

**Field Key to Ecological Systems of Map Zones 47, 48, and 53
Appalachia Bluegrass Hills, Cumberland Highlands, Appalachia, and
Adjacent Areas, United States**

**NatureServe
Terrestrial Ecology Department
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Slopes at Mammoth Cave National Park, Kentucky, October 2007. photo by Milo Pyne



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Introduction

The following keys to NatureServe ecological systems cover the areas found in NLCD map zones 47, 48, and 53 (Appalachia Bluegrass Hills, Cumberland Highlands, and Appalachia respectively). This diverse area includes parts of EPA Level III Ecoregions 55 (minor), 65, 67, 68, 69, 70, 71, 72, 73 (minor) and 74. This is primarily parts of the Ridge and Valley, Cumberlandian/Alleghenian (EPA 68, 69, 70), and Interior Low Plateau and Interior River Lowlands regions (EPA 71, 72) regions generally, but with attachments of upper Coastal Plain (EPA 65, 74), partially glaciated plateaus (EPA 55), and Mississippi Alluvial Plain (EPA 73). These units as well as the EPA Level IV Ecoregions are referred to in the key. The systems included in these keys are intended to represent the legend that LANDFIRE will be striving to map for existing vegetation (Figure 1). Some types are in the keys that characteristically occur at small spatial scales (generally <2 ha in size) and hence may not be mappable by the LANDFIRE project. However, we have chosen to be inclusive in the keys, so that the user will have information on these system types for comparison purposes. In some cases they may be important for modeling fire condition class and, given their relative distinctiveness on the landscape, they may indeed be mappable.

Plant names are almost always in Latin and follow the nomenclature of Kartesz (1999). In limited cases, we have included synonyms and/or common names for some taxa.

The keys are “dichotomous”, which means the user follows the order of the ‘couplets’ and makes a choice between the 2 options represented in the couplet. The ordering of the couplets in each key does matter, and the user should choose the option in each couplet that best fits the data or field situation. The users should carefully read both couplets before making the best choice of the two available leads. A choice leads the user to the next couplet to be utilized in the keying process, via a number at the far right, or else leads to a final result (an ecological system type or an alliance).

If the choice the user makes leads to a “result”, then either an Ecological System or a Vegetation Alliance is named. Alliances are recognizable because “alliance” is in the name, and they all start with one or more Latin names (e.g. *Pinus taeda* Forest Alliance).

Systems do not include Latin species names in them, and always start with a Biogeographic region (e.g. Central Interior Highlands, Eastern Highland Rim, South-Central Interior, Central Appalachian), and may include plant species or genus common names (e.g. Pine, Oak). Numbers in parentheses placed after the System Name are the EVT (Existing Vegetation Type) codes assigned by Landfire to the Systems.

Some keys or portions of keys may follow a different logic from one another, depending on what ecological or biogeographic variable is best suited to the types included in the key. A group of higher-order couplets or choices guides the user to one of several individual keys for a more specific group of systems. Some systems include a variety of manifestations on the landscape, and these may appear more than once in the key or keys. These examples will be noted by reference to the other examples.

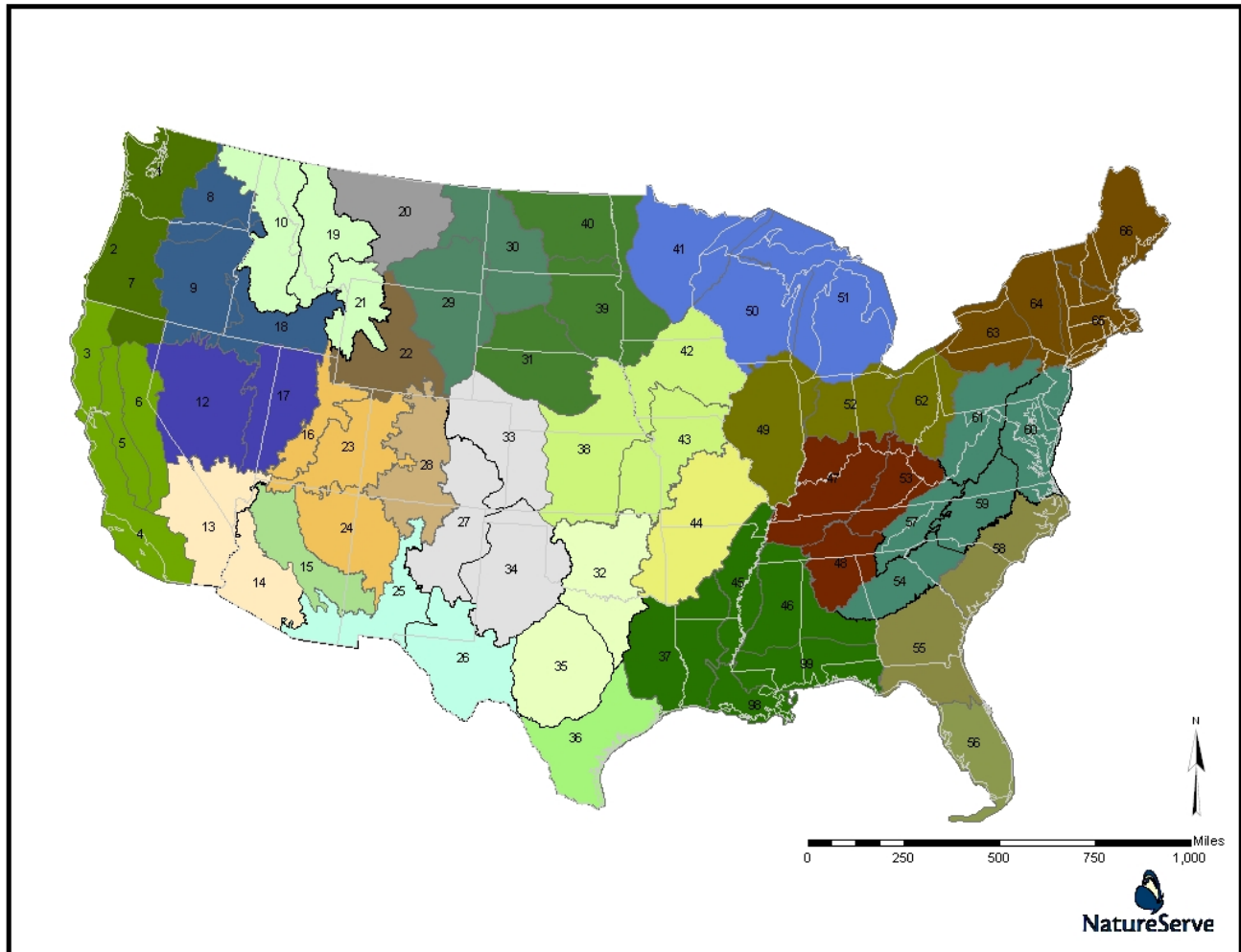


Figure 1. LANDFIRE map zone clusters with keys to ecological systems and selected alliances.

