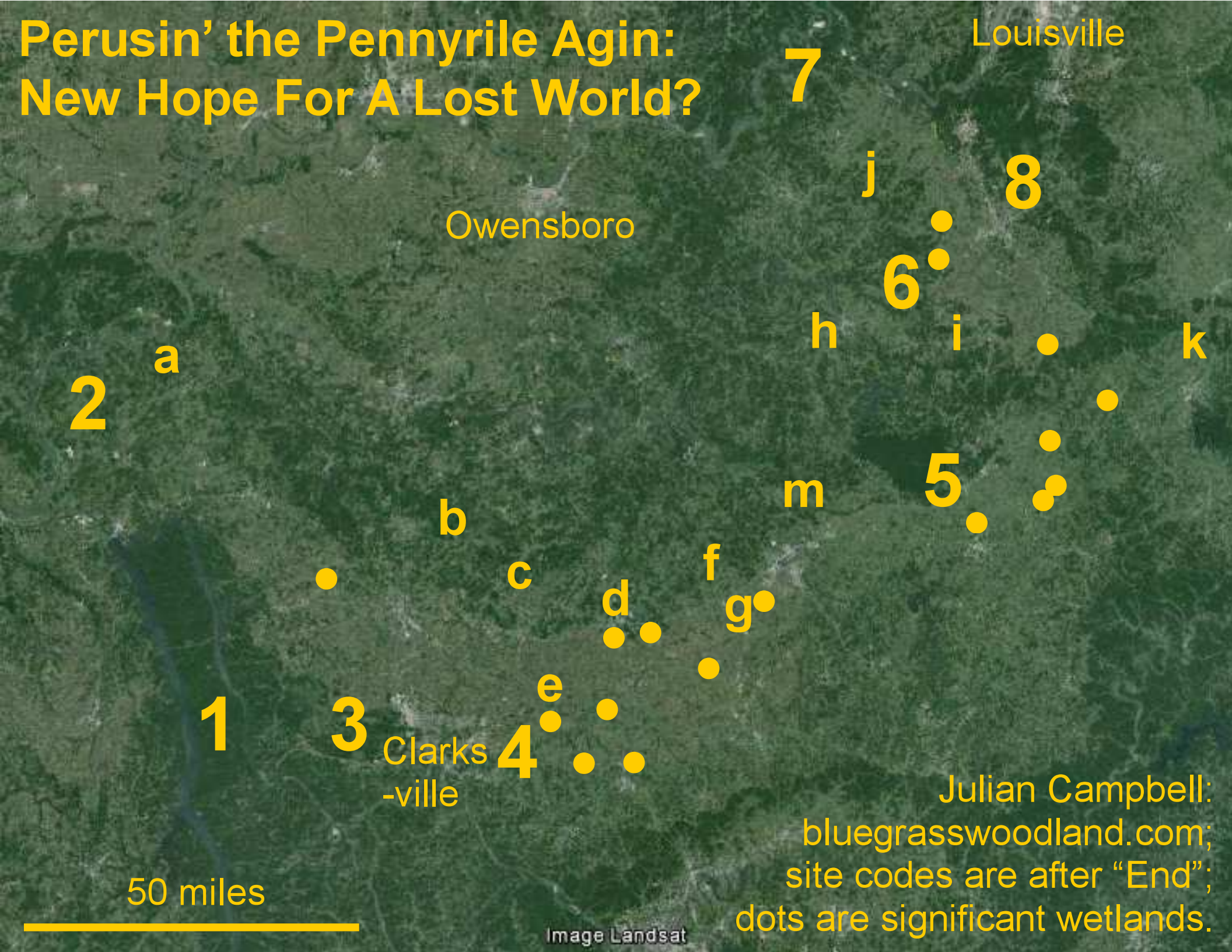
I am posting this slide show plus many other details at my website:

<bluegrasswoodland.com>

especially "Shawnee Hills+" page which combines treatment of the Shawnee Hills (in strict sense) with Pennyrile and some other plains around the Shawnee Hills.

Perusin' the Pennyrile Again: New Hope For A Lost World?



Julian Campbell:
bluegrasswoodland.com;
site codes are after "End";
dots are significant wetlands.

Fundamental Principles for the Third Age of Conservation?

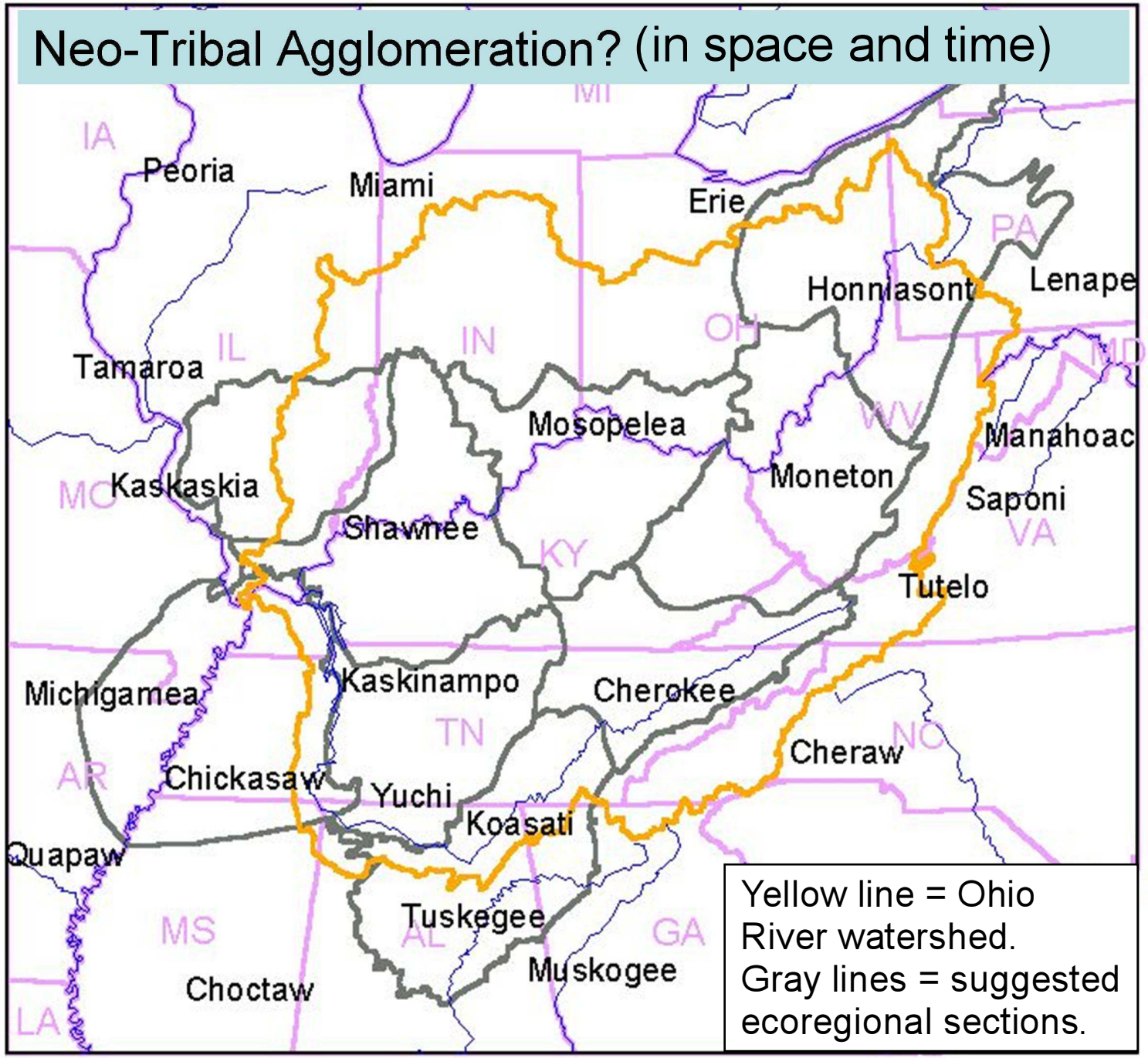
1. Teamwork: focussing most of our work on regional sections that can be traversed in a day; defining "native" in this context; educating with regular field trips; fostering transparency and dialog; building communities that care.

2. Targets: integrating the 3 levels

- Landscape or watershed level: focus on size (mega-management)
- Habitat level: focus on needs for restoration (macro-management)
- Species level: focus on needs for recovery (micro-management); and into the weeds for reduction.

3. Tradeoffs: improving consensus or compromise in such matters as

- Suggested priorities (sites etc.)
- Cooperative methods (with $)
- Critical questions for research
- Resolution of differences
- Political action



These are approximate central locations of named tribes from DeSoto's expedition in "Florida" to Boone's explorations of Kentucky.

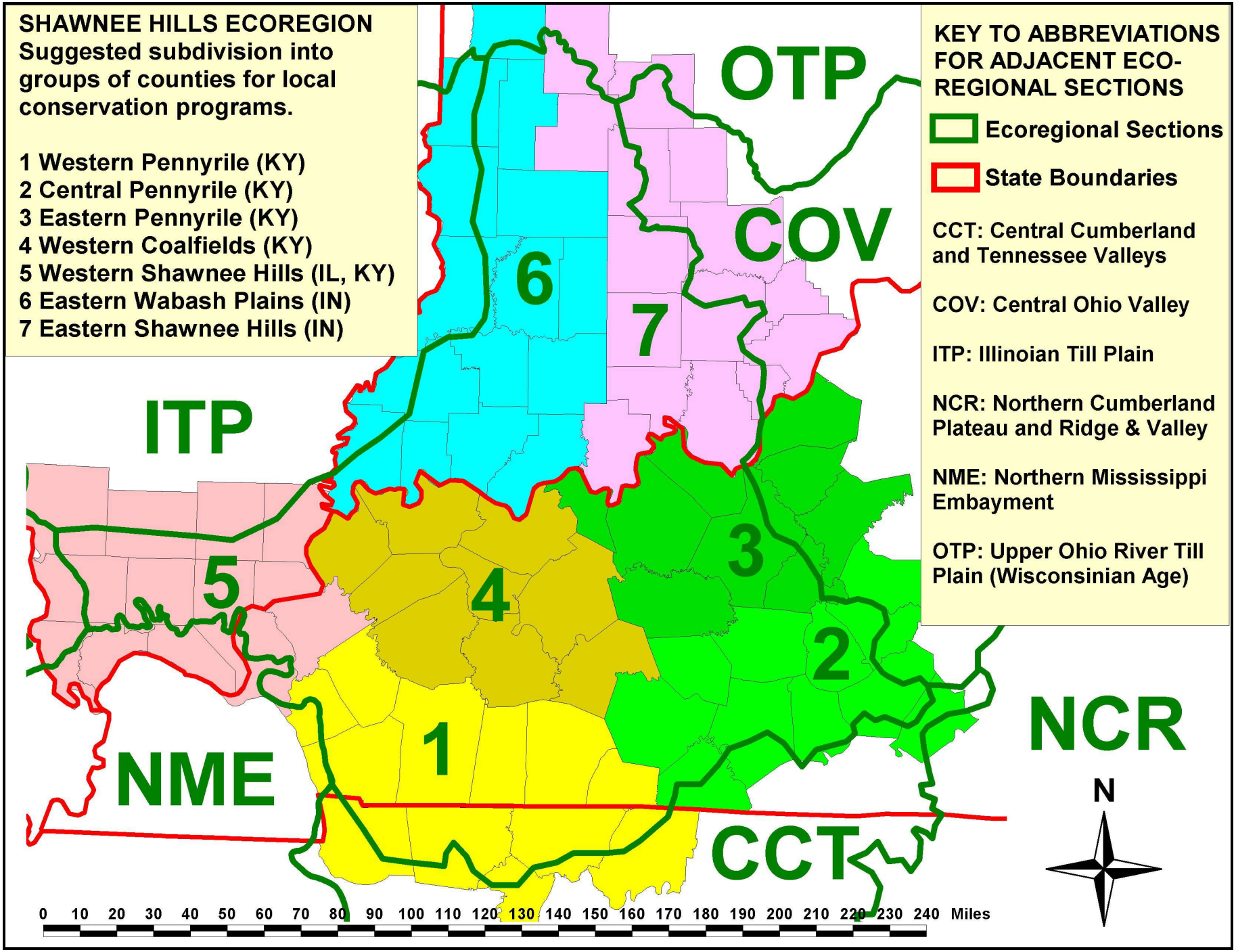
There is, however, considerable uncertainty about some tribes, especially where migrations occurred.

