Clay Hill Memorial Forest Extension

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BOTANICAL SURVEY OF THE CLAY HILL MEMORIAL FOREST EXTENSION, TAYLOR COUNTY, KENTUCKY

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For Campbellsville University and
Kentucky's Heritage Land Conservation Fund

Typical scene at head of ravine, with sugar maple (left) and shagbark hickory (right).

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Mesic ravine slope with *Pachysandra* (left), sweet buckeye (right) and its early fallen leaves.

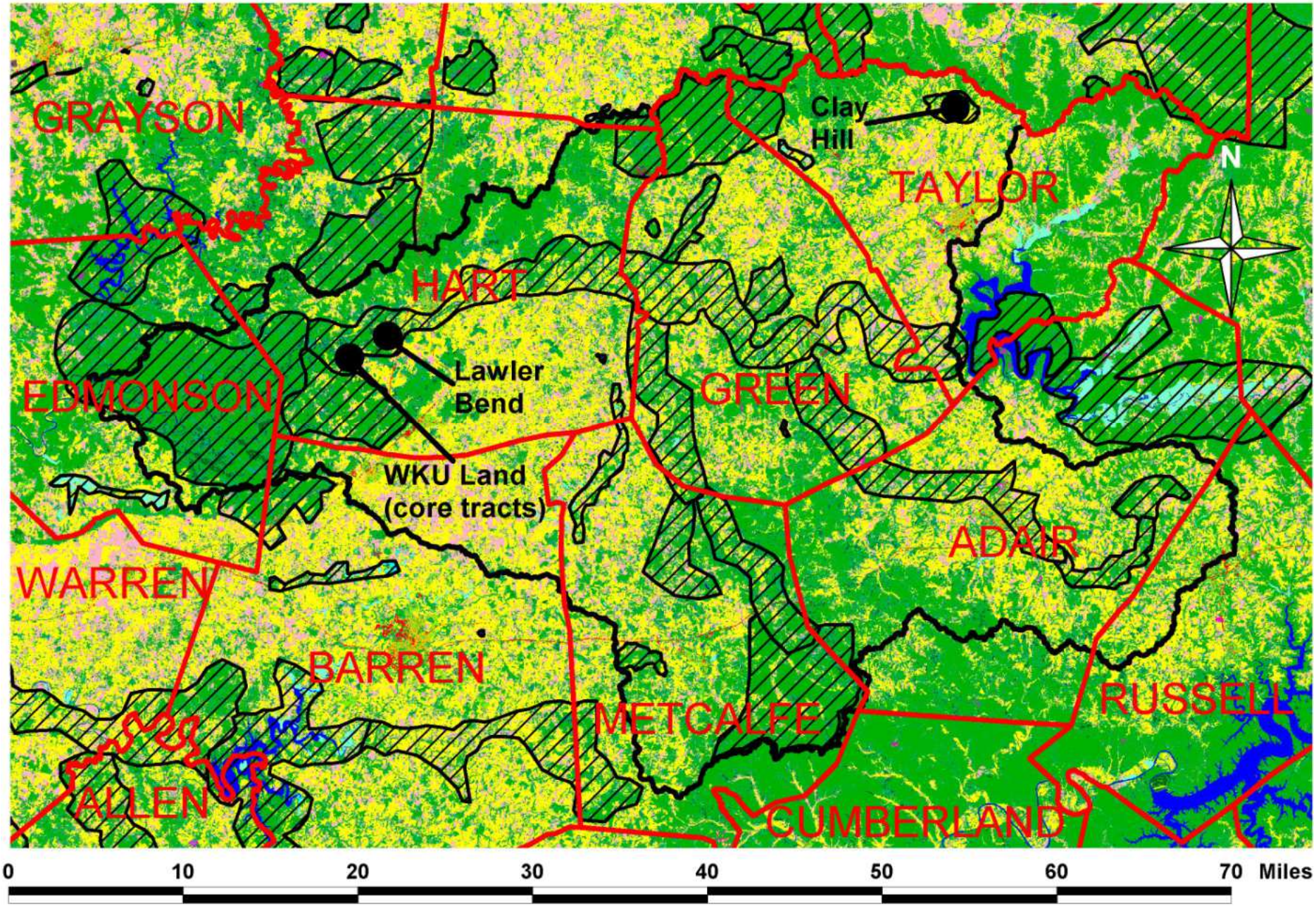
INTRODUCTION: Regional Context for Focus on Conserved Area

This project documents the flora and vegetation of the ca. 100 acre addition to Clay Hill Memorial Forest that has been recently acquired using Kentucky's Heritage Land Conservation Fund. Clay Hill is a well-established preserve that is owned and managed by Campbellsville University for research and education. There has been no prior published botanical work concerning this site, but R. Thompson and B. Tungate (pers. comm.) have made a general survey of the core preserve.

Clay Hill Memorial Forest, in Taylor County of south-central Kentucky, lies within the "Mississippian Plateaus" of the Interior Low Plateaus, but close the Knobs region, broadly defined (Woods et al. 2002; Campbell & Medley 2012). The climate at nearby Campbellsville is humid mid-temperate, with mean annual temperature of 13.7 °C or 56.7 °F and precipitation of 137 cm or 54.1 inches (US Climate Data 2014). Bedrock is primarily Mississippian limestones, siltstones and shales (KGS 2014): Salem Limestone > Harrodsburg Limestone > Borden Formation (Muldraugh, New Providence Shale & Halls Gap Members). Despite the calcareous bedrock, soils on uplands are largely mapped as ultisols; most alfisols and eutrochrepts occur on shallower soils, often eroding and especially on steeper slopes. Soils on lowlands are generally more base-rich, from eutrochrepts to entisols (Appendix 2).

This survey was conducted mostly on three days in June to August of 2014, traversing all patches of woodland in the project area. There was also a thorough review of floristic data from the region in order to indicate rare species that might be expected. And local ecological classification was developed in association with the author's continuing research plus attempts to 'crosswalk' with Ky. State Nature Preserves Commission and other authorities.

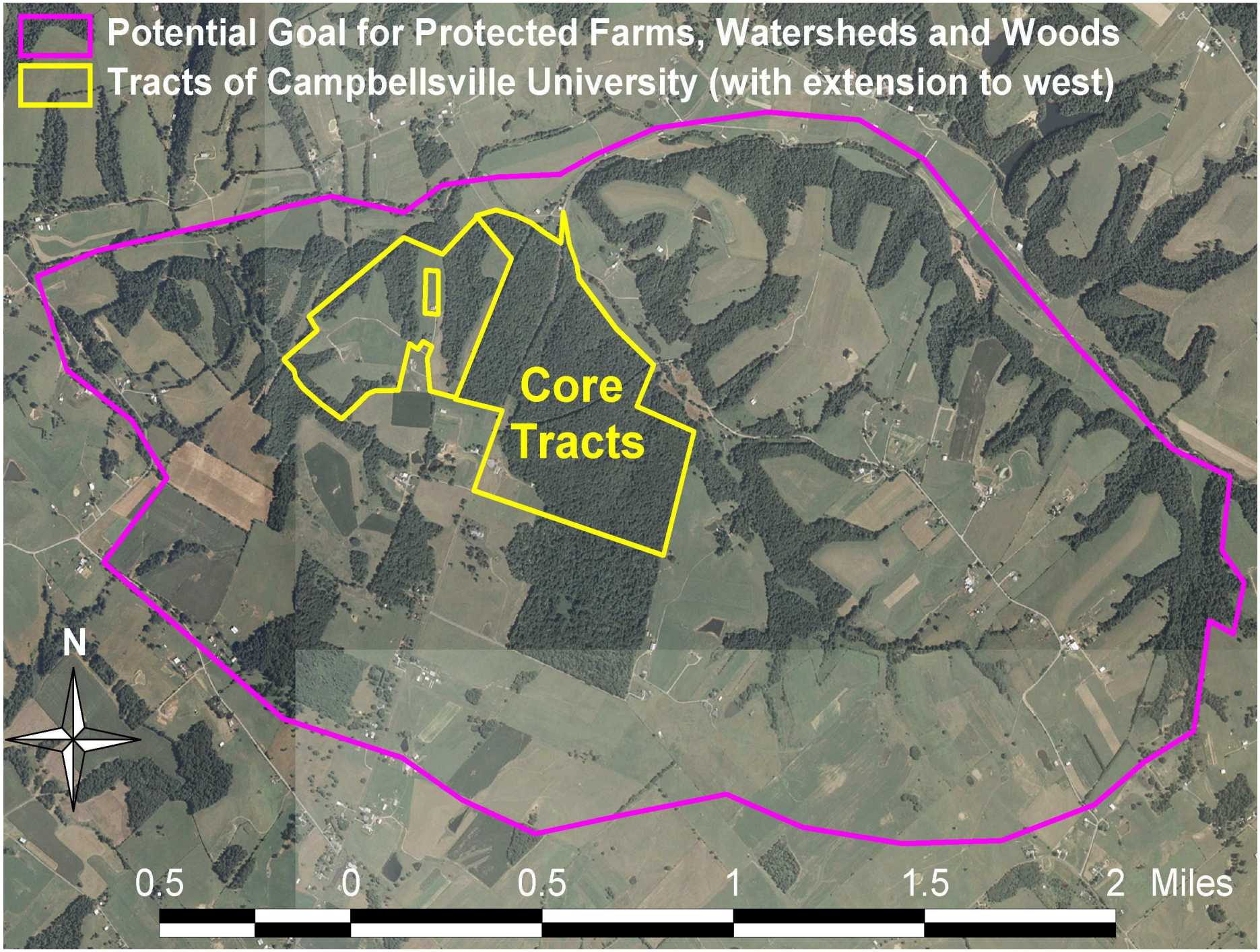
Middle Green River Watershed (black line) in relation to Land Use (see legend on next page). River corridors and other focal areas for conservation are hatched. Counties are shown in red.

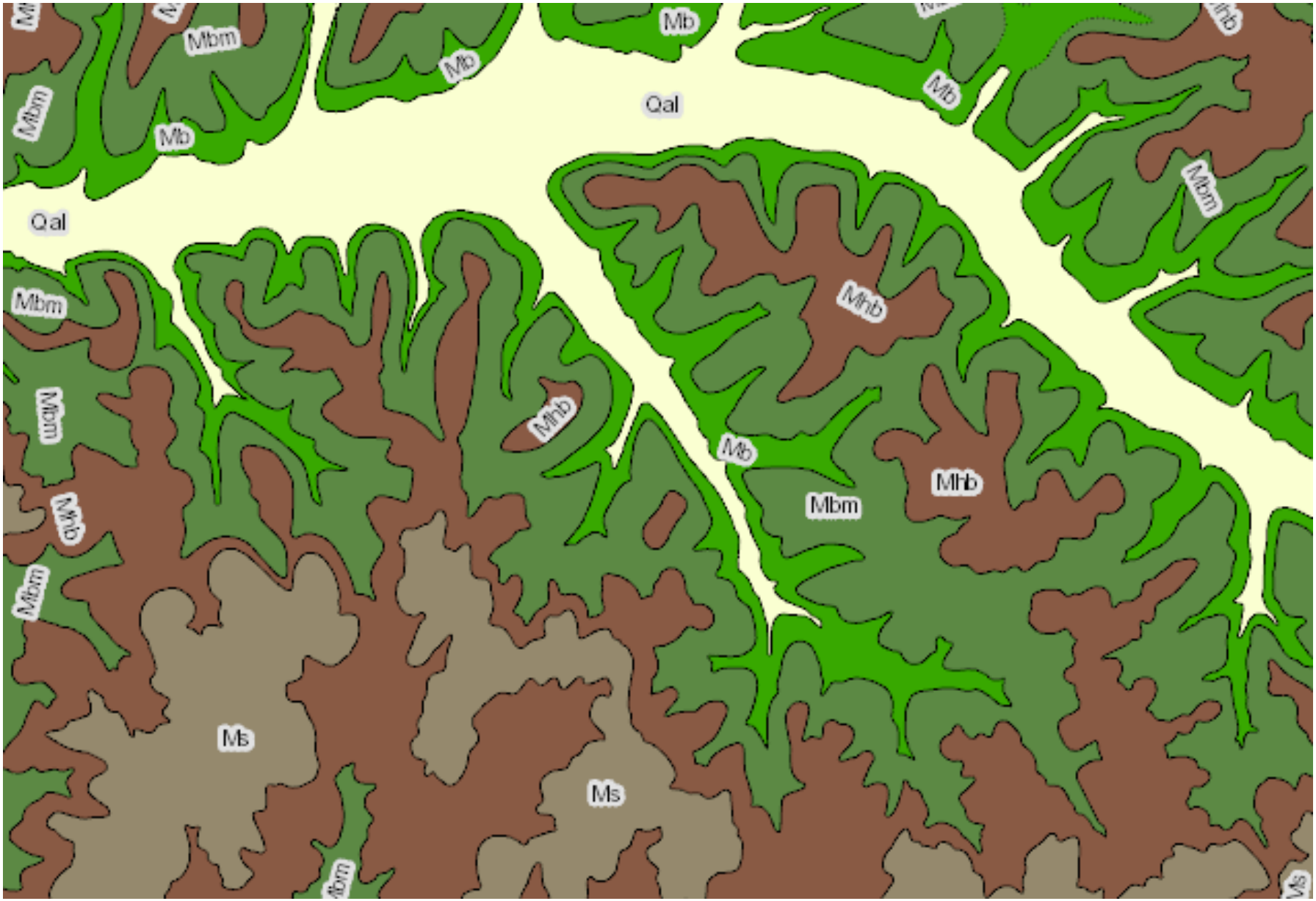


Land Use [NLCD 1992]