The keys to ecological systems use a variety of different variables, which are applied in various sequences, depending on the relative significance of the variable. Variables that are less ambiguous in their application will ideally be used earlier or “higher” in the key. The principal (and more-or-less “universal”) variables that help provide the upper structure for the key include broad physiognomy (e.g. forested vs. non-forested), broad biogeography (where a map zone is heterogeneous in this respect), and general hydrology (e.g. upland and wetland). Common terms instead of overly jargonistic or technical language is preferred in the key where possible, but some terms may require definition. In our sense of meaning, “wetland” vegetation is that which “whose composition is affected by flooding or saturated soil conditions.” The term is not used in the sense of a “jurisdictional wetland” which is a more limited as well as a legal meaning of this term.

Systems might occur in the key in several places, if their range of variability would require this. In more detailed (or “lower”) places in the key, dominance within vegetation strata may play a role. Tree cover is generally considered first, then that of shrubs, then the herbaceous component. Codominant species within a given strata are important as well, in some cases a system type or alliances will have 2 or more codominant species, which may or may not be present in all stands.

Some terminology is commonly employed throughout the keys that distinguish general spatial characteristics of the vegetation or environmental setting. For example 'matrix' types of vegetation are dominant across the majority of a given landscape, while 'large patch' types tend to occur as distinctive patches, which represent specific environments within the larger 'matrix.' In the southeastern coastal plains, elevation is not of much use in distinguishing systems, but soil composition or latitude may be of some importance. These variables and others are used to provide the framework for the key.

Ideally, the user of the key will be able to locate themselves in relation to the EPA Level IV Ecoregions, as in some cases this may be the determining factor between two otherwise similar systems. These ecoregional limits are in a sense a general guide, and different systems of classifying ecoregions vary in terms of precisely where these boundaries occur. In many cases, the ecoregional line correlates well with an observable variable in vegetation, topography, soil type, etc., but this may not always be the case and ecotonal areas may occur in some cases near a boundary. If difficulties arise, the first step to be taken would be to read the detailed description of the Ecological System(s) in question. These are available from <http://www.natureserve.org/explorer/>

The Southern US Office of NatureServe has also developed range map shapefiles for most Ecological Systems that are being employed as Landfire target map units. These were developed with funding and support from, and in collaboration with, the USGS BDR Southeastern GAP Analysis Project. Please contact Milo Pyne (milo_pyne@natureserve.org) 919.484.7857 ext. 136 for more information.

Users of this key should also contact the Southern US Office of NatureServe in Durham, NC (at the phone number and email given above) if any issues arise with the use and interpretation of the key presented here. It is the sincere hope of NatureServe that this key will be of use to field workers in the location and interpretation of examples of Ecological Systems. Any factual errors or other information contained herein that is incorrect or misleading is entirely our responsibility, and we would hope to correct or improve it in the future.

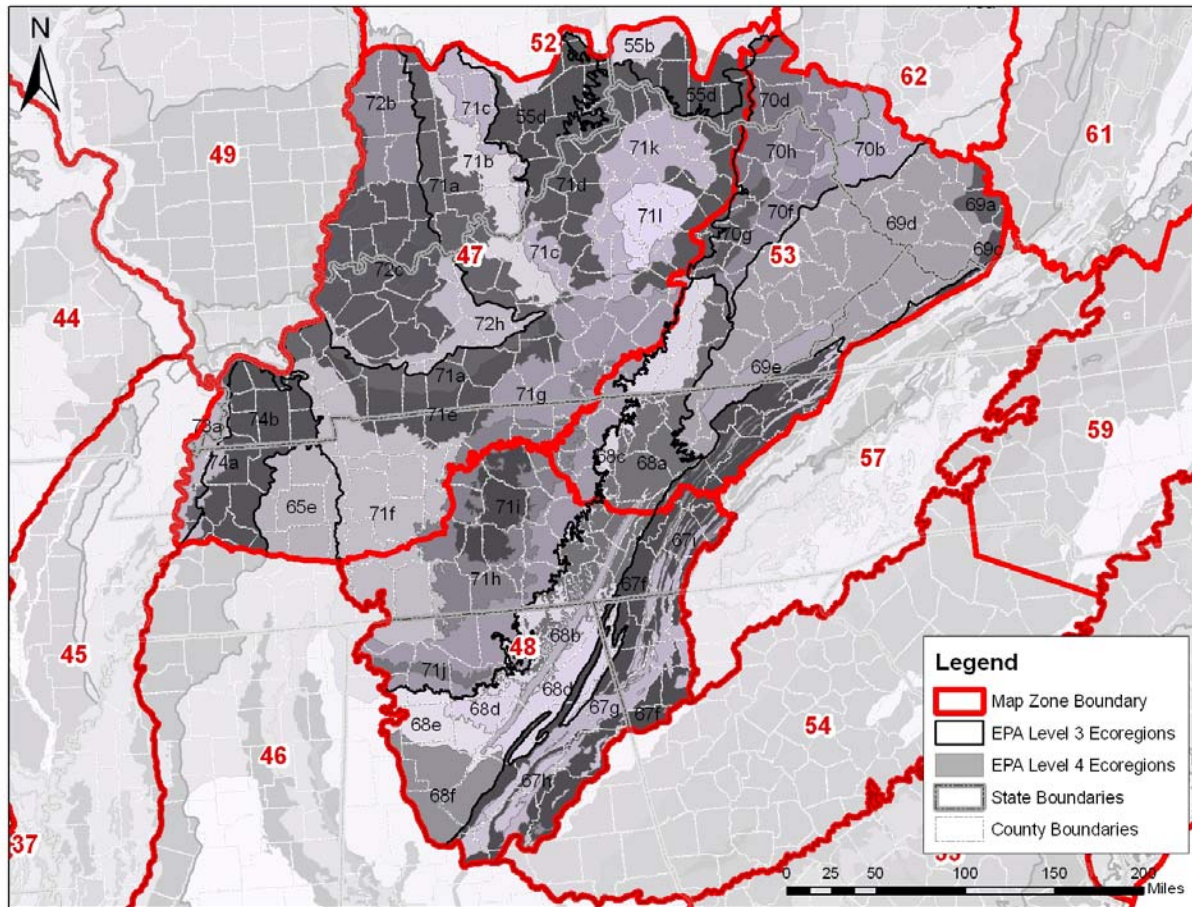


Figure 2– EPA Level III and Level IV Ecoregions for Map Zones 47, 48, 53

In the section of the document immediately following, we have provided a table showing the LANDFIRE legend units that represent non-natural vegetation and a short description for each of them. They are not formally incorporated into the keys, since they are typically recognizable without the use of a key, or else their floristic composition is so variable as to be not useful in a field key. Our primary purpose was to provide keys for the natural and near-natural vegetation of these zones.