Teamwork – Promise of Natural Heritage?

From The Nature Conservancy's (2002) Ecoregional Plan for the Interior Low Plateaus:

"The Core Team will have the responsibility for ensuring that future iterations of the plan are completed on a periodic basis. It is reasonable at this point to expect that, given the gaps in data identified above, the next iteration of the portfolio should be done within 5-6 years. This proposed schedule would allow for the state offices to incorporate newly acquired data and revised priorities into their strategic planning as soon as possible. Following the next revision, future revisions may not need to be as frequent."

No such iteration has ever taken place!
We need smaller regional sections to focus on.


SHAWNEE HILLS ECOREGION
Suggested subdivision into groups of counties for local conservation programs.
1 Western Pennyrile (KY)
2 Central Pennyrile (KY)
3 Eastern Pennyrile (KY)
4 Western Coalfields (KY)
5 Western Shawnee Hills (IL, KY)
6 Eastern Wabash Plains (IN)
7 Eastern Shawnee Hills (IN)
KEY TO ABBREVIATIONS FOR ADJACENT ECO-REGIONAL SECTIONS
Ecoregional Sections
State Boundaries
CCT: Central Cumberland and Tennessee Valleys
COV: Central Ohio Valley
ITP: Illinoian Till Plain
NCR: Northern Cumberland Plateau and Ridge & Valley
NME: Northern Mississippi Embayment
OTP: Upper Ohio River Till Plain (Wisconsinian Age)
OTP
COV
ITP
NME
CCT
NCR
1
2
3
4
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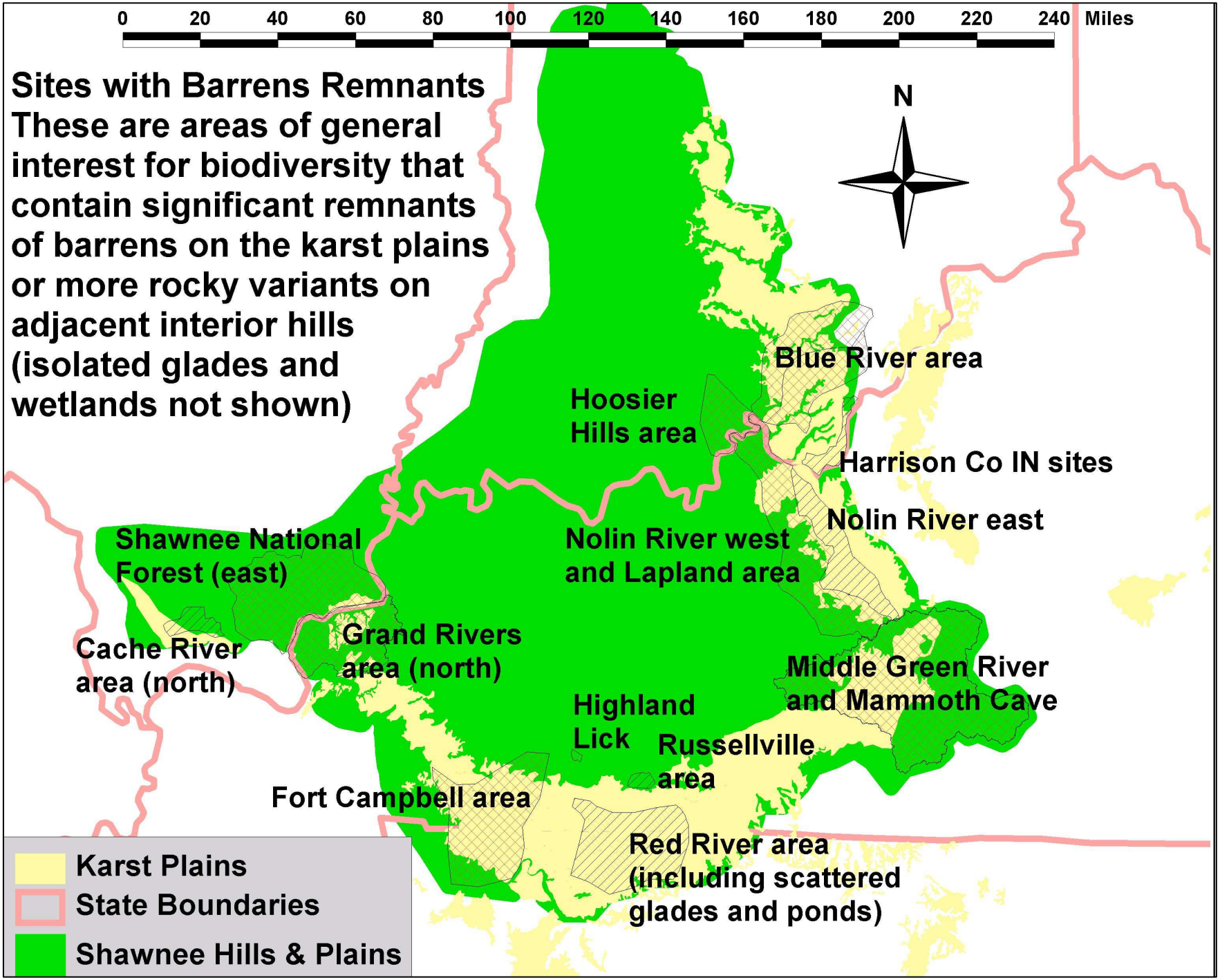
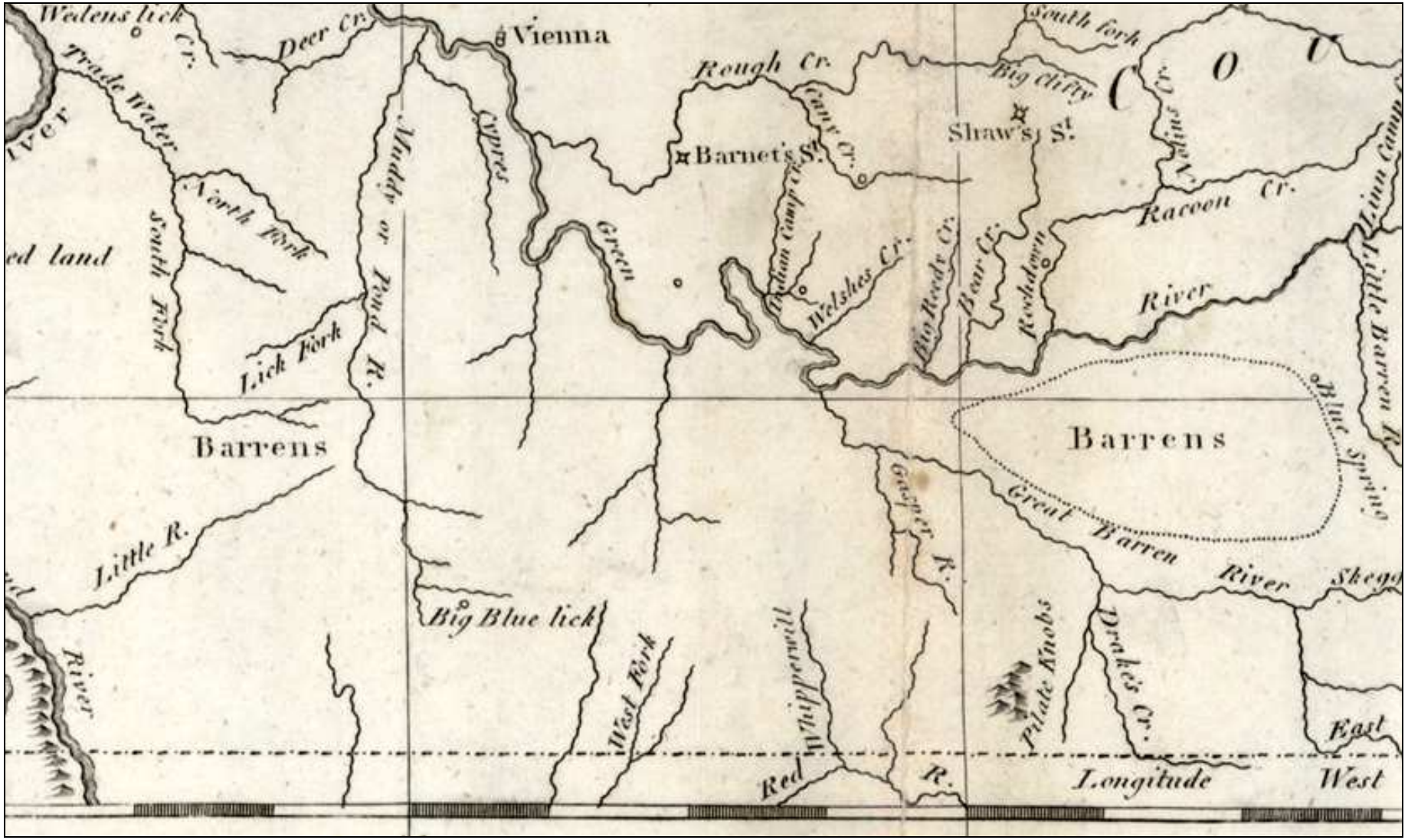
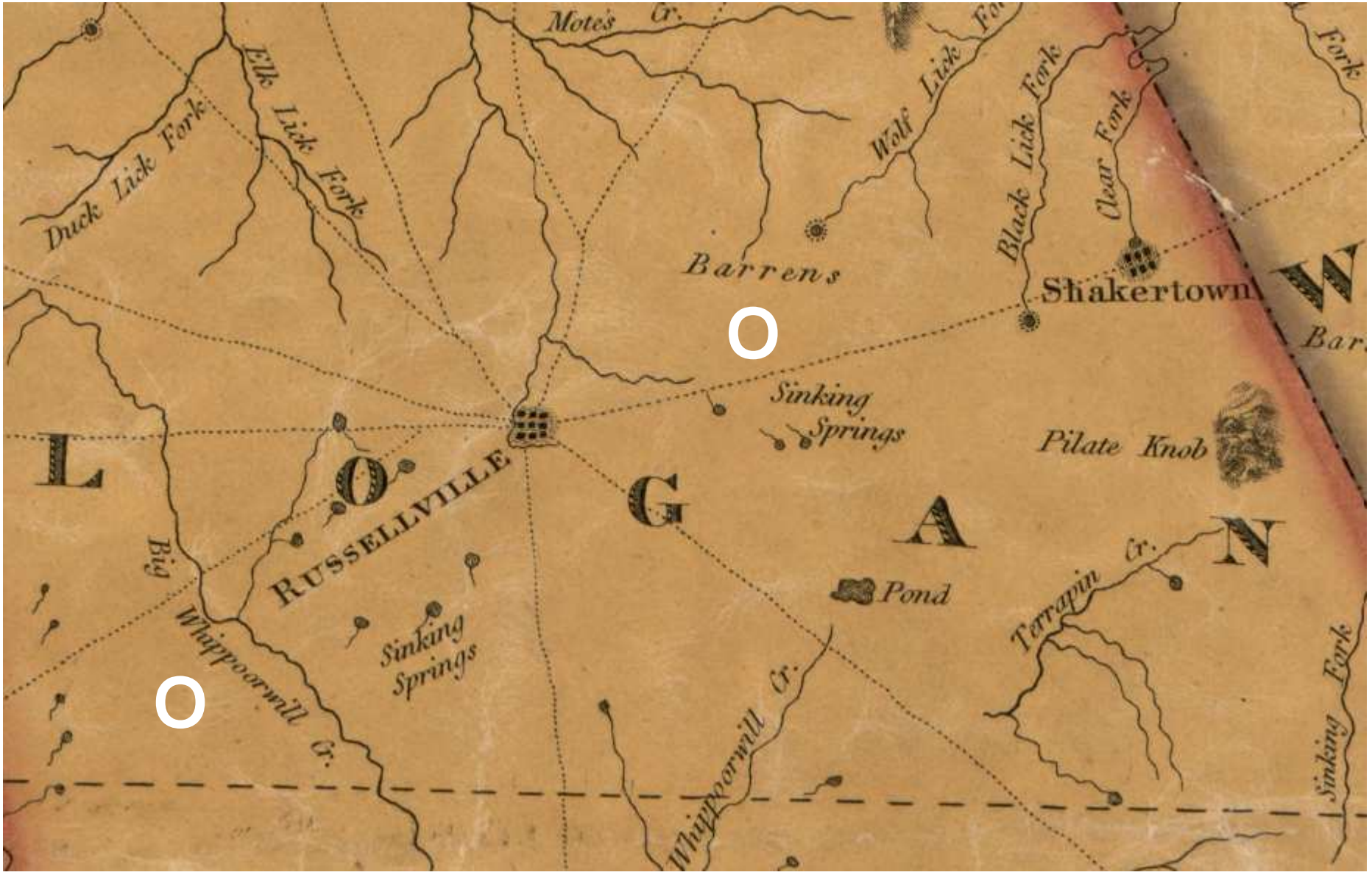
7
N
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 Miles


