair and transparent fashion. This kind of collaborative framework was envisioned at the 2010 "Ecological Restoration" conference of the Southern Region at Knoxville. Sadly, there has been rather little follow-up to this meeting, except for a somewhat truncated effort in the Redbird River watershed.

2. Targets: goals for conservation. During the 1990s, The Nature Conservancy (TNC) developed a good framework for defining central goals, based on the three levels of organization: landscape, habitat and species (or species-groups). Unfortunately, TNC and partners did not continue to focus on such basic matters through regular meetings.

(a) At the landscape or watershed level, our priorities for conservation of large forest-blocks are mostly clear. For example, the Beaver Creek area has been identified as a priority for several decades, as well as the whole Big South Fork Corridor (National Park Service).

(b) At the habitat level, we need to focus on areas that require active restoration using 'macro-management' such as burning, browsing, mowing or logging. These areas include formerly extensive open grassy woodland dominated by pines, oaks and shrubs. DBNF has not yet incorporated enough historical information on this vegetation, for example, using surveys from the Tellico land grants of 1802-1817. Several sun-loving rare plants remain, especially along rights-of-way, and they can help indicate the former extent of more open conditions.

A recent statistical model used by DBNF (from Steve Simon, 2009) uses geology, topography and soils to indicate the pattern of historical vegetation, but it is flawed. It only considers modern forest with trees over 60 years old, ignoring the original existence of "roughs" in the most disturbed areas, dominated by shrubs or grasses with little pine. Most seriously, the model ignores the potential for ignitions to have been more frequent or more widespread on broader ridges, with generally deeper soils and denser grass. Such ridges were probably travelled more often by large animals and native people, promoting fires that spread farther due to fewer interruptions by mesic ravines.

Cecil Frost has incorporated such factors into a more sophisticated model for Mammoth Cave National Park; DBNF should follow suit. The Forest Service has been attempting to burn about 130,000 acres in DBNF, but it can only manage to burn about 10,000 acres per year, so an average interval of about 10-15 years is projected. Unfortunately, almost no sites in DBNF are being restored with an effective fire interval of 1-3 years; and the best remnants of more open woodland or grassland are generally being overlooked.

(c) At the species level, several globally or regionally rare plants and animals are dependent on open grassy woods, or restored streams with high quality, or other habitats that have been degraded. Some groups of these species deserve 'micro-management' in terms of special protection for remnants or artificial propagation. Such work should eventually lead to a proper botanical garden in Whitley City.

3. Tradeoffs: resolution of differences. Conservation in general is a balance between reverence for Nature versus extraction from Nature. It is important for different agencies and diverse interest-groups to 'put their cards on the table'. DBNF tends to manage too much—the National Park Service, too little! Financial and political constraints on management in DBNF remain somewhat unclear. How much income does the Forest Service need or want from timber production?
To what extent do 'politics' influence decisions about logging and hunting versus other recreation? We should start with a shared set of clear goals, as outlined above, at least among those interested in some form of pure 'nature conservation'. Given these goals, the discussion —or debate—would then become more productive for us all.

Basic questions about goals of the Fire Learning Network

1. To what extent does the FLN (or DBNF in general) aim to restore vegetation that resembles the open grassy pine-oak woodland that was largely maintained by fall fire for 1000s of years before 1776? Shrubs and grasses dominated the most intensively burned zones. [*Or is the primary goal of the FLN etc. to advance prescribed fire for more varied reasons?*]

> This event's goal (June 2016): "This upcoming shared learning event is for resource professionals and researchers involved in controlled burning, or who have an interest in learning more about the FLN, controlled burns, fire effects on vegetation and wildlife, fire surrogate activities such as mastication, etc."
>
> Proposal for Cumberland River Fire Learning Network Project (2011), primary goal (not funded): "The historically fire-adapted landscape of the southern Daniel Boone NF project area is generally overstocked, mesic-encroached, and vulnerable to disease, pests, and other disturbances. Using a combination of prescribed fire and mechanical treatments, forest composition and structure should be restored to a mosaic of oak – hickory forest and pine – oak forest, woodland, and prairie (CFLRP target forest types), as well as mesic coves and alluvial forest (non-target forest types)." [*Was the lack of funding for this proposal related to lack of specific details about restoration?*]

2. What are the reference conditions, with specific examples of sites if they exist, for us to understand and detail the goasl for restoration?

3. Where are the prioritized sites for this restoration, and how are they selected? And given that the best botanical remnants of the woodland are along rights-of-way, how can we improve their management through dialog with road and utility managers?

4. Why did DBNF not link the initial RCW recovery program with broader ecological restoration in a more continuous fashion? Note the lack of continued effective burning in most areas with initial efforts to restore RCW habitat (e.g. east of Cumberland Falls).

5. How does current activity of FLN guide management by DBNF?

Priorities for cooperative data-sharing and further research

There should be a general focus on the following projects, which are not necessarily expensive but require more collaboration. Other federal agencies (especially NPS at Big South Fork and Obed River), state agencies (including Natural Heritage), and local universities should be involved in discussion about priorities across the region. In particular, we can learn much from the Catoosa WMA in Tenn.

1. Synthesis and review of relevant historical, archaeological and paleo-ecological data. I started to do this for the Big South Fork NRRA in 2000; see Cumberland page at bluegrasswoodland.com.

2. Data on regionally rare or conservative species that are remnants of openings before settlement; see my initial mapping for McCreary Co.

3. Vegetation data from terrain that appears to have had open grassy woodland before settlement. We need to develop a proper botanical description of the original open pine or oak woodland, including zones dominated by post & blackjack oak, shrubs and grasses.

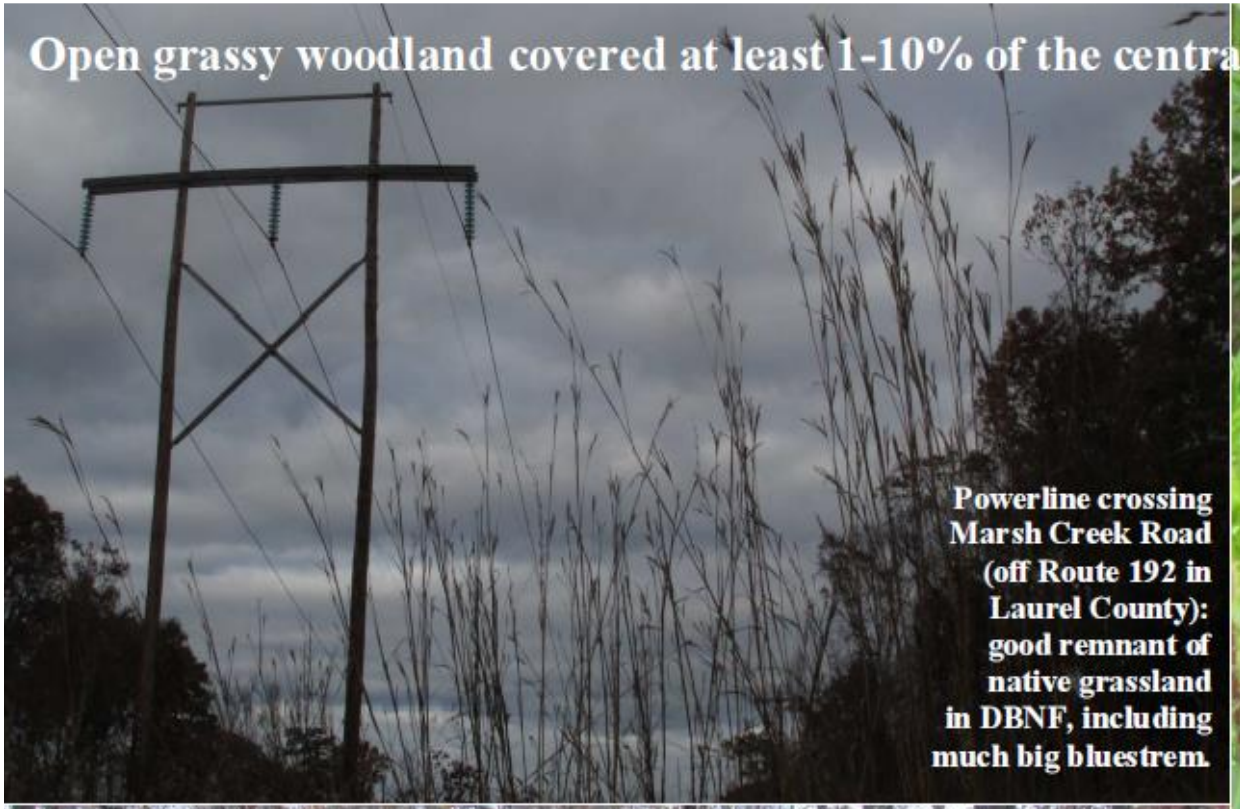
4. Provision of GIS maps for all recorded fires, including wildfire and prescribed, together with attributes—combining state & federal data.

