Outline of Targets for Conservation in the Central Bluegrass Region of Kentucky

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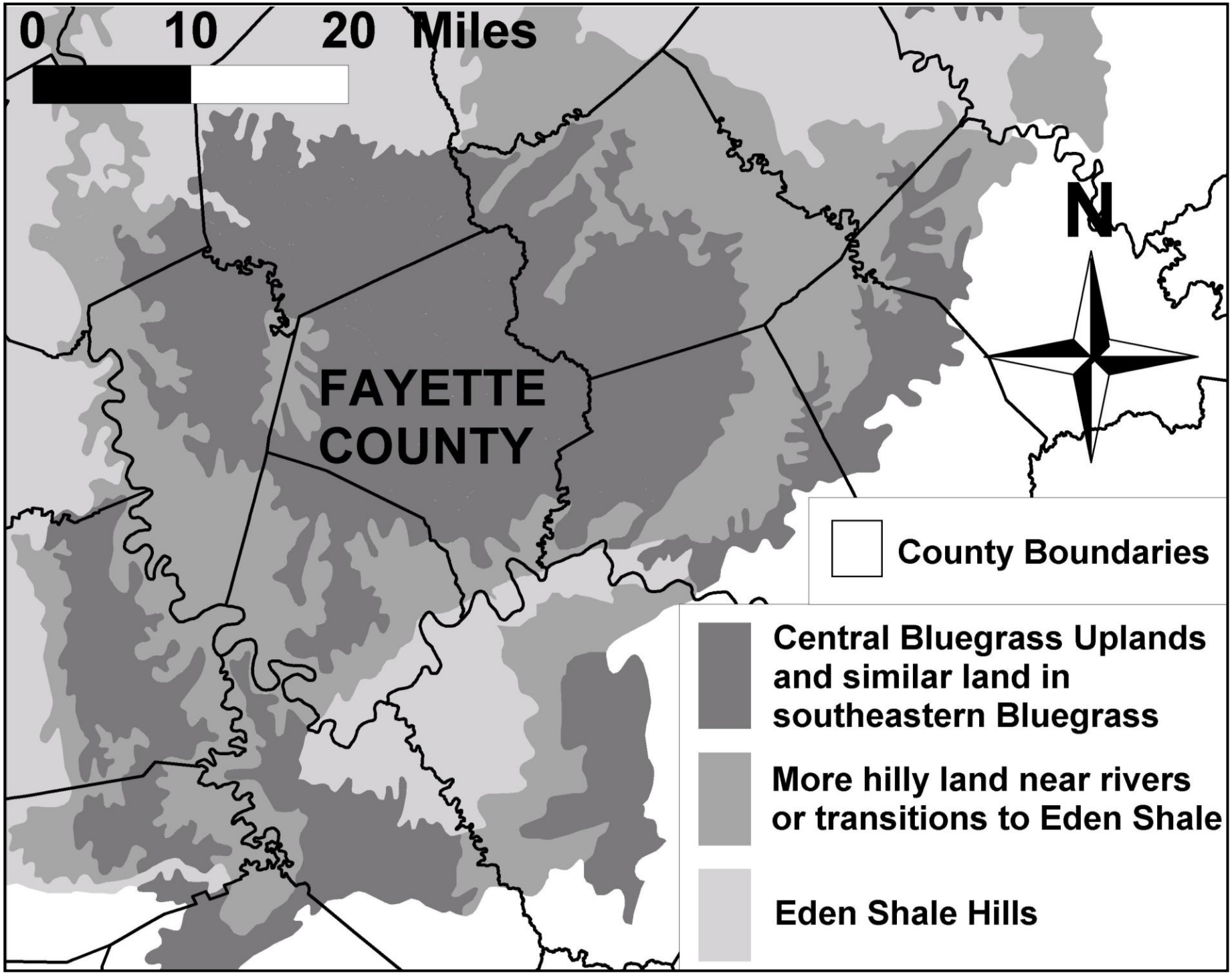
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N
FAYETTE COUNTY
County Boundaries
Central Bluegrass Uplands and similar land in southeastern Bluegrass
More hilly land near rivers or transitions to Eden Shale
Eden Shale Hills

SUMMARY: Conservation Targets in Central Bluegrass Region. These notes are based on a fundamental logic in conservation. **First**, define the larger blocks of wilder land and watersheds that best represent the region, and that form priorities for legal protection. S**econd**, define the best remnants of habitat types that need special attention for restoration and future management (more than just legal protection of land); some of these are disjunct from the larger blocks. **Third**, define the groups of species that deserve special assistance through micro-management in situ, propagation or other recovery (more than just protection of land and restoration of habitat).

A. Landscape Level: the following extensive corridors or large blocks of land provide concentrated opportunities for conservation of our distinct landscapes and watersheds.

A1. South Fork Licking River watershed. The primary focus is aquatic, since this is a free-flowing system, but it is highly degraded due to siltation and eutrophication from farming or other disturbances. The main stem of Licking River has better quality in general, with some rare mussels still present, and it is anticipated that a program of improvements along the South Fork will lead to recovery of rare species here after many years. Some sections of the river corridor contain forest of moderate natural quality. A few additional areas on the uplands have special significance as remnants of the original woodland, especially Griffith Woods. Over the long-term, it is conceivable that protection of farmland and associated woodland could connect wilder areas through designed corridors.

A2. Kentucky River Palisades and adjacent tributaries (especially from Boonesboro to Frankfort). The primary focus is terrestrial, since there are extensive wooded corridors along ravines of the river and its tributaries. The river's natural qualities became highly degraded when dams were put in during the 19th century; but the potential for one or more dams to be removed should be envisioned for future centuries. Some of the tributary watersheds have potential for focus on improvements in aquatic ecology, stream corridors and terrestrial features. These include Elkhorn Creek (draining Lexington area), Benson Creek (draining hills to the east of Frankfort), Jessamine Creek (draining Nicholasville area), Boone Creek, and Muddy Creek (draining Richmond area and linked to Bluegrass Army Depot).

B. Habitat Level: although classification of habitats can become complex, we need relatively simple goals for action, as follows.

B1. Sensitive watershed sections with special significance.
(a) Karst: especially caves used by bats or other rare animal species.
(b) Wetlands & ponds: restoration is needed in the few real remnants.
(c) Better riffles in free-flowing streams: see notes on streams above.

B2. Oak-hickory extension from river bluffs to fields. This broadly defined forest type used to prevail on drier uplands, especially in more hilly areas, but most has been converted to farmland. Active management should include browsing or burning to maintain local open character and reduce alien invasion; plantings are also needed.

