

Descriptions of Ecological Systems for Modeling of LANDFIRE Biophysical Settings

Ecological Systems of location US State TN ; Excluding Aggregates

18 July 2006

Descriptions provided to TNC and LANDFIRE by NatureServe

About this document

This document contains brief definitions of the Biophysical Settings (BpS) currently identified as occurring in location US State TN ; Excluding Aggregates. BpS are based on the vegetation units called ecological systems, developed by NatureServe. Most of the following BpS will be further described, quantitatively modeled, and mapped for LANDFIRE.

The ecological systems classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset may be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC, <mary_russo@natureserve.org>.



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Citation:

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NatureServe. 2006. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 18 July 2006.

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FOREST AND WOODLAND

1317 ALLEGHENY-CUMBERLAND DRY OAK FOREST AND WOODLAND (CES202.359)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Acidic Soil; Broad-Leaved Tree

Non-Diagnostic Classifiers: Lowland; Forest and Woodland (Treed)

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2317; ESLF 4123; ESP 1317

CONCEPT

Summary: This system encompasses dry hardwood forests on predominately acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the Ridge and Valley. This system can also be found as small isolated patches in the Southern Blue Ridge. Its range is more or less consistent with the "Mixed Mesophytic Forest Region" of Braun (1950) and Greller (1988), although it is not a mesic forest type. These 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 invading some stands in the absence of fire. These occur in a variety of situations, including on nutrient-poor or acidic soils. Sprouts of *Castanea dentata* can often be found where it was formerly a common tree.

Similar Ecological Systems:

- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Oak Forest (CES202.886)--is a related broader and overlapping concept (conceptually and geographically).
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)--is found in some similar landscapes but on more base-rich substrates, which usually correspond to different landform positions.

Related Concepts:

- Xeric Acidic Forest (Evans 1991) Broader

DESCRIPTION

Environment: This system is most likely found on predominantly nutrient-poor or acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the Ridge and Valley. This system can also be found as small isolated patches in the Southern Blue Ridge. Related forests on more base-rich substrates may be classified as examples of Southern Ridge and Valley Dry Calcareous Forest (CES202.457), where this distinction may be made.

Vegetation: These forests are typically dominated by *Quercus alba*, *Quercus falcata*, *Quercus prinus*, *Quercus coccinea*, *Acer rubrum*, *Carya glabra*, and *Carya alba*. These occur in a variety of situations, most likely on nutrient-poor or acidic soils and, to a much lesser extent, on circumneutral soils. Sprouts of *Castanea dentata* can often be found where it was formerly a common tree. Small inclusions of *Pinus echinata* and/or *Pinus virginiana* may occur, particularly adjacent to escarpments or following fire. In addition, *Pinus strobus* may be invading some stands in the absence of fire.

MEMBERSHIP

Associations:

- *Quercus alba* - (*Quercus prinus*) / (*Hydrangea quercifolia*) - *Viburnum acerifolium* / *Carex picta* - *Piptochaetium avenaceum* Forest (CEGL008430, G3G4)
- *Quercus alba* - *Carya (ovata, alba, glabra)* - *Pinus virginiana* Forest (CEGL007231, G4G5)
- *Quercus alba* - *Carya alba* - (*Quercus velutina*) / *Desmodium nudiflorum* - (*Carex picta*) Forest (CEGL007795, G4)
- *Quercus alba* - *Quercus falcata* / *Vaccinium (arboreum, hirsutum, pallidum)* Forest (CEGL008567, G3G4)
- *Quercus alba* - *Quercus prinus* - *Carya glabra* / *Cornus florida* / *Vaccinium pallidum* / *Carex pensylvanica* Forest (CEGL008515, G4)
- *Quercus alba* - *Quercus rubra* - *Carya ovata* / *Cercis canadensis* - *Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba* - *Quercus stellata* / *Ostrya virginiana* - *Acer barbatum* / *Chasmanthium sessiliflorum* Forest (CEGL008443, G3G4)
- *Quercus falcata* - *Quercus (coccinea, stellata)* / *Vaccinium (pallidum, stamineum)* Forest (CEGL007247, G4)
- *Quercus falcata* - *Quercus alba* - *Carya alba* / *Oxydendrum arboreum* / *Vaccinium stamineum* Forest (CEGL007244, G4G5)
- *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* - *Vaccinium pallidum* Forest (CEGL008431, G4G5)
- *Quercus prinus* - *Carya (alba, glabra, ovata)* / *Juniperus virginiana* var. *virginiana* Forest (CEGL004786, G2G3)
- *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268, G4?)
- *Quercus prinus* - *Carya* spp. - *Quercus velutina* / *Vaccinium arboreum* / *Iris verna* var. *smalliana* Forest (CEGL007261, G3G4)
- *Quercus prinus* - *Quercus rubra* - *Carya (ovata, glabra)* - *Pinus virginiana* Forest (CEGL007269, G4?)

- *Quercus prinus* - *Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia*, *Styrax grandifolius*) Forest (CEGL007700, G4)
- *Quercus stellata* - *Pinus virginiana* / (*Schizachyrium scoparium*, *Piptochaetium avenaceum*) Woodland (CEGL008406, G2?)

Alliances:

- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus alba* - *Quercus (falcata, stellata)* Forest Alliance (A.241)
- *Quercus falcata* Forest Alliance (A.243)
- *Quercus prinus* - (*Quercus coccinea*, *Quercus velutina*) Forest Alliance (A.248)
- *Quercus prinus* - *Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Quercus velutina* - *Quercus alba* - (*Quercus coccinea*) Forest Alliance (A.1911)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- South-Central Interior Mesophytic Forest (CES202.887)

Adjacent Ecological System Comments: The somewhat more mesic and/or more base-rich forests of the lower slopes of the Cumberlands and the lower slopes and valleys in the Ridge and Valley are covered by South-Central Interior Mesophytic Forest (CES202.887).

DISTRIBUTION

Range: Allegheny and Cumberland plateaus, and ridges in the Ridge and Valley. This system can also be found as small isolated patches in the Southern Blue Ridge

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, OH, PA, TN, VA, WV

Map Zones: 48:C, 53:C, 57:C, 60:N, 61:C, 62:C

TNC Ecoregions: 49:C, 50:C, 51:C

SOURCES

References: Braun 1950, Comer et al. 2003, Greller 1988

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723154#references

Description Author: R. Evans, M. Pyne, C. Nordman, mod. J. Teague

Version: 26 Jan 2006

Concept Author: R. Evans, M. Pyne, C. Nordman

Stakeholders: East, Midwest, Southeast

ClassifResp: Southeast

1370 APPALACHIAN (HEMLOCK)-NORTHERN HARDWOOD FOREST (CES202.593)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*

Non-Diagnostic Classifiers: Moderate (100-500 yrs) Persistence; Lowland; Forest and Woodland (Treed); Sideslope;

Toeslope/Valley Bottom; Temperate; Acidic Soil; Shallow Soil; Deep Soil; Mineral: W/ A-Horizon >10 cm; Ustic; Long Disturbance Interval

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Mixed evergreen-deciduous closed tree canopy

National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370

CONCEPT

Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to Virginia, continuing down the Appalachians to Georgia in a more attenuated fashion. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. 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*. It is of more limited extent and more ecologically constrained in the southern part of its range (more or less from central Virginia southwards), occurring at a smaller spatial extent.

Classification Comments: Northward this system is replaced by Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563) and Laurentian-Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 212 and M212 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian-Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.

The status and system affiliation of limited, disjunct occurrences of hemlock-dominated stands in southern Indiana, western Kentucky (Shawnee Hills), central Tennessee, and Cumberland Alabama are unclear. Kentucky Shawnee Hills examples are temporarily considered as examples of South-Central Interior Mesophytic Forest (CES202.887) which contain hemlock. The relationship between this system (Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)) and southern mesophytic forests (e.g., "acidic cove forests") needs to be clarified. It is problematic to have one system represent both the widespread and matrix forest of northern areas and the much more limited-extent hemlock-dominated stands in the south. Can these two things be separated? Should they be? More information is needed.

Similar Ecological Systems:

- Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)--found to the north and northeast of this system.
- South-Central Interior Mesophytic Forest (CES202.887)

Related Concepts:

- Acidic Cove Forests (Fleming et al. 2005) Intersecting
- Central Appalachian Northern Hardwood Forests (Fleming et al. 2005) Intersecting
- Eastern Hemlock - Hardwood Forests (Fleming et al. 2005) Intersecting

DESCRIPTION

Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the southern Appalachians, it often occurs between Southern and Central Appalachian Cove Forest (CES202.373) in the lowest areas and Southern Appalachian Oak Forest (CES202.886) on the midslopes. In the central Appalachian center of its range, its ecological amplitude is somewhat more broad, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.

Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. In the southern portion of its range, hemlock is almost always present and is often dominant. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.

Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause hemlock communities to more closely resemble Southern Appalachian Oak Forest (CES202.886) as time passes and canopy hemlocks are replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock.

MEMBERSHIP

Associations:

- *Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis* / *Sphagnum* spp. Forest (CEGL006014, GNR)
- *Acer rubrum* - *Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132, GNR)

- *Acer saccharum* - *Betula alleghaniensis* - *Fagus grandifolia* / *Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum* - *Betula alleghaniensis* - *Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum* - *Pinus strobus* / *Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum* - *Quercus rubra* / *Hepatica nobilis* var. *obtusata* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / *Leucothoe fontanesiana* Forest (CEGL007861, G3G4Q)
- *Betula lenta* - *Acer rubrum* / *Lycopodium annotinum* - *Dennstaedtia punctilobula* Forest (CEGL008503, GNA)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Deschampsia caespitosa* - *Claytonia virginica* var. *hammondiae* Herbaceous Vegetation (CEGL006101, G1)
- *Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543, G5)
- *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220, GNA)
- *Picea rubens* - *Betula alleghaniensis* - *Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus* - *Tsuga canadensis* / *Acer pensylvanicum* / *Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus* - *Tsuga canadensis* / *Rhododendron maximum* - (*Leucothoe fontanesiana*) Forest (CEGL007102, G4)
- *Pinus strobus* - *Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Pinus strobus* Successional Forest (CEGL007944, GNA)
- *Quercus bicolor* / *Vaccinium corymbosum* / *Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra* - *Acer saccharum* - *Fagus grandifolia* / *Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra* - *Acer saccharum* - *Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra* - *Tsuga canadensis* - *Liriodendron tulipifera* / *Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis* - *Pinus strobus* - *Tsuga canadensis* / *Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis*, *Quercus rubra*) / *Ilex montana* / *Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis* - (*Fagus grandifolia*, *Tilia americana* var. *heterophylla*) / *Magnolia tripetala* Forest (CEGL008407, G4)
- *Tsuga canadensis* - *Betula alleghaniensis* - *Acer saccharum* / *Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis* - *Betula alleghaniensis* - *Prunus serotina* / *Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis* - *Betula alleghaniensis* / *Veratrum viride* - *Carex scabrata* - *Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043, G3?)
- *Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest (CEGL006088, G4G5)
- *Tsuga canadensis* - *Quercus prinus* / *Kalmia latifolia* - *Rhododendron (catawbiense, maximum)* / *Galax urceolata* Forest (CEGL008512, G4)
- *Tsuga canadensis* / *Rhododendron maximum* - (*Clethra acuminata*, *Leucothoe fontanesiana*) Forest (CEGL007136, G3G4)
- *Tsuga caroliniana* - (*Tsuga canadensis*) / *Rhododendron maximum* Forest (CEGL007138, G1G2)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Acer saccharum* - *Betula alleghaniensis* - (*Fagus grandifolia*) Forest Alliance (A.216)
- *Chrysosplenium americanum* Saturated Herbaceous Alliance (A.1685)
- *Deschampsia caespitosa* Saturated Herbaceous Alliance (A.1456)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Picea rubens* - *Betula alleghaniensis* Forest Alliance (A.384)
- *Pinus strobus* - *Acer saccharum* Forest Alliance (A.3012)
- *Pinus strobus* - *Tsuga canadensis* Forest Alliance (A.127)
- *Pinus strobus* Forest Alliance (A.128)
- *Prunus serotina* - *Acer rubrum* - *Amelanchier canadensis* - *Quercus* spp. Forest Alliance (A.237)
- *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance (A.329)
- *Quercus rubra* - (*Acer saccharum*) Forest Alliance (A.251)
- *Rhododendron maximum* Shrubland Alliance (A.745)
- *Thuja occidentalis* Woodland Alliance (A.544)
- *Tsuga canadensis* - *Acer rubrum* Saturated Forest Alliance (A.447)
- *Tsuga canadensis* - *Betula alleghaniensis* Forest Alliance (A.412)
- *Tsuga canadensis* - *Liriodendron tulipifera* Forest Alliance (A.413)
- *Tsuga caroliniana* Forest Alliance (A.144)

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch in the southern Appalachians.

Size: Some examples may be more than 1000 acres, but in the southern part of the range, most are probably less than 50 acres.

Adjacent Ecological Systems:

- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Oak Forest (CES202.886)

Adjacent Ecological System Comments: Southern and Central Appalachian Cove Forest (CES202.373) occurs downslope from these forests in the coves and tends to be more mesic and more species-rich than the hemlock forests. Southern Appalachian Oak Forest (CES202.886) occurs upslope from this system and tends to be drier and even less diverse than hemlock forests. Hemlock

forests may grade into Southern Appalachian Low Mountain Pine Forest (CES202.332) in especially dry occurrences of this system.

DISTRIBUTION

Range: This system is found from central New England south to West Virginia and Georgia.

Divisions: 202:C

Nations: US

Subnations: CT, GA, KY, MA, MD, NC, NH, NJ, NY, OH?, PA, SC, TN, VA, VT, WV

Map Zones: 48:C, 53:C, 54:C, 57:C, 59:C, 60:C, 61:C, 62:C, 63:P, 64:C, 65:C, 66:C

TNC Ecoregions: 49:P, 50:P, 51:C, 52:C, 59:C, 60:P, 61:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723013#references

Description Author: S.C. Gawler, R. White, R. Evans, M. Pyne

Version: 17 Apr 2006

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne

Stakeholders: East, Midwest, Southeast

ClassifResp: Southeast

1340 APPALACHIAN SHALE BARRENS (CES202.598)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Sideslope; Talus (Substrate); Unglaciated; Unconsolidated

Non-Diagnostic Classifiers: Lowland; Ridge/Summit/Upper Slope; Temperate; Acidic Soil; Very Shallow Soil; Ustic; Landslide

FGDC Crosswalk: Vegetated, Tree-dominated, Open tree canopy, Deciduous open tree canopy

National Mapping Codes: EVT 2340; ESLF 4147; ESP 1340

CONCEPT

Summary: This system encompasses the distinctive shale barrens of the central and southern Appalachians at low to mid elevations. The exposure and lack of soil create extreme conditions for plant growth. Vegetation is mostly classified as woodland, overall, but may include large open areas of sparse vegetation. Dominant trees are primarily *Quercus prinus* and *Pinus virginiana*, although on higher-pH substrates the common trees include *Juniperus virginiana* and *Fraxinus americana*. The substrate includes areas of solid rock as well as unstable areas of shale scree, usually steeply sloped. The fully exposed areas are extremely dry. These barrens are high in endemic species.

Classification Comments: Examples of related barrens in the "Knobs" region of Kentucky are included in Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692), not here. The southern range limit is not completely clear. "Central Appalachian Shale Barrens" (sensu VADNH) are the "core" concept.

Similar Ecological Systems:

- Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692)
- Southern and Central Appalachian Mafic Glade and Barrens (CES202.348)
- Southern Appalachian Montane Cliff and Talus (CES202.330)

Related Concepts:

- Central Appalachian Shale Barrens (Fleming et al. 2004) Finer

DESCRIPTION

Environment: This system is found at low to mid elevations in the central and southern Appalachians. The exposure and lack of soil create extreme conditions for plant growth. The chemistry and pH vary somewhat from site to site, and this variability may be reflected in the vegetation. The substrate includes areas of solid rock as well as unstable areas of shale scree, usually steeply sloped.

Vegetation: Although stunted trees of several species such as *Quercus prinus*, *Pinus virginiana*, and *Carya glabra* are common, Central Appalachian Shale Barrens are strongly characterized by their open physiognomy and by a suite of uncommon and rare plants found almost exclusively in these habitats (Fleming et al. 2004). Endemic or near-endemic shale barren species include shale-barren rock-cress (*Arabis serotina*), white-haired leatherflower (*Clematis albicoma*), Millboro leatherflower (*Clematis viticaulis*; also endemic to Virginia), shale-barren wild buckwheat (*Eriogonum allenii*), shale-barren evening-primrose (*Oenothera argillicola*), shale-barren ragwort (*Packera antennariifolia*), and Kate's Mountain clover (*Trifolium virginicum*). Other more-or-less widespread and characteristic herbaceous species of Virginia shale barrens include Pennsylvania sedge (*Carex pensylvanica*), little bluestem (*Schizachyrium scoparium*), poverty oatgrass (*Danthonia spicata*), wavy hairgrass (*Deschampsia flexuosa* var. *flexuosa*), moss phlox (*Phlox subulata*), mountain nailwort (*Paronychia montana*), rock spike-moss (*Selaginella rupestris*), shale-barren pussytoes (*Antennaria virginica*), Canada cinquefoil (*Potentilla canadensis*), smooth sunflower (*Helianthus laevigatus*), false bonaset (*Brickellia eupatorioides* var. *eupatorioides*), hairy woodmint (*Blephilia ciliata*), and western wallflower (*Erysimum capitatum* var. *capitatum*; Bath and Alleghany counties).

MEMBERSHIP

Associations:

- (*Pinus virginiana*, *Juniperus virginiana*) / *Schizachyrium scoparium* - *Eriogonum allenii* Wooded Herbaceous Vegetation (CEGL008530, G2)
- *Carya glabra* - *Fraxinus americana* - *Quercus prinus* / *Ostrya virginiana* / *Philadelphus hirsutus* Woodland (CEGL004995, G2)
- *Juniperus virginiana* - *Fraxinus americana* / *Carex pensylvanica* - *Cheilanthes lanosa* Wooded Herbaceous Vegetation (CEGL006037, G2)
- *Paulownia tomentosa* Woodland (CEGL003687, GNA)
- *Pinus virginiana* - *Juniperus virginiana* - *Quercus rubra* / *Solidago arguta* var. *harrisii* - *Opuntia humifusa* Woodland (CEGL006288, G3)
- *Pinus virginiana* - *Quercus prinus* / *Packera antennariifolia* - *Phlox subulata* Woodland (CEGL006562, G3G4)
- *Pinus virginiana* - *Quercus prinus* / *Quercus ilicifolia* / (*Hieracium greenii*, *Viola pedata*) Woodland (CEGL008525, G3)
- *Pinus virginiana* / *Vaccinium pallidum* / *Schizachyrium scoparium* - *Carex pensylvanica* Woodland (CEGL003624, G2)
- *Quercus prinus* - *Juniperus virginiana* - (*Pinus virginiana*) / *Philadelphus hirsutus* - *Celtis occidentalis* Woodland (CEGL007720, G2)

- *Quercus prinus* / *Danthonia spicata* - *Silene caroliniana* Woodland (CEGL004439, G2?)
- *Quercus prinus* / *Quercus ilicifolia* / *Danthonia spicata* Woodland [Provisional] (CEGL008526, G3?)

Alliances:

- (*Fraxinus americana*, *Juniperus virginiana*) / *Carex pensylvanica* - *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.3014)
- *Fraxinus americana* - *Carya glabra* - (*Juniperus virginiana*) Woodland Alliance (A.604)
- *Paulownia tomentosa* Woodland Alliance (A.609)
- *Pinus (rigida, pungens, virginiana)* - *Quercus prinus* Woodland Alliance (A.677)
- *Quercus prinus* - *Quercus coccinea* Woodland Alliance (A.622)

DISTRIBUTION

Range: This system is found from Pennsylvania south to Virginia and Tennessee. Application of the concept south of Virginia is uncertain. It is not attributed to Kentucky.

Divisions: 202:C

Nations: US

Subnations: MD, NC, PA, TN, VA, WV

Map Zones: 53:N, 57:C, 59:N, 60:N, 61:C, 62:N, 64:N

TNC Ecoregions: 50:P, 51:P, 59:C, 61:?

SOURCES

References: Comer et al. 2003, Fleming et al. 2004

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723010#references

Description Author: S.C. Gawler, mod. M. Pyne

Version: 13 Apr 2006

Concept Author: S.C. Gawler

Stakeholders: East, Southeast

ClassifResp: East

1350 CENTRAL AND SOUTHERN APPALACHIAN SPRUCE-FIR FOREST (CES202.028)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Montane; Forest and Woodland (Treed); Needle-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Evergreen closed tree canopy

National Mapping Codes: EVT 2350; ESLF 4253; ESP 1350

CONCEPT

Summary: This system consists of forests in the highest elevation zone of the Southern Blue Ridge and parts of the central Appalachians, generally dominated by *Picea rubens*, *Abies fraseri*, or *Abies balsamea*, or by a mixture of spruce and one of the firs. *Abies fraseri* is the constituent fir from Mount Rogers in Virginia southward and is replaced northward by *Abies balsamea*. Examples occur above 1676 m (5500 feet) in the Southern Blue Ridge but as low as 975 m (3200 feet) at the northern range in West Virginia and may range up to the highest peaks. Elevation and orographic effects make the climate cool and wet, with heavy moisture input from fog as well as high rainfall. Strong winds, extreme cold, rime ice, and other extreme weather are periodically important.

Classification Comments: The border of this system with adjacent systems is often gradational. The non-forested systems that occur in the same elevation zone may have transition zones of open woody vegetation, though some have sharp borders. The transition to Southern Appalachian Northern Hardwood Forest (CES202.029) or other systems that adjoin at lower elevation is marked by a gradual shift in canopy dominance from conifers to hardwoods. In relatively undisturbed stands, the canopy composition and structure are the best way to determine the boundary of this system.