Land Use, Unvegetated, Semi-natural and Altered Vegetation

| LAND USE OR UNVEGETATED SURFACES | |
|---|--|
| Open Water | Open water |
| Developed | Generally developed lands. |
| Developed, Open Space | Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20% of total cover. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses. |
| Developed, Low Intensity | Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-50% of total cover. These areas most commonly include single-family housing units. |
| Developed, Medium Intensity | Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-80% of the total cover. These areas most commonly include single-family housing units |
| Developed, High Intensity | Includes highly developed areas where people reside in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100% of the total cover. |
| Agriculture | Generally developed for agricultural uses. |
| Pasture/Hay | These agriculture lands typically have perennial herbaceous cover (e.g. regularly-shaped plantings) used for livestock grazing or the production of hay. There are obvious signs of management such as irrigation and haying that distinguish it from natural grasslands. Identified CRP lands are included in this land cover type. |
| Cultivated Crops and Irrigated Agriculture | These areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards. |
| SEMI-NATURAL / ALTERED VEGETATION | |
| Ruderal Vegetation | Vegetation resulting from succession following significant anthropogenic disturbance of an area. It is generally characterized by unnatural combinations of species (primarily native species, though they often contain slight or substantial numbers and amounts of species alien to the region as well) |
| Ruderal Upland - Old Field | |
| Ruderal Upland – Abandoned Tree Plantation | |
| Ruderal Wetland | |
| Introduced Vegetation | Vegetation dominated by introduced species. These are spontaneous, self-perpetuating, and not (immediately) the result of planting, cultivation, or human maintenance. Land occupied by introduced vegetation is generally permanently altered (converted) unless restoration efforts are undertaken. |
| Introduced Upland Vegetation – Treed | Land cover is significantly altered/disturbed by introduced tree species. |
| Introduced Upland Vegetation - Shrub | Land cover is significantly altered/disturbed by introduced woody and/or herbaceous vegetation (including . |
| Introduced Upland Vegetation – Annual and Biennial Forbland | Land cover is significantly altered/disturbed by introduced annual and biennial forbs. Natural vegetation types are no longer recognizable. |
| Introduced Upland Vegetation - Perennial Grassland and Forbland | Land cover is significantly altered/disturbed by introduced, non-native perennial grasses and forbs. Natural vegetation types are no longer recognizable. |
| Introduced Riparian Vegetation | Land cover is altered/disturbed and dominated by introduced woody vegetation (woodlands and shrublands). Typical riparian trees and shrubs include <i>Elaeagnus angustifolia</i> , <i>Triadica sebifera</i> , etc. |
| Introduced Wetland Vegetation | Land cover is altered/disturbed and dominated by introduced wetland vegetation. Species may include <i>Lythrum salicaria</i> , <i>Phalaris arundinacea</i> , <i>Phragmites australis</i> , etc. |
| Modified/Managed Vegetation | Vegetation resulting from management or modification of natural/near natural; vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue. Modified vegetation may be easily restorable by either management, restoration of ecological processes, and/or succession. |

| | |
|-------------------------------------|---|
| Modified/Managed Upland Vegetation | Land cover is apparently managed/modified and dominated by trees and/or shrubs. Vegetation is a mixture of herbaceous, shrub, and tree species. |
| Recently Burned Forest and Woodland | Land cover is apparently modified by recent fires which have burned forest and woodland vegetation. Vegetation is a mixture of herbaceous, shrub, and tree species. |
| Recently Burned Shrubland | Land cover is apparently modified by recent fires which have shrubland vegetation. Vegetation is a mixture of herbaceous and shrub species. |
| Recently Burned Grassland | Land cover is apparently modified by recent fires which have burned grassland vegetation. Vegetation is a mixture of herbaceous and shrub species. |
| Managed Tree Plantation | Land cover is apparently modified and appears as a managed tree plantation. |
| Recently Logged Timberland | Land cover is apparently modified and appears as logged timberland. |
| Modified/Managed Wetland Vegetation | These areas include created and obviously managed wetlands of varying size resulting from water diversion. Artificial Wetlands will be mapped where obvious built structures may be distinguished from imagery. |

Map Zone 47, 48, and 53 Ecological Systems

This key is intended to aid in the identification of Ecological Systems and selected semi-natural or altered vegetation types that are found in the Appalachia Bluegrass Hills, Cumberland Highlands, and Appalachian Regions (NLCD Map Zone 47, 48, and 53), which covers an area ranging from north-central and north-eastern Alabama and northwestern Georgia, going north in an expanding wedge to southern Indiana, extreme southern Ohio, southwestern West Virginia, the far western part of the “panhandle” of Virginia, and including all of Kentucky and most of Tennessee.

KEY TO KEYS

- 1a. Vegetation of herbaceous composition, at least partly, or of variable physiognomy depending on management and disturbance regime; under disturbance or management, if trees are present they are sparse and widely scattered (this includes various glade and barrens systems as well as herbaceous and shrub wetlands) **KEY A**
- 1b. Forest or woodland, trees dominant in the uppermost vegetation layer **2**
- 2a. Upland forest or woodland, trees dominant in the uppermost vegetation layer..... **KEY B**
- 2b. Wetland forest or woodland, trees dominant in the uppermost vegetation layer..... **KEY C**

KEY A: Herbaceous Ecological Systems of Map Zone 47, 48, and 53

- 1a. Vegetation with non-native perennial herbaceous plants or grasses having >20% relative cover **2**
- 1b. Vegetation dominated by native plants, non-native perennial herbaceous plants or grasses having <20% relative cover **3**
- 2a. Vegetation with significant cover of non-native perennial herbaceous plants, riparian areas with moderate to high cover of invasive exotic plants, (i.e. >20% relative cover of *Ligustrum sinense*, *Alliaria petiolata*, *Lolium arundinaceum*, *Lolium pretense*, *Lygodium japonicum*, *Paspalum urvillei*, or *Cyperus enterianus*) **Introduced Riparian Vegetation (2180)**
- 2b. Vegetation with non-native perennial herbaceous plants or grasses having >20% relative cover and >20% relative cover with any combination of these species: *Paspalum notatum*, *Alliaria petiolata*, *Lolium arundinaceum*, *Lolium pretense*, *Cynodon dactylon*, *Sorghum halepense*, *Sporobolus indicus*, *Lespedeza cuneata*, *Eremochloa ophiuroides*, *Solanum viarum* **Introduced Upland Vegetation - Perennial Grassland and Forbland (2182)**
- 3a. Deep to shallowly flooded areas of freshwater marsh restricted to the northeastern part of the area in Indiana and Ohio (EPA 55b, 55d, 55f, 72b). The vegetation is dominated by emergent and submergent species that may be surrounded by a zone of wet meadow. Stands may be open ponds with floating or rooted aquatics, deep marsh with bulrush or cattails, or wet meadow. Dominant species may include *Carex spp.*, *Calamagrostis canadensis*, *Cephalanthus occidentalis*, *Cornus spp.*, *Salix spp.*, *Schoenoplectus spp.*, *Spartina pectinata*, *Typha spp.* **Central Interior and Appalachian Herbaceous Wetland Systems (2493)**
- 3b. Primarily upland, generally herbaceous, vegetation of glades, barrens, or prairies; possibly of variable physiognomy (with variable coverage of trees) depending on management and disturbance regime..... **4**
- 4a. Glades, barrens, or prairies restricted to the Upper East Gulf Coastal Plain (EPA 74b) **East Gulf Coastal Plain Jackson Plain Prairie and Barrens (2427)**
- 4b. Glades, barrens, or prairies in areas other than the Upper East Gulf Coastal Plain (EPA 74b), including the Ridge and Valley (EPA 67), Southwestern Appalachians (including Cumberland Plateau; EPA 68), and Interior Plateau (EPA 71) **5**
- 5a. Glades, barrens, or prairies of the Interior Plateau (EPA 71) **6**
- 5b. Glades, barrens, or prairies of the Ridge and Valley (EPA 67) or the Southwestern Appalachians (including Cumberland Plateau; EPA 68) **7**