B3. Submesic upland woods: these broadly defined types used to prevail on deeper upland soils, now largely cleared. Excluded here are woods along ravines that can persist with less special attention.
(a) Deeper woods dominated by sugar maple and bitternut hickory.
(b) Intermediate woods with walnut, buckeye, ashes, elms, oaks, etc.
(c) More open woods with regeneration of bur oak, locusts, cane etc.
In (c) it is likely that intense seasonal browsing by large herbivores was a major factor maintaining trails and glades before human use.

C. Species Level: Natives. Provisional priorities are as follows.

C1. Selected aquatics: mussels, fishes & plants that have disappeared.

C2. Most bats: now threatened with white-nose-syndrome.

C3. Simulation of wild ungulates: without bison and elk, can we manage deer or livestock to replace effects in woodland?

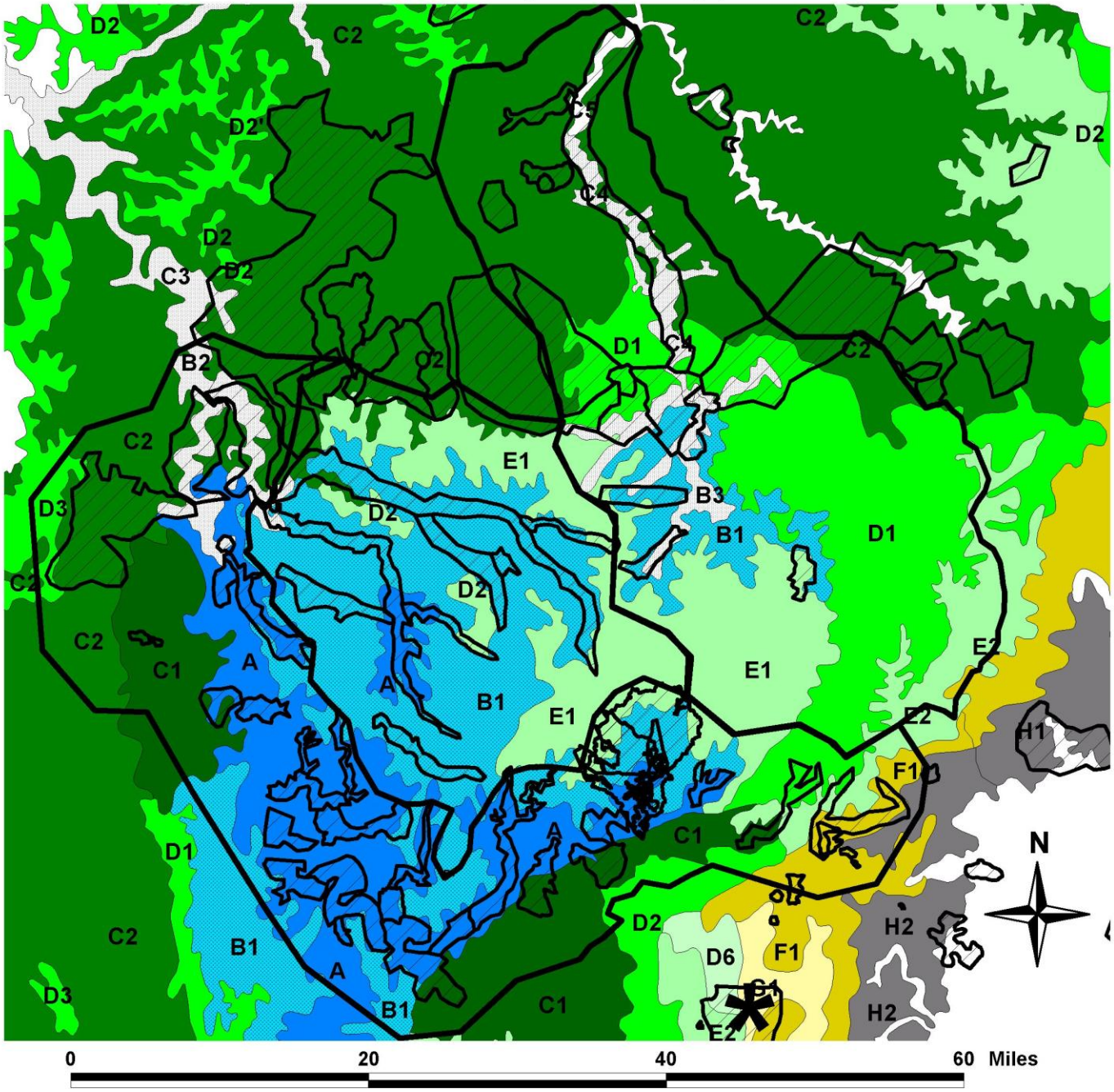
C4. Plants of drier woods or glades: bladder-pod, gromwell, mallow.

C5. Plants of submesic uplands: hyacinth, buffalo clovers, cane, etc.

C6. Trees with acute pests or pathogens: ashes, butternut, elms, etc.

D. Species Level: Aliens. Appropriate management of habitats can sometimes reduce these, but more focussed reduction is often needed.
Herbs: garlic mustard, chickweed, stiltgrass, gill-over-the-ground etc.
Vines: especially winter creeper; also Japanese honeysuckle etc.
Shrubs: bush honeysuckles, privets, burning bush, multiflora rose etc.
Trees: callery pear, white mulberry, tree-of-heaven (few others).

Central Bluegrass Region (Kentucky River Palisades, Elkhorn Plain, South Fork of Licking River): Land Type Associations



Palisades and Elkhorn area (to SW)
South Fork of Licking (to NE)