This system is similar to the spruce-fir systems of the northern Appalachians and the boreal forests but differs in having less frequent natural fire, having southern seasonal dynamics (shorter winters, less extreme cold temperatures, lack of long summer days), lacking a history of glaciation, and in a flora and fauna that has southern Appalachian endemics and lacks some characteristic northern species. High-elevation spruce-fir in West Virginia is placed in this system because its location well below the glacial boundary and presence of species of more southern affinity (e.g., *Rhododendron maximum* and *Vaccinium erythrocarpum*) differentiate it from the northern Appalachian system, despite having *Abies balsamea* rather than *Abies fraseri*. *Abies balsamea* appears to be infrequent in this system, for example being restricted to wet areas in West Virginia.

DESCRIPTION

Environment: This system occurs at elevations typically above 1676 m (5500 feet), up to the highest peaks. It occurs on most of the landforms that are present in this elevational range; most sites are strongly exposed and convex in shape. Elevation and orographic effects make the climate cool and wet, with heavy moisture input from fog as well as high rainfall. Strong winds, extreme cold, rime ice, and other extreme weather are periodically important. Concentration of air pollutants has been implicated as an important anthropogenic stress in recent years. Soils are generally very rocky, with the matrix ranging from well-weathered parent material to organic deposits over boulders. Soils may be saturated for long periods from a combination of precipitation and seepage. Any kind of bedrock may be present, but most sites have erosion-resistant felsic igneous or metamorphic rocks.

Vegetation: Vegetation consists primarily of forests dominated by *Picea rubens*, *Abies fraseri*, or *Abies balsamea*, occasionally by *Sorbus americana*, *Betula alleghaniensis*, *Tsuga canadensis*, and *Quercus rubra* are the only other locally common canopy species. Lower strata are most typically dominated by mosses, ferns or forbs, but a few associations have dense shrub layers of *Rhododendron catawbiense*, *Rhododendron maximum*, or *Vaccinium erythrocarpum*.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Despite the extreme climate, *Picea rubens* is long-lived (300-400 years). Both *Picea* and *Abies* seedlings are shade-tolerant, and advanced regeneration is important in stand dynamics. Natural disturbances include lightning fire, debris avalanches, wind events, and ice storms (White and Pickett 1985, Nicholas and Zedaker 1989). Occasional extreme wind events disturb larger patches on the most exposed slopes. There are hints of fir wave activity in the uncommon forests strongly dominated by *Abies fraseri*, but this is not well-developed. Fire is a very rare event under natural conditions, due to the wetness and limited flammability of the undergrowth, and return intervals have been estimated between 500-1000 years. If fires occur, they are likely to be catastrophic, because few of the species are at all fire-tolerant. Anthropogenic disturbances and stresses, beyond the effects of logging, have had major effects on dynamics in these systems in recent decades. An introduced insect, the balsam woolly adelgid (*Adelges piceae*), has killed almost all of the mature *Abies fraseri*. Saplings are not susceptible, resulting in many dense stands of young trees. It is unclear if these stands will establish seedlings before they too are killed. Stress caused by concentrated air pollutants on the mountain tops has been suggested as a cause of observed growth declines in *Picea rubens*. Earlier, unnatural fires fueled by logging slash turned large expanses of this system into grass-shrub-hardwood scrub that has not recovered to conifer dominance after 90 years. Climatic changes may affect this systems severely. Global warming can be expected to raise the lower elevational limit and greatly reduce the land area available to this system.

MEMBERSHIP

Associations:

- *Abies fraseri* / (*Rhododendron catawbiense*, *Rhododendron carolinianum*) Forest (CEGL006308, G1)
- *Abies fraseri* / *Viburnum lantanoides* / *Dryopteris campyloptera* - *Oxalis montana* / *Hylocomium splendens* Forest (CEGL006049, G1)
- *Picea rubens* - (*Abies fraseri*) / (*Rhododendron catawbiense*, *Rhododendron maximum*) Forest (CEGL007130, G1)
- *Picea rubens* - (*Abies fraseri*) / *Vaccinium erythrocarpum* / *Oxalis montana* - *Dryopteris campyloptera* / *Hylocomium splendens* Forest (CEGL007131, G2)
- *Picea rubens* - (*Betula alleghaniensis*, *Aesculus flava*) / *Rhododendron (maximum, catawbiense)* Forest (CEGL004983, G1?)
- *Picea rubens* - (*Betula alleghaniensis*, *Aesculus flava*) / *Viburnum lantanoides* / *Oxalis montana* - *Solidago glomerata* Forest (CEGL006256, G2)
- *Picea rubens* - (*Tsuga canadensis*) / *Rhododendron maximum* Forest (CEGL006152, G2G3)
- *Picea rubens* / *Acer rubrum* / *Maianthemum canadense* - (*Lycopodium clavatum*, *Lycopodium dendroideum*) Forest (CEGL008501, G2)
- *Picea rubens* / *Ribes glandulosum* Forest (CEGL007128, G1)
- *Rubus canadensis* - (*Rubus idaeus* ssp. *strigosus*) / *Athyrium filix-femina* - *Solidago glomerata* Shrubland (CEGL003893, GNA)

Alliances:

- *Abies fraseri* - *Picea rubens* Forest Alliance (A.136)
- *Picea rubens* - *Betula alleghaniensis* Forest Alliance (A.384)
- *Picea rubens* Forest Alliance (A.138)
- *Rubus allegheniensis* - *Rubus canadensis* Shrubland Alliance (A.930)

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch to matrix system, dominating the highest mountain areas. Small-patch systems may be embedded.
Size: Generally covers most of the landscape in the limited areas at the tops of the highest mountain ranges. Natural patches range from hundreds to thousands of acres. A couple remnant patches of thousands of acres remain, while other intact patches are dozens of acres embedded in landscapes of degraded spruce-fir systems.

Adjacent Ecological Systems:

- Southern Appalachian Grass and Shrub Bald (CES202.294)
- Southern Appalachian Northern Hardwood Forest (CES202.029)
- Southern Appalachian Rocky Summit (CES202.327)

Adjacent Ecological System Comments: Bordered by Southern Appalachian Northern Hardwood Forest (CES202.029) or Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593) at lower elevation. It may contain embedded small patches of Southern Appalachian Rocky Summit (CES202.327) and Southern Appalachian Grass and Shrub Bald (CES202.294).

DISTRIBUTION

Range: This system ranges from the Balsam Mountains and Great Smoky Mountains of North Carolina and Tennessee northward to the mountains of Virginia and West Virginia.

Divisions: 202:C

Nations: US

Subnations: NC, TN, VA, WV

Map Zones: 53:N, 57:C, 60:N, 61:C

TNC Ecoregions: 51:C, 59:C

SOURCES

References: Comer et al. 2003, Lohman and Watson 1943, Nicholas and Zedaker 1989, White and Pickett 1985

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722677#references

Description Author: M. Schafale and R. Evans, mod. S.C. Gawler and M. Pyne

Version: 17 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

1363 CENTRAL INTERIOR HIGHLANDS DRY ACIDIC GLADE AND BARRENS (CES202.692)

CLASSIFIERS

Conf.: 1 - Strong

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Non-Diagnostic Classifiers: Forest and Woodland (Treed); Woody-Herbaceous; Sedimentary Rock; Igneous Rock; Acidic Soil

FGDC Crosswalk: Vegetated, Tree-dominated, Open tree canopy, Mixed evergreen-deciduous open tree canopy

National Mapping Codes: EVT 2363; ESLF 4305; ESP 1363

CONCEPT

Summary: This system is primarily found in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions with small occurrences in northern Missouri. It occurs on flatrock outcrops and along moderate to steep slopes or valley walls of rivers along most aspects. Parent material includes chert, igneous and/or sandstone bedrock with well- to excessively well-drained, shallow soils interspersed with rock and boulders. These soils are typically dry during the summer and autumn, becoming saturated during the spring and winter. 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. In Kentucky, this system includes both sandstone glades found in the Shawnee Hills (EPA Ecoregions 71a, 72h of Woods et al. (2002)), as well as shale glades found in the Knobs region (EPA Ecoregions 70d, 71c of Woods et al. (2002)), both in the Kentucky Interior Low Plateau. It also includes dry *Quercus stellata*-dominated barrens on Cretaceous-aged gravel substrates on the northern fringes of the Upper East Gulf Coastal Plain Ecoregion in southern Illinois and western Kentucky. This system is influenced by drought and infrequent to occasional fires. Prescribed fires help manage this system by maintaining an open glade structure.

Classification Comments: The occurrence of this system in TNC Ecoregion 43 is apparently confined to southern Illinois and/or Kentucky but does not include any portions of states to the south.

Similar Ecological Systems:

- Appalachian Shale Barrens (CES202.598)
- Cumberland Sandstone Glade and Barrens (CES202.337)

Related Concepts:

- Sandstone Prairie (Evans 1991) Finer
- Shale Barrens (Evans 1991) Finer
- Shawnee Hills Sandstone Glade (Evans 1991) Finer
- Xeric Acidic Forest (Evans 1991) Finer

DESCRIPTION

Environment: This system occurs on flat outcrops of sandstone rock and along moderate to steep slopes or valley walls of rivers along most aspects. Parent material includes chert, shale, igneous and/or sandstone bedrock with well- to excessively well-drained, shallow soils interspersed with rock and boulders. These soils are typically dry during the summer and autumn, becoming saturated during the spring and winter.

Vegetation: 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. In the Shawnee Hills (EPA Ecoregions 71a, 72h of Woods et al. (2002)) of the Kentucky Interior Low Plateau, *Quercus marilandica*, *Quercus stellata*, and *Juniperus virginiana* are the dominant trees. Scattered shrubs, such as *Vaccinium arboreum* and *Chionanthus virginicus*, occur on the margins in patches of deeper soil. *Quercus prinus* may be present in the eastern part of the range.

Dynamics: This system is influenced by drought and infrequent to occasional fires. Prescribed fires help manage this system by maintaining an open glade structure.

MEMBERSHIP

Associations:

- (*Quercus stellata*, *Ulmus alata*) / *Schizachyrium scoparium* - *Symphotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation (CEGL007824, G2?)
- *Asplenium montanum* - *Heuchera parviflora* var. *parviflora* - *Silene rotundifolia* Sparse Vegetation (CEGL004392, G3G4)
- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus marilandica* - *Juniperus virginiana* var. *virginiana* / *Schizachyrium scoparium* - *Hypericum gentianoides* Wooded Herbaceous Vegetation (CEGL004062, G3?)
- *Quercus marilandica* / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland (CEGL002425, G3G4)
- *Quercus prinus* / *Cornus florida* - *Amelanchier arborea* / *Pityopsis graminifolia* var. *latifolia* Woodland (CEGL003706, G2?)
- *Quercus prinus* / *Danthonia spicata* - *Silene caroliniana* Woodland (CEGL004439, G2?)
- *Quercus stellata* - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation (CEGL007814, G2?)

- *Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland (CEGL002149, G2G3)
- *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* - *Silphium terebinthinaceum* Wooded Herbaceous Vegetation (CEGL005134, G1)
- *Schizachyrium scoparium* - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation (CEGL002242, G3)
- *Schizachyrium scoparium* - *Sedum nuttallianum* - *Selaginella rupestris* - *Portulaca pilosa* / Lichens Wooded Herbaceous Vegetation (CEGL002244, G1G2)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Andropogon ternarius* - *Coreopsis grandiflora* Sandstone - Shale Herbaceous Vegetation (CEGL002212, G3)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Coreopsis lanceolata* - *Croton willdenowii* Wooded Herbaceous Vegetation (CEGL002243, G4?)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Danthonia spicata* - *Silene regia* Chert Herbaceous Vegetation (CEGL002211, G3)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Asplenium montanum* Sparsely Vegetated Alliance (A.1831)
- *Pinus virginiana* Forest Alliance (A.131)
- *Quercus prinus* - *Quercus coccinea* Woodland Alliance (A.622)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

DISTRIBUTION

Range: This system is found in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions, with rare and limited occurrences in the Upper East Gulf Coastal Plain of Kentucky and Illinois.

Divisions: 202:C; 203:C

Nations: US

Subnations: AR, IL, IN, KY, MO, OK, TN?

Map Zones: 43:P, 44:C, 46:?, 47:C, 48:C, 49:C, 53:C

TNC Ecoregions: 36:C, 38:C, 39:C, 43:C, 44:C

SOURCES

References: Comer et al. 2003, Evans 1991, Heikens and Robertson 1995, Nelson 1985, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.722967#references

Description Author: S. Menard and T. Nigh, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: S. Menard and T. Nigh

Stakeholders: Midwest, Southeast

ClassifResp: Midwest

1372 EAST GULF COASTAL PLAIN INTERIOR SHORTLEAF PINE-OAK FOREST (CES203.506)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Short Disturbance Interval

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Mixed evergreen-deciduous closed tree canopy

National Mapping Codes: EVT 2372; ESLF 4315; ESP 1372

CONCEPT

Summary: This forested system of the East Gulf Coastal Plain occurs most extensively on generally rolling uplands north of the range of *Pinus palustris*. It was the historical matrix in large areas of the region in Alabama and Mississippi, particularly between about 32 degrees 30 minutes N latitude (the approximate local northern limit of the historic range of *Pinus palustris*), and about 35 degrees N latitude (the approximate limit where relatively extensive examples of *Pinus echinata* are replaced by predominantly hardwood-dominated systems, although isolated examples of this system may occur both north and south of these boundaries in limited areas. Stands tend to occur on generally well-drained sandy or clayey soils with dry to dry-mesic moisture regimes. *Pinus echinata* is the dominant pine species of the generalized "dry and dry-mesic oak-pine" forest type in the Gulf Coastal Plain (White and Lloyd 1998) and is the most characteristic floristic component of this system. The actual amount of *Pinus echinata* present varies based on a number of factors, but intact examples of this system often include stands that are dominated by *Pinus echinata* grading into stands with a mixture of upland hardwoods. Locally, on mid to lower slopes, *Pinus taeda* may be a component, extending further upslope in the absence of fire. Fire is possibly the most important natural process affecting the floristic composition and vegetation structure of this system, although fire-return intervals are lower than those associated with the East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland (CES203.496). *Pinus echinata* may have difficulty replacing itself in the absence of fire, particularly on sites other than the driest ones (Eyre 1980). Landers (1989) inferred a fire-return interval of 10 times per century for *Pinus echinata*. Local topographic conditions affecting natural fire compartment size generally lend themselves to this fire frequency, although some examples may have more frequent fires and some less than this generalized value. Where fire is most frequent the system may develop a relatively pure canopy of *Pinus echinata* typified by a very open woodland structure with scattered overstory trees and an herbaceous-dominated understory; such examples are rare on the modern landscape. More typical are areas in which *Quercus* spp., *Carya* spp., *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Acer* spp., and *Nyssa sylvatica* have become prominent in the midstory and even overstory and in which herbaceous patches are rare. Although the general distributional boundaries described above indicate where this system formed an historical landscape matrix, smaller patches of the system may also be present in limited areas both north and south of these boundaries. Although Lawson (1990) maps the native range of shortleaf throughout a relatively large area of western Tennessee, the actual distribution of the species appears to be much more confined and almost absent from the Coastal Plain (Chester 1990); when present, it occurs in only small stands on dry southwestern aspects (C. Nordman pers comm.).

Classification Comments: The range of this system overlaps with East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483) in the Fall Line Hills ecoregion (65i) of Alabama and in the Southern Hilly Gulf Coastal Plain ecoregion (65d) of Mississippi and may overlap to some degree with Southern Coastal Plain Dry Upland Hardwood Forest (CES203.560) as well. In parts of the overlapping range (including the Oakmulgee Ranger District of the Talladega National Forest), these types occur in a mosaic which is difficult to interpret environmentally and ecologically (A. Schotz pers. comm.). East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482) replaces this system along the northern and northwestern boundary in Tennessee.

Similar Ecological Systems:

- East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland (CES203.496)
- East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)
- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)
- Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland (CES202.313)

DESCRIPTION

Environment: The core distribution of this system lies between about 32 degrees 30 minutes N latitude and about 35 degrees N latitude; more localized occurrences may be found as small patches both north and south of these boundaries embedded in other systems. The belted character of this region, in the form of inner lowlands and cuestas and other low-ridge landforms (Bowman 1911, Fenneman 1938), the associated diversity of soil types, and differences in settlement history appear to account for the importance of shortleaf pine in the Gulf Coast region when compared to the Atlantic Coastal Plain (White and Lloyd 1998). Cuestas and other hills create strong environmental gradients which, coupled with soil characteristics, promote a variety of mixed pine and pine-hardwood vegetation in this region; local differences in topography, parent material, and exposure influence site characteristics, resulting in numerous different plant communities. This system primarily occupies the dry and dry-mesic portion of regional moisture gradients. Wide variation in vegetation composition across this gradient is also strongly related to fire frequency and intensity (White and Lloyd 1998). Generally to the south and southeast it grades into longleaf pine-dominated system(s), and to the north into hardwood-dominated ones.

Vegetation: This system is primarily composed of forest or woodland vegetation dominated by trees generally up to about 33 m (100 feet) in height. Individual patches or stands may be predominantly evergreen, predominantly deciduous, or mixed. The canopy will be primarily relatively closed (greater than 60%), but some areas may exhibit lower canopy closures, either as a result of repeated surface fires, timber removal, or other disturbances. This system includes the Shortleaf Pine-Oak Cover Type (Eyre 1980) as expressed in the Upper East Gulf Coastal Plain. In contrast to most of the Atlantic Coastal Plain, *Pinus echinata* is a much more ecologically and economically important species across much of the Gulf Coastal Plain, both presently and historically (Mohr 1901, Harper 1920, 1943). The actual vegetation composition depends greatly upon local site conditions, ongoing management, and disturbance history of an area. Locally, the species that comprise the system are strongly influenced by soil, slope, and aspect (Eyre 1980). Examples may be composed of various mixtures of pines and hardwoods. Although the actual amount of *Pinus echinata* present varies based on a number of factors, intact examples of this system often include stands that are dominated by *Pinus echinata* grading into stands with a mixture of upland hardwoods. Where fire is most frequent the system may develop a relatively pure canopy of shortleaf typified by a very open woodland structure with scattered overstory trees and an herbaceous-dominated understory; such examples are rare on the modern landscape. More typical are areas in which *Pinus echinata* trees occur in mixture with *Quercus* spp. and *Carya* spp. Many such areas also support *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Acer* spp., and *Nyssa sylvatica*, and even *Pinus taeda*. When these species are prominent in the overstory and midstory it is generally thought to be indicative of fire suppression. *Quercus alba* and *Quercus stellata* are common hardwood components, particularly in later-seral or higher-quality stands, typically combined with *Carya alba*, *Carya pallida*, *Carya glabra*, and other *Carya* spp. Higher-quality areas may exhibit somewhat open canopies. Other tree species indicative of recent disturbance and/or fire suppression are *Quercus nigra*, *Quercus hemisphaerica*, *Quercus falcata*, and *Quercus velutina*. Subcanopies will typically contain *Cornus florida*, *Oxydendrum arboreum*, *Nyssa sylvatica*, and *Liquidambar styraciflua*. The patchy shrub layer includes *Vaccinium arboreum*, *Vaccinium elliotii*, *Asimina parviflora*, *Aesculus pavia*, *Hamamelis virginiana*, *Callicarpa americana*, *Hypericum hypericoides*, *Gelsemium sempervirens*, *Vitis rotundifolia*, and *Arundinaria gigantea*. Herbs, which may be few and sparse, include *Cnidocolus stimulosus*, *Indigofera caroliniana*, *Aristolochia serpentaria*, *Piptochaetium avenaceum*, *Chasmanthium sessiliflorum*, *Elephantopus tomentosus*, *Hexastylis arifolia*, *Iris verna*, *Rudbeckia fulgida*, *Solidago juncea*, *Euphorbia pubentissima*, *Mitchella repens*, and *Desmodium* spp. (NatureServe Ecology unpubl. data 2003). Other associates may include *Smilax* spp., *Symphotrichum* spp., *Coreopsis* spp., *Lespedeza* spp., *Viola pedata*, *Mimosa microphylla*, *Antennaria* spp., *Clitoria mariana*, *Senna* spp., *Chasmanthium latifolium*, *Dichantherium* spp., *Andropogon* spp., *Schizachyrium scoparium*, and *Carex* spp. (Lawson 1990).

Dynamics: The frequent presence of surface fire is important in order to support the reproduction of *Pinus echinata*, which is a critical species characteristic to the system. *Pinus echinata* is a shade-intolerant species and does not survive or grow well when fire-suppressed. Outbreaks of *Dendroctonus frontalis* (Southern Pine Beetle) also play an important role in shaping the dynamics of this system and the balance of pine versus hardwood dominance over time. Young shortleaf pines are generally slower growing and slower to dominate a site than *Pinus taeda* or many hardwood competitors, but they usually will endure competition longer than the common associate, *Pinus taeda*. *Pinus echinata* can maintain dominance on most sites after it overtops competing vegetation, but in general hardwoods cannot be eliminated from pine sites. On very good sites (i.e., with high site index), however, it may not outgrow competing species such as sweetgum and red maple (Lawson 1990).

MEMBERSHIP

Associations:

- *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest (CEGL007124, GNA)
- *Pinus echinata* - *Pinus taeda* - *Quercus* (*alba*, *stellata*) - *Carya alba* / *Oxydendrum arboreum* Forest (CEGL008493, G2G3)
- *Pinus echinata* - *Quercus alba* - *Carya alba* East Gulf Coastal Plain Forest (CEGL004050, G2G3)
- *Pinus echinata* - *Quercus falcata* East Gulf Coastal Plain Forest (CEGL004052, G2G3)
- *Pinus echinata* - *Quercus stellata* - (*Quercus marilandica*) Forest (CEGL004053, G1)
- *Pinus echinata* Early-Successional Forest (CEGL006327, GNA)
- *Pinus taeda* - *Liquidambar styraciflua* Semi-natural Forest (CEGL008462, GNA)

Alliances:

- *Juniperus virginiana* Semi-natural Forest Alliance (A.137)
- *Pinus echinata* - *Quercus* (*alba*, *falcata*, *stellata*, *velutina*) Forest Alliance (A.394)
- *Pinus echinata* Forest Alliance (A.119)
- *Pinus taeda* Forest Alliance (A.130)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Limestone Forest (CES203.502)
- East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)
- East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods (CES203.557)
- Southern Coastal Plain Dry Upland Hardwood Forest (CES203.560)
- Western Highland Rim Prairie and Barrens (CES202.352)

Adjacent Ecological System Comments: East Gulf Coastal Plain Limestone Forest (CES203.502) occurs adjacent in parts of the region, especially the Black Belt.