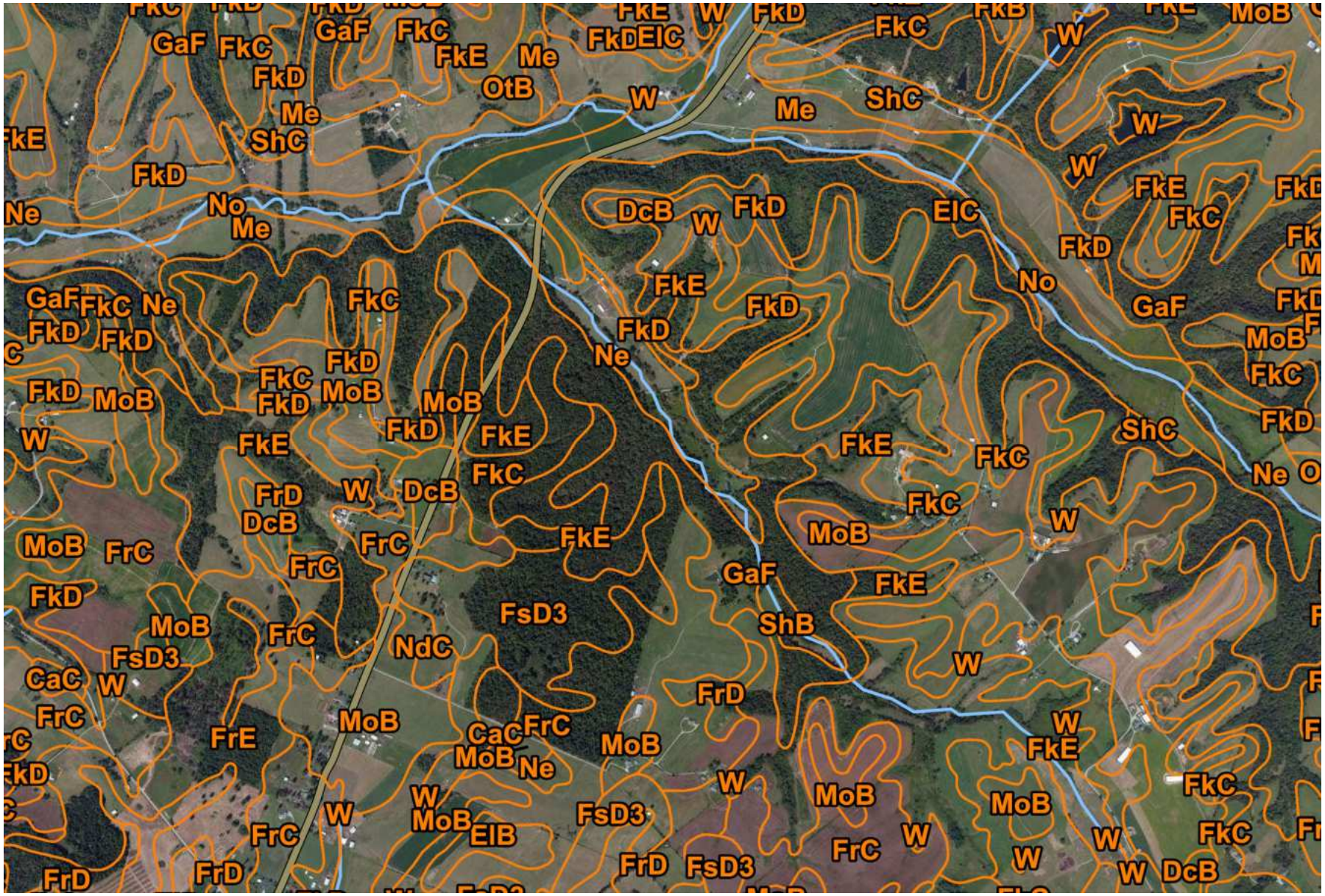
- water
- wetland
- woods: mostly deciduous
- woods: mixed
- woods: mostly evergreen
- fields: mostly grass
- fields: mostly row-crops
- suburban/developed
- urban/industrial
- quarries/similar
- stripped coal mines

Above: legend for land use map on previous page, adapted and simplified from the National Land Cover Dataset of 1992 (Vogelmann et al., 2002).
Right: lateral gullies are common within the ravines, with rapid runoff and no real floodplain.

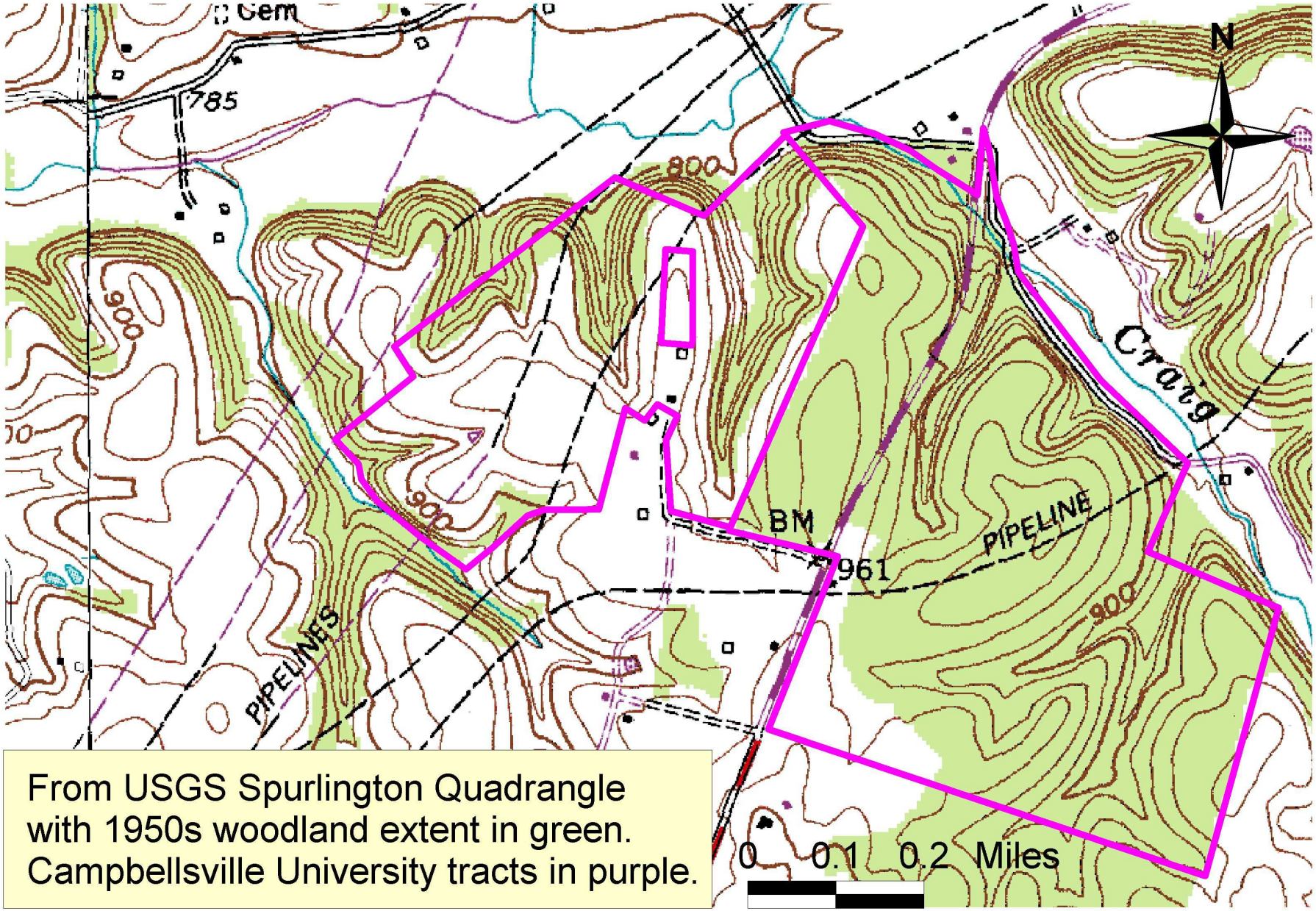

Potential Goal for Protected Farms, Watersheds and Woods
Tracts of Campbellsville University (with extension to west)
Core Tracts
N
0.5
0
0.5
1
1.5
2
Miles



Geological Map of Clay Hill area (KGS 2014): Qal = Quaternary Alluvium; Mb = Borden Formation (lower); Mbm = Muldraugh Member of Borden Formation; Mhb = Harrodsburg Limestone; Ms = Salem Limestone.

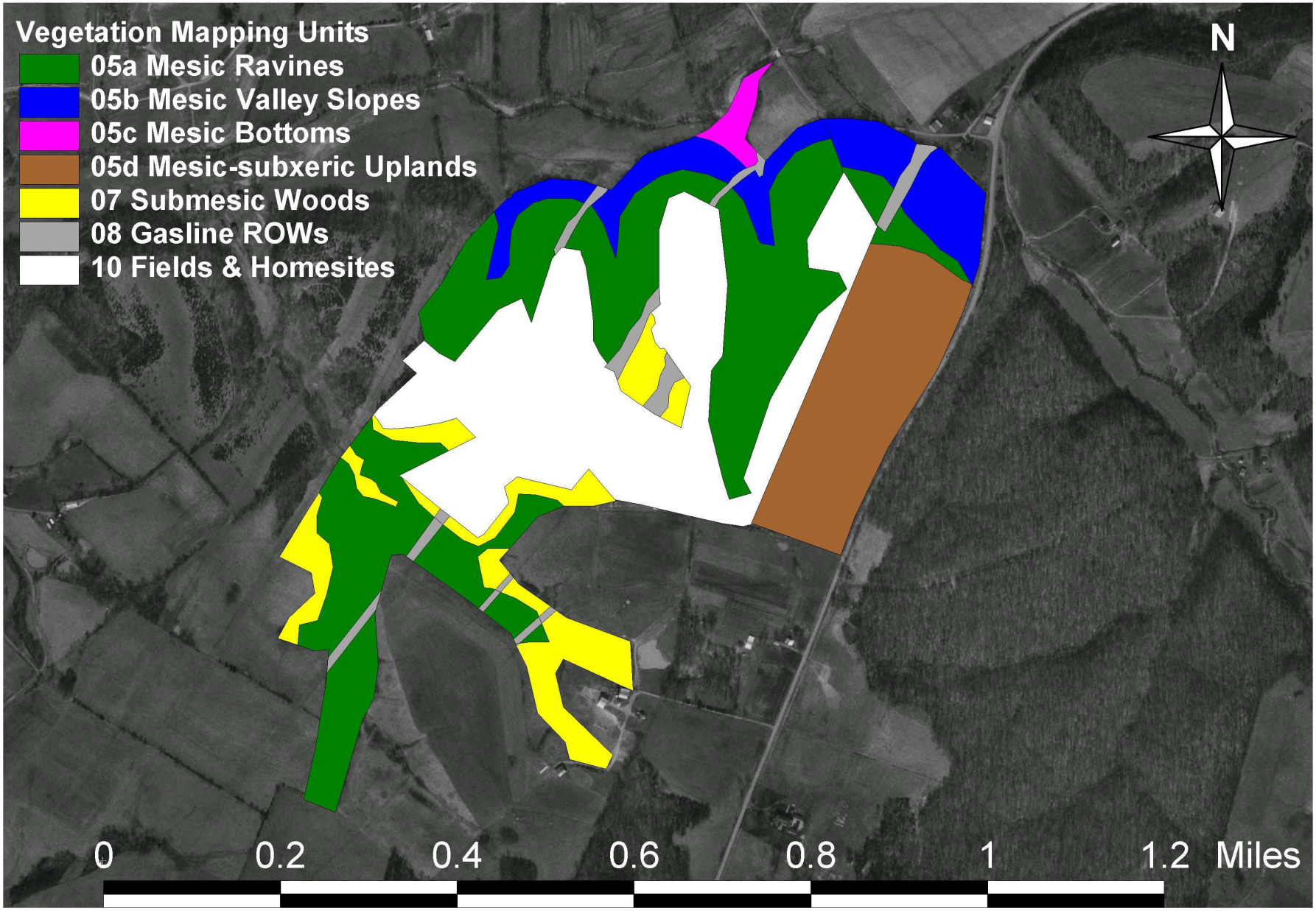


Map of Soil Series in Clay Hill area (NRCS 2014): Ca = Caneyville; Dc = Dickson; El = Elk; Fk = Frankstown; Fr = Frederick; Fs = Frederick (eroded); Ga = Garman-Shelocta complex; Me = Melvin; Mo = Mountview; Ne = Newark; Nd = Needmore; No = Nolin; Sh = Shelocta.