5. Ecological models relating various potential conditions to landform and disturbance regime. For understanding the presettlement condition, it is important to compare the FLN's 'Steve Simon' model (relating vegetation directly to geology, topopgraphy and soil) with a 'Cecil Frost' type of model (using more frequent ignitions on broader upland units between ravines, especially along major trails)

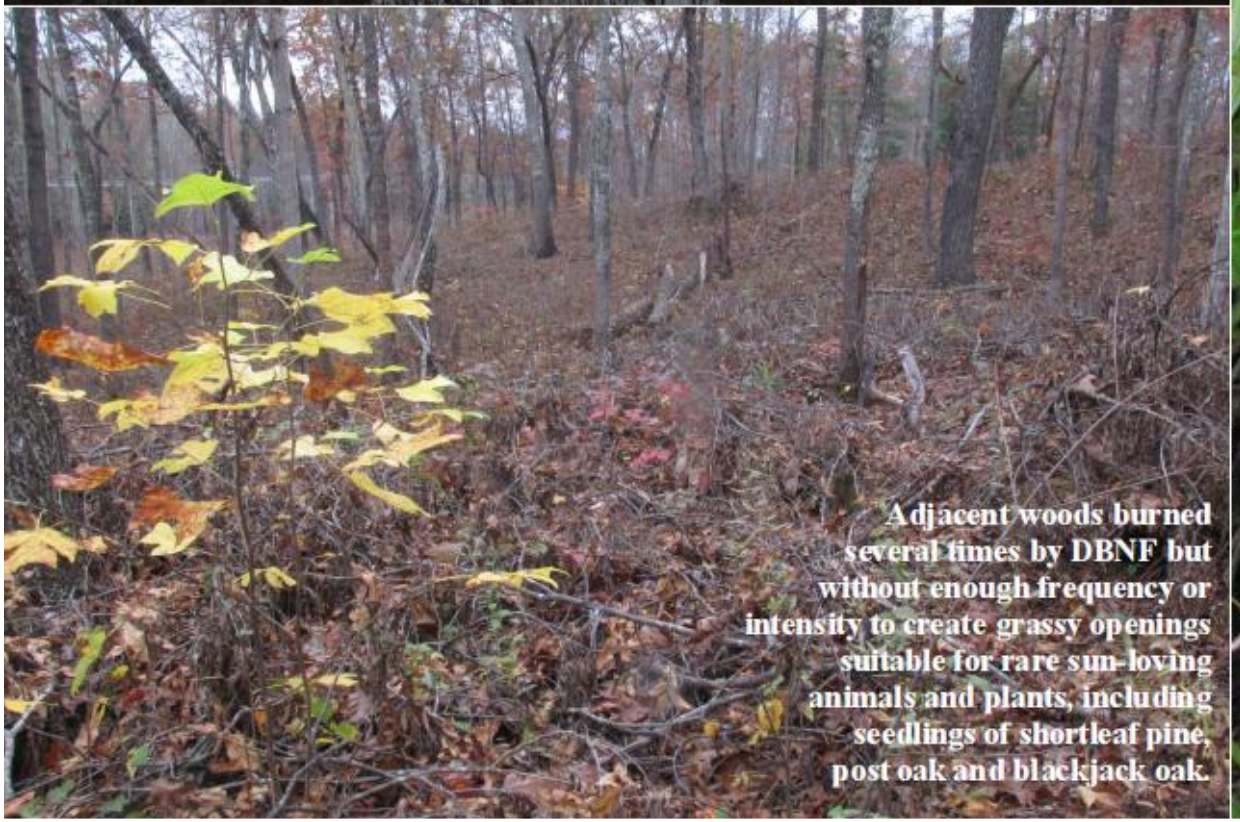
6. Deeper literature review about effects of different fire seasons on vegetation and rare species. Research on this issue has been slow to emerge and become accepted in some regions; for example, on the Coastal Plain of Florida (Platt et al. 2015) and in the Tallgrass Prairie of Kansas (Towne & Craine 2014). There has been none in DBNF.

7. Posting of as much relevant material as possible (including initial planning documents and spreadsheets for FLN) on a public website. More sensitive material (due to proprietary issues or resource security) could be posted for well-defined cooperative teams instead of the general public.

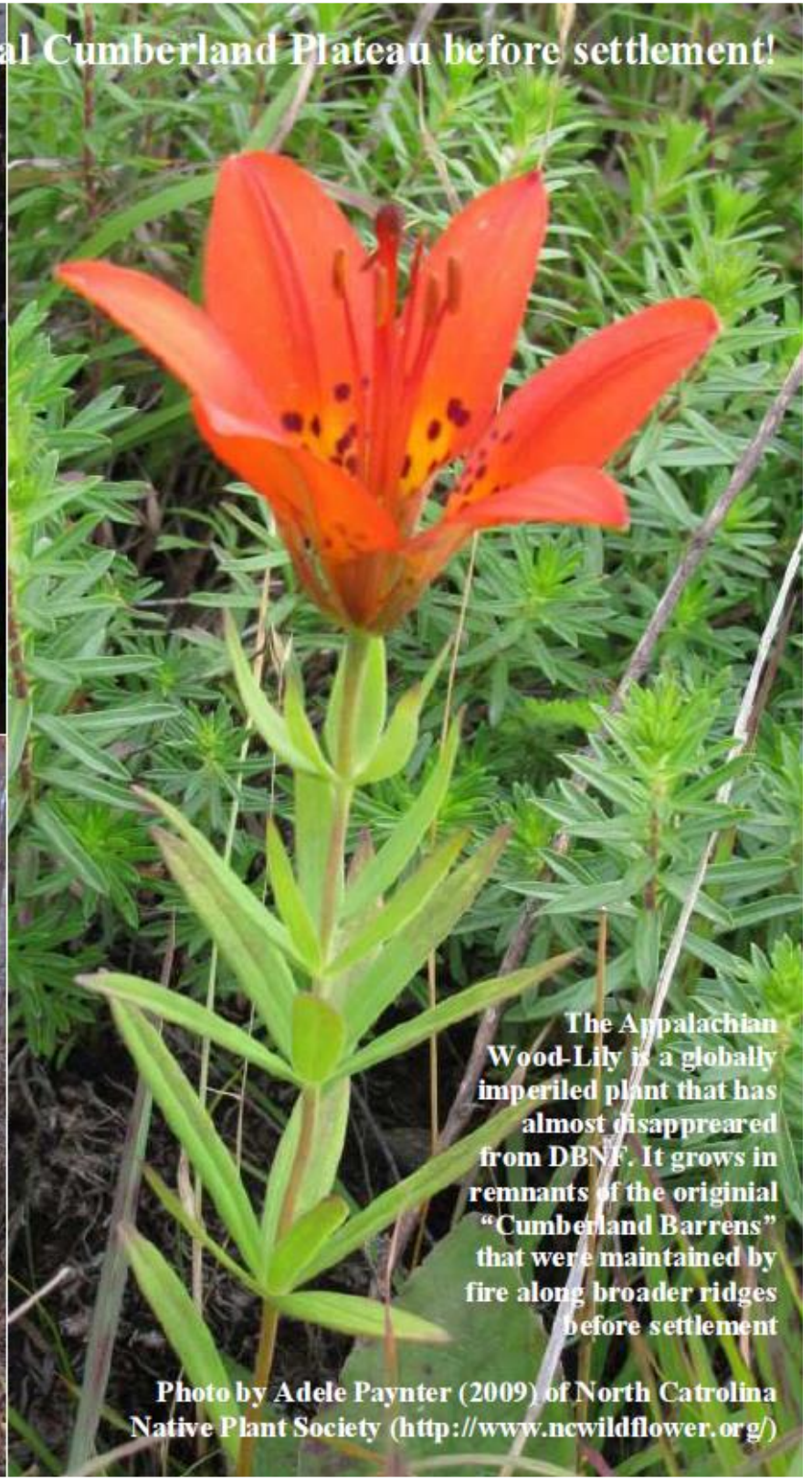
Open grassy woodland covered at least 1-10% of the central Cumberland Plateau before settlement!



