Revised Notes (again) on Native Vegetation Types of Uplands in the Central Bluegrass Region

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"*Conservation is really applied historical ecology. ...conservationists need to combine the mind-sets of scientists and historians in an age which discourages dialogue between the two*." (Rackham 2003, p. xviii)

"The beautiful estate of Spring Hill, originally consisting of upward of 3,000 acres, comprised a military grant to Captain Nathaniel Hale."

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INTRODUCTION

The following notes apply to much of the Bluegrass region where relatively deep well-drained, fertile calcareous soils prevail. Although most quotations come from the central Bluegrass (including the strictly defined 'Inner Bluegrass'), similar vegetation occurs—or used to occur—across much of the whole Bluegrass region and elsewhere in the central Ohio Valley. In addition to the usually fertile uplands in parts of the Bluegrass region, alluvial terraces in this region and in some other sections of Ohio watershed used to support similar vegetation. However, most of these land types have been cleared for farming. These notes focus on typical well-drained (mostly 'mesic' to 'submesic') uplands of less rugged landscapes, excluding riparian zones and wetlands. They generally exclude descriptions from more rugged land closer to larger streams, where shallower soils prevail and where there are pronounced differences from cool to warm aspects on slopes. On drier ('subxeric' to 'xeric') sites oaks were much more common. Underlining is added to this document for indicating the special importance of certain passages.

At the end of this document is appended a set of three diagrams which outline a functional concept for the original vegetation. These diagrams focus on the general disturbance-related gradient that seems to have existed, from deeper shade to more open conditions. But, somewhat independant of this primary gradient, there also seems to have been a browsing-related gradient. As an initial hypothesis, suggested dynamic patterns along these two gradients are affiliated with the general theory of Vera (2000) for central Europe.

Deeper (mesic) woods, suggested name: *Acer* (*nigrum, saccharum*) – (*Carya cordiformis, Aesculus glabra*) / *Carpinus caroliniana – Lindera benzoin / Camassia scilloides – Podophyllum peltatum*

The definition here includes transitions to walnut-buckeye (*Juglans-Aesculus*) or ash-elm (*Fraxinus-Ulmus*) types. Evidently, there was an intimate mixture of these types on the landscape, with sugar maples presumably concentrated in less disturbed areas. Initial clues suggest that the sugar maple type often occurred on slight slopes along small headwater gullies, but patterns in disturbance regime may have been at least as important as direct effects of topography and soil. Wild sugar maples do occur widely on uplands, with little or no relation to elevation, but are much less common within intensively farmed areas on the modern landscape. They sometimes suffer or even die prematurely during droughts, but seedlings and saplings do grow back.

In future extensions of this historical analysis across the region, it will be useful to extract quotations that indicate more beech (*Fagus grandifolia*) and tulip poplar (*Liriodendron tulipifera*) with the sugar maple and other mesophytic trees. Such woods were prevalent on more acid or less fertile soils in parts of the Eden Shale Hills (especially on Garrard Siltstone) and along older alluvial terraces of larger streams and rivers; see Campbell (1989) for other relevant data.

Original deed surveys from ca. 1775-1800 indicate that this type covered ca. 20-40% of the central Bluegrass. It had the following approximate composition (Campbell 1980; Table 2).

Acer saccharum (sensu lato, including much *nigrum*): 40-55%
Carya spp. (*cordiformis, laciniosa, ovata*): 10-15%
Ulmus spp. (*americana, rubra*): 1-10%
Juglans spp. (*nigra, cinerea*): 2-6%
Fraxinus spp. (*americana, quadrangulata*): 1.5-6%
Celtis occidentalis: 0.5-6%
Tilia americana (sensu lato, including *heterophylla*): 1-5%
Aesculus glabra (plus some *flava* near larger streams): 1.5-3%
Fagus grandifolia: 0.5-6% [largely in transitions to the Eden Shale Hills]
Liriodendron tulipifera: 0.5-6% [similar restriction to *Fagus* but in younger woods]
Acer negundo: 0.25-2.5%
Quercus: whites (*muhlenbergii, macrocarpa*): 2-4%
Quercus: reds (*rubra, shumardii*): 0.5-1%
Other species each comprised < 1%

A more complete description can be estimated from general knowledge of the flora in this region; see appended species lists [Central Bluegrass and Griffith Woods Floras], where species coded 1 in the right column are most typical of this woodland type, but the species coded 2 are also frequent.

At KSNPC and NatureServe (CEGL), the closest matches are as follows:
KSNPC: Deep soil mesopytic forest

But this is defined for loessic soils in western regions.

KSNPC: Calcareous mesophytic forest;

But that is usually on shallower soil with more oaks.

CEGL: 4411 *Acer* (*nigrum, saccharum*) - *Carya cordiformis* Forest

This is based on our data. Although defined for the central Bluegrass, this type probably used to occur in much of the central Ohio Valley.

CEGL: 5035 *Acer saccharum - Carya cordiformis* / *Asimina triloba* Floodplain Forest

This is more widely reported in the Ohio Valley, but strictly on floodplains.

Other types of comparative interest are as follows.
CEGL: 6914 *Acer saccharinum* - (*Acer saccharum, Juglans cinerea, Juglans nigra, Ulmus rubra, Ulmus americana, Prunus serotina, Celtis occidentalis*) Forest
CEGL: 6288 *Acer saccharum - Fraxinus americana - Tilia americana* Forest
CEGL: 6237 *Acer saccharum - Fraxinus americana - Tilia americana - Liriodendron tulipifera* / *Actaea racemosa* Forest
CEGL: 6211 *Acer saccharum* - (*Fraxinus americana*) / *Arisaema triphyllum* Forest
CEGL: 6459 *Acer saccharum - Fraxinus americana* / *Carpinus caroliniana* / *Podophyllum peltatum* Forest
CEGL: 6020 *Acer saccharum - Fraxinus americana - Juglans cinerea* / *Staphylea trifolia* For.

CEGL: 7811 *Acer* (*barbatum, saccharum*) - *Juglans nigra - Fraxinus americana / Hybanthus concolor* Forest
CEGL: 2060 *Acer* (*saccharum, barbatum*) - *Quercus rubra - Carya cordiformis / Asimina triloba* Forest
CEGL: 6017 *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest

EARLY ACCOUNTS THAT INDICATE THIS VEGETATION TYPE
The following accounts all come from the Bluegrass region; a wider search is still needed.

Nourse (1775). “Afterwards it is light with timber—little oak—mostly sugar tree, walnut, ash, and buckeye (horse chestnut) but the tops of the trees mostly scraggy, the surface of the ground covered with grass along the path, which was as well trod as a market-town path [probably on or near Ky. Route 1681 in southeast Franklin Co.].”

Fleming (1779-83)
1780, May 27th: surveying on Beargrass Creek near Louisville.
(1) “Warrant for 1000 acres on the waters of Goose, Beargrass Creeks beginning at a sugar tree, ash, elm and buckeye on the side of a hill corner to Wm Christians land, thence N. 53° E. 400 poles crossing the creek to a sugar tree, thence So. 37° E. 400 poles crossing the creek to two sugar trees on Col. Christians land, and along the same crossing the creek twice N. 37° W. 400 poles to the beginning.”

Filson (1784), p. 12-14; describing settlements in the Bluegrass region.
“The country in general may be considered as well timbered, producing large trees of many kinds, and to be exceeded by no country in variety. Those which are peculiar to Kentucke are the sugar-tree, which grows in all parts in great abundance, and furnishes every family with plenty of excellent sugar.”

Regarding the label “Capt. Johnson” on Filson’s (1784) map.
In 1785, there was a survey of 1220 acres on “Greys Run” made for Samuel Haws; this survey adjoined land of Thomas Johnson (on the N and NW sides), James Haggin, Benjamin Harrison, and “Alline & Smith.” Witness-trees in the Haws survey were: sugar tree (5), ash (3), hickory (3), hoopwood [probably hackberry] (2), buckeye (1) and a “double white thorn” [*Crataegus mollis* or *crus-galli*]. However, that Johnson tract may have been on the east side of Gray’s Run, near the intersections of US 62, US 27 and Ky. Route 32, based on initial mapping of Nancy O’Malley (1987) for her book on early stations.

Toulmin (1793a), p. 71-74. “Everyone makes sugar from the natural sugar tree and some are beginning to leave the tree standing when they clear the ground, and they are of they opinion that the detriment which the crops receive from the shade, is in some measure compensated for in the advantage it is of to the stock... The caterpillar has done considerable injury to the sugar tree and to fruit trees. In the latter it is kept off by sulphur, but nothing has yet been found to arrest its depradations on the sugar tree.”

Toulmin (1793b), p. 106. “The manufacture of SUGAR has long been established in Kentucky; and at one time it promised to become an object of some importance to the country. Two years ago, however, a most wonderful number of caterpillars made their appearance and committed such merciless depradations upon the leaves of the sugar trees as to leave scarcely a single one standing in some parts of the country. This evil was principally experienced on the southern side of the Kentucky River; and the country

people still make a considerable qualtity of brown sugar in the northern part of the state..."

Barrow (1795), p. 25. "They [the inhabitants] have been much afflicted with caterpillars for seven or eight years past. They have done much damage in the woodlands especially among the sugar trees, viz [thereby] leaving them bare so many years an abundance of that valuable growth is dead. They have a worm (tho I did not see them) in some places but by what I can learn they are a kind of ground worm that prove very fatal where they prevail. They [eat] everything before them and leave the face of nature bare. This is always in the spring and as the hot season approaches they entirely disappear."

[The "caterpillars" on sugar maple probably were the forest tent caterpillar (*Malacosoma disstria*), which can cause widespread regional outbreaks, lasting 2-5 years, at intervals of 5-15 years (see USDA websites); this should not to be confused with the eastern tent caterpillar that often infests cherry trees. Outbreaks may be enhanced by promoting monoculture of sugar maples and by various stresses in the trees.]

Meade (1796a), p. 132-133. "Property in Fayette County is much divided, consequently high. Few people hold more than three or four hundred acres, and (perhaps) there are more who own less than a hundred acres than over three hundred. Farms of fifty & even twenty five are not uncommon. An oak tree is as scarce in this country as a black walnut or ash is upon high land with you. The growth here is sweet maple [sugar maple], wallnut, ash, both kinds of locust, particularly the fruit bearing [honey locust], which is

extremely high & large. Poplar [tulip/yellow poplar] only in some places & these of vast size, scaly bark hickory [shagbark/shellbark] not uncommon. Buckeye (differing materially from your horse chestnut being only a species or variation of the same genus); cherry tree, mulberry, &c with but few of the common kinds to the eastwards. The undergrowth, usually the spice bush & frequently a young growth of sugar maple..."

Short (1828-29). Notes on large trees of deeper woods, listed under his names.
"*Acer saccharinum* (Sugar Maple).The Sugar tree, as it is here universally called, is one of the most common of our forest trees, and perhaps in this particular locality, it attains its greatest altitude. As it does not materially interfere with the growth of grasses beneath it, it is often reserved in clearing ground, particularly in situations intended for pasture or meadows. It here forms the densest shade, and in autumn constitutes a prominent feature in the landscape, by the bright orange and red colours assumed by its leaves. Its wood is preferred to almost any other for fuel, and large quantities of sugar are annually made from the sap. Flowers about the first of April..." [*A. saccharum*, sensu lato; Short did not distinguish *A. nigrum*].
"*Aesculus pallida* (Common Buckeye). This species is abundant throughout the forests in the rich lands of Kentucky. It is a tree of but ordinary stature, and for the most part of crooked growth... it is sometimes eaten by cattle, and often with fatal effects: Flowers about the 20th of April..." [*A. glabra*].
"*Carya porcina* (Pig-Nut Hickory, brown hickory). It is in every respect the least valuable of the family, the wood being not fitted for useful application to the arts, less valuable as fuel; and the nut unfit to eat in consequence of its bitterness and astringency.

Young trees of this kind are, however, more common around Lexington than any other Hickory." [Short was clearly referring to *C. cordiforms*, not *C. glabra*, which is virtually absent in the Inner Bluegrass except near the Kentucky River.]

Short (1828-29). Notes on small trees, shrubs and vines of deeper woods.
"*Bignonia capreolata* (Cross vine). This handsome climber occurs frequently among the mural cliffs of the Kentucky river, sometimes covering the face of the rock to a considerable extent... ...flowers...appearing about the middle of May, but so transient in duration as not often to be met with in bloom."
"*Carpinus americana* (Iron-wood). In other parts of the union it is called Hornbeam. It is found throughout this state among other forest trees and is perhaps especially abundant in the country about Lexington, growing generally to the height of 30 or 40 feet.—The wood is possessed of great hardness and strength, but it is not applied to many useful purposes. Flowers beginning of April.." [*C. caroliniana*].
"*Laurus benzoin* (Spicewood). The Spicewood is a common shrub throughout the Union; and is here met with in all shaded, rich woods where the undergrowth has not been destroyed; preferring mostly situations near small streams of water. The bark of the wood is pleasantly aromatic and is sometimes used in warm infusion as a diaphoretic." [*Lindera benzoin*]
"*Ostrya virginica* (Hop-hornbeam). This small tree which is also called Ironwood in the Northern and Eastern States... is likewise frequent in this locality being found in company with the preceding [*Carpinus*]. Its wood is also hard and strong; but the size of the tree

being inconsiderable, it is susceptible of no useful application. Flowers about the 1st of April." [*O. virginiana*].

Short (1828-29). Notes on herbs of deeper woods, listed under his names.
"*Anemone pennsylvanica*? Tor. Found in abundance in woods, flowering from the middle to the last of March." [*Enemion biternatum*].
"*Arabis rhomboidea*. Found in moist rich woods, or on creek sides. Blooms about the 10th of March." [*Cardamine douglasii*, but apparently confused in name with *C. bulbosa*.]
"*Arum triphyllum* (Indian turnip). In rich moist woods it attains the height of 2 feet or upwards. Flowers 1st of May." [*Arisaema triphylla*].
"*Asarum canadense* (Wild Ginger). Occasionally abundant in rich shaded woods among rocks: flowering about the 20th of April."
"*Caulophyllum thalictroides* (Pappoose-root). This, the only species of the genus, was once abundant throughout this country, but has now almost disappeared from the more cultivated districts, and is consequently rare about Lexington, being only met with in the more secluded and unfrequented woodlands. Under the name of Pappoose-root this plant has had some medical virtues ascribed to it.--Flowers towards the latter part of April..."
"*Chelidonium majus* (Large Celandine). This handsome plant, so abundant on the borders of the Ohio river, is comparatively rare in this neighbourhood; its large showy yellow flowers, which would probably double under cultivation, are highly ornamental: in their natural state they are exceedingly fugacious. The whole plant is imbued with a

yellow juice of an acrid, bitter, opiate taste. ...in rich shaded situations. Flowers last of April..." [*Stylophorum diphyllum*].
"*Collinsia verna* (Early flowering Collinsia). This beautiful little plant, which is seen in profuse abundance on many parts of the Dry-ridge road to Cincinnati, is occasionally, though rarely, found in this immediate vicinity. ...flowers...first appear about the last day of April, and continue to bloom during the month of May."
"*Corydalis formosa*. It is found, in common with the former, on the precipitous banks of water courses, in the rich soil among lime stone rocks...they flower at the same time." [*Dicentra canadensis*].
"*Corydalis cucullaria* (Dutchman's breeches). ...among the earliest vegetation seen in secluded rich situations among decaying logs, &c. Towards the 20th of March." [*Dicentra cucullaria*].
"*Delphinium tricorne* (Wild Larkspur). Found on creek sides, particularly preferring rocky precipices. This is one of the plants which are indefinitely called staggerweed; to eating which the diseases of cattle are sometimes attributed. 1st to 10th of April."
"*Erigenia bulbosa* Nuttall This is the first of the umbelliferous tribe to bloom in this vicinity, and is met with most frequently in the rich alluvions of our larger streams. ...flowers appearing among the fallen forest leaves from the 1st to the 15th of March..."
"*Erythronium albidum* Torrey ...more abundant in this neighborhood than the yellow-flowered one, but they are found in common, affecting the same localities and blooming at the same time."
"*Erythronium americanum* (Dog-tooth Violet). Found most generally on the rich alluvial bottoms of streams. Blooms about the 20th of March."