From USGS Spurlington Quadrangle with 1950s woodland extent in green. Campbellsville University tracts in purple.

Topographic Map for Clay Hill Memorial Forest Extension



Vegetation Map for Clay Hill Memorial Forest Extension

HABITATS: Ecological Gradients, Land Use History and Targets for Conservation

The attached vegetation map provides a first approximation of the pattern in this project area. Mapping units indicate the most typical vegetation type, but there are frequent transitions and mixtures at smaller scales. The following broad classes (A through I) follow usage of JC developed during the 1990s for NPS at Mammoth Cave National Park and Big South Fork NRRA, and.for USFS in Daniel Boone National Forest. For internal 'crosswalk' notes on these JC-coded classes are inserted below in brackets [ ] after headings, with reference of names of Kentucky Natural Heritage Program (NHP) and to the "CEGL" codes of the National Vegetation Classification (NVC: NatureServe 2014). Appendix 2 includes a chart showing the relationship of these vegetation types to ecological gradients.

A. Rheic zones: not distinguished in vegetation map
[= JC Class 01; KHP generic "gravel/cobble bar"; NVC 4331, 4286, 6480, 4739]. These are narrow (1-5 m wide) zones along open rocky banks, ledges, bars, spits and riffles with varied vegetation. Water-willow (*Justicia americana*) is locally dominant in more gradual transitions from gravel bars to flowing water. The transition to forest is often characterized by dense stands of wild oats (*Chasmanthium latifolium*).
Clay Hill Memorial Forest: only minor development in project area but expected along Pitman Creek downstream. The stream channels themselves could eventually be mapped as a distinct unit, perhaps combined with the following.

B. Riparian Woods: not mapped as a distinct zone.
[= JC Class 04; KHP "riparian forest" in part; NVC 2586, 5033, 7184, 7334]. This often grades into submesic or mesic forest on the well drained levee crests or on higher terraces [JC

06/05]. It is generally difficult to make a clean separation in mapping the strict "front" zone, with some scouring, versus more mesic terraces, without regular scouring. In addition to field notes, elevation could be used to guide further refinement of the map.
Clay Hill Memorial Forest: not well-developed, just scattered sycamore, white elm, black willow, etc., along larger streams and artificial pond margins. Streambanks within the ravines do have distinctive vegetation within a meter or so from the channel, which could ultimately be mapped as distinct 'channel-plus-bank' units to include attenuated expressions of Classes A plus B. Characteristic species (uncommon in some cases) include *Acalypha deamii*, *Boehmeria cylindrica, Clematis virginiana, Pilea pumila, Stachys hispida* and *Viola rostrata*.

C. Mesic Woods: mapped as codes 05a/b/c
[= JC Class 05 (see segregates below); KHP "calcareous" and "acidic mesophytic forest", with some local "bottomland ridge/terrace forest"; NVC, potential matches noted below]. Best developed on N/NE-facing slopes, but grading into subxeric slopes on drier sites. It also grades into riparian or submesic woods on toe-slopes and high terraces.
Clay Hill Memorial Forest Variant 05a [= NVC 2411, perhaps tending 5222]. This is widespread on gully slopes within the project area, generally somewhat mature with most canopy trees 2-5(7) dm dbh, but with frequent tree falls as well as past logging. Sugar maple and beech are dominant in more mature woods; tulip poplar is locally abundant, especially in younger woods. Other frequent trees include sweet buckeye, black walnut and white oak. The shrub layer includes frequent *Asimina* and *Lindera*. Common species in ground vegetation include *Asasum, Pachysandra* and *Polystichum*; others include *Arisaema triphylla, Collinsonia, Hybanthus, Podophyllum, Solidago caesia, Viola pennsylvanica*, etc. More disturbed areas, often with much past browsing, include abundant *Microstegium* and in more open woods (transitional to submesic), *Verbesina occidentalis*.

Clay Hill Memorial Forest Variant 05b [~ NVC 6201, perhaps tending to 4411]. This is on steeper slopes and toe slopes with more calcareous soils, especially along the main stream valley on the north side of the project area and in a few adjacent ravines. Sugar maple is generally dominant; other typical trees include sweet buckeye (frequent) and bitternut hickory (local). Shrubs include locally common *Staphylea* on steeper slopes, as well as generally abundant *Lindera* and local *Asimina*. Ground vegetation includes locally common *Actaea, Diplazium, Hydrophyllum canadense, Laportea* and *Stylophorum*.
Clay Hill Memorial Forest Variant 05c [~ NVC 4418 / 6492]. This is in small areas along gully bottoms and stream terraces at lower elevation, mostly just outside the project area. Tulip poplar is generally dominant together with much sugar maple in the understorey; other trees include shumard oak, shellbark hickory, beech, black walnut, white elm, hackberry, etc.

D. Mesic-subxeric Woods Transitions: mapped as code 05d
[= JC Classes 05-11, varied transitions; KHP, varied transitions; NVC, potential matches noted below]. This is relatively mature forest that is transitional from mesic to subxeric conditions.
Clay Hill Memorial Forest [~ NVC 7881, 7233, etc.]. This occurs locally on upper slopes, especially sites with S- or W-facing aspects but also on relatively level gound. In addition to the common trees of mesic woods (especially beech, sugar maple, tulip, bitternut), there is an admixture of shagbark hickory, pignut hickory, white oak and black oak (up to ca. 6 dm dbh and 110-120 years old from cut stumps). Oaks of more calcareous sites (chinquapin, shumard) and ashes (blue, white) are also characteristic on steeper slopes with more rock, but in small numbers. The shrub layer includes frequent *Cornus florida* and *Ostrya virginiana*; other species include *Staphylea* (local on steeper slopes) and *Viburnum rufidulum*. Typical species in the ground vegetation include *Dichanthelium boscii, Hydrophyllum macrophylum, Krigia*

biflora, Podophyllum peltatum, Scutellaria elliptica, Symphyotrichum shortii, Solidago ulmifolia, **etc.**

E. Subxeric Woods: to be mapped as code 11a but not yet in project area.
[= JC Class 11, locally grading into Class 10; KHP "acidic" and "calcareous subxeric forest" with some local inclusion of cliffs/outcrops; NVC, potential matches noted below]. Mostly on drier ridges, S/W-facing slopes, and locally clifftops, often grading into mesic forest.
Clay Hill Memorial Forest [= NVC 2067 / 2076]. This is not well-developed in the project area. But before settlement, such woods probably used to cover drier uplands, especially on narrower ridges. The rectanglular block of old growth along the highway contains patches of subxeric woods, dominated by oaks and hickories, within more transitional or mesic woods, dominated by beech and sugar maple.

F. Submesic Woods (varied disturbed transitions): mapped as code 07.
[= JC Class 07; KHP ~ "deep soil mesophytic forest" and subxeric types; NVC, potential matches noted below]. These diverse areas are mostly on gentle slopes at upper or lower levels, and they often grade into more xeric or more mesic forest on steeper slopes. They generally have an 'average mix' of tree species, in terms of ecological gradients from mesic to xeric, mesic to hydric, and mesic to disturbed. These areas have been largely cleared for farming in the past, and are now recovering in various mixtures, degrees of disturbance and successional stages.
Clay Hill Memorial Forest [~ NVC 4096, 4741, etc.]. These varied woods are locally extensive in transitions from deeper mesic woods to the largely cleared uplands, or to fields on lowlands. Canopy trees are mostly 1-5(6-7) dm dbh. In addition to common trees of mesic woods (beech, sugar maple, tulip poplar) or subxeric woods, the following are locally frequent:

sassafras, black walnut, hackberry, Ohio buckeye, black cherry, mulberry, red cedar; shellbark hickory and shumard oaks are infrequent at lower edges. Ashes—blue and white (*americana* sensu lato) are frequent as seedlings but with few mature trees. The shrub layer includes frequent *Carpinus* and *Ostrya*, especially where browsed by livestock or deer. Elder (*Sambucus*) and cane (*Arundinaria*) are present in a few areas at lower elevation. Ground vegetation includes abundant *Microstegium* and, in more open areas, *Verbesina occidentalis*; other typical species include *Amphicarpaea bracteata*, *Smallanthus uvedalia*, etc.

G. Red cedar/scrub pine woods, rocky xeric woods and glades: mapped as 12.
[= JC Class 12; KHP "xeric red cedar-oak forest/woodland" and "xeric Virginia pine forest / woodland" with some local "dry limestone cliff/outcrop" or remnants of "limestone slope glade"; NVC to be determined]. This class is broadly defined to include relatively stable open woods and glades on xeric sites, plus young successional cedar/pine woods on more mesic sites.
Clay Hill Memorial Forest: not in project area, but young red cedar stands do occur nearby.

H. Varied disturbed habitats on deeper upland soils: mapped as 10.
[= JC Classes 08 (more brushy) and 10 (more grassy); KHP remnants of "acidic" and calcareous xeric forest/woodland", perhaps also remnants of "limestone/dolomite prairie" or associated open types; NVC to be determined] These areas are on relatively deep soils; disturbance (formerly with burning and browsing) rather than xeric conditions maintains the openings.
Clay Hill Memorial Forest: not present in project area, except as small transitions or inclusions between woods and fields (excluding the planted areas). Brushy old fields have some interest as largely native vegetation, with frequent red cedar, *Desmodium canescens, Panicum anceps*, *Symphyotrichum dumosus*, *Sabatia angularis*, etc.

I. Swampy woods and open wetlands: mapped as 2 (ponds) or 6 (woods).
[= JC Class 02; KHP aff. "shrub swamp" and "sinkhole/depression" marsh or pond; NVC to be determined—see notes for Mammoth Cave National Park].
Clay Hill Memorial Forest: only present in and around the few small artificial ponds.

Acalypha deamii **(left center) among several** *Pilea pumila*'**s on banks of stream; this species is widely scattered across Kentucky but easily overlooked within such boring-looking vegetation.**

SPECIES: Priorities for Micromanagement of Rare Plants and Alien Plants

The flora of Taylor County is poorly documented, with only about 240 species collected in herbaria (Campbell & Medley 2012). The attached list includes species that have been found elsewhere in the county, so that comparisons can be easily made with Clay Hill and so that new county records can be made efficiently in the future. In general, the flora is a mix of widespread eastern species plus a minor component of largely Appalachian species, such as *Aesculus flava, Aralia spinosa, Aruncus dioicus, Allium triccocum, Osmunda cinnamomea, Poa cuspidata, Prosartes lanuginosa, Rubus odoratus, Tiarella cordifolia, Uvularia perfoliata, Verbesina occidentalis* **and** *Viola rostrata*. **Several of these species occur at Clay Hill.**

No state-listed or even unusually rare species were discovered during the survey. Perhaps the most unusual species discovered was *Acalypha deamii*, **but this is probably overlooked in much of the state rather than truly rare. Moreover, few listed species are known anywhere in the county and their records are mostly old or obscure (***Adiantum capillus-veneris*, *Aureolaria patula*, *Helianthus eggertii*). **Among sun-loving woody plants, the complete absence of records for** *Crataegus* **and** *Malus* **is notable.**

A few relatively conservative species are known from the county that may indicate a local history of disturbed openings in the original woods. These species include the following: *Asclepias purpurascens, A. viridiflora, Crotolaris spectabilis, Echinacea purpurea, Helianthus angustifolius, Liatris spicata, Nothoscordium bivalve, Ratibida pinnata* **and** *Solidago rigida*. **Some of these have been found at Clay Hill in a remarkable brushy old field east of the road Also expected are some uncommon to rare species of mesic woods: goat's beard (***Aruncus dioicus***), yellow lady slipper (***Cypripedium pubescens***), goldenseal (***Hydrastis***

canadensis) and ginseng (*Panax quinquefolius*). Some of these uncommon plants will deserve special propagation for recovery, since they are slow to establish even in good restored habitat.