Powerline crossing Marsh Creek Road (off Route 192 in Laurel County): good remnant of native grassland in DBNF, including much big bluestrem.



Adjacent woods burned several times by DBNF but without enough frequency or intensity to create grassy openings suitable for rare sun-loving animals and plants, including seedlings of shortleaf pine, post oak and blackjack oak.



The Appalachian Wood-Lily is a globally imperiled plant that has almost disappreared from DBNF. It grows in remnants of the originial "Cumberland Barrens" that were maintained by fire along broader ridges before settlement

Photo by Adele Paynter (2009) of North Catrolina Native Plant Society (http://www.ncwildflower.org/)

The Ideal Research Program in Landscape with "Cumberland Barrens"

It may be useful eventually to develop three geographic components, with linkage to overall watershed interests: the Rockcastle River watershed; main Cumberland River corridor; and the Big South Fork watershed. For overall goals in forest-management, there are benefits from combining data on all conservation targets within each area.

1. GENERAL QUESTIONS: focus on critical uncertainties and disagreements.

A. What was the original condition before settlement and its ecological function?
Gather more historical data; improve mapping of conservative / indicator species.

B. How has the condition changed, and how have varied threats influenced targets?
Compare maps of best remnants with original extent; correlate to land-use history.

C. How do varied aspects of management, or lack of management, influence targets?
Detail differences in effect of different vegetation management histories (e.g. fire season).

2. SPECIFIC PROPOSALS: focus on projects with good replication at different sites.

A. Long-term monitoring of targets with diverse parameters at "field stations" / RNAs.
Select a few sites: e.g. Keno Road, Marsh Branch, Duck Run, Grove Road.

B. Experimental comparison of effects on conservation targets from selected actions.
Deepen research already initiated with Univ. of Tenn. and Ky., adding more sites

3. REVIEW & SYNTHESIS: focus on critical data-sharing, management applications.

A. Develop cooperative aspects of Natural Heritage Programs, plus relevant collections.
Incorporate all new data acquired on rare / conservative species since 1990s.

B. Build conceptual or computer models of ecological dynamics, using initial results.
Integrate models of vegetation pattern and dynamics with models of fire effects.

C. Produce educational material for public, schools & colleges, using research results.
Form organization of partners to share in funding mechanisms for all of the above.

Browsing and Burning Issues in Naturalistic Management of Kentucky's Woodlands

Julian Campbell: julian.campbell@twc.com; bluegrasswood.com

One of the first hard lessons a naïve conservationist in Kentucky must learn is that we cannot restore the past. Yes, we can yearn back to that time of yore when elephantine creatures trundled over the land and human beings were just beginning to emerge into temperate climes. Yet can we really hope to put back the impact of those animals and their interactions with coevolved predators or with the budding humans? And when we awake from our dreams, startled by the flash of lightning or rumble of thunder across the plains, can we even imagine the extent to which an occasional fire started from such storms might spread—if lucky enough to escape the rain? In a dry year, without modern firebreaks and controls, a big fire might have spread from southern Mississippi to western Kentucky. The Chickasaw and other tribes could have quickened, then amplified this frequency through increase and maintenance of broad grassy pathways through the landscape. But then modern humans rapidly killed off the remaining larger animals, reduced the wild burning, cleared most of the clearable forest, drained most of the drainable swamps, and subdivided the precious land to various degrees.

So after we each outline our current regions of interest, and seek some kind of 'neotribal agglomeration' with others of conserving ilk, just what do we mean by 'restoration of habitats' or similar terminology? That is a wonderful question with many answers—often, it seems, as many as the number of conservationists themselves. The search for consensus in this matter is the very heart of conservation—where inspiration and strength can be based, or where disharmony and anger can be lodged, clogging the arteries of cooperative spirit. Because we all—humans of every type—do appreciate our environment, and want it to be a certain way, we are keen then to ask our neighbors on the horizon, cautiously, how they feel. Even within conserving organizations, there are many viewpoints.

There are, indeed, so many 'things' to be considered in conservation—species, habitats and landscapes. But a simplifying way forward, following The Nature Conservancy's initial method of the 1990s, is to outline for each project a handful of grouped 'targets' that can be readily communicated, managed more or less as units, and then measured for insight to success or failure of efforts. So once a location of interest is agreed and mapped, then which of its contained habitats (or groups of habitats) deserve special attention for restoration, as opposed to just leaving them to recover without the hand of man? And even if a habitat returns to some desired degree of 'naturalness', which of its species (or groups of species) will still deserve micromanagement— either dwindled natives for recovery or invasive aliens for reduction?

In central Kentucky, concepts for two types of upland habitat have been particularly problematic during recent decades: (1) the original 'Bluegrass Woodlands' of current horse and cattle country, but formerly elk and bison, especially on the plains of Elkhorn Creek and South Fork of Licking River; (2) the original 'Cumberland Barrens' that supported Red-Cockaded Woodpeckers on broader ridges of the southern Daniel Boone National Forest. Bluegrass Woodlands—also known as 'savanna-woodland' by some authors—used to occupy the most fertile upland soils in Kentucky, on relatively gentle slopes with deep silty soils on partly phosphatic limestone, but prone to drought in years when springs dry up. Large animals congregated in this part of the Ohio Valley, apparently drawn to mineral-rich forage and overwintering potential in the cane. But there is virtually no evidence that fires played a significant role before Virginian settlement. Cumberland Barrens—often conceptually merged with pine or oak woodland of various types—also used to occupy relatively gentle slopes and broad ridges on infertile sandy soils with subxeric to xerohydric hydrology. Large animals were probably less abundant here, and fires seem to have been relatively frequent, at least along the pathways used by native people for walking and hunting across the Cumberland Plateau.

==========

Next two pages: Figure Captions.