"*Geranium maculatum* (Spotted crane's-bill, Wild Geranium). The root is knotty and tuberous, possessed of considerable astringency, and hence called wild Tormentil. It is a good deal used medicinally in some portions of the Union, and is perhaps nowise inferior to the exotic just mentioned. Found in moist, rich situations, about fence-roads &c. rare. ...flowers... make a handsome show during May, about the first week of which they begin to appear."
"*Hydrophyllum appendiculatum*. This species of water-leaf is more commonly confined to the rocky banks of creeks and rivers... Flowers usually during the first week of May."
"*Hydrophyllum canadense* (Shawnee salad). The leaves are said to be eaten by the Indians as a salad. Common in half cultivated lands, about fence corners &c. Flowers about 5th of May."
"*Jeffersonia diphylla* Bart. ...at this time exceedingly scarce in this locality. A few years ago it grew abundantly on the south bank of Royle's mill pond, but is now only met with in the more secluded hill-sides bordering the Elkhorn, or on the cliffs of the Kentucky river. The flowers appear about the 30th of March..."
"*Orchis spectabilis* (Showy Orchis). Of this extensive genus, the present subject is the only species I have met with in this neighbourhood... A few years since this occurred frequently in moist rich woods; it has now, however, almost disappeared before cultivation and the ravages of cattle. Flowers about the middle of May." [*Galearis spectabilis*].
"*Phalangium esculentum* Nuttall This is decidedly one of the most beautiful of our indigenous plants... The root, which is bulbous and situated deep in the ground, is eatable

and nutritious—Frequent in moist meadows in certain localities, but generally disappearing upon culture—flowers from the 20th of April." [*Camassia scilloides*.].
"*Phlox divaricata*? Generally known under the name of Sweet William or May Pink. Abundant in half reclaimed lands and borders of fields, from 10th to 20th April."
"*Pulmonaria virginica* (American Cowslip). This very showy plant, so common in most parts of the Union, is comparatively rare in this immediate vicinity, being only occasionally met with on the alluvion banks of Elkhorn and Kentucky river. April 1st to 15th." [*Mertensia virginica*].
"*Podophyllum peltatum* (May-Apple, Mandrake, Wild Lemon, &c.). No portion of the Union affords the May-apple in greater abundance than this, where it is found in profusion in all rich shaded woodlands. The [fruit] is highly grateful to the taste of most persons; its leaves are deleterious and not eaten by any cattle; whilst its root, when properly dried and pulverised, affords an excellent cathartic, but little inferior to jalap. ...it blooms generally towards the end of April..."
"*Polemonium reptans* (Jacob's-ladder). This beautiful native well deserves a place in all flower-gardens; it bears transplantation well and improves by cultivation. Its favorite localities are in rich shaded situations among rocks and decaying logs... about the 19th of April."
"*Ranunculus fascicularis* Muhl. Moist woods and grass beds. Flowers first of April." [Probably *R. hispidus* for the most part, confused with the true *R. fascicularis*, which occurs today only at a few sites in rocky woods near the Kentucky River.]
"*Sanguinaria canadensis* (Puccoon). No plant is more commonly met with in early spring, in this vicinity, than the puccoon, by which name it is universally recognised.

Perhaps no wild plant better deserves cultivation than this... highly medicinal, being emetic, expectorant and escharotic. It prefers rich, moist, shaded woods, and in such situations it is every where abundant in the spring, disappearing however entirely towards midsummer. The flower-stalks appear above ground about the 1st of April."
"*Sedum ternatum* (Stone-crop). This handsome little vegetable... On the shelving rocks bordering Elkhorn. Flowers beginning of April."
"*Stellaria pubera* (Starwort). Rare; in woodlands. Flowers 20th April." [*S. corei* was not distinguished in Short's time; typical *S. pubera* is much less common in the central Bluegrass.]
"*Thalictrum dioicum* (Meadow rue). Grows in rocky bluffs on water courses. Flowers last of March."
"*Trillium sessile*. Grows in rich woods or grass grounds. Flowers last of March--April."
"*Viola hastata* (Yellow Violet). ...much less frequently met with than either of the preceding [*V. striata, V. sororia*]... Rare in this neighbourhood, being only occasionally found in shaded woods. Flowers during the fore part of April." [*V. pubescens*].
"*Viola obliqua* Aiton. This species is by no means easily distinguished from the preceding [cf. *V. papilionacea*], with which it is found in common. It is, however, a larger plant, and minute examination will detect specific differences in the leaves [flat versus hooded at base], petioles, stipules [lanceolate versus linear] and flowers [obliquely bent versus inverted]." [Perhaps *V. sororia*, sensu stricto; treatment remains uncertain; Short cites Schweinitz's monograph on the genus *Viola* in American Journal of Science and Arts, Vol. 5, No. 1; to be studied further.]

Owen (1857). Summarized as ‘sugar maple type’ for central/eastern Bluegrass by Campbell (1989): mostly sugar maple (but not strongly dominant); also black walnut, ashes (mostly “black”), oaks, buckeye, etc.

Owen (1861): sugar-tree (3); walnut (3); ash (3, white and black); buckeye (2); oak (1); hickory (1); cherry (1).
p. 152: “Growth, sugar-tree, walnut, buck-eye, &c.” Virgin soil, Charles Marshall’s farm near Mount Carmel, Fleming Co.
p. 220: “Forest growth, sugar-tree, black walnut, oak, black ash, cherry, and hickory. Set in blue-grass: no undergrowth.” Virgin soil from woodland on farm of James C. McAfee, 4 mi S Harrodsburg.
p. 217: “Growth, sugar tree, walnut, black and white ash, buckeye, &c.” Virgin soil from hillside near Dover, ca. 150 ft above Ohio Rv., Mason Co.

Peter (1887). Regarding cane lands of central Bluegrass: “The primeval forest on these rich lands, as given by the late Dr. Owen, are, pignut hickory [*Carya cordiformis*], sugar tree, hackberry, ash, walnut, mulberry, buckeye, box elder, etc., etc.”

Young & Duncan (1898), p. 216-218: notes on Chaumiere. “Prior to 1796 David Meade, a son of the founder of Chaumiere, came to Kentucky. He was attracted by the splendid climate, fertile soil, wonderful forests, and charming surroundings, and induced his father [also David] to leave a beautiful home in Virginia, on the James river, and come to the wilds of Kentucky… David Meade [the father] was a man of large fortune… He

purchased about three hundred acres of land from the Crocketts and the Woodsons… The beautiful forest trees attracted his admiration and won his affections. Sugar trees, poplar, ash, oak, hackberry and walnut, all growing in most superb profusion, determined his choice of residence"…

Rogers, James R. 1910, p. 1 [check]: about the pioneers in Kentucky; Rogers cites "Manuscript of Peter Houston, one of the number" as a source for this story.
"A band of Boone's former neighbors from the valley of the Yatkin, North Carolina, seeking homes, sought Boone, inquiring "where the best farming lands were to be found." "On the Cane Ridge; the most game is there, the biggest sugar-trees and the best corn grow there. I think it the best farming lands. I gave it the name." It may prove of interest to note the confirmation of Boone's judgment of soils, based on the growth of sugar-trees and corn, by reciting that Dr. Robert Peter, State geologist, in his analysis of soils from the counties of Kentucky, found the richest to be from Cane Ridge, Bourbon County." [See also Peter's reports; to be compiled.]

Harrison (1915), p. 570. "In 1825 Doctor Craik, Rector of the Episcopal Church in Lexington, writes of it [Chaumiére] with equal enthusiasm. He says:... "Colonel Meade told me he had selected his present residence on account of the natural beauties of the country, and he pointed with enthusiasm to several groups of sugar maples, with the lovely grass beneath them, as the most attractive features of the place.""

Intermediate (mesic to submesic) woods: a complex of types here provisionally segregated as follows.

(A) *Fraxinus* (*americana*, *quadrangulata*) – *Ulmus* (*americana*, *rubra*): fresh gap-phase?

(B) *Juglans nigra* – (*Aesculus glabra*, *Celtis occidentalis*): moderately browsed?

(C) *Quercus* (*macrocarpa*, *muhlenbergii*, *shumardii*) – *Carya* (*cordiformis*, *laciniosa*, *ovata*): seasonally dried, browsed or aged?

About 50-70% of the uplands had these ‘intermediate’ (submesic) woods—between deeper shade and open conditions. They ranged from ash/elm woods to walnut/buckeye woods or locally oak/hickory, with the latter most common on drier sites. The oak or hickory woods appear to have been relatively minor and indistinct—they included little or no white oak (*Quercua alba*), except in transitions to the Eden Shale Hills.

Research is needed to understand how patterns in herbivory, droughts and fires can influence composition. With reanalysis of historical and modern data, it will be possible to separate out descriptions for two or three subtypes, as suggested by the names above. General knowledge suggests that the ash/elm type occurred in less browsed areas, perhaps often successional in gaps after decline of sugar maples. The walnut/buckeye and oak/hickory types would have been more tolerant of browsing and perhaps droughts. An overall ecological model for the variation is attached to the end of this document.

In many places, these woods intergraded with deeper woods that had more sugar maple and bitternut, or with thinner or younger woods that had more locust, cherry, bur oak, cane, plum, hawthorn and other indicators of more disturbance. Included here are a few notes from the peripheral Beargrass Creek area of Jefferson Co., where tulip poplar and beech were intermixed: see Peyton (1780) and Meriwether (1783-85).

See appended tables [Central Bluegrass and Griffith Woods Floras] for complete lists of vascular plants typical in these habitats. Species coded 2 or 3 in the right column would be most chracteristic.

At KSNPC and NatureServe (CEGL), the closest matches are as follows:

KSNPC: Bluegrass mesophytic cane forest: especially B

This is based on our previous data, but defined too narrowly (or idiosyncratically) to include areas with dense cane, which probably used to occur mostly in more open woods rather than this type. This type was moderately—or patchily—shady. Cane may have been generally present but it did not form dense canebrakes until the woods had declined due to varied causes.

KSNPC: Bluegrass woodland: especially C.

This description is based partly on "savanna-woodland" remnants from old woodland-pastures that were selected out of the original wilderness. It focusses on the high proportion of ashes and oaks in those remnants. Differences from the "Bluegrass mesophytic cane forest" may be largely due to the history of management (with selection of blue ash and oaks) rather than more nature factors. Nevertheless, it is possible that seasonal droughts can also increase the proportion oaf ashes and oaks. Further analysis of compositional data, with environmental relationships, will help to clarify these patterns.

CEGL: 2014 *Fraxinus pennsylvanica - Ulmus* (*americana, rubra*) - *Celtis occidentalis* Forest [Mid-western to Great Lakes]; especially A.

This is not listed for KY, but it can be readily applied if definition is broadened to include *F. americana* and occurrence on eutrophic uplands with deep/loessic soils.

CEGL: 4436 *Fraxinus quadrangulata - Quercus macrocarpa - Quercus muehlenbergii / Arundinaria gigantea* ssp. *gigantea* / *Elymus* spp. Woodland; especially A.

This is based on the "Bluegrass Woodland" of KSNPC; see above.

CEGL: 4437 *Juglans nigra - Aesculus glabra var. glabra - Gymnocladus dioicus / Arundinaria gigantea ssp. gigantea - (Asimina triloba)* Forest; especially B.

This is based partly on the "Bluegrass mesophytic cane forest"; see notes above.

CEGL: 4741 *Acer saccharum - Carya ovata - Juglans nigra / Symphoricarpos orbiculatus / Galium circaezans* Forest; especially C.

This is a more widespread type defined for the Interior Low Plateaus, but originally described from centrall Tennessee. It could be used to match transitions from the typical 'intermediate' woods outlined here to deeper woods on more rocky soils on more rugged topography. Such transitions are common along the Palisades of the Kentucky River, South Fork Licking River and other large streams in the central Bluegrass.

Several other NVC (CEGL) types of eutrophic soils have considerable similarity. Rather than focussing on details of individual matches (and dubiously associated accounting of 'biodiversity' into poorly understood classifications), it would be most useful to develop concepts for the major ecological gradients among these types. For example, it is likely that a gradient of increasing browsing or seasonal drought is associated with the

following sequence, from affinity with ash/elm to walnut/buckeye to oak/hickory. This hypothesis can be tested.

CEGL: 2090 *Ulmus americana - Celtis* (*laevigata, occidentalis*) - *Fraxinus pennsylvanica* Forest
CEGL: 2091 *Ulmus* (*americana, rubra*) - *Quercus muehlenbergii* Forest
CEGL: 2081 *Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana* - (*Quercus macrocarpa*) Forest
CEGL: 5239 *Fraxinus pennsylvanica - Ulmus americana* - (*Juglans nigra, Celtis occidentalis*) Forest [perhaps converted to 2014]
CEGL: 8458 *Fraxinus americana* - *Carya ovata* / *Frangula caroliniana* / *Helianthus hirsutus* Woodland
CEGL: 7897 *Fraxinus americana - Celtis laevigata - Nyssa sylvatica - Quercus shumardii - Ulmus americana* Forest [West Gulf Coastal Plain]
CEGL: 7180 *Fraxinus americana - Juglans nigra - Ulmus rubra / Acer barbatum - Ostrya virginiana / Ptelea trifoliata* Forest [FL]
CEGL: 4794 *Acer saccharum - Ulmus rubra - Juglans nigra* Forest
CEGL: 4697 *Celtis* (*laevigata, occidentalis*) - *Ulmus* spp. - (*Aesculus glabra*) Forest [internal NVC records; see Stones River National Battlefield report]
CEGL: 7879 *Juglans nigra* / *Verbesina alternifolia* Forest [internal NVC records]
CEGL: 4693 *Juglans nigra - Celtis occidentalis* Forest [internal NVC records]
See also notes of Steinauer & Rolfsmeier (2003) on their walnut segregate of the more widely defined bur oak woodland in Nebraska (CEGL 2052).

CEGL: 6449 *Juglans nigra - Fraxinus americana* / *Lindera benzoin* Forest [Provisional]
CEGL: 7214 *Juglans nigra - Quercus muehlenbergii* Forest [Provisional]
CEGL: 4671 *Acer barbatum - Aesculus glabra - Carya myristiciformis - Quercus shumardii - Quercus muehlenbergii* Forest
CEGL: 6445 *Carya cordiformis - Prunus serotina* / *Ageratina altissima* Forest
CEGL: 3876 *Quercus imbricaria - Quercus shumardii - Quercus muehlenbergii* / *Celtis occidentalis* / *Urtica chamaedryoides* Forest
CEGL: 4685 *Quercus shumardii - Fraxinus americana - Carya* spp. / *Juniperus virginiana* var. *virginiana* Forest
CEGL: 4544 *Quercus macrocarpa - Quercus shumardii - Carya cordiformis* / *Chasmanthium latifolium* Forest
CEGL: 2140 *Quercus macrocarpa - Quercus bicolor* - (*Celtis occidentalis*) Woodland
CEGL: 2098 *Quercus macrocarpa - Quercus bicolor - Carya laciniosa* / *Leersia* spp. - *Cinna* spp. Forest
CEGL: 5055 *Quercus macrocarpa - Carya ovata* Alvar Woodland
CEGL: 4602 *Quercus muehlenbergii - Quercus shumardii* Forest
CEGL: 4793 *Quercus muehlenbergii - Quercus* (*alba, rubra*) - *Carya cordiformis* / *Viburnum prunifolium* Forest
CEGL: 5020 *Quercus muehlenbergii - Fraxinus* (*americana, quadrangulata*) Forest
CEGL: 5021 *Quercus muehlenbergii - Celtis occidentalis - Juniperus virginiana* Forest
CEGL: 7633 *Quercus alba - Quercus rubra* / *Ostrya virginiana* / *Arundinaria gigantea* / *Cynoglossum virginianum* Forest

EARLY ACCOUNTS THAT SUGGEST THIS VEGETATION TYPE
The following accounts all come from the Bluegrass region; a wider search is still needed.

Gist (1751), p. 123: Jan 20th, in southeast Ohio, along the Scioto River valley or nearby. "All the way from Licking Creek [Salt Creek of Scioto River] to this place [Lower Shawnee Town near the Ohio River] is fine rich level land, with large meadows, clover bottoms and sporadic plains covered with wild rye; the wood chiefly large walnuts and hickories, here and there mixed with poplars, cherry trees and sugar trees."

Gist (1795), p. 135: Feb 17th, in Ohio, between Lower Shawnee Town—the Indian settlement at mouth of Scioto River—and upper sections of the Little Miami River, about 30 miles northeast of modern Cincinnati.
"All the way from the Shannoah Town to this place (except the first 20 miles which is broken) is fine, rich level land, well timbered with large walnut, ash, sugar trees, cherry trees, &c, it is well watered with a great number of little streams or rivulets, and full of beautiful natural meadows covered with wild rye, blue grass and clover, and abounds with turkeys, deer, elk and most sorts of game particularly buffaloes, thirty or forty of which are frequently seen feeding in one meadow; in short it wants nothing but cultivation to make it a most delightful country."

Gist (1751), p. 147: Mar. 4th, southeast from Little Miami River towards the mouth of Scioto River. "This day I heard several guns, but was afraid to examine who fired them,

lest they might be some of the French Indians, so I travelled thro the woods about 30 M[iles]; just at night I killed a fine barren cow-buffaloe and took out her tongue and a little of her best meat: the land still level rich and well timbered with oak, walnut, ash, locust, and sugar trees.

Nourse (1775), May 30th . [See preceding quote under sugar maple type.] "About twelve mile the further we went the richer the land, better though of the same sort of timber, the ash very large and high, and large locusts of both sorts—some cherry—the growth of grass under amazing—blue grass [perhaps *Poa pratensis*], white clover [probably *Trifolium stoloniferum*], buffalo grass [perhaps *Dichanthelium clandestinum*] and seed knee and waist high: what would be called a fine swarth of Grass in cultivated meadows, and such was its appearance without end—in little dells in this [probably on or near Ky. Route 1681 in northern Woodford Co.]. We passed several dry branches but no running water our course S.E. At about twelve miles came to a small run and soon after I discovered a pretty spring that joined its waters—here we resolved to dine, being both hungry and thirsty [perhaps Lees Branch]. We had in our walk seen about 5 herd of buffaloes."