0 20 40 60 80 100 120 140 160 180 200 220 240 Miles
Sites with Barrens Remnants
These are areas of general interest for biodiversity that contain significant remnants of barrens on the karst plains or more rocky variants on adjacent interior hills (isolated glades and wetlands not shown)
N
Blue River area
Hoosier Hills area
Harrison Co IN sites
Nolin River east
Nolin River west and Lapland area
Shawnee National Forest (east)
Grand Rivers area (north)
Cache River area (north)
Middle Green River and Mammoth Cave
Highland Lick
Russellville area
Fort Campbell area
Red River area (including scattered glades and ponds)
Karst Plains
State Boundaries
Shawnee Hills & Plains



On Elihu Barker's (1795) map: "Big Blue Lick" was apparently about four miles northwest of Elkton, probably at intersection of trails marked on Munsell's (1818) map at "Croghan's Grove"; see below.



From Luke Munsell's 1818 map of Kentucky (at Library of Congress).
Central white dot: location of Athey Barrens State Nature Preserve.
Lower left white dot: location of Mosly Pond, which still remains but...

Current condition of Munsell's "Pond" at head of Whippoorwill Creek.

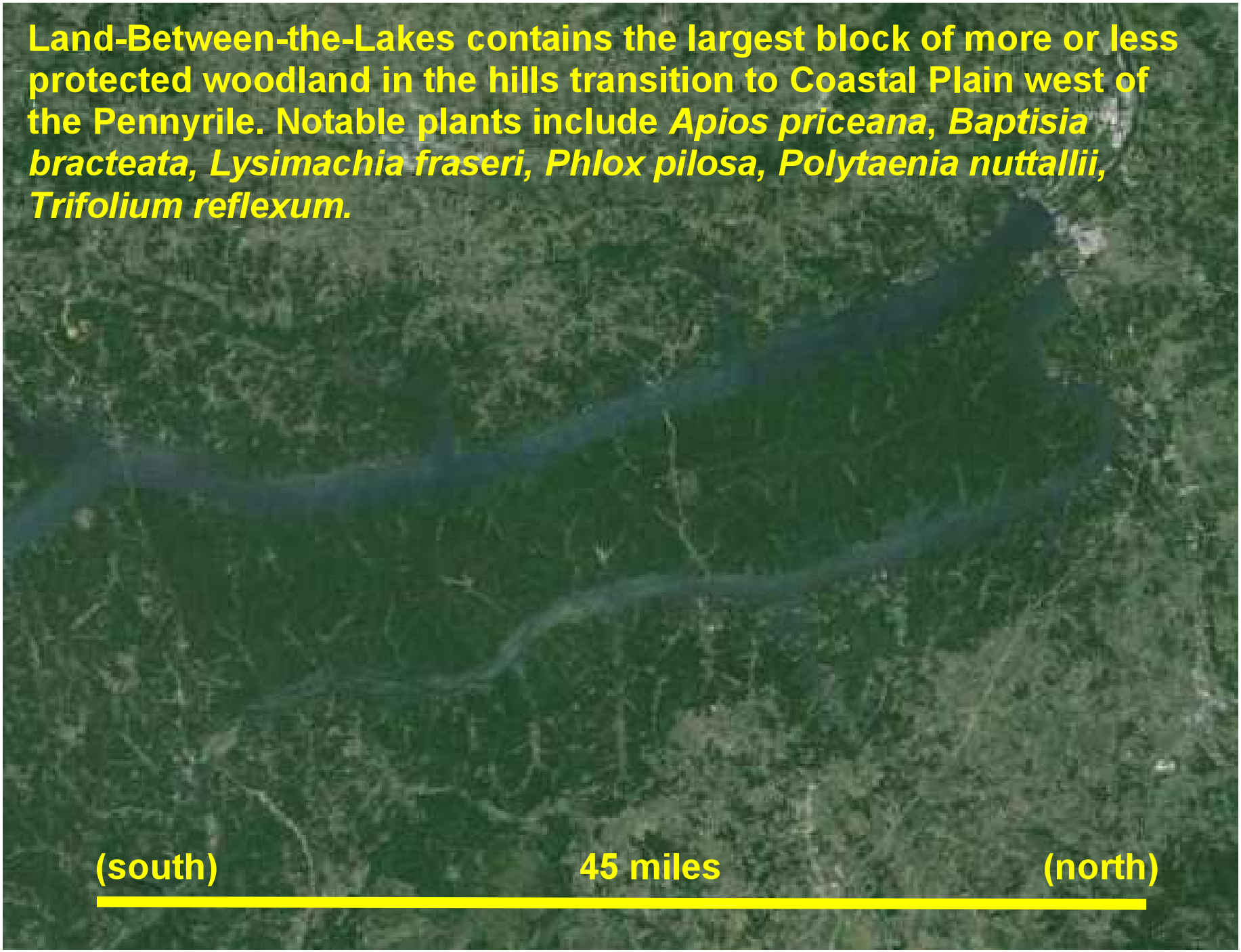
Targets at Landscape or Watershed Level

Within the Pennyrile Region of KY and TN, loosely defined, there are three large federal areas with great significance for conservation—All deserve more botany, buffer zones, etc.

- Land-Between-the-Lakes: hills transitional to Coastal Plain; much interest in restoring some open woods and grassland; but lack of coordinated planning in botanical matters; some discord with academia and community!

- Fort Campbell: most extensive remnant of native grassland in states east of the Mississippi River; military mission prevails but more can be done to focus on ecological restoration, rare species recovery and vegetation mapping!

- Mammoth Cave National Park: most extensive protected forest in transition from Karst Plain to Shawnee Hills; despite focus on cave system, NPS is interested to restore open woods and grassland, but needs more staffing!


Land-Between-the-Lakes contains the largest block of more or less protected woodland in the hills transition to Coastal Plain west of the Pennyrile. Notable plants include *Apios priceana*, *Baptisia bracteata, Lysimachia fraseri, Phlox pilosa, Polytaenia nuttallii, Trifolium reflexum.*
(south)
45 miles
(north)

Notable plants include *Agalinis auriculata, A. skinneriana, Oenothera perennis, Sabatia brachiata*.

15 miles
Mammoth Cave National Park contains the largest block of protected forest in the Shawnee Hills adjacent to Pennyrile Plain. Notable plants include *Gentiana puberulenta, Helianthus eggertii, Trifolium reflexum*.

Targets at Habitat Level

All grassland types deserve targeted action, especially those types on deeper well-drained soil that has been virtually all converted to farmland.

We need protection of best remnants, even if small, isolated and degraded, as well as general restoration around them—they are sources!

Classifications need to be rooted in ecological gradients [not hierarchies]: dryness / wetness, soil pH-related, and transitions to woodland.

Simplify to guide restoration and education. Start with major functional divisions, such as: ‘burned barrens’ (especially summer?) versus ‘pastured prairie” (especially winter?)...

We need much more research on appropriate patterns of burning versus browsing / grazing; more on this below...

Decisions about prescribed fire are often disconnected from clear priorities for ecological restoration (with botanical input)...

More or less traditional names for types

APPROXIMATION FOR ECOLOGICAL GRADIENTS OF GRASSLAND TYPES IN INTERIOR LOW PLATEAUS.
Four-number codes are for associations (CEGLs) in the National Vegetation Classification, followed by abbreviated names.
In several cases (~) close NVC matches are not available, but the most similar associations in USA are referenced here. Only grassland without much woody cover is detailed here; more wooded variants are indicated on lower line in each box.
Infertile or rocky ground = "barrens" (broad historical sense) **Fertile or low productive ground = "prairie"**

POSITION ALONG MOISTURE GRADIENT	POSITION ALONG pH-RELATED GRADIENT IN SOILS		
	ACID INFERTILE SOILS: mostly ultisols (pH ca. 4-5); sandy or cherty "barrens"	AVERAGE SOILS: mixed or intermediate (pH ca. 5-6); including typical "barrens"	BASE-RICH SOILS: mostly alfisols (pH ca. 6-7); resembling midwestern "prairie"
TRULY XERIC (rocky sites)	Sandstone glades (or similar)	Non-calcareous glades (other)	Cedar glades (at least patches)
XERIC TO SUBXERIC	Drier barrens on sand or chert	Drier barrens on karst plains	Xeric limestone prairie
SUBXERIC TO MESIC	Barrens on sandy or cherty plains	Less dry barrens on karst plains	Tall-grass prairie (like midwestern)
SOMEWHAT MESIC (drying in summer/fall)	Damper sandy or cherty barrens	Tall-grass prairie (or SEern variant)	Wet-mesic prairie (MWern) or cane
SOMEWHAT HYDRIC (swales, seeps)	Wet-mesic barrens	Wet-mesic prairie (SEern) or cane	Reed-grass marsh (seasonally wet)
TRULY HYDRIC (edge of water)	Wet barrens: esp. depression ponds	Wet prairie (MW or SEern?)	Rice-grass marsh (staying wet)

Characteristic species for different types

GENERAL SEPARATION OF GRASSES IN INTERIOR LOW PLATEAUS ALONG ECOLOGICAL GRADIENTS.
Only species typical of full sun are included. Species are located where they are most common, but some species have wide ranges. This is a approximation, to be tested with plot data; there is much overlapping of species along the gradients.
*** annuals; # cool-season (C3 versus C4); bold = most common to locally dominant; [ ] = rare, locally extinct or peripheral.**
short grassland with many annuals | **medium grassland** | **tall grassland** | **cool-season/C3 dominated**