First: A photograph of Bluegrass Woodland from about 1900 (perhaps along US 60 about a mile north of the junction with US 62 north of Versailles). Such areas had been converted to "woodland pasture" by Virginian settlers. Although blue ash, burr oak and chinquapin oak have now come dominate old woods of this type, their original condition was much more diverse and generally more shady than today (including two endangered species of clover). It has been difficult to explore concepts of the original vegetation through scientific means, because entrenched views are embedded in the language of much relevant writing from recent decades, and conservation culture in Kentucky has not encouraged extensive shared databases on flora and vegetation. For details, see following document: http://bluegrasswoodland.com/uploads/Rebuilding_Concept_of_Bluegrass_Woodland.pdf.

Second: Michael Stambaugh peruses the Cumberland Barrens at Catoosa Wildlife Management Area, in Morgan County, Tennessee. He is doing fundamental research into naturalistic fire regimes across southeastern states, together with Richard Guyette and others, based in Missouri. At this Catoosa meeting in Sep 2012, many ecologists and biologists from Tennessee and other states came to see the amazing work that Tennessee Wildlife Resources Agency has conducted at this site during the past 10-20 years. It is the best current showcase for what the Cumberland Barrens might become, and much more attention to this site is needed by managers in Kentucky. For further details, see following document: http://bluegrasswoodland.com/uploads/Cumberland_Barrens.pdf.

==========


Photo from Knight & Greene (1904).
Country Estates of the Blue Grass.


Canon

A scientific approach can reduce the uncertainties in how to proceed and show us the degree of difficulty with various types of restoration. Historical work is first needed to organize and interpret the clues from early records, and this should ideally be deepened with paleoecological research. A general understanding of the ecological gradients in native vegetation is essential for interpretation of the past and future applications. A detailed mapping of the better remnants allows understanding of associations with geology, topography and soils—but allowances must be made for the massive changes in landscapes after Virginian settlement. Remnants of native vegetation on more rocky soils that have been less cleared and less farmed do not represent the typical conditions that used to occur on deeper soils. Instead, maintained rights-of-way on deeper soils in some places contain small strips of vegetation with unusual sun-loving native species that appear to indicate true 'remnant' status—including patches of cane (*Arundinaria gigantea*) in the Bluegrass, and big bluestem (*Andropogon gerardii*) on the Cumberland Plateau. In a few areas, old rough pastures with scattered open-grown trees can also have a degree of 'remnant' status.

Optimal methods for management of these habitats are not clear. In the Bluegrass Woodlands, it may be possible to use livestock for simulating the ancient seasonal migrations of bison and other original patterns in herbivory. In the Cumberland Barrens, the U.S. Forest Service has been using various combinations of prescribed burning and thinning to restore conditions suitable for shortleaf pine. But, in both situations, what seasons, frequencies and intensities of browsing or burning would be appropriate? There has been insufficient comparative analysis of different experiences, and little true experimentation. The degree of disturbance required is often underestimated. For example, running buffalo clover—a critical indicator of the original Bluegrass Woodlands—tends to dwindle or disappear without

disturbance several times during the year. And restoration of the Cumberland Barrens appears to need much fire at 1-3 year intervals, not the 5-10+ year intervals that are mostly used.

The appropriate season for browing and burning remains poorly understood. The overall effects of different seasons on alien plants deserves attention, as well as effects on natives. It would be nice if simple application of such naturalistic processes could be relied upon in these habitats, but we do not yet know if that is possible. In the meantime, special sites with urgent issues like invasive plants may be attacked with 'micromanagement' using mechanical or chemical methods. Based on current observation and historical research, I have suggested that intensive browsing of Bluegrass Woodland during September to December would be most effective for reducing invasive alien plants and promoting natives. Excessive browsing during spring to summer could be the worst condition. Prescribed fire is often applied during the spring, across Kentucky, partly because there tends to be less arson during spring than fall, when fire-managing crews are often preoccupied or exhausted by emergencies. However, late summer to fall would have probably been the season with most burning before settlement. In old pastures spring burns are useful for reducing fescue, which is a cool season grass, but in woodlands spring burns can actually increase the alien Japanese stilt-grass (*Microstegium vimineum*), which flowers and seeds much later in the year.

Griffith Woods, in Harrison County, is one of our best opportunities to restore something like the original Bluegrass Woodlands. In 2003, The Nature Conservancy (TNC) acquired this site after considerable preparation by myself plus an anonymous donation of one million dollars—the largest single private donation so far to the Kentucky Chapter. Additional funding was provided by the Ky. Heritage Land Conservation Fund (HLCF). The organizational concept was to include the University of Kentucky (UK) and the State Nature Preserves

Commission (KSNPC) as partners in ownership, oversight, planning and management. However, confusion and disagreement about fundamental goals and proposals for the site led to my dismissal in 2006 and to TNC's eventual withdrawal from the project in 2012. The land was transferred to Kentucky State Department of Fish and Wildlife Resources, and no part of the orginally donated funds has been left over for management.

A central failure of the Griffith Woods project to date has been the lack of open communication, let alone consensus, about what past research has already shown for Bluegrass Woodlands, and what research is still needed. The site (also known as Silver Lake Farm) covers 745 acres, with plenty of room for research and education about local ecology and environmental history in the central Bluegrass. There is a rich historical record from this region, including many old deed surveys that marked 'witness trees' of different types. Also, slices of old trees—and their branches—have provided insight to their development, revealing large increases in growth after thinning of the original forest circa 1790-1820 (McEwan & McCarthy 2008, J. Biogeog. 35: 965-975), when 'woodland-pastures' dominated by oaks and ashes were created by more prosperous settlers—and their slaves—from Virginia and other eastern states. KSNPC, HLCF and UK got involved in several studies, mostly with graduate students, but few results have been published. The farm should allow basic research into how native woodlands interacts with varied disturbance regimes, and then demonstration of trials for the public. One of the most important questions is how best to use livestock for restoration of diverse native vegetation and for reduction in the proportion of aliens.

In Daniel Boone National Forest (DBNF), there are few distinct remnants of the Cumberland Barrens, and there has been considerable disagreement about management, even among biologists. There is a general acceptance that much of the uplands used to burn

frequently before settlement, and that some of the broader ridges have unusual patches of grassy vegetation with concentrations of rare sun-loving plants. The U.S. Forest began to focus on a few areas for restoration with thinning and prescribed fire in the 1980s, driven largely by efforts to save the small population of Red-cockaded Woodpeckers. This federally endangered species used to inhabit thin woodland with large pines, especially short-leaf. However, most pine stands on the National Forest had become too dense for the bird, and then an epidemic of the southern pine-bark beetle killed off most of the larger trees in the late 1990s. Despite some previous success on a small scale, DBNF decided to abandon direct recovery of its few remaining birds, which were captured and released further south.

After 2000, there has been a general increase in efforts by DBNF to apply prescribed fire on large blocks of land, but usually at intervals of 5-10 years. The goals have appeared somewhat confusing or even contradictory to many biologists. Funds for this burning seem to come largely from a congressional budgetary allocation for "Fuels Reduction" on National Forests—based on interest in avoiding catastrophies after large fires in western states during recent decades (especially Yellowstone in 1988). Other justification is often presented in terms of overall "Forest Health"—together with an exaggerated claim that oaks usually need fire for establishment and growth into the forest canopy. Potential benefits of fire to restore native biodiversity are also recited, but exactly how these benefits will be assessed remains unstated. There is a general 'narrative' within the National Forest that prescribed fire will have all of the above benefits. But almost none of the best remnants of open woodland—in a few rights-of-way or old pastures—have become integrated into plans with sufficient fire for expanding them into ecologically viable systems. At several sites, pines have been replanted at moderately high density, rather than letting them regenerate more slowly into more open grassy woodland. This woodland used to have much post oak and blackjack, which has declined more than shortleaf.