Henderson (1775), p. 170: May 14th, describing the site at Boonesborough where meetings occurred, on the terrace near the Kentucky River, under a large elm tree with special symbolic importance. "The [elm] tree is placed in a beautiful plain surrounded by a turf of white clover forming a green to its very stock, to which there is scarcely any to be likened. The trunk is about 4 feet through to the first branches, which are about 9 feet

from the ground. From thence it regularly extends its large branches on every side, at such equal distances as to form the most beautiful tree the imagination can suggest. The diameter of the branches from the extreme end is 100 foot, and every fair day it describes a semicircle in the heavenly green around it upwards of 400 feet in circumference. At any time between the hours of 10 and 2, 100 persons may commodiously seat themselves under the branches."

Nourse (1779-80), Feb 17th, 1780: "As we came upon Elkhorn waters, [we] got upon lands which seem to me to be of the very best quality, and I believe it is The soil [is] very dark, and by the roots of the trees which were blown down, I could discover no variation. The ground even in this season of the year [is] green with clover and wild rye; the growth [of trees consist of] black walnut, wild cherry, locust, Ash of different sorts, [and] shell bark hickory. I thought I has got into a garden spot, but found the lands continued nearly the same all the way to Bryan's."

Fleming (1779-83). 1780, Mar. 20th: presumably at Harrodsburg but describing the country in general, apparently including some rockier land or sandy terraces near the river. "The richest soil is reckoned the black, the timber black walnut, cherry, honey locust etc. I have observed the richest soil to bear the shortest timber and to be the shallowest in the mold. I would therefore prefer a good timbered tract tho not quite so rich, to a richer tho worse timbered tract as there is a great probability of the ground being lasting [perhaps meaning 'holding water'] not so subject to drought and where

springs of their [sic, perhaps meaning 'springs of these tracts'] being constant [end of footnote].

Anonymous (1780). "I am now owner of 2800 acres of land on Bear Grass with in four miles of the Falls of Ohio which is as rich land can be & perfectly level on which I have several never failing springs & the most butyfull places to build on, with the gratest quantity of fine timber, the greater part of which is popular, which grow there in grate plenty & to a most innormous size. The other groath is chiefly buck eye with walnut & cherry. I think it is rich enough & I am confident will be worth more money than any lands in this countrey. (Colo. Todd offered me two acres of the best Elk Horn land for one on Bear Grass.)"

Peyton (1781). Mar. 8th: witness-trees extracted from surveys on Clear Creek, about 2.5 miles northeast of Shelbyville.
"(1) large white oak, buckeye and hickory—honey locust, small walnut, wht. thorn, ironwood and small hickory—two sugar-trees, mulberry and hickory—two small sugartrees and a mulberry.
(2) large white oak, buckeye and hickory—elm, ironwood, hickory and white oak—hickory, elm and ironwood—white oak and buckeye—sugartree and ash and white oak.
(3) honey locust, small walnut and white thorn, ironwood and small hickory—hoopwood and sugar tree growing from one root and two buckeye—honey locust, walnut and buckeye—hickory, elm and ironwood—elm, ironwood, hickory and white oak—large white oak, buckeye and hickory."

Meriwether (1783-85). Two original surveys are for land on "Beargrass Creek" with notes on trees extracted as follows.
(1) 1783, December 15th: "on the head of the South fork of Beargrass... honey locust, buckeye & sugartree... dogwood, poplar & elm... ash & two beeches... three beeches...
(2) 1785, August 29th: "on South Fork of Bear Grass Creek... large forked ash... beech, elm & ash... walnut and beeches... two poplars and cherry tree and elm..."

Morse (1789), p. 404: an early description of the Elkhorn Creek area for general publication, based partly on Filson (1784).
"Elkhorn River, a branch of the Kentucky from the southeast, waters a country fine beyond description. Indeed, the country east and south of this, including the headwaters of Licking River, Hickman's and Jessamine Creeks, and the remarkable bend in Kentucky River, may be called an extensive garden. The soil is deep and black, and the natural growth, large walnuts, honey and black locust, poplar, elm, oak, hickory, sugar tree, etc. Grape vines, running to the tops of the trees, and the surface covered with clover, blue grass and wild rye. On this fertile tract, and on the Licking River, and the head waters of Salt River, are the bulk of settlements in this country."

Toulmin (1793a), p. 71-74. "In the first-rate land, in the very black and light soil, are black and white walnut; hackberry, bearing a sweet nut, not unlike a cherry; honey locust; black locust; buckeye (so called on accounty of its bearing a nut somewhat resembling the eye of a deer); mahogany, which bears a nut which when prepared by drying resembles coffee in its taste; burr oak (which bears an acorn with a long fringe round its

shell); cherry tree; scaly-barked [*Carya laciniosa, C. ovata*] and white hickory [*C. cordiformis*]; sugar tree; mulberry; elder; elm, red and white (N.B. The red elm bark is valuable for bruises and wounds and is also nutritive food; the white elm bark is used for dyeing red); grape vine; poplar; white gum [presumably *Liquidambar*]; sycamore; and puccoon [perhaps pecan, *Carya illinoenensis*, which appears to be native near mouth of Licking Rv.] on the banks of the river; sassafras and lyn [linden] (the inner bark of which is good for burns)... Another kind of first-rate land, when the soil is somewhat stiffer, produces, besides the timber above enumerated, the blue ash (so called from the property which the wood has of dyeing blue), the roots of which render this kind of land more difficult to be cultivated."

"The *undergrowth* found on first-rate land is spice wood, pawpaw, white thorn [perhaps *Crataegus mollis*], plums, wild apples, black thorn [perhaps *Crataegus crus-gallii*], cancerweed [= *Salvia lyrata* in some sources but probably another plant here], and the saplings of the timber. At a distance from the settlements where the ground has not been trodden, herbs and grass grow luxuriantly in the woods, that you may trace even the footsteps of a turkey with the same ease as it the earth were covered with snow. The sorts of grass are white clover, of a kind peculiar to this country [*Trifolium stoloniferum*]; rye grass [*Elymus macgregorii* etc.]; a sort of blue grass, or greensward [perhaps *Poa sylvestis*, or in open land, *P. angustifolia*]; fern [*Cystopteris protrusa* etc.]; the gall of the earth (containing in the stalks and leaves a juice which is esteemed a valuable application for the bite of a snake) [perhaps a species of *Prenanthes*, based on Fernald 1950]; wild ginger [*Asarum canadense*]; a vegetable called the Shawnee cabbage [perhaps

Hydrophyllum appendiculatum; see also, notes of Braun 1950]; and another called the Shawnee lettuce [perhaps *Campanula americana*; see also, notes under Filson 1784]. After a settlement has been established and stock has been turned into the woods, a high, white-blossomed weed puts up in a few years [probably *Eupatorium rugosum*], which keeps down the pasture and consequently destroys the summer range."

"In the good lands of Kentucky, the vegetation is astonishingly rapid... Mahogany sprouts, from the side of the tree near the earth, frequently grow in three or four months to the length of seven feet, and will measure four or five inches in corcumference... As to the size of the timber, it is not uncommon to see the burr oak, in the best lands, five to seven feet through; the sycamore much larger, but generally hollow; the poplar ten feet; and the hickory, which in the eastern country seldom exceeds one foot, often three feet through. The first-rate lands, however, have no great proportion of large timber... Both the woods and the meadows are covered an infinite variety of the most beautiful flowers..."

Parry (1794), p. 232: June 6th: from Limestone to Lexington, crossing Hinkston Creek [on US 68]. "The land here being excellent, and timbered with walnut, honey locust, buckeye, and cherry trees..."

Parry (1794), p. 237-238: June 21-22ndst, from the big bend of Hinkston Creek (now near Millersburg in Bourbon Co.) to the Cane Ridge and then Mount Sterling (Montgomery Co.). "I crossed Stoner again [now in the Paris area, Bourbon Co.), and rode about 15

miles through the country [now Ky. Route 627], and came to John Coulson's [perhaps at the intersection with Ky. Route 57, southern Bourbon Co.]. The land I rode through today was also of the first quality, being timbered like the rest, with walnut, cherry, blue-ash, buckeye, locust, and hackberry; and the water good.

Barrow (1794), p. 23. "The growth in these parts is black walnut in great abundance; vastly large and tall sugar tree, black lin [*Tilia* or perhaps *Magnolia acuminata*], hackberry, white ash, white walnut, wild cherry, coffee nut tree and buckeye with a mixture of others too tedious to mention. These are in the first quality of land."

"The growth of trees in those countries is so luxurious that they form a shade so universal and add thereto the darkness of the soil, that it may be called as it is rendered from some of the Indian tongue, "The dark and bloody ground". Undergrowth: shrubs of various kinds as wild spice [*Lindera benzoin*], red bud [*Cercis canadensis*], prickley [?ash] [probably *Zanthoxylum americanum*], elder-ash [*Sambucus canadensis*].—Without any mixture of any kind [of] whortle berry [*Vaccinium* spp. and allies], pink elder [*Sambucus pubens*], sour wood [*Oxydendron arboreum*] etc. The herbage is very plentiful in the uninhabited parts (tho' as usual it is mostly devoured in the settlements) as wild pea vine [*Amphicarpaea bracteata*], wild rice [ryes] [*Elymus* spp.], buffalo grass [perhaps *Panicum clandestinum*], Kentucky nettle, a weed peculiar to those countries and a sign of great fertility [perhaps *Urtica chamaedryoides*], and many others too numerous to mention. The wild grape vine [mostly *Vitis vulpina*] grows in those regions to an astonishing size; which indicated to me that it is famous for vineyards. These parts are

totally exempt from the curse of broom-sedge [*Andropogon virginicus*] and wild sorrel [*Rumex acetosella*], tho' they abound pretty generally with most other weeds and grass that we have among us; as crab grass [*Digitaria* spp.], a kind they call nimble will [*Muhlenbergia schreberi*] [and] several other kinds of wild grass which I do not recollect. They also [have] Jamestown weeds [*Datura stramonium*], cuckold burs [*Xanthium strumarium*], carrot weeds [*Daucus carota*], poke [*Phytolacca americana*], pusley [perhaps *Portulacca oleracea*], waterweed [perhaps *Polygonum* spp.], stickweed [perhaps *Desmodium perplexum*], careless weed [perhaps *Amaranthus hybridus*], pie-markers [*Abutilon theophrasti*] etc."

Smith (1795-97), p. 379-380: November 18th, from Hamilton, Ohio, down Great Miami River to the Ohio River.
"We set out early and traveled to and fro thro the wild woods. A body of low grounds which we came tho last evening, for beauty and fertility exceeding any that I had ever seen. I had therefore a wish to see the lands on the heights; for this purpose we ascended the highest hills we could find and to my great astonishment found the lands here in no respect inferior to the low grounds. The growth being mostly walnut was amazing large; buckeye, sugartree and white ash abounded here also. Scarcely any undergrowth but pawpaw was to be seen. The earth we found light and green as a carpet; wild rye [*Elymus* spp.] and clover [*Trifolium stoloniferum*] was here in abundance. Game we found in great plenty."

Smith (1795-97), p. 380. Recounting the previous day from Cincinnati to Hamilton, as follows. “Within 9 or 10 miles of Hamilton, the lands I think are the richest I ever saw. The growth is mostly walnut, sugartree, &c., tied together by clusters of grapevines, which in this country grow amazingly large. From this to Hamilton we saw several pararas, as they are called. They are large tracts of fine, rich land, without trees and producing as fine grass as the best meadows.”

Harris (1797), p. 129. “To enumerate all the natural herbage & flowers in the woods would be too tedious & I should want names for them; buffaloe clover [*Trifolium stoloniferum*], rye grass [*Elymus* spp.]—pea vine [*Amphicarpaea bracteata*] & a broad leaf grass [perhaps *Panicum clandestinum*] & what is call’d rich weed [perhaps *Pilea pumila*] is what the cattle most delight in, but there is in the month of march a great variety of food all over the woods; the under brush is what you call fever bush [spice bush] which grows large with a red berry, some haws or thorn; the natural fruit is the custard apple [pawpaw], cherrys, mulberrys, & a variety of plum like damsons, blackberries, rawsberries, may apples, resembling an orange, goosberries, & crab apples, (nuts) hickory, black walnut, chesnut, beachnut, coffee nut & buck eye; this last resembles the chesnut, but is a large as a hickory nut of the largest size.

Michaux, F.A. (1802), p. 229-230: summarizing patterns in the trees of the settlements in Kentucky and Tennessee. “In support of this mode of appreciating in America the fecundity of the soil by the nature of the trees it produces, I shall impart a remarkable observation that I made on my entering this state. In Kentucky and Cumberland

[Tennessee], independent of a few trees, [among] natives of this part of these countries, the mass of the forests in estates of the first class, is composed of the same species which are found, but very rarely, east of the mountains. In the most fertile soil, these species are the following: cerasus virginia [*Prunus serotina*], or cherry-tree; juglans oblonga [*Carya cordiformis*], or white walnut; pavia lutea [*Aesculus* spp.], buck-eye; fraxinus alba [*F. americana*], nigra [perhaps *F. pennsylanica*], cerulea [*F. quadrangulata*], or white, black, and blue ash; celtis foliis villosis [*Celtis occidentalis*], or ack berry; ulmus viscosa [*U. rubra*], or slippery elm; *Quercus imbricaria* [sic], or black-jack oak; guilandina dioica [*Gymnocladus dioica*], or coffee tree; *Gleditsia triacanthos* [sic], or honey locust; and the annona triloba [*Asimina triloba*], or pawpaw, which grows thirty feet in height. These latter three species denote the richest lands."

Marshall (1812)
p. 5: speaking of the pioneers in Kentucky during 1775 and thereafter.
"Their arrival on the plains of Elkhorn, was in the dawn of summer; when the forest composed of oaks of various kinds, of ash, of walnut, cherry, buckeye, hackberry, sugar trees, towering aloft to the clouds, overspread the luxuriant undergrowth, with their daily shade; while beneath, the class of trees—the shrubs, the cane, the herbage, and the different kinds of grass, and clover, interspersed with flowers, filled the eye, and overlaid the soil with the forest's richest carpet...
p. 8-9: speaking of the Indian conflicts over the land.

"In consequence of which, and because these combats were frequent—the country being thickly wooded, and deeply shaded—was called in their expressive language, THE DARK AND BLOODY HUNTING GROUND."

S.R. Brown (1817), p. 83-84, under "FACE OF THE COUNTRY"
"The angles of ascent are from eight to twenty-four degrees; the vallies are very narrow, and what is quite singular, inferior in point of fertility to the uplands. The soil, is black and friable, generally, but sometimes of a deep vermillion hue, or of the color of strong ashes. These lands produce black walnut, black cherry, honey locust, buckeye, pawpaw, sugar tree, mulberry, elm, ash, cotton wood, white thorn, with a grape vine encircling almost every fourth tree. The depth of the soil is always the greatest on the summits of the ridges and hills, varying from one to twenty feet. There is little or no under wood; but its place was supplied, when the country was first settled by the whites, by the reed cane, which covered all the rich lands. In the woods the earth is not incumbered with the rubbish of fallen timber, nor the trunks of partially decayed trees, as is the case in the northern states. The trees are small and strait, and do not in many places average more than twenty to an acre, except near the principal streams, where the prevailing timber is oak, and the soil hard and sterile to the distance of two or three miles. This part of the state is not so well watered as the hilly strip near the Ohio and the broken country near the Virginia boundary line, yet almost every farm is blessed with a durable spring."

Short (1828-29). Notes on trees of intermediate woods; his notes on *Aesculus glabra* are quoted above under deeper woods, since this species tends to be transitional.

"*Carya sulcata* Ell. (Thick Shell-bark Hickory). This one of the most abundant of the genus in this neighborhood, rising to a very considerable height, (80 or 90 feet,) with a slender body in proportion to its elevation, and destitute of limbs for more than half its length. The wood like that of the most of hickories, is highly prized for fuel, and is much used by mechanics on account of its toughness and elasticity. Flowers towards the last of April..." [*C. laciniosa*].
"*Carya squamosa* (Shell bark hickory, shagbark, scaly bark, &c. &c.). A large tree... nuts have thin shells, are easily cracked between the teeth and are more highly esteemed than any other of the hickory nuts, except the pecan. The wood is very similar to that of the preceding [*C. laciniosa*], and indeed the trees are often confounded." [*C. ovata*].
"*Celtis occidentalis* (Hackberry). The Hackberry is a very common tree throughout the best lands of this state, attaining in such situations a very great height. The wood splits well but is not durable; nor does it make good fuel. ...berries are eagerly sought after by birds, and the coarse harsh leaf is the favourite food of many insects. ...flowers unfolded during the first part of May..."
"*Fraxinus americana* (White Ash). This is one of the largest as well as the most useful of our forest trees; growing frequently to the height of 80 feet with a diameter of 3 feet; and applicable to many useful purposes in building, the mechanical arts and rural economy. ...abundantly met with on the richer lands throughout the state. Flowers about the middle of April."
"*Fraxinus quadrangulata* (Blue Ash). The blue ash is more limited in its geographical range than the preceding species [*F. americana*]; but in this locality it is equally abundant and attains nearly if not quite to as large a size. Its wood unites strength with elasticity

and hence is applicable to a great variety of uses. Flowers about the same time with the former."