- 6a. Rocky glades (and woodlands) of the Interior Plateau (EPA 71), found on shallow soil over or adjacent to rock outcrops **8**
- 6b. Glades, barrens, or prairies in the Interior Plateau (EPA 71), found on deeper soils (possibly with gravel deposits, hardpans/fragipans, or other edaphic limitations in the soil profile), not on or adjacent to rock outcrops **9**
- 7b. Glades, barrens, or prairies on acidic substrates (e.g. sandstone or shale) in the Southwestern Appalachians (including Cumberland Plateau; EPA 68)..... **Cumberland Sandstone Glade and Barrens (2398)**
- 7a. Glades, barrens, or prairies on base-rich substrates (e.g. limestone, dolomite and related geologies) in the Ridge and Valley (EPA 67) or the Southwestern Appalachians (including Cumberland Plateau; EPA 68)..... **13**
- 8a Rocky glades (and woodlands) of the Interior Plateau (EPA 71), found on shallow soil over or adjacent to rock outcrops composed of acidic material (e.g. sandstones, shales) with well- to excessively well-drained, shallow soils interspersed with rock and boulders. Grasses such as *Schizachyrium scoparium* and *Sorghastrum nutans* dominate this system with stunted oak species (*Quercus stellata*, *Quercus marilandica*) and shrub species such as *Vaccinium* spp. occurring on variable depth soils. *Juniperus virginiana* can be present and often increases in the absence of fire.....
..... **Central Interior Highlands Dry Acidic Glade and Barrens (2363)**
- 8a Rocky glades (and woodlands) of the Interior Plateau (EPA 71), found on shallow soil over or adjacent to rock outcrops composed of basic to circumneutral material (e.g. limestones, dolomites) **10**
- 9a. Barrens (dry to seasonally wet) on the Eastern Highland Rim (EPA 71g) of Tennessee or the Western Highland Rim (EPA 71f) of Tennessee and adjacent Kentucky **11**
- 9b. Prairie/barrens or savanna/woodlands of specific areas in either the Pennyroyal Karst Plain of Kentucky and Tennessee (e.g. Fort Campbell Military Base) or the Bluegrass Basin (vicinity of Frankfort/Lexington) of Kentucky **12**
- 10a. Basic/circumneutral rocky glades (and woodlands) restricted to limestones in the Nashville Basin of Tennessee (EPA 71i and rarely 71h, with one limited example known from Kentucky) typically containing grasses *Sporobolus* spp., *Schizachyrium scoparium*, *Sorghastrum nutans*, *Andropogon gerardii*, *Bouteloua curtipendula*, *Panicum flexile* and forbs *Silphium trifoliatum*, *Silphium terebinthinaceum*, *Helianthus mollis*, *Grindelia lanceolata*, *Liatris* spp., *Hedyotis nigricans*, *Croton capitatus*, *Heliotropium tenellum*, *Isanthus brachiatus*, *Manfreda virginica*, *Ruellia humilis*, *Talinum calcaricum*, *Sedum pulchellum*, *Echinacea tennesseensis*, *Astragalus bibullatus* with *Juniperus virginiana* at varying cover. **Nashville Basin Limestone Glade and Woodland (2397)**
- 10b. Other basic/circumneutral rocky glades (and woodlands), found in areas other than the Nashville Basin of Tennessee (EPA 71i); includes glades and barrens in the Moulton Valley of Alabama (southern part of EPA 71g) and the Western Valley of the Tennessee River (a very limited part of EPA 71f in Decatur County Tennessee), as well as glades on Silurian dolomite in Bullitt County, Kentucky (EPA 71d); this is additionally a “catch-all” for other rocky glades and barrens in the map zones which are not as specifically delineated or as well known. *Schizachyrium scoparium* dominates this system and is commonly associated with *Andropogon gerardii*, *Bouteloua curtipendula*, and calcium-loving plant species. Stunted woodlands primarily dominated by *Quercus muehlenbergii* interspersed with *Juniperus virginiana* occur on variable-depth-to-bedrock soils
..... **Central Interior Highlands Calcareous Glade and Barrens (2401)**
- 11a. Barrens (dry to seasonally wet) on the Eastern Highland Rim of Tennessee (EPA 71g; primarily Coffee and Franklin counties) with *Quercus alba*, *Quercus stellata*, *Quercus falcata*, and native grasses and forbs including *Andropogon gerardii*, *Schizachyrium scoparium*, *Andropogon glomeratus*, *Calamagrostis coarctata*, *Sorghastrum nutans*, *Panicum virgatum*, *Eurybia* spp., *Symphotrichum* spp., *Helianthus* spp., *Solidago* spp., *Aristida* spp., *Chasmanthium laxum*, *Dichanthelium* spp., *Gymnopogon* spp. **Eastern Highland Rim Prairie and Barrens (2417)**
- 11b. Barrens (dry not wet) on the Western Highland Rim (EPA 71f) of Tennessee and adjacent Kentucky (Tennessee counties of Dickson, Hickman, Lewis, and Lawrence , as well as possibly on Tertiary age material in eastern Calloway and Marshall and southern Livingston counties of Kentucky with *Quercus stellata*, *Quercus marilandica*, and native grasses and forbs including *Schizachyrium scoparium*, *Andropogon glomeratus*, *Sorghastrum nutans*, *Symphotrichum* spp., *Helianthus* spp., *Solidago* spp. **Western Highland Rim Prairie and Barrens (2416)**
- 12a. Prairies and barrens restricted to the Pennyroyal Karst Plain of Kentucky and Tennessee (e.g. Fort Campbell Military Base), dominated by *Quercus* spp. (e.g. *Quercus falcata*, *Quercus imbricaria*, *Quercus alba*, *Quercus marilandica*) with *Schizachyrium scoparium*, with some *Sorghastrum nutans*
..... **Pennyroyal Karst Plain Prairie and Barrens (2418)**

12b. Savannas and woodlands restricted to the Bluegrass Basin (vicinity of Frankfort/Lexington) of Kentucky, dominated by Bur Oak and Blue Ash, with cool season native grasses (e.g. *Elymus* spp., *Dichanthelium* spp.), with *Arundinaria gigantea* (cane) in some examples..... **Bluegrass Savanna and Woodland (2413)**

13a. Glades, barrens, or woodlands on Ketona Dolomite, restricted to limited areas of the Ridge and Valley in Bibb County Alabama..... **Alabama Ketona Glade and Woodland (2408)**

13a. Glades, barrens, or prairies on base-rich substrates (e.g. limestone, dolomite and related geologies) in other parts of the Ridge and Valley (EPA 67) (or rarely on the escarpment of the Cumberland Plateau EPA 68c), not on Dolomite in Bibb County Alabama **Southern Ridge and Valley Patch Prairie (2419)**