DISTRIBUTION

Range: East Gulf Coastal Plain; it was the historical matrix in large areas of the region in Alabama and Mississippi, particularly between about 32 degrees 30 minutes N latitude and about 35 degrees N latitude. In southwestern Mississippi, this system is

apparently dominant on the landscape west of 91 degrees W longitude to the limits of the alluvial plain and northwest of a line running approximately from the intersection of 31 degrees N latitude and 91 degrees W longitude, northeastward to the city of Jackson, Mississippi, extending at least to about 34 degrees N latitude. This is consistent with the ranges of Oak-Pine vegetation (generally equivalent to this system) versus Longleaf-Loblolly-Slash Pines in Shantz and Zon (1924).

Divisions: 203:C

Nations: US

Subnations: AL, MS, TN?

Map Zones: 46:C, 47:?

TNC Ecoregions: 43:C

SOURCES

References: Bowman 1911, Chester 1990, Comer et al. 2003, Eyre 1980, Fenneman 1938, Harper 1920b, Harper 1943, Landers 1989, Lawson 1990, Mohr 1901, NatureServe Ecology - Southeastern U.S. unpubl. data, Nordman pers. comm., Schotz pers. comm., Shantz and Zon 1924, White and Lloyd 1998

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723082#references

Description Author: R. Evans and A. Schotz

Version: 25 Aug 2004

Concept Author: R. Evans and A. Schotz

Stakeholders: Southeast

ClassifResp: Southeast

1328 EAST GULF COASTAL PLAIN LIMESTONE FOREST (CES203.502)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Circumneutral Soil; Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2328; ESLF 4134; ESP 1328

CONCEPT

Summary: This system represents deciduous forests of the East Gulf Coastal Plain where limestone or other calcareous substrates occur near enough to the surface to influence vegetation composition. Examples are most common in the Black Belt region of Alabama and Mississippi, but are also present in more isolated patches in other portions of the region, including western Alabama, eastern Georgia, and southwestern middle Tennessee. Generally, the vegetation consists of forests and woodlands on well-developed, deep soils. Related vegetation surrounding rock outcrops and calcareous prairies is accommodated within other ecological systems.

DESCRIPTION

Environment: Stands typically occur on ridges and upper to middle slopes of the East Gulf Coastal Plain where limestone or other calcareous substrates occur near enough to the surface to influence vegetation composition.

Vegetation: Typical stands are dominated by oaks and hickories, particularly species which are indicative of finer-textured soils and/or a higher base status in the soil (e.g., *Carya carolinae-septentrionalis*, *Quercus muehlenbergii*, *Quercus pagoda*, *Quercus shumardii*, *Quercus stellata*). Other hardwood trees include *Fraxinus americana*, *Liquidambar styraciflua*, *Acer barbatum*, and *Aesculus glabra*. The rare *Carya myristiciformis* may also be found in some stands. Understory trees may include *Fraxinus americana* and *Juniperus virginiana* var. *virginiana*. Early-successional or fire-suppressed stands may exhibit greater dominance by *Juniperus virginiana*. More nutrient-rich or fire-sheltered stands may exhibit dominance or codominance by *Fraxinus americana*, *Tilia americana* (most commonly var. *caroliniana*, but var. *heterophylla* along the Chattahoochee River), and/or *Acer barbatum*. Understory trees may include smaller examples of canopy species in addition to *Aesculus pavia* var. *pavia*, *Cercis canadensis*, *Cornus florida*, *Ostrya virginiana*, and *Ulmus alata*. Shrubs and woody vines may include *Arundinaria gigantea*, *Berchemia scandens*, *Bignonia capreolata*, *Coccolus carolinus*, *Cornus drummondii*, *Crataegus* spp., *Euonymus americanus*, *Euonymus atropurpureus*, *Frangula caroliniana*, *Hydrangea quercifolia*, *Ilex decidua*, *Menispermum canadense*, *Parthenocissus quinquefolia*, *Ptelea trifoliata*, *Sideroxylon lycioides*, *Staphylea trifolia*, *Symphoricarpos orbiculatus*, *Toxicodendron radicans*, *Viburnum* spp., and *Vitis* spp. Some typical herbs include *Chasmanthium laxum*, *Chasmanthium sessiliflorum*, *Dichanthelium boscii*, *Lithospermum tuberosum*, *Polystichum acrostichoides*, *Sanicula* spp., *Solidago auriculata*, *Spigelia marilandica*, *Trillium* spp., and *Verbesina virginica*. The ground layers of some stands may exhibit dominance by native warm-season grasses and other graminoids, including *Schizachyrium scoparium*, *Andropogon* spp., *Danthonia* spp., and *Carex cherokeensis*. In addition, *Tillandsia usneoides* may be present as an epiphyte.

MEMBERSHIP

Associations:

- *Acer barbatum* - *Aesculus glabra* - *Carya myristiciformis* - *Quercus shumardii* - *Quercus muehlenbergii* Forest (CEGL004671, G1G2)
- *Fraxinus americana* - *Juglans nigra* - *Ulmus rubra* / *Acer barbatum* - *Ostrya virginiana* / *Ptelea trifoliata* Forest (CEGL007180, G2)
- *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest (CEGL007124, GNA)
- *Quercus pagoda* - *Liquidambar styraciflua* / *Quercus shumardii* / *Verbesina virginica* - *Solidago auriculata* Forest (CEGL008585, G3G4)
- *Quercus shumardii* - *Fraxinus americana* - *Carya* spp. / *Juniperus virginiana* var. *virginiana* Forest (CEGL004685, G2?)
- *Quercus shumardii* - *Quercus pagoda* - *Fraxinus americana* / *Ostrya virginiana* - *Cornus florida* / *Trillium ludovicianum* Forest (CEGL007272, G1)
- *Tilia americana* (var. *caroliniana*, var. *heterophylla*) - *Acer barbatum* - *Fraxinus americana* / *Arundinaria gigantea* / *Tillandsia usneoides* Forest (CEGL008557, G2G3)

Alliances:

- *Acer barbatum* - *Fraxinus americana* - (*Juglans nigra*) Forest Alliance (A.214)
- *Juniperus virginiana* Semi-natural Forest Alliance (A.137)
- *Quercus shumardii* - *Quercus pagoda* Forest Alliance (A.252)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)

DISTRIBUTION

Range: This system occurs in the East Gulf Coastal Plain, most commonly in the Black Belt region of Alabama and Mississippi. It is also present in more isolated patches in other portions of the region, including western Alabama, eastern Georgia, and marginally in southwestern middle Tennessee.

Divisions: 203:C

Nations: US

Subnations: AL, GA?, MS, TN

Map Zones: 46:C, 55:C

TNC Ecoregions: 43:C, 53:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723086#references

Description Author: A. Schotz and R. Evans, mod. M. Pyne

Version: 29 Sep 2006

Concept Author: A. Schotz and R. Evans

Stakeholders: Southeast

ClassifResp: Southeast

1307 EAST GULF COASTAL PLAIN NORTHERN DRY UPLAND HARDWOOD FOREST (CES203.483)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2307; ESLF 4113; ESP 1307

CONCEPT

Summary: This system represents dry, upland, predominantly hardwood forests of limited portions of the Coastal Plain of western Kentucky and Tennessee, northern Mississippi and Alabama. The core range of this type lies within the Northern Hilly Coastal Plain (Level IV Ecoregion 65e) of Omernik (EPA 2004), which includes the Northern Pontotoc Ridge (222Cf), Upper Loam Hills (222Cg), and Northern Loessal Hills (222Ce) subsections of Keys et al. (1995). These areas occupy the eastern margin of the upper Coastal Plain where elevation is greatest and influence of loess is less than adjacent areas to the west. The vegetation has been broadly considered distinct from other Coastal Plain forests (Bryant et al. 1993, Fralish and Franklin 2002) but has received almost no specific study. Although vastly forested when compared to the loess plains to the west (USGS 1992), most of the vegetation is recovering from one or more forms of severe disturbance (Franklin and Kupfer 2000). *Quercus alba* dominates the upland forests which have been studied in a limited portion of this area (Franklin and Kupfer 2000), but communities have not been described to the same detail as in other ecological systems.

Classification Comments: The range of this system overlaps with East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506) in the Fall Line Hills (Ecoregion 65i) of Alabama and in the Southern Hilly Gulf Coastal Plain (Ecoregion 65d) of Mississippi and may overlap to some degree with Southern Coastal Plain Dry Upland Hardwood Forest (CES203.560) at its southern boundary as well. In parts of the overlapping range (including the Oakmulgee Ranger District of the Talladega National Forest), these types occur in a mosaic which is difficult to interpret environmentally and ecologically (A. Schotz pers. comm.). The vegetation of this system has received almost no specific study and is extremely poorly documented.

Similar Ecological Systems:

- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)

DESCRIPTION

Environment: The most northern examples (e.g., western Tennessee and Kentucky) occur along the eastern margin of the Coastal Plain where elevation is greatest and influence of loess is minimal, and where they occur as predominantly slope forests in relatively deep, dissected stream valleys. The vegetation in this region has been broadly considered distinct from other Coastal Plain forests (Bryant et al. 1993, Fralish and Franklin 2002) but has received almost no specific study (Franklin and Kupfer 2000). Although vastly forested when compared to the loess plains to the west (USGS 1992), most of the vegetation is recovering from one or more forms of severe disturbance (Franklin and Kupfer 2000). *Quercus alba* dominates the upland forests which have been studied in a limited portion of this area (Franklin and Kupfer 2000), but communities have not been described to the same detail as in other ecological systems.

Dynamics: Fire suppression and the resulting greater understory density and resulting cooler conditions on the forest floor affect this system.

MEMBERSHIP

Associations:

- *Liquidambar styraciflua* - *Quercus (alba, falcata)* Forest (CEGL007217, GNA)
- *Liriodendron tulipifera* - *Quercus* spp. Forest (CEGL007221, GNA)
- *Quercus alba* - *Carya glabra* - *Carya alba* / *Aesculus pavia* Forest (CEGL007225, G4?)
- *Quercus alba* - *Carya glabra* / Mixed Herbs Coastal Plain Forest (CEGL007226, G4?)
- *Quercus falcata* - *Quercus alba* - *Carya alba* / *Oxydendrum arboreum* / *Vaccinium stamineum* Forest (CEGL007244, G4G5)
- *Quercus falcata* - *Quercus stellata* - *Carya alba* / *Vaccinium* spp. Coastal Plain Forest (CEGL007246, G4?)
- *Quercus muehlenbergii* - *Carya* spp. / *Ostrya virginiana* Upper East Gulf Coastal Plain Forest (CEGL003903, G3)
- *Quercus pagoda* - (*Quercus falcata*) / *Ostrya virginiana* Forest (CEGL003871, G3?)
- *Quercus prinus* - *Carya* spp. - *Quercus velutina* / *Vaccinium arboreum* / *Iris verna* var. *smalliana* Forest (CEGL007261, G3G4)
- *Quercus prinus* - *Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia*, *Styrax grandifolius*) Forest (CEGL007700, G4)
- *Quercus stellata* - *Quercus marilandica* - *Carya (alba, pallida)* Upper East Gulf Coastal Plain Woodland (CEGL003952, G2G3)
- *Quercus velutina* - *Carya pallida* - *Tilia americana* var. *heterophylla* / *Celtis laevigata* / *Aesculus pavia* Forest (CEGL008565, G3G4)

Alliances:

- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Liriodendron tulipifera* Forest Alliance (A.236)

- *Quercus alba* - (*Quercus nigra*) Forest Alliance (A.238)
- *Quercus alba* - *Quercus (falcata, stellata)* Forest Alliance (A.241)
- *Quercus falcata* Forest Alliance (A.243)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus prinus* - *Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)
- *Quercus shumardii* - *Quercus pagoda* Forest Alliance (A.252)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Quercus velutina* - *Quercus alba* - (*Quercus coccinea*) Forest Alliance (A.1911)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)
- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)
- South-Central Interior / Upper Coastal Plain Flatwoods (CES203.479)

Adjacent Ecological System Comments: To the west this system grades into East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482). The two types are similar and may be difficult to distinguish where they come together. The loess plain type is believed to be more mesic and richer floristically due to the influence of the loessal soils. However, it is also rare due to the fertility of the soils for agriculture. More work is needed to better quantify the differences between these types and their exact boundaries.

DISTRIBUTION

Range: Coastal Plain of western Kentucky and Tennessee, northern Mississippi and Alabama.

Divisions: 203:C

Nations: US

Subnations: AL, KY, MS, TN

Map Zones: 46:C, 47:C

TNC Ecoregions: 43:C

SOURCES

References: Bryant et al. 1993, Comer et al. 2003, Fralish and Franklin 2002, Franklin and Kupfer 2000, Keys et al. 1995, Smalley et al. 1996, Springer and Elder 1980, USGS 1992

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723103#references

Description Author: R. Evans and M. Pyne

Version: 30 Sep 2003

Concept Author: R. Evans and M. Pyne

Stakeholders: Southeast

ClassifResp: Southeast

1327 EAST GULF COASTAL PLAIN NORTHERN LOESS BLUFF FOREST (CES203.481)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Loess deposit (undifferentiated); Forest and Woodland (Treed); Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2327; ESLF 4133; ESP 1327

CONCEPT

Summary: This system is largely confined to steep bluffs bordering the northern portion of the eastern edge of the Mississippi River Alluvial Plain. The geology is typically mapped as the Jackson Formation. These bluffs extend up to 150 m (500 feet) in elevation and from 30 to 60 m (100-200 feet) above the adjacent plain. They consist of a belt of Pleistocene and Tertiary eolian deposits (Braun 1950) that are often deeply eroded and very steep, with fertile top soil and abundant moisture (Miller and Neiswender 1987). The vegetation is often richer than surrounding non-loessal areas, or those with only thin loess deposits. The forests found on these bluffs are intermediate in soil moisture for the region and may best be thought of as mesic. The vegetation may sometimes be referred to as western mesophytic forest and may share some superficial similarities with cove forests of the Interior Highlands. In many cases, these bluffs provide habitat for plant species that are rare or absent from other parts of the Coastal Plain. Braun (1950) noted that the composition of forest changes from north to south along the bluffs; more southerly examples are represented by the East Gulf Coastal Plain Southern Loess Bluff Forest (CES203.556), and these would contain *Magnolia grandiflora* as an important component. As currently defined this system ranges northward from about 32 degrees N latitude (where the Big Black River cuts through the bluffs), and occurs only in the westernmost portions of the Upper East Gulf Coastal Plain, including northern and central Mississippi, western Tennessee, and western Kentucky, being restricted to the northern part of the Loess Bluff Hills (Ecoregion 74a of EPA (2004)).

Classification Comments: Similar ecological systems include East Gulf Coastal Plain Southern Loess Bluff Forest (CES203.556) which occurs further southward in the East Gulf Coastal Plain and has greater dominance by broad-leaved and needle-leaved evergreen trees, Southern Coastal Plain Mesic Slope Forest (CES203.476), and East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477). There are other mixed deciduous mesic systems in the West Gulf Coastal Plain as well as other mesic forest systems to the east of this one, in areas other than the loess bluffs.

Similar Ecological Systems:

- East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477)
- East Gulf Coastal Plain Southern Loess Bluff Forest (CES203.556)
- Mississippi River Alluvial Plain Loess Slope Forest (CES203.037)
- Southern Coastal Plain Mesic Slope Forest (CES203.476)

Related Concepts:

- Coastal Plain Mesophytic Cane Forest (Evans 1991) Finer

DESCRIPTION

Environment: This system is largely confined to steep bluffs east of the Mississippi River consisting of a belt of Pleistocene and Tertiary eolian deposits (Braun 1950) that are often deeply eroded and very steep, with fertile topsoil and abundant moisture (Miller and Neiswender 1987). The core of this is mapped as the Jackson Formation (Hardeman 1966) and corresponds more broadly with Ecoregion 74a (Bluff Hills) (EPA 2004). These bluffs border the eastern edge of the Mississippi River Alluvial Plain from about 32 degrees N latitude (where the Big Black River cuts through the bluffs) northward to western Tennessee and Kentucky. Examples may extend up to 150 m (500 feet) in elevation and from 30 to 60 m (100-200 feet) above the adjacent Mississippi Alluvial Plain. In Tennessee the loess soils may be 9-27.5 m (30-90 feet deep) (Springer and Elder 1980).

Vegetation: Examples of this system have deciduous canopies dominated by *Fagus grandifolia* or this species in combination with *Quercus alba*. The most mesic stands may lack codominance by *Quercus* spp. In addition, a variety of other hardwood species may also be found in the overstory, including *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Nyssa sylvatica*, *Fraxinus americana*, *Magnolia acuminata* (of local distribution), and *Pinus taeda* (in more southern stands). This system is defined as being north of the range of *Magnolia grandiflora*, which excludes the "Beech-Magnolia" forests of the southern loess bluffs. Some subcanopy components (in addition to canopy species) include *Carpinus caroliniana*, *Diospyros virginiana*, *Oxydendrum arboreum*, *Cornus florida*, *Acer barbatum*, *Magnolia macrophylla*, *Ostrya virginiana*, *Ulmus alata*, and *Ilex opaca*. Other shrubs and woody vines include *Decumaria barbara*, *Rhododendron canescens*, *Toxicodendron radicans*, *Vitis rotundifolia*, and *Smilax glauca*. Important herbs include *Polystichum acrostichoides*, *Woodwardia areolata*, *Osmunda cinnamomea*, *Mitchella repens*, and *Hexastylis arifolia*. In many cases, these bluffs provide habitat for plant species that are rare or absent from other parts of the Coastal Plain, such as *Magnolia acuminata*, *Aralia racemosa*, and *Hydrophyllum canadense* (Chester et al. 1997).

Dynamics: These are stable, generally fire-sheltered forests. There is presumably some natural disturbance from the effects of windstorms, which are relatively frequent in the range of this system.

MEMBERSHIP

Associations:

- *Liquidambar styraciflua* - *Carya illinoensis* - *Quercus nigra* Forest (CEGL004122, GNA)
- *Quercus alba* - *Quercus nigra* - *Carya pallida* - (*Quercus pagoda*) / *Magnolia (grandiflora, macrophylla)* Forest (CEGL004775, G3G4)
- *Quercus pagoda* - *Quercus nigra* Forest (CEGL004109, G3)

Alliances:

- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Quercus alba* - (*Quercus nigra*) Forest Alliance (A.238)
- *Quercus shumardii* - *Quercus pagoda* Forest Alliance (A.252)

DISTRIBUTION

Range: This system is endemic to the loess bluffs ("Bluff Hills" [Ecoregion 74a] of EPA (2004)) along the eastern edge of the Mississippi River Alluvial Plain in Mississippi, Tennessee, and Kentucky.

Divisions: 203:C

Nations: US

Subnations: KY, MS, TN

Map Zones: 46:C, 47:C

TNC Ecoregions: 43:C

SOURCES

References: Braun 1950, Chester et al. 1997, Comer et al. 2003, EPA 2004, Hardeman 1966, Miller and Neiswender 1987, Springer and Elder 1980

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723105#references

Description Author: R. Evans and M. Pyne

Version: 17 Jan 2006

Concept Author: R. Evans and M. Pyne

Stakeholders: Southeast

ClassifResp: Southeast

1306 EAST GULF COASTAL PLAIN NORTHERN LOESS PLAIN OAK-HICKORY UPLAND (CES203.482)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Loess deposit (undifferentiated); Forest and Woodland (Treed); Broad-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2306; ESLF 4112; ESP 1306

CONCEPT

Summary: This is the former matrix hardwood system flanking the loess bluffs of the most northern portions of the Upper East Gulf Coastal Plain of western Tennessee, western Kentucky, possibly southern Illinois, and northern Mississippi. The core distribution of this system is mapped as the Loess Plains (Level IV Ecoregion 74b) of Omernik (EPA 2004). Extensive forests once covered this broad area of generally flat to rolling uplands. Most have been cleared for agriculture due to the rich, productive soils derived from relatively thick loess deposits. The areal extent of this forested system has been so heavily reduced, that the component community types remain undocumented and speculative at best.

Classification Comments: The southern boundary of this system has not been clearly delineated; Omernik (EPA 2004) Ecoregion 74b extends farther south than the presumed boundary of this system. For now, the boundary is assumed to occur in northern Mississippi at the latitude of the junction of Omernik (EPA 2004) Ecoregion 65e and Ecoregion 65d (ca. 34 degrees N). To the east, this system grades into East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483). The two types may be similar and difficult to distinguish where they come together, but the former is believed to be more mesic and richer floristically due to the influence of the loessal soils. However, it is also rare due the fertility of the soils for agriculture. More work is needed to better quantify the differences between these types and their exact boundaries.

Similar Ecological Systems:

- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)

Related Concepts:

- Acidic Subseric Forest (Evans 1991) Broader

DESCRIPTION

Environment: Soils included in this system in western Tennessee are silty and rich, derived from loess deposits. Most of the soils have fragipans and some are poorly drained (Springer and Elder 1980).

Vegetation: Typical stands would contain oaks and other hardwoods, with scattered successional stands dominated by *Juniperus virginiana* var. *virginiana*. Some typical canopy dominants include *Quercus falcata*, *Quercus alba*, *Carya alba*, *Quercus stellata*, *Quercus marilandica*, and *Quercus velutina*.

MEMBERSHIP

Associations:

- *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest (CEGL007124, GNA)
- *Liquidambar styraciflua* - *Quercus* (*alba*, *falcata*) Forest (CEGL007217, GNA)
- *Quercus falcata* - *Quercus alba* - *Carya alba* / *Oxydendrum arboreum* / *Vaccinium stamineum* Forest (CEGL007244, G4G5)
- *Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland (CEGL002149, G2G3)

Alliances:

- *Juniperus virginiana* Semi-natural Forest Alliance (A.137)
- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Quercus alba* - *Quercus* (*falcata*, *stellata*) Forest Alliance (A.241)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)

SPATIAL CHARACTERISTICS

Spatial Summary: Historically a matrix system which dominated the landscape; in current condition only exists in small isolated patches.