Several alien invasive species present serious problems, but these are largely restricted to the fields and edges (including multiflora rose). In shade only the following species are notable problems or potential problems. These are widely scattered within the woods, and have not been mapped.

Euonymus fortunei (winter-creeper): small patches appear in deeper woods, but much browsed by deer and also suffer from scale insect; this should be carefully monitored and pulled put whenever easy; if vines grow up trees they should be cut off.

Lonicera japonica (Japanese honeysuckle): locally abundant, especially on upper slopes in thin woods and edges; larger patches might be herbicided.

Microstegium vimineum (Japanese stiltgrass): locally frequent patches, especially on streambanks and toeslopes where browsing of cattle and deer has promoted this species; larger patches might be herbicides or mowed if possible; also, we need trials with establishment of native perennials that might reduce this annual (e.g., *Leersia virginica*).

Perilla frutescens (beef-steak plant): occasional patches in fields and thin woods, especially lower slopes and bottoms where formerly grazed; this aromatic plant is avoided by mammalian herbivores; it is not a widespread problem and might decline where cattle have been removed, but further monitoring is desirable.

Winter-creeper (*Euonymus fortunei*): small patches of this seriously invasive species are scattered through the woods, but tend to be reduced by browsing of deer and scale-insects.

Old fields planted with largely native species, adjacent to young woods with much red cedar. These coneflowers (*Echinacea purpurea, Ratibida pinnata*) were in the original "barrens."

SUMMARY AND RECOMMENDATIONS

This botanical survey was conducted for Campbellsville University during June to August of 2014, resulting in description of native vegetation types plus an initial list of the flora. No rare species were discovered, but notes are provided on species that might be expected in these habitats, and that might be recovered with future management. Although the ephemeral spring flora was not covered directly by this survey, a thorough floristic knowledge of the county and the region suggests that there is little chance of listed rare species occurring here. An annotated list of the known and expected flora for Taylor County is being prepapred and an initial draft is appended to this report.

In addition to any immediate requirements for the Heritage Land Conservation Fund, it is suggested that botanical work should be continued in the following manner.

1. With further cooperative planning of interested people, conduct a series of botanical workships at Clay Hill in order to compile all botanical information from the whole site, and to ensure that herbarium collections are made and deposited (especially new county records).
2. When all relevant data are compiled, produce a more thorough document that covers the whole preserve, integrating vegetation maps for all sectors plus adjacent private land of interest.
3. Ensure that short-term and long-term goals for the conservation incorporate botanical interests: (a) develop a more detailed plan for restoration of native vegetation in the open areas, with special attention to true remnants of the original 'barrens' flora; (b) identify selected rare species that most deserve micromanagement for recovery; (c) manage and monitor the most problematic alien invasive species.

Such interests are already active at the site, and can now be extended to the west.

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Medium-sized stream in shady ravine, with bedrock of Nancy Shale in Borden Formation.

APPENDIX 1: PROVISIONAL ANNOTATED LIST OF VASCULAR FLORA FOR THE SITE PLUS WHOLE TAYLOR COUNTY. Trees; shrubs; vines; ferns & allies; herbs (non-legume/composite/monocot); legumes (Fabaceae s.l.); composites (Asterceae); monocots (with graminoids).

"New Scientific Name" is generally accepted today; see Excel file for older names.

"Common Name" is suggested informally in several cases (with no standard).

"TAYL" indicates with "p" species that have collections from Taylor County in herbaria, based on recent inventory by Campbell & Medley (2012); "T" refers to recent collections of R. Thompson and B. Tungate.*

"Clay Hill Addition" provides initial notes from the project area, with abbreviations as follows. abu (abundant); com (common); dbh (diameter-at-breast-height); esp (especially); exp (expected); fre (frequent); loc (local / locally); nea (nearby)*; occ (occasional); pla (planted); pre (present); sap (sapling); sca (scattered); sdl (seedling); rar (rare); row (right-of-way); wid (widespread / widely)

* "Nea" refers to observations and collections made in other parts of the Clay Hill Memorial Forest, mostly by R. Thompson and B. Tungate during 2007-2012 but including some observations of this author (JC). It is hoped that a collaborative effort will procede to synthesisze all local data on flora and vegetation for a complete publication

NEW SCIENTIFIC NAME	COMMON NAME	Alien Status	TAYL	Clay Hill addition
				----------
TREES				*TREES*
Acer nigrum Michx. f.	black maple		p	occ: N slope beyond fence
Acer rubrum L. var. rubrum	upland red maple		p	rar: small
Acer saccharum Marsh.	sugar maple		T	abu: to 4-5 (7) dm
Aesculus flava Ait.	sweet (mountain) buckeye		p	fre; loc dom mostly 2-4 dm); esp low
Aesculus glabra Willd.	stinking (Ohio) buckeye		p	occ: upper slopes W face
Ailanthus altissima (P. Mill.) Swingle	tree-of-hell	AAA		loc: edges (being reduced)
Carya cordiformis (Wangenh.) K. Koch	bitternut hickory		p	loc fre: lower slopes; and N slope beyond fence; also sca sdl in upper slopes with younger woods
Carya glabra (P. Mill.) Sweet	pignut hickory		p	loc fre: upper slopes
Carya laciniosa (Michx. f.) G. Don	shellbark hickory		p	rar: bottom edge N of fence
Carya ovalis (Wangenh.) Sarg.	sweet pignut hickory			occ: upper
Carya ovata (P. Mill.) K. Koch	shagbark hickory		p	loc fre: upper slopes; to 6 dm
Carya tomentosa (Lam.) Nutt.	mockernut hickory		T	nea
Celtis occidentalis L.	common hackberry			occ; loc fre: esp edges, some X tenuifolia?
Celtis tenuifolia Nutt.	dwarf hackberry			rar? Or just hybrid?
Diospyros virginiana L.	persimmon		p	occ: more disturbed woods, edges

Fagus grandifolia Ehrh.	beech		p	loc abu: mesic slopes and local on uplands; to 8 dm
Fraxinus americana L.	northern white ash			occ; perhaps in more sheltered places???
Fraxinus biltmoreana Beadle	southern white ash		p	loc fre: esp drier or more disturbed sites; ?some may be "smallii" in saplings but usually can find hairs and petioles can be more enclosing with flanges low on shoots, but blunt at upper nodes
Fraxinus quadrangulata Michx.	blue ash			occ; loc fre? but large trees not seen; many sdl in mesic woods at W side
Gleditsia triacanthos L.	honeylocust		T	rar: near old cabin in field
Ilex opaca Ait.	holly		p	rar: upper slope
Juglans cinerea L.	white walnut		p	nea: 15 cm and 30 cm on main trail, sick
Juglans nigra L.	black walnut		p	occ; loc fre: esp edges of upper slopes (and lower?)
Juniperus virginiana L.	redcedar		T	loc fre: esp upper edges
Liriodendron tulipifera L.	tuliptree			loc abu: esp toeslopes and bottoms
Morus rubra L.	red mulberry		p	occ: esp edges
Nyssa sylvatica Marsh.	blackgum		p	occ: upper slopes
Platanus occidentalis L.	plane-tree/sycamore		T	occ; loc fre: esp streams, disturbed lower slopes
Prunus serotina Ehrh.	black cherry		p	occ; loc fre: esp edges, upper slopes with younger woods
Pyrus calleryana Decne.	Callery / Bradford pear	AAA	T	rar: edge with Juniperus
Quercus alba L.	white oak		p	loc abu: upper slopes; to 8 dm
Quercus imbricaria Michx.	shingle oak		T	nea
Quercus muehlenbergii Engelm.	chinquapin oak		p	occ; esp midslopes; to 8 dm ?
Quercus rubra L.	northern red oak		p	loc com: esp upper slopes in Qualba transitions

Quercus shumardii Buckl.	western red oak			occ: N toeslope beyond fence, some perhaps X rubra
Quercus velutina Lam.	black oak		T	occ; loc fre: upper slopes (formerly upland flats?)
Robinia pseudoacacia L.	black locust		p	occ: edges
Salix nigra Marsh.	black willow		p	occ: pond
Sassafras albidum (Nutt.) Nees	sassafras		T	fre: sca larger trees at upper edges, also widespread small suckers in drier woods
Ulmus americana L.	white elm		T	occ; loc fre?: bottoms, low disturbed slopes
Ulmus rubra Muhl.	red elm		p	occ: esp lower slopes?

SHRUBS				*SHRUBS*
Amelanchier arborea (Michx. f.) Fern.	common serviceberry		T	nea
Aralia spinosa L.	devil's walking stick		p	occ: esp upper slopes
Arundinaria gigantea (Walt.) Muhl.	cane		p	loc: toeslopes and bottoms at W side; and a little in central ravine
Asimina triloba (L.) Dunal	pawpaw		p	loc abu: mesic slopes
Carpinus caroliniana Walt.	hornbeam		T	occ; loc fre: lower slopes, cutover midslopes near gullies
Cercis canadensis L.	redbud		T	occ: upper edges and/or planted??
Cornus florida L.	flowering dogwood		T	occ: upper slopes
Elaeagnus umbellata Thunb.	autumn olive	AAA	T	nea
Euonymus alatus (Thunb.) Sieb.	burning-bush		T	occ: upper slopes, much browsed
Euonymus americana L.	strawberry-bush		p	rar: ?much browsed

Hamamelis virginiana L.	witchhazel		T	nea
Hydrangea arborescens L.	wild hydrangea		p	loc fre: lower slopes; esp N slope base beyond fence
Lindera benzoin (L.) Blume	spicebush		p	loc abu: mesic slopes, bottoms
Ostrya virginiana (P. Mill.) K. Koch	hophornbeam		T	fre: esp upper edges
Philadelphus cf. inodorus L.	scentless mock-orange	AA	T	pla nea?
Rhamnus caroliniana Walt.	common buck-cherry		p (mollis)	fre: widely sca sdl esp along deer trails???; smooth except veins
Rhodotypos scandens (Thun.) Makino	jetbead	AA	T	pla nea?
Rhus copallinum L.	shining sumac		T	loc fre: upper edges
Rhus glabra L.	smooth sumac		T	occ? streamside in ravine
Rosa carolina L.	hill rose		p	nea
Rosa multiflora Thunb. ex Murr.	multiflora rose	AAA	p	loc fre: edges, gaps, streamsides
Rosa setigera Michx.	climbing rose		p	occ: edges, streamsides
Rubus allegheniensis Porter	wood blackberry			loc fre: mesic-subxeric woods
Rubus argutus Link	southern blackberry			loc abu: edges, esp upper
Rubus occidentalis L.	wild raspberry			loc fre: lower edges, esp N-facing more or less
Sambucus canadensis L.	elderberry		T	loc fre: thinned woods and edges; esp bottoms, disturbed toeslopes with Arundinaria etc
Staphylea trifolia L.	bladdernut			loc: patch on N slope beyond fence and lower slopes in ravine to W
Symphoricarpos orbiculatus Moench	coralberry			com: esp upper slopes and edges in general
Viburnum cf. dentatum L.	southern/hairy arrow-wood		T	pla nea?

Viburnum rufidulum Raf.	rusty blackhaw		p	rar: more disturbed woods (formerly cattle?)