"*Gymnocladus canadensis* (Coffee-nut-tree). ...peculiar to the forests of Canada and the western states of North America, in no portion of which is it more commonly met with, or seen in greater perfection than in the immediate neighbourhood of Lexington. The wood is porous and of a reddish hue, not unlike the coarse kind of mahogany: it splits well but is little used in mechanicks. ...the kernel, extracted by roasting in the fire, ground and boiled in water forms a drink not unlike coffee. Flowers generally from the 10th to 15th of May."

"*Juglans cathartica* (White walnut, Butternut). This is a smaller tree, and even more abundant than the preceding [J. nigra]. The woods is soft and light-coloured, little used in mechanicks except for the purpose of making firkins for holding butter, lard and other oily substances, for which it is said to be peculiarly fitted. An extract made from the inner bark, by boiling in water and evaporation, has long been a deservedly popular cathartic in the western country." [*J. cinerea*].

"*Juglans nigra* (Black walnut). No tree of the same magnitude is more common throughout the better lands of Kentucky than the black walnut; but it appears to be particularly obnoxious to lightning and other accidents; hence the older stocks have very generally a mutilated appearance. Next to the elm this tree is the most usual domicil of the parasitic mistletoe. The wood of the black walnut is a good deal used in house-joinery, and in the coarser sort of cabinet work. The kernels of the nuts abound in a mild oil, and when thoroughly dried are palatable to the most of persons; and the spongy

envelope of the nut is much used as a domestic brown dye for woolen cloths. Flowers towards the 25th of April." [*J. nigra*].
"*Morus rubra* (Common Mulberry). Owing to the depradations of stock upon this valuable tree, whose bark is a favourite food with horses and sheep, it is becoming rare in this quarter where it once abounded; young trees are never met with in exposed situations, and the old ones have generally a decaying aspect. The sexes are sometimes together on the same plant and again seperate, so that trees are occasionally found which never bear fruit. The wood of the mulberry is more durable when exposed to the vicissitudes of weather than any other timber of this region, except the red-cedar and black-locust; hence, in those parts of the country where those trees are not found, this is much used as posts for fencing. It blooms about the last of April..."
"*Prunus virginiana* (Wild cherry). One of the largest trees of our forests, occurring abundantly on the richest soils, and one of the most valuable of the lumber yielding kind, in consequence of the beauty, hardness, and durability of its wood, which is more extensively used than any North American tree, in cabinet work. When portions of the tree are selected for this purpose, at the bifurcation of the stocks, the plank, when polished, exhibits a rich and varied appearance, nowise inferior to the best mahogany. The bark has been long used as a domestic medicine in jaundice and debility. Flowers about the 8th of May..." [Short was clearly referring to *P. serotina*, not *P. virginiana*, which is restricted to ravines near the Kentucky River.]
"*Quercus imbricaria* (Laurel oak). The laurel oak, though a very common tree in some portions of Kentucky, especially in that section called "the barrens," is comparatively rare in this locality; nevertheless it does occur occasionally in company with the last [*Q.*

muhlenbergii...] on the richest lands, and is always, when in foliage, a pleasing object, in consequence of the deep glossy green on its leaves... It does not attain any considerable size, nor is its timber valuable."

"*Quercus macrocarpa* (Over-cup White oak, Bur-oak). This noble species is every where met with in the rich forests of this neighbourhood, towering above the most of other trees and throwing out its large umbrageous branches to a considerable distance around. The bark of the trunk and limbs is much rougher and more furrowed than the preceding species [*Q. alba*], and its wood more porous, and less durable; nevertheless it is valuable for fencing and fuel."

"*Quercus prinus acuminata* (Chestnut white oak, Yellow oak). This species is not so abundant, nor is it so large a tree as the last, [*Q. macrocarpa*] though in common with it, it is found growing on the richest soils. The acorn... is said by Michaux to be also sweeter than any other of the American oaks. Different individuals of this species differ essentially in the size of their leaves, these being generally larger in proportion as the tree is young..." [*Q. muehlenbergii*].

"*Quercus palustris* (Pin oak, Swamp Spanish oak). Next to that just mentioned [Q. macrocarpa], the present species is most frequently met with in the woods around Lexington; although, from its specific name, it might not be looked for in the dry upland of this portion of the state; for Michaux affirms that it "grows constantly in moist places, and of preference about swamps enclosed in the forests," in confirmation of which remark it may be observed that where such situations occur in this country, the tree will always be found. Like the *Q. Macrocarpa*, it attains to a great size, and in consequence of its wood splitting well it is often used for rails, shingles, laths &c. although it is not

durable. The fine, glossy texture, and beautifully scolloped form of the leaves, which are more delicate than those of any other oak, give to this tree a peculiar and softer aspect than is common with the family, whose foliage for the most part is harsh and coarse." [He was generally referring to *Q. shumardii* rather than *Q. palustris*, which is not native in the Lexington area; the two species were not generally distinguished in Short's time.] "*Ulmus americana* (White Elm). ...in the more immediate vicinity of the Ohio river, it attains its greatest perfection... The Elms in this neighborhood are the favourite habitations of the missletoe, (Viscum verticillatum) whose clusters are so densely interposed among the branches of almost every Elm as to give this tree a dusky verdure throughout the winter. In ordinary seasons its blossoms appear towards the middle or latter part of February, and on some occasions as early as the first part of that month." "*Ulmus fulva* (Slippery Elm). ...has almost disappeared from the forest around Lexington in consequence of its destruction by cattle. In the more inaccessible situations among the cliffs of Elkhorn and the Kentucky river, it is occasionally met with... The inner bark is medicinal, being mucilaginous and demulcent. It blooms a few days later..." [*U. rubra*].

Short (1828-29). Notes on smaller trees and shrubs of intermediate woods.
"*Annona triloba* (Pawpaw, Custard-apple). This portion of Kentucky was once the paradise of pawpaws, where immense orchards of large trees were every where met with; but cultivation and the ravages of cattle have greatly lessened the number. Trees of this species are occasionally met with 25 or 30 feet high, but for the most part they do not attain half that stature; and are often loaded with fruit when not more than 6 or 8 feet high. This fruit, when fully ripe, and slightly touched by the frost, is highly esteemed by

the most of persons; and although Dr. Smith, the learned president of the Linnaean Society of London, affrims that it is "relished by few except the negroes," yet I have known many persons of cultivated taste declare it equal to any of the tropical luxuries. The bark of the pawpaw is so strong and fibrous that ropes are occasionally made of it; the wood is soft and worthless. The flowers appear about the 20th of April..." [*Asimina triloba*].

"*Euonymus atropurpuraeus* (Burning-bush, Spindletree, Indian arrow-wood, Wahoo). The Indian arrow-wood or Wahoo, by which names this shrub is here universally known, is found in rich moist forests, not too much frequented by cattle. The bark of the root is actively cathartic, and a decoction in water exhibited in small and frequently repeated does, has proved highly beneficial in asthmatic cases."

"*Ptelea trifoliata* (Shrubby trefoil). A shrub of 8 or 10 feet... The whole plant has an unpleasant odour, not unlike that of the common buckeye... Grows on stony lands bordering watercourses. Rare in this neighbourhood. Flowers from 10th to 15th May."

"*Rhus radicans* (Poison oak, Poison vine). It is extremely common in this section of the Union, covering almost every dead tree, and climbing to the tops of the loftiest branches... ... flowers...appear towards the middle of May..."

"*Viburnum prunifolium* (Black-haw). The Black-haw is a common shrub or small tree on the more broken and rocky lands bordering the Elk-horn and Kentucky river. Blooms about the 10th of May." [Short was evidently referring to *V. rufidulum* as well as *V. prunifolium*.]

Short (1828-29). Notes on herbs of intermediate woods.
"*Arum dracontium* (Green dragon, &c.). This species is not so common as the preceding [*A. triphyllum*]. Flowers at the same time and is found in similar situations." [*Arisaema dracontinm*, which tends to occur in more open woods than *triphyllum*.]
"*Claytonia virginica* Gr. This delicate little plant adorns our meadows and pastures profusely in early spring. It blooms generally from the middle to the 30th of March."
"*Corydalis aurea* (Golden-flowered C.). ...more abundant, and is sometimes found in cultivated situations among the grass &c. in fence corners. ...towards the 20th of March, continuing in bloom longer than either of the former [*Dicentra* spp.]" [*C. flavula*].
"*Dentaria laciniata*. ...when growing in good soil not too much shaded, its dense heads of white and purplish flowers, contrasted with the rich green of its verticillate leaves, make it a very pleasing object in early spring. Flowers last of March."
"*Erigeron bellidifolium*. ...in pastures and meadows abundant. The flowers begin to shew themselves about the 10th of April..." [Probably *E. philadephicus*; *E. pulchellus* is virtually unknown in the central Bluegrass region.]
"*Oxalis stricta* (Sheep-sorrel, Wood-sorrel). It is common in gardens and other cultivated grounds. Although considerable diversity obtains, according to the season, in the time of the sorrels' flowering. yet the middle of this month [May] may be regarded as the medium period; however it is occsasionally found in bloom much earlier." [*O. dillenii* and *O. stricta* have been generally much confused, and may not be clearly distinct; *O. dillenii* is native, while *O. stricta* is alien and perhaps more weedy in open areas.]
"*Phacelia fimbriata*. ...abundant throughout the western country... Moist meadows--flowers from the middle of April." [*P. purshii*].

"*Ranunculus abortivus* (Small flowered crow-foot). Grows in woods and meadows. Blooms last of March."
"*Ranunculus recurvatus*. Rarer than the two first mentioned species [*R. hispidus*, *R. caricetorum*]. In shaded woods and meadows. The flowers...appear towards the latter end of April..."
"*Urtica urens* (Small stinging nettle). Frequent in rich moist woods among decaying leaves, flowering in the latter part of March and after." [*U. chamaedryoides*].
"*Viola cucullata* (Hooded Violet). This is with us the most abundant of the violets, as well as the first to bloom; the whole surface of moist meadows and pastures being covered with them in the fore part of April. ...1st to 15th April." [Interpreted here to be the common smooth violet known as *V. papilionacea* to Fernald (1950) and many others in the 20th century.]
"*Viola ochroleuca*? Schw. (White Violet). It is found in common with the two preceding [cf. *papilionacea* and *sororia*], and forms dense patches among the grass in moist situations." [*V. striata*].

Draper (1842-51). 11CC, p. 158 [?]: Samuel Matthew, interviewed by John D. Shane in the 1840s [?]; p. 158: his account of land around Bryan's Station in about 1783.
"There was a great deal of walnut about Bryan's Station. Land that had not cane on it, was grown up with white blossoms, and the trees were tall ash, sugar-trees, elms, hackberry, tall and very thick. What locust there was, was very high and wind broken. [In contrast] Locust, walnut, low scrubby hackberry, and some elm, and sometimes sugar trees, vast quantities of buckeye, where cane grew abundant. Soil much better where cane

was. Buckeye outlasts sugar tree [perhaps meaning that it persists in settlements]. Plums, haws, wild-cherry, pawpaw, hackberry, grass nuts, turkeys fed on. Mistletoe grew on walnut and elm. No chestnut N of Kentucky River: all S and W of that River."
[See also note under locust type].

Draper (1842-51). 12CC, p. 212: ... Weston, letter from Missouri with details of timber... [check details]. Notes elm, hackberry, walnut, hickory, lynn, box-elder, honey-locust, coffee-bean, w. some oaks; undergrowth of pawpaw, ironwood, unusual grapevine...

Draper (1842-51), 13CC, p. 1-7 [-16?]: Asa Ferrar interviewed by John D. Shane in about 1851 [?].
p. 2: after arriving in Lexington on December 19th, 1788 [probably 1778; but original states 1788; recheck]; clearing the road along what became Main Street or US 25. "There where not over 100 men in Lexington (at this time). As many of them as we could get, were employed two days in clearing out the road from Brennan's now Chiles' [where the Phoenix Hotel stood], as far as what we called VanPelt's Lane [Rose Street]; in clearing out to where the race ground was [probably near what became Ashland]. There was one burr oak so large we couldn't get a saw long enough to run through it. Had to cut out on each side to let the saw in. Have no doubt the tree was four feet over. Forest of burr oak and black walnut."
p. 16: about Lexington in about 1785.

“With no open land in or around Lexington, every acre had to be cleared of timber or cane, before a cabin could be built or crops planted. As late as 1785 stumps were being removed from the streets.”

Drake (1845-48), p. 36-38: in 1794, his father purchased 200 acres about one mile directly west of Mayslick. “The land acquired was covered with an unbroken forest, which much be cleared away, and a new cabin erected... I was provided with a small axe—father had a larger, and a mattock for grubbing. Thus equipped, with some bread & meat wrapped in a towel, we charged upon the beautiful blue ash and buckeye grove, in the midst of which he proposed to erect his cabin... The forest consisted chiefly of blue ash—tall, straight, soft while green, easily hewed & easily split into rails and puncheons; of sugar trees—generally preserved [in clearing]; of several kinds of hickory [at least *Carya cordiformis* and *laciniosa*] and walnut; and of buckeye [probably *Aesculus glabra*]... It has a parasite, which sought the air and light of heaven by climbing to its limbs, and weaving those of many adjoining trees into a broad and tangled canopy. That parasite was the winter grapevine [*Vitis vulpina*]...”

p. 75-77: when he was about 8-15 years old, in 1794-1801.
“In the latter part of winter we were often short of fodder for our stock, and had to resort to the woods with both cattle and horses for *browse*. Of the whole forest, the red or slippery elm [*Ulmus rubra*] was the best, next to that of the white elm [*U. americana*] and then the pignut or white hickory [*Carya cordiformis*]... The woods immediately beyond our fields were unmutilated and not thinned out as you see them at present. They

were, in fact, as nature received them from the land of her Creator... The cane as high as my head and shoulders... the winter grapes [*Vitis vulpina*]... tufts of mistletoe [*Phoradendron serotinum*]... the *Celastrus scandens* [*sic*]... and the Indian arrow wood (Euonymus carolinensis) [*E. atropurpurea*] below." [To be checked further in original; elms and hickory also noted near Washington.]

p. 79: more about 1794-1801.
"It was a custom with father and some of his neighbours in those days, to take their mares and colts & the horses which were not yet broke into what they called the *range*. Within 3 miles of where we lived, on Johnson's Fork of Licking [at edge of Eden Shale Hills along Mason-Fleming county line], there [were] no settlements, and consequently, there was a luxuriant herbage consisting largely of what was named pea vine [*Amphicarpaea bracteata*], with a full growth of Buffalo grass [probably *Panicum clandestinum*]. The months of May, June & July were selected for this resort to the untrodden wilderness. Some salt was tied up in a rag (for paper was scarcer than the raw materials), and when we reached a wild and unfrequented spot where there was water, the salt was placed on the grounds to be licked up. From this "whetter of the appetite" the animals eagerly fell on the rich herbage, which they devoured with as much avidity as I feasted my eyes on the surrounding scenery; which from its being "oak land" [with much white oak on uplands] presented many productions and aspects different from the woods with which I was familiar. When the horses had wandered off a little way we left them; and it is remarkable that they would remain there, and make the spot where they were salted a kind of rallying point or place of resort."

p. 86: making maple sugar, perhaps along Lees Creek to the north.
“There were but few sugar trees on Father’s land, and he rented a “camp”, as the grove was called, about two miles off.”

p. 127-129: collecting wild fruits.
“The pawpaw [*Asimina triloba*] was a general favorite... There are two varieties, the pale yellow and the white. The latter are intolerable to all tastes, until they have been frostbitten half a dozen times. I observed that but two animals ate the pawpaw—ants and oppssms... the greatest charm of haw [perhaps *Viburnum prunifolium*] hunting was found in the favorite locality of that tree, always on the margin of some rocky brook... Crabapple [*Malus coronaria*]... was always found solitary (while the pawpaw formed groves or patches)... In clearing land, this lady like tree [crabapple] was always spared... [Of nuts] black walnuts [*Juglans nigra*] were most abundant, and they made our staple; next came hickory nuts [probably *Carya laciniosa* and *ovata*], and lastly, butternuts [*Juglans cinerea*].”