Focal Areas for Conservation

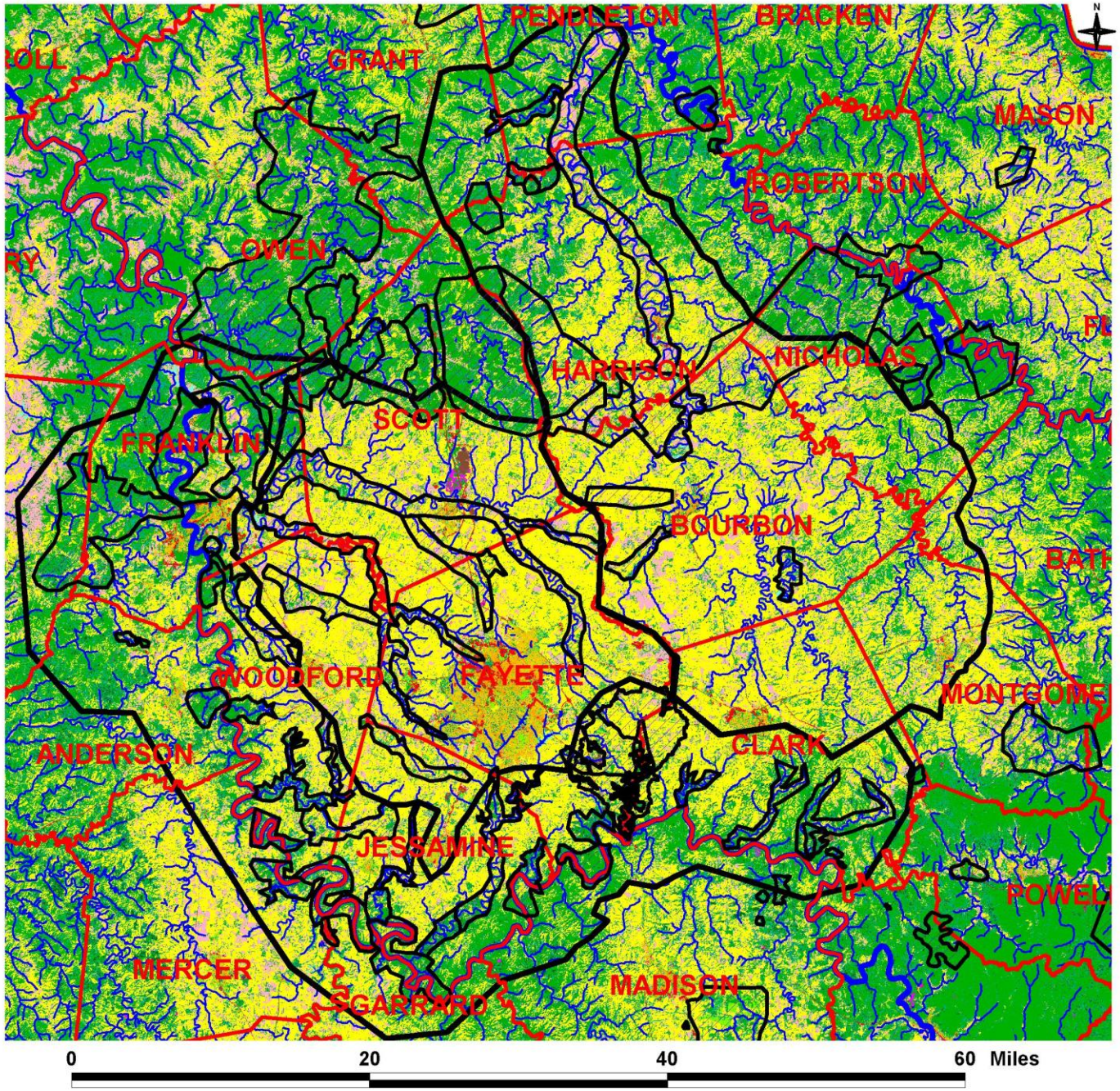
Land Type Associations

- A. Inner Bluegrass Ravines
- B1. Inner Bluegrass Plains
- B2. Inner Bluegrass Valleys (Elkhorn)
- B3. Inner Bluegrass Valleys (Licking)
- C1. Garrard Siltstone Hills
- C2. Eden Shale Hills
- C3. Lower Kentucky Valley
- C4. Lower Licking Valley
- D1. E Bluegrass-Eden Shale Hills
- D2. Eastern Bluegrass Hills
- D3. Western Bluegrass Hills
- D6. E Bluegrass-Damp Flats Transition
- E1. East-central Bluegrass Plain
- E2. Eastern Bluegrass Plains
- F1. Dolomitic Foothills
- G1. Eastern Foothill Flats
- H1. Black shale-siltstone Knobs
- H2. Black shale-dolomite Knobs

The Palisades Area is the broad zone along the Kentucky River. The Elkhorn Plains lie on the north and east side of the Palisades. The Palisades are mapped here with adjacent hilly land that have long-term potential for wilder conditions, native flora and fauna. Most land is currently farmed or residential, but there is increasing interest in further conservation around the farms and sudivisions.

The Blue Grass Army Depot, to the southeast (with asterisk) has potential for addition to the overall planning for the Central Bluegrass.

Central Bluegrass Region (Kentucky River Palisades, Elkhorn Plain, South Fork of Licking River): Landuses, Counties and Streams



County Boundaries

Palisades and Elkhorn (to SW)
South Fork of Licking (to NE)

Focal areas for conservation

Focal areas for conservation include stream corridors and watershed units (such as Boone Creek and parts of Benson Creek) where there is potential for a coordinated effort to improve the general environmental quality, in addition to strict protection and restoration of woodland. See individual site plans for details of exactly what lands are most appropriate for conservation of native vegetation and wildlife.

Color code for land uses:
blue = creeks/rivers/lakes
green = woodland
yellow = grassland
pink = cropland
orange/red = urban/suburban
brown/purple = industrial or other intensive uses

A. LANDSCAPE LEVEL. The Central Bluegrass is defined here in somewhat flexible terms as the Inner Bluegrass plus adjacent sections of the Eden Shale Hills, especially where there are gradual transitions in soils and native vegetation (1). The attached map shows landtypes based on soil classification of NRCS. The following extensive corridors or large blocks of land provide concentrated opportunities for conservation of our distinct landscapes and watersheds.

A1. South Fork Licking River watershed. The primary focus is aquatic, since this is a free-flowing system, but it is highly degraded due to siltation and eutrophication from farming and other disturbances (2). The main stem of Licking River has better quality in general, with some rare mussels still present, and it is anticipated that a program of improvements along the South Fork will lead to recovery of rare species here after many years. TNC implemented a EPA-funded program of riparian restoration along Townsend Creek during 2005-2015, and some improvement in water quality was claimed (3). A similar program has begun along Strodes Creek (draining Winchester), but results are not yet thoroughly reported (4).

Some sections of the river corridor contain forest of relatively high quality. TNC has secured conservation easements for several tracts (5). Some additional areas on the uplands have special significance as remnants of the original woodland, especially Griffith Woods. TNC acquired the 745 acre farm with Griffith Woods but abandoned plans to develop a plan for restoration with the University of Kentucky, and all of the land has been resold to Ky. Dept. of Fish and Wildlife, who are now developing a plan (6). This farm provides our best opportunity to restore somethng like the original woodland, containing many ancient trees, areas of unplowed land with native wildflowers, and a few rare species (formerly including running buffalo clover).

Over the long-term, protection of farmland and woodland patches on uplands could connect wilder areas in designed corridors. For example, it might be reasonable to promote a corridor centered on Griffith Woods, connecting protected land with forest blocks in hills to the west, and with the riparian zone along South Fork of Licking to the east (see map). During recent decades, government-funded programs that could be applied to such goals included the PACE program (7) and the Grassland Reserve Program of USDA (8).

A2. Kentucky River Palisades and adjacent tributaries (especially from Boonesboro to Frankfort). The primary focus is terrestrial, since there are extensive wooded corridors along ravines of the river and its tributaries (9). Although covering only 5-10% of the region, these corridors contain over 80% of extant records for listed rare species. The river's natural qualities became highly degraded when dams were constructed during the 19th century. Several aquatic species (especially mussels, fishes and plants) are known to have disappeared from the river after damming. The potential for one or more dams to be removed should be envisioned for future centuries.