KEY B: Upland Forest and Woodland Ecological Systems of Map Zone 47, 48, and 53

- 1a. Trees in planted stands, generally with >70% relative cover of *Pinus palustris*, *Pinus elliottii*, *Pinus echinata* or *Pinus taeda* **Managed Tree Plantation - Southeast Conifer & Hardwood Plantation Group (2502)**
- 1b. Not a tree plantation or planted stand of trees **2**
- 2a. Stand dominated by introduced exotic trees (i.e. *Melia azedarach*, *Ailanthus altissima*, *Broussonetia papyrifera*) ...
..... **Introduced Upland Vegetation – Treed (2187)**
- 2b. Stand dominated by native trees, not introduced exotic trees **3**
- 3a. Forests or woodlands in the Southeastern Plains (EPA 65), the Mississippi Alluvial Plain (EPA 73) or the Mississippi Valley Loess Plains (EPA 74); these restricted to a small part of Map Zone 47 in Kentucky, Missouri and Tennessee **4**
- 3b. Forests or woodlands outside the above-named areas, found in Appalachian or Interior regions (e.g. EPA 55, 67, 68, 69, 70, 71, 72), not in the Coastal Plains (e.g. EPA 65, 73, 74)..... **11**
- 4a. Dry-mesic upland forests on loessal slopes that rise above the Mississippi River alluvial plain surface dominated by *Quercus alba*, *Quercus falcata*, *Quercus pagoda*, *Quercus stellata*, *Carya texana*, *Quercus shumardii*, and *Quercus velutina*. Restricted to a limited part of map zone 47 in Kentucky, Missouri, and Tennessee (EPA 73 only)
..... **Mississippi River Alluvial Plain Dry-Mesic Loess Slope Forest (2509)**
- 4b. All other upland forests or woodlands in the Southeastern Plains (EPA 65) or Mississippi Valley Loess Plains (EPA 74)..... **5**
- 5a. Forests or woodlands found on the Bluff Hills (loess slopes) or Loess Plains (EPA 74), restricted to a limited area of map zone 47 in Kentucky and Tennessee **6**
- 5b. Forests or woodlands found in the Southeastern Plains (EPA 65), restricted to a limited area of map zone 47 in Tennessee **7**
- 6a. Flatwoods, wet or only seasonally wet, found on poorly drained uplands in the Loess Plains (EPA 74b) **8**
- 6b. Other forests and woodlands of the Bluff Hills (loess slopes) or Loess Plains (EPA 74a or 74b), not flatwoods, not found on poorly drained uplands **9**
- 7a. Mixed forests of hardwoods and shortleaf pine (*Pinus echinata*), restricted to the southern margin of map zone 47 in Tennessee (very peripheral to this map zone; part of EPA 65). Stands should have over 25% shortleaf pine (*Pinus echinata*), which occurs in mixtures with *Quercus* spp. and *Carya* spp., with *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Acer* spp., and *Nyssa sylvatica*. **East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (2372)**
- 7b. Hardwood forests of EPA 65 dominated either by *Quercus* species in combination with a host of dry to dry-mesic site hardwood species, or by mesic hardwoods (e.g. *Fagus grandifolia*, *Liriodendron tulipifera*, *Liquidambar styraciflua*). **10**
- 8a. Wet flatwoods of the “Jackson Purchase” in Kentucky (EPA 74b) and possibly adjacent Tennessee; small-patch system that usually occurs on poorly drained uplands dominated by *Quercus palustris*, often associated with *Quercus bicolor* **South-Central Interior / Upper Coastal Plain Wet Flatwoods (2457)**
- 8b. Flatwoods of the “Jackson Purchase” in Kentucky (EPA 74b) and possibly adjacent Tennessee, less wet than above, composed of dry-mesic, or dry oak species, *Quercus falcata*, *Quercus stellata*, with *Acer rubrum*, *Liquidambar styraciflua* and *Nyssa sylvatica*..... **South-Central Interior / Upper Coastal Plain Flatwoods (2326)**
- 9a. Mesic Hardwood Forests of ravines and sideslopes in the Bluff Hills (EPA 74a). Vegetation indicators are mesic hardwoods such as *Fagus grandifolia*, *Quercus alba*, and *Ilex opaca*, along with a variety of other hardwood species including *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Nyssa sylvatica*, *Fraxinus americana*, and *Magnolia acuminata* (of local distribution). This system is largely confined to steep bluffs bordering the northern portion of the eastern edge of the Mississippi River Alluvial Plain
..... **East Gulf Coastal Plain Northern Loess Bluff Forest (2327)**
- 9b. Dry to dry-mesic forests of hardwoods, or open oak woodlands, on the Loess Plains (EPA 74b) containing *Quercus falcata*, *Quercus alba*, *Carya alba*, *Quercus stellata*, *Quercus marilandica*, and *Quercus velutina*. Scattered successional stands would be dominated by *Juniperus virginiana* var. *virginiana*. In addition, *Liquidambar styraciflua*

and *Liriodendron tulipifera* may be present; most stands have been cleared for agriculture due to the rich, productive soils derived from relatively thick loess deposits
 **East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (2306)**

10a. Mesic Hardwood Forests of ravines and sideslopes in the Southeastern Plains (EPA 65). Vegetation indicators are mesic hardwoods such as *Fagus grandifolia*, *Quercus alba*, and *Ilex opaca*, along with a variety of other hardwood species including *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Nyssa sylvatica*, *Fraxinus americana*
 **East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (2325)**

10b. Dry to dry-mesic forests of hardwoods, or open oak woodlands, in the Southeastern Plains (EPA 65) containing *Quercus falcata*, *Quercus alba*, *Carya alba*, *Quercus stellata*, *Quercus marilandica*, and *Quercus velutina*. In addition, *Liquidambar styraciflua* and *Liriodendron tulipifera* may be present.....
 **East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (2307)**

11a. Upland forests restricted to the glaciated northern margin of map zone 47 in Indiana and Ohio (EPA 55b, 55f, 72b) **12**

11b. Upland forests found in Appalachian or Interior regions (e.g. EPA 55c, 67, 68, 69, 70, 71, 72a, 72c, 72h), neither in the Coastal Plains (EPA 65, 73, 74) nor glaciated northern margin of map zone 47 in Indiana and Ohio (EPA 55b, 55f, 72b)..... **15**

12a. Wet flatwoods; a small-patch system that usually occurs on poorly drained uplands or in depressions associated with glacial features, dominated by *Quercus palustris*, often associated with *Quercus bicolor*, *Acer rubrum*. *Liquidambar styraciflua* and *Nyssa sylvatica*..... **North-Central Interior Wet Flatwoods (2518)**

12b. Other Mesic, dry-mesic, or dry oak forests or woodlands, not wet flatwoods found on poorly drained uplands .. **13**

13a. Mesic deciduous forests with *Acer saccharum* and *Fagus grandifolia* as the most common trees. Associates include *Quercus rubra*, *Tilia americana*, *Carpinus caroliniana*, and *Ostrya virginiana*.....
 **North-Central Interior Beech-Maple Forest (2313)**

13b. Dry to dry-mesic oak forests or woodlands, typically or characteristically oak-dominated..... **14**

14a. Dry oak forests or woodlands in which *Quercus velutina*, *Quercus macrocarpa*, or *Quercus coccinea* dominate the overstory sometimes with *Carya glabra*, *Prunus serotina*, and *Sassafras albidum*. If *Quercus macrocarpa* is dominant, then *Quercus velutina* and *Quercus coccinea* are more abundant than *Quercus alba* and *Quercus rubra*.....
 **North-Central Interior Dry Oak Forest and Woodland (2311)**