Finley (1853), p. 105-106 [in 1855 printing]: describing the Scioto River bottoms near “Chilicothe” in 1796.
“It would be impossible for me to describe the beauty of these rich bottoms. The soil itself for richness was not exceeded by any in the world. The lofty sugar-tree, spreading its beautiful branches; the graceful elm, waving its tall head, the monarch of the forest; the cherry and hackberry; the spicewood, with its fragrance; the pawpaw, with its

luscious fruit; the wild plum; the rich clusters of grapes, which, hanging from the massy vines, festooned the forest; and, beneath all, the wild rye, green as a wheat-field, mixed with the prairie and buffalo clover—all formed a garden of nature most enchanting to behold."

Young & Duncan (1898), p. 69. "The following letter to Lewis Tapp will be extremely interesting, as he has many descendants in Jessamine county: "Lexington, Ky., May 10, 1805... Jessamine county was formed eight years ago. I settled in the limits of the county in 1788 The population is 5,400. The surface of the land for the most part gently undulating, rising here and there into hills and moderate elevations. The timber is white ash, hickory, hackberry, elm, white oak, also white and black walnut..."

Owen (1861): walnut (6, mostly black); sugar-tree (5); locust (5, mostly black), blue ash (4), other ash (4), oak (3, mostly burr), hickory (3); buckeye (1); coffee-nut (1); hackberry (1); cherry (1); elm (1); mulberry (1); box-elder (1); beech (1)
p. 72: "Best hemp soil, from heavy black walnut land," 1.5 mi SW Sharpsburg, Bath Co.
p. 73: "Primitive growth, blue ash, sugar-tree, hickory, &c., &c." 2 mi W Owingsville, Bath Co.
p. 75: "Primitive growth, black locust, black walnut, black and blue ash, and sugar-tree" 1.5 mi E Sharpsburg, Bath Co.
p. 83: "woods pasture" Cane Ridge, Bourbon Co.
p. 115: "Primitive growth, black walnut, locust, mulberry, blue ash, &c." Judge Simpson's farm near Winchester, Clarke Co.

p. 116: “Forest growth, sugar-tree, black locust, white and blue ash.” Virgin soil from Wm. R. Duncan’s farm, Clarke Co.
p. 155: “Primitive growth, large ash, burr oak, black locust, walnut, &c.” Virgin soil from farm of Isaac Wingate, Franklin Co.
p. 192: “Principal growth walnut, with black locust, wild cherry, elm, ash, hackberry, box-elder, buckeye, pignut and shellbark hickory, coffee-nut, red and over-cup oak, large sugar maple, and root-covered beech.” Virgin soil under the sod of native blue-grass, in woodland pasture, some of the best “Beargrass” land.
p. 223: “Forest growth, black walnut, sugar tree, &c.” farm of Mr. R. Apperson, Mount Sterling, Montgomery Co.

Open woods with canebrakes, other thickets:

(A) (*Gleditsia triacanthos, Robinia pseudo-acacia, Prunus serotina, Quercus macrocarpa*) / *Arundinaria gigantea – Amphicarpaea bracteata*

(B) Plum & Prickly ash thickets; browsed?

(C) Redbud & Hazel thickets; droughted?

This is a complex of types that intergraded with each other and with the less open woods outlined in previous sections. Only about 1-10% of the land had truly open conditions with dense canebrakes, other shrubbery, or largely treeless grassland. These included variants on lowlands and uplands. The so-called 'savannas' were mostly opened up in pastures after 1780.

See appended tables [Central Bluegrass and Griffith Woods Floras] for complete lists of typical vascular plants. Species coded 4 in the right column are most characteristic, but those coded 3 and 5 can also be frequent.

At KSNPC and NatureServe (CEGL), the closest matches are as follows:

KSNPC: Bluegrass Woodland; especially A.

See notes above under 'intermediate woods; The KSNPC type is defined too broadly to include old woodland-pasture trees, varied mixtures with 'intermediate woods' and canebrakes.

CEGL: 3835 *Fraxinus quadrangulata - Quercus macrocarpa* / *Arundinaria gigantea* ssp. *gigantea* Wooded Shrubland; especially A.

This is based on the preceding KSNPC type.

CEGL: 3836 *Arundinaria gigantea* ssp. *gigantea* Shrubland; especially A.

CEGL: 7281 *Robinia pseudoacacia - Celtis occidentalis* - (*Fraxinus americana, Liriodendron tulipifera*) Forest; especially A.

Other types of comparative interest are as follows, and further literature review would be useful. It is notable that NatureServe does not list any plum-dominated type for eastern states, although several early accounts indicate that plum thickets were common here before European settlement, especially along ancient animal trails and around villages of native people.

CEGL: 4419 *Liriodendron tulipifera* / *Asimina triloba* / *Arundinaria gigantea* ssp. *gigantea* Forest

CEGL: 6599 *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest

CEGL: 7279 *Robinia pseudoacacia* Forest

CEGL: 3686 *Gleditsia triacanthos* - *Ulmus* (*alata, rubra*) Woodland

CEGL: 4345 *Gleditsia triacanthos - Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland

CEGL: 5219 *Cornus drummondii* - (*Rhus glabra, Prunus* spp.) Shrubland

Reported only from midwestern states (AR?, IA, KS, NE, OK)

CEGL: 1108 *Prunus virginiana* - (*Prunus americana*) Shrubland

Reported only from western states (CO, ID, MT, NM, NV, OR, SD, UT, WA, WY)

CEGL : 5230 *Carya ovata* / *Zanthoxylum americanum* / *Panicum philadelphicum - Carex pensylvanica* Wooded Herbaceous Vegetation

EARLY ACCOUNTS THAT INDICATE THIS CLASS OF VEGETATION

The following accounts almost all come from the Bluegrass region; but a wider search is still needed for similar vegetation. The notes by Stuart (1755) and Heckewelder (1797) from Pennsylvania are also relevant.

Gist (1751), p. 150-151: Mar. 18th, probably near Pilot Knob, in northern Powell Co., or some other knobs between "Salt Lick Creek" [Licking River] and "Cuttaway River" [Kentucky River].

"We then went down the mountain and set out S 20 W about 5 M[iles], thro rich level land covered with small walnut, sugar trees, red-buds &c."

Stuart. (1755-57), p. 69-70: about 19 Nov 1755, traveling along Mohican River between Coshocton and Walhonding in western Pennsylvania.

"After we had left the Traders House on Muskingum where I parted with my son, we travelled about 5 or 6 miles through hasel bushes and small plumb bushes or shrubs, to the edge of a long savannah—we travelled along the edge of it about 12 miles, leaving it on our left hand, afterwards we went slanting across it where it was about 4 miles broad; we still continued up the savannah about 7 miles, leaving it on the right hand till we came to a great Buffaloe Lick where we met a Wondot Indian who had killed a buffaloe there the day before..."

J. & R. McAfee (1773).
August 2nd, arriving in what became central Madison Co., perhaps Irvine's Lick at the head of Tates Creek on the east side of what became Richmond.
James: "We travelled an east course about 20 miles through rich woods and mostly cane—a great many branches mostly dry—we camped at a Lick."
Robert: "...we came from morning till about the middle of the day through high rich cane woods, across several creeks, & in the after part of the day we came to where the woods grew flatter & more fit for farming—where we lay all night at a Lick..."

Hanson (1774). July 8th: "We continued our surveys, the lines running parallel to each other, running in length N. 20E., in breadth, S. 70E. The land is so good that I cannot give it its due praise. Its undergrowth is clover pea vine cane & nettles.—intermixed with richweed. Its timber is honey locust, black walnut, sugar tree, hickory, iron wood, hoop wood [hackberry], mulberry, ash, & elm, & some oak."

Cresswell (1774-77). 1775, May 19th, down the Ohio River to the Cincinnati area, then into what became Boone Co. but probably not far from the river.
"Got to the mouth of the Great Miamme River... Stopped to cook and take a view of the land on the S.E. side of the Ohio River. It is a little hilly but rich beyond conception. Wild clover [*Trifolium stoloniferum*], what they here call wild oats [perhaps *Chasmanthium latifolium*] and wild rye [*Elymus macgregorii*] in such plenty it might be mown and would turn out a good crop. The great quantity of grass makes it disagreeable walking. The land is thin of timber and little underwood."

June 5th, from “Harwood’s Landing” [later known as Warwick then Oregon] to Harrodsburg. “walked along 15 miles to Hardwoodstown... the land most part of the way rich—weeds as high as you head—the path but badly trod and continual logs and sticks that I fell twice...”

[Following reference is outside Bluegrass but was perhaps typical of some adjacent valleys in the Knobs and Appalachians.]
August 23rd-26th: between Fort Pitt [Pittsburgh] and the Moravian towns on the Monongahela River, in western Pennsylvania [?].
August 25th: “Here are wild plums in great abundance, about the size of our common white plums in England, some red, others white and very well flavoured. The cherries are small and black, very sweet, and grow in bunches like currents...”
August 26th: “...we passed through the largest plum thicket I ever saw. I believe it was a mile long, nothing but plum and cherry trees. Killed a rattlesnake. Just as the sun went down we stopped to get our supper on some dewberries (a small berry something like a gooseberry)...”

Nourse (1779-80). Thursday, Feb 17th, 1780. “Set off with Capt. Swearingen for Harodsburg by way of Bryan's 1[31] and Lexington stations. Strouds station lies near a due north course from Boonsburg about 10 miles, [while] Bryans [is] about N.W. from Boons [at a] distance [of] 16 m[iles.] On my journey to these two stations, [I] was obliged

1[31] Bryan's Station was located about 8 miles northeast of the center of Lexington, and at that time was one of the largest forts in Kentucky. In August, 1782, 44 rifilemen defended this fort against an attack of 400 or so Indians.

to avoid a very thick cane break and keep near a south course from Strouds, then [proceed] to the west till we got upon the ridge which divides the Elkhorn from the Licking Creek waters. Along this ridge where there are vast cane breaks, there has been during the winter a great resort of buffalo, as we judged from the quantities of dung, but the snows now wetted off the ground, they have now left it. The lands along this ridge is very good and in many places we came across sink holes, where I do not doubt in the least but water would be easily got at."

Fayette County Court Records (1779-80).
"13. "The Locust Thicket," on the waters of Dick's River. (Pp. 54 and 133.) (Property of John Dougherty.)"
"16. "An Old Indian Town," on Slate Creek, a branch of Licking. (P. 57.) (Property of James Patton.)"
Interpretation. This may have been in the general area of the Knob Lick on Barker's (1795) map, Indian Creek (of Licking), Prickly Ash Creek (of Slate Creek), Peasticks, Polksville and the old Bourbon Furnace. Several rare sun-loving plants have been found here, suggesting a grassy open history before settlement (Campbell et al. 1992, Morehead District Inventory for Daniel Boone National Forest). Mud Lick (Olympia Springs) is about 5 miles south of the area indicated here on Slate Creek.
"31. "An Old Indian Town House," on the head of an Eastern branch of Paint Lick Creek, near a Sink Hole Spring. (P. 86.) (Property of John Tate.)"
Interpretation. This might have been on Walnut Meadow Branch (see 18 above), just west of Berea in Madison Co. Evidently, there were grassy walnut woods (probably with

wild ryes) here before Virginian settlement. The "Old Indian Town" on Silver Creek (see No. 57) might have been a few miles away to the north, perhaps near Elk Garden Branch. "Best's Cane Brake" (see 33 below) was apparently near here, or to the west on White Lick Creek (in southern Garrard Co.); "White Lick" was mapped by Barker (1795) on the east side of the upper forks in White Lick Creek (between Paint Lick and Cartersville). Cane remains locally abundant in this area, and there are also some records of conservative grassland plants in the adjacent dolomitic foothills of the Knobs; see also my notes on Blue Grass Army Depot.

"43. "The Locust Thicket," on the waters of Muddy Creek and Otter Creek, within one mile of the "Little Fort." (P. 95.) (Apparently not the same as No. 13, supra.) (Property of James Estill.)"

Interpretation. This may have been on the southeast side of Richmond, where perhaps "Little Fort" was located. If this thicket was a notable feature, extending into both watersheds, it probably covered more than 100 acres.

"124. "A Honey Locust Flat," on a branch of Silver Creek, about 27 miles south from the Locust *Bent* (or Bend). (P. 312.) (Property of Hugh McGary, assignee of Jos. Robertson.)"

Interpretation. The "27 miles" may be a misprint; most likely this was on Silver Creek in southwest Madison Co.

Filson (1784), p. 12-14 [317-321 in Imlay]: under the heading "Soil and Produce"; describing land in what became known as the Bluegrass region, clearly with special emphasis on the more fertile soils in central and eastern sections, plus the Bardstown

area, as indicated by his attached map. "The soil of Kentucke is of a loose, deep, black mould, without sand, in the first rate lands about 2 or 3 feet deep, and exceeding luxurious in all its productions. In some places the mould inclines to brown. In some the wood, as the natural consequence of too rich a soil, is of little value, appearing like dead timber and large stumps in a field lately cleared. These parts are not considerable. The country in general may be considered as well timbered, producing large trees of many kinds, and to be exceeded by no country in variety...

"There are many cane breaks [so] thick and tall, that it is difficult to pass through them. Where no cane grows, there is [an] abundance of wild-rye [*Elymus* spp.], clover [probably *Trifolium stoloniferum*], and buffalo-grass [perhaps *Panicum clandestinum*], covering vast tracts of country, and affording excellent food for cattle."

Watkins (1789). "June 24th Wednesday—After breakfasting I set out from the fork of Dickses River for Mr. Watkins's in Woodford County on the north side of Kentucky River—the Land Broken to the River and the groth Oak etc. forded the River at the Mouth of Hickman after Le[a]ving the river the Land & groth nearly the same as have mentioned above [—] after traveling seven or Eight miles on the rode that Leads from the River to lexington I turn'd to the left of sd. rode and cross'd a Water Course that's Call'd East-Jessiman after [—] after Leaving the said Creek the Land is very Level and of a very Pretty Mulatto soil and <u>the groth is Black & White oak [,] hickory and some Walnut and Sugar Tree and the undergroth Hazelnut and red Bud</u>—'till I arrived to West Jessiman [—]."

Todd (1791), p. 160... [in Draper 15CC]: his account of land around Lexington in 1776. "Here I will take time to digress from a regular details of facts by observing that the face of the country was, at the times I have been speaking, delightful beyond conception, nearly one-half of it covered with cane, but between the brakes, spaces of open ground as if intended by nature for fields. The ground appeared fertile, and producing amazing quantities of various kinds, some wild grass, wild rye and clover."
Interpretation. "Open ground" probably referred to the ground vegetation not the associated trees—other descriptions indicate that this was generally a wooded area, with or without cane; see especially Samuel Matthew's interview under Draper (1842-51: 11CC, p. 158).

Anonymous (1791), p. 53-60 [1973]: "The stories told of the abundance of grass in the woods are in many instances true. You frequently find beds of clover [*Trifolium stoloniferum*] to the horse's knees, sometimes a species of rush-grass commonly called wild rye [*Elymus macgregorii*, etc.], from the similarity of it's [sic] stalk to the rye so called among us; in other places we meet with tracts of wild cane [*Arundinaria gigantea*], very much esteemed by the wild and tame cattle, it continuing in verdure all the winter. There is also a species of vine called the pea vine [*Amphicarpaea bracteata*], from which its producing a small pod, resembling that of the garden pea, of which both horses and cattle are extremely fond. These are scattered generally through the country, according to the different soils, but are not to be met with universally. The woods, however, afford abundance of food for cattle, and in consequence of this abundance the people pay very

little attention to making and improving pasture lands. The milk from this food is thin, and both that and the butter retain a strong taste of weeds..."

Imlay (1792), p. 29-30: in "Letter II", from Kentucky; describing land along what is now US 68 in Mason Co. "From Limestone [now Maysville] to Johnson's Fork [Johnson Creek] of Licking creek, the land is immensely rich, and covered with cane, rye-grass, and the native clover. The cane is a reed that grows to the height frequently of fifteen or sixteen feet, but more generally about ten to twelve feet, and is in thickness from the size of a goose-quill to that of two inches diameter; sometimes, yet seldom, it is larger. When it is slender, it never grows higher than four to seven feet; it shoots up in one summer, but produces no leaves until the following year. It is an evergreen, and is, perhaps, the most nourishing food for cattle upon earth. No other milk or butter has such flavour and richness as that which is produced from cows which feed upon cane. Horses which feed upon it work nearly as well as if they were fed upon corn, provided care is taken to give them once in three or four days a handful of salt; otherwise this food is liable to heat, and bind their bowels."

"The rye-grass [*Elymus* spp.], or more properly speaking, wild rye, when it arrives to maturity, is from two feet and a half to three and a half, and the head and beard resemble the real rye, and sometimes produce a small grain, long and slender, not unlike the rye. Whether cultivation would bring it to the same perfection, I can form no idea; it is however certain that it is a very good and valuable grass. The clover [*Trifolium stoloniferum*] is in no respect different from the clover in Europe, but as it is more coarse

and luxuriant. There is a variety of other kinds of grass, which are found in different places; but I have only mentioned the two former, they being esteemed the most valuable."