VINES				*VINES*
Bignonia capreolata L.	crossvine		p	none??? (NOT 2nd visit either 29Jul; or 3rd 8Aug)
Campsis radicans (L.) Seem. ex Bureau	trumpet creeper		p	rar: lower slope in disturbed woods (formerly cattle?)
Celastrus scandens L.	American bittersweet		T	occ: upper slopes, fencerows; some scale in shade
Clematis virginiana L.	virgin's-bower		T	occ: streamside banks
Euonymus fortunei (Turcz.) Hand.-Maz.	purplish winter-creeper	AAA	T	occ: widely sca but not spreading on ground; one vine up tree on streambank; some scale in shade
Hedera helix L.	European ivy	AA	T	nea
Lonicera japonica Thunb.	Japanese honeysuckle	AAA	T	com; loc abu: upper slopes, esp edges
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper		p	com: more or less mesic woods on slopes in general
Smilax bona-nox L.	rough greenbrier		T	nea
Smilax glauca Walt.	pale greenbrier		T	occ: upper slopes, edges
Smilax hispida Raf.	bristly greenbrier		p	occ: esp lower slopes
Smilax rotundifolia L.	common greenbrier		T	occ; loc fre; upper slopes
Toxicodendron radicans (L.) Kuntze	poison ivy		p	occ? Not common in general !
Vitis aestivalis Michx.	upland hairy-grape		p	occ; upper slopes; var. bicolor (and Atlas)
Vitis vulpina L.	common smooth-grape			occ; loc fre: esp bottoms?

FERNS AND ALLIES				*FERNS AND ALLIES*
Adiantum capillis-veneris L.	southern maiden-hair fern		p	
Adiantum pedatum L.	maidenhair fern		p	occ: N slope beyond fence
Asplenium platyneuron (L.) B.S.P.	common ebony spleenwort		T	occ: esp drier younger woods
Asplenium rhizophyllum L.	climbing spleenwort			nea
Botrypus virginianum (L.) Michx.	rattlesnake fern		p	occ: upper slopes often with cedars/nearby
Diplazium pycnocarpon (Spreng.) Broun	giant spleenwort		p	loc fre: toeslopes/bottoms beyond N fence and in best mesic ravines
Equisetum hyemale L.	straight horsetail		T	nea
Osmundastrum cinnamomea (L.) C. Presl.	cinnamon fern			nea; JC in upland woods ca 2007
Polypodium virginianum L.	rock polypody			occ; esp lower slopes in thin woods
Polystichum acrostichoides (Michx.) Schott	Christmas fern		p	loc fre: esp mesic-subxeric woods
Thelypteris hexagonoptera (Michx.) Weatherby	beech-fern		T	occ: midslope with beech
DICOT HERBS (non-legume/composite)				*DICOT HERBS (non-legume/composite)*
Acalypha deamii (Weatherby) Ahles	lowland mercury			occ; streamside banks in central ravine
Acalypha virginica L.	lesser mercury			occ: drier slopes
Actaea pachypoda Ell.	white baneberry		T	occ; loc fre: N slope beyond fence and best mesic ravine to W
Agrimonia parviflora Ait.	marsh agrimony			nea
Agrimonia pubescens Wallr.	hairy agrimony			occ; drier woods

Agrimonia rostellata Wallr.	smooth agrimony		p	occ: drier slopes in woods, edge, brushy fields
Alliaria petiolata (Bieb.) Cavara & Grande	garlic mustard	AAA		nea
Anagallis arvensis L.	scarlet pimpernel		p	nea
Anemone virginiana L.	thimbleweed		p	rar: upper slopes in thin woods near edge
Anemonella thalictroides (L.) Spach.	rue-anemone		T	nea
Antenoron virginianum (L.) Roberty & Vautier	wood knotweed		p	pre???
Apocynum cannabinum L.	dogbane		p	occ: fields
Arabidopsis thaliana (L.) Heynh.	mouseear cress	AA	T	nea: fields
Aruncus dioicus (Walt.) Fern.	goat's-beard			nea
Asarum canadense L.	wildginger		T	loc fre: toeslopes/bottoms beyond N fence and in mesic ravines to W
Asclepias purpurascens	purple milkweed			nea
Asclepias quadrifolia Jacq.	fourleaf milkweed			nea
Asclepias syriaca L.	common milkweed			loc fre: fields (?)
Asclepias tuberosa L.	orange milkweed		p	nea
Asclepias viridiflora Raf.	slender green milkweed			nea
Asclepias viridis Walt.	common green milkweed		T	occ: fields
Aureolaria patula	riparian yellow foxglove		p	
Barbarea vulgaris Ait. f.	winter-cress	AA	T	nea
Blephilia ciliata (L.) Benth.	blue wood-mint			nea

Blephilia hirsuta (Pursh) Benth.	white wood-mint		p	rar: streamside bank in central ravine (partly eaten)
Boehmeria cylindrica (L.) Sw.	water hemp			occ: bottoms
Brassica napus L.	rape	AA	T	nea: fields
Campanulastrum americanum (L.) Small	tall bellflower			nea
Capsella bursa-pastoris (L.) Medik.	shepherd's purse	AA	T	nea: fields
Cardamine douglassii Britt.	limestone bittercress		T	nea
Caulophyllum thalictroides (L.) Michx.	blue cohosh		T	loc fre: N slope beyond fence
Cerastium vulgare Hartman	common mouse-ear chickweed	AA	T	nea: fields
Chamaesyce nutans (Lag.) Small	greater milk-purslane			occ: fields
Chimaphila maculata (L.) Pursh	striped wintergreen		p	nea
Circaea canadensis (L.) Hill	enchanter's nightshade		p	occ; low W side (check)
Claytonia virginica L.	common spring-beauty		T	nea
Collinsonia canadensis L.	horse-balm		p	loc: fre in best mesic ravine (3) at bottom with much deer impact
Conopholis americana (L.) Wallr. f.	squawroot		T	nea
Corydalis flavula (Raf.) DC.	yellow fumewort		T	nea
Croton capitatus Michx.	woolly croton			occ??? fields check
Croton monanthogynus Michx.	lime croton			loc fre: fields in exposed/eroded spots
Cruciata pedemontana (Bellardi) Ehrend.	piedmont bedstraw	AA	T	nea: fields
Cryptotaenia canadensis (L.) DC.	honewort		T	occ: streamsides

Cuscuta gronovii Willd. ex J.A. Schultes	common dodder			pre??? pond
Cynanchum laeve (Michx.) Pers.	honey-vine		T	occ: fields
Cynoglossum virginianum L.	wild comfrey		T	nea
Datura stramonium L.	jimsonweed	A		nea
Daucus carota L.	wild carot	AAA		loc fre: fields
Delphinium tricorne Michx.	wood larkspur			nea
Dentaria diphylla Michx. @	broad-leaved toothwort		T	nea
Dentaria laciniata Muhl. ex Willd. @	laciniate toothwort		T	nea
Dentaria multifida Muhl. ex Ell. @	fine-leaved toothwort		T	nea
Dianthus armeria L.	Deptford pink	AA	T	nea
Diodia teres Walt.	upland buttonweed		p	loc com: fields
Diodia virginiana L.	lowland buttonweed			occ: fields in lower areas on uplands
Draba verna L.	weed draba	AA	T	nea
Duchesnea indica (Andr.) Focke	false strawberry	AAA		nea
Endodeca serpentaria (L.) Raf. @	birthwort		T	occ: mesic-subxeric slopes
Enemion biternatum Raf.	deep-lobed rue anemone			nea
Epifagus virginiana (L.) W. Bart.	beechdrops		p	nea
Erigenia bulbosa (Michx.) Nutt.	harbinger-of-spring		T	nea
Fragaria virginiana Duchesne	wild strawberry		p	nea

Galium aparine L.	cleaving bedstraw	a		nea
Galium circaezans Michx.	dry wood bedstraw		T	com: esp mesic-subxeric woods
Galium concinnum Torr. & Gray	needle-leaved bedstraw		p	nea
Galium pilosum Ait.	hairy bedstraw			occ: old field to W with Panicum anceps, Solidago
Geranium carolinianum L.	field geranium		T	nea: fields
Geranium maculatum L.	wood geranium			nea
Geum canadense Jacq.	white avens			occ; streamsides? etc?
Geum vernum (Raf.) Torr. & Gray	spring avens		T	nea?
Geum virginianum L.	cream avens			occ: drier woods
Glechoma hederacea L.	gill-over-the-ground	AAA	p	nea
Hepatica acutiloba DC.	acute hepatica		T	nea
Heuchera macrorhiza Small	lime-cliff alumroot		p	nea? "villosa"
Houstonia lanceolata (Poir.) Britt.	lance-leaved bluets			nea?
Houstonia purpurea L.	broad-leaved bluets		T	occ: gas ROW in ravine to W
Hybanthus concolor (T.F. Forst.) Spreng.	greenviolet		p	occ: mesic ravine to W, lower slopes
Hydrastis canadensis L.	goldenseal			nea
Hydrophyllum canadense L.	lowland waterleaf			loc abu: toeslopes/bottoms beyond N fence and better ravines
Hydrophyllum macrophyllum Nutt.	upland waterleaf		p	occ: mesic-subxeric slopes
Hypericum perforatum L.	weedy St. John's-wort	AA		nea

Hypericum punctatum Lam.	common St. Johnswort		p	occ: fields
Hypericum stragulum P. Adams & Robson	common St. Andrew's-cross		p	nea
Impatiens capensis Meerb.	orange jewelweed		p	loc abu: streambanks, gasline across ravine
Impatiens pallida Nutt.	yellow jewelweed			nea
Ipomoea hederacea Jacq.	ivy-leaved morning-glory			nea
Ipomoea pandurata (L.) G.F.W. Mey.	greater morning-glory			nea
Ipomoea purpurea (L.) Roth	garden morning-glory			nea
Jeffersonia diphylla (L.) Pers.	twinleaf		T	occ: toeslope beyond N fence
Lamium amplexicaule L.	dryland henbit	AA	T	nea
Lamium purpureum L.	common henbit	AA	T	nea
Laportea canadensis (L.) Weddell	wood nettle		p	loc abu: esp toeslopes and bottoms; absent from upstream sections of ravines
Lepidium campestre (L.) Ait. f.	old-field pepperweed		T	nea: fields
Lepidium virginicum L.	common pepperweed			occ; loc fre: fields
Lithospermum cf. canescens	orange puccoon		T	nea; to be checked
Lobelia cardinalis L.	cardinal-flower			nea
Lobelia inflata L.	common lobelia			loc fre: fields, thin woods
Lysimachia quadrifolia L.	wood loosestrife			nea
Menispermum canadense L.	common moonseed		T	loc: streambanks
Mentha spicata L.	spearmint	AAA		occ: pond

Microthlaspi perfoliatum (L.) F. K. Meyer	lesser pennycress	AA	T	nea: fields
Monarda fistulosa L.	common bergamot			pla: loc abu in fields; perhaps native also?
Monotropa uniflora L.	Indianpipe		p	nea
Obolaria virginica L.	pennywort			nea
Oenothera biennis L.	common evening-primrose			occ: fields
Osmorhiza claytonii (Michx.) C.B. Clarke	hairy cicely		T	occ: N slope beyond fence and W ravine
Osmorhiza longistylis (Torr.) DC.	smooth cicely			nea?
Oxalis grandis Small	eastern wood-sorrel		T	nea?
Oxalis dillenii Jacq.	common wood-sorrel		T	occ; loc fre: fields, thin woods
Pachysandra procumbens Michx.	box-spurge		T	loc fre: lower slopes and terraces; mostly absent from upstream sections of ravine
Panax quinquefolius L.	ginseng			nea
Passiflora incarnata L.	purple passionflower	a		occ; fields (GWeddle)
Passiflora lutea L. var. glabriflora Fern.	yellow passionflower		T	nea?
Penstemon calycosus Small	felty open beardtongue			nea? "digitalis"
Perilla frutescens (L.) Britt.	beef-steak-plant	AAA		occ: fields, thin woods; esp lower slopes, bottoms where grazed before?
Persicaria longiseta (de Bruyn) Kitagawa	Asian pink smartweed	AAA		pre???
Persicaria pensylvanicum (L.) Small	greater pink smartweed		p?	
Persicaria punctata (Ell.) Sm.	common white smartweed			pre???
Phlox divaricata L.	eastern wood phlox		T	loc fre: esp lower slopes