Adjacent Ecological Systems:

- East Gulf Coastal Plain Jackson Plain Prairie and Barrens (CES203.353)
- East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)
- East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477)
- South-Central Interior / Upper Coastal Plain Flatwoods (CES203.479)
- South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480)

Adjacent Ecological System Comments: Included within this former matrix system were patches of other systems including East Gulf Coastal Plain Jackson Plain Prairie and Barrens (CES203.353), South-Central Interior / Upper Coastal Plain Wet Flatwoods

(CES203.480), and South-Central Interior / Upper Coastal Plain Flatwoods (CES203.479). It is bordered on the west by East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477) and to the east by East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483).

DISTRIBUTION

Range: This system would have occupied the most northern portions of the Upper East Gulf Coastal Plain of western Tennessee, western Kentucky, possibly southern Illinois, and northern Mississippi. Today it is reduced to remnants in a largely agricultural landscape.

Divisions: 203:C

Nations: US

Subnations: IL?, KY, MS, TN

Map Zones: 46:C, 47:C, 49:?

TNC Ecoregions: 43:C

SOURCES

References: Comer et al. 2003, EPA 2004, Springer and Elder 1980

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.723104#references

Description Author: R. Evans and M. Pyne

Version: 29 Jan 2003

Concept Author: R. Evans and M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

1325 EAST GULF COASTAL PLAIN NORTHERN MESIC HARDWOOD SLOPE FOREST (CES203.477)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Slope; Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2325; ESLF 4131; ESP 1325

CONCEPT

Summary: This system includes mesic deciduous hardwood forests of inland portions of the East Gulf Coastal Plain, including Alabama, Mississippi, western Kentucky, and western Tennessee. This system covers parts of the more mesic forests in the coastal plain portion of the Western Mesophytic Forest Region of Braun (1950) referred to as mesophytic mixed hardwoods, as well as mesic forests in the adjacent "Oak-Pine-Hickory" region to the south (Greller 1988). Examples of this system occur on slopes and ravines between dry uplands and stream bottoms. Mesic forests of the loess bluffs are treated in separate ecological systems, being confined to that landform of steep bluffs and ravines on deep loess. The most characteristic feature of the vegetation in some examples may be *Fagus grandifolia*, but a variety of other hardwood species may also be found in the overstory, and *Fagus grandifolia* may not always be present. Some stands may be dominated by *Fagus grandifolia* and *Quercus alba*, others by *Quercus alba* or *Quercus pagoda* with other mesic hardwoods. In addition, *Pinus taeda* may be common in some examples in the southern portion of the range and, depending on previous disturbance and site conditions, may be locally dominant [see CEGLO04763]. To the south this system is replaced by Southern Coastal Plain Mesic Slope Forest (CES203.476), which is within the range of *Pinus glabra* and *Magnolia grandiflora*. Most of the vegetation is recovering from one or more forms of severe disturbance (Franklin and Kupfer 2000).

Classification Comments: Southern Coastal Plain Mesic Slope Forest (CES203.476) is a similar mesic forest system to the south of this one in the East Gulf Coastal Plain with greater dominance by broad-leaved evergreen trees. The systems of the loess bluffs to the west of this one, bordering the Mississippi River Alluvial Plain, are treated as distinct and are more extensive and continuous in their extent both vertically and latitudinally [see East Gulf Coastal Plain Northern Loess Bluff Forest (CES203.481) and East Gulf Coastal Plain Southern Loess Bluff Forest (CES203.556)]. One association now (2005) included here (*Quercus alba* - *Fagus grandifolia* / *Hydrangea quercifolia* - *Viburnum acerifolium* / *Carex picta* - *Polystichum acrostichoides* Forest (CEGL007213)) has the majority of its occurrences in the interior regions (southern Cumberland Plateau, Ridge and Valley), but its flora contains some Coastal Plain elements as well as more interior ones. It is from a "transition region" where *Quercus rubra* may be present in parts of the upper Coastal Plain and conversely some more southerly affiliated species (e.g., *Decumaria barbara*) range farther north. This association is now affiliated with two different ecological systems.

Similar Ecological Systems:

- East Gulf Coastal Plain Northern Loess Bluff Forest (CES203.481)
- East Gulf Coastal Plain Southern Loess Bluff Forest (CES203.556)
- Southern Coastal Plain Mesic Slope Forest (CES203.476)

Related Concepts:

- Deep Soil Mesophytic Forest (Evans 1991) Intersecting

DESCRIPTION

Environment: This system occurs along the eastern margin of the Upper Coastal Plain where elevation is greatest and influence of loess is minimal where they occur as predominantly slope forests in relatively deep, dissected stream valleys. The vegetation in this region has been broadly considered distinct from other Coastal Plain forests (Bryant et al. 1993, Fralish and Franklin 2002) but has received almost no specific study (Franklin and Kupfer 2000). Although vastly forested when compared to the loess plains to the west (USGS 1992), most of the vegetation is recovering from one or more forms of severe disturbance (Franklin and Kupfer 2000).

Quercus alba dominates the upland forests which have been studied in a limited portion of this area (Franklin and Kupfer 2000), but communities have not been described to the same detail as in other ecological systems.

Vegetation: The most characteristic feature of the vegetation is a high cover value for *Fagus grandifolia*, but a variety of other hardwood species may also be found in the overstory. Stands are mesic, and some may be dominated by *Fagus grandifolia* and *Quercus alba*, others by *Quercus alba* or *Quercus pagoda* with other mesic hardwoods. This system is defined as being north of the range of *Magnolia grandiflora*, which excludes the "Beech-Magnolia" forests of the deeper south. From north to south, there is some floristic variability in the component floristics of this system. *Quercus rubra* will be of greater importance north of 35 degrees N latitude, and *Pinus taeda* conversely of greater importance to the south of this boundary. The core concept of this system consists of association types in which *Quercus* spp. can be present in the canopy, but are not dominant; but some may exhibit codominance by *Fagus grandifolia* and *Quercus alba* or other mesic *Quercus* spp. Other important canopy components include *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Nyssa sylvatica*, *Fraxinus americana*, *Magnolia acuminata* (of local distribution), *Magnolia virginiana*, and *Pinus taeda*. Some subcanopy components (in addition to canopy species) include *Carpinus caroliniana*, *Diospyros virginiana*, *Oxydendrum arboreum*, *Cornus florida*, *Acer barbatum*, *Magnolia macrophylla*, *Ostrya virginiana*, *Ulmus alata*, and *Ilex*

opaca. Other shrubs and woody vines include *Decumaria barbara*, *Rhododendron canescens*, *Toxicodendron radicans*, *Vitis rotundifolia*, and *Smilax glauca*. Important herbs include *Polystichum acrostichoides*, *Woodwardia areolata*, *Osmunda cinnamomea*, *Mitchella repens*, and *Hexastylis arifolia*. This system is found north of the distribution of *Pinus glabra* and *Magnolia grandiflora*, which will be absent.

Dynamics: These are stable, generally fire-sheltered forests. There is presumably some natural disturbance from the effects of hurricanes (to the south), or from other windstorms, which are relatively frequent in the range of this system.

MEMBERSHIP

Associations:

- *Fagus grandifolia* - *Acer saccharum* - *Liriodendron tulipifera* Unglaciated Forest (CEGL002411, G4?)
- *Fagus grandifolia* - *Liriodendron tulipifera* / *Euonymus americanus* / *Athyrium filix-femina* ssp. *asplenoides* Forest (CEGL007201, G4)
- *Fagus grandifolia* - *Quercus alba* / *Cornus florida* Forest (CEGL007881, G4)
- *Pinus taeda* - *Quercus alba* / *Chasmanthium sessiliflorum* Forest (CEGL004763, G3G4)
- *Quercus alba* - *Carya (alba, ovata)* - *Liriodendron tulipifera* - (*Quercus phellos*) / *Cornus florida* Forest (CEGL007709, G4)
- *Quercus alba* - *Carya glabra* - *Carya alba* / *Aesculus pavia* Forest (CEGL007225, G4?)
- *Quercus alba* - *Fagus grandifolia* / *Hydrangea quercifolia* - *Viburnum acerifolium* / *Carex picta* - *Polystichum acrostichoides* Forest (CEGL007213, G3G4)
- *Quercus alba* - *Quercus rubra* - *Carya (alba, ovata)* / *Cornus florida* Acid Forest (CEGL002067, G3)
- *Quercus pagoda* - *Quercus nigra* Forest (CEGL004109, G3)

Alliances:

- *Fagus grandifolia* - *Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance (A.227)
- *Fagus grandifolia* - *Quercus rubra* - *Quercus alba* Forest Alliance (A.229)
- *Pinus taeda* - *Quercus (alba, falcata, stellata)* Forest Alliance (A.404)
- *Quercus alba* - (*Quercus nigra*) Forest Alliance (A.238)
- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus shumardii* - *Quercus pagoda* Forest Alliance (A.252)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)

DISTRIBUTION

Range: This system is found in northern and inland portions of the East Gulf Coastal Plain, including Alabama, Mississippi, western Kentucky, and western Tennessee.

Divisions: 203:C

Nations: US

Subnations: AL, AR?, GA, KY, MS, TN

Map Zones: 46:C, 47:C

TNC Ecoregions: 43:C

SOURCES

References: Braun 1950, Bryant et al. 1993, Comer et al. 2003, Fralish and Franklin 2002, Franklin and Kupfer 2000, Greller 1988, USGS 1992

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723109#references

Description Author: R. Evans, M. Pyne, A. Schotz

Version: 17 Jan 2003

Concept Author: R. Evans, M. Pyne, A. Schotz

Stakeholders: Southeast

ClassifResp: Southeast

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

Diagnostic Classifiers: Pimple mounds; Forest and Woodland (Treed); Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2326; ESLF 4132; ESP 1326

CONCEPT

Summary: This system represents hardwood-dominated "xerohydric flatwoods" of limited areas of the most inland portions of the East Gulf Coastal Plain in western Kentucky, as well as in the nearby Shawnee Hills in the western Interior Low Plateau. The core of the area from which this system was initially described is referred to as the Jackson Purchase or "Jackson Plain," where these areas have long been recognized as a distinctive subdivision within this region (Davis 1923, Bryant and Martin 1988). There is some local variability in the expression of this system along a hydrologic/microtopographic gradient. The elevated ridges are composed of somewhat coarser-textured soils and retain less moisture than do the lower areas, although both occur in a tight local mosaic. The soils appear to have well-developed subsurface hardpans, the impermeability of which contributes to shallowly perched water tables during portions of the year when precipitation is greatest and evapotranspiration is lowest (not due to overbank flooding). Thus, soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to as xerohydric (Evans 1991). Fire was an important natural process in this system, and well-burned examples tend to be relatively open-canopied with well-developed herbaceous layers (M. Evans pers. comm.).

Classification Comments: The component associations are poorly known and described. More work is needed to clarify which types are present.

Similar Ecological Systems:

- South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480)

Related Concepts:

- Flatwoods (Evans 1991) Broader

DESCRIPTION

Environment: Examples of this system occur along the northeastern flank of the Upper East Gulf Coastal Plain ecoregion where loess deposits thin out and gravelly or sandy soils predominate. Examples occur on relatively high flat areas that are not directly affected by overbank flooding. These environments include ancient Quaternary or Tertiary post-glacial meltwater lakebeds and high terraces of the Upper Gulf Coastal Plain. The most typical soil is Okaw Silt Loam. The same system is found in the Shawnee Hills of Kentucky (M. Evans pers. comm. 2006). The lakes were originally formed by glacial damming of the Ohio River.

Vegetation: Stands of this system are dominated by *Quercus stellata*, a somewhat fire-tolerant oak. In addition, *Quercus alba*, *Carya ovata*, *Carya glabra*, and *Quercus velutina* may be present. The presence of *Quercus falcata* indicates longer fire-return times. The presence of *Quercus imbricaria* indicates that the stands were formerly more open. *Pinus* spp. are not prevalent in this area, but could invade from nearby plantations. Herbaceous cover is sparse to moderate; leaf litter is the dominant ground cover. Some shrubs include *Crataegus viridis*, *Ilex decidua*, and *Ulmus alata*. Characteristic grasses could include *Schizachyrium scoparium*, *Sorghastrum nutans*, and *Andropogon* spp. Some other typical herbs include *Manfreda virginica*, *Croton willdenowii*, *Danthonia spicata*, *Porteranthus stipulatus*, and *Pycnanthemum tenuifolium* (Hendricks et al. 1991). Lower areas (drainage ways and depressions) have *Quercus michauxii*, *Quercus pagoda*, *Quercus phellos*, *Liquidambar styraciflua*, or even *Taxodium distichum*. Local herb dominance in depressions is of wetland species such as *Juncus* spp. and *Carex* spp. For this related and possibly juxtaposed wetland vegetation, see South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480).

MEMBERSHIP

Associations:

- *Quercus stellata* / (*Danthonia spicata*, *Croton willdenowii*) Woodland (CEGL005057, G1)
- *Quercus stellata* / *Cinna arundinacea* Flatwoods Forest (CEGL002405, G2G3)

Alliances:

- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Quercus stellata* Flatwoods Forest Alliance (A.261)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)
- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)

Adjacent Ecological System Comments: East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483).

DISTRIBUTION

Range: This system occurs in limited areas of the most inland portions of the East Gulf Coastal Plain in western Kentucky and adjacent Tennessee (the "Jackson Purchase" or "Jackson Plain" region; 222Cb; 74b in part), as well as in the nearby "Shawnee Hills" of the Interior Low Plateau (222Dh, 222Di; 72c) of Kentucky and adjacent Indiana.

Divisions: 203:C

Nations: US

Subnations: IL?, IN, KY, TN

Map Zones: 46:P, 47:C, 49:?, 53:N

TNC Ecoregions: 43:C, 44:C

SOURCES

References: Bryant and Martin 1988, Comer et al. 2003, Davis 1923, Evans 1991, Hendricks et al. 1991, M. Evans pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723107#references

Description Author: R. Evans and M. Evans, mod. M. Pyne

Version: 18 Apr 2006

Concept Author: R. Evans and M. Evans

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

1321 SOUTH-CENTRAL INTERIOR MESOPHYTIC FOREST (CES202.887)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Sideslope; Unglaciated; Eutrophic Soil; Broad-Leaved Deciduous Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2321; ESLF 4127; ESP 1321

CONCEPT

Summary: These high-diversity, predominately deciduous forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), usually in somewhat protected landscape positions such as coves or lower slopes. The core distribution of this system lies in the Cumberland and Allegheny plateaus, extending into the adjacent southern Ridge and Valley and portions of the Interior Low Plateau where it is located entirely south of the glacial boundary.

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. Many examples may be bisected by small streams.

Classification Comments: Southern and Central Appalachian Cove Forest (CES202.373) (Ecoregions 51 and 59) is being treated as a separate system. The concept of this type (CES202.887) is more-or-less consistent with the "Mixed Mesophytic Communities" of both the Mixed Mesophytic Forest Region and the non-coastal plain portion of the Western Mesophytic Forest Region of Braun (1950) and Greller (1988).

There is much variability in different examples of this system across its range, with the composition of some occurrences in the escarpment of the Cumberland Plateau approaching that of examples of Southern and Central Appalachian Cove Forest (CES202.373). One solution for this problem is to split off the "mixed mesophytic" system (of the Cumberlands and Ridge and Valley) from, on the one hand, CES202.373 of the 'true' Appalachians and, on the other, CES202.887 in a more narrow sense (of the non-coastal plain portion of the Western Mesophytic Forest Region).

Similar Ecological Systems:

- Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
- North-Central Interior Beech-Maple Forest (CES202.693)--is an equivalent system of glaciated terrain to the north.
- Ozark-Ouachita Mesic Hardwood Forest (CES202.043)
- Southern and Central Appalachian Cove Forest (CES202.373)--is found in adjacent regions to the east.

Related Concepts:

- Acidic Mesophytic Forest (Evans 1991) Finer
- Bluegrass Mesophytic Cane Forest (Evans 1991) Finer
- Calcareous Mesophytic Forest (Evans 1991) Finer

DESCRIPTION

Environment: These high-diversity deciduous forests occur on deep and enriched soils, usually in somewhat protected landscape positions such as coves or lower slopes.

Vegetation: Dominant tree 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. The herb layer is very rich, often with abundant spring ephemerals.

MEMBERSHIP

Associations:

- *Acer saccharum* - *Carya ovata* - *Juglans nigra* / *Symphoricarpos orbiculatus* / *Polymnia canadensis* - *Bromus pubescens* Forest (CEGL004741, G2G3Q)
- *Acer saccharum* - *Fraxinus americana* - *Juglans cinerea* / *Staphylea trifolia* Forest (CEGL006020, G4?)
- *Fagus grandifolia* - *Acer saccharum* - *Liriodendron tulipifera* Unglaciated Forest (CEGL002411, G4?)
- *Fagus grandifolia* - *Liriodendron tulipifera* / *Euonymus americanus* / *Athyrium filix-femina* ssp. *asplenioides* Forest (CEGL007201, G4)
- *Fagus grandifolia* - *Quercus alba* - (*Quercus prinus*) / *Kalmia latifolia* - (*Rhododendron catawbiense*) Forest (CEGL004539, G2?)
- *Fagus grandifolia* - *Quercus alba* / *Cornus florida* Forest (CEGL007881, G4)
- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* / (*Magnolia tripetala*) Forest (CEGL005222, G4?)
- *Quercus alba* - (*Liriodendron tulipifera*, *Liquidambar styraciflua*) / *Calycanthus floridus* / *Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba* - (*Quercus rubra*, *Acer saccharum*, *Fagus grandifolia*) / *Aesculus flava* Forest (CEGL007233, G4)
- *Quercus alba* - *Fagus grandifolia* / *Hydrangea quercifolia* - *Viburnum acerifolium* / *Carex picta* - *Polystichum acrostichoides*

- Forest (CEGL007213, G3G4)
- *Quercus rubra* - *Acer saccharum* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - (*Cladrastis kentukea*) Forest (CEGL007698, G3)
 - *Quercus rubra* - *Tilia americana* var. *heterophylla* - *Carya carolinae-septentrionalis* / *Acer (barbatum, leucoderme)* / *Hydrangea quercifolia* Forest (CEGL008488, G2G3)
 - *Tsuga canadensis* - (*Liriodendron tulipifera*, *Fagus grandifolia*) / (*Magnolia macrophylla*, *Ilex opaca*) / *Polystichum acrostichoides* Forest (CEGL004767, G1G2)

Alliances:

- *Acer saccharum* - *Fraxinus americana* - *Tilia americana* Forest Alliance (A.217)
- *Fagus grandifolia* - *Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance (A.227)
- *Fagus grandifolia* - *Quercus rubra* - *Quercus alba* Forest Alliance (A.229)
- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* Forest Alliance (A.235)
- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus rubra* - (*Acer saccharum*) Forest Alliance (A.251)
- *Tsuga canadensis* - *Liriodendron tulipifera* Forest Alliance (A.413)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)

DISTRIBUTION

Range: This system occurs in southeastern Ohio and southwestern Pennsylvania south to Virginia, West Virginia, Kentucky, Tennessee, Georgia, and Alabama. This range is more-or-less consistent with the "Mixed Mesophytic" and "Western Mesophytic" (non-coastal plain portion only) forest regions of Braun (1950) and Greller (1988), versus the "Oak-Chestnut" region to the east, and the "Beech-Maple" region to the north. Thus, this system is most extensive in the Cumberland and Allegheny plateaus, as well as the unglaciated Interior Low Plateau, and becomes relatively limited in extent towards its western limit in the Ozark Hills of Illinois. It is replaced in the Upper East Gulf Coastal Plain by other systems. Its range also includes the southern Ridge and Valley from Tennessee (and adjacent southwestern Virginia) to Alabama. Parts of the Cumberland Mountains are instead occupied by Southern and Central Appalachian Cove Forest (CES202.373).

Divisions: 202:C

Nations: US

Subnations: AL, GA, IL, IN, KY, OH, PA, TN, VA, WV

Map Zones: 47:C, 48:C, 49:C, 53:C, 57:C, 60:N, 61:C, 62:C

TNC Ecoregions: 44:C, 49:C, 50:C

SOURCES

References: Braun 1950, Comer et al. 2003, Greller 1988

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722791#references

Description Author: M. Pyne and R. Evans

Version: 17 Apr 2006

Concept Author: M. Pyne and R. Evans

Stakeholders: East, Midwest, Southeast

ClassifResp: Southeast

1318 SOUTHERN AND CENTRAL APPALACHIAN COVE FOREST (CES202.373)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Broad-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2318; ESLF 4124; ESP 1318

CONCEPT

Summary: This system consists of mesophytic hardwood forests of sheltered topographic positions in the Southern Blue Ridge and central Appalachian Mountains. Examples are generally found on concave slopes that promote moist conditions. The system includes a mosaic of acidic and "rich" coves that may be distinguished by individual plant communities based on perceived differences in soil fertility and species richness (rich examples have higher diversity and density in the herbaceous layer). Both acidic and rich coves may occur in the same site, with the acidic coves potentially creeping out of the draw-up to at least midslope on well-protected north-facing slopes. Characteristic species in the canopy include *Aesculus flava*, *Acer saccharum*, *Fraxinus americana*, *Tilia americana*, *Liriodendron tulipifera*, *Halesia tetraptera*, *Tsuga canadensis*, *Fagus grandifolia*, and *Magnolia fraseri*.

Classification Comments: This system is best distinguished from others in its range by the combination of sheltered topography, low elevation, and mesophytic flora with high species richness. Canopies can sometimes become depauperate after repeated logging. It is presently defined as not including rich, mesophytic "cove" forests of the Cumberland Plateau and Interior Low Plateau, even though some of these approach or exceed Appalachian examples in their species composition and or their "coveyness." This requires study, possibly by the creation of a "Cumberland Cove" ecological system.

Similar Ecological Systems:

- South-Central Interior Mesophytic Forest (CES202.887)--found in adjacent regions to the west.
- Southern Piedmont Mesic Forest (CES202.342)--found in adjacent regions to the east.