During the 1990s, TNC expanded their program to protect land in the central Palisades section between Camp Nelson and Shaker Village. Rare species tend to be concentrated in this section (10). However, TNC resold their land along Jessamine Creek Gorge to the county government; that ravine is the most interesting and spectacular area within the Palisades (11). TNC has sought to coordinate conservation among partners along the Palisades, but there is no regular meeting with all obvious stakeholders (government agencies, non-profits, knowledgeable biologists, recreational managers, relevant schools and colleges). As a result, some management issues have not received enough mutual discussion among interested people. For example, there is often disagreement about where and how to maintain open fields adjacent to forested slopes; and methods to reduce alien plants have been implemented at few sites (esp. 12).

Some of the tributary watersheds have potential for focus on improvements in their aquatic ecology as well as terrestrial features. In addition to Jessamine Creek (draining the Nicholasville area), these include Benson Creek (draining peripheral hills to the east of Frankfort), Elkhorn Creek (draining the Lexington area), Boone Creek (between Lexington and Winchester), and Muddy Creek (draining the Richmond), potentially linking with the Bluegrass Army Depot. Programs have been initiated in some cases, with some progress, but these have been generally limited or even abandoned due to lack of funding or leadership (13-18). For example, Friends of Jessamine Creek focussed on improvements to sewage treatment from Nicholasville and Wilmore during the 1980s, but then disbanded. In contrast, one of the most active current local efforts is led by Friends of Wolf Run, a urban tributary of Elkhorn Creek (18).

A1. South Fork of Licking River, upstream of Falmouth with large gravel bars and riffles, where more rare mussels occurred before farming [http://outpostusa.org/Littlesouthfork.html].

A1 headwaters. Typical pastured scene along Townsend Creek, a tributary to South Fork of Licking River; riparian restoration is underway [from 2011 report at water.ky.gov/TDML/].

A2. High Bridge, along central Palisades section of Kentucky River; much forest remains but many aquatic species are gone due to impoundments [http://www.kentuckyriverblueway.com].

A2 headwaters. Ken Cooke (right), the main organizer for Friends of Wolf Run, Lexington, Fayette County; this focussed group has accomplished much in just 10 years [kentucky.com].

B. HABITAT LEVEL: although classification of habitats can become complex (19), we need relatively simple outlines for broadly defined habitat types, in order to indicate goals for action as follows.

B1. Sensitive watershed sections with special significance. General programs to protect watersheds often deserve fine-tuning to focus on some quite local features that can become highly disturbed.

(a) Karst: especially caves used by bats or other rare animal species. In addition to some important caves along the larger rivers and streams (A1, A2), there are scattered caves and sinking creeks elsewhere, some of which are associated with rare species (20). Few of these sites have been protected (e.g. single caves in Harrison and Madison Cos.). In Fayette Co., a sinking system of Cave Run almost became highly altered by a foolish stream-engineering project (21).

(b) Natural ponds and wetlands. There are few remnants, mostly degraded, and restoration is needed. These deserve much more attention (22). They were probably significant for wallowing of large herbivores before settlement. An initial probe of sediment at Duncannon Pond (Madison Co.) revealed spruce pollen, probably over 8000 years old (23); that pond is perhaps the only one protected.

(c) Better riffles in free-flowing streams: see notes on streams above. Although rare mussels are generally absent, the larger tributaries of do have significant riffles in some areas. Special protection from farming, roads or other disturbance is sometimes needed. In addition to aquatic features, several rare plants can be expected along shores.

B2. Oak-hickory extension from river bluffs to fields. This broadly defined forest type used to prevail on drier uplands, especially in more hilly areas, but most has been converted to farmland (24). Common trees used to include white oak (locally dominant), black oak, shagbark hickory, pignut hickory and others. In a few areas, disturbance from browsing or burning appears to have maintained more open areas with post oak, shingle oak, prickly pear and other unusual plants. The best remnants of this vegetation along the Palisades have not yet been protected; these include Scotts Grove (Jessamine Co.). Active management should involve browsing or burning to maintain some open character and reduce alien invasion (see D). Also, replanting of several native plant species is desirable.

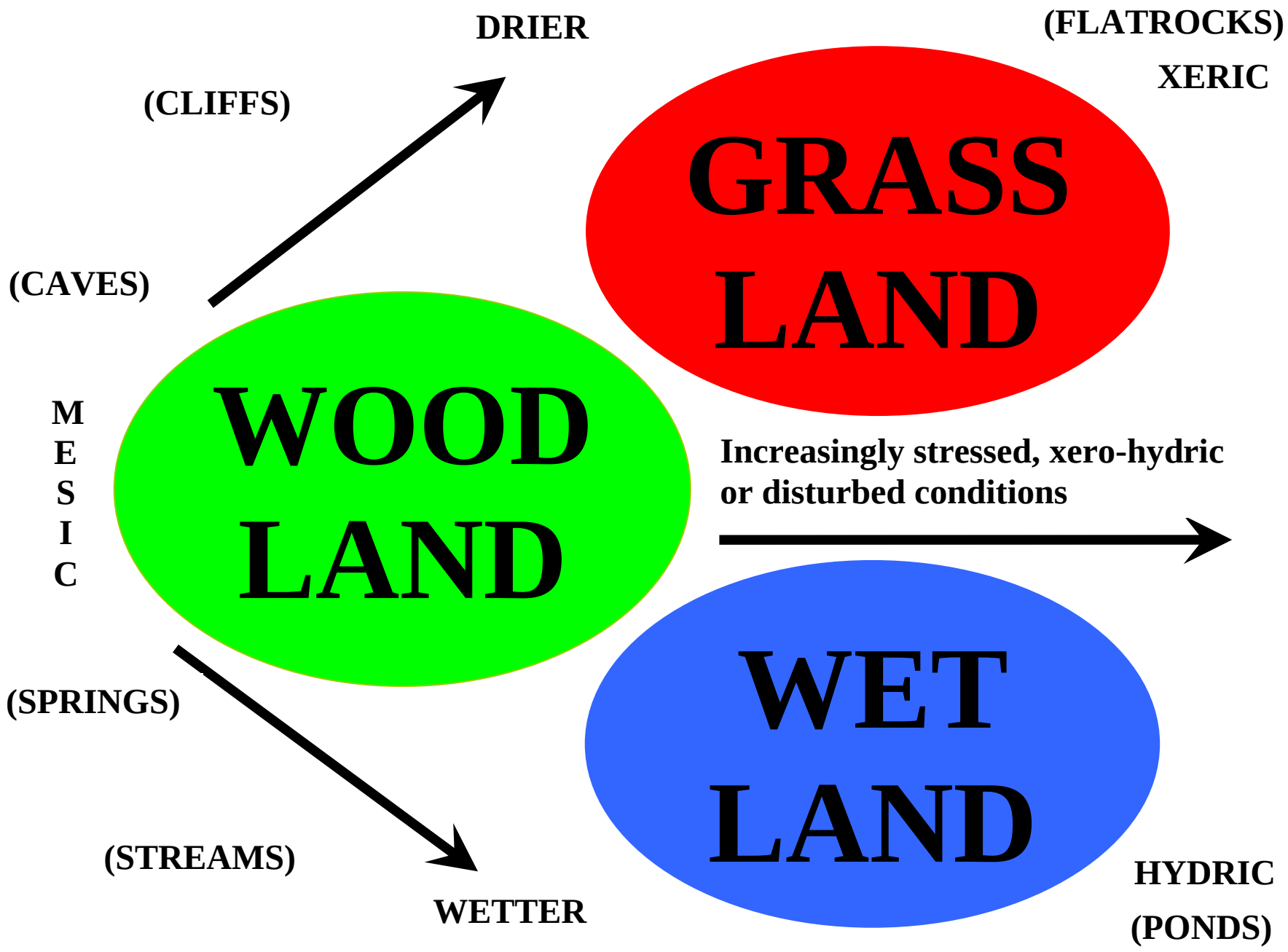
B3. Bluegrass Woodland: three types, broadly defined below, once covered deeper upland soils, but now are largely cleared. Excluded here are woods along ravines that can persist with less special attention. Restoration will require careful experimentation with disturbance regimes (including seasonal aspects), and with designed replantings of diverse species. Initial efforts at Griffith Woods have lacked institutional support, and plans for KSNPC's "Julian Savanna" project remain uncertain. The UK Arboretum offers a smaller venue, connectable to regular classwork with students (25). The Blue Grass Army Depot could also play a role. Vera's (2000) hypothesis provides an initial approach to understanding the ecology of such vegetation (26), but conservationists in the region have not been able to meet regularly, share information and develop these concepts (27).