Imlay (1792), p. 233-235: in "Letter X", probably from Kentucky.
"We have a variety of spontaneous kinds of grass, for many of which we have no name. I have spoken of the cane and its properties in a former letter, which the farmer may consider as a grass, since it will answer every purpose of grass to him. I have also mentioned our clover and rye-grass. Besides which, we have, of the grass kind, the pea-vine [*Amphicarpaea bracteata*], which in a small degree resembles your pea-vine. It has the same kind of tendril, and runs up the cane, shrubs and rye-grass, which frequently grows interspersed with it. Its blossoms are of a reddish hue, and it produces a small and imperfect pea. In very rich soil, it grows from 3 to 5 feet high; but in general it does not exceed 18 inches or 2 feet, and is not so luxuriant a growth as the vine of the cultivated pea, but it has a much nearer resemblance to grass."

Imlay (1792), p. 278: "The best soil produces little timber but the locust, cherry, walnut, buck eye, sugar-tree, elm, beech, ash, satin wood [*Gymnocladus dioica*], and pawpaw: the middle rate land oaks, hiccory, dogwood, some sugar trees, and beech."

Parry (1794), p. 237-238: June 21-22ndst, from the big bend of Hinkston Creek (now near Millersburg in Bourbon Co.) to the Cane Ridge and then Mount Sterling (Montgomery Co.). "... and so came to Mt. Sterling, or the Little Mountain Town, and as the road was

but narrow, hemmed in with cane, the most of the way, and the weather wet, caused the road to be exceeding muddy, and a good deal of it very hilly, that it made a tiresome days journey [probably Ky. Route 537 to US 460]. The land all the way was very good; the timber in some places was chiefly honey-locust, but in others varyfied with walnut, buckeye, hackberry and sugar-tree."

Barrow (1795), p. 21: June 28th, notes on the area around Cincinnati, in Ohio.
"The lands are confessedly as good as in Kentucky, and said generally to be better watered; but they do not lie in so large bodies together. There is an abundance of game here at present, such as deer, bear, turkey etc. The range for all kinds of animals is very good at this time and consists of wild pea-vine [*Amphicarpaea bracteata*] etc., but no cane as I saw or could hear of on this side of the Ohio until one falls low down the said river."

Heckewelder (1797), p. 140-151 [to detail]: 12 May 1797, at the destroyed "White Eyes Town", near what became Gnadenhütten on the Tuscarawas River in western Pennsylvania (between Uhrichsville and Newcomerstown).
"The whole situation of the town could be easily traced from the ruined chimneys which were still visible. Everything, however, is overgrown with heavy grass, & as this becomes matted down during the winter, we soon perceived that this would serve as a good shelter for numberless snakes. Besides this, the ground was so thickly overgrown with plum trees, hazel-bushes, and black-berries, that there was no getting through them except by means of the paths made by the bears, deer & wolves. This wild mass we set on

fire, & obtained thereby considerable more air. Then only did we obtain a correct view of the ruins of the village. Everywhere bones could be seen, & in the cellars of the houses, where some of the Brethren had been massacred & burnt, they were also to be found."

F.A. Michaux (1802), p. 212: mid-August, at the plantation of General Adair.
"His plantation is situated near Harrodsburg in the county of Mercer. Magnificent peach orchards, immense fields of Indian wheat, surround the house. The soil there is extremely fertile, which shews itself by the largeness of the blades of corn, their extraordinary height, and the abundance of the crops, that yield annually thirty or forty hundred weight of cord per acre. The mass of the surrounding forests is composed of those species that are found in the better sort of land, such as the gleditsia acanthus [*Gleditsia triacanthos*], guilandina dioica [*Gymnocladus dioica*], ulmus viscosa [*Ulmus rubra*], *Morus rubra* [*sic*], corylus [*Corylus americana*], annona triloba [*Asimina triloba*]. In short, for several miles round the surface of the ground is flat, which is very rare in that country."

F.A. Michaux (1802), p. 229-230. "In all the fertile parts covered by the forests the soil is completely barren; no herbage is seen except a few plants, scattered here and there; and the trees are always far enough apart that a stag may be seen a hundred or a hundred and fifty fathoms off. Prior to the Europeans settling, the whole of this space, now bare, was covered with a species of the great articulated reed, called arundinaria macrosperma [*Arundinaria gigantea*], or cane, which is in the woods from three to four inches diameter, and grows seven or eight feet high; but in the swamps and marshes that border the Mississippi it is upwards of twenty feet. Although it often freezes in Kentucky, from

five to six degrees, for several days together, its foliage keeps always green, and does not appear to suffer by the cold."

F. Walker (1824), p. 163-164: recounting events of 1775, during late March to July, traveling from Appalachian hills to Boonesborough, probably camping near Irvine's Lick when they were attacked.
"On leaving that river [Rockcastle], we had to encounter and cut our way through a country of about twenty miles [probably hills of northern Rockcastle County], entirely covered with dead brush, which we found a difficult and laborious task. At the end of which [in the Berea area] we arrived at the commencement of a cane country, traveled about thirty miles [into modern Madison County] through cane [*Arundinaria gigantea*] and reed [perhaps *Phalaris arundinacea*], and as the cane ceased, we began to discover the pleasing and rapturous appearance of the plains of Kentucky [central Madison Co.]."

Bradford (1826-29), p. 49-50: Simon Girty's speech of 1782 as reported in this source; earlier renditions are unknown but the military history should be searched; see also Marshall (1812). According to Bradford, Girty addressed the Indians in Chillicothe, Ohio, before their attack on Bryan's Station north of Lexington as follows.
"Brothers: the fertile region of Kentucky is the land of cane and clover—spontaneously growing to feed the buffaloes, the elk and the deer; there the bear and beaver are always fat... Brothers, the intruders on your lands exult in the success that has crowned their flagitious acts:—They are planting fruit trees and ploughing the land where not long since were the cane break and clover field."

Short (1828-29). Notes on thorny or thicket-forming woody plants; some of these are also common in intermediate woods.

"*Bignonia radicans* (Trumpet flower). No vine is more common in the forests of this country, or more commonly planted for ornament, than the trumpet flower; climbing over buildings and the loftiest trees... Some circumstances have occurred within my knowledge which induce me to think this plant is always injurious and sometimes fatal to the tree supporting it. ...flowers...appear somewhat later than [*B. capreolata*]." [*Campsis radicans*.]

"*Cercis canadensis* (Red Bud). ...does not occur spontaneously in the level rich lands immediately round Lexington; but as the face of the country becomes more broken on approaching the Kentucky river, it is met with in great abundance. The flowers appear generally by the 12th of April..."

"*Corylus americana* Walt. (Hazel). ...although originally a native of this country, is no longer found growing wild in this immediate neighbourhood, yet it is frequently met with in gardens and shrubberies. In the western part of the state it abounds, often forming on the richest barrens almost impenetrable brakes. In these situations the bush attains the greatest perfection; its stems often measuring near the root more than an inch in diameter, rising 10 or 12 feet high, and bearing a profusion of large well-flavored nuts. ...blossom during February..."

"*Crataegus coccinea* (Red-haw). A small, well known and very common tree, flowering about the 20th April, and producing of scarlet haws which are large and pleasantly tasted. They ripen in September." [The name *C. coccinea* has not been consistently applied; Short clearly was referring to *C. mollis*, the most common hawthorn in the region.]

“*Crataegus flava* (Yellow-haw). A small tree, about the size of the red-haw and flowering at the same time, but less common, and differing from it in producing yellow fruit which are larger, and not so numerous: they are acid and also pleasantly tasted, and ripen in October." [Perhaps *C. intricata*, which often has yellowish fruits, and is known from a few sites in peripheral regions.]
“*Malus coronaria* (Crab-apple). The crab-apple, which was at one time more abundant than at present, is yet found occasionally in the more secluded woods of this county; and, where in clearing the land it has been allowed to remain, it forms a tree nearly equalling in magnititude the cultivated variety. The flowers of the wild crab are, indeed, more showy than those of the domestic apple tree...when in full bloom they produce a beautiful effect and diffuse a delicious odour to a great distance: The fruit is sometimes preserved with sugar.” [Flowers last of April and first of May.]
"*Prunus chicasa* (Chickasaw plum). A small tree ten or fifteen feet high, thickly studded with limbs which are garnished with small shining leaves, persistent to a late season in the fall, and giving to the tree an evergreen appearance. Frequent in shrubberies occasionally occurring wild. Flowers from 1st to 15th of May: fruit, of a yellowish red colour, ripens in August: it is pleasantly tasted when thoroughly ripe, and is frequently preserved with sugar." [Probably *P. munsoniana*, which was not distinguished from *P. angustifolia* in Short's time, and is much more frequent in the region today.]
"*Rhus glabrum* (Common Sumach). This, the only other species of Rhus found in this neighbourhood, is universally known by the name of Sumach. It is frequently introduced into shrubberies and forms a pleasing object in ornamental gardening... The berries and

leaves are used in tanning morocco. The flowers appear considerably later than those of [*Rhus radicans*]..."
"*Robinia pseudo-acacia* (Black locust). My own observations do not agree with those of M. Michaux in regard to habits of this tree; for although it does occur in profuse abundance in this and other richest lands of Kentucky; yet I have found the largest and most thrifty stocks on the Ohio river in Boon county, seventy miles north of Lexington, where the soil is greatly inferior to that in this vicinity. Its handsome foliage and deliciously scented flowers have long recommended it here, as elsewhere, as an ornamental tree for plantations, street-walks &c. and the excellence of its wood, in point of durability, hardness and strength, particularly recommends it to the attention of landed proprietors. The forests of the adjoining counties furnish a considerable amount of this timber which is used in the construction of Steam Boats: and there is an immense annual consumption of it in making the posts of fences. Within the last few years, however, this excellent tree has sustained serious injury from the depredations of an insect, which penetrates to the very centre of the wood permeating its whole substance with large hollows; in consequence of which many of the finest trees have become destroyed. Where planted in town the locust tree flowers about the 1st of May, those in the country are observed to be a week or ten days later."

Rafinesque (1822).
"The vegetation of the western states offers several singular peculiarities: among which one of the most remarkable is the paucity of species to be found in the rich soil of the limestone region. For instance no more than 600 species of plants that grow

spontaneously within 15 miles of Lexington in every direction, while a similar circle of 30 miles diameter round Philadelphia, affords about three times as many or 1800 species.

Many tribes of plants afford but a very small number of species in this region, such as the Ferns, Mosses, Lichens, Orchidaceous, Liliaceous, etc.

But to compensate for their small quantities the number of Individuals of the spondtaneous growth is [?very great, with?—illleg.] species of grasses, radiacious, and trees, grow in compact social clusters, covering many acres of ground, and with the utmost luxuriance.

This may be ascribed to that region having been covered formerly with an extensive growth of Canes (*Miega arundinacea*) forming almost a general canebrake under the forests, where but few plants could take a stand.

Another remarkable feature in our Botany, is the casual change of the prevailing plants and trees upon many peculiar spots of grounds. It has been observed by the ancient settlers that the following plants have followed each other in succession in many [?places?] as the prevailing growth.

The Canes, or *Miega arundinacea* [*Arundinacea gigantea*].

The Butterweed, or *Lupatorium urticaefolium* [*E. rugosum*].

The Ironweed, or *Vernonia prealta* [*V. gigantea*].

The Nimblewill, or *Panicum dactylon*

[*Cynodon dactylon* or, more likely, *Muhlenbergia schreberi*].

The Hardgrass, or *Panicum glaucum* [probably *Setaria pumila*]

The wild Camomile, or *Anthemis cotula*, &c.

There is therefore a kind of natural perennial change of vegetation, when a species has exhausted the soil of a peculiar nutrition which it requires, it gives way to another for a series of years, &c.

The number of plants peculiar to the limestone region is small, I have however detected several new genera and species in it, some of which will be described in my next number."

Draper (1842-51), 11CC, p. 58-68 [?]: William Clinkenbeard interviewed by Rev. John D. Shane in approximately 1842, about events in pioneer years, mostly 1779-1780 in Clark Co. and presumably much in Strode's Valley [north of Winchester]. Transcribed [loosely in places] by Lucien Beckner. 1928. Shane's interview with pioneer William Clinkenbeard. Filson Club History Quarterly. 2: 104-128.

p. 58 [p. 107 in Beckner]: in 1780, about clearing 15 acres of land near Strode's Station. "Colonel Thomas Swearingen, with Van his son and a negro fellow of his, cleared five; John Kirk two; Adam Mooney, a little Frenchman, two; my brother and I, six acres, at Strode's Station. We all fenced in under one, fifteen acres. All came out from one neighborhood in Virginia, and as we knew each other there, we worked together. Some had to stand guard while others wrought. We went 1/2 mile from the fort to get rid of [away from] the cane—Every bit as good soil and easier cleared—No cane to cut. Trees grew in the cane, the same as elsewhere. Most all cane in this high country with some shaune ridges [probably "shorn", i.e. grazed ground vegetation, but transcribed as "chance" in Beckner's copy, which makes no sense].—Monstrous place to travel thro'

once, grape-vines, thorn-bushes, cane and everything. Where the soil was very rich there was a good deal of locust. Cane-ridge [Bourbon Co.] was also the greatest place for plumb-bushes.—We always called it the plum orchard. [We] Grubbed with our axes, [in] them times; nothing to grub hardly, but paw-paws and spice-bushes, and they had very little root. Could not burn this country; always too damp. Burning out in the poor barrens, it did [?].—But never could here, or [it] would [have] been all burnt up, so many hunting fires.—Wet damp soil under the grass, kept it wet."

p. 58 [p. 105 in Beckner]: in 1780.
"One of the men off a piece shot a buffalo. Strode took the alarm, rushed through the prickly ash that grew very thick on Green Creek [in southeast Bourbon Co.] at that time, and never stopped until he got into Strode's Station [which became Winchester]...

Draper (1842-51), 11CC, p. 216-217: **Robert Gwynne**, interviewed by John D. Shane in the 1840s [?].
p. 216-217: recalling the Clover Bottom area on "Shawnee Run Road" (now Mundys Landing Road in southern Woodford Co.); Gwynne came to Kentucky in 1784, and appears to have lived in Jessamine or Woodford Co. close to this area.
"Cane down here [along Shawnee Run Road] was only in very little patches, and that not the big rank quality but a kind of maiden cane, as high as a man's head. Here the timber was white, red, and black oak. There [presumably further from the river on better soils] ash and walnut. Where ever big ash or big walnut now grows, there was cane lands. But little black walnut [in second growth] is not on what was cane ground. The Shawnee Run

Indian trace was never more than a foot wide.—was a foot deep. It passed thro' Clover bottom, where Mr. Clanahan made a pre-emption.—called so becs [because] the Buffalo clover grew up there in a little space, about twice as big as this house (a stone house w 3 rooms on the ground floor.)"

Draper (1842-51), 11CC, p. 226...[?]: **Stephen Shelton**, perhaps interviewed in the 1840s [check details]. Transcribed in N.E. Hammon. 1978. Early Louisville and the Beargrass Stations. The Filson Club History Quarterly 52:147-165.
p. 226: describing Louisville in 1779.
"At Louisville was the greatest world of cane I ever saw. Some I know [was] full 30 feet high. All the level places were covered with this cane. Someone had cleared a little place and planted corn and pumpkins when we got there, but I now do not know who it was. It was on the hill, right back of the fort. They've got it all level now. There was a pond right back of the fort. It is all filled up now... After we got back from the campaign we cleared all around the fort that open flat below town, except on a little quad of cane."

Draper (1842-51), 13CC, p. 130-134: **Jesse Graddy**, interviewed by John D. Shane in 1842 [?].
p. 130 [?]: recalling the settlement during 1788 on Glenn's Creek, draining from Versailles, now in west-central Woodford Co.
"Couldn't find 10 acres of uncleared land that was not cane. Cane was all through here very thick. And [the Woodford County] Courthouse was made in the midst of cane 10 + 12 feet high.—Very rank there... I had the job of building the Courthouse [in

Versailles]... Buckeye logs just hewed straight—inside, a platform for the judge, a place for the bar, and some benches...

Finley (1853), p. 39 [in 1853 printing]: describing how his father, Robert W. Finley, moved to Bourbon County.
“This was in the spring of 1790 on what was then called Cane Ridge... The land purchased by my father was part of an unbroken canebrake, extending twenty miles toward what was called the Little Mountain (now Mount Sterling). We had to cut out roads before we could haul the logs to build our cabins. The cane was so thick and tall that it was almost impossible for a horse or a cow to pass through it. We first cut the cane and gathered it in piles to be burned. This was performed by a cane-hoe. The next thing was to plow, which was first done by cutting the cane roots with a coulter, fastened to a stock of wood, which was called the blue boar. This turned no furrow, and hence it was necessary to follow it with the bar shear, which turned over the sod.”

Grassland and "Weeds"

(A) Old fields or similar sites
(B) Animal/human trails or similar sites
(C) Animal licks or similar sites

These are broadly defined here, but exclude canebrakes and other thickety transitions to woods. Also, the quotations below generally exclude references to openings in the Knobs, or on dolomitic foothills of the Knobs, where more typical warm-season grassland appears to have existed. There is virtually no evidence of such grassland from within the Bluegrass proper—on the Ordovician geology. A few references are made to "Indian Towns" that were located at the junction of the eastern Bluegrass and foothills of adjacent Knobs, with diverse surrounding vegetation that included "a small prairie." Within the Bluegrass proper, inside the ring of dolomitic foothills on Silurian bedrock, the evidence indicates that truly open grassland—or other treeless vegetation—covered no more than 1% of the upland landscape. These sites were mostly along trails and around licks.