DESCRIPTION

Environment: This system occurs below 1525 m (5000 feet) elevation and generally below 1375 m (4500 feet) in low topographic positions such as valley bottoms and ravines. This cove type has two primary components, an acid cove of lower soil fertility that ranges from the lowest slope positions up the slope on north-facing protected slopes, and a rich, high-fertility cove forest that tends to occur only at the lowest slope positions. Both are sheltered from wind and may be shaded by topography, promoting moist conditions. Local slopes are usually concave. Bedrock may be of virtually any type. Acidic rocks, such as felsic igneous and metamorphic rocks, support rich cove forests in a more limited range of sites than do basic rocks, such as mafic metamorphic rocks or marble. Soils may be rocky or fine-textured, and may be residual, alluvial, or colluvial.

Vegetation: Vegetation consists of forests dominated by various combinations of mesophytic species, usually with many species of trees present. *Liriodendron tulipifera*, *Tilia americana* var. *heterophylla*, *Fraxinus americana*, *Aesculus flava*, *Betula lenta*, *Magnolia acuminata*, *Magnolia fraseri*, *Halesia tetraptera*, *Prunus serotina*, and *Tsuga canadensis* are the most frequent dominant canopy species. Canopies are generally very diverse, with all species potentially occurring in one 20x50-meter plot in rich cove areas. A well-developed herb layer, often very dense and usually high in species richness, is present in all but the acid coves. Well-developed and fairly diverse subcanopy and shrub layers are often also present in all but the acid coves. Ulrey (1999) listed *Caulophyllum thalictroides*, *Actaea racemosa* (= *Cimicifuga racemosa*), *Laportea canadensis*, *Osmorhiza claytonii*, *Sanguinaria canadensis*, *Viola canadensis*, *Acer saccharum*, *Aesculus flava*, *Carya cordiformis*, and *Tilia americana* var. *heterophylla* as characteristic species.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and probably only occurred in years that were extremely dry. Fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. Most of the component species are among the less fire-tolerant in the region.

MEMBERSHIP

Associations:

- *Acer* (*nigrum*, *saccharum*) - *Tilia americana* / *Asimina triloba* / *Jeffersonia diphylla* - *Caulophyllum thalictroides* Forest (CEGL008412, G4G5)
- *Acer saccharum* - *Fraxinus americana* - *Juglans cinerea* / *Staphylea trifolia* Forest (CEGL006020, G4?)
- *Acer saccharum* - *Fraxinus americana* - *Tilia americana* - *Liriodendron tulipifera* / *Actaea racemosa* Forest (CEGL006237, G4?)
- *Acer saccharum* - *Liriodendron tulipifera* - *Fraxinus americana* / *Staphylea trifolia* Forest (CEGL006201, G4?)
- *Aesculus flava* - *Acer saccharum* - (*Fraxinus americana*, *Tilia americana* var. *heterophylla*) / *Hydrophyllum canadense* - *Solidago flexicaulis* Forest (CEGL007695, G3G4)
- *Betula alleghaniensis* - *Tilia americana* var. *heterophylla* / *Acer spicatum* / *Ribes cynosbati* / *Dryopteris marginalis* Forest (CEGL004982, G3)

- *Caltha palustris* - *Impatiens capensis* - *Viola cucullata* Herbaceous Vegetation [Provisional] (CEGL006258, GNR)
- *Diphylleia cymosa* - *Saxifraga micranthidifolia* - *Laportea canadensis* Herbaceous Vegetation (CEGL004296, G3)
- *Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest (CEGL005013, G3G4)
- *Impatiens (capensis, pallida)* - *Monarda didyma* - *Rudbeckia laciniata* var. *humilis* Herbaceous Vegetation (CEGL004293, G3)
- *Liriodendron tulipifera* - *Aesculus flava* - (*Fraxinus americana*, *Tilia americana*) / *Actaea racemosa* - *Laportea canadensis* Forest (CEGL007710, G4)
- *Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543, G5)
- *Liriodendron tulipifera* - *Quercus rubra* - *Magnolia acuminata* / *Cornus florida* Forest (CEGL008510, G5?)
- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - (*Aesculus flava*) / *Actaea racemosa* Forest (CEGL007291, G4?)
- *Quercus alba* - (*Quercus rubra*, *Acer saccharum*, *Fagus grandifolia*) / *Aesculus flava* Forest (CEGL007233, G4)
- *Quercus rubra* - *Acer saccharum* / *Ostrya virginiana* / *Ageratina altissima* Forest (CEGL008517, G4)
- *Quercus rubra* - *Tilia americana* var. *heterophylla* - *Halesia tetraptera* var. *monticola* / *Collinsonia canadensis* - *Tradescantia subaspera* Forest (CEGL007878, G3?)
- *Tilia americana* var. *heterophylla* - *Fraxinus americana* - (*Ulmus rubra*) / *Sanguinaria canadensis* - (*Aquilegia canadensis*, *Asplenium rhizophyllum*) Forest (CEGL007711, G2G3)
- *Tsuga canadensis* - *Halesia tetraptera* - (*Fagus grandifolia*, *Magnolia fraseri*) / *Rhododendron maximum* / *Dryopteris intermedia* Forest (CEGL007693, G2)

Alliances:

- *Acer saccharum* - *Fraxinus americana* - *Tilia americana* Forest Alliance (A.217)
- *Betula alleghaniensis* - *Fagus grandifolia* - *Aesculus flava* Forest Alliance (A.266)
- *Diphylleia cymosa* - *Saxifraga micranthidifolia* Saturated Herbaceous Alliance (A.1688)
- *Fagus grandifolia* - *Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance (A.227)
- *Impatiens (capensis, pallida)* - *Monarda didyma* Saturated Herbaceous Alliance (A.1690)
- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* Forest Alliance (A.235)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus rubra* - (*Acer saccharum*) Forest Alliance (A.251)
- *Symplocarpus foetidus* - *Caltha palustris* Saturated Herbaceous Alliance (A.1694)
- *Tsuga canadensis* - *Liriodendron tulipifera* Forest Alliance (A.413)

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch system commonly occurring in a landscape mosaic with several other systems.

Size: Most individual patches are tens to sometimes a few hundred acres. Because it frequently occurs in mosaics with other systems, separation distance for occurrences has a strong effect on the size of occurrences. Complexes of thousands of acres of this system are possible.

Adjacent Ecological Systems:

- Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
- Southern and Central Appalachian Bog and Fen (CES202.300)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Appalachian Oak Forest (CES202.886)
- Southern Appalachian Seepage Wetland (CES202.317)
- Southern Appalachian Spray Cliff (CES202.288)

Adjacent Ecological System Comments: This system is usually bordered by Southern Appalachian Oak Forest (CES202.886) in the Southern Blue Ridge. The border with adjacent systems is gradational. It may also contain small embedded patches of Southern Appalachian Montane Cliff and Talus (CES202.330) or other small-patch systems.

DISTRIBUTION

Range: This system occurs in the southern and central Appalachian Mountains, ranging into the Cumberland Mountains of Kentucky and Tennessee. This range is more-or-less consistent with the "Oak-Chestnut" forest region of Braun (1950) and Greller (1988), versus the "Mixed Mesophytic" and "Western Mesophytic" forest regions to the west. Distribution in Ecoregion 61 needs review.

Divisions: 202:C

Nations: US

Subnations: GA, KY, MD, NC, PA, SC, TN, VA, WV

Map Zones: 48:C, 53:C, 54:C, 57:C, 59:C, 60:N, 61:C, 62:C, 64:N

TNC Ecoregions: 49:P, 50:C, 51:C, 52:P, 59:C, 61:C

SOURCES

References: Comer et al. 2003, Ulrey 1999

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723143#references

Description Author: M. Schafale, M. Pyne, R. White, R. Evans

Version: 17 Apr 2006

Concept Author: M. Schafale, M. Pyne, R. White, R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

1353 SOUTHERN APPALACHIAN LOW-ELEVATION PINE FOREST (CES202.332)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Acidic Soil; Short Disturbance Interval; Needle-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Evergreen closed tree canopy

National Mapping Codes: EVT 2353; ESLF 4256; ESP 1353

CONCEPT

Summary: This system consists of shortleaf pine- and Virginia pine-dominated forests in the lower elevation southern Appalachians and adjacent Piedmont and Cumberland Plateau, extending into the Interior Low Plateau of Kentucky and Tennessee. Examples can occur on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, as well as lower elevations (generally below 700 m [2300 feet]) in the southern Appalachians such as mountain valleys. Examples occur on a variety of acidic bedrock types. Frequent, low-intensity fires coupled with severe fires (Harrod and White 1999) may have been the sole factor determining the occurrence of this system rather than hardwood forests under natural conditions.

Classification Comments: This system and its component associations are among the least studied in the southern Appalachians (Harrod and White 1999). Settlement, universal logging, pine beetle outbreaks, and fire suppression potentially have altered their character and blurred their boundaries more than most systems in the region. The situation is further complicated by the potential for pine-dominated forests to have been both created and destroyed in different places by these disturbances. Obviously successional pine forests associated with the recovery of heavily logged or plowed slopes and valleys are grouped into the matrix Central and Southern Appalachian Montane Oak Forest (CES202.596).

The relationship between this system and Southern Appalachian Montane Pine Forest and Woodland (CES202.331) may need further clarification. Southern Appalachian Low-Elevation Pine Forest (CES202.332) is distinguished by its occurrence as large patches on lower terrain (generally below 700 m [2300 feet]) and less extreme topography. The vegetation of the two systems may overlap due to the factors outlined above, but pitch pine and Table Mountain pine are more typical of the former, while shortleaf pine and Virginia pine are more typical of the latter.

Presently the shortleaf pine-dominated vegetation of the Interior Low Plateau (ILP), including the Tennessee portion of Land Between the Lakes, is included in this system. Frost (1998) treats the ILP region in a different fire-return-interval class than the core range of this system, although local variation may overwhelm the broad regional differences. If more detailed information becomes available to document important ecological differences between these areas, a new system may be required.

This system (CES202.332) at its western extent in central Tennessee would be distinguished from equivalent Ozarkian systems (e.g., Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland (CES202.313)) by the presence of *Pinus virginiana* and *Quercus prinus*, which do not cross the Mississippi River.

Similar Ecological Systems:

- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)
- Central and Southern Appalachian Montane Oak Forest (CES202.596)
- Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland (CES202.313)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)
- Southern Piedmont Dry Oak-(Pine) Forest (CES202.339)

Related Concepts:

- Appalachian Pine-Oak Forest (Evans 1991) Finer

DESCRIPTION

Environment: Occurs on ridge tops, upper and mid slopes, in mountain valleys and the lower ranges. Bedrock may be a variety of types, but the system may be limited to acidic substrates. Fire is undoubtedly a very important influence.

Vegetation: Vegetation consists of closed to open forests or woodlands dominated by *Pinus echinata* or *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. The hardwood component may be partly 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*. Herbs probably were more abundant and shrubs less dense when fires occurred more frequently, and the communities of this system may have been grassy under more natural conditions, with *Schizachyrium scoparium* being a typical component, possibly with *Danthonia* sp.

Dynamics: Little is known about the dynamics of this system. Fire is clearly an important influence, and may be the sole factor determining the occurrence of this system rather than hardwood forests under natural conditions. Fires probably were frequent and of low intensity, or a mix of low and higher intensity. Fire probably is important for determining the balance of the two pine species, the component of hardwoods, and the overall vegetation structure. *Pinus echinata* is fairly resilient to fire once mature, while *Pinus virginiana* individuals are fairly susceptible to fire but well-adapted to establishing in areas opened by intense fire.

Southern pine beetles are an important factor in this system, at least under present conditions. Beetle outbreaks can kill all the pines without creating the conditions for the pines to regenerate. Effects of logging and past clearing as well as fire suppression make understanding of this system's natural character and dynamics difficult. Some pine-dominated areas appear to be successional stands established in former hardwood forests after logging or cultivation, and would not be expected to have the same dynamics or ecosystem characteristics as natural pine forests maintained by fire. In natural pine forests, logging may allow pines to regenerate or may change the composition to weedy hardwoods. It might alter canopy composition as well as structure.

MEMBERSHIP

Associations:

- *Pinus echinata* - *Quercus (prinus, falcata)* / *Oxydendrum arboreum* / *Vaccinium pallidum* Forest (CEGL007493, G3G4)
- *Pinus echinata* - *Quercus alba* / *Vaccinium pallidum* / *Hexastylis arifolia* - *Chimaphila maculata* Forest (CEGL008427, G3G4)
- *Pinus echinata* - *Quercus prinus* / *Rhododendron minus* / *Vaccinium pallidum* Forest (CEGL007496, G2G3)
- *Pinus echinata* - *Quercus stellata* - *Quercus marilandica* / *Vaccinium pallidum* Woodland (CEGL003765, G4?)
- *Pinus echinata* - *Quercus stellata* - *Quercus prinus* - *Carya glabra* / (*Danthonia spicata*, *Piptochaetium avenaceum*) Forest (CEGL007500, G3?)
- *Pinus echinata* / *Schizachyrium scoparium* Appalachian Woodland (CEGL003560, G2)
- *Pinus echinata* / *Vaccinium (pallidum, stamineum)* - *Kalmia latifolia* Forest (CEGL007078, G4?)
- *Pinus strobus* / *Kalmia latifolia* - (*Vaccinium stamineum*, *Gaylussacia ursina*) Forest (CEGL007100, G2G3)
- *Pinus virginiana* - (*Pinus rigida*, *Pinus pungens*) / *Schizachyrium scoparium* Forest (CEGL008500, G3G4)
- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Pinus virginiana* Successional Forest (CEGL002591, GNA)

Alliances:

- *Pinus echinata* - *Quercus (alba, falcata, stellata, velutina)* Forest Alliance (A.394)
- *Pinus echinata* - *Quercus (coccinea, prinus)* Forest Alliance (A.395)
- *Pinus echinata* - *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.680)
- *Pinus echinata* Forest Alliance (A.119)
- *Pinus echinata* Woodland Alliance (A.515)
- *Pinus strobus* Forest Alliance (A.128)
- *Pinus virginiana* Forest Alliance (A.131)

SPATIAL CHARACTERISTICS

Spatial Summary: Probably naturally a large patch system, covering thousands of acres. Most remnants in relatively natural condition are probably small patches

Size: Natural size distribution not well known, but probably a large patch system with patches or complexes covering hundreds to thousands of acres. The current distribution of patch size is also not well known. Size of defined occurrences may be strongly affected by standards for condition and separation distances.

Adjacent Ecological Systems:

- Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)
- Southern Appalachian Oak Forest (CES202.886)

Adjacent Ecological System Comments: Probably usually bordered and intermixed with Southern Appalachian Oak Forest (CES202.886). Southern and Central Appalachian Cove Forest (CES202.373) may be present in more mesic areas. This system may also intergrade into Southern Appalachian Montane Pine Forest and Woodland (CES202.331) at high elevations.

DISTRIBUTION

Range: This system is found primarily in the Appalachian regions of Kentucky and the Southern Blue Ridge in northern Georgia, western North Carolina, southeastern Tennessee, the Cumberlands of Alabama, parts of the Interior Low Plateau (e.g., the Knobs Region of Kentucky), and southwestern Virginia.

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, NC, SC, TN, VA, WV?

Map Zones: 47:C, 48:C, 53:C, 54:C, 57:C, 59:C

TNC Ecoregions: 44:C, 50:C, 51:C, 52:C

SOURCES

References: Comer et al. 2003, Frost 1998, Harrod and White 1999

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723171#references

Description Author: M. Schafale, R. Evans, R. White, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: M. Schafale, R. Evans, R. White

Stakeholders: East, Southeast

ClassifResp: Southeast

1352 SOUTHERN APPALACHIAN MONTANE PINE FOREST AND WOODLAND (CES202.331)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Montane; Forest and Woodland (Treed); Needle-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Open tree canopy, Evergreen open tree canopy

National Mapping Codes: EVT 2352; ESLF 4255; ESP 1352

CONCEPT

Summary: This system consists of predominantly evergreen woodlands (or more rarely forests) occupying very exposed, convex, often rocky south- and west-facing slopes, ridge spurs, crests, and clifftops in the central Appalachians, Southern Ridge and Valley and Southern Blue Ridge. They occur at moderate to upper elevations (450-1200 m [1500-4000 feet]), with the more southerly examples at the higher elevations. In the Southern Blue Ridge, this system is best developed above 700 m (2300 feet) in elevation. The underlying rock is acidic and sedimentary or metasedimentary (e.g., quartzites, sandstones and shales). The soils are very infertile, shallow and droughty. A thick, poorly decomposed duff layer, along with dead wood and highly volatile ericaceous shrubs, creates a strongly fire-prone habitat. Most examples are dominated by *Pinus rigida*, *Pinus pungens*, and/or *Pinus virginiana*, and occasionally *Tsuga caroliniana*. The canopy is usually patchy to open, but areas of closed canopy may be present, especially where *Tsuga caroliniana* is prominent. Fire is a very important ecological process in this system. Pines may be able to maintain dominance due to edaphic conditions, such as very shallow soil or extreme exposure in some areas, but most sites appear eventually to succeed to oak dominance in the absence of fire. Fire is also presumably a strong influence on vegetation structure, producing a more open woodland canopy structure and more herbaceous ground cover.

Classification Comments: This system is related to Central Appalachian Pine-Oak Rocky Woodland (CES202.600), which is distinguished by a mixed or deciduous canopy and absence of *Pinus pungens*. Stands with *Pinus echinata* present are generally accommodated by Southern Appalachian Low-Elevation Pine Forest (CES202.332). The relationship between these two systems may need further clarification. This system is distinguished by occurrence as small patches on the most extreme topography, as well as by the species of pines dominating. However, *Pinus echinata* may codominate in Southern Appalachian Low-Elevation Pine Forest (CES202.332) at times. Sites that would support this system under a natural fire regime, but which have lost the pines by logging, southern pine beetle or senescence in the absence of fire, should probably be regarded as degraded examples of this system. However, they become virtually indistinguishable from Southern Appalachian Oak Forest (CES202.886) and Central Appalachian Pine-Oak Rocky Woodland (CES202.600) over time.

Similar Ecological Systems:

- Central Appalachian Pine-Oak Rocky Woodland (CES202.600)
- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Oak Forest (CES202.886)
- Southern Piedmont Dry Oak-(Pine) Forest (CES202.339)

Related Concepts:

- Pine Savanna/Woodland (Evans 1991) Finer

DESCRIPTION

Environment: This system occurs on ridgetops, usually only on the sharpest and narrowest spur ridges, and adjacent convex upper slopes. These sites are the extreme of convex landforms. Rapid drainage of rainfall and exposure to wind, sun and lightning are probably the important characteristics. Bedrock may be of any acidic type, including felsic igneous and metamorphic rocks, sandstone and quartzite. Soils are shallow and rocky residual soils. Fire appears to be an important factor.

Vegetation: Vegetation consists of open forests or woodlands dominated by *Pinus rigida*, *Pinus pungens*, or *Tsuga caroliniana*, sometimes with *Pinus virginiana* or rarely *Pinus echinata* codominant. In examples that have not had fire in a long time, *Quercus prinus*, *Quercus coccinea*, or other oaks are usually present and are sometimes abundant, as are *Nyssa sylvatica* and *Acer rubrum*. *Castanea dentata* may also have once been abundant. A dense heath shrub layer is almost always present. *Kalmia latifolia* is the most typical dominant, but species of *Rhododendron*, *Vaccinium*, or *Gaylussacia* may be dominant. Herbs are usually sparse but probably were more abundant and shrubs less dense when fires occurred more frequently.

Dynamics: Fire is apparently a very important process in this system (Harrod and White 1999). Pines may be able to maintain dominance due to shallow soils and extreme exposure in some areas, but most sites appear eventually to succeed to oak dominance in the absence of fire. Fire is also presumably a strong influence on vegetation structure, producing a more open woodland canopy structure and more herbaceous ground cover. Occurrence in highly exposed sites may make this system more prone to ignition, but most fires probably spread from adjacent oak forests. Fires could be expected to show more extreme behavior in this system than in oaks forests under similar conditions, due to the flammability of the vegetation and the dry, windy and steep location. Both intense catastrophic fires and lower-intensity fires probably occurred naturally. Natural occurrences probably include both even-aged and

uneven-aged canopies.

Southern pine beetles are an important factor in this system, at least under present conditions. Beetle outbreaks can kill all the pines without creating the conditions for the pines to regenerate. If the pines are lost, the distinction between this system and Southern Appalachian Oak Forest (CES202.886) or Central Appalachian Pine-Oak Rocky Woodland (CES202.600) becomes blurred.

MEMBERSHIP

Associations:

- *Pinus (pungens, rigida) - Quercus prinus / (Quercus ilicifolia) / Gaylussacia baccata* Woodland (CEGL004996, G4)
- *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland (CEGL007097, G3)
- *Pinus rigida - (Pinus pungens) / Rhododendron catawbiense - Kalmia latifolia / Galax urceolata* Woodland (CEGL004985, G2)
- *Pinus rigida / Schizachyrium scoparium - Sorghastrum nutans - Baptisia tinctoria* Woodland (CEGL003617, G2?)
- *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Tsuga caroliniana - Pinus (rigida, pungens, virginiana)* Forest (CEGL006178, G2)
- *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (CEGL007139, G2)

Alliances:

- *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)
- *Pinus pungens - (Pinus rigida)* Woodland Alliance (A.521)
- *Pinus rigida* Woodland Alliance (A.524)
- *Pinus virginiana* Forest Alliance (A.131)
- *Tsuga caroliniana* Forest Alliance (A.144)

SPATIAL CHARACTERISTICS

Spatial Summary: Large- to small-patch system, occurring as a frequent part of the landscape mosaic.

Size: Occurs as a large- to small-patch system. Contiguous bodies probably once covered dozens to 100 or more acres. Patches often occur in complexes with other systems. Size of defined occurrences may be strongly affected by separation distances for occurrences.