(a) Deeper woods dominated by sugar maple and bitternut hickory. This vegetation used to cover 20-40% of the region, including less disturbed areas on the broad upland plains. Although shady during the summer, disturbance from herbivores was probably significant, especially during the winter, reducing spread from ravines of palatable species such as basswood. Although many small patches occur in woodlots and fencerows, few remnants on the uplands exceed 10 acres, and the understory is usually gone.

(b) Intermediate woods with walnut, buckeye, ashes, elms, oaks, etc. This varied vegetation used to cover 50-70%, including less browsed phases (typified by ashes and elms) and more browsed phases (typified by buckeye and coffee tree). Degraded remnants of these woods are widespread in the region, but the shrub layer and herb layer generally lack most of the native species that used to occur.

(c) More open woods with regeneration of bur oak, locusts, cane etc. The original condition of this vegetation, and the factors that maintained it, remain somewhat uncertain. There had probably been regular intense browsing by larger herbivores, followed during recent millenia by increasing human influence (with local cutting and burning). Paths through the woods appear to have connected glades where animals congregated and humans later camped. When Virginians settled the region, such vegetation covered up to 10% of the landscape, but there was much intermixing with 'internediate' and 'deeper' woods. [For original descriptions of a, b & c see 27 and 28.]

SIMPLEST HABITAT CLASSIFICATION (emphasizing terrestrial vegetation)



HABITAT CLASSIFICATION ADOPTED HERE

DRIER

B2. Oak-Hickory Woods and transitions (on more acid soils)

Less imperiled: Dry/disturbed Red-cedar Woods and rocky glades

Less imperiled: Maples or associates on steeper slopes and along riparian corridors

Less imperiled: Oak-Ash Woods on steeper slopes

B3b/c. Blue-grass Wood-land: more open phases

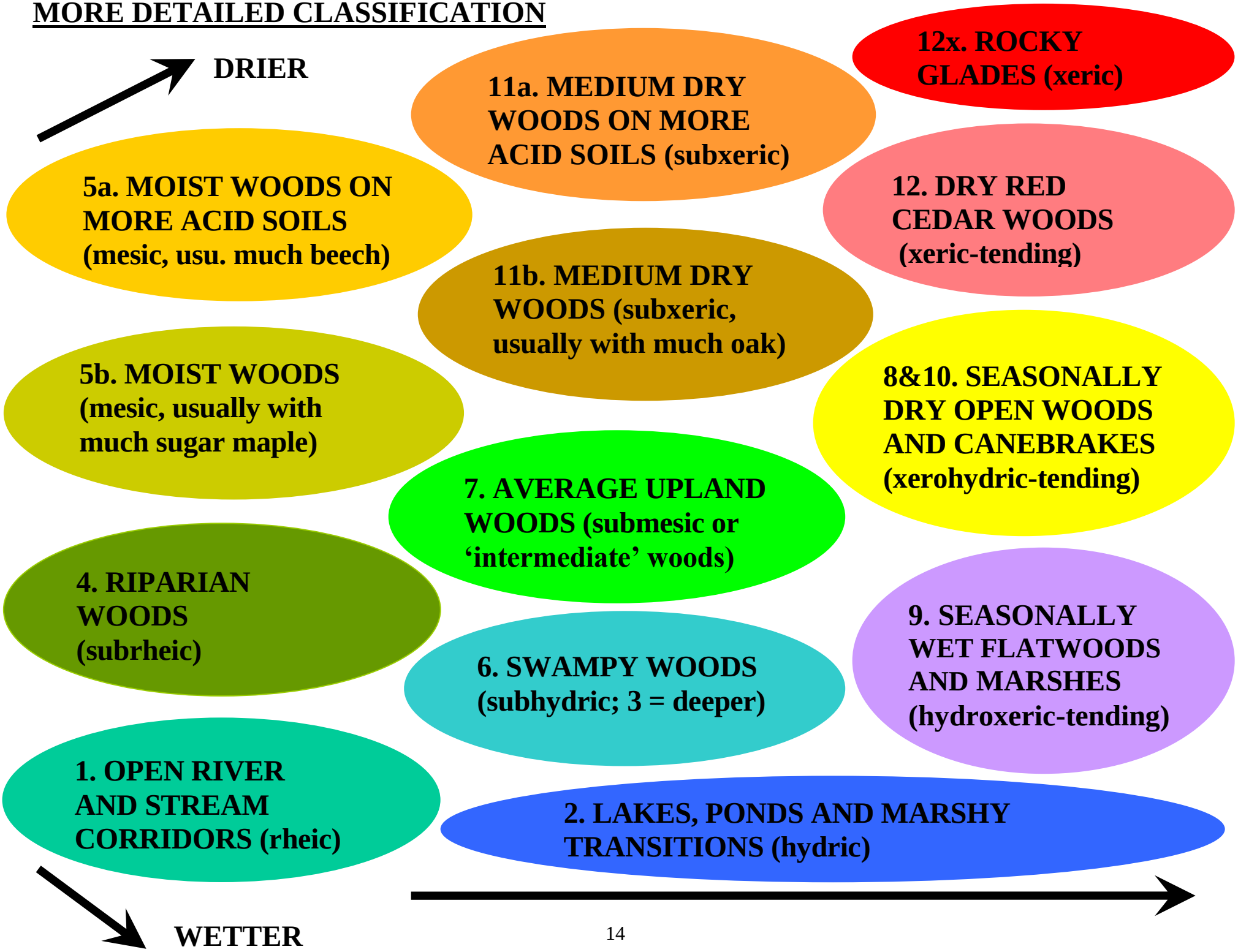
B3a/b. Bluegrass Woodland: less open phases