Restoration of this grassy extreme on deeper soils would require fire to be applied usually at 1-3 intervals, especially during late summer to fall. Moreover, shortleaf pine usually regenerates best into such vegetation, so that a long-term plan for naturalistic restoration of open piney woods should include such openings for its ecological dynamics. During Pre-DeSotan times, it is likely that both lightning and human ignitions spread most often into grassy open woods along broader ridges, then downslope to various degrees, leaving a complex zonation of habitat types from uplands to ravines. Based on several historical records and recent observations, the most common trees in the most open grassy areas may well have been relatively short or scrubby post oaks and blackjack oaks, rather than the pines—which have often grown up as canopy emergents within more densely wooded transitions from ridges to ravines. There has been virtually no documented interest by the National Forest in describing such zonation or in explaining how the U.S. Forest Service might proceed to restore it. There often appears to be an assumption of uniformity in the vegetation and fire-regime across the landscape, versus a zonation, mosaic or network of patterns.

There are common themes in these notes on Bluegrass Woodland and Cumberland Barrens. These are best summarized in the form of general questions that the community of conservationists in Kentucky should address in a more responsible, fair and transparent fashion, allowing varied hypotheses, interpretations and viewpoints.

1. What are the visions for these habitat types, from historical nature to future condition?
2. What do we know about their ecology, reviewing all relevant research on management?
3. What are the critical issues that divide interested people and how can we resolve them?
4. Who should truly lead such efforts in Kentucky (1,2,3), if not KSNPC and their partners?

In order to address these four questions, there is a fundamental need for better meetings (with appropriate regularity and regional scales), better sharing of information (with an expanded Natural Heritage Program at the core), and better resolving of issues (with critical divisive questions identified for research). A more open, flexible process is required for this effort, avoiding excessively bureaucratic or legalistic approaches where possible. It is especially important to include those people with most expressed knowledge of particular sites for management, and those who labor on or near them. Ideally, local managers and laborers would guide much of this effort, including some of the research and education. It may well be that practicalities or politics will continue to guide some aspects of management rather than the direct biology and ecology of restoration. But any conflicts should be clearly stated so that the public can see how compromises are made in final decisions.

==========

Appendix 1. Notes to US Forest Service and others in 2916

Following material are miscellaneous notes and memos to USFS during 2013-2016

Memo to USFS administration: Stearns & London Districts; DBNF-Winchester; SRO-Atlanta.

From: Julian Campbell, Ph.D; julian.campbell@twc.com* Date: 20 June 2016

[See further details posted at: http://www.bluegrasswoodland.com/Cumberland_Plateau.html]

I am writing to you about the "Cumberland Fire Learning Network" currently led by Daniel Boone National Forest, in which I have participated to some extent. Although I strongly support the general goal to restore more open grassy woodland in the southern DBNF, I am

concerned that not enough attention has been given to the details—where and when should we burn? I understood that there would be cooperative discussion and research into these details but there has not been nearly enough. DBNF currently presents little documentation about where the best remnants of the original open woodland and grassland exist. And there has been little discussion of optimal frequency and season for fire, even though there is a growing body of research across eastern North America that indicates different fire season can result in radically different vegetation.

The CFLN proposal of 2011 states: "Up to 5% of the landscape will be native grasslands located on appropriate sites, dominated by a diversity of grasses and forbs, maintained by frequent (2 to 5 year) high intensity spring and fall growing season burns. Burn rotations would also include some summer, lower intensity burns. Other maintenance disturbances may include mechanical and/or herbicide treatments." Intervals of 1-3 years are needed for good grassland, not 2-5 years. And because native grassland will be limited, it is important to determine where the priorities for this grassland should be. Before settlement, more open zones were probably concentrated along broader ridges, following ancient animal trails, and these zones probably had the most frequent ignitions from human causes, especially during fall. Such zonation is supported by natural history of the region, but it was not incorporated into the "Ecological Zones" study by contractor Steven Simon in 2009.

I am sure you subscribe to the notion that conservation of publicly owned natural resources has to be linked with general interests of the community and with good science. Indeed, the USFS hosted a 2-day "Ecological Restoration" conference at Knoxville in July 2010 that focussed on these topics, with participation of over 100 conservationists from across the southeastern region. Unfortunately, there has been inadequate follow-up to that meeting in DBNF.

Basic Questions about Goals

1. To what extent does the FLN (or DBNF in general) aim to restore vegetation that resembles the open grassy pine-oak woodland (including zones with mostly shrubland or grassland) that was largely maintained by fall fire for 1000s of years before settlement?
[*Or is the primary goal of the FLN etc. to advance prescribed fire for varied reasons?*]

This event (June 2016), goal: "This upcoming shared learning event is for resource professionals and researchers involved in controlled burning, or who have an interest in learning more about the FLN, controlled burns, fire effects on vegetation and wildlife, fire surrogate activities such as mastication, etc."

London Fuels Treatment (2012), purposes:
(1) "Maintain and enhance existing grassland habitat to increase biodiversity and improve resilience and stability of ecosystems";
(2) "To promote native warm season grasses and associated forbs in upland grassy openings";
(3) "Move the Fire Regime Conditions Class from 2 [moderately altered] and 3 [significantly altered] towards 1 [within an historical range]".

Cumberland River Fire Learning Network Project (2011), primary goal, <u>not funded</u>!
"The historically fire-adapted landscape of the southern Daniel Boone NF project area is generally overstocked, mesic-encroached, and vulnerable to disease, pests, and other disturbances. Using a combination of prescribed fire and mechanical treatments, forest composition and structure should be restored to a mosaic of oak – hickory forest and pine – oak

forest, woodland, and prairie (CFLRP target forest types), as well as mesic coves and alluvial forest (non-target forest types)."

[*Is the lack of funding for this proposal related to lack of specific details about restoration?*]

DBNF Forest Plan (2004), selected goals:
"Objective 1.1.D. Restore and maintain 3,000 acres of pitch pine and pitch pine-oak forest types on appropriate landtype phases."
"Objective 1.1.F. On appropriate landtype phases, restore and maintain 18-24 percent of forest acreage in forest types having a significant (>30%) component of yellow pine."
"Objective 1.5.A. Provide for 2,200 acres of grassland habitat in various Prescription Areas. Promote native warm season grasses and associated forbs in upland grassy openings."

[*Do these goals get applied to restoration of vegetation that resembles presettlement?*]

2. What are the reference conditions (and ideally particular sites if they exist) for us to understand and detail the goal for restoration?

3. Where are the prioritized sites for this restoration, and how are they selected?

4. Why did not DBNF not link the initial RCW recovery program with broader ecological restoration in a more continuous fashion? Note the lack of continued effective burning in most areas with initial efforts to restore RCW habitat (e.g. east of Cumberland Falls).

5. How does the current FLN activity guide actual management by DBNF?

For a new era of cooperative planning, I advocate Teamwork based on defined Targets and negotiated Tradeoffs. Other federal agencies (NPS, NRCS, USFWS etc.) and state agencies (especially KSNPC) should be more involved. And in addition to more building of consensus among professionals, there should be regular field trips and presentations for the public.

"Teamwork" should cover moderately large areas, within which regular effective field trips and meetings are held. Perhaps the most practical local areas would be major sections of the upper Cumberland River: (1) Buck Cr & Rockcastle River watersheds; (2) main Cumberland Rv. corridor (including lower Laurel Rv.); and (3) South Fork of Cumberland River watershed (including Little South Fork). The current FLN project area covers only a central section of the broad Cumberland River corridor. An essential problem is that we need to learn from experiences across the whole central Cumberland Plateau. Therefore, there should also be regular comparative synthesis of information from the whole upper Cumberland and Tennessee watersheds. In particular, we should learn much from the Big South Fork NRRA, from the Catoosa WMA in Tennessee, and even prescribed fire programs elsewhere in the broader region (as at Oak Ridge National Laboratory).