14b. Dry-mesic oak forests or woodlands in which *Quercus macrocarpa*, *Quercus rubra*, and/or *Quercus alba* dominate the overstory. *Carya* spp. may also be important canopy trees. If *Quercus macrocarpa* is dominant, then *Quercus alba* and *Quercus rubra* more abundant than *Quercus velutina* and *Quercus coccinea*.....
 **North-Central Interior Dry-Mesic Oak Forest and Woodland (2310)**

15a. Forests or woodlands found in the eastern margins of map zones 48 and 53, in the Ridge and Valley, Southwestern Appalachians (including the Cumberlands), Central Appalachians, and Western Allegheny Plateau (e.g. EPA 67, 68, 69, 70)..... **16**

15b. Forests or woodlands found in the remainder of map zones 48 and 53 (not only in the eastern margins of these Zones) as well as in zone 47, including the Interior Plateau and Interior River Lowlands (and southern part of Eastern Corn Belt Plains) from southern Indiana, southern Ohio, Kentucky, Tennessee, Alabama and Georgia (e.g. EPA 55d, 71, 72a, 72c, 72h) **27**

16a. Mixed or evergreen forests or woodlands containing a combination of broadleaved hardwoods and needleleaved evergreen trees, found in the eastern margins of map zones 48 and 53 (e.g. EPA 67, 68, 69, 70), generally containing from 25% to 75% each of deciduous broadleaved or evergreen needleleaved trees, or greater than 75% needleleaved trees **17**

16a. Deciduous broadleaved forests or woodlands found in the eastern margins of map zones 48 and 53 (e.g. EPA 67, 68, 69, 70), generally containing greater than 75% broadleaved trees **22**

17a. Mesic to dry-mesic mixed forests, stands containing some amount (>25%) of Eastern Hemlock (*Tsuga canadensis*). Northern hardwoods such as *Acer saccharum*, *Betula alleghaniensis*, and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and

- sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera*, *Prunus serotina*, and *Betula lenta*. The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Its status in Kentucky is unclear. At a minimum it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (map zone 53).....
- **Appalachian (Hemlock)-Northern Hardwood Forest (2370)**
- 17b. Dry or dry-mesic mixed forests and woodlands, dominated by some combination of Oaks and/or Pines (*Quercus* species and/or *Pinus* species). Pines may include *Pinus echinata*, *Pinus palustris* (in a limited area of EPA 67 and 68), *Pinus pungens* (only at higher elevations), *Pinus rigida*, and/or *Pinus strobus* **18**
- 18a. Dry or dry-mesic mixed forests and woodlands, containing a mixture of Oaks (*Quercus* species) and Longleaf Pine (*Pinus palustris*), found in limited areas of the Cumberlands of Alabama and the Ridge and Valley of Alabama and adjacent Georgia (e.g. EPA 67f, 67h, 68e, 68f)..... **Southeastern Interior Longleaf Pine Woodland (2351)**
- 18b. Dry or dry-mesic mixed forests and woodlands, dominated by some combination of Oaks and Pines (*Quercus* species and *Pinus* species). Pines may include *Pinus echinata*, *Pinus pungens* (only at higher elevations), *Pinus rigida*, and/or *Pinus strobus*; not including *Pinus palustris* **19**
- 19a. Pine-oak woodlands on higher ridges (EPA 67h, over 700 meters / 2300 feet elevation) in the eastern part of map zone 53 in which *Pinus pungens*, often with *Pinus rigida* and/or *Pinus virginiana*, are the dominants, occasionally with *Tsuga caroliniana*..... **Southern Appalachian Montane Pine Forest and Woodland (2352)**
- 19b. Other dry pine-oak woodlands, without *Pinus pungens*, primarily found in the eastern margins of map zones 48 and 53 (e.g. EPA 67, 68, 69, 70), but also more widespread in map zones 48 and 53 (and rarely in map zone 47). Stands contain *Pinus echinata* and/ or *Pinus virginiana* with various oak species, including *Quercus alba*, *Quercus rubra*, *Quercus falcata*, *Quercus stellata*, *Quercus velutina*, and *Quercus marilandica*. In some examples, the aggregate importance of hardwoods may be greater than pine, especially on subxeric and mesic sites **20**
- 20a. Pine-oak woodlands occurring on open or sparsely wooded hilltops and outcrops or rocky slopes, mostly at lower elevations, in the rugged and northeastern parts of map zone 53 (e.g. EPA 69a, 69d, 69e, 70a, 70b, 70d, 70f, 70g) .
..... **Central Appalachian Pine-Oak Rocky Woodland (2377)**
- 20b. Other types of pine-oak or oak-pine forests and woodlands, primarily found in the eastern margins of map zones 48 and 53 (e.g. EPA 67, 68, 69, 70), but also more widespread in map zones 48 and 53 (and rarely in map zone 47) ...
..... **21**
- 21a. Pine-oak forests occurring as large patches on lower terrain than **2352** (18a above), generally below 700 meters / 2300 feet elevation, and on less extreme topography. Dominants include *Pinus echinata* and *Pinus virginiana*. *Pinus rigida* may sometimes be present. Hardwoods are sometimes abundant, especially dry-site oaks such as *Quercus falcata*, *Quercus prinus*, and *Quercus coccinea*, but also *Carya glabra*, *Acer rubrum*, and others. A substantial hardwood component may partly be the result of fire suppression. The shrub layer may be well-developed, with *Vaccinium pallidum*, *Gaylussacia baccata*, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*.....
..... **Southern Appalachian Low-elevation Pine Forest (2353)**
- 21b. Pine-oak forests occurring as small inclusions of *Pinus echinata* and/or *Pinus virginiana*, which may occur (particularly adjacent to escarpments or following fire) on predominately acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the Ridge and Valley. These are attributable to the following:
..... Examples with >25% pine cover of **Allegheny-Cumberland Dry Oak Forest and Woodland (2317)**
- 22a. Generally dry to dry-mesic deciduous broad-leaved forests that are typically dominated by oaks, possibly with hickories, black gum, sweetgum, etc. Some stands may have had some oaks removed by logging, or oaks may not be the truly dominant trees, but the typical suite of dry to dry mesic oaks is characteristic [e.g. white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*); chinquapin oak (*Quercus muehlenbergii*), Shumard oak (*Quercus shumardii*) on base-rich substrates; possibly northern red oak (*Quercus rubra*) within its range] ... **23**
- 22b. Mesic forests of the eastern margins of map zones 48 and 53, found on concave landforms and “rich” sites, including lower slopes and coves; or higher elevation forests of the eastern and more rugged portions of map zone 53 (“Cove Forests”, “Mesophytic Forests” and “Northern Hardwood Forests”); not oak-hickory-(pine) dominated but dominated by a diverse mix of other trees..... **24**