B1c. Natural Streams (with riffles and gravel-bars)

B1b. Natural Ponds and Wetlands (broadly defined)

WETTER

MORE DETAILED CLASSIFICATION



B1a. Russell Cave, on Mount Brilliant Farm: one of the largest caves on uplands in central Bluegrass [https://mtbrilliant.com/wp-content/uploads/2016/03/mt-brilliant-russell-cave.jpg].

B1b. Author at Allendale wetland in Lexington, fed by Moberly Spring and drained by Wolf Run; plant is *Angelica atropurpurea*, reintroduced from southwest Ohio [photo: Ken Cooke].

B1c. Banks of Kentucky River below High Bridge dam: remnants of scoured rocky banks with big bluestem grass, riverbank goldenrod and other uncommon plants that need special attention.

B2. Scotts Grove, along US 27 south of Nicholasville: the best remnant of oak-hickory forest on uplands along the Palisades, with deep sinkholes, large trees and several rare plants.

B3. Wild hyacinth locally prospering at Griffith Woods, near back of farm with relatively good remnants of the original herbaceous vegetation in addition to scattered ancient trees.

C. SPECIES LEVEL: Natives. Provisional priorities are as follows. Many details can be added regarding lists of species and recovery plans for each species, but we first need a programmatic summary for functional groups of species that share similar problems.

C1. Selected aquatics: mussels, fishes and plants that have disappeared. Even in better streams, several species have declined, and in the locked-and-dammed Kentucky River many species typical of free-flowing systems are gone (29). Ky. Dept. of Fish & Wildlife are perfecting methods to raise rare mussels and fishes in captivity, then releasing them into restored streams (30). However, it is not yet clear if and when the South Fork of Licking will become suitable for such work. In addition to strict aquatics, several species typical of shorelines have largely disappeared, especially plants along rocky banks of the Ky. Rv. and those typical of natural ponds or seeps. Some of these plants need to be brought into cultivation and seed-storage for future use in restored systems

C2. Most bats: now threatened with white-nose-syndrome. There is now enhanced interest in bats due to this disease, and measures are being developed to safeguard their habitats and populations. Unfortunately, little progress can be shown yet in reducing effects of the disease. USFWS has published general recommendations for forested regions of the state, but it is difficult to implement within the central Bluegrass (31). Ideally, some caves should be fenced or gated soon in order to prevent human disturbance of hibernacula. Disturbance of feeding habitat should be reduced within critical distances from hibernacula.

C3. Simulation of wild ungulates: without bison and elk. Management of deer alone may not be enough for restoration. The native elk, bison, sloth and mastodon have disappeared, with no foreseeable hope for recovery as free-ranging animals. However, there is considerable potential to use livestock in controlled browsing for simulation of the former ecological conditions. We know that sheep, goats, horses or cattle can reduce some invasive alien plants under some conditions (32). Unfortunately there has been little research into this matter within eastern North America, and there has been virtually no progress within Kentucky. Griffith Woods still offers the best opportunity in the region for this kind of research.

C4. Imperiled plants of drier woods or glades. Globally rare examples include cleft phlox (*P. bifida*), rat-stripper (*Paxistima*), glade-mallow (*Malvastrum*), bladder-pod (*Paysonia*), hispid gromwell (*Onosmodium*), and Kentucky clover (33). Some of these cannot be expected to expand their range, since they are restricted to small areas of rocky or xeric extremes, but an effort is needed to safeguard germplasm in cases of declines due to climate change or invasive aliens. Others in this group are less restricted to these habitat extremes, and could be increased on deeper soils in dry woods and in associated openings, through use of appropriate browsing or burning. It is likely that such species (34) have declined greatly due to both excessive disturbance in farmland plus insufficient disturbance in remaining woodland. Propagation is urgently needed in several cases.

C5. Imperiled plants of submesic to subhydric uplands. The only globally rare species is running buffalo clover (35), but several are rare across the state (e.g. *Floerkea, Lilium michiganense, Lysimachia hybrida, Stenanthium*). Others are locally abundant elsewhere on steeper wooded slopes have largely disappeared from uplands in the region, such as wild ginger, wild hyacinth (36), peavine, alexanders and cane. There are clear distinctions in dispersal ability by most of these species, which do not generally show up within restored habitat, versus more weedy species that often remain within disturbed woodland remnants or can spread from nearby remnants.

C6. Trees with acute pathogens, pests or predators. The obvious examples are ashes, butternut and elms. Currently, most ash trees are being killed by the Emerald Ash Borer (37). Although parasitic wasps may be used to slow the pest (38), spread of these wasps will not be fast enough to make much difference in coming years. For the long-term, we need to collect more ash seed, and to study how remaining seedlings in the woods (which escape the borer) will respond after the epidemic abates. In the case of butternut, its almost complete loss from the region is due to a fungal canker (39). But it is possible to replant seedlings from more resistant trees that have been found in Appalachian regions. Many large American elms have been lost to Dutch Elm Disease, but some survivors exhibit resistance (40). The slippery elm has declined much more since settlement, probably due to livestock browsing on its palatable bark, as in basswood (41). It is one of the native trees that most deserves propagation for replanting.



Many species have disappeared from the Kentucky River but might be reintroduced if a section became free-flowing again. For example, plants (above): river indigo, threadfoot, eelgrass. And mussels (below): ringpink, clubshell, pyramid pigtoe.






Extinct animals: globally (passenger pigeon, Carolina parakeet) and locally (bison, elk); but the ecological effects of bison and elk might be simulated partially with wise use of livestock (C3).

Species that used to depend on seasonal grazing or similar disturbances, but which now largely depend upon the helping hand of mankind.

Lilium michiganense, the midwestern lily of thin submesic woods, appears to have been almost eradicated, especially by free-ranging hogs; recovery now depends on propagation (C5).

Above: white-nose syndrome on Indiana bats [photo by Nancy Heaslip, NYDEC] (C2).
Below: Emerald Ash Borer on ash trees [http://www.emeraldashborer.info] (C6).