In the appended lists of species [Central Bluegrass and Griffith Woods Floras], those coded 5 or 6 in the right column would be typical.

At KSNPC and NatureServe (CEGL), there are no close matches, and there is little historical evidence anyway to provide a description. However, NatureServe does outline vegetation types with some of the same species that are common in old fields of the Bluegrass region.

Some of these types are described from scoured zones on floodplains, or from shorelines of seasonal pools (especially Polygonum spp.), as follows.
CEGL: 7302 Acer negundo / Dichanthelium clandestinum - Carex spp. Forest
CEGL: 4031 Platanus occidentalis / Dichanthelium clandestinum - Festuca subverticillata Woodland
CEGL: 6458 Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia Forest
CEGL: 6218 Quercus bicolor - Fraxinus pennsylvanica - (Platanus occidentalis) / Chasmanthium latifolium - Dichanthelium clandestinum - Zizia aurea Woodland
CEGL: 6480 Verbesina alternifolia - Elymus riparius - Solidago gigantea - (Teucrium canadense) Herbaceous Vegetation
Herbaceous Vegetation
CEGL: 4124 Iva annua - (Xanthium strumarium) Temporarily Flooded Herbaceous
CEGL: 6481 Eupatorium serotinum - Polygonum (lapathifolium, punctatum, pensylvanicum)
CEGL: 2277 Polygonum pensylvanicum - Polygonum lapathifolium Herbaceous Vegetation
CEGL: 2430 Polygonum spp. - Mixed Forbs Herbaceous Vegetation

Other types are described from old fields or similar sites.
CEGL: 7879 Juglans nigra / Verbesina alternifolia Forest Vegetation
CEGL: 4345 Gleditsia triacanthos - Juglans nigra / Bromus secalinus - Poa pratensis Successional Woodland
CEGL: 3161 Solidago canadensis - Achillea millefolium Herbaceous Vegetation [Provisional]
Additional generic types not listed here are Rubus spp., Solidago spp., Andropogon spp., etc.

EARLY ACCOUNTS THAT INDICATE THIS CLASS OF VEGETATION
The following accounts mostly come from the northern Bluegrass region and adjacent parts of Ohio; a wider search is still needed.

Gist (1751): p. 123: Jan 20th, in southeast Ohio, along the Scioto River valley or nearby.
"All the way from Licking Creek [Salt Creek of Scioto River] to this place [Lower Shawnee Town near the Ohio River] is fine rich level land, with large meadows, clover bottoms and sporadic plains covered with wild rye; the wood chiefly large walnuts and hickories, here and there mixed with poplars, cherry trees and sugar trees."

p. ...: Feb 17th, in Ohio, between Lower Shawnee Town—the Indian settlement at mouth of Scioto River—and upper sections of the Little Miami River, about 30 miles northeast of modern Cincinnati.
"All the way from the Shannoah Town to this place (except the first 20 miles which is broken) is fine, rich level land, well timbered with large walnut, ash, sugar trees, cherry trees, &c, it is well watered with a great number of little streams or rivulets, and full of beautiful natural meadows covered with wild rye, blue grass and clover, and abounds with turkeys, deer, elk and most sorts of game particularly buffaloes, thirty or forty of which are frequently seen feeding in one meadow; in short it wants nothing but cultivation to make it a most delightful country."

p. 146: Mar. 3rd, down the Little Miami River, about 30-50 miles north of Cincinnati.

"I left the path, and went to the south westward down the little Miamee River or Creek, where I had fine traveling thro rich land and beautiful meadows, in which I coud [sic] sometimes see forty or fifty buffaloes feeding at once—the little Miamee River or Creek continued to run the middle of a fine meadow, about a mile wide very clear like an old field, and not a bush in it, I coud see the buffaloes in it above two miles off."

Croghan (1765), p. 133: May 31st at what is now called Big Bone Lick, now Boone County. "Early in the morning we went to the great Lick, where those bones are only found, about four miles from the river, on the south-east side. In our way we passed through a fine timbered clear wood; we came into a large road which the Buffaloes have beaten, spacious enough for two waggons to go abreast, and leading straight into the Lick."

Gordon (1766), p. 466: July 8th at what is now called Big Bone Lick.
"We encamped opposite the great Lick, and next day I went with a party of Indians and batteau-men to view this much talked of place. The beaten roads from all quarters to it easily conducted us. They resemble those to an inland village where cattle go to and fro from a large common. The pasturage near it seems to be of the finest kind, mixed with grass and herbage, and well watered. On our arrival at the lick, which is 5 miles distance south of the river, we discovered laying about many large bones, some of which [were] the exact patterns of elephants tusks, and others of different parts of a large animal. The extent of the muddy part of the lick is 3/4 of an acre. This mud being of a salt quality is greedily lick'd by buffaloe, elk, and deer, who come from distant parts, in great numbers

for this purpose. We picked up several of the bones, some out of the mud, others off the firm ground..."

J. & R. McAfee (1773).
July 9th, at Drennon's Lick in what became Henry Co.
Robert: "The Lick is about one mile in length & one hundred yards in breadth, & the roads that came to that lick no man would believe till he saw the place; & the woods round that place are trod for many miles that there is not as much food as would feed one sheep..."
James: "We travelled round the Lick, 10 or 12 miles upland, very good, mostly oak timber."

July 15th, heading further south, probably on or near what became Ky. Route 389 in southeast Henry Co., then US 421 in northwest Franklin Co. to the river-crossing at Leestown.
James [?]: "[took] a small buffaloe path about the size of the road leading out of Williamsburgh (the Capitol of Va)."
Robert: "...took a small buffalo path which was about 50 and a hundred yards wide in common about 30 miles across low flat ridges, middling good land & timber, but no water."

July 16th, in the area near what became Frankfort, in central Franklin Co., probably crossing the river near what became Leestown and finding "meadow" on bottomland

further south near the river (perhaps Trumbo Bottom on Vaughn Branch just south of Frankfort).
James: "...we crossed the Cantucky river to the east side along the path; five miles in a piece of black oak timber land; we stopped and surveyed one track of land for Robert McAfee containing 600 acres about 100 of that meadow land."
Robert: "The land on the river seemed to be very full of beech; & from that bend I made two surveys near joining to the river, with about 50 acres meadow now ready made, & there can be made 50 more with a little trouble..."

Cresswell (1774-79). 1775, June 14th: "Went to the lick in the morning but found no buffaloes there, determined to go to Grinin's Lick [Drennon's Lick]. Fell down to Grinin's Lick, shot at some buffaloes but killed none, tho' I am certain we must have wounded a great number. Five of us fired at a herd of two hundred odd not more than twenty yards. This is the largest lick I ever saw. I suppose here is 50 acres of land trodden by buffaloes, but there is not a blade of grass upon it. Incredible numbers come here to the salt springs. Here is a number of salt and brackish springs in a small compass, some of them so strong of the brine that the sun forms the salt round the edge of the spring..."

[The following reference is from outside the Bluegrass but was perhaps typical of some adjacent valleys.]
Hutchins (1778), p. 492 in Imlay (1797): "On the north-west and south-east sides of the Ohio, below the great Kanhaway river, at a little distance from it, are extensive natural meadows, or savannas. These meadows are from 20 to 50 miles in circuit. They have

many beautiful groves of trees interspersed as if by art in them, and which serve as shelter for the innumerable herds of buffalo, deer, &c. with which they abound."
[See also other notes on similar places in upper Ohio watershed.]

Fayette County Court Records (1779-80).
"75. "About 3 or 4 Acres of Clear and Open Land," about seven or eight miles northeast of the Lower Blue Licks, on Licking, on a Large Buffalo Road. (P. 142.) (Property of James Peake.)"
"117. "A Large Meadow," about six or seven miles, near a southwest course, from the Falls of Ohio. (P. 248.) (Property of Benjamin Roberts, Junior.)"
Interpretation. Presumably, this was the large bottom west of US 60 & 31W, between Shively and Valley Station; much further investigation into the botanical history here is needed. Was this meadow maintained by flooding, beaver, browsing or burning or all of the above? Was it similar to the "meadows" further up the Ohio River, noted by several people (Ohio, West Virginia and Pennsylvania)?

Imlay (1792), p. 233-235: in "Letter X", probably from Kentucky.
"Our other principal sorts of natural grass are, the buffalo [perhaps *Panicum clandestinum*], orchard [*Dactylis glomerata*], spear [perhaps *Poa pratensis*], blue [perhaps *Poa trivialis*], and crab grasses [*Digitaria* spp.]. The buffalo grass is rather coarse, grows from 9 to 18 inches high, and is generally found most plentiful in a middling soil. It has a broad leaf, and seems unworthy of cultivation. The latter kinds

generally spring up after the land has been cultivated, and form excellent pastures; and are also capable of being made into hay, particularly the spear and blue grass."

Imlay (1792), p. 265: "Scarlet strawberries; fragaria virginiana; of an excellent flavour, and so plentiful, that from the beginning of April the savannahs appear quite red with them." [*Fragaria virginiana*; elsewhere Imlay used the word savanna[h] only as a synonym for "natural meadows" in Ohio, northeast of the Bluegrass region.]

Toulmin (1793), p. 67: under the heading "Natural Circumstances."
"...A most excellent plum grows in the woods, and likewise wild cherries, hickory nuts, walnuts, puccoon nuts (a very fine fruit) [presumably pecans but perhaps referring to areas downstream on the Ohio Rv.], raspberries, pawpaws, and grapes, but not palatable ones, and strawberries on the poorer lands... The soil is too rich for strawberries, till it has been impoverished. The vine of the strawberry grows so luxiriantly that it affords a continual succession of blossoms, without allowing time to the fruit to come to maturity. Raspberries flourish finely. Amongst the medical roots, plants, etc., are the senna, the puccoon root [*Sanguinaria canadensis*], the snakeroot, ginseng, and various others..."

Smith (1795-97), p. 379-380: November 18th, from Hamilton, Ohio, down Great Miami River to the Ohio River. Recounting the previous day from Cincinnati to Hamilton, as follows. "Within 9 or 10 miles of Hamilton, the lands I think are the richest I ever saw. The growth is mostly walnut, sugartree, &c., tied together by clusters of grapevines, which in this country grow amazingly large. From this to Hamilton we saw several

pararas, as they are called. They are large tracts of fine, rich land, without trees and producing as fine grass as the best meadows."

Meade (1796a), p. 132-133: in 1796, written from Lexington, Kentucky, to Williamsburg, Virginia.
"Wherever the woods are a little open or a piece of cleared ground not in cultivation, the whole is covered with elder bushes mixed with a high weed call'd devils bit or iron weed [*Vernonia gigantea*], well known to me at Maycox [Virginia] to be eradicated only by the grubing hoe. The only wild grass in the settled parts is what is here call'd the nimble-will [*Muhlenbergia schreberi*] more resembling the wire grass [*Poa compressa* according to Gill & Curtis] than any other in Virginia. It is rather finer."

"Perhaps there never has been heretofore a time or is likely to be hereafter when this country did or will appear to greater disadvantage where the early stations were established. The wild herbage consisting of cane & pea vine is entirely eat out and the place of it supplied by weeds not agreeable to cattle. The wood range is therefore not good yet but where the wild food has been more recently consumed the whole face of the earth is as bare of every kind of herbage as the gravel walks in your garden. In these parts of cow would starve in the woods. In the very earliest settlements as about Danville, the nimble-will, a very good pasture grass, has taken place of the weedy growth which first succeded the primitive cane brake. This will be the case in four or five years every where on this side [of] the Kentucky River."

Fayette Circuit Court (1804), p. 564. “Deposition of John McIntyre—taken on 27 July 1804 at a Grassy Lick in Montgomery county before Jacob Coons, J.P., deposes:—” “That he had been acquainted with what is now called Grassy Lick creek which this deponent as well as he recollects generally bore that name since the year 1780 at which time he first became acquainted with said creek and Lick—and further saith that he has often been informed by Thomas Clarke, John Crittenden etc., that they called the lick Buck Lick and the creek Buck Lick creek as early as the year 1775. He was informed by said Clark and company of the name of said Lick and creek as early as the year 1780 and nearly about the same time was informed by some of the people living at Boonesborough, that they called the above mentioned creek Pasture Lick creek and have been entries calling for Pasture Lick which I always thought to be the creek we are now on and this deponent further sayth the lick stands in the fork of the creek and the creek known to be the waters of Licking and this deponents says the lick we are now at was most noted on the creek and much more frequented by Buffalo than any of the other licks on said creek. We then proceeded from said Lick down to the place--called for in complaintants entry which is a low piece of ground remarkable for English grass. This ground was more noted for Blue Grass than any other within half of a mile below the licks.”

Rafinesque (1822). See account of disturbance gradient in previous section.

Short (1826-29). Notes of herbs of open land, but only those flowering in spring. “*Cardamine virginica*? This little plant excites no other interest than that arising from the early period at which it blooms; being here, as the *Draba verna* in the Eastern states, the

earliest harbinger of spring... In cultivated fields abundant; flowering from the middle of February. ...towards the last of February..." [*Planodes virginica*].
"*Erigeron philadelphicum*. This is one of the greatest pests of the farmer, frequently so completely overrunning meadows as to destroy the hay. Some repute it medicinal, attributing to it tonic and sudorific properties. Flowers later than the last [probably true *philadelphicus*], and continues in bloom much longer." [Short was probably referring here to *E. annuus*.]
"*Fragaria virginiana* (Wild strawberry). ...not a common plant in this vicinity: it does, however, occasionally occur in old fields and road sides... In the western part of the state it consitutes a principal feature in the vegetation of the barrens; where, in situations fully exposed to the influence of the sun, its fruit becomes matured to perfection, is darker-coloured and sweeter than the strawberry of the gardens. ...flowering towards the last of April."
"*Veronica peregrina* (Neckweed). The plant has had some reputation in scrofula, hence the name of Neckweed. Abundant in gardens and cultivated fields. Flowers middle of March and after."

Draper (1842-56), p. 205: about John Findlay's coming to Eskippakithiki with Shawanoes in the fall of 1752. "To this invitation he yielded a ready assent, and passing from Big Bone Creek through the rich lands of Kentucky along an Indian trail traced on Evan's old map, they arrived at an Indian settlement situated a mile west of the oil spring on Lulbegrud Creek, a northern tributary of Red River of Kentucky. This town is evidently the one laid down on the Evans' map between Licking and Kentucky rivers,

and called by the uncouth name of Es-kip-pa-ki-thi-ki. It was directly on the route of the great *Warrior's Road* leading from the Ohio southward through Cumberland Gap and was doubtless the town alluded to by Franklin when he asserted that "in the year 1752, the Six Nations, Shawaness and Delawares had a large town on Kentucke River. The location of the settlement on a small prairie was extremely beautiful, with a more level region adjacent and a better quality of land that was generally found in the country."

Draper (1842-51), 11CC, p. 86-90: William Risk interviewed by John D. Shane in about 1840. Transcribed partially in 1932. The Filson Club History Quarterly 6: ...377...
p. ... [check original]: about the settlement of Indian Old Fields, formerly Eskippakithiki, in southeast Clark Co. near the mouth of Lulbegrud Creek.
"I heard one of the partners, Gen. [Marquis] Calmes, say the Old Fields were all covered with bluegrass when he first saw it [in 1775]. And when I first saw it, it was very high with grass, as high, some, as a horse's back, and with a head on it. I believe this was a white oak valley, at 1st, and [then] cultivated. There were sprouts of white hiccory [perhaps *Carya cordiformis*], and cherry tree, and black locust, and black walnut, all through the Old Field. There was a place, where there were stumps, some off as high as a chair back, and around these stumps were trees, some of them would make five rail cuts. I could not tell whether the trees were sprouts (of the stumps) or not. If they were, why had not the stumps rotted out? I did not know whether the trees were of the same kind [as] the stump. It was very singular how they had come to grow so close around the stumps. Suppose some of the trees had been cut down to put up a white oak pole cabin that was there close by on a point. Saw there about a year after I came."

Draper (1842-51), 11CC, p. 58-68 [?]: William Clinkenbeard interviewed by Rev. John D. Shane in approximately 1842, about events in pioneer years, mostly 1779-1780 in Clark Co. and presumably much in Strode's Valley [north of Winchester]. Transcribed [loosely in places] by Lucien Beckner. 1928. Shane's interview with pioneer William Clinkenbeard. Filson Club History Quarterly. 2: 104-128.
p. 60 [p. 112 in Beckner]: around Strode's Station.
"When we first came out, there was a great many paroqueets in the country; like a parrot, only not so large; lived on cuckleburrs; flew in large gangs. Good many about the Station the first winter and spring. Saw a good many at the French Lick, between this and Louisville, on my way home in the late war [of 1812].—Last I've seen."