Ideally, we should work towards monthly field trips within each of the three local sections outlined above (at least educational field trips for public, schools, colleges), plus an annual meeting for the whole upper Cumberland and Tennessee Rivers. Local meetings, field trips and workshops could be focussed on developing information relevant to partucular management plans, and on comparing the results of past management at different sites. The annual meeting could be rotated between different institutional partners within the broader region. It should include brief presentations solicited from all involved professionals, and it should include facilitated discussion to improve consensus on the way forward, or at least decide on how the most controversial issues might be resolved with further research and education.

"Targets" should integrate the three levels of conservation: (1) major landscapes or watersheds; (2) habitat restoration (with details of fire location, frequency and timing); and (3) imperiled species that most deserve active recovery (including plans for propagation of selected species). Priorities for conservation at the landscape level (1) are already agreed to a large extent, although we need to refine boundaries for teamwork within potential sections of the upper Cumberland River, as outlined above. The focus of FLN and discussion here is on habitat restoration with fire (as part of 2), but interacting issues in management cannot be easily disentangled (especially logging history and plans, past agricultural uses and mining). Rather than focussing on fire itself, we need to develop clearer goals for restoration of degraded habitats, from frequently burned grassland to mesic old growth forest.

There is, unfortunately, little attention by the FLN to recovery plans for rarer species, but this is a general problem in much conservation planning in Kentucky. There has not been enough good definition of which species most deserve micromanagement, either in nature or, with plants, in nurseries for reintroduction. And there has been too much disconnection of such recovery (3) from work at the habitat (2) and landscape (1) levels. Thus, initial work to restore habitat for the red-cockaded woodpecker (RCW) was largely relaxed or even abandoned after the birds were removed from DBNF. A lot of valuable habitat restoration around colony trees for the RCW was conducted—what is the status of that habitat now? The FLN plan makes no mention of *Schwalbea americana* (chaffseed), a federally endangered plant species that we should eventually reintroduce to restored grassy open woodland, as well as red-cockaded woodpeckers. And there are a few dozen locally rare plant species that we should be growing for recovery. A few years ago, DBNF funded myself and Roundstone Seed Inc. to establish a base for propagation of some native plants for restoration, but based largely in Hart County. We should establish a center for propagation in the upper Cumberland and Tennessee region.

"Tradeoffs" should include discussion of difficult decisions that should be made not just in-house by the USFS; e.g. selecting sites for ease of management versus most significant remnants; e.g. fire season for convenience versus optimal effect; e.g. conducting more research versus acting more now. A wise balance of interests is needed, based on an effort to develop consensus across the community of professionals and the general public. Regular meetings and educational field trips will be essential.

The central theme here should be how to build consensus, or at least to define the most difficult or controversial issues clearly for further research and education. At root, many of the disagreements about forest management revolve around different goals by different interest-groups. In particular, it appears the FLN is largely focussed on increasing prescribed fires across the southern DBNF, while the more traditional 'nature conservation' approach focusses primarily on how to restore open grassy pine-oak woodland. Such restoration would of course include prescribed fire, but there would more attention to locations and schedules for burning, and more attention to recovery of rare species within this habitat. A broader approach to conservation planning would help reduce disagreements.

Optimal season for fire (or for grazing) is a critical issue in eastern North America. Research into this issue has been slow to occur or slow to be accepted in some regions; for example, on the Coastal Plain of Florida (Platt et al. 2015, in PLOS ONE 10(1): e0116952) and in the Tallgrass Prairie of Kansas (Towne & Craine 2014, in PLOS ONE 9(7): e103423). In DBNF, there has been no research, but some uncommon to rare plants that flower before July may be reduced by repeated burning (or grazing or mowing) during March to May, when most prescribed fire currently takes place. These species include *Baptisia tinctoria, Castilleja coccinea, Lilium* spp., *Oenothera* spp., *Phlox* spp., *Polygala* spp., *Trifolium* spp. and *Viola* spp. The best remnants for grassland include several roadsides that are currently mowed too much.

Priorities for cooperative research should include synthesis of the following information. These are not expensive projects but they require more leadership and more collaborative spirit.#

1. Synthesis and review of relevant historical, archaeological and paleaecological data.

2. Data on regionally rare or conservative species that are remnants of openings before settlement.

3. Vegetation data from terrain that appears to have had open grassy woodland before settlement

4. Provision of GIS maps for all known fires, including wildfire and prescribed; with attributes.

5. Ecological models that relate the various potential conditions to landform and disturbance regime.

6. Deeper literature review concerning effects of different fire seasons on vegetation and rare species.

7. Posting of as much relevant material as possible (including initial planning documents and spreadsheets for FLN) on a public website; more sensitive material (due to proprietary issues or resource security) should be posted for well-defined cooperative teams, not the general public.

Problems with the report by S. Simon (2009), "Ecological Zones in the Kentucky Fire Learning Network Project Area"; this reported was contracted by FLN or TNC.

1. The classification of forest types is imposed by Simon, without any multivariate analysis of composition (as would be standard practice in a traditional vegetation study), and without any review of prior classifications in the region (e.g. by KSNPC, TNC and DBNF itself). Although 100s of plots are referenced in the report, there are no raw data presented from these plots.

2. The report provides results from a statistical analysis that relates his forest types, based on plots with trees at least 60 years old, to topographic and geologic parameters in a deterministic fashion. There does not appear to be a general attempt to include soil mapping units by NRCS as environ-mental variables, even though these have proven to be useful integrators of topography and geology within previous studies. Moreover, relationships of soil types with vegetation are being detailed currently by NRCS. [There is an estimation of distance to clayey or non-clayey soils.]

3. There is also no attempt to relate forest type directly to disturbance history, although we may assume that different land types have experienced very different disturbance regimes during the past few centuries. Visual inspection of the maps indicates that shortleaf pine-oak is associated with some broader ridges that have gentle slopes, as well as some south-facing slopes. It is well known that broad ridges have been much more intensively farmed during since settlement, and before settlement these landforms may have burned relatively often due to extensive grassy openings and animal trails.

4. Because there is no inclusion of information about native shrubland and native grassland, there is no analysis of how the small fragments and remnants of these vegetation classes are related to environmental parameters.

5. The report provide zero information on the mean values for environmental parameters in each of the assumed forest types. This severely limits the value of the report, in terms of fundamental understanding of the ecological factors. A provisional interpretation of Simon's forest types is presented below based on limited clues in the report

6. There is no reference to previous work on the vegetation of DBNF, such as Martin et al. (1989), inventory reports by TNC and partners, fire management planning at Big South Fork NRRA, and the initial paper describing fire-maintained pine-oak woodland and associated openings (Campell et al. 1989).

7. There is no review of fire history, vegetation history, distributions of conservative grassland plant species, archaeological patterns, and information about animal or human trails before settlement.

HYDROLOGICAL CATEGORY	**DISTURBANCE CATEGORY**	
	LESS DISTURBED	**MORE DISTURBED**
XERIC	**Dry oak forest [or limestone ridge]**	**Xeric pine-oak forest**
SUBXERIC	**Dry-mesic forest**	**Shortleaf pine-oak forest**
MESIC	**Mesic forest [or Acidic cove]**	**(old fields, rights-of-way)**
ALLUVIAL (or subhydric?)	**Alluvial forest**	**(open boggy sites)**

Appendix 2. Notes to US Forest Service and others in 2014.