Adjacent Ecological Systems:

- Southern Appalachian Grass and Shrub Bald (CES202.294)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Appalachian Oak Forest (CES202.886)

Adjacent Ecological System Comments: This system is almost always bordered and intermixed with Southern Appalachian Oak Forest (CES202.886) or (in the northern half of its range) by Central Appalachian Pine-Oak Rocky Woodland (CES202.600). The distinctions are made more difficult by the suppression of fire and subsequent invasion of less fire-tolerant species such as *Acer rubrum* and *Nyssa sylvatica*. Generally speaking, communities with a heavy component of pine (at least 25 or 50% of canopy) are categorized as Southern Appalachian Montane Pine Forest and Woodland (CES202.331), whereas communities with a much smaller component of pines are considered Southern Appalachian Oak Forest (CES202.886) or Central Appalachian Pine-Oak Rocky Woodland (CES202.600). At the highest elevations that this system is seen, it may intergrade with Southern Appalachian Grass and Shrub Bald (CES202.294).

DISTRIBUTION

Range: This system ranges throughout the southern and central Appalachians, from northern Georgia and South Carolina north through Virginia into southern Pennsylvania.

Divisions: 202:C

Nations: US

Subnations: GA, KY, MD?, NC, PA, SC, TN, VA, WV

Map Zones: 48:N, 53:C, 54:C, 57:C, 59:C, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 52:C, 59:C

SOURCES

References: Comer et al. 2003, Harrod and White 1999

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723172#references

Description Author: M. Schafale, R. Evans, M. Pyne, R. White, mod. S.C. Gawler

Version: 02 Feb 2005

Concept Author: M. Schafale, R. Evans, M. Pyne, R. White

Stakeholders: East, Southeast

ClassifResp: Southeast

1309 SOUTHERN APPALACHIAN NORTHERN HARDWOOD FOREST (CES202.029)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Montane; Broad-Leaved Tree

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2309; ESLF 4115; ESP 1309

CONCEPT

Summary: This system consists of hardwood forests of the higher elevation zones of the southern Appalachians, generally above 1372 m (4500 feet) elevation. Included are classic northern hardwood forests as well as high-elevation oak forests. Thus, examples may be dominated by *Quercus rubra* or various combinations of mesophytic hardwoods. High-elevation climate is the most important ecological factor. Included in this system are limited areas locally known as "beech gaps" and "boulderfields." In Kentucky, this system is of extremely limited extent, being restricted to areas above about 1100-1160 m (3600-3800 feet) elevation on Black Mountain, the highest elevation in Kentucky, which is apparently higher in elevation than adjacent areas in Tennessee and Virginia.

Classification Comments: The high-elevation *Quercus rubra* associations are placed in this system rather than the related Central and Southern Appalachian Montane Oak Forest (CES202.596) because they occur in the same elevation zone as the mesophytic northern hardwood forests, with the same set of landscape associations. They differ from the mesophytic northern hardwood forests in the dominance of oaks and the probable importance of fire as a process. The border of this system with adjacent systems is usually gradational. The transition to Central and Southern Appalachian Spruce-Fir Forest (CES202.028) that often adjoins at higher elevation is marked by a gradual shift in canopy dominance from hardwoods to conifers. The transition to a lower elevation hardwood forest systems is similarly marked by a gradual turnover of dominant trees but may be more subtle because more species are shared. The transition to Southern and Central Appalachian Cove Forest (CES202.373) is particularly gradual, being marked mainly by the addition of species without loss of species. The non-forested systems that occur in the same elevation zone may have transition zones of open woody vegetation, though some have sharp borders. In relatively undisturbed stands, the canopy composition and structure are the best way to determine the boundary of this system.

This system is similar to the northern hardwood forests of the northeastern U.S., i.e., Laurentian-Acadian Northern Hardwoods Forest (CES201.564), but differs in having a southern mountain climate (shorter winters, less extreme cold temperatures, shorter summer days), lacking a history of glaciation, and in having a flora and fauna with many southern Appalachian endemics. A few characteristic dominants of the northern hardwoods are lacking, including *Betula papyrifera* and *Populus tremuloides*. It differs from Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593) in its more montane setting and its flora and fauna having many southern Appalachian endemics. The northern boundary of this system follows a gradual northward transition through central and northern Virginia and West Virginia.

Similar Ecological Systems:

- Central and Southern Appalachian Montane Oak Forest (CES202.596)
- Southern Appalachian Oak Forest (CES202.886)

DESCRIPTION

Environment: This system occurs at elevations above 1372 m (4500 feet), occasionally up to nearly 1830 m (6000 feet). It occurs on most of the landforms that are present in this elevational range, from exposed peaks and ridges to sheltered coves. Convex slopes are the most abundant landform. Elevation and orographic effects make the climate cool and wet, with significant moisture input from fog as well as high rainfall. Strong winds, ice glaze, and extreme cold may occur but are less important than in Central and Southern Appalachian Spruce-Fir Forest (CES202.028). Soils are generally very rocky, with the matrix ranging from well-weathered parent material to coarse colluvial boulder deposits. Soils are probably moist but not saturated most of the time. Any kind of bedrock may be present. Limited areas support boulderfields. In Kentucky, this system is of extremely limited extent, being restricted to areas above about 1100-1160 m (3600-3800 feet) elevation on Black Mountain, the highest elevation in Kentucky, which is apparently higher in elevation than adjacent areas in Tennessee and Virginia.

Vegetation: Vegetation consists of forests dominated by various combinations of *Betula alleghaniensis*, *Fagus grandifolia*, *Aesculus flava*, *Acer saccharum*, *Quercus rubra*, and *Tsuga canadensis*. *Prunus serotina* and *Tilia americana* var. *heterophylla* are occasionally abundant. *Quercus rubra* dominates on warmer exposures, the mesophytic species on cooler. Lower strata usually include a dense herb layer and often a well-developed deciduous shrub layer as well. Limited areas may have a dense evergreen shrub layer. Plant species richness ranges from fairly high to very low.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine to medium scale. Occasional extreme wind or ice events disturb larger patches on exposed slopes. Fire appears to be uncommon under natural conditions, perhaps extremely rare in the more mesic portions. Fire may be important in regeneration of *Quercus rubra* and may be crucial in maintaining its dominance in drier sites. Many *Quercus rubra* forests now appear to be

succeeding to mesophytic hardwoods. Little is known about natural fire behavior. Fires are likely to be low in intensity because of limited flammability of the vegetation and prevailing moist conditions, but most of the component tree species are probably not very tolerant of fire.

MEMBERSHIP

Associations:

- *Aesculus flava* - *Betula alleghaniensis* - *Acer saccharum* / *Acer spicatum* / *Caulophyllum thalictroides* - *Laportea canadensis* Forest (CEGL004973, G3)
- *Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / *Leucothoe fontanesiana* Forest (CEGL007861, G3G4Q)
- *Betula alleghaniensis* - *Acer saccharum* - *Aesculus flava* / *Acer pensylvanicum* / *Trillium grandiflorum* Forest (CEGL004417, G2G3Q)
- *Betula alleghaniensis* - *Fagus grandifolia* - *Aesculus flava* / *Viburnum lantanoides* / *Eurybia chlorolepis* - *Dryopteris intermedia* Forest (CEGL007285, G3G4)
- *Betula alleghaniensis* / *Ribes glandulosum* / *Polypodium appalachianum* Forest (CEGL006124, G2G3)
- *Fagus grandifolia* / *Ageratina altissima* var. *roanensis* Forest (CEGL006246, G1)
- *Fagus grandifolia* / *Carex pensylvanica* - *Carex brunnescens* Forest (CEGL006130, G1)
- *Liriodendron tulipifera* - *Tilia americana* - *Betula lenta* / *Asimina triloba* / *Dryopteris marginalis* Forest [Provisional] (CEGL008527, GNR)
- *Quercus rubra* / (*Kalmia latifolia*, *Rhododendron maximum*) / *Galax urceolata* Forest (CEGL007299, G4)
- *Quercus rubra* / (*Vaccinium simulatum*, *Rhododendron calendulaceum*) / (*Dennstaedtia punctilobula*, *Thelypteris noveboracensis*) Forest (CEGL007300, G4)
- *Quercus rubra* / *Carex pensylvanica* - *Ageratina altissima* var. *roanensis* Forest (CEGL007298, G2)

Alliances:

- *Betula alleghaniensis* - *Fagus grandifolia* - *Aesculus flava* Forest Alliance (A.266)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Quercus rubra* Montane Forest Alliance (A.272)
- *Tsuga canadensis* - *Betula alleghaniensis* Forest Alliance (A.412)

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch to local matrix system, dominating the landscape of fairly high mountain ranges and occurring as a broad elevational zone on the highest. Small-patch systems may be embedded.

Size: Generally covers most of the landscape in the elevational range where it occurs. In the highest ranges it occupies a broad elevational zone on the flanks. On somewhat lower mountain ranges it dominates the mountain tops. Natural patches covered thousands to maybe 10,000 to 20,000 acres. A few remnant patches of thousands of acres remain, along with patches of hundreds of acres.

Adjacent Ecological Systems:

- Central and Southern Appalachian Montane Oak Forest (CES202.596)
- Central and Southern Appalachian Spruce-Fir Forest (CES202.028)
- Southern and Central Appalachian Bog and Fen (CES202.300)
- Southern Appalachian Grass and Shrub Bald (CES202.294)
- Southern Appalachian Rocky Summit (CES202.327)
- Southern Appalachian Seepage Wetland (CES202.317)

Adjacent Ecological System Comments: Central and Southern Appalachian Montane Oak Forest (CES202.596) most typically adjoins at lower elevation. Central and Southern Appalachian Spruce-Fir Forest (CES202.028) may adjoin at higher elevation. Small-patch systems such as Southern Appalachian Rocky Summit (CES202.327), Southern Appalachian Seepage Wetland (CES202.317), Southern and Central Appalachian Bog and Fen (CES202.300), and Southern Appalachian Grass and Shrub Bald (CES202.294) may be embedded.

DISTRIBUTION

Range: This system ranges from northwestern Georgia, western North Carolina and eastern Tennessee northward to Virginia and West Virginia. In Kentucky, this system is restricted to the Cumberland Mountains in the extreme southeastern corner of that state.

Divisions: 202:C

Nations: US

Subnations: GA, KY, NC, TN, VA, WV

Map Zones: 53:C, 57:C, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 59:P

SOURCES

References: Comer et al. 2003, Lohman and Watson 1943

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722676#references

Description Author: M. Schafale and R. Evans, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

1315 SOUTHERN APPALACHIAN OAK FOREST (CES202.886)

CLASSIFIERS

Conf.: 1 - Strong

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Unglaciaded; Broad-Leaved Deciduous Tree; *Quercus* - *Carya*

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2315; ESLF 4121; ESP 1315

CONCEPT

Summary: This system consists of predominantly dry-mesic forests occurring on open and exposed topography at lower to mid elevations in the Southern Blue Ridge and Southern Ridge and Valley ecoregions and the southern half of the Central Appalachians ecoregions. Substrates of stands included in this system can range from acidic to circumneutral or basic, and the vegetation varies accordingly. Typically, the vegetation consists of forests dominated by oaks, especially *Quercus prinus*, *Quercus alba*, *Quercus rubra*, and *Quercus coccinea*, with varying amounts of *Carya* spp., *Acer rubrum*, and other species. This system concept also includes many successional communities that have been impacted by logging or agriculture such as types dominated by *Liriodendron tulipifera*, *Pinus* spp., and *Robinia pseudoacacia*.

Classification Comments: The western and northern extent of this system needs clarification. This system is distinguished from the oak forests of the Piedmont by substantial floristic differences that probably are determined by biogeography as well as climate and topography. Compositional differences were more pronounced in the past, when *Castanea dentata* was a major species in this system and not in Piedmont oak forests. This system is distinguished from most other systems in its primary range by the canopy dominance of oaks (other than strong dominance by red oak) without a large component of yellow pines (*Pinus echinata*, *Pinus virginiana*, *Pinus pungens*) in the canopy. It shares those characteristics with Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359), which might be thought of as a subtype of this system on the more exposed and acidic substrates. The environment is intermediate within the region in topography and moisture. Northward this system grades into Northeastern Interior Dry-Mesic Oak Forest (CES202.592), which occurs in similar environmental conditions. This southern Appalachian system is characterized by the presence, in most occurrences, of plant species of southern Appalachian affinity, such as *Magnolia fraseri*, *Gaylussacia ursina*, *Rhododendron calendulaceum*, etc.

Similar Ecological Systems:

- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)--may represent a narrower concept subset of this.
- Central Appalachian Dry Oak-Pine Forest (CES202.591)
- Northeastern Interior Dry-Mesic Oak Forest (CES202.592)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)
- Southern Appalachian Northern Hardwood Forest (CES202.029)

DESCRIPTION

Environment: Occurs on open slopes, ridgetops, lower elevation peaks, and higher parts of broad valley bottoms, at low to moderate elevations. Bedrock may be of any type. Soils are usually deep residual soils, but are often rocky. Some shallow soils, colluvium, and other soils may be present locally within the system, but shallow soils tend to produce environments that are more extreme and have a larger component of *Pinus* spp. than this system. Moisture levels are intermediate for the region. Soil chemistry and topography are important determinants of different associations within the system. Topography, elevation, and soil depth are the most important factors separating this system from others.

Vegetation: Vegetation consists of forests dominated by *Quercus* species, most typically *Quercus prinus*, *Quercus alba*, and *Quercus coccinea*, with varying amounts of *Carya* spp., *Acer rubrum*, and other species. Less typical are stands dominated by other species, such as *Pinus strobus*, or other hardwood species. *Castanea dentata* was once dominant or codominant in many of these forests. Subcanopies and shrub layers are usually well-developed. Some associations have dense evergreen shrub layers, while others have open shrub layers. Herbs are usually sparse to moderate in density.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Extreme wind or ice storms occasionally create larger canopy openings. Fire occurred fairly frequently in presettlement times, though there is some dispute whether most of the fires were natural or anthropogenic in origin (Abrams 1992, Delcourt and Delcourt 1997). Fires were usually low-intensity surface fires. The dominant species are fairly fire-tolerant, making most fires non-catastrophic. Fire may be important for favoring oak dominance over more mesophytic tree species within some of the topographic range of this system. Fire also can be expected to have a moderate effect on vegetation structure, producing a somewhat more open canopy and less dense understory and shrub layer than currently seen in most examples. Fire frequency or intensity may be important for determining the boundary between this system and both the more mesic and the drier systems. Virtually all examples have been strongly affected by the introduction of the chestnut blight, which killed all of the *Castanea dentata* trees, eliminating it as a canopy dominant. Past logging affected most occurrences by changing canopies to an even-aged, or more even-aged, structure.

MEMBERSHIP

Associations:

- *Acer rubrum* var. *rubrum* - *Betula* (*alleghaniensis*, *lenta*) - *Magnolia fraseri* / (*Rhododendron maximum*, *Kalmia latifolia*) Forest (CEGL008558, GNA)
- *Carya glabra* - *Fraxinus americana* - *Quercus prinus* / *Ostrya virginiana* / *Philadelphus hirsutus* Woodland (CEGL004995, G2)
- *Pinus strobus* - *Quercus* (*coccinea*, *prinus*) / (*Gaylussacia ursina*, *Vaccinium stamineum*) Forest (CEGL007519, G4)
- *Pinus strobus* - *Quercus alba* - (*Carya alba*) / *Gaylussacia ursina* Forest (CEGL007517, G3G4)
- *Quercus* (*prinus*, *coccinea*) / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271, G5)
- *Quercus alba* - *Quercus* (*rubra*, *prinus*) / *Rhododendron calendulaceum* - *Kalmia latifolia* - (*Gaylussacia ursina*) Forest (CEGL007230, G5)
- *Quercus alba* - *Quercus coccinea* - *Quercus falcata* / *Kalmia latifolia* - *Vaccinium pallidum* Forest (CEGL007691, G2G3)
- *Quercus alba* - *Quercus falcata* / *Vaccinium* (*arboreum*, *hirsutum*, *pallidum*) Forest (CEGL008567, G3G4)
- *Quercus alba* - *Quercus rubra* - *Carya ovata* / *Cercis canadensis* - *Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba* - *Quercus rubra* - *Quercus prinus* / *Collinsonia canadensis* - *Podophyllum peltatum* - *Amphicarpaea bracteata* Forest (CEGL007692, G3)
- *Quercus alba* / *Kalmia latifolia* Forest (CEGL007295, G2Q)
- *Quercus muehlenbergii* - *Quercus* (*alba*, *rubra*) - *Carya cordiformis* / *Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* - *Vaccinium pallidum* Forest (CEGL008431, G4G5)
- *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest (CEGL007267, G4G5)
- *Quercus prinus* - *Quercus rubra* - *Carya* spp. - *Fraxinus americana* / *Cercis canadensis* / *Solidago sphacelata* Forest (CEGL008549, G3?)
- *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEGL006286, G4)
- *Quercus rubra* - *Acer rubrum* / *Calycanthus floridus* - *Pyrularia pubera* / *Thelypteris noveboracensis* Forest (CEGL006192, G4?)
- *Quercus rubra* - *Quercus muehlenbergii* / *Hamamelis virginiana* / *Polymnia canadensis* Forest (CEGL007215, G1Q)
- *Sassafras albidum* - *Quercus* spp. Forest (CEGL004096, G5)
- *Vitis aestivalis* Vine-Shrubland (CEGL003890, G2G3)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* - *Magnolia fraseri* Forest Alliance (A.2009)
- *Fraxinus americana* - *Carya glabra* - (*Juniperus virginiana*) Woodland Alliance (A.604)
- *Pinus strobus* - *Quercus* (*alba*, *rubra*, *velutina*) Forest Alliance (A.401)
- *Pinus strobus* - *Quercus* (*coccinea*, *prinus*) Forest Alliance (A.402)
- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus alba* - *Quercus* (*falcata*, *stellata*) Forest Alliance (A.241)
- *Quercus alba* Montane Forest Alliance (A.271)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus prinus* - (*Quercus coccinea*, *Quercus velutina*) Forest Alliance (A.248)
- *Quercus prinus* - *Quercus* (*alba*, *falcata*, *rubra*, *velutina*) Forest Alliance (A.249)
- *Quercus prinus* - *Quercus rubra* Forest Alliance (A.250)
- *Quercus velutina* - *Quercus alba* - (*Quercus coccinea*) Forest Alliance (A.1911)
- *Sassafras albidum* Forest Alliance (A.2019)
- *Vitis aestivalis* Vine-Shrubland Alliance (A.911)

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix system, covering a majority of the landscape over large areas.

Size: Occurs as a large-patch to matrix system. Contiguous bodies of tens of thousands of acres once occurred. The oak forests probably make up slightly more than 50% of the landscape in all but the higher elevations of the region. Size of existing occurrences may be strongly affected by separation distances for occurrences. A few remaining occurrences over 10,000 acres are probably present.

Adjacent Ecological Systems:

- Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
- Central and Southern Appalachian Montane Oak Forest (CES202.596)
- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern and Central Appalachian Mafic Glade and Barrens (CES202.348)
- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)

Adjacent Ecological System Comments: This system is almost always bordered by Southern and Central Appalachian Cove Forest (CES202.373) or Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593) in more mesic sites. It is often bordered by Southern Appalachian Low Mountain Pine Forest (CES202.332) on more exposed topography. It may grade into Central and Southern Appalachian Montane Oak Forest (CES202.596) at the highest elevations. Various rock outcrop systems may be present as embedded small patches.

DISTRIBUTION

Range: This system ranges throughout the southern and central Appalachians, from northern Georgia and South Carolina north into the Southern Blue Ridge of Virginia to the Roanoke River in the Blue Ridge, and slightly farther south in the Ridge and Valley.

Divisions: 202:C

Nations: US

Subnations: GA, KY, NC, SC, TN, VA

Map Zones: 53:N, 57:C, 59:N, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 52:C

SOURCES

References: Abrams 1992, Comer et al. 2003, Delcourt and Delcourt 1997, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722792#references

Description Author: M. Schafale, R. Evans, M. Pyne, R. White, mod. S.C. Gawler

Version: 17 Apr 2006

Concept Author: M. Schafale, R. Evans, M. Pyne, R. White

Stakeholders: East, Southeast

ClassifResp: Southeast

1305 SOUTHERN INTERIOR LOW PLATEAU DRY-MESIC OAK FOREST (CES202.898)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Deciduous closed tree canopy

National Mapping Codes: EVT 2305; ESLF 4111; ESP 1305

CONCEPT

Summary: This system of upland hardwood-dominated forests occurs in the Interior Low Plateau region of the southeastern United States along ridgetops and slopes of various aspects. The system includes essentially all upland hardwood stands of the region except for mesic hardwood forests (which are accommodated by South-Central Interior Mesophytic Forest (CES202.887)). The floristic expression of different stands included in this system varies considerably with aspect and soil type. Included here are a variety of associations ranging along a moisture gradient from submesic to drier ones. The submesic to dry-mesic expressions tend to be found on midslopes with northerly to easterly aspects, and the drier ones on southerly to westerly aspects and on broad ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the drier expressions and moderately well-drained soils in the submesic to dry-mesic ones. The canopy closure of this system ranges from closed to somewhat open in the drier examples. Historically, these examples may have been more open under conditions of more frequent fire. A number of different *Quercus* species may dominate stands of this system, with *Carya* species also prominent. In the drier examples, *Quercus prinus* is typical over most of the range, reflecting relations with other Appalachian systems to the east. In addition, *Quercus stellata*, *Quercus marilandica*, and *Quercus coccinea* will also share dominance or be prominent in many of the drier examples. *Quercus shumardii* may appear in drier examples with high base status. *Quercus alba* may also be present but not typically dominant. In the submesic to dry-mesic examples, *Quercus alba* will typically exhibit dominance, possibly with *Quercus rubra* or *Quercus falcata*. The understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations.

Classification Comments: The range of this system is consistent with the non-coastal plain portion of the "Western Mesophytic" Forest region of Braun (1950), Keever (1971), and Greller (1988). To the glaciated north, it is replaced by North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046) or North-Central Interior Dry Oak Forest and Woodland (CES202.047).

Similar Ecological Systems:

- North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046)--is found to the (glaciated) north.

Related Concepts:

- Calcareous Xeric Forest (Evans 1991) Finer
- Xeric Acidic Forest (Evans 1991) Finer

DESCRIPTION

Environment: This system encompasses a variety of associations ranging along a moisture gradient from submesic to drier ones. The submesic to dry-mesic expressions tend to be found on midslopes with northerly to easterly aspects, the drier ones on southerly to westerly aspects and on broad ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the drier expressions and moderately well-drained soils in the submesic to dry-mesic ones.