Draper (1842-51), 11CC, p. 121-123 [?]: **Col. John Graves**, interviewed by John D. Shane in the 1840s.
p. 123: in 1787 or afterwards, at "Great Crossing" west of where Georgetown now stands. "Very shortly after this, at the great crossing, some of Robin Johnson's negroes were out at a black-berry patch, which was only a small distance from the fort. (Blackberries was a very rare thing, owing to the cane's being so thick. On my place, here, was an open space thick set with raspberry.)"

Drake (1845-48), p. 53: describing his childhood in the 1790s.
"In the latter part of summer and in early autumn, after the corn was "laid by", various rank weeds, including Spanish needles [probably *Bidens frondosa* or *bipinnata*] and wild-

cucumber vines [*Sicyos angulata*], covered with an armature of bristles, would spring up among it... Always we returned from the field at night with Spanish needles (Bidens of the botanists as I learned 10 years afterwards)."

Poage (1853).
"One other circumstance in connection with George Poage's first summer in Kentucky, in 1774. He with others were out hunting, and in a long ramble of 75 or 80 miles they chanced to come upon the Blue Licks, which no white man had ever before visited unless it was Boone. These famous licks, it will be recollected, are near Licking River, some 25 or 30 miles S. SW. from Maysville. They came upon a ridge which overlooks the basin in which are the Licks, and there, perhaps, was one of the greatest sites ever seen; ten thousand or more, buffaloes were there, it maybe, ten thousand other animals of every species known in the western wilds, bears, wolves, panthers, foxes, wild cats, deer, elks, &c. - 20,000 wild animals, all moving about in one vast throng and rubbing against each other, the stronger frequently praying upon the weaker. The ground about for miles was a perfect barren waste, worn out and torn up by the stamping and pawing of these wild nyriads. What a site!"

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Figure Captions (for three following pages). Hypothetical major gradients in composition and eco-morphology within Bluegrass Woodlands before settlement.

These diagrams are designed to allow application of Vera's (2000) concepts; see text for further explanation. The outline of vegetation types, and the location of each species' modal position, are first approximations, based on multivariate analysis of modern compositional data within the region, and of eco-morphological characters.

I (upper). Overview of structural types and dynamic relationships between them; note that these conceptual types would have intergraded extensively in composition, structure and processes; in reality, there may not have been any special consistency or stability within each of them.

II (middle). Typical plants suggested for each structural type; note that most species probably occurred widely in adjacent types. This is only a provisional sketch, to be explored further with ordination methods.

III (lower). Primary ecological processes that may have been involved in transitions between types; note that these are largely hypothetical within the context of Bluegrass woodlands, but several are consistent with literature elsewhere. Only the primary suggested directional trends are detailed here; the potential for reversed trends is discussed in the text.

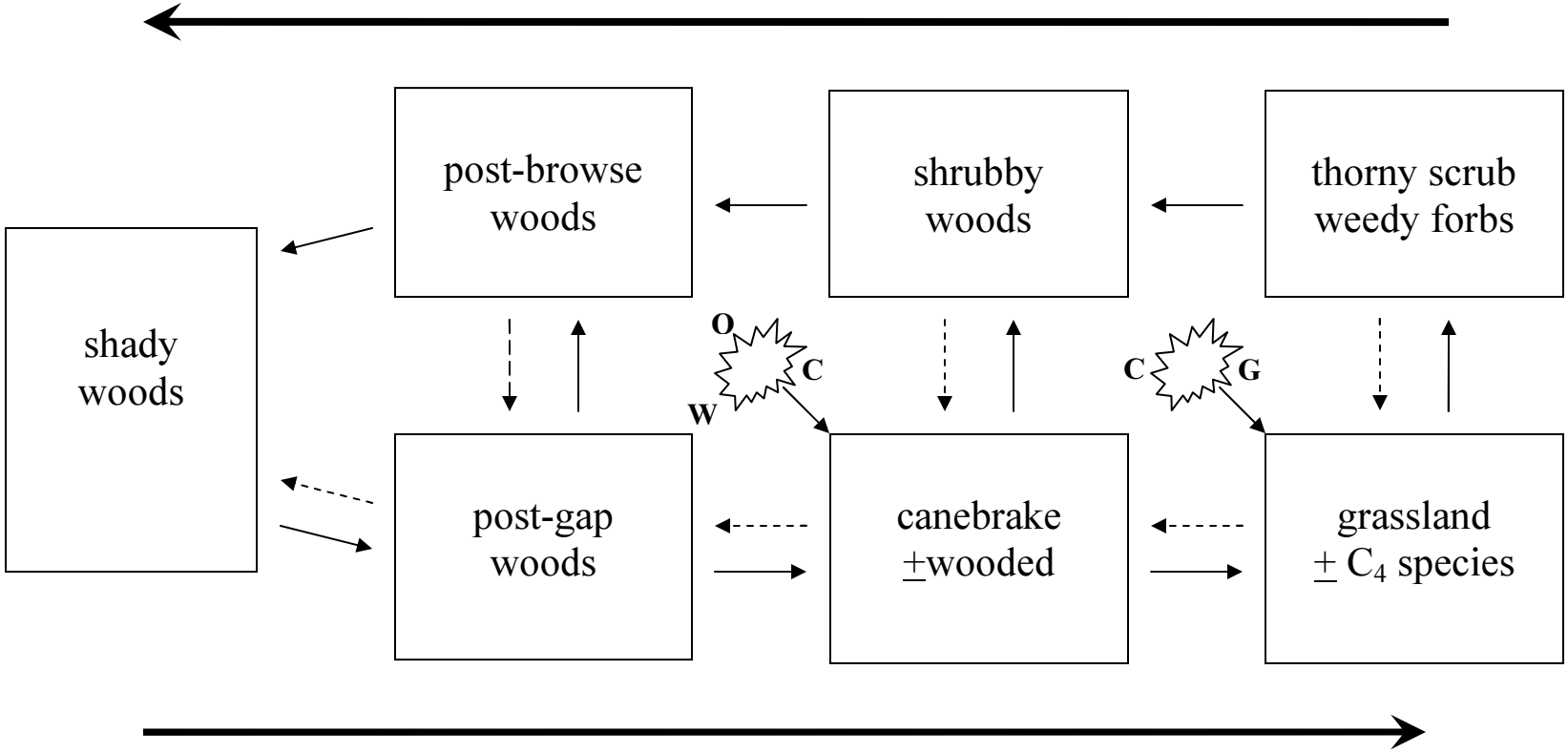
These processes are identified by each transition (A1-3, B1-3, C1-3) and subcategories within each transition (a,b,c,d,e). Transitions B1, B2 and B3, with no room in the diagram, are detailed in following notes.

B1a Decrease in browsing-sensitive plants, especially grasses, elms, ashes.
B1b Increase in browsing-resistant plants, especially trees with large/nutty seeds.
B1c Decrease in prolonged winter/spring browsing; continued along trails and for fruit/nuts.

B2a Decrease in cane, hog-peanut, and other browsed plants.
B2b Increase in browsing-resistant plants, especially thorny/suckering locusts, weedy/toxic forbs & shrubs.
B2c Regeneration of more resistant long-lived trees with large seeds.
B2d Decrease in prolonged browsing; continued along trails, and for fruit/nuts.

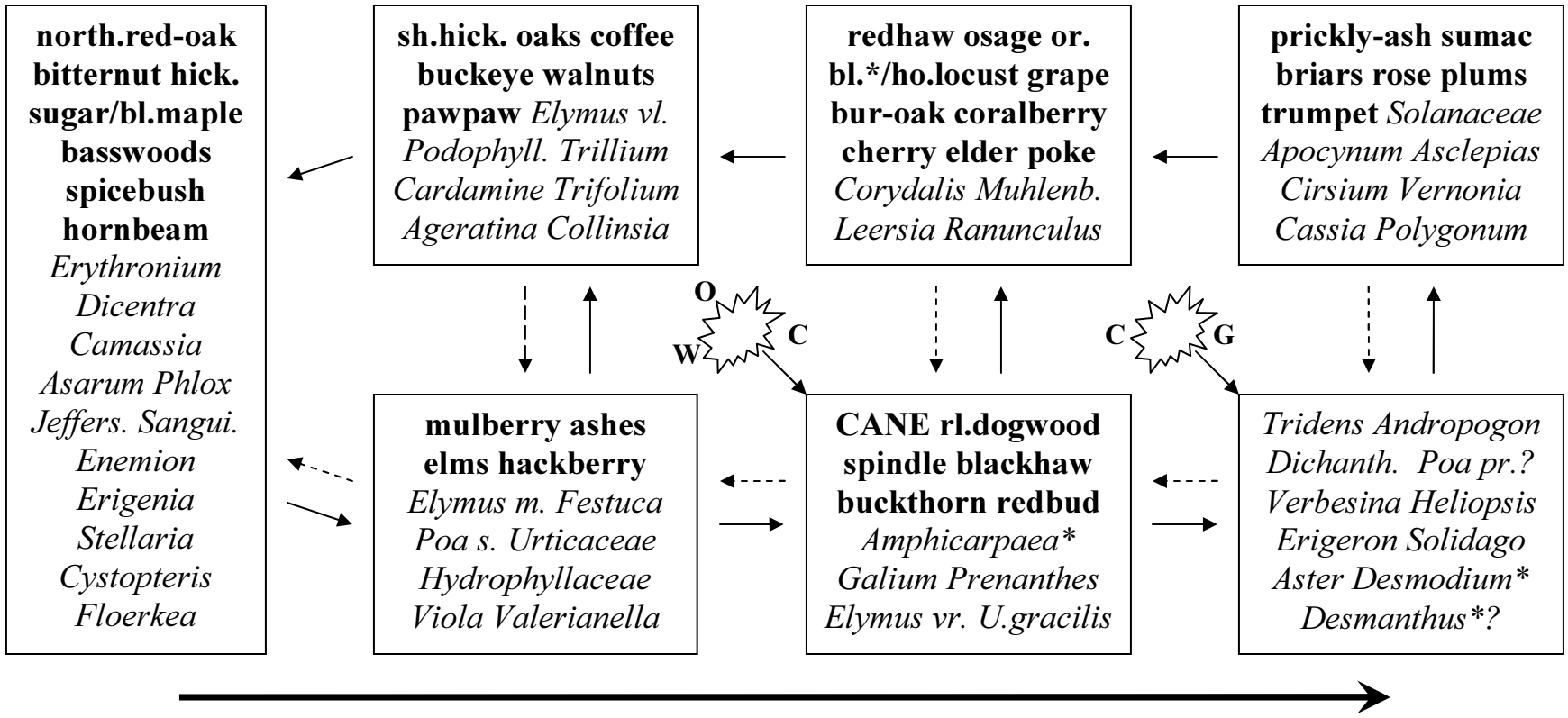
B3a Decrease in grasses and palatable forbs
B3b Increase in browsing-resistant plants, especially toxic forbs & thorny scrub.
B3c Decrease in browsing, except along trails.
B3d Increase in birds feeding and roosting in scrub; local input of minerals in droppings.

Woodland development after intense browsing/grazing, with resistant species

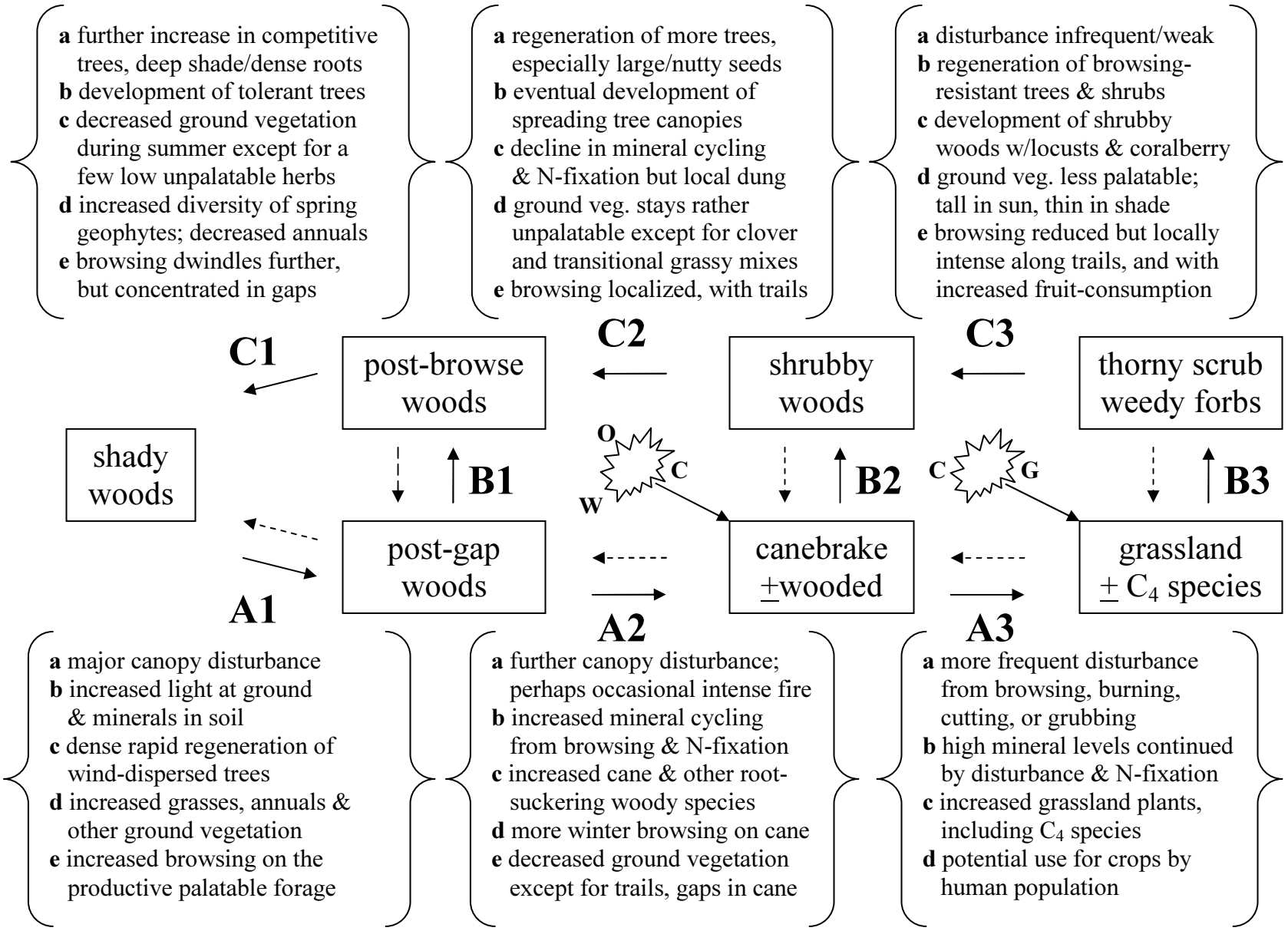


Tree canopy decline due to wind/ice, dry/wet episodes, pests/pathogens, fire, cutting; plus increases in forage for ungulates/other herbivores; formerly elephants/mammoths. Potential fuel types are: W = woody debris; O = oak litter; C = old cane; G = old grass.

Woodland development after intense browsing/grazing, with resistant species



Tree canopy decline due to wind/ice, dry/wet episodes, pests/pathogens, fire, cutting; plus increases in forage for ungulates/other herbivores; formerly elephants/mammoths. Potential fuel types are: W = woody debris; O = oak litter; C = old cane; G = old grass. Asterisks indicate nitrogen-fixing legumes.


a further increase in competitive trees, deep shade/dense roots
b development of tolerant trees
c decreased ground vegetation during summer except for a few low unpalatable herbs
d increased diversity of spring geophytes; decreased annuals
e browsing dwindles further, but concentrated in gaps
a regeneration of more trees, especially large/nutty seeds
b eventual development of spreading tree canopies
c decline in mineral cycling & N-fixation but local dung
d ground veg. stays rather unpalatable except for clover and transitional grassy mixes
e browsing localized, with trails
a disturbance infrequent/weak
b regeneration of browsing-resistant trees & shrubs
c development of shrubby woods w/locusts & coralberry
d ground veg. less palatable; tall in sun, thin in shade
e browsing reduced but locally intense along trails, and with increased fruit-consumption
C1
C2
C3
post-browse woods
shrubby woods
thorny scrub weedy forbs
shady woods
B1
B2
B3
O
C
W
C
G
post-gap woods
canebrake ±wooded
grassland ± C4 species
A1
A2
A3
a major canopy disturbance
b increased light at ground & minerals in soil
c dense rapid regeneration of wind-dispersed trees
d increased grasses, annuals & other ground vegetation
e increased browsing on the productive palatable forage
a further canopy disturbance; perhaps occasional intense fire
b increased mineral cycling from browsing & N-fixation
c increased cane & other root-suckering woody species
d more winter browsing on cane
e decreased ground vegetation except for trails, gaps in cane
a more frequent disturbance from browsing, burning, cutting, or grubbing
b high mineral levels continued by disturbance & N-fixation
c increased grassland plants, including C4 species
d potential use for crops by human population