- 23a. Dry to dry-mesic forests on base-rich substrates (e.g. limestone, dolomite), restricted to the lower slopes and valleys in the Ridge and Valley physiographic province (EPA 67f, 67, 69c), or the lower slopes of the west-facing Cumberland Plateau escarpment as well as related areas of the Sequatchie Valley (EPA 68b and 68c). It may also be found in the Carter Hills of Kentucky (EPA 70h). Stands will typically be dominated by oaks, hickories, and maples which prefer base-rich substrates (e.g. *Acer barbatum*, *Acer leucoderme*, *Acer saccharum*, *Quercus muehlenbergii*, *Quercus shumardii*, *Quercus alba*, *Quercus stellata*, with any of several *Carya spp.*). The system concept also includes successional communities that have been impacted by logging or agriculture, including upland forest types dominated by *Liriodendron tulipifera*, *Pinus spp.*, *Juniperus virginiana*, and *Robinia pseudoacacia*.
..... **Southern Ridge and Valley / Cumberland Dry Calcareous Forest (2376)**
- 23b. Other dry to dry-mesic forests of the eastern margins of map zones 48 and 53 (e.g. EPA 67, 68, 69, 70), not heavily influenced by base-rich substrates, not restricted to the lower slopes and valleys in the Ridge and Valley physiographic province (EPA 67f, 67, 69c), or the lower slopes of the west-facing Cumberland Plateau escarpment as well as related areas of the Sequatchie Valley (EPA 68b and 68c). **25**
- 24a. Higher elevation “Southern Appalachian Northern Hardwood Forests,” found at about 1100-1160 m / 3600-3800 feet elevation; stands dominated by northern hardwoods including *Fagus grandifolia*, *Betula alleghaniensis*, *Acer saccharum*, and *Prunus serotina* with patches of *Quercus rubra* in a matrix of the montane northern hardwoods. In the area of this key, restricted to the extreme eastern margin of Map Zone 53 (EPA 69 and a very minor sliver of EPA 67 where these overlap with USFS section M221) in the Black and Cumberland Mountains of Kentucky and Tennessee
..... **Southern Appalachian Northern Hardwood Forest (2309)**
- 24b. Other rich and mesic forests of concave landforms and “rich” sites, including lower slopes and coves of map zones 47, 48, and 53 (“Cove Forests” and “Mesophytic Forests”); not oak-hickory-(pine) dominated but dominated by a diverse mix of other trees **26**
- 25a. High-elevation primarily oak-dominated deciduous forests occur on exposed sites, including ridgecrests and south- to west-facing slopes, mostly between 915 and 1372 m / 3000-4500 feet elevation. Stands are dominated by *Quercus rubra* and, more rarely, *Quercus alba*. Often the trees are stunted or at least not as tall as they would be in other systems farther downslope. Species richness is low to moderate. Tree associates include *Prunus serotina*, *Betula lenta*, and *Betula alleghaniensis*. Typical small trees and shrubs include *Ilex montana*, *Hamamelis virginiana*, *Acer pensylvanicum*, *Menziesia pilosa*, *Rhododendron prinophyllum*, *Vaccinium pallidum*, *Corylus cornuta var. cornuta*, and sprouts of *Castanea denata*.
..... **Central and Southern Appalachian Montane Oak Forest (2320)**
- 25b. Lower elevation dry to dry-mesic oak forests, not found at higher elevations, generally below 915 m / 3000 feet elevation, primarily in the Cumberlands and Ridge and Valley of map zones 48 and 53. These are forests of predominately acidic substrates in the Allegheny and Cumberland plateaus (EPA 68), and ridges in the Ridge and Valley (EPA 67), as well as related parts of the Central Appalachians (EPA 69) and Western Allegheny Plateaus (EPA 70). These dry (and dry-mesic) forests are typically dominated by *Quercus alba*, *Quercus falcata*, *Quercus prinus*, *Quercus coccinea*, with lesser amounts of *Acer rubrum*, *Carya glabra*, and *Carya alba*. Small inclusions of *Pinus echinata* and/or *Pinus virginiana* may occur, particularly adjacent to escarpments or following fire. In addition, *Pinus strobus* may be prominent in some stands in the absence of fire. It occurs in a variety of situations, including on nutrient-poor or acidic soils. Found in EPA Ecoregions 67h, 67i, 68a, 68c, 68d, 68e, 68f, 69a, 69d, 69e, 70a, 70b, 70c, 70d, 70e, 70f, 70g. [Related forests on more base-rich substrates may be classified as examples of Southern Ridge and Valley / Cumberland Dry Calcareous Forest (2376), where this distinction may be made.]
..... **Allegheny-Cumberland Dry Oak Forest and Woodland (2317)**
- 26a. Lower elevation mesic hardwood forests in the eastern margins of map zones 48 and 53 (e.g. portions of EPA 67 and 69 [67f, 67g, 67h, 67i, 69a, 69d, 69e], where these overlap with USFS subsections M221A and M221C); varying combinations of the following taxa will be found in stands; but no single one is dominant or even characteristic by itself: *Acer saccharum*, *Fraxinus americana*, *Tilia heterophylla*, *Liriodendron*, *Tsuga canadensis*, *Fagus*, *Magnolia acuminata*, *Aesculus flava*, *Halesia tetraptera*, *Magnolia fraseri*
..... **Southern and Central Appalachian Cove Forest (2318)**
- 26b. Mesophytic deciduous hardwood forests in the in the Interior Plateau region (EPA 71) and unglaciated Interior River Lowland (EPA 72) regions as well as in the Ridge and Valley and Cumberland/Allegheny regions (EPA 67, 68, 69, 70) of map zones 47 and the larger portion of map zones 48 and 53 not included above. These high-diversity forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), and usually in somewhat protected landscape positions such as coves or lower slopes. Dominant species include *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Tilia americana*, *Quercus rubra*, *Magnolia*

acuminata, and *Juglans nigra*. *Tsuga canadensis* may be a component of some stands. Trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals.
.....**South-Central Interior Mesophytic Forest (2321)**

27a. Mixed pine-oak forests occurring as large patches in scattered areas of the Interior Low Plateau (e.g., the Knobs Region of Kentucky and southern Indiana and the western Highland Rim of Tennessee), typically absent from highly base-rich substrates. Dominants include *Pinus echinata* and *Pinus virginiana*. Hardwoods are sometimes abundant, especially dry-site oaks such as *Quercus falcata*, *Quercus prinus*, and *Quercus coccinea*, but also *Carya glabra*, *Acer rubrum*, and others. A substantial hardwood component may partly be the result of fire suppression. The shrub layer may be well-developed, with *Vaccinium pallidum*, *Gaylussacia baccata*, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*.
.....**Southern Appalachian Low-elevation Pine Forest (2353)**

27b. Hardwood forests (pines, if present, below 25% of a stand) of the Interior Low Plateau and unglaciated Interior River Lowlands (EPA 71 and 72), including both oak-dominated dry and dry-mesic stands as well as diverse mesophytic ones..... **28**