Vegetation: A number of different *Quercus* species may dominate stands of this system, with *Carya* species also prominent. In the drier examples, *Quercus prinus* is typical over most of the range, reflecting relations with other Appalachian systems to the east. In addition, *Quercus stellata*, *Quercus marilandica*, and *Quercus coccinea* will also share dominance or be prominent in many of the drier examples. *Quercus shumardii* may appear in drier examples with high base status. *Quercus alba* may also be present but not typically dominant. In the submesic to dry-mesic examples, *Quercus alba* will typically exhibit dominance, possibly with *Quercus rubra* or *Quercus falcata*. The understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations. Some typical species include *Cornus florida*, *Cercis canadensis*, *Oxydendrum arboreum*, *Vaccinium pallidum*, *Vaccinium stamineum*, *Vaccinium arboreum*, other highbush *Vaccinium* species, *Kalmia latifolia*, *Viburnum acerifolium*, *Styrax americanus*, and others. Some more open and drier stands may exhibit an understory of grassland species such as *Schizachyrium scoparium*, *Danthonia spicata*, and others. Forbs of the Fabaceae (e.g., *Desmodium*) and Asteraceae (e.g., *Helianthus*) will be prominent in many examples.

MEMBERSHIP

Associations:

- *Juglans nigra* / *Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest (CEGL007124, GNA)
- *Liquidambar styraciflua* - *Quercus* (*alba*, *falcata*) Forest (CEGL007217, GNA)
- *Liriodendron tulipifera* - *Quercus* spp. Forest (CEGL007221, GNA)
- *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220, GNA)

- *Prunus serotina* - *Sassafras albidum* / *Juniperus virginiana* - *Fraxinus americana* Forest (CEGL004133, GNA)
- *Quercus alba* - *Carya alba* - (*Quercus velutina*) / *Desmodium nudiflorum* - (*Carex picta*) Forest (CEGL007795, G4)
- *Quercus alba* - *Quercus (falcata, stellata)* / *Chasmanthium laxum* Forest (CEGL007746, G3G4Q)
- *Quercus alba* - *Quercus rubra* - *Carya (alba, ovata)* / *Cornus florida* Acid Forest (CEGL002067, G3)
- *Quercus alba* - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest (CEGL002070, G4G5)
- *Quercus alba* / *Cornus florida* Unglaciated Forest (CEGL002066, GNR)
- *Quercus falcata* - *Quercus (coccinea, stellata)* / *Schizachyrium scoparium* Woodland (CEGL004214, GNA)
- *Quercus falcata* - *Quercus (coccinea, stellata)* / *Vaccinium (pallidum, stamineum)* Forest (CEGL007247, G4)
- *Quercus falcata* - *Quercus alba* - *Carya alba* / *Oxydendrum arboreum* / *Vaccinium stamineum* Forest (CEGL007244, G4G5)
- *Quercus falcata* - *Quercus alba* - *Quercus stellata* - *Quercus velutina* Forest (CEGL005018, G3G5)
- *Quercus imbricaria* - *Quercus shumardii* - *Quercus muehlenbergii* / *Celtis occidentalis* / *Urtica chamaedryoides* Forest (CEGL003876, G3?)
- *Quercus muehlenbergii* - *Quercus (falcata, shumardii, stellata)* / *Cercis canadensis* / *Viburnum rufidulum* Forest (CEGL007699, G3)
- *Quercus muehlenbergii* - *Quercus shumardii* - *Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808, G3)
- *Quercus pagoda* - (*Quercus falcata*) / *Ostrya virginiana* Forest (CEGL003871, G3?)
- *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268, G4?)
- *Quercus prinus* - *Quercus spp.* / *Vaccinium arboreum* - (*Kalmia latifolia*, *Styrax grandifolius*) Forest (CEGL007700, G4)
- *Quercus prinus* / *Smilax spp.* Forest (CEGL005022, G3G5)
- *Quercus rubra* - (*Acer saccharum*, *Quercus alba*) Forest (CEGL005017, GNRQ)
- *Quercus shumardii* - *Quercus muehlenbergii* - *Acer (barbatum, leucoderme, saccharum)* / *Ostrya virginiana* Forest (CEGL008442, G2G3)
- *Quercus stellata* - *Quercus marilandica* - *Carya (glabra, texana)* / *Vaccinium arboreum* Forest (CEGL002075, G4)
- *Quercus velutina* - *Carya (alba, glabra)* / *Vaccinium arboreum* Forest (CEGL004987, G2G3Q)
- *Quercus velutina* - *Quercus alba* - *Carya (glabra, ovata)* Forest (CEGL002076, G4?)
- *Robinia pseudoacacia* Forest (CEGL007279, GNA)

Alliances:

- *Juglans nigra* Forest Alliance (A.1932)
- *Juniperus virginiana* Semi-natural Forest Alliance (A.137)
- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Prunus serotina* - *Acer rubrum* - *Amelanchier canadensis* - *Quercus spp.* Forest Alliance (A.237)
- *Quercus alba* - (*Quercus rubra*, *Carya spp.*) Forest Alliance (A.239)
- *Quercus alba* - *Quercus (falcata, stellata)* Forest Alliance (A.241)
- *Quercus falcata* Forest Alliance (A.243)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus prinus* - (*Quercus coccinea*, *Quercus velutina*) Forest Alliance (A.248)
- *Quercus prinus* - *Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)
- *Quercus rubra* - (*Acer saccharum*) Forest Alliance (A.251)
- *Quercus shumardii* - *Quercus pagoda* Forest Alliance (A.252)
- *Quercus stellata* - *Quercus marilandica* Forest Alliance (A.253)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Quercus velutina* - *Quercus alba* - (*Quercus coccinea*) Forest Alliance (A.1911)
- *Robinia pseudoacacia* Forest Alliance (A.256)

SPATIAL CHARACTERISTICS

Spatial Summary: This is the matrix forest in large parts of the Interior Low Plateau region.

Adjacent Ecological Systems:

- Nashville Basin Limestone Glade and Woodland (CES202.334)

DISTRIBUTION

Range: This system occurs in the southeastern Interior Highlands of the Interior Low Plateau region, including southern Indiana and a small part of southeastern Ohio.

Divisions: 202:C

Nations: US

Subnations: AL, IL, IN, KY, OH, TN

Map Zones: 47:C, 48:C, 49:C, 53:C

TNC Ecoregions: 44:C

SOURCES

References: Braun 1950, Comer et al. 2003, Greller 1988, Keever 1971

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722783#references

Description Author: M. Pyne

Version: 17 Apr 2006
Concept Author: M. Pyne

Stakeholders: Midwest, Southeast
ClassifResp: Southeast

1376 SOUTHERN RIDGE AND VALLEY / CUMBERLAND DRY CALCAREOUS FOREST (CES202.457)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch, Matrix

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Forest and Woodland (Treed); Circumneutral Soil; Broad-Leaved Tree

FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Mixed evergreen-deciduous closed tree canopy

National Mapping Codes: EVT 2376; ESLF 4319; ESP 1376

CONCEPT

Summary: This system includes dry to dry-mesic calcareous forests of the Southern Ridge and Valley region of Alabama and Georgia, extending north into Tennessee, Kentucky, Virginia and adjacent West Virginia. It includes calcareous forests on lower escarpments of the Cumberland Plateau and other related areas. Examples occur on a variety of different landscape positions and occur on generally deeper soils than glade systems of the same regions. This system is distinguished from those farther north in the Ridge and Valley because of its southerly location in the region, an area which is transitional to the "Oak-Pine-Hickory" region. High-quality and historic examples are typically dominated by combinations of *Quercus* species and *Carya* species, sometimes with *Pinus* species and/or *Juniperus virginiana* as a significant component in certain landscape positions and with particular successional histories. These forests occur in a variety of habitats and are the matrix vegetation type that covers most of the landscape under natural conditions. Examples can occur on a variety of topographic and landscape positions including ridgetops and upper and midslopes. Fire frequency and intensity are factors determining the relative mixture of deciduous hardwood versus evergreen trees in this system. Much of this system is currently composed of successional forests that have arisen after repeated cutting, clearing, and cultivation of the original forests. The range of this system is primarily composed of circumneutral substrates, which exert an expected influence on the composition of the vegetation.

Classification Comments: This system is defined as distinct because of its location in the portion of the Ridge and Valley region which is transitional to the "Oak-Pine-Hickory" region (Greller 1988). Most of the zone of occurrence is attributed to the "Southern Limestone/Dolomite Valleys and Low Rolling Hills" (67f) and the "Southern Shale Valleys" (67g) of Griffith et al. (2001), as well as calcareous parts of 68b and 68c (where it is more limited in extent). In addition, the system could be found in drier, more exposed portions of 66f, "Limestone Valleys and Coves" (Griffith et al. 2001), but most of this terrain is probably more mesic and concave. This ecoregion and "Southern Sedimentary Ridges" (66e) are part of the "Blue Ridge" but are clearly transitional to the Ridge and Valley region. Ecoregion 66e is more likely too acidic to support this system. It is also likely in the "Carter Hills" (EPA Ecoregion 70h of Woods et al. (2002)) of Kentucky and in limited portions of related parts of Ecoregion 70 (Western Allegheny Plateau) in Kentucky.

Similar Ecological Systems:

- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)--is found in some similar landscapes but on more acidic and nutrient-poor substrates, which usually correspond to different landform positions.
- Central Appalachian Alkaline Glade and Woodland (CES202.602)--of central Appalachians, mainly Virginia and north; need to clarify ranges; generally more open stands, not closed canopy.
- Central Interior Highlands Calcareous Glade and Barrens (CES202.691)--is related and overlapping in range, with more open physiognomy.
- Ridge and Valley Calcareous Valley Bottom Glade and Woodland (CES202.024)--is more open, with an overlapping range.

Related Concepts:

- Xeric Calcareous Forest (Evans 1991) Intersecting

DESCRIPTION

Environment: Examples can occur on a variety of topographic and landscape positions including ridgetops and upper and mid slopes, where soils are influenced by calcareous/circumneutral geology. Fire frequency and intensity is a factor determining the relative mixture of deciduous hardwood versus evergreen trees in this system.

Vegetation: Natural vegetation consists of forests (or woodlands) dominated most typically by *Quercus alba*, *Quercus muehlenbergii*, and *Quercus shumardii*, with varying amounts of *Carya* spp., *Acer saccharum*, *Acer barbatum*, *Acer leucoderme*, *Acer rubrum*, and other species. This 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*.

MEMBERSHIP

Associations:

- *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest (CEGL007124, GNA)
- *Quercus alba* - *Quercus rubra* - *Carya ovata* / *Cercis canadensis* - *Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba* - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest (CEGL002070, G4G5)
- *Quercus alba* - *Quercus stellata* / *Ostrya virginiana* - *Acer barbatum* / *Chasmanthium sessiliflorum* Forest (CEGL008443, G3G4)

- *Quercus muehlenbergii* - *Quercus shumardii* - *Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808, G3)
- *Quercus shumardii* - *Quercus muehlenbergii* - *Acer (barbatum, leucoderme, saccharum)* / *Ostrya virginiana* Forest (CEGL008442, G2G3)
- *Quercus stellata* - *Juniperus virginiana* var. *virginiana* / *Ulmus alata* - (*Cotinus obovatus*) Woodland (CEGL004583, G3)
- *Robinia pseudoacacia* - *Celtis occidentalis* - (*Fraxinus americana, Liriodendron tulipifera*) Forest (CEGL007281, GNA)

Alliances:

- *Juniperus virginiana* Semi-natural Forest Alliance (A.137)
- *Quercus alba* - (*Quercus rubra, Carya* spp.) Forest Alliance (A.239)
- *Quercus alba* - *Quercus (falcata, stellata)* Forest Alliance (A.241)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Robinia pseudoacacia* Forest Alliance (A.256)

SPATIAL CHARACTERISTICS

Spatial Summary: This system can be large patch in some areas and matrix in others, depending on the arrangement of geological strata and relative degree of erosion of the landscape. If erosion has exposed extensive areas of calcareous materials, the extent is likely to be matrix rather than large patch.

DISTRIBUTION

Range: This systems is endemic to the Southern Ridge and Valley and the Cumberland Plateau escarpment in Alabama, Georgia, Tennessee, Kentucky, Virginia and adjacent West Virginia.

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, TN, VA, WV

Map Zones: 48:C, 53:C, 57:C

TNC Ecoregions: 50:C, 59:C

SOURCES

References: Comer et al. 2003, Greller 1988, Griffith et al. 2001, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723128#references

Description Author: R. Evans and M. Pyne

Version: 29 Sep 2006

Concept Author: R. Evans and M. Pyne

Stakeholders: East, Southeast

ClassifResp: Southeast

SAVANNA AND SHRUB-STEPPE

1400 CENTRAL APPALACHIAN ALKALINE GLADE AND WOODLAND (CES202.602)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Ridge/Summit/Upper Slope; Unglaciated; Alkaline Soil; Shallow Soil

Non-Diagnostic Classifiers: Lowland; Forest and Woodland (Treed); Temperate; Mesotrophic Soil; Circumneutral Soil; Ustic; Intermediate Disturbance Interval; F-Patch/Medium Intensity

FGDC Crosswalk: Vegetated, Tree-dominated, Sparse tree canopy, Mixed evergreen-deciduous sparse tree canopy

National Mapping Codes: EVT 2400; ESLF 5416; ESP 1400

CONCEPT

Summary: This system occurs at low to moderate elevations from the central Appalachians down into the Ridge and Valley. It consists of woodlands and open glades on thin soils over limestone, dolostone or similar calcareous rock. In some cases, the woodlands grade into closed-canopy forests. *Juniperus virginiana* is a common tree, and *Quercus muehlenbergii* is indicative of the limestone substrate. Prairie grasses are the dominant herbs (*Andropogon gerardii*, *Schizachyrium scoparium*, *Bouteloua* spp.); forb richness is often high. Fire is an important natural disturbance vector.

Similar Ecological Systems:

- Central Interior Highlands Calcareous Glade and Barrens (CES202.691)--is a related system to the south and west of CES202.602.
- Laurentian-Acadian Calcareous Rocky Outcrop (CES201.572)
- North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)
- Ridge and Valley Calcareous Valley Bottom Glade and Woodland (CES202.024)--has a possibly overlapping range.
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)--has a more closed canopy.

DESCRIPTION

Environment: This system occupies mid-elevation rocky ridges, slopes, and outcrops with thin soils and calcareous bedrock. Large amounts of exposed mineral soils and/or gravel are characteristic. Soils are high in pH and rich in calcium and magnesium. Although these areas are subject to prolonged droughts, local areas of ephemeral vernal seepage occur in microtopographic concavities, and they may have distinctive vegetation (e.g., colonies of *Dodecatheon meadia*). A series of glades in western Virginia is somewhat distinctive because of the dolostone, which contains a high magnesium content. These glades are located on low dolomite knobs and foothills of Elbrook dolomite that occupy middle to upper slopes and crests of south- or southwest-facing spur ridges at relatively low elevations.

MEMBERSHIP

Associations:

- *Acer saccharum* - *Quercus muehlenbergii* / *Cercis canadensis* Forest (CEGL006017, G4?)
- *Ailanthus altissima* Forest (CEGL007191, GNA)
- *Fraxinus americana* - *Carya ovata* / *Frangula caroliniana* / *Helianthus hirsutus* Woodland (CEGL008458, G1?)
- *Juniperus virginiana* / *Bouteloua curtipendula* - *Carex eburnea* Wooded Herbaceous Vegetation (CEGL006047, G1G2)
- *Quercus alba* - *Quercus rubra* - *Carya (alba, ovata)* / *Cornus florida* Acid Forest (CEGL002067, G3)
- *Quercus muehlenbergii* - *Cercis canadensis* / *Packera obovata* - *Lithospermum canescens* Woodland (CEGL006231, G3G4)
- *Quercus muehlenbergii* - *Juniperus virginiana* / *Schizachyrium scoparium* - *Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131, G2G3)
- *Quercus muehlenbergii* - *Quercus (alba, rubra)* - *Carya cordiformis* / *Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus muehlenbergii* / *Packera plattensis* - *Parthenium auriculatum* - *Schizachyrium scoparium* Woodland (CEGL006030, G2)
- *Quercus muehlenbergii* / *Salix humilis* / *Eryngium yuccifolium* Woodland (CEGL006239, G1Q)
- *Quercus rubra* - *Carya (glabra, ovata)* / *Ostrya virginiana* / *Carex lucorum* Forest (CEGL006301, G4?)
- *Rhus aromatica* - *Celtis tenuifolia* / *Carex eburnea* Shrubland (CEGL004393, G3)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- *Ailanthus altissima* Forest Alliance (A.221)
- *Carya (glabra, ovata)* - *Fraxinus americana* - *Quercus (alba, rubra)* Forest Alliance (A.258)
- *Fraxinus americana* - *Carya glabra* - (*Juniperus virginiana*) Woodland Alliance (A.604)
- *Juniperus virginiana* - *Rhus aromatica* Shrubland Alliance (A.1049)
- *Quercus alba* - (*Quercus rubra*, *Carya* spp.) Forest Alliance (A.239)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus muehlenbergii* Woodland Alliance (A.621)

DISTRIBUTION

Range: This system is known from Pennsylvania south through the Ridge and Valley to western Virginia, southeastern Kentucky and northeastern Tennessee.

Divisions: 202:C

Nations: US

Subnations: KY, MD, NJ, OH, PA, TN, VA, WV

Map Zones: 54:N, 59:N, 60:C, 61:C, 62:C, 64:N, 65:P

TNC Ecoregions: 49:P, 50:C, 59:C, 61:P

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723007#references

Description Author: S.C. Gawler, G. Fleming, R. Evans, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: S.C. Gawler, G. Fleming, R. Evans

Stakeholders: East, Midwest, Southeast

ClassifResp: East

1401 CENTRAL INTERIOR HIGHLANDS CALCAREOUS GLADE AND BARRENS (CES202.691)

CLASSIFIERS

Conf.: 1 - Strong

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Rock Outcrops/Barrens/Glades; Alkaline Soil

Non-Diagnostic Classifiers: Forest and Woodland (Treed); Sedimentary Rock; F-Patch/Medium Intensity

FGDC Crosswalk: Vegetated, Tree-dominated, Sparse tree canopy, Mixed evergreen-deciduous sparse tree canopy

National Mapping Codes: EVT 2401; ESLF 5417; ESP 1401

CONCEPT

Summary: This system is found primarily in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions with scattered occurrences in northern Missouri. It occurs along moderate to steep slopes and steep valleys on primarily southerly to westerly facing slopes. Limestone and/or dolomite bedrock typify this system with shallow, moderately to well-drained soils interspersed with rocks. These soils often dry out during the summer and autumn, and then become saturated during the winter and spring. *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. Fire is the primary natural dynamic, and prescribed fires help manage this system by restricting woody growth and maintaining the more open glade structure.

Classification Comments: In Alabama, this system is found in the Moulton Valley region, which is technically part of TNC Ecoregion 50, but ambiguously placed there. This region is included in the Interior Plateau (71) of EPA (2004). Also included here, somewhat uncomfortably, is an unusual series of flatrock glades on Silurian dolomite in Bullitt County, Kentucky (71d of Woods et al. (2002)).

Similar Ecological Systems:

- Bluegrass Savanna and Woodland (CES202.888)
- Central Appalachian Alkaline Glade and Woodland (CES202.602)--of central Appalachians, mainly Virginia and north; need to clarify ranges.
- Nashville Basin Limestone Glade and Woodland (CES202.334)
- Ridge and Valley Calcareous Valley Bottom Glade and Woodland (CES202.024)--has a possible overlapping range.
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)--has a more closed canopy.

Related Concepts:

- Dolomite Glade (Evans 1991) Finer
- Limestone Glade (Evans 1991) Finer
- Xeric Calcareous Forest (Evans 1991) Finer

DESCRIPTION

Environment: This system is found primarily along moderate to steep slopes and steep valleys on primarily southerly to westerly facing slopes. Limestone and/or dolomite bedrock typify this system with shallow, moderately to well-drained soils interspersed with rocks. Soils are affected by the bedrock chemistry and tend to have high levels of calcium and potassium and a relatively high pH. Due to seasonal rainfall patterns and the extremely thin soils, these soils dry out during the summer and autumn and become saturated during the winter and spring. In northern Alabama (Moulton Valley), the stratum on which the system is found is a type of "marl." Seeps may occur where impervious rock strata meet relatively permeable limestone.

Vegetation: *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. The trees typically occur as islands in a wider herbaceous or rocky area. The islands are found in microenvironments where the soil depth and available water are sufficient to support trees (e.g., depressions in the bedrock). Other woody plants associated with this system (within their ranges) include *Quercus shumardii*, *Cercis canadensis*, *Ulmus alata*, *Fraxinus quadrangulata*, *Juniperus ashei*, *Acer saccharum*, and *Frangula caroliniana*. Other herbaceous taxa include *Silphium trifoliatum*, *Silphium terebinthinaceum*, *Liatris* spp., *Symphytotrichum oblongifolium*, *Castilleja coccinea*, *Hedyotis nigricans*, *Talinum* spp., *Sedum* spp., and *Panicum flexile*. Small-scale stands of annual *Sporobolus* spp. may be prominent in some examples. In some examples, small-scale seepage areas may contain *Eleocharis compressa*, *Nothoscordum bivalve*, *Isoetes butleri*, and *Hypoxis hirsuta*.

Dynamics: Fire is the primary natural dynamic, and prescribed fires help manage this system by restricting woody growth and maintaining the more open glade structure.

MEMBERSHIP

Associations:

- (*Quercus stellata*, *Ulmus alata*) / *Schizachyrium scoparium* - *Symphytotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation (CEGL007824, G2?)