To: friends and associates in USFS, TNC and state agencies who work on fire and its planning.
From: Julian Campbell, ca. May 2014; julian.campbell@twc.com; 859 229 7711.

From a botanical perspective, much management of fire for native vegetation in Kentucky needs to be refocused on basic goals. For example, the Fire-Learning-Network of Daniel Boone National Forest has adopted a simplistic model of the idealized relationship between topography and vegetation, with the most open grassy woodland and most frequent fire prevalent on all dry ridges in the southern Cliff Section. But available evidence from historical sources and modern remnants of native vegetation suggests that more open areas were concentrated on broader ridges and flatter uplands with relatively deep soils (seasonally mesic to hydric in places). Shortleaf pine was probably most common in transitions from these openings to deeper woods. Narrower ridges near the larger watercourses with drier rockier soils probably had less frequent fires and more continuous, shrubbier woods (with local pitchpine, blueberries and huckleberries). Fires from lightning strikes (especially on dead pines) and human ignitions (especially along trails) probably spread to become more extensive, on average, along the broader ridges and flatter uplands due to less interruption by damp swales and ravines, and due to the deeper soils allowing more annual accumulation of fuel in bluestems, Indian grass and associated graminoids. The best current remnants of open grassy vegetation, with concentrations of conservative sun-loving plants, tend to be on broader ridges and flats.

There are similar concerns about some aspects of fire management at Land-Between-the-Lakes, where the USFS seeks to maintain most of the landscape as oak-hickory woods with

prescribed fire, and does not consider mesic forest to be a significant target for restoration on uplands. They have selected some areas for more aggressive management and more frequent fire, with local plantings of shortleaf pine. But the best remnants of more open grassy woodland do not seem to have been comprehensively identified, and do not seem to be the main targets for more intensive management. Also, fire may be more effective during Jul to Nov than spring (often the default).

I have general suggestions for improving this situation—please can we implement some of these?

1. Deeper review is needed regarding the few ponds sampled for ancient pollen and charcoal. In addition to the Delcourts' work at Cliff Palace Pond, DBNF had a contractor work (Jim Chatters) at some sites further south, but his data has not been made available. More sites should be studied.

2. We need more synthesis of historical information about the forest. For example, the early land surveys of the Tellico Land Grants (1802-1817) in southeastern Kentucky have not been examined at all in relation to forest history. There would be important information about pine distribution.

3. Records of conservative sun-loving species should be mapped across the region for useful insight to the original concentrations of more open grassy vegetation. I have already done this for McCreary County as an initial local effort, and state-wide trends by county are also fascinating.

4. Plant species in this group (3) that most deserve micromanagement and local propagation should be identified for action. It would not be expensive to initiate a local effort in southeastern Kentucky, based in small wildflower gardens adjacent to USFS buildings and partners.

5. We need broader synthesis and deeper analysis of vegetation data from the region, much of which is sitting unused in old files (e.g., the 100s of plots from 1990s that I worked on). These data can be used to construct a better model of the original landscape, together with (3). Recent monitoring data, experimental data from universities, and planned plots in the future should become integrated into a GIS system for use by all appropriate researchers and planners.

6. More research is needed on some aspects of fire effects, especially the role of season, and the influence on alien species and conservative/rare species.

7. The potential role of ungulates in restoration deserves more consideration, especially on more productive soils. How do deer interact with fire effects? Could livestock be useful in restoration?

8. A regular cooperative network should be set up for each region, with annual meetings where new research and data-sharing would be emphasized. Such efforts were envisaged at the 2010 meeting hosted by USFS in Knoxville: “Advancing Ecological Restoration in the Southern Appalachians” but they have not really taken root in Kentucky. TNC’s ecoregional planning should be dusted off.

Appendix 3. Notes to US Forest Service and other in 2013.

To: Fellow Pyrophiles of the Plateau. It is rather tragic that we do not get together regularly, discuss the situation, and seek more common ground. At the center of our attention should be restoration of the "Cumberland Barrens"—as I have dubbed this largely extinguished habitat type, former home to two Federally Endangered Species, Red-cockaded Woodpeckers and Chaffseed (Schwalbea). We should have an annual tour of better sites, with frequent educational events at Catoosa WMA (Morgan Co. TN) for demonstrating what is possible on a relatively grand scale. In the meantime, some of us send irritating comments to the Daniel Boone National Forest on their proposal burning plans, which seem to avoid good restoration. And critical research that would help guide and monitor restoration remains largely undone, at least in Kentucky.

In my opinion, there is a desperate need to reform some kind of Central Cumberland Conservation network (including a 'fire learning network') that would focus largely on sections of the Cumberland Plateau drained by the Cumberland and Obed/Emory Rivers. Can the "Alliance for the Cumberlands" be reset to coordinate such efforts? Can we actually get U.S. Forest Service (DBNF) and National Park Service (Big South Fork & Obed) to sit down for shared transparent discussion about management of their common resources? And surely many of the people interested in fire could also work on coordination for other aspects on conservation within this region. I continue to yearn for some kind of 'neotribal agglomeration' where diverse information and viewpoints can be brought together in a friendly context, leading to a better chance for finding common ground. Some 10-15 years ago, TNC hosted 'ecoregional' planning that included this region (meeting at Rugby in some cases). And in 2009, the USFS hosted a two day meeting in Knoxville on community-based planning for

restoration. But such efforts seem to fizzle out without local coordination from the grassroots. Who might emerge as coordinators? Perhaps some hope might come from the unusual biological expertise among a several local officials and residents in McCreary County, Kentucky!

See comments below, sent to DBNF yesterday;
also http://bluegrasswoodland.com/uploads/Cumberland_Barrens.pdf
and other material to be posted at bluegrasswoodland.com

==========

To: District Ranger, USDA Forest Service, London Ranger District
761 S. Laurel Road, London, KY 40744
"Comments may also be submitted electronically in a common digital format to comments-southern-daniel-boone-london@fs.fed.us. Although written comments are strongly preferred, comments may also submitted by calling project team leader Alison Coons at 606-376-5323."

Comments on Scoping Document for London Fuels Treatment Project

Julian Campbell, 22 April 2013.

These comments below are based on general knowledge and personal experience on the DBNF. The general concerns expressed here have been made several times before to DBNF, but the message does not seem to be received or understood or believed. Thus, I will be increasing the intensity of response, with additional information and literature. A campaign is clearly needed among conservationists in Kentucky to open up the public discussion of these issues. The current plan is off the mark for ecological restoration and should be largely reworked.

Goals are too Vague and General

The first sentence of the Introduction indicates that goals are as follows (p. 5):
"reduce fire regime condition class";
"reduce dead fuel loading";

“promote fire-mediated upland ecosystems”.

The Purpose and Need provide the following items (see complete statement on p. 5)
“Maintain and enhance existing grassland habitat...”
“Re-introduce fire use across the landscape...”
“Move the fire regime condition class from 2 and 3 towards 1.”

The cited Forest-wide goals that pertain are as follows (p. 5-6); specific goals are indented.
“Maintain a variety of life and recover native and desirable non-native populations...”
    “Provide adequate habitat to support populations of Management Indicator Species.”
“Improve the ability of the Forest’s ecosystems to withstand and recover from disturbance...”
    “Re-introduce fire use across the landscape to increase biodiversity and improve resilience and stability of ecosystems.”
    “Move acres from Fire Regime Condition Classes 3 and 2 into Classes 2 and 1.”
    “Reduce/eliminate white pine and other fire-intolerant species from upland...”
    “Annually increase the number of acres to be prescribed burned.”