Phryma leptostachya L.	lopseed			occ: thin woods?
Physalis heterophylla Nees	clammy groundcherry			loc fre: both vars; fields, ROWs
Phytolacca americana L.	pokeweed			fre: thin woods, edges
Pilea pumila (L.) Gray	clearweed		p	loc abu: bottoms and streambanks
Plantago aristata Michx.	bristly plantain			loc fre: eroded paths through fields
Plantago lanceolata L.	English plantain	AA		pre???
Plantago rugelii Dcne.	broad-leaf plantain			pre???
Plantago virginica L.	hoary plantain		T	nea: fields
Podophyllum peltatum L.	mayapple		p	occ; loc fre: lower slopes
Polemonium reptans L.	Jacob's-ladder		T	nea; T has "var. villosum"
Potentilla recta L.	sulphur cinquefoil	AA	T	nea
Potentilla simplex Michx.	common cinquefoil			occ; loc fre: fields, thin woods on upper slopes
Prunella lanceolata W. Bart.	lance-leaved selfheal			occ: fields, ROWs
Pycnanthemum pycnanthemoides (Leavenworth) Fern.	hoary head-mint			nea + "incanum"
Pycnanthemum tenuifolium Schrad.	narrow-leaved head-mint			nea
Ranunculus abortivus L.	smooth little-buttercup		T	nea
Ranunculus bulbosus L.	bulbous buttercup	AA	T	nea
Ranunculus micranthus Nutt.	hairy little-buttercup		T	nea
Ranunculus recurvatus Poir.	lobed wood-buttercup		p	occ: midslope

Ranunculus sardous Crantz	pasture-buttercup	AA		occ: fields
Ruellia caroliniensis (J.F. Gmel.) Steud.	upland petunia			loc fre: fields, thin woods on upper slopes
Ruellia strepens L.	lowland petunia			nea?
Rumex crispus L.	curlyleaf dock	AA	T	nea
Rumex obtusifolius L.	broadleaf dock	AA		nea
Sabatia angularis (L.) Pursh	rosepink			occ; loc fre: fields near woods edge
Salvia lyrata L.	lyreleaf sage		T	nea: fields, roadsides
Sanguinaria canadensis L.	bloodroot		T	occ: lower slopes
Sanicula canadensis L.	common sanicle		T	occ: thin woods, edges
Scutellaria elliptica Muhl. ex Spreng.	small wood skullcap		T	occ: drier woods in ravine
Scutellaria incana Biehler	tall wood skullcap			nea: old woods edge on road in (pubescent)
Scutellaria nervosa Pursh	small wood skullcap			nea
Scutellaria ovata Hill	heart-leaved skullcap			rar: streambank in central ravine? check scrap seems to be typical ovata of W but lvs long hairy with few glands = var. calcarea?
Sedum ternatum Michx.	wood stonecrop		T	nea
Solanum carolinense L.	horse-nettle		T	occ; loc fre: fields
Stachys cordata Riddell	hairy woundwort			occ: lower slopes; check seems to be nuttallii sensu stricto; but need to grow
Stachys hispida Pursh	hispid woundwort			
Stellaria media (L.) Vill.	common chickweed	AAA	p	occ; loc fre: by cabin
Stellaria pubera Michx.	wood-chickweed		T	occ: midslope near beech

Stylophorum diphyllum (Michx.) Nutt.	wood poppy		p	loc fre: N slope beyond fence (sev deer browsed!!!); also com in best mesic ravine to W
Teucrium canadense L.	germander			loc fre: bottom beyond N fence
Thalictrum dioicum L.	early wood-rue		p	occ; loc fre: upp N slope beyond fence
Tiarella cordifolia L.	foamflower			nea
Triodanis perfoliata (L.) Nieuwl.	Venus looking-glass		T	nea
Truellum sagittatum (L.) Soják	arrow-leaved tearthumb			occ: bottoms beyond N fence
Valerianella radiata (L.) Dufr.	southern cornsalad		T	nea
Verbascum thapsus L.	common mullein	AA		nea
Verbena hastata L.	marsh vervain			occ; by pond?; also nea
Verbena urticifolia L.	white vervain			occ: edges, fields, streamside?
Veronica hederifolia L.	ivy-leaved speedwell	AA	T	nea
Veronica cf. persica Poir.	birdeye speedwell	AA	T	nea
Vinca minor L.	periwinkle	AAA	T	nea: roadside fencerow
Viola affinis Le Conte	northern blue-violet			occ? Lower slopes; with small scattered hairs above
Viola bicolor Pursh	common field-pansy		T	nea: fields
Viola palmata L. (sensu stricto)	trilobed blue-violet		p	occ: upper slopes
Viola papilionacea Pursh p.p.	common blue-violet			nea
Viola pensylvanica Michx.	smooth yellow stemmed-violet		T	occ; loc fre: lower slopes esp best mesic areas; consistently goes to pen versus pub but need to check more
Viola rostrata Pursh	long-spurred spreading violet		T	occ: streambanks, lowest slopes

Viola sororia Willd.	hairy blue-violet		T	nea
Viola striata Ait.	creamy spreading-violet		T	nea

FABACEAE				*FABACEAE*
Amphicarpaea bracteata (L.) Fern.	common hogpeanut		p	com; loc abu: esp lower slopes/bottoms, upper edges; most/all is small leaved variant l
Cassia tora L.	sicklepod	AA	p?	
Chamaecrista fasciculata (Michx.) Greene	greater partridge-pea			loc fre: fields, rows; perhaps some/all planted
Crotalaria spectabilis L.	showy rattlebox		p	
Desmodium canescens (L.) DC.	hoary field ticktrefoil			occ: fields with Panicum anceps, Solidago altissima
Desmodium glutinosum (Muhl. ex Willd.) Wood	rich wood tick-trefoil			nea
Desmodium paniculatum (L.) DC.	narrow-leaved tick-trefoil			loc fre: upper edges, adj fields
Desmodium perplexum Schub.	hairy field tick-trefoil			loc fre: fields
Hylodesmum nudiflorum (L.) H. Ohashi & R.R. Mill @	common wood tick-trefoil		p	loc fre: upper slopes
Lathyrus latifolius L.	Caley pea	AA		nea
Lespedeza cuneata (Dum.-Cours.) G. Don	sericea bush-clover	AAA		loc com: fields
Medicago lupulina L.	black medick	AA	T	nea: fields, roadsides
Melilotus officinalis (L.) Lam.	yellow sweetclover	AAA		occ; fields
Securigera varia (L.) Lassen	crown-vetch	AAA	T	nea: fields, roadsides
Trifolium campestre Schreb.	yellow clover	AA	T	loc fre: fields

Trifolium pratense L.	red clover	AA	T	loc com: fields
Trifolium repens L.	white clover	AA	T	loc fre: fields/mowed areas
Vicia angustifolia L.	spring vetch	AA	T	nea: fields

ASTERACEAE				*ASTERACEAE*
Achillea millefolium L.	yarrow	a	T	occ: fields
Ambrosia artemisiifolia L.	common ragweed			loc com: fields
Ambrosia bidentata Michx.	narrow ragweed			loc com: eroded paths through fields (with Plantago aristata)
Ambrosia trifida L.	giant ragweed			occ??? (lower edges???)
Antennaria plantaginifolia (L.) Richards.	hairy pussytoes			nea
Arctium minus Bernh.	burrdock	AA		occ: fields
Symphyotrichum dumosum (L.) Nesom	sand little-white-aster			loc: old field with Panicum anceps
Symphyotrichum lateriflorum (L.) A.& D. Löve	purplish little-white-aster			occ: esp thin woods on slopes
Symphyotrichum novae-angliae (L.) Nesom	tall purple-aster			pla; occ? fields; some perhaps native
Symphyotrichum ontarione (Wieg.) Nesom	soft little-white-aster			occ; loc fre? Fields
Symphyotrichum pilosum (Willd.) Nesom	old-field little-white-aster			loc fre: fields
Symphyotrichum shortii (Lindl.) Nesom	lime wood-blue-aster			loc fre: upper slopes; one with weird narrow lvs ???x lateriflorus???
Bidens frondosa L.	small discoid bur-marigold			occ: pond
Carduus nutans L.	nodding plumeless thistle	AA	T	nea: fields

Chrysopsis camporum Greene	western goldenaster	A		pla? Fields to check
Cichorium intybus L.	chicory	AA		nea
Cirsium discolor (Muhl. ex Willd.) Spreng.	old-field thistle		T	occ: fields, ROWs
Cirsium vulgare (Savi) Ten.	bull thistle	AA		occ: mowed area nr cabin
Conoclinium coelestinum (L.) DC.	blue mistflower		T	occ; fields
Coreopsis lanceolata L.	lance-leaved coreopsis	A	T	pla nea?
Echinacea purpurea (L.) Moench.	broad-leaved purple coneflower		p	pla; loc fre: fields
Elephantopus carolinianus Raeusch.	common elephant's-foot		p	occ; loc fre: fields; also grazed bottom at W side
Erigeron annuus (L.) Pers.	common daisy-fleabane		T	fre: fields
Erigeron canadensis L.	common horseweed			loc fre??? fields???
Erigeron philadelphicus L.	early daisy-fleabane			nea
Erigeron strigosus Muhl. ex Willd.	western daisy-fleabane		T	nea
Eupatorium perfoliatum L.	marsh boneset			nea
Ageratina altissima (L.) King & H.E. Robins.	common snakeroot		p	loc fre: esp bottoms in more grazed area to W
Eupatorium serotinum Michx.	lowland boneset		p	occ: fields
Euphorbia corollata L.	showy spurge			occ: old fields, thin cedars to W
Euthamia graminifolia (L.) Nutt.	common narrow-leaved aster		p	nea
Eutrochium fistulosum (Barratt) E.E. Lamont	common joe-pye-weed			nea
Eutrochium purpureum (L.) E.E. Lamont	wood joe-pye-weed			rar: thin woods in disturbed ravine; much browsed

Gamochaeta purpurea (L.) Cabrera	purple everlasting		T	nea
Grindelia squarrosa (Pursh) Dunal	curlycup gumweed			pla??? fields to check
Helianthus maximiliani Schrad.	western giant sunflower	A		pla: fields
Helianthus microcephalus Torr. & Gray	small wood sunflower		p	nea: woods edge to E
Helianthus tuberosus L.	tuberous sunflower			occ: bottomland in/near ROW
Heliopsis helianthoides (L.) Sweet	oxeye-sunflower			pla: fields
Iva annua L.	annual sumpweed			occ; loc fre: fields
Krigia biflora (Walt.) Blake	common orange dandelion			occ: upper slopes
Lactuca canadensis L.	common wild lettuce			occ: fields esp near fences
Lactuca floridana (L.) Gaertn.	common blue lettuce			occ: lower slopes
Lactuca serriola L.	prickly lettuce	AA	p	loc fre: fields
Leucanthemum vulgare Lam.	oxeye daisy	AA	T	occ; fields
Liatris spicata (L.) Willd.	dense blazing star			nea
Nabalus altissimus (L.) Hook.	common wood-lettuce			occ: esp mesic-subxeric woods
Oligoneuron rigidum (L.) Small	stiff goldenrod			nea; seems native at back of fields
Packera anonyma (Wood) W.A. Weber & Á. Löve	common ragwort		T	nea: fields
Packera aurea (L.) Á. Löve & D. Löve	golden ragwort		T	nea
Packera glabella (Poir.) C. Jeffrey	butter ragwort		T	pre???
Packera obovata (Muhl. ex Willd.) W.A. Weber & Á. Löve	wood ragwort		T	nea

Ratibida pinnata (Vent.) Barnh.	prairie coneflower			pla: loc abu in fields
Rudbeckia hirta L. var. pulcherrima Farw.	common blackeyed Susan			occ??? fields???
Smallanthus uvedalius (L.) Mackenzie ex Small	yellow wood-rosin			occ: lower edges
Solidago altissima L.	old-field goldenrod			loc com: fields
Solidago caesia L.	blue-stem goldenrod		p	fre: esp mesic-subxeric woods
Solidago flexicaulis L.	common zig-zag goldenrod		p	???none???
Solidago nemoralis Ait.	gray-haired goldenrod			occ: fields
Solidago ulmifolia Muhl. ex Willd.	lime-wood/elmleaf goldenrod			occ: drier woods
Sonchus asper (L.) Hill	spiny sowthistle	AA		occ: by cabin
Symphyotrichum cordifolium (L.) Nesom	common wood-blue-aster		p	loc fre: esp lower slopes on/near streamside banks
Taraxacum officinale G.H. Weber ex Wiggers	common dandelion	AA		occ: fields
Verbesina alternifolia (L.) Britt. ex Kearney	lowland wingstem		p	occ: lower edges, bottoms
Verbesina occidentalis (L.) Walt.	eastern wingstem		p	loc fre: fields, upper edges AND old grazed bottom to W
Vernonia gigantea (Walt.) Trel.	common ironweed			loc fre: fields
				----------
MONOCOT HERBS (non-graminoid)				*MONOCOT HERBS (non-graminoid)*
Allium canadense L.	wild onion			nea
Allium tricoccum Ait.	broad wild leek			nea
Allium vineale L.	weed onion	AA	T	loc fre: fields