- *Acer saccharum* - *Quercus muehlenbergii* / *Cercis canadensis* Forest (CEGL006017, G4?)
- *Eleocharis compressa* - *Nothoscordum bivalve* Herbaceous Vegetation (CEGL004669, GNR)
- *Fraxinus quadrangulata* - *Juniperus virginiana* var. *virginiana* / *Schizachyrium scoparium* - *Lithospermum canescens* Woodland (CEGL007994, G2)
- *Juniperus ashei* / *Cotinus obovatus* / *Carex eburnea* - *Rudbeckia missouriensis* Woodland (CEGL007833, G2?)
- *Juniperus ashei* Dry Chalk Outcrop Woodland (CEGL007967, G1)
- *Juniperus ashei* Ozark Clifftop Woodland (CEGL004672, G2?)
- *Juniperus virginiana* / *Schizachyrium scoparium* - (*Andropogon gerardii*, *Sorghastrum nutans*) - *Silphium (trifoliatum, terebinthinaceum)* Wooded Herbaceous Vegetation (CEGL004738, G2)
- *Juniperus virginiana* / *Schizachyrium scoparium* - *Silphium terebinthinaceum* var. *luciae-brauniae* - *Carex juniperorum* - *Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464, G1Q)
- *Juniperus virginiana* Alkaline Bluff Woodland (CEGL002426, GNR)
- *Juniperus virginiana* var. *virginiana* - *Fraxinus quadrangulata* / *Symphyotrichum oblongifolium* - *Panicum flexile* - *Sedum pulchellum* Woodland (CEGL004271, G2)
- Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291, G4G5)
- Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292, G4G5)
- Limestone - Dolostone Talus Sparse Vegetation (CEGL002308, G4G5)
- *Quercus marilandica* - (*Juniperus virginiana*) / *Schizachyrium scoparium* - *Danthonia spicata* Wooded Herbaceous Vegetation (CEGL002428, G2)
- *Quercus muehlenbergii* - *Fraxinus (quadrangulata, americana)* / *Schizachyrium scoparium* Woodland (CEGL002143, G3G4)
- *Quercus muehlenbergii* - *Juniperus virginiana* - *Acer saccharum* / *Frangula caroliniana* Forest (CEGL002108, G3G4)
- *Quercus muehlenbergii* - *Juniperus virginiana* / *Schizachyrium scoparium* - *Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131, G2G3)
- *Quercus muehlenbergii* - *Quercus shumardii* Forest (CEGL004602, G2G4)
- *Quercus muehlenbergii* / *Schizachyrium scoparium* - *Bouteloua curtipendula* Wooded Herbaceous Vegetation (CEGL005284, G2G3)
- *Quercus stellata* - *Quercus alba* - (*Quercus falcata*) / *Schizachyrium scoparium* Woodland (CEGL004217, G1)
- *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391, G2G3)
- *Rhus aromatica* - *Celtis tenuifolia* / *Carex eburnea* Shrubland (CEGL004393, G3)
- *Schizachyrium scoparium* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation (CEGL002251, G2)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation (CEGL002398, G3G4)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Tradescantia bracteata* Alkaline Bedrock Herbaceous Vegetation (CEGL005280, G1G2)
- *Schizachyrium scoparium* - *Sporobolus compositus* var. *compositus* - *Rudbeckia fulgida* var. *fulgida* Wooded Herbaceous Vegetation (CEGL004078, G2)
- *Sedum pulchellum* - *Talinum calcaricum* - *Leavenworthia* spp. / *Nostoc commune* Herbaceous Vegetation (CEGL004346, G3)
- *Sedum pulchellum* - *Talinum calycinum* - *Oenothera linifolia* Shale Herbaceous Vegetation (CEGL004347, G2G3)
- *Sporobolus (neglectus, vaginiflorus)* - *Leavenworthia exigua* var. *laciniata* - *Viola egglesonii* Herbaceous Vegetation (CEGL007772, G1Q)
- *Sporobolus vaginiflorus* var. *ozarkanus* Ozark Herbaceous Vegetation (CEGL008563, G3?)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Eleocharis compressa* - *Nothoscordum bivalve* Saturated Herbaceous Alliance (A.1458)
- *Fraxinus quadrangulata* - (*Juniperus virginiana*) Woodland Alliance (A.1913)
- *Juniperus ashei* Woodland Alliance (A.501)
- *Juniperus virginiana* - *Quercus (muehlenbergii, stellata)* Forest Alliance (A.382)
- *Juniperus virginiana* - *Rhus aromatica* Shrubland Alliance (A.1049)
- *Juniperus virginiana* Woodland Alliance (A.545)
- Lowland Talus Sparsely Vegetated Alliance (A.1847)
- Open Cliff Sparsely Vegetated Alliance (A.1836)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus muehlenbergii* Woodland Alliance (A.621)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)
- *Sedum pulchellum* Saturated Herbaceous Alliance (A.1820)
- *Sporobolus (neglectus, vaginiflorus)* Herbaceous Alliance (A.1815)

DISTRIBUTION

Range: This system is found primarily in the Interior Highlands of the Ozark, Ouachita, and the Interior Low Plateau regions ranging east to southern Ohio and including the Knobs region and Cliff section of Kentucky, the Cumberland Plateau escarpment of

Tennessee, and the Moulton Valley of northern Alabama.

Divisions: 202:C; 203:C

Nations: US

Subnations: AL, AR, IL, IN, KY, MO, OH, OK, TN

Map Zones: 43:P, 44:C, 46:C, 47:C, 48:C, 49:C, 53:C

TNC Ecoregions: 36:C, 38:C, 39:C, 43:C, 44:C, 50:C

SOURCES

References: Comer et al. 2003, Delcourt and Delcourt 1997, DeSelm and Murdock 1993, EPA 2004, Erickson et al. 1942, Evans 1991, Nelson 1985, USFWS 1974, Webb et al. 1997, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722968#references

Description Author: S. Menard, T. Nigh, M. Pyne, mod. J. Drake

Version: 18 Jul 2006

Concept Author: S. Menard, T. Nigh, M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Midwest

1398 CUMBERLAND SANDSTONE GLADE AND BARRENS (CES202.337)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Rock Outcrops/Barrens/Glades; Acidic Soil

FGDC Crosswalk: Vegetated, Tree-dominated, Sparse tree canopy, Mixed evergreen-deciduous sparse tree canopy

National Mapping Codes: EVT 2398; ESLF 5414; ESP 1398

CONCEPT

Summary: This system encompasses a complex of sparsely vegetated rock outcrops, perennial grasslands, and woodlands on shallow soils on the Cumberland Plateau of Kentucky, Tennessee, Alabama, and Georgia. Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of the outcrops in Tennessee. In Alabama, *Bigelovia nuttallii* and *Schizachyrium scoparium* are important. *Pinus virginiana* and *Acer rubrum* are typical of the woodlands surrounding these outcrops on the Cumberland Plateau. Scattered shrubs, such as *Vaccinium arboreum* and *Chionanthus virginicus*, occur on the margins in patches of deeper soil. Fruticose lichens such as *Cladonia* spp. and *Cladina* spp. may be prominent in some examples. To the west, in the Interior Highlands (Ozark, Ouachita, and Interior Low Plateau regions), this system is replaced by Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692) (both are found in Kentucky, with the latter in the Shawnee Hills of the Interior Low Plateau).

Similar Ecological Systems:

- Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692)

Related Concepts:

- Cumberland Mtns. Xeric Virginia Pine Woodland (Evans 1991) Finer

DESCRIPTION

Environment: Some examples of this system may occur adjacent to sandstone cliff faces.

Vegetation: Herbaceous plants, including *Diamorpha smallii* and *Minuartia glabra*, are typical of the outcrops in Tennessee. In Alabama, *Bigelovia nuttallii* and *Schizachyrium scoparium* are important (A. Schotz pers. comm.). *Pinus virginiana* and *Acer rubrum* are typical of the woodlands surrounding these outcrops on the Cumberland Plateau (Perkins 1981). Other herbaceous plants which may be found include *Danthonia sericea*, *Liatris microcephala*, *Eurybia surculosa* (= *Aster surculosus*), *Hypericum gentianoides*, *Talinum mengesii*, *Nuttallanthus canadensis* (= *Linaria canadensis*), *Opuntia humifusa* var. *humifusa*, *Sporobolus vaginiflorus*, *Erigeron strigosus*, *Grimmia* spp., and fruticose lichens such as *Cladonia* spp. and *Cladina* spp. Scattered shrubs, such as *Vaccinium arboreum* and *Chionanthus virginicus*, occur on the margins of more open areas, in patches of deeper soil.

MEMBERSHIP

Associations:

- *Bigelovia nuttallii* - *Coreopsis pulchra* - *Liatris microcephala* Herbaceous Vegetation (CEGL004622, G2)
- *Diamorpha smallii* - *Minuartia glabra* Sandstone Herbaceous Vegetation (CEGL004343, G2G3)
- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Schizachyrium scoparium* - *Danthonia sericea* - *Liatris microcephala* - (*Eurybia surculosa*) Wooded Herbaceous Vegetation (CEGL004061, G3)

Alliances:

- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Bigelovia nuttallii* Herbaceous Alliance (A.1617)
- *Minuartia glabra* - *Talinum* spp. - *Diamorpha smallii* Saturated Herbaceous Alliance (A.1819)
- *Pinus virginiana* Forest Alliance (A.131)

DISTRIBUTION

Range: This system is found in the Cumberland Plateau of Kentucky, Tennessee, Virginia, Alabama, and Georgia.

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, TN, VA

Map Zones: 48:C, 53:C, 57:?

TNC Ecoregions: 50:C

SOURCES

References: Comer et al. 2003, Perkins 1981, Schotz pers. comm.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723168#references

Description Author: M. Pyne, R. Evans, C. Nordman

Version: 12 Dec 2002

Stakeholders: East, Midwest, Southeast

1397 NASHVILLE BASIN LIMESTONE GLADE AND WOODLAND (CES202.334)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Rock Outcrops/Barrens/Glades; Alkaline Soil; Graminoid

FGDC Crosswalk: Vegetated, Tree-dominated, Sparse tree canopy, Mixed evergreen-deciduous sparse tree canopy

National Mapping Codes: EVT 2397; ESLF 5413; ESP 1397

CONCEPT

Summary: This system encompasses a range of plant communities associated with thin soils on flat areas of Ordovician limestone in the Inner Nashville Basin of Tennessee (Ecoregion 71i of Griffith et al. (1998), EPA (2004); Subsection 222Ed of Keys et al. (1995)), with a few disjunct occurrences in Kentucky. The vegetation of this system includes sparsely vegetated rock outcrops, annual *Sporobolus* spp.-dominated grasslands, *Schizachyrium scoparium*-dominated perennial grasslands, seasonally wet herbaceous washes and seeps, shrublands, as well as woodlands dominated by *Juniperus virginiana* and oaks. *Echinacea tennesseensis* and *Astragalus bibullatus* are completely endemic to this system. There are numerous other disjunct and near-endemic plants.

Classification Comments: This system occupies a small portion of the landscape but many associations are only found in this system. The most closely related system is Central Interior Highlands Calcareous Glade and Barrens (CES202.691). Also included here are related disjunct examples in Kentucky on Mississippian limestones (EPA ecoregions 71a, 71e of Woods et al. (2002)).

Similar Ecological Systems:

- Central Interior Highlands Calcareous Glade and Barrens (CES202.691)--is typically found on sloping surfaces, not flatrocks, and has a broader distribution.

Related Concepts:

- Limestone Flat-Rock Glade (Evans 1991) Finer

DESCRIPTION

Vegetation: The vegetation of this system includes sparsely vegetated rock outcrops, annual *Sporobolus* spp.-dominated grasslands, *Schizachyrium scoparium*-dominated perennial grasslands, seasonally wet herbaceous washes and seeps, shrublands, as well as woodlands dominated by *Juniperus virginiana* and oaks. Other woody plants associated with this system include *Quercus shumardii*, *Cercis canadensis*, *Ulmus alata*, *Fraxinus quadrangulata*, and *Acer saccharum*. Characteristic shrubs include *Forestiera ligustrina*, *Rhus aromatica*, *Hypericum frondosum*, and *Frangula caroliniana*. Other herbaceous taxa include *Andropogon gerardii*, *Bouteloua curtipendula*, *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*, and *Panicum flexile*. *Echinacea tennesseensis* and *Astragalus bibullatus* are completely endemic to this system. There are numerous other disjunct and near-endemic plants, including *Astragalus tennesseensis*, *Dalea gattereri*, and *Pediomelum subacaule* (Somers et al. 1986). Small-scale seepage areas and washes may contain *Eleocharis compressa*, *Nothoscordum bivalve*, *Isoetes butleri*, and *Hypoxis hirsuta*.

MEMBERSHIP

Associations:

- *Dalea foliosa* - *Mecardonia acuminata* - *Mitreola petiolata* Herbaceous Vegetation (CEGL004292, G2?)
- *Eleocharis compressa* - *Schoenolirion croceum* - *Carex crawei* - *Allium cernuum* Herbaceous Vegetation (CEGL004169, G2?)
- *Juniperus virginiana* var. *virginiana* - *Forestiera ligustrina* - *Rhus aromatica* - *Hypericum frondosum* Shrubland (CEGL003938, G3G4)
- *Juniperus virginiana* var. *virginiana* - *Fraxinus quadrangulata* / *Polymnia canadensis* - (*Astranthium integrifolium*) Woodland (CEGL003754, G3)
- *Quercus muehlenbergii* - *Juniperus virginiana* / *Schizachyrium scoparium* - *Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131, G2G3)
- *Quercus stellata* / *Viburnum rufidulum* - *Forestiera ligustrina* / *Andropogon gerardii* Woodland (CEGL003712, G2?)
- *Sedum pulchellum* - *Talinum calcaricum* - *Leavenworthia* spp. / *Nostoc commune* Herbaceous Vegetation (CEGL004346, G3)
- *Sporobolus* (*neglectus*, *vaginiflorus*) - *Aristida longispica* - *Panicum flexile* - *Panicum capillare* Herbaceous Vegetation (CEGL004340, G3)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- *Dalea foliosa* - *Mecardonia acuminata* Saturated Herbaceous Alliance (A.1686)
- *Eleocharis compressa* - *Nothoscordum bivalve* Saturated Herbaceous Alliance (A.1458)
- *Fraxinus quadrangulata* - (*Juniperus virginiana*) Woodland Alliance (A.1913)
- *Juniperus virginiana* - *Rhus aromatica* Shrubland Alliance (A.1049)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)

- *Sedum pulchellum* Saturated Herbaceous Alliance (A.1820)
- *Sporobolus (neglectus, vaginiflorus)* Herbaceous Alliance (A.1815)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

DISTRIBUTION

Range: This system is restricted to flat areas of Ordovician limestone in the Inner Nashville Basin of Tennessee, as well as limited and disjunct examples on flat Mississippian limestones in Kentucky.

Divisions: 202:C

Nations: US

Subnations: KY, TN

Map Zones: 35:N, 47:C, 48:C

TNC Ecoregions: 44:C

SOURCES

References: Comer et al. 2003, EPA 2004, Griffith et al. 1998, Keys et al. 1995, Somers et al. 1986, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723170#references

Description Author: M. Pyne, R. Evans, C. Nordman

Version: 05 Jul 2006

Concept Author: M. Pyne, R. Evans, C. Nordman

Stakeholders: Southeast

ClassifResp: Southeast

RIDGE AND VALLEY CALCAREOUS VALLEY BOTTOM GLADE AND WOODLAND (CES202.024)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Rock Outcrops/Barrens/Glades

CONCEPT

Summary: This system consists of open glades and surrounding woodlands on shallow, high pH, rich soils of the Ridge and Valley region from Virginia southward. These glades occur in broad valley bottoms or rolling basins where soils are shallow over flat-lying limestone strata. The flat terrain and locally xeric soils may have been especially susceptible to periodic fires that helped maintain the prairie-like openings and savanna-like woodlands. Today, much of the system is currently somewhat more closed and brushy, suggesting fire suppression. *Quercus muehlenbergii* (chinquapin oak) is typical where there is canopy.

Classification Comments: Other calcareous glade systems of the same region occur on hillslopes. They are subject to different erosional processes, zonal vegetation patterns, and generally different ecological dynamics.

Similar Ecological Systems:

- Central Appalachian Alkaline Glade and Woodland (CES202.602)--of central Appalachians, mainly Virginia and north; need to clarify ranges.
- Central Interior Highlands Calcareous Glade and Barrens (CES202.691)--is related, with possibly overlap in range?
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)--is a more closed-canopy system with a similar range.

MEMBERSHIP

Associations:

- *Quercus muehlenbergii* - *Juniperus virginiana* / *Schizachyrium scoparium* - *Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131, G2G3)
- *Quercus muehlenbergii* - *Quercus (falcata, shumardii, stellata)* / *Cercis canadensis* / *Viburnum rufidulum* Forest (CEGL007699, G3)
- *Quercus muehlenbergii* / *Salix humilis* / *Eryngium yuccifolium* Woodland (CEGL006239, G1Q)
- *Sporobolus vaginiflorus* (var. *ozarkanus*, var. *vaginiflorus*) - *Hypericum dolabriforme* Herbaceous Vegetation (CEGL004339, G2G3)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- *Quercus muehlenbergii* - (*Acer saccharum*) Forest Alliance (A.1912)
- *Quercus muehlenbergii* Woodland Alliance (A.621)
- *Sporobolus (neglectus, vaginiflorus)* Herbaceous Alliance (A.1815)

DISTRIBUTION

Range: According to Gary Fleming, this type may be restricted to the Southern Ridge and Valley section of Keys et al (1995).

Divisions: 202:C

Nations: US

Subnations: GA, TN, VA

Map Zones: 48:C, 53:C, 57:C, 59:N, 60:N, 61:C

TNC Ecoregions: 50:C, 59:C

SOURCES

References: Comer et al. 2003, Keys et al. 1995

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722681#references

Description Author: M. Pyne, G. Fleming, R. Evans

Version: 17 Apr 2006

Concept Author: M. Pyne, G. Fleming, R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

1399 SOUTHERN AND CENTRAL APPALACHIAN MAFIC GLADE AND BARRENS (CES202.348)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Steppe/Savanna

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Woody-Herbaceous; Rock Outcrops/Barrens/Glades; Shallow Soil

FGDC Crosswalk: Vegetated, Tree-dominated, Sparse tree canopy, Mixed evergreen-deciduous sparse tree canopy

National Mapping Codes: EVT 2399; ESLF 5415; ESP 1399

CONCEPT

Summary: This southern and central Appalachian system consists of vegetation associated with shallow soils over predominantly mafic bedrock, usually with significant areas of rock outcrop. Bedrock includes a variety of igneous and metamorphic rock types such as greenstone and amphibolite. These areas support a patchy mosaic of open woodland and grassy herbaceous vegetation sometimes with a predominant woody short-shrub community present.

Classification Comments: These glades and barrens are intermediate between other rock outcrop and forest systems, with less dense vegetation than the closed forests supported by the region's climate but with more vegetation than bare rock cover. They may grade very gradually into both kinds of systems. Systems of similar physiognomy and setting but on acidic substrates are generally included in Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

Similar Ecological Systems:

- Appalachian Shale Barrens (CES202.598)
- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Appalachian Rocky Summit (CES202.327)
- Southern Piedmont Glade and Barrens (CES202.328)

DESCRIPTION

Environment: Occurs on upper to mid slopes, usually on gentle to moderate slopes but occasionally steeper. The ground is mostly shallow soil over bedrock, usually with significant areas of rock outcrop. The rock usually has few fractures but may have a pitted or irregular surface. This rock structure supports more extensive and deeper soil development than in Southern Appalachian Granitic Dome (CES202.297), but has few of the crevices and deeper rooting sites available in Southern Appalachian Rocky Summit (CES202.327). Micro-scale soil depth and presence of seepage are important factors in determining the vegetation patterns. Shallow soil, unable to support a closed tree canopy, separates this system from forest systems. Bedrock includes a variety of igneous and metamorphic rock types. Some examples are on mafic substrates such as amphibolite, some are on felsic rock such as granitic gneiss but have flora that suggests a basic influence, and a few occur on felsic rocks and are clearly acidic. Rock or soil chemistry appears to be the most important factor affecting different associations on sites that have the physical structure to belong to this system. Elevation may also be an important factor causing variation.

Vegetation: Vegetation is a fine mosaic of different physiognomies, with open woodland and grassy herbaceous vegetation or short shrubs predominating. Some instances may have closed canopies of small trees or large shrubs, but no examples have large canopy trees with a closed canopy. Bare rock outcrops are usually present in a minority of the area. The canopy species are species tolerant of dry, shallow soils, most commonly *Quercus prinus*, *Pinus* spp., and *Juniperus virginiana*. Basic examples may also have *Carya glabra*, *Fraxinus americana*, and other species abundant. Shrubs may be dense, with species determined by soil chemistry. The herb layer is usually fairly dense and dominated by grasses, both in treeless areas and beneath open canopy. An abundant forb component is also usually present, especially in the more basic examples. The forbs include species characteristic of other rock outcrops and grassland species, with a smaller number of forest species present.

Dynamics: The dynamics of this system are not well known. The occurrence of the system appears to be primarily determined by site physical properties, with physical and chemical properties determining vegetational variation. Fire may be an important influence on vegetation, and may in the long run be important for keeping the vegetation structure open, though the patchy distribution of vegetation might limit fire intensity. Periodic drought and wind storms may also be an important factor limiting canopy density and stature. The shallow soil would make these sites particularly prone to all three. These glades do not appear to be undergoing the kind of cyclic succession that has been described for granitic domes, but some balance of soil accumulation and destruction may be occurring on a longer term or coarser scale. It is possible that the slightly irregular curved surface of some examples represents a late stage in the weathering of old exfoliation surfaces that once supported granitic domes, but most known examples are not spatially associated with existing granitic domes.

MEMBERSHIP

Associations:

- *Carya (glabra, alba) - Fraxinus americana - (Juniperus virginiana var. virginiana)* Woodland (CEGL003752, G2)
- *Carya glabra - Fraxinus americana - Quercus prinus / Ostrya virginiana / Philadelphus hirsutus* Woodland (CEGL004995, G2)
- *Diervilla lonicera - Solidago simplex var. randii - Deschampsia flexuosa - Hylotelephium telephioides - Saxifraga michauxii*

- Herbaceous Vegetation (CEGL008536, G1)
- *Fraxinus americana* - *Carya glabra* / *Muhlenbergia sobolifera* - *Helianthus divaricatus* - *