There is no focus on the best remnants of "fire-mediated upland ecosystems"
What and where are they, what have they been, and what or should they be? The plan's maps give no indication that sites are chosen with specific FMUEs in mind, unless one assumes that the whole of London District contains them. There is no information about the many rare plants and animals (even RCWs) that would be associated with more distinctive FMUEs. Should not the USFS be concentrating on the best remnants, where the most significant fire-dependant biodiversity occurs or might be enhanced in the future? There is no mention of sites on the Cumberland Plateau that currently support the best examples of FMUEs, such as the Catoosa WMA in Morgan County, Tennessee. The Catoosa WMA should be a standard reference for fire-management plans on the Kentucky side of the border.

This plan gives no indication that fire-frequency would be sufficient to restore the best remnants, even if they occur within the proposed units. Thin piney woods for Red-cockaded Woodpeckers (RCWs) and more open grassy areas, where pines can best regenerate by themselves, require fire at 1-3 year intervals if they are to remain ecologically viable. However, the plan identifies only five "fire-regimes", and those regimes with most frequent fire are described only as "0 to 35-year frequency." It does not distinguish "grassland" from open woodland or forest, even though "grassland habitat" is listed as a goal under Purpose and Need. The plan goes on to state that (p. 9): "Each of the 41 proposed areas would initially be treated with a three-to eight-year burn-cycle until the predetermined reference conditions (identified in biophysical setting descriptions) have been reached. Periodic burning to maintain reference conditions would occur at longer intervals (eight plus-year cycles) and would be triggered by the adaptive management strategy described below." There is no consideration of more frequent fire-regimes, and "fire-regime 2" with stand-replacing fire is dismissed with no discussion (Table 1 on p. 7).

Curiously, “regeneration areas” are to be excluded from burning in this plan. Yet if such areas contain pines and oaks (especially blackjack oak and post oak), it would be good for restoration to burn these often, in order to maintain the open character.

There is also no consideration of the best season for burning, despite increasing research on this critcally important factor in southeastern states. Recent research by S.L. Flory et al. (Univ. of FL, Gainesville) has shown that spring fires, in particular, generally increase the abundance of the alien Japanese grass, *Microstegium vimineum*. For more naturalistic restoration, with most benefit to natives versus aliens, we will probably need burning to be concentrated in summer to fall, when lightning-caused fires used to occur more widely and when Native Americans extended them into the fall. Table 4 indicates that “dormant-season” or “growing-season” fires would be used, with little or no preference for more exact timing.

There is inherent exaggeration of fire-dependance for oaks

See papers by C.D. Oliver, M.A. Arthur, N. Pederson, R. McEwan et al., which present evidence for alternative hypotheses. Oaks tend to live longer than red maple, and early abundance of red maple in stand development need not indicate its eventual dominance. Because USFS has tended to cut stands at 60-100 years in age, the potential dominance of oaks is often thwarted. Also, oaks tend to be more drought-resistant than red maple. During occasional intense droughts, as appear to have occurred in the past, the red maple may well have become thinned out or stunted below oak-dominated canopies. Also, maples tend to be more browsed by herbivores than oaks.

To describe oaks simply as “fire-mediated species” (p. 8) is much too simplistic and misleading. Several oak species (especially those of more mesic or hydric habitats) can

regenerate and grow well with other kinds of disturbance-regime—including major windstorms, droughts, periods of poor drainage, or along larger animal trails. In contrast, blackjack and post oak have indeed been generally associated with frequent fire, and those two species are now much declined in DBNF (especially blackjack) due to lack of frequent fire and more open grassy "regeneration areas" for them.

Increase in overall "number of acres" to be burned is emphasized, not increase in FMUEs
There are no clear biological goals for abundance or quality of restored FMUEs. Instead, some indications are provided for fuel loadings, duff thickness and woody seedling densities in Table 4. It is clear that sites with higher fuel loads would be burned more often. But sites with good potential for truly fire-mediated species would become burned less often when their fuel loads are reduced, and thus would NOT be truly restored. The "trigger-points" for restoration of such biodiversity are NOT considered—just the "trigger-points" for reduction of fuels. This paradox can only be solved by recasting some of this plan in terms of species composition rather than the excessive focus on fuels and physical structure.

Conclusion
There appears to be a general claim among DBNF administrators that most prescribed fire on uplands in the southern districts is good for the Forest. This claim involves a simplification of the science that is available to them, with vague or exaggerated statements about "Forest Health", oak-regeneration and other effects. There are no clear biological goals with measurable parameters in terms of species composition. The "burn-fare" hypothesis holds for this project—that USFS employees seek internal funds for prescribed fire programs partly in order to suplement their local budgets, and that the congressional mandate for "fuels reduction" using these funds remains their primary justification rather than restoration of native

biodiversity, even though the latter is often claimed and exaggerated. We do desperately need restoration of the most open grassy conditions using fire at 1-3 year intervals, centered on the best remnants of "Fire-mediated Upland Ecosystems." But this plan will not accomplish that goal, and it would be to some extent a sad waste of federal funds.

Added notes on prioritized sites for frequent burning on the current London District.

The ten areas listed below form the highest priorities for restoration with frequent fire; they include virtually all of the sites with RCWs from the 1970s onwards. Only four of them are largely included within the proposed "London Fuels Reduction" plan. Their mapping is based on the original biological inventories on DBNF during the 1980s and 1990s (in then Berea, Somerset and London Districts), plus continued experience on the Forest. Details can be found in those inventory reports, KSNPC data, and my personal notes. Sites with the highest local significance are shown by asterisks; but larger acerages will also deserve special consideration.

It will be important to develop more consensus on the geographic clusters of imperiled or conservative "fire-mediated species". Also, we need to articulate hypotheses for how fire-regimes caused by lightning and Native Americans were distributed over the landscape. It does seem likely that the anthropogenic fires were concentrated along broader ridges with relatively deep soils, which were probably used most often for travel and hunting across the Cumberland Plateau. It is a mistake to assume that relatively uniform fire-regimes occurred over all of the uplands in the southern DBNF. Why was so much effort put into the inventory program and subsequent ecological classification during 1986-1995, if its most important applications are now largely ignored?

Following sites are mostly outlined by inventory reports for each district (with page numbers).

1. Mill Creek Streamheads (Berea p. 78): this is included within the plan's "Mill Creek" site.

2. Cane Creek Uplands (London p. 131): largely included within the plan's "Cane Creek" and "Middlefork" sites; but some adjacent significant roadsides are not included.

3. Bald Rock Uplands* (London p. 132): excluded from this plan.

4. Flatwoods Uplands (London p. 133): excluded from this plan.

5. Grove Road/Spruce Creek Uplands* (London p. 134): excluded from this plan.

6. Bark Camp Uplands (London p. 135): largely excluded from this plan (moderate/high significance).

7. Seminary Branch/Bunches Creek Uplands* (London p. 136): largely included within this plan's "Bunches" site; but some important roadsides are excluded.

8. Mount Victory Seeps* (KSNPC site): excluded but check extent & context with USFS land.

9. Hindsfield Ridge* (Somerset p. 82): excluded from this plan (high significance).

10. Little Lick & Addison Branches area (Somerset p. 86): largely included within this plan's "Little Lick" and "Tom Heath" sites.

Note distributed to group by Nancy Ross (DBNF) after the Knoxville meeting in 2010: from "Willfull Blindness" by Margaret Heffernan.

"As we pursue like-minded people, in like-minded communities, doing similar jobs in homogeneous corporate cultures; we feel good.

Like a creek following the path of least resistance, over time the channel deepens and the sides become steeper and steeper.

The absence of resistance provides a sense of comfort and certainty, our river becomes a canyon.

We don't sense our perspective closing in as we are embedded more snugly in our comfort zone.

But our blindness to the world around us grows."