POSITION ALONG MOISTURE GRADIENT	TYPICAL POSITION ALONG pH-RELATED GRADIENT IN SOILS		
	ACID INFERTILE SOILS: mostly ultisols (pH ca. 4-5); sandy or cherty "barrens"	AVERAGE SOILS: mixed or intermediate (pH ca. 5-6); including typical "barrens"	BASE-RICH SOILS: mostly alfisols (pH ca. 6-7); resembling midwestern "prairie"
TRULY XERIC (rocky sites)	***Aristida dichotoma****	***Danthonia spicata***	***Sporobolus vaginiflorus****
XERIC TO SUBXERIC	***Andropogon ternarius***	***Schizachyrium scoparium***	***Sporobolus compositus***
SUBXERIC TO MESIC	***Erianthus alopecurioides***	***Sorghastrum nutans***	***Tridens flavus***
SOMEWHAT MESIC (drying in summer/fall)	***Erianthus giganteus***	***Andropogon gerardii***	***Elymus glabriflorus#***
SOMEWHAT HYDRIC (swales, seeps)	***Andropogon glomeratus***	***Tripsacum dactyloides***	***Phalaris arundinacea#***
TRULY HYDRIC (edge of water)	***Panicum rigidulum***	***Eragrostis hypnoides****	***Leersia oryzoides#***

Truly Hydric? Shoreline with *Eragrostis hypnoides* (Creeping Love Grass), other annuals; note *Calamagrostis canadensis* and *Spartina pectinata* are rare in most of KY and TN.
http://oe.oregonexplorer.info/ExternalContent/wetland_type_images/ERAHYP_GNAPAL.JPG

Somewhat Hydric: *Tripsacum dactyloides* (Gama Grass); *Panicum virgatum* and *Tridens strictus* are rare [http://dsfamilyfarm.com/wp-content/uploads/2015/08/graze_egama_earlyjuly.jpg]

Somewhat Mesic: *Andropogon gerardii* (Big Bluestem)
http://www.cedarcreek.umn.edu/plants1/midsize/JAH11502.jpg

Subxeric to Mesic: *Sorghastrum nutans* (Indian Grass)
http://plants.usda.gov/gallery/pubs/sonu2_014_php.jpg

Subxeric to Xeric: *Schizachyrium scoparium* (Little Bluestem)

https://s-media-cache-ak0.pinimg.com/736x/b3/b1/39/b3b1396eacb547864ec90705e8a28c0b.jpg

Truly Xeric: *Danthonia spicata* (Poverty Grass); note abundant on chert along LBL Trace.

http://1.bp.blogspot.com/-Atj2Kvj4RKI/UNdwYyDpx6I/AAAAAAAAT60/e2YJEsqS6zk/s1600/IMG_1374.jpg

Targets at Species Level: Positive

There is a desperate need to increase our focus on the most globally or regionally imperiled species. It is especially important to target those species that most deserve micro-management or propagation for recovery.

We need local botanical gardens in Pennyrile region to develop this capacity, and to become integrated leaders in conservation: Austin Peay! Also, Baker (WKU), Mahr (Madisonville), Univ. of KY, Owensboro Botanical Garden?

Provisional list: most imperiled "mesic" species
g/s=new global/state ranks; ~ woody transition
a = relatively acid soil; h = hydric transition

g3? s4? *Phlox deamii* a

g4 s2 *Apios priceana~*
g4 s1? *Desmodium ochroleucum~*
g4? (IN) *Rudbeckia deamii*

g5 s2 *Agalinis auriculata*
g5 s3 *Baptisia aberrans*
g5? s5 *Helianthus eggertii~* a
g5 s2 *Nabalus barbatus* a
g5? s2 *Silene regia* a
g5? s2 *Trifolium reflexum~* a
g5? s2 *Trillium ozarkanum~* a

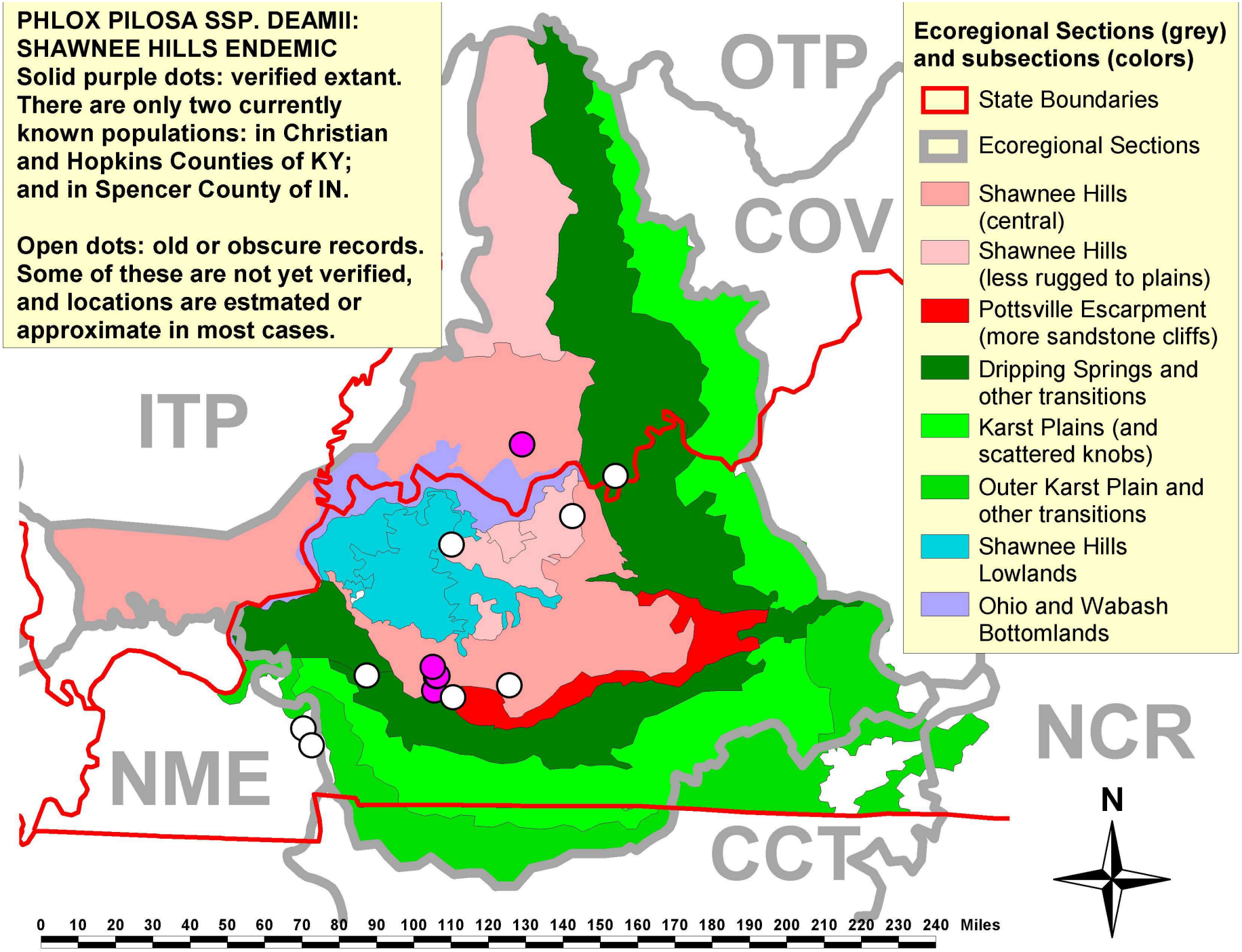
g6? s2? *Agalinis skinneriana* Ah
g6? s3 *Cypripedium candidum* h
g6 s2 *Paysonia lesqurii* riparian
g6 s4 *Perideridia americana~*
g6 s6 *Silphium pinnatifidum*

g7 s2 *Gentiana puberulenta*
g7 s4 *Pycnanthemum torreyi*
g7? s3 *Salvia urticifolia*

g8 s2 *Amianthium muscitoxicum* A
g8? s3 *Castilleja coccinea* a
g8 s3 *Lilium michiganense~* etc.
g8 s4 *Nabalus asper*
g8 s1 *Polytaenia nuttallii*

Neville Crawford at *Phlox pilosa* ssp. *deamii* site along Raile Road, southern Hopkins County.

Left: Phlox hybrids at Ohio State Univ. (OPGC) in Columbus. Right: *Phlox pilosa* ssp. *deamii*. From Peter Zale [https://plinthetal.files.wordpress.com/2015/03/phlox_villossissima.jpg]

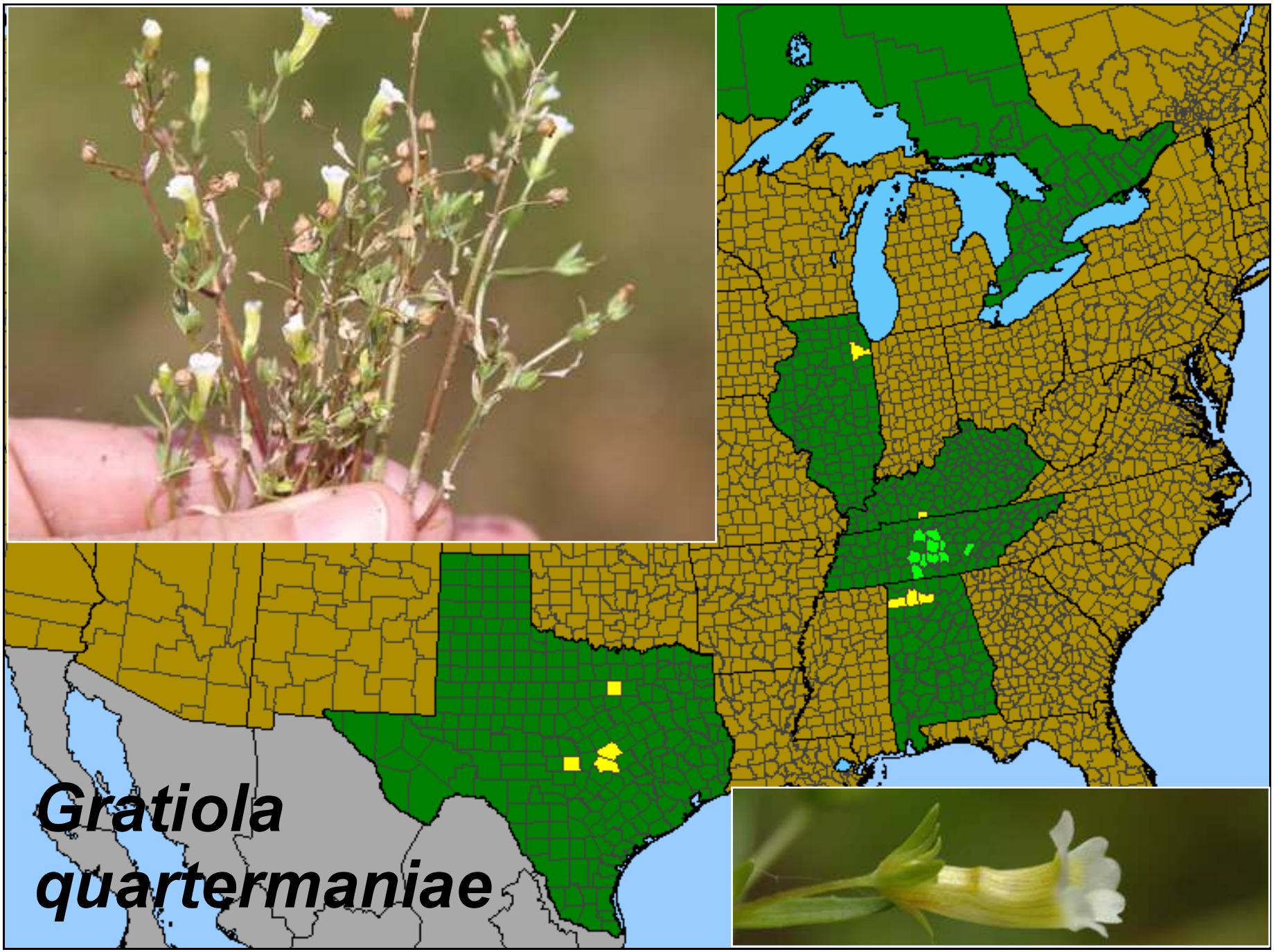

PHLOX PILOSA SSP. DEAMII:
SHAWNEE HILLS ENDEMIC
Solid purple dots: verified extant.
There are only two currently
known populations: in Christian
and Hopkins Counties of KY;
and in Spencer County of IN.
Open dots: old or obscure records.
Some of these are not yet verified,
and locations are estmated or
approximate in most cases.
OTP
COV
ITP
NME
NCR
CCT
Ecoregional Sections (grey)
and subsections (colors)
State Boundaries
Ecoregional Sections
Shawnee Hills
(central)
Shawnee Hills
(less rugged to plains)
Pottsville Escarpment
(more sandstone cliffs)
Dripping Springs and
other transitions
Karst Plains (and
scattered knobs)
Outer Karst Plain and
other transitions
Shawnee Hills
Lowlands
Ohio and Wabash
Bottomlands
N
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 Miles