Aplectrum hyemale (Muhl. ex Willd.) Torr.	puttyroot orchid			nea
Arisaema dracontium (L.) Schott	green dragon		T	nea
Arisaema pusillum	dwarf Jack-in-the-pulpit		p	
Arisaema triphyllum (L.) Schott	jack-in-the-pulpit		T	occ: N slope beyond fence and best mesic ravine to W
Commelina communis L.	common dayflower	AA		occ; loc fre: streambanks; near cabin
Cypripedium pubescens Willd.	yellow lady's slipper			nea
Dioscorea quaternata J.F. Gmel.	upland wild yam			occ: mesic-subxeric slopes
Erythronium americanum Ker-Gawl.	yellow trout-lily			nea
Galearis spectabilis (L.) Raf.	showy orchid		p	nea
Goodyera pubescens (Willd.) R. Br. ex Ait. f.	rattlesnake plantain			nea
Hemerocallis fulva (L.) L.	orange daylily	AA		nea
Iris cristata Ait.	common dwarf iris		p	loc fre: more or less mesic slopes; esp with beech/tulip
Iris pseudacorus L.	yellow iris	AAA	T	nea: pond margins
Iris shrevei Small	midwestern swamp iris		T	pla nea: pond margins (?)
Liparis liliifolia (L.) L.C. Rich. ex Ker-Gawl.	tway-blade orchid			occ; mesic-subxeric transition
Maianthemum racemosum (L.) Link	false solomon's-seal		p	occ: local in west ravine on steep low slopes with Fagus, Hydrangea
Narcissus pseudonarcissus L.	daffodil	AAA	T	nea
Ornithogalum umbellatum L.	star-of-Bethlehem	AAA		nea
Polygonatum biflorum (Walt.) Ell.	common Solomon's seal			occ: esp mesic-subxeric woods

Prosartes lanuginosa (Michx.) D. Don	hairy mandarin		T	nea
Sisyrinchium angustifolium P. Mill.	common blue-eyed grass		T	nea
Smilax ecirrata (Engelm. ex Kunth) S. Wats.	upright carrionflower		p	occ: lower slopes; pub lower leaf surfaces, not lasionuera???
Spiranthes gracilis (Bigelow) Beck	southern little ladies'-tresses			nea
Tipularia discolor (Pursh) Nutt.	cranefly-orchid		p	nea
Trillium flexipes Raf.	nodding trillium		p	occ; loc fre: toeslope beyond N fence; T has "sulcatum"
Trillium sessile L.	small sessile-trillium		T	nea
Uvularia perfoliata L.	lesser bellwort		p	nea; none seen on project!

GRAMINOIDS				*GRAMINOIDS*
Agrostis gigantea Roth	redtop grass	AAA		loc fre: fields
Andropogon gerardii Vitman	big bluestem			pla? Fields
Andropogon virginicus L.	common broomsedge			loc com: fields
Anthoxanthum odoratum L.	sweet vernalgrass	AA	T	loc fre: fields
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	beech-grass			???none???
Bromus cf. japonicus Thunb. ex Murr.	Japanese cheat-grass	AA	T	nea: fields
Bromus pubescens Muhl. ex Willd.	eastern brome-grass			???none???
Carex albicans Willd. ex Spreng.	exert tufted fine-sedge			pre???
Carex albursina Sheldon	greater lax-sedge			occ; loc fre? mesic ravine slopes; check more vs kraliana

Carex amphibola Steud.	common wrinkled-sedge			pre???
Carex blanda Dewey	weedy lax-sedge		T	pre???
Carex cephalophora Muhl. ex Willd.	woodland headed spike-sedge			pre???
Carex cumberlandensis Naczi, Kral & Bryson	hidden lax-sedge			loc fre: low-mid slopes in ravines esp with Fagus, Lirio???
Carex digitalis Willd.	lesser lax-sedge			occ???: slopes in ravine??? Check vs cumb.
Carex frankii Kunth	scaly head-sedge		T	occ; loc fre: pond, lower streambank
Carex glaucodea Tuckerman ex Olney	bluish wrinkled-sedge		T	nea: fields, thin woods
Carex gracilescens Steud.	slender lax-sedge			occ? streamsides in ravine
Carex hirsutella Mackenzie	common grassland hairy-sedge		T	pre???
Carex jamesii Schwein.	rich-wood tufted-sedge			pre???
Carex kraliana Naczi & Bryson	Kral's sedge			occ: mesic-subxeric slopes
Carex laxiculmis Schwein.	lesser blue lax-sedge			occ?? var copulata; to grow and check later
Carex lupulina Muhl. ex Willd.	greater hop-sedge			nea
Carex planispicata Naczi	planar wrinkled-sedge			pre???
Carex prasina Wahlenb.	mountain-seep graceful-sedge		T	
Carex rosea Schkuhr ex Willd.	moist-woods little-spike-sedge			loc fre: lower slopes
Carex tribuloides Wahlenb.	marsh thin-scale-sedge		T	nea: pond margins
Carex vulpinoidea Michx.	fine-fox-sedge		T	nea: pond margins
Carex willdenowii Schkuhr ex Willd.	dry-wood tufted-sedge		T	nea?

Cyperus strigosus L.	common flatsedge		p	occ: fields
Dactylis glomerata L.	orchardgrass	AA	T	occ: fields
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	common poverty-grass			loc fre: upper slopes on driest sites
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. fasciculatum (Torr.) Freckmann	small hairy panic-grass		T	occ: fields
Dichanthelium boscii (Poir.) Gould	hairy-noded broadleaf panic-grass		T	occ? drier woods?
Dichanthelium clandestinum (L.) Gould	dotted broadleaf panic-grass		p	occ; loc fre: low slopes, bottoms in disturbed woods
Dichanthelium dichotomum (L.) Gould	small wood panic-grass		T	loc fre: drier slopes
Dichanthelium laxiflorum (Lam.) Gould	low yellowish panic-grass		T	nea
Elymus hystrix L.	bottlebrush-grass			occ; loc fre: upper slopes esp near rocks
Elymus villosus Muhl. ex Willd.	upland nodding wild-rye			occ: ravines to W
Elymus virginicus L. var. virginicus	smooth common wild-rye			loc fre: thin woods/edges; esp bottoms, gully heads
Festuca subverticillata (Pers.) Alexeev	wood fescue			loc fre: lower slopes
Juncus effusus L. var. solutus Fern. & Wieg.	greater marsh-rush			occ; loc fre: pond
Juncus tenuis Willd.	common path-rush		T	pre???
Leersia virginica Willd.	common rice-grass			loc fre: streambanks and low slopes in disturbed woods
Microstegium vimineum (Trin.) A. Camus	Japanese grass	AAA		loc fre: esp streambanks and toeslopes.
Muhlenbergia schreberi J.F. Gmel.	nimblewill			occ; loc com: mowed area around cabin
Panicum anceps Michx.	meadow fall-panicgrass		p	loc abu: fields
Panicum boscii Poir.	hairy-noded broadleaf panic-grass			loc fre: drier slopes

Panicum polyanthes J.A. Schultes	lowland roundseed panic-grass			occ: swale in woods edge near fields
Poa annua L.	common annual bluegrass	AA	T	pre???
Poa autumnalis Muhl. ex Ell.	tulip-wood bluegrass			pre???
Poa compressa L.	compressed bluegrass			pre???
Poa cuspidata Nutt.	early wood bluegrass		T	nea
Poa pratensis L.	common bluegrass	a	T	pre???
Poa sylvestris Gray	walnut-wood bluegrass		T	nea
Schedonorus arundinaceus (Schreb.) Dumort., nom. cons.	tall fescue	AAA	T	loc abu: fields
Scirpus georgianus Harper	dark marsh bulrush			occ: pond
Scirpus pendulus Muhl.	prairie bulrush			nea: fields
Sorghum halepense (L.) Pers.	Johnson-grass	AAA		loc com: fields
Tridens flavus (L.) A.S. Hitchc.	purpletop-grass			loc abu: fields
Tripsacum dactyloides (L.) L.	gama-grass		T	pla nea: fields
Typha latifolia L.	broad cattail			loc abu: pond
END				*END*

Colluvial hapludults (such as the Shelocta soil series) prevail on gentler toe-slopes in ravines, with relatively acid infertile soils suitable for *Iris cristata* (foreground) and beech.

APPENDIX TWO: NOTES ON GRADIENTS AMONG TERRESTRIAL HABITATS

Figure 1. Diagram showing general relationship of soil series in Green and Taylor Counties to parent material and topography. See Ross & Leather (1982) and USDA NRCS (2014) for detailed descriptions of each soil series. Asterisks (*) in these charts indicate series mapped by Ross & Leather (1982); other information is derived from continuing summary and integration with counties elsewhere in the Middle and Upper Green River section. "Adj" after series name indicate that soils were "taxadjuncts" outside the range of typical profiles.

Figure 1a (upper) presents soils that are partly non-calcareous, with much subsoil derived from sandstone, siltstone, acid shale or alluvium from uplands with these rocks.
Figure 1b (lower) presents soils that have a largely calcareous origin, but intergrading in places.
Within each box: 1st line = soil group modifier; 2nd line = soil group/class (upper case); 3rd line = series name; 4th line = typical texture. Upper bar indicates color-coding for each soil order.
Several of these series have been mapped by NRCS within a mile of Clay Hill; these soils are indicated by the underlined series names.

Note that in previous surveys by the NRCS in this region, some soils have been given different series names, or have overlapping descriptions: Crider—formerly Pembroke in part; Frederick—formerly Talbott; Gatton—formerly Zanesville; Hagerstown—formerly Lowell in part (in w. Ky.); Jefferson—formerly Frondorf in part; Lily—formerly Hartsells; Tilsit—formerly Clarkrange; Vertrees—formerly Faywood (in w. Ky.); Wallen—formerly Steinsburg. Soils approximating the Bledsoe and Brooksville series (by some definitions) are expected locally on purely calcareous slopes, but those series are not regularly recognized in this region, and Needmore is an approximate match.

ULTISOLS	ALFISOLS	VERTISOLS	MOLLISOLS	INCEPTISOLS	ENTISOLS
DIAGRAM FOR MOSTLY NON-CALCAREOUS SOIL SERIES	MORE HILLY LANDSCAPE IN GENERAL: less deep, more drained		INTERMEDIATE LANDSCAPE IN GENERAL moderately deep		LESS HILLY LANDSCAPE IN GENERAL: more deep, less drained
UPLAND acid shale or sand-stone or residuum on slopes or ridges	Lithic DYSTROCHREPT Colyer Adj* silt loam	Typic HAPLUDULT Gilpin loam	Typic HAPLUDULT Lily loam	Typic FRAGIUDULT Tilsit silt loam	Typic FRAGIAQUULT Mullins silt loam
UPLAND silt- & limestone; colluvial slopes / flats with loess	Dystric EUTROCHREPT Garmon Adj* gravelly silt loam	Ultic PALEUDULT Frankstown* silt loam	Typic PALEUDULT Mountview Adj* silt loam	Glossic FRAGIUDULT Dickson Adj* silt loam	Glossaquic FRAGIUDULT Taft Adj* silt loam
TRANSITION siltstone & shale, local loess; talus slopes to ridges	Typic HAPLUDALF Donahue loam	Ultic HAPLUDALF Lenberg* silt loam	Ultic HAPLUDALF Carpenter silt loam	Ultic HAPLUDALF Rosine silt loam	Note: alfic soils in transitions are on loess, trace lime or seepage zones
TRANSITION acid shale; side slopes to toe slopes and terraces	Typic HAPLUDULT Shelocta* silt loam	Typic HAPLUDULT Allegheny loam	Typic FRAGIUDULT Monongahela* silt loam	Aeric FLUVIAQUULT Tyler* silt loam	Note: the vertical arrangment here is not a consistent real stratification
TRANSITION sandy/silty colluvium or alluvium; low slopes, terraces	Typic HAPLUDULT Jefferson fine sandy loam	Aquic HAPLUDULT Morehead* silt loam			
LOWLAND miscellaneous; terraces to fresh and locally wet	Fluventic DYSTROCHREPT Clifty gravelly silt loam	Fluventic DYSTROCHREPT Cuba silt loam	Fluvaquentic DYSTROCHREPT Steff silt loam	Aeric FLUVAQUENT Stendal silt loam	Typic FLUVAQUENT Bonnie* silt loam