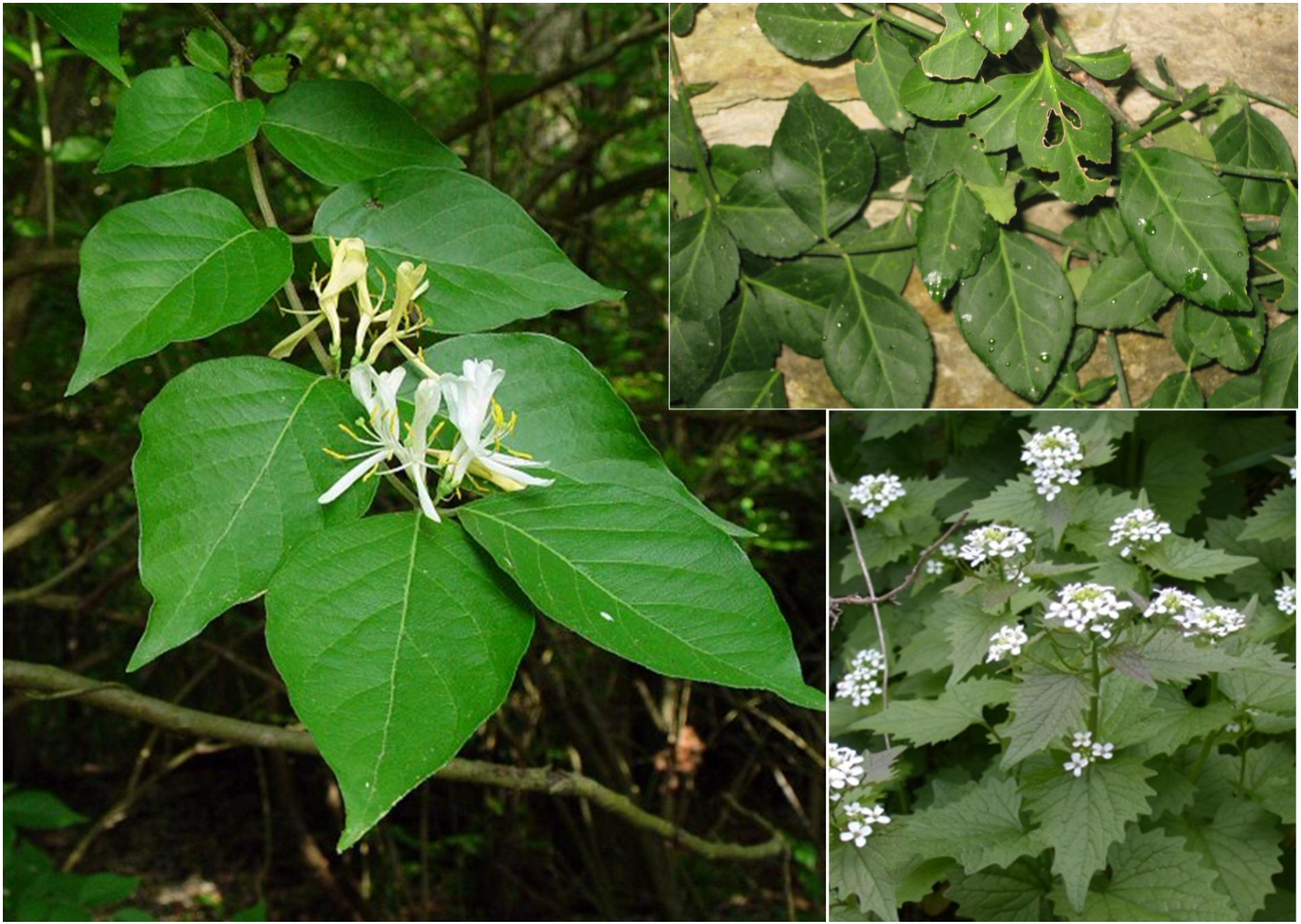
D. SPECIES LEVEL: Aliens. Some of the worst examples are listed below. Appropriate management of habitats can sometimes reduce these species, and the discussion can then be moved up to the level of whole habitat restoration (B above). However, more focussed micro-management is often needed using manual labor and herbicides. An additional approach is to search for native species that can provide the strongest competition, and then to promote those species. These notes below emphasize invaders of woodland rather than grassland, because native grassland was rare in the original landscape. True restoration of old fields should generally involve return to a more woody condition, including thickets of locust and cane—which tend to eliminate fescue, Johnson grass and other aliens in the fields.

Herbs: garlic mustard, chickweed, gill-over-the-ground, stilt-grass. In the first two cases, there is some evidence that sheep or deer can sometimes reduce their abundance (42). Such effects are probably most useful during the fall and winter, when there is less collateral damage to native spring-flowering plants (43). But in the case of gill (*Glechoma*) and stilt-grass (*Microstegium*), these are highly unpalatable to mammals, and deer have probably contributed to their rise in the woods, especially along trails (44). It is likely that most of these aliens can be reduced in the shade by aggressive native plants such as purple phacelia, wood-chickweed, wood-nettle, wild ryes and rice-grass (*Leersia virginica*). We need planting trials with these natives.

Vines: especially winter creeper; also Japanese honeysuckle, etc. Winter-creeper (*Euonymus fortunei*) is perhaps the most problematic invasive plant across the region, since it persists on the ground in shade as well as climbing trees and cliffs. There are almost no native evergreen vines to replace it, although crossvine could play some role. There is much potential to use livestock for reduction, based on varied circumstantial evidence; again, we need proper research (32). In the short-term, chemical control is possible using triclopyr or 2,4-D plus a strong surfactant such as Pentra-Bark; glyphosate alone is generally ineffective. Most other invasive woody vines tend to be evergreen, and livestock can often reduce them. Native herbivores do also browse on these species in some cases, and dense deer herds can virtually eliminate spread of winter-creeper on the ground (32). However, it is generally not easy to control the seasonal behavior of deer—we need them to browse natives less during spring!

Shrubs: bush-honeysuckles privets burning-bush multiflora-rose etc. The spread of Amur bush-honeysuckle (*Lonicera maackii*) since 1970 has become the most obvious alien invasion within woodland of the region. This species is most successful in thin woods and edges where native understory has been removed, but it can also spread into moderate shade. It does appear to be greatly reduced in the deepest shade, especially under maples, oaks and hickories (45), and especially where browsing by deer is intense as well (46). Thus, some discussion of control can again be shifted up to the level of overall habitat restoration (B above). However, larger bushes generally need to be cut down and poisoned as part of restoration plans. Some ideal program of controlled herbivory using deer and livestock may be possible, but we need much more research. It is interesting that most of the invasive shrubs in this region are moderately to highly palatable for mammalian herbivores. Burning-bush is especially palatable to deer (47), and it is not spreading much across the region, although it is locally common around residential areas. Multiflora-rose has been common across the region for over 50 years, but does not persist in deeper shade; pests and disease also reduce it (48).