28a. Dry-mesic to dry hardwood-dominated forests found in the Interior Plateau region (EPA 71) and Interior River Lowland (EPA 72) regions along ridgetops and slopes of various aspects. Stands are dominated by a number of different *Quercus* species, with *Carya* species also prominent. In some drier examples on more acidic substrates, *Quercus prinus* is typical. *Quercus stellata*, *Quercus marilandica*, and *Quercus coccinea* will also share dominance or be prominent. *Quercus muehlenbergii* and/or *Quercus shumardii* may appear in drier examples with high base status, in addition to *Quercus alba*. In the submesic to dry-mesic examples, *Quercus alba* will typically exhibit dominance, possibly with *Quercus velutina* or *Quercus falcata*. Found in EPA Ecoregions 71a, 71b, 71c, 71d, 71e, 71f, 71g, 71h, 71k, 71l, 72a, 72c, 72h.....**Southern Interior Low Plateau Dry-Mesic Oak Forest (2305)**

28b. Mesophytic deciduous hardwood forests in the in the Interior Plateau region (EPA 71) and unglaciated Interior River Lowland (EPA 72) regions as well as in the Ridge and Valley and Cumberland/Allegheny regions (EPA 67, 68, 69, 70). These high-diversity forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), and usually in somewhat protected landscape positions such as coves or lower slopes. Dominant species include *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Tilia americana*, *Quercus rubra*, *Magnolia acuminata*, and *Juglans nigra*. *Tsuga canadensis* may be a component of some stands. Trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals.
.....**South-Central Interior Mesophytic Forest (2321)**

KEY C: Wetland Forest, Woodland, and Shrubland Ecological Systems of Map Zone 47, 48, and 53

- 1a. Trees in planted stands generally with >70% relative cover of *Pinus palustris*, *Pinus elliottii*, *Pinus echinata* or *Pinus taeda* **Managed Tree Plantation - Southeast Conifer & Hardwood Plantation Group (2502)**
- 1b. Not a tree plantation or planted stand of trees **2**

- 2a. Riparian areas with > 20% relative cover of non-native perennial shrubs or herbaceous plants, (i.e. >20% relative cover of *Ligustrum sinense*, *Paspalum urvillei*, *Lygodium japonicum*, or *Cyperus entrerianus*)..... **Introduced Riparian Vegetation (2180)**
- 2b. Vegetation not dominated by or with significant cover of non-native shrubs or perennial herbaceous plants..... **3**

- 3a. Wetlands (riparian or influenced by flooding or saturation) with >20% relative cover of *Triadica sebifera* (Chinese tallow tree) **Introduced Wetland Vegetation – Mixed (2185)**
- 3b. Wetlands (riparian or influenced by flooding or saturation) with <20% relative cover of *Triadica sebifera* (Chinese tallow tree)..... **4**

- 4a. Wetlands of the Southeastern Plains (EPA 65) Mississippi Alluvial Plain (73), and Mississippi Valley Loess Plains (EPA 74), restricted to the southwestern part of map zone 47 in western Kentucky, southeastern Missouri, and western Tennessee **5**
- 4b. Wetlands of the rest of map zones 47, 48, and 53 **10**

- 5a. Flatwoods, wet or only seasonally wet, found on poorly drained uplands primarily in the Loess Plains (EPA 74b), also possibly in the adjacent Southeastern Plains (EPA 65). **6**
- 5b. Other forests, woodlands or shrublands, not flatwoods, of EPA 65. 73, and 74 **7**

- 6a. Wet flatwoods of the “Jackson Purchase” in Kentucky (EPA 74b) and possibly adjacent Tennessee; also possibly in the adjacent Southeastern Plains (EPA 65); small-patch system that usually occurs on poorly drained uplands dominated by *Quercus palustris*, often associated with *Quercus bicolor* **South-Central Interior / Upper Coastal Plain Wet Flatwoods (2457)**
- 6b. Flatwoods of the “Jackson Purchase” in Kentucky (EPA 74b) and possibly adjacent Tennessee, also possibly in the adjacent Southeastern Plains (EPA 65); less wet than above, composed of dry-mesic, or dry oak species, *Quercus falcata*, *Quercus stellata*, with *Acer rubrum*, *Liquidambar styraciflua* and *Nyssa sylvatica* **South-Central Interior / Upper Coastal Plain Flatwoods (2326)**

- 7a. Forests and shrublands on saturated soils associated with springs and seepage flow at slope bases, characterized by *Nyssa sylvatica*, *Nyssa biflora*, and *Acer rubrum*. **Eastern Gulf Coastal Plain Northern Seepage Swamp (no EVT code assigned; ESLF 9351)**
- 7b. Other forested wetlands along rivers, creeks or in non-alluvial flats with organic soils or organic upper soil horizons **8**

- 8a. Wetlands in poorly drained, organic or mineral soil flats or basins, saturated by rainfall and seasonal high water tables. Not associated with river floodplains **Gulf and Atlantic Coastal Plain Swamp Systems (2480)**
- 8b. Forests found on rivers, creeks, and streams **9**

- 9b. Forests found on moderately to very high-gradient smaller rivers, creeks, and streams, primarily riparian in character. This system develops on small floodplains and shores along river channels that lack a broad, flat floodplain due to steeper sideslopes, higher gradient, or both. Common trees include *Betula nigra*, *Platanus occidentalis*, and *Acer negundo*. Where somewhat more stable, linear forests develop; typical trees include *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Celtis laevigata*, *Fraxinus pennsylvanica*, *Quercus michauxii*, and *Quercus pagoda* **Gulf and Atlantic Coastal Plain Small Stream Riparian Systems (2474)**
- 9b. Forests found along medium to large river floodplains. Characteristic trees include *Acer saccharinum*, *Populus deltoides*, *Betula nigra*, *Celtis laevigata*, *Liquidambar styraciflua*, willows, especially *Salix nigra* in the wettest areas, and *Platanus occidentalis*, with *Fraxinus pennsylvanica*, *Ulmus americana*, *Liriodendron tulipifera*, *Quercus pagoda*, and *Quercus michauxii* **Gulf and Atlantic Coastal Plain Floodplain Systems (2473)**

10a. Wetlands in basins, characterized by some of these species *Acer rubrum*, *Alnus spp.*, *Carex spp.*, *Cephalanthus occidentalis*, *Fraxinus nigra*, *Ilex spp.*, *Nyssa sylvatica*, *Osmunda cinnamomea*, *Quercus bicolor*, *Quercus palustris* **Central Interior and Appalachian Swamp Systems (2479)**

10b. Wetlands or bottomlands found along rivers or creeks **11**

11a. Forests found along medium to large river floodplains. Characteristic trees include *Acer saccharinum*, *Populus deltoides*, *Betula nigra*, *Celtis laevigata*, *Liquidambar styraciflua*, willows, especially *Salix nigra* in the wettest areas, and *Platanus occidentalis*, with *Fraxinus pennsylvanica*, *Ulmus americana*, *Liriodendron tulipifera*, and *Quercus macrocarpa* in more well-drained areas **Central Interior and Appalachian Floodplain Systems (2471)**

11b. Forests found on moderately to very high-gradient smaller rivers, creeks, and streams over a wide range of elevations. This system develops on small floodplains and shores along river channels that lack a broad, flat floodplain due to steeper sideslopes, higher gradient, or both. Common trees include *Betula nigra*, *Platanus occidentalis*, and *Acer negundo*. Where somewhat more stable, linear forests develop; typical trees include *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Celtis laevigata*, and *Fraxinus pennsylvanica*. **Central Interior and Appalachian Riparian Systems (2472)**