Provisional lists of most imperiled hydric and xeric species (some "mesic" are transitional)

HYDRIC	XERIC [some are less imperiled]
g4? s1 *Gratiola quartermaniae*	g4 s2 *Physaria globosa* rocky roads
g4? s1 *Schoenoplectiella hallii*	g4? (IN, IL) *Penstemon deamii*
g7 s2 *Isoetes butleri*	g5? s4? *Symphyotrichum priceae*
	g6 s3 *Lobelia gattingeri*
g8? s3? *Lysimachia hybrida*	g6? s4 *Malvastrum hispidum*
g8 s1 *Physostegia intermedia*	g6 s2 *Phemeranthus calcaricum*
g9 s0 *Zizania palustris*	g7 s3 *Leavenworthia torulosa*
	g7? s3 *Onosmodium hispidissimum*
	g7 s4 *Symphyotrichum pratense*
	g9 s1 *Psoralidium tenuifolium*

==========

Gratiola: http://static.inaturalist.org/photos/2846519/medium.jpg?1451946052
http://www.cas.vanderbilt.edu/bioimages/g/wgrqu--flside0100-1x1e5273.jpg


Gratiola
quartermaniae

Targets at Species Level: Negative

Within mesic grassland maintained by burning or browsing or mowing, following are perhaps the worst invasive alien plants, needing micro-management, but can macromanagement help?

Lespedeza cuneata: but fire-grazing patches (Fuhlendorf+ 2004)?
Festuca arundinacea: but declines with repeated fire, esp. early spring?
Sorghum halepense: but spring burning and then grazing may reduce?
Phalaris arundinacea: but much may be native (Lavergne+ 2007)
Poa pratensis: but may be partly native (Jack White, 2016)

Within transitions to woodland, the following can become a problem instead.

Microstegium vimineum: but Sep fires may reduce (Flory+ 2009)
Arthraxon hispidus: esp. on sandy soils; but perhaps like *Microstegium*
Lonicera japonica: but burning or browsing effective, esp. fall/winter

Alien versus native distinction can be difficult

Some western species are often planted, but there is zero evidence of native status in KY.

Coreopsis lanceolata: lance-leaved coreopsis; first KY record 1941.
Helianthus maximiliani: Maximilian sunflower; first KY record 1956.

Distinction of some western species is difficult

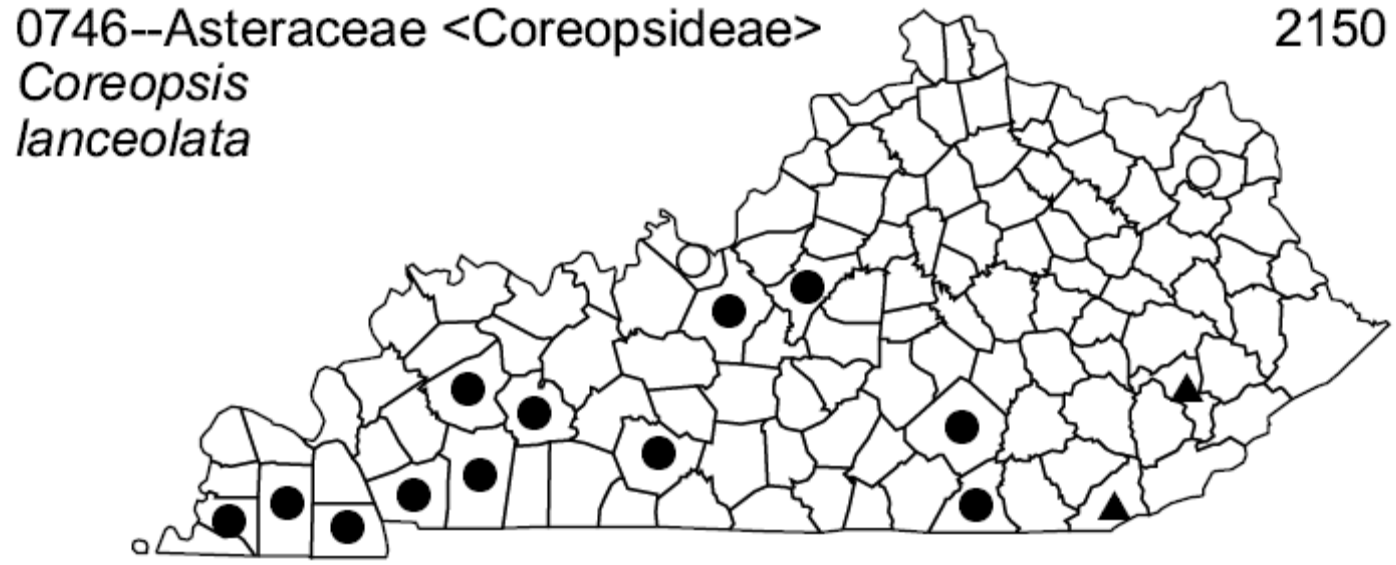
Penstemon digitalis (midwestern) vs, *P. alluviorum* (Ohio Valley+) etc.
Rudbeckia "hirta"—western race that may be distinct = *R. serotina*

Botanists have confused issues in other cases; the following species is not native to the region.

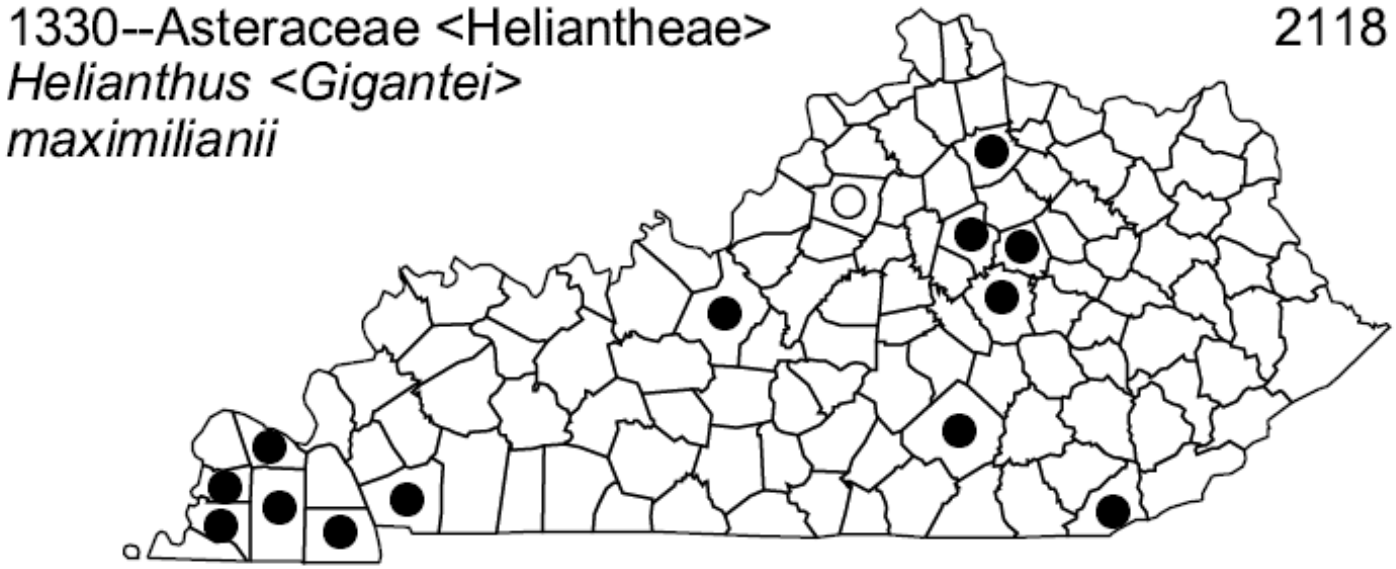
Baptisia alba var. *alba*: native instead to se Coastal Plain & Piedmont.
But *B. alba* var. *macrophylla* (= *B. leucophaea* or *B. lactea*) is clearly native, deserves propagation and targeted recovery.

Coreopsis lanceolata. This adventive was used much along recently widened US 68 in LBL. Also, it appears to have been sown along the trail at entrance to Mammoth Cave National Park. [http://pgtnaturegarden.org/2012/05/coreopsis-hillside/coreopsis-hillside_1409/]

Left: *Helianthis maximiliani* [http://www.kentucky.com/living/home-garden/article44444967.html]
Right: *H. grosseserratus* [http://www.illinoiswildflowers.info/prairie/photox/saw_snflower1.jpg]



1st 1941



1st 1956

Baptisia leucantha = *B. lactea* or *B. alba var. macrophylla*
http://wisflora.herbarium.wisc.edu/spec_images/photos/BAPALBvMAC_MRB11.jpg
Baptisia alba sensu stricto = *B. alba* var. *alba*
http://www.mtcubacenter.org/images/plant-trials/Baptisia_Waynes_World_5-24-13.jpg

How "native" do you want to be?

Several locally conservative species are now more widely planted, especially switch grass

Panicum virgatum, switch grass; appears to have been largely restricted to riverbanks before settlement, with no record from uplands in region; but now widely grown for general restoration, fuel, hay (if cut early).

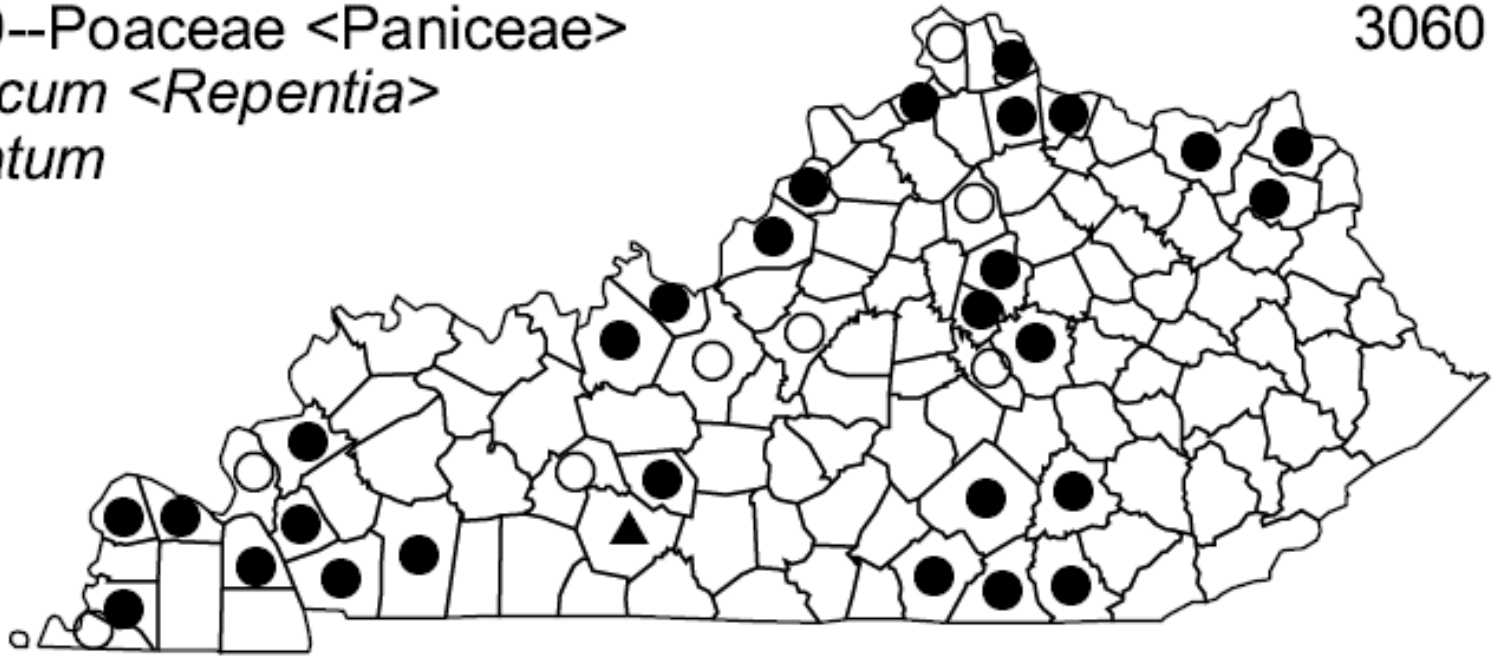
Tripsacum dactyloides, gama grass; appears to have been widespread in the Pennyrile and along some larger rivers in the Ohio Valley, but not in most of Kentucky; now widely grown for forage and other interests.

Baptisia spp., indigos; mostly uncommon to rare in this region, with native ranges and habitats that were not widespread. But some species are now widely grown in gardens and in claimed restoration projects.

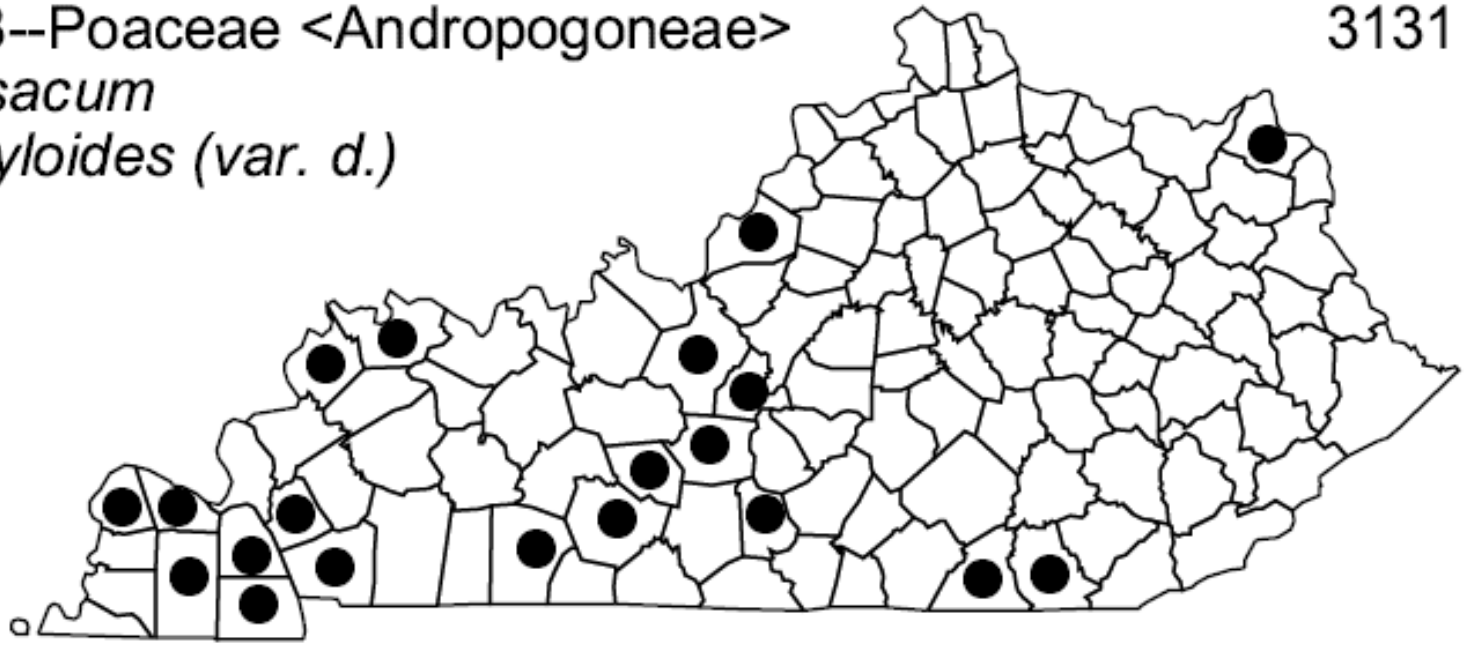
Dalea spp., prairie-clovers; also uncommon to rare, as above.

Liatris spp., blazing-stars; also uncommon to rare, as above. etc. etc.

1969--Poaceae <Paniceae> 3060
Panicum <Repentia>
virgatum



2928--Poaceae <Andropogoneae> 3131
Tripsacum
dactyloides (var. d.)



Baptisia australis var. *australis*: native to rocky river banks draining eastern mts. and hills.
IN: http://www.cavecountrycanoes.com/assets/510597648ad7ca2b510008b1/top_photo/bluffs_retina.jpg
AL: http://www.jimbotany.com/BAPAUAU1.JPG. TN: Mason Brock 2013 Jun 9. Next: *aberrans* Todd Co.

Tradeoffs: we need to negotiate a better balance of interests and build consensus.

It is important to address some issues for public lands, and how their management is funded.

- Focus on strict preserves versus restored sites
- Small remnants versus large degraded sites
- To harvest plant or animal material or not?
- Locally-versus-regionally native genetic pool
- Burning, browsing / grazing or mowing
- Burn season for convenience versus natural & allied insect issues; research in old fields?

And we should identify what we do not know that is most critical, with goals for research.

An issue that deserves much more research is the optimal season for burning or browsing or mowing. Today, early flowering is uncommon to rare in much mesic to hydric grassland; disturbance in summer-fall might allow more.

Antennaria spp. (was common)
Astranthium integrifolium (ditto)
Castilleja coccinea (ditto)
Fragaria virginiana (ditto)
Houstonia spp. (*pusilla* pastures)
Krigia spp.
Nothoscordium bivalve (WKU)
Oenothera fruticosa complex
Phlox pilosa complex (ditto)
Penstemon spp. (but herbicides)
Phacelia purshii (Mantle Rock)
Potentilla spp.
Trifolium reflexum (ditto)
Trillium recurvatum, T. pusillum?
Valerianella spp.
Viola spp., *Zizia* spp.

Fragaria virginiana—the wild strawberry—is locally common on moderately fertile, well-drained soil in native grasslands of eastern states. But it does not prosper without repeated mowing, grazing or trampling (with dung)—especially in summer-fall?—which reduces competition taller plants [photo from sierrapotomac.org/W_Needham/Strawberry_050710.htm].

Nothoscordium bivalve in SE Ohio [http://jimmccormac.blogspot.com/2011/04/false-garlic.html]

And what about more native summer annuals and biennials—spring disturbances increase?

See species list for "barrens" at: http://www.bluegrasswoodland.com/uploads/Big_Barrens_and_other_native_grassland.pdf

Ambrosia spp. (ragweeds)
Bidens spp.
Cirsium spp.
Cirsium carolinianum
Chamaecrista spp.
Descurainea pinnata s.l.
Gaura biennis s.l.

Hedeoma pulegioides (pennyroyal)
Iva annua
Triodanis spp.

versus alien annuals/biennials such as *Carduus, Centaurea,* *Papaver* (poppy), *Zinnia*, etc. etc.

Might we select or breed natives for roadsides? And perhaps for reduced effects of herbicides?

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Next Page: from Ken Mink in "Kentucky New Era" of 1999, Jul 9; published in Hopkinsville. https://news.google.com/newspapers?nid=266&dat=19990709&id=YvIrAAAAIBAJ&sjid=JgYGAAAAIBAJ&pg=2856,730115&hl=en

NEW ERA/Peter Wright

A pennyroyal plant in Hopkinsville, demonstrates its size.

Pennyrile area: do you know what it means?

Pennyroyal (*Hedeoma*)—increased after overgrazing in early settlement? Note *Perilla, Mosla*. First use as term for region of Kentucky dates from mid-19th Century?

[http://lh3.ggpht.com/XCxoFnSg3viqDYnRfIUzXNiaSoMLxBFtQXIZBel5tnTLfslA8I3gwNcNm6MfqOLtZ8R0tYnu1VGsQxBgDhKf=s1200]

END

The Pennyrile Region of KY & TN: New Hope for a Lost World?

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http://www.bluegrasswoodland.com/Shawnee_Hills_and_Plains.html

The "Pennyrile"—karst plain of western Kentucky and adjacent Tennessee—was largely covered with grassland and thin woodland before settlement, but over 99% has been converted to farmland. Most remnants are highly degraded and lack appropriate cycles of burning and browsing that used to maintain these habitats. Efforts to restore better remnants have been limited to a few sites, totaling less than 1000 acres. A much larger acreage has been planted with a few species of "native warm season grass", but usually adding little further diversity of native forbs or other plants. We still do not have an integrated program of restoration, which should include coordinated action at the three levels: landscape (protecting the better potential blocks), habitat (restoring the most degraded types with appropriate burning or browsing regimes), and species (recovering declined natives, reducing invasive aliens). The latter level tends to be neglected; we need more synthesis of information on the original condition, more organized propagation of species that have declined the most, and more concentration on better remnants or restoration with higher quality. Good botanical gardens would be very useful.

As in any regional program for conservation or restoration, success will depend on the following three fundamental principles.
1. Team-work is needed within regional sections of reasonable size. It would be useful to have more regular meetings within each of these sections: western, central, Green River & Nolin River / northeastern. All interested people should be invited to participate in such efforts.
2. Target-definition is needed with more clarity, for communication among professionals and for public education. Programs should have a good balance of effort at the three levels (as outlined above).
3. Trade-offs are needed in order to forge compromises for projects of satisfactory size. Success at larger scales will require deeper understanding of the ecological and economic issues involved in different burning or browsing regimes (including effects of different seasons). For extensive plantings, definitions of "native provenance" should be reasonably moderate. Where different approaches are controversial, we should frame useful questions for further research.

Following are most interesting areas; lead agencies in parentheses.
1. Land-Between-the-Lakes (USFS) is a more hilly area at western margin, with relatively little grassland before settlement but containing much woodland that should be restored to a more open condition.
2. Big Rivers area (KDFWR, KDF, TNC) has few good remnants but much newly acquired woodland and old fields for restoration.
3. Fort Campbell area (US Army) contains the most extensive remnants of grassland in the Ohio Valley, with much potential for restoration despite the priority given to military training.
4. Red River watershed (APSU USDA?) has highly degraded aquatic systems, but thus worthy of considerable action; grassland remnants are few, but with some opportunities for restoration of old fields.
5. Middle Green River watershed, with Mammoth Cave National Park (NPS, TNC, WKU); although subterranean and aquatic systems have been the focus of conservation, there are many small remnants of grassland, especially in transitional hills north of the karst plain.
6. Nolin River watershed (TNC?) includes some of the best remnants (Eastview Barrens) and these deserve much more attention; this is the home of Roundstone Native Seed Inc. (John & Randy Seymour).
7. Lapland Barrens (KDFWR?) is a more hilly area near the Ohio River, where several rocky glades could be expanded and restored, but extensive land-deals and agreements have been difficult.
8. Fort Knox area (US Army) is in peripheral hilly zone transitional to the Knobs region; history of military use has helped maintain some openings, and much more restoration is possible.

The following list adds small or isolated remnants of local interest.
a. Crittenden Springs Glade (TNC): small, rocky but high quality.
b. Putnam's Blue Lick: apparent remnant of old buffalo lick / road.
c. Highland Lick: large *Baptisia australis* population.
d. Russellville area (KSNPC): Russellville, Baker, Athey, etc.
e. Wright Spring Woods: unusual karst features, old woodland.
f. Petros-Browning Road: small remnant along road on deep soil.
g. Flat Rock-Woodburn area (KSNPC): rocky glades & woodland.
h. Baumberger Barrens (TNC): small glades; needs much more fire.
i. Knight's Barrens (TNC): small glades; extensive woods; needs fire
j. Corner's Glades (KSNPC?): several glades, caves, extensive woods
k. Clay Hill Memorial Forest (Campbellsville Univ.): small remnant
m. Sunset Barrens (TNC): small sandstone glade.

Literature Cited

Barker, Elihu. 1795. A Map of the State of Kentucky from Actual Survey. J. Debrett, Picadilly, London, England. Also printed in the 1797 edition of Imlay's "Topographical Description..."

Brewer, J.S., & W.J. Platt. 1994. Effects of fire season and herbivory on reproductive success in a clonal forb, *Pityopsis graminifolia*. Journal of Ecology 82: 665-675.

Brockway, D.G.,, & C.E. Lewis. 1997. Long-term effects of dormant-season prescribed fire on plant community diversity, structure and productivity in a longleaf pine wiregrass ecosystem. Forest Ecology and Management 96: 167-183.

Burton, J.A. 2013. Effects of prescribed fire on Mammoth Cave National Park's oak-hickory vegetation: a decade of fire monitoring. In: Mammoth Cave National Park's 10th Research Symposium.

Chester, E.W., & B.L. Palmer-Ball. 2011. Second county records for two Kentucky endangered species, *Echinodorus tenellus* (Alismataceae) and *Schoenoplectus hallii* (Cyperaceae). Phytoneuron 2011-43: 1–4.

Flory, S.L., & J. Lewis. 2009. Nonchemical methods for managing Japanese stiltgrass (*Microstegium vimineum*). Invasive Plant Science and Management 2: 301-308.

Frost, C., J.A. Burton & L. Scoggins. 2013. Fire Regimes, Buffalo and the Presettlement Landscape of Mammoth Cave National Park.

Fuhlendorf, S.D., & D.M. Engle. 2004. Application of the fire–grazing interaction to restore a shifting mosaic on tallgrass prairie. Journal of Applied Ecology 41: 604-614.

Glitzenstein, J.S., W.J. Platt & D.R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. Ecological Monographs 65:: 441-476.

Homoya, M.A., D.B. Abrell, J.R. Aldrich & T.W. Post. 1984. The natural regions of Indiana. Proceedings of the Indiana Academy of Science 94: 245-268.

Lavergne, S., & J. Molofsky. 2007. Increased genetic variation and evolutionary potential drive the success of an invasive grass. Proceedings of the National Academy of Sciences of the U.S.A. 104: 3883-3888.
Munsell, Dr. Luke. 1818. A Map of the State of Kentucky. From actual Survey. Also part of Indiana and Illinois, Compiled principally from Returns in the Surveyor General's Office by Luke Munsell. [Printed in Frankfort with a loan from the State of Kentucky.]
Olson, M.S., & W.J. Platt. 1995. Effects of habitat and growing season fires on resprouting of shrubs in longleaf pine savannas. Vegetatio 119: 101-118.
Platt, W.J. 1999. Chapter 2: Southeastern Pine Savannas. Pages 23-51 in: R.C. Anderson, J.S. Fralish & J.M. Baskin (eds), Savannas, Barrens, and Rock outcrop plant communities of North America. Cambridge University Press, New York.
Price, S.F. 1906-07. “Perusin’” the “Pennyrile” Country. American Botany 11: 76-81, 105-112.
Ray, J. A. 1997. Natural Vegetation Patterns of the Mammoth Cave Region as Maintained by Lightning Fires and Aboriginal Burning Prior to Settlement. Proceedings of the Sixth Annual Mammoth Cave Science Conference. Mammoth Cave, KY: USDOI, National Park Service.
Streng, D.R., J.S. Glitzenstein & W.J. Platt. 1993. Evaluating effects of season of burn in longleaf pine forests: a critical literature review and some results from an ongoing long-term study. Proceedings of the Tall Timbers Fire Ecology Conference 18: 227-263. Tall Timbers Research Station Tallahassee, Florida.
The Nature Conservancy [TNC]. 2002. The Interior Low Plateau Ecoregion: a Conservation Plan. [Details obscure but apparently produced by the Indiana Field Office, Indianapolis.] < https://www.conservationgateway.org/Documents/ILP%20plan.pdf>
White, John “Jack”. 2015. Historical ecology of Kentucky Bluegrass in the midwestern United States. Presentation at Natural Areas Conference, Oct 31.

MISCELLANEOUS EXTRA MATERIAL

Platt 1999

1993). Fire frequency increases during the spring (April–June) when intervals between successive rainfalls also are increasing; at these times, natural lightning-initiated fires that at least sometimes are of high intensity (Figure 2.3) burn large areas, especially in dry years (Komarek 1964, 1974; D. L. Taylor 1981; Huffman and Blanchard 1991; Snyder 1991; Gunderson and Snyder 1994). Summer fires occur more frequently than spring fires, but tend to burn smaller areas and appear usually to be of lower intensity (Huffman and Blanchard 1991; Glitzenstein, Platt and Streng 1995). In the fall, intervals between successive rainfalls increase, but the frequency of thunderstorms and lightning declines rapidly. As a result, natural lightning-initiated fires are uncommon in the fall and winter (Komarek 1964, 1974; Snyder 1991).

An Evolutionary Fire Ecology Model

Data from the effects of fire on plant populations and communities in southeastern savannas suggest a nonsuccessional scenario in which a "dependable" environment (Chapman 1932a) involving predictable fire regimes could result from high frequencies of lightning strikes at certain times of the year, combined with pyrogenic vegetation (Platt, Glitzenstein and Streng 1991; Glitzenstein, Platt and Streng 1995). The high frequencies of fires that occur most often around the onset of the lightning season in the spring could mold characteristics of the indigenous flora if such fire regimes occurred predictably over long intervals of time (Mutch 1970; Platt, Glitzenstein and Streng 1991; Glitzenstein, Platt and Streng 1995). These adaptations fall into three groups: resistance to fire, adaptation to environmental conditions produced by fires, and modification of fire regimes (Platt 1994).

Glitzenstein, Jeff S., William J. Platt, and Donna R. Streng. "Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas."*Ecological Monographs* 65, no. 4 (1995): 441-476.

Contrary to prior hypotheses, our results showed few systematic or predictable effects of season or frequency of burning on dynamics of longleaf pine. Instead, variability in the population dynamics of this species appeared to be related largely to variation in fire behavior, regardless of the season of burning.

Consistent with prior hypotheses, we found that deciduous oak species (*Quercus laevis, Q. margaretta,* and *Q. incana*) were least vulnerable to dormant-season burning and most vulnerable to burning early in the growing season. This was shown particularly by seasonal trends in the effect of burning on oak mortality (both topkill and complete kill) and, to a lesser extent, on oak recruitment. Oak densities and basal areas also declined in the spring-burned plots, resulting in a shift away from oaks and towards increased dominance by longleaf pine. Detrimental effects of spring burning on oaks were partly explained by fire behavior, but there appeared also to be an important residual effect of burning season, particularly on complete kill.

http://thevasculum.blogspot.com/

The Vasculum: The Official Blog of the Institute of Botanical Training [Justin Thomas]
Thursday, January 28, 2016

Fall Fire for Effective Management: Is There a Seasonal Affective Disorder in Prescribed Fire?
Over the years, I have noticed several intriguing responses in natural communities to seasonal variations in prescribed fire. I've discussed this issue with many folks, have initiated several interesting, though largely unsatisfying, email strings on the subject and wrote an essay on the subject in a recent Missouri Natural Areas Newsletter. Through this process, I have found that the increasing utilization of spring burning, as opposed to the more historically relevant application of autumnal anthropogenic burning, is primarily driven by convenience rather than ecological soundness. And, that the assumptions underlying the prescription of spring fire (that either spring fire is harmless or that it is at least better than no fire at all) are potentially more wishful than accurate. Having observed significant losses in plant diversity and subsequent increases in weedy shrubs like sumac and blackberries in areas where spring fire has reigned supreme, my concern has only grown. Steve Buback (Natural History Biologist for the Missouri Department of Conservation), sharing my concerns, suggested we investigate the matter via a summary of the pertinent literature on the subject and present the summary at the Missouri Natural Resource Conference. So, that is what we are doing. On Friday, February 5, 2016 Steve Buback and I will be presenting a talk on the effects of spring and summer prescribed fire compared to fall and winter prescribed fire.

Email June 4th, 2016; from John M. Briggs, Professor of Biology, Director of Konza Prairie Biological Station, Kansas State University [responding to comments at The Vasculum].

Due to confidentiality, I do not discuss personal issues. However, I will let you know that Konza Prairie Biological Station (KPBS) is still conducting the season of year experiments and we have no intention of stopping them (and we are partially supported by the College of Agriculture at KSU). In addition, the data collected from them are available to everyone through the Long Term Ecological Program (as are other data sets that they collect) that has been in place on KPBS since 1980 (http://www.konza.ksu.edu/knz/pages/home/home.aspx). KPBS is constantly hosting individuals from across the State (and country) who are interested in seeing the long-term consequences of burning at different times of the years. Many of these individuals are associated with the College of Agriculture at K-State. In addition, I along with other scientists from the K-State College of Agriculture and Oklahoma State University were speakers at a fall burning working shop that was held at the Tallgrass National Preserve last year. At this meeting, ranchers, K-State extension agents, Federal, State and private land managers learned about the impacts of seasonal burning. Thus, I am not sure how anyone could think that KSU (especially the College of Agriculture) would not allow data to be published on season of fire impacts.

I hope this helps and since the last paper was published, no surprising visible results (we have not worked up the data) are evident. Let me know if you have any more questions and good luck with your review of impact of seasonal burns.

Price 1906-1907; extracts only here
[Bowling Green was the “Seat of Science” as early as 1818, on Munsell’s map.]

It is this love of Nature that one must have to endure the discomforts of an excursion through the "ridge country" of southern Kentucky. The State is divided into four parts, known in local parlance, as the bluegrass and the bear-grass countries, the "penny-rile" and the Purchase. Though the people of the blue grass" may speak disdainfully of the rugged hills and knobs of southern Kentucky,—the "penny-rile",—yet it has a charm and interest for the botanist and the lover of Nature that more cultivated farm lands and level stretches of even the beautifuul blue-grass, cannot give...

With "a comrade neither glum nor merry" I made a botanical collecting tour through this country some years ago, seeing much of its caves and cliffs, and its quaint people,—a type by the way, quite as interesting as their much-writtenabout brothers of the east Kentucky and Tennessee mountains....

A feeling of sadness came over us as we watched our driver turn the horses homeward and we were left in the wilderness, may miles from a railway. Checking, however, any thoughts of the flesh pots we immediately started on a collecting tramp—a sure cure for any of the worries of life—and were soon absorbed in its pleasures. We were prepared to rough it. so were not surprised that our room was of unplaned and unsealed boards. A weed grew up through the floor, a foot or more above the boards. There was no fastening on the door; a chair with the water-bucket on it answered as a bolt at night. The people there were all hospitable and treated us well, but were primitive and quaint in habits and in speech. The members of the dialect society would be pleased at the many obsolete words heard here, many that may be traced to

old English and Scotch words. An old woman was "sorry she did not have time to peruse these hills" with us. A thicket of either cane or other under-brush is called a "harricane," this originally meaning a place where a hurricane had once passed...

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"PERUSIN"' THE "PENNYRILE" COUNTRY. BY SADIE F. PRICE (Concluded).

OUR NEXT drive of twenty miles brought us to a little village among the knobs, a village of perhaps a dozen houses. Unfortunately the day of our journey was a rainy one; but the impulse to dash out into the mud and rain when some especially interesting plant was seen, could not be resisted. The beautiful yellow-fringed orchis, a plant not before found in this State, we gathered in this way. It had ceased raining when we reached the town, and as we drove up to a house on a hill, where we had heard we could obtain good board, we were the cynosure of all eyes. Before night it was known to all the town that "a woman that's huntin' weeds," was among them...

The forests here are a generation older than those in adjoining countries, and the trees much larger. The country has evidently been burned over at an earlier date than other parts of "the barrens. "But the county is fast being denuded of these large trees. Many companies, each employing two and three-hundred men, are at work in different parts of the county, cutting trees for cross-ties. Many lordly chestnut and other oaks, have been felled, and still the work goes on. The deep gulches cut by these two streams, Nolin and Bear Creeks, considerably modify the climate. In the gulches, at least, and between the ridges of sandstone and conglomerate, the extremes of heat and cold are greatly reduced; but when the country is laid bare of its trees there is likely to be a greater climatic change, as well as the disappearance of many plants now found there...

THREE AGES OF CONSERVATION?

1900-1940! MASSIVE FEDERAL COMMITMENT (NPS, USFS, USDA...)

"Conservation of natural resources is the fundamental problem. Unless we solve that problem, it will avail us little to solve all others."

Theodore Roosevelt, Address to the Deep Waterway Convention in Memphis; October 4, 1907.

1960-2000! EXPANSION OF LAW AND SCIENCE (End Spp Act, EPA, NEPA...)

"Nothing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed. It is a many-faceted treasure, of value to scholars, scientists, and nature lovers alike, and it forms a vital part of the heritage we all share as Americans."

Richard Nixon, Statement on Signing the Endangered Species Act; December 28, 1973.

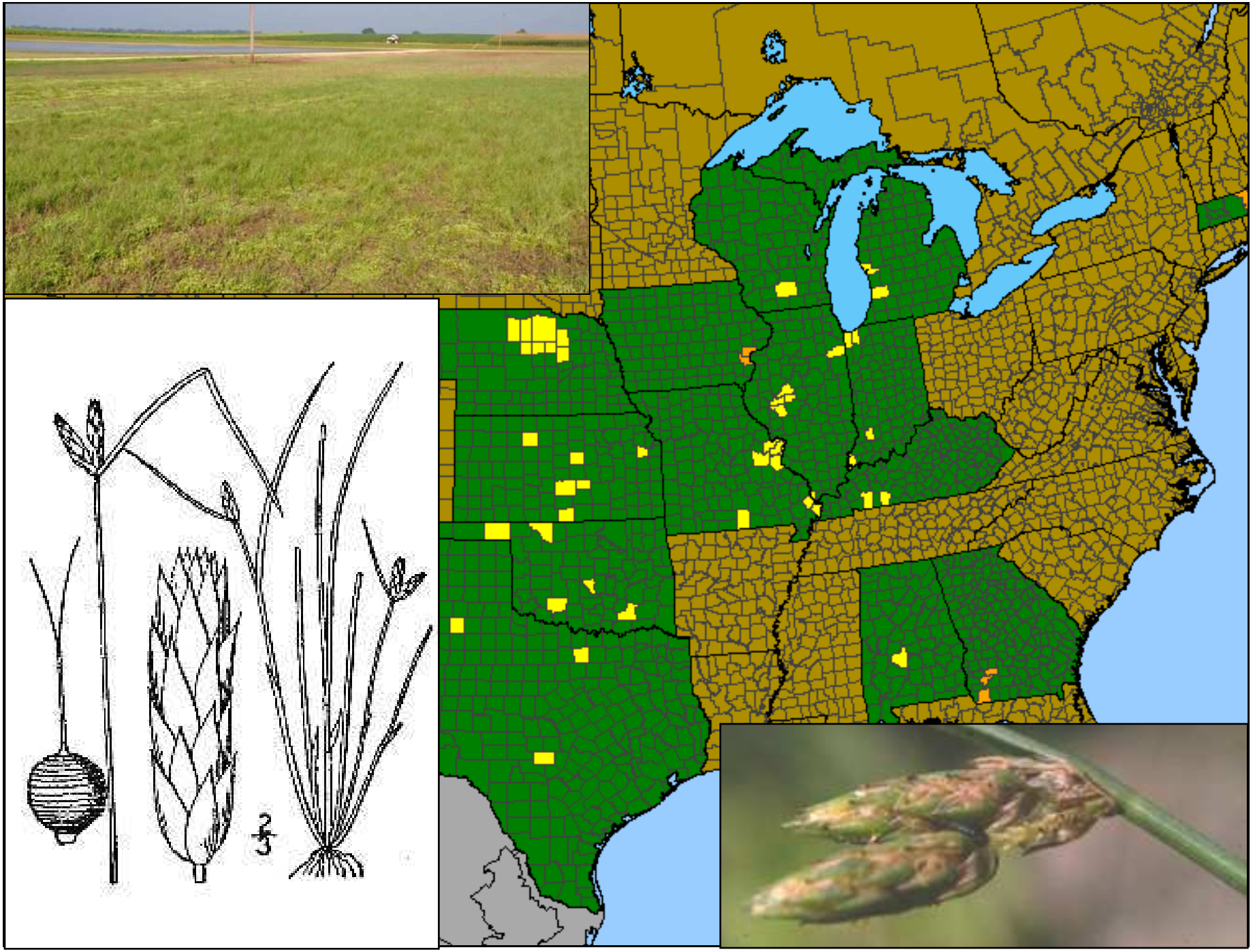
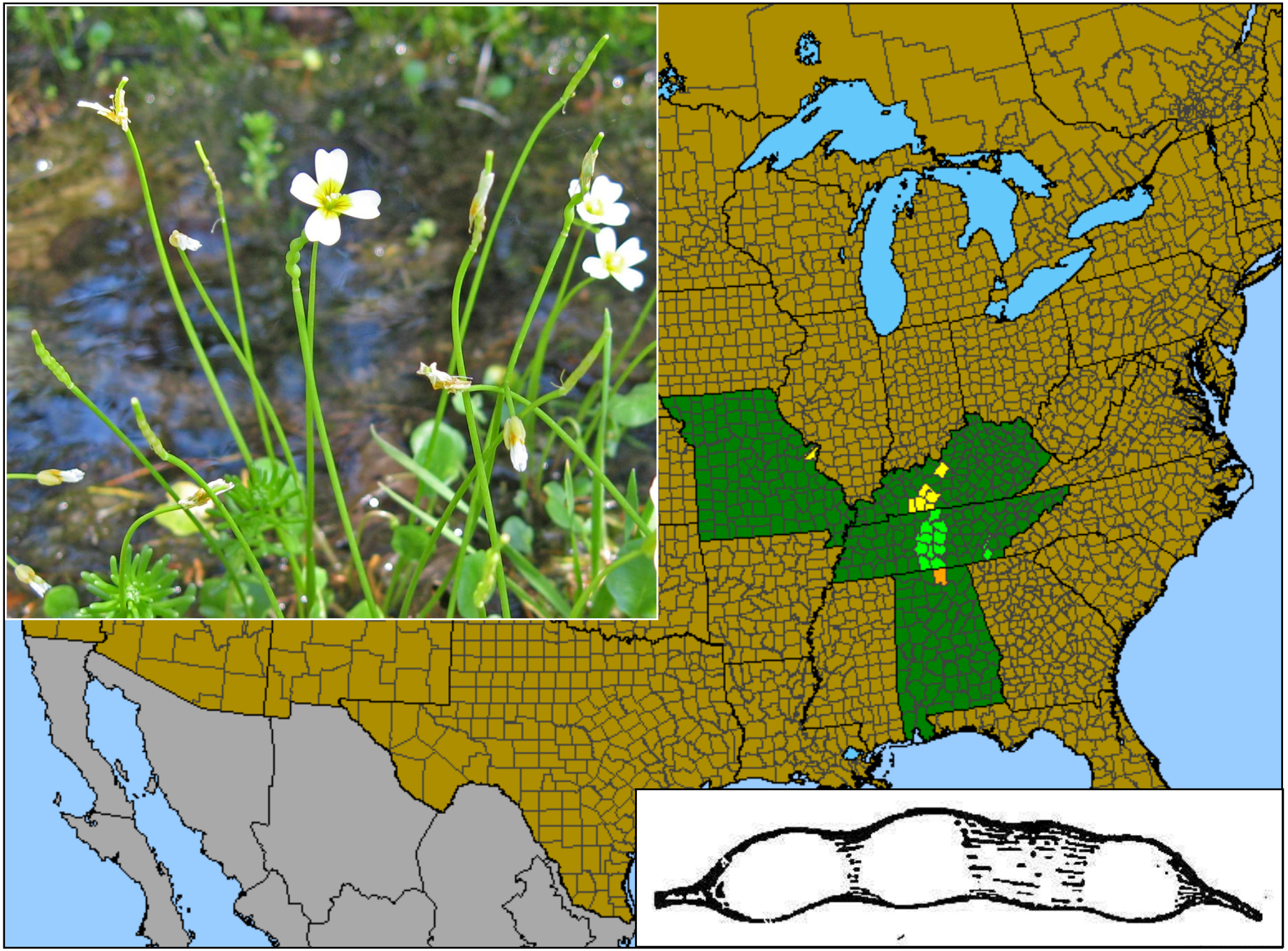
2020-2060? BUILDING CONSENSUS IN COMMUNITIES: REGIONAL, LOCAL...

"This is magnificent land. And we have to be great stewards of this land. And the hunters do such a great job—I mean, the hunters and the fishermen and all of the different people that use that land... This is going to be a beautiful and loving country..."

Donald Trump, Field and Stream; January 21, 2016... etc...

At the end of the second age, we now have an excessive diversity of professional divisions and public ideologies, often lacking clear support for local efforts.

We need a third age of conservation, centered on a rediscovered sense of human ecological community, deeper academic work in these matters, and broader building of consensus.

Schoenoplectiella halli: second site found near Mosely Pond in Logan Co., Ky. (Chester & Palmer-Ball 2011). This small rare midwestern bulrush lives in ephemeral ponds, with seed often lying dormant for several years [inset from mnfi.anr.msu.edu/element-images/2591.jpg].

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