Trees: callery pear, tree-of-heaven, white-mulberry. These three species are locally abundant invasive trees. They generally need intensive micro-management for control, but they do not succeed in deeper shade; long-term succession will also tend to eliminate them. Callery pear has become abundant only during the past 30 years, and it is now a widespread problematic invader of old fields, roadsides and woodland edges (49). Manual removal using saws and herbicides is needed for restoration, and the dangerous thorns on its low branches can make such work difficult in dense thickets. Tree-of-heaven also needs manual removal, and its vigorous lateral suckers require persistence over several years before complete control; in contrast, its wind-dispersed seeds do not usually spread far (50). White mulberry has been present since early settlement but it is only a local problem. Most rural areas do not have dense white mulberry, perhaps due its high palatability for deer, rabbits and other mammalian herbivores. Unlike the other two trees, white mulberry may be largely controlled using deer and livestock. But in residential areas and along major streams, large trees are established and require cutting. We also need to plant the native red mulberry, often confused in nurseries (51).



Some of most abundant alien plants. Left: Amur bush-honeysuckle (*Lonicera maackii*). Right upper: purple wintercreeper (*Euonymus fortunei*). Lower: garlic mustard (*Alliaria petiolata*).

Submesic woods in Shelby County with intense browsing by deer (and previously cattle): bush-honeysuckle and purple wintercreeper are largely prevented from invasion in many sections.

Woods behind Henry Clay High School in Fayette County: dense bush-honeysuckle and purple winter-creeper has developed since 1970, without deer and livestock to browse them back.

Callery pear (*Pyrus calleryana*), often known as the “Bradford pear” cultivar: now locally dominant in suburban thickets, as viewed here next to Nicholasville in Jessamine County.

Left: ten-year old red mulberry planted in center of deer-browsed field at Griffith Woods.
Right: five-year white mulberry in nearby field, restricted to ‘bonsai’ form by deer and rabbits.

CONSERVATION BASED ON COMMUNITY & SCIENCE? For many years, TNC has advocated that we base action on community and science (52), but how should we make these connections within our region, and are they currently satisfactory?

A brief history of the local conservation community. Some pioneers expressed concern in the 1770s that the human influence would become excessive (53). On more affluent estates, large open grown trees were left to create "woodland pastures" that had much aesthetic appeal as well as shading livestock in the summer (54). But with the clearance of most uplands, remaining forest along the Kentucky River came to receive most interest for more natural experiences of people in the region. In the 1930s, Jillson first advocated for protection of this corridor in a state park system (55).

During the 1960s, Mary Wharton was the first to establish a legally protected preserve along the Palisades, now named "Floracliff" in Fayette Co. (56) And she helped found a non-profit organization for conservation in the region—the Land and Nature Trust of the Bluegrass (57). But that group later disbanded when other organizations got involved. Along the Palisades, Shaker Village also established a large area of protected forest within their non-profit domain. Then in the 1990s, TNC accelerated their acquisitions, especially in Garrard Co. In 2015, their website claimed (10): "The Master Plan, on track for completion by the end of 2013, will provide a blueprint for the broader Kentucky River Palisades as well as for a handful of nature preserves where the Conservancy works." However, some stakeholders have not yet been consulted, and no plan has been released.

It has been difficult to bring all relevant organizations together in the region for building consensus on goals. In addition to state government agencies and TNC, there are diverse local governments and smaller non-profits that have interests in conservation. There are several somewhat protected tracts, including much farmland now covered by easements of the Bluegrass Conservancy (58) or the state PACE program (5). Moreover, much riparian restoration is now being conducted at scattered sites. Just who would lead a regional effort? One can suggest Bluegrass Tomorrow (59) or Bluegrass Greensource (60), but those regional organizations are not clearly involved with the details of land preservation, restoration and management.

A brief history of our local conservation science. In 1828, Rafinesque was the first scientist in this region to note how disturbance creates a gradient in vegetation types (61). However, despite considerable biological research in this region there was little published interest in conservation by the scientific community until the Kentucky Chapter in Shelford's "Naturalist's Guide to the Americas" of 1926 (62). About that time conservation was taking root across the state, but it was an Ohioan—E. Lucy Braun—who first detailed the native vegetation types of Kentucky, including notes on the central Bluegrass in 1950 (63).

Local universities (especially UK and EKU) supported several researchers in natural history during 1890 to 1950, but details from this region were not applied to conservation until after 1970. Papers of Meijer, Bryant, Martin and Wharton then began to provide a better picture of the flora and vegetation, while several zoologists also provided details in their fields. Martin et al. delivered a report on the Palisades for TNC (64). Wharton and Barbour's "Bluegrass Land and Life" was the first general biological synthesis for the region, and it delivered a message about conservation as well (65).

The Griffith Woods project, begun in 2003, provided a challenge for cooperative work by TNC, UK and state government (6). At root, reasons for its partial failure so far revolve around the lack of clear goals in ecological restoration, together with the lack of methods for effective consensus-building. Despite plenty of room to experiment with different types of management across the 745 acres, scientific planning became eclipsed by financial and professional struggles.

Conclusion. A careful outline of prioritized ecological and biological features (as attempted above) should form the core of conservation planning. There is of course some uncertainty about the details of this outline, and we do not know about how best to proceed with various aspects of conservation, restoration or other work. In matters with most uncertainty, it is then important to define alternative approaches for comparison, using scientific methods. These central themes for conservation science should ideally be refined through dialog among all interested people in the region. Such dialog would be advanced by regular meetings to review progress plus educational field trips to varied sites across the region.

Abbreviations

EKU: Eastern Kentucky University
EPA: Environmental Protection Agency
KDFWR: Kentucky Department of Fish and Wildlife Resources
KSNPC: Kentucky State Nature Preserves Commission
NRCS: Natural Resources Conservation Service
PACE: Purchase of Agricultural Conservation Easements
TNC: The Nature Conservancy
UK: University of Kentucky
USDA: United States Department of Agriculture
USFS: United Stated Forest Service

Above: remarkable plant of *Veratrum woodii* (midwestern hellebore) discovered at Floracliff Nature Sanctuary in Fayette County by Beverly James (her photo). Does its toxicity and avoidance by mammals allow it to increase with dense deer populations?

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Left: rediscovery of *Galearis spectabilis* (showy orchid) in the region, by Liz Hobson (her photo) at Marble Creek in Jessamine Co.. Although often browsed by deer, does it spread along their trails?

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Back cover: early wild rye (*Elymus macgregorii*) in young woods at Allen Dale Farm of Shelby County; similar to parts of Griffith Woods