ULTISOLS	ALFISOLS	VERTISOLS	MOLLISOLS	INCEPTISOLS	ENTISOLS
DIAGRAM FOR MOSTLY CALCAREOUS SOIL SERIES	MORE HILLY LANDSCAPE IN GENERAL: less deep, more drained		INTERMEDIATE LANDSCAPE IN GENERAL moderately deep		LESS HILLY LANDSCAPE IN GENERAL: more deep, less drained
UPLAND sandy material slumped on karst; slopes to plains	Typic HAPLUDALF Donahue loam	Note: Jefferson, Donahue, Bledsoe + Brookside are not reliably mapped	Typic HAPLUDULT Riney* loam	Note: Riney is close to Lily, Rosine + Latham (on bedrock above)	Typic PALEUDALF Sonora silt loam
UPLAND more limey; rocky slopes to young karst plain	Typic HAPLUDALF Bledsoe fine sandy loam	Typic HAPLUDALF Caneyville* rocky silt loam	Typic HAPLUDALF Lowell Adj* silt loam	Typic HAPLUDALF Fredonia silt loam	Typic PALEUDALF Crider silt loam
UPLAND less limey; shaley slopes to older karst plain	Ultic HAPLUDALF Needmore* silt loam	Typic PALEUDALF Vertrees silt loam	Typic PALEUDALF Baxter cherty silt loam	Mollic PALEUDALF Pembroke silt loam	Typic FRAGIUDALF Nicholson silt loam
UPLAND less hilly; old high terraces and old impure karst	Typic HAPLUDULT Allegheny loam	Typic PALEUDULT Nolichucky Adj* loam	Typic PALEUDULT Canmer silt loam	Typic PALEUDULT Frederick* silt loam	Aquic FRAGIUDALF Lawrence silt loam
LOWLAND mostly high/old alluvium with more mature soils	Dystric-fluventic EUTROCHREPT Grigsby fine sandy loam	Fluventic EUTROCHREPT Chagrin loam	Ultic HAPLUDALF Elk* silt loam	Typic FRAGIUDALF Otwell* silt loam	Aquic FRAGIUDALF Lawrence silt loam
LOWLAND mostly fresh/low alluvium with less mature soils	Dystric-fluventic EUTROCHREPT Sensabaugh* gravelly silt loam	Dystric-fluventic EUTROCHREPT Nolin* silt loam	Fluventic EUTROCHREPT Lindside silt loam	Aeric FLUVAQUENT Newark* silt loam	Typic FLUVAQUENT Melvin* silt loam

Figure 2.1. Diagram showing general relationship of vegetation to hydrology in this region

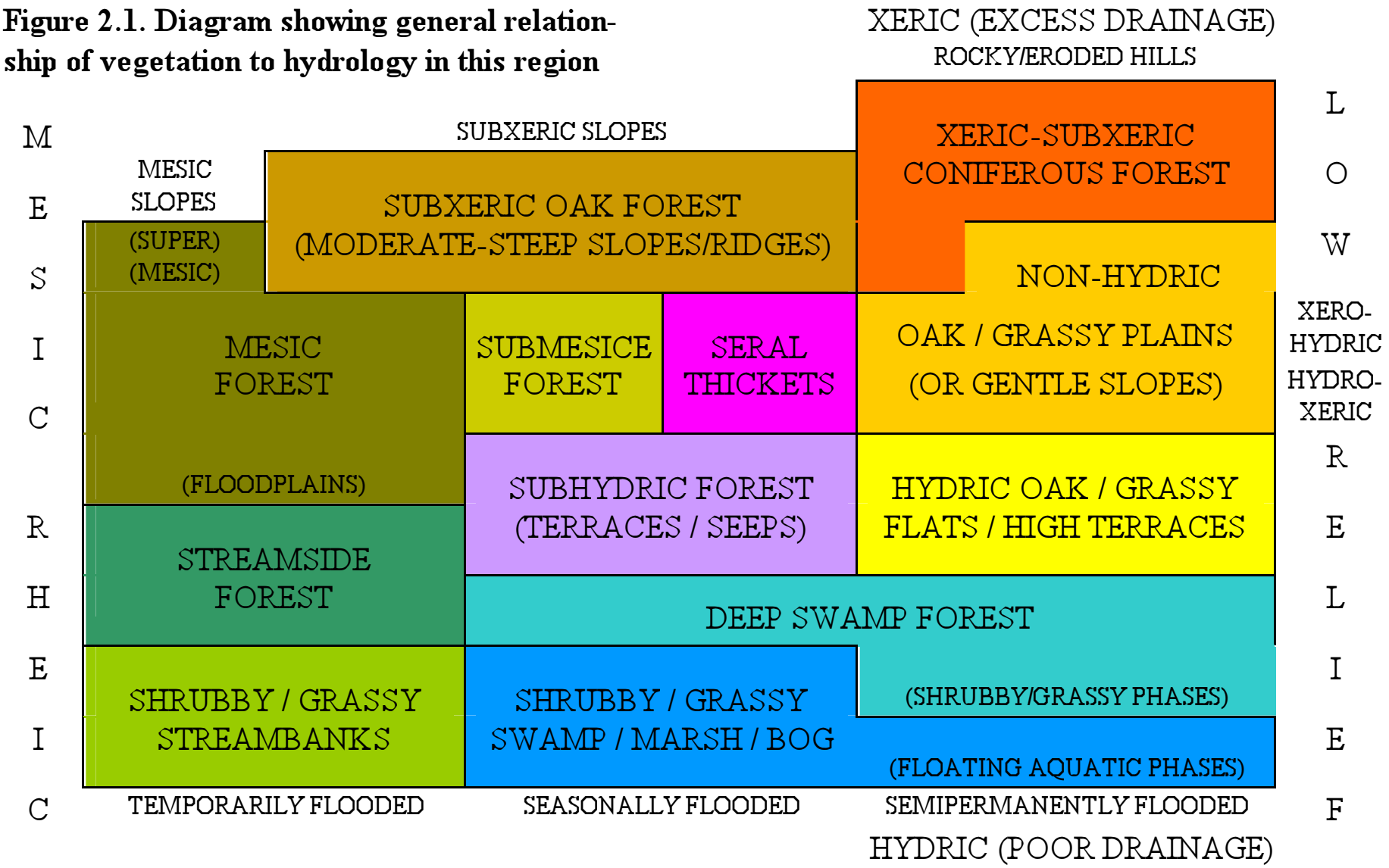


Figure 2.2. Summary diagram showing major forest types at MCNP in 1930s and 1990s data*

XERIC (EXCESS DRAINAGE)

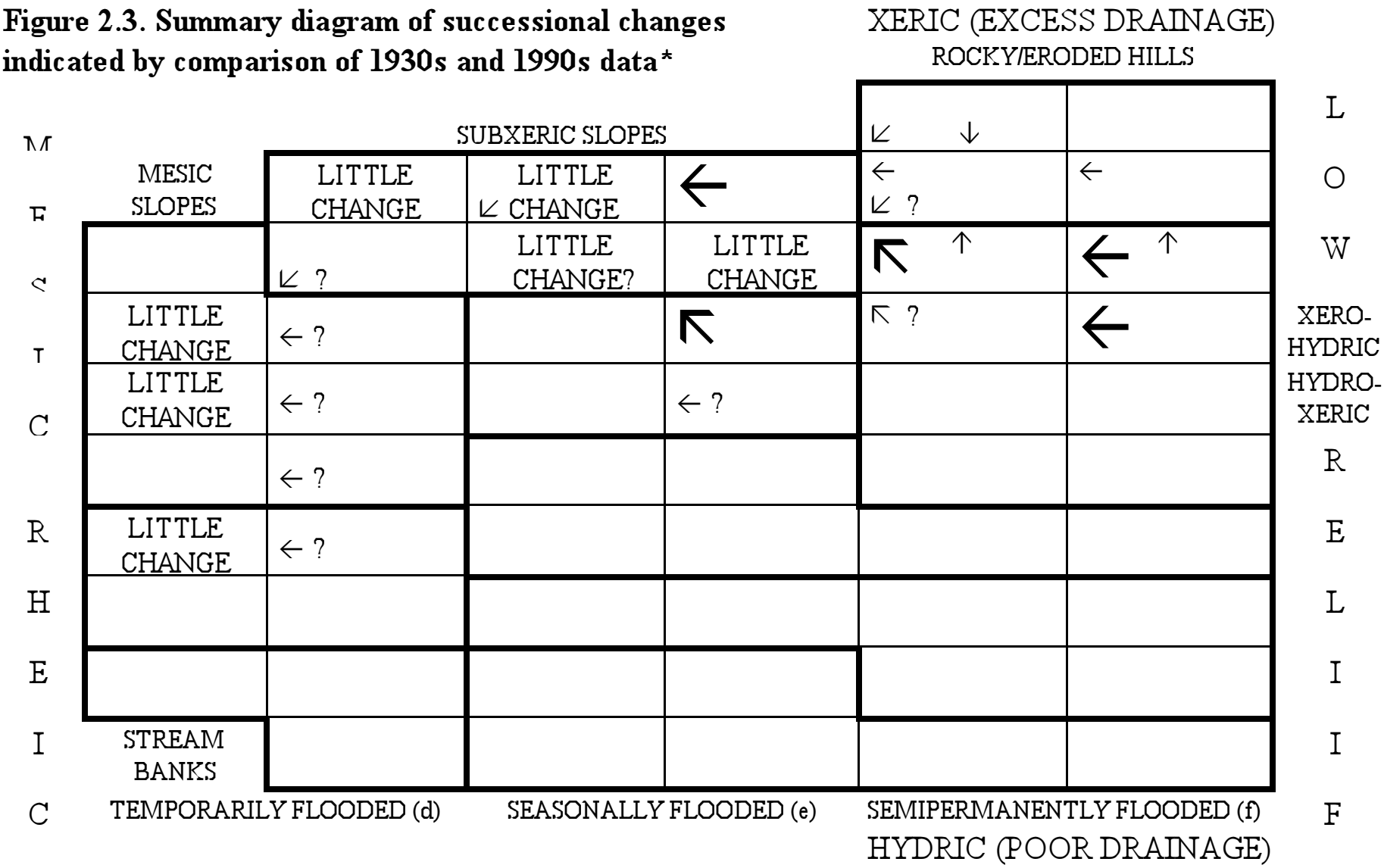
ROCKY/ERODED HILLS

					RED CEDAR OR VA PINE		L
M		SUBXERIC SLOPES					
E	MESIC SLOPES	WHITE OAK N RED OAK	CHESTNUT O. OR WHITE	SCARLET OAK OR BLACK	CEDAR/PINE OAK SPP. 1	RED CEDAR BJ./POST OAK	O
S		TULIP POPLAR (SUG. MAPLE)	WHITE OAK (S RED OAK)	S RED OAK (WH./POST O.)	BLACK OAK POST OAK	BLACKJACK O. POST OAK	W
I	BEECH (N RED, WHITE	TULIP POPLAR	(also local walnut on richer soils)	SASSAFRAS PERSIMMON	S RED OAK POST OAK	POST OAK	XERO-HYDRIC
C	BEECH SUGAR	TULIP POPLAR (WHITE ASH)	(also local elms on richer soils)	(SWEETGUM) (RED MAPLE)			HYDRO-XERIC
	(transitions from mesic to riparian)	TULIP POPLAR (SUG.MAPLE)					R
R	BOXELDER SYCAMORE	(SYCAMORE)					E
H							L
E							I
I	STREAM BANKS						I
C	TEMPORARILY FLOODED (d)		SEASONALLY FLOODED (e)		SEMIPERMANENTLY FLOODED		F

HYDRIC (POOR DRAINAGE)

* Based on current and historical vegetation data from Mammoth Cave National Park.
Parentheses indicate types with relatively little data but based largely on general subjective observations.
Typical old field succession begins at following numbered positions:
1 = xeric/eroded sites; 2 = subxeric/submesic sites; 3 = mesic upland sites; 4 = mesic floodplain sites.

Figure 2.3. Summary diagram of successional changes indicated by comparison of 1930s and 1990s data*



*This overlay condenses information from current and historical vegetation. Large arrows indicate general changes in forest types; small arrows indicate minor or uncertain (?) changes; in some uncertain cases, changes may still be large.

Lower slope with red cedar and persimmon, probably much influenced by livestock in the past.

APPENDIX 3: CONTEXT WITHIN MIDDLE GREEN RIVER WATERSHED

To be appended from previous reports on Green River.

Back cover: western edge of project area, on bottomland in submesic woods with highly varied trees species but much *Microstegium*; probably long history of wood-cutting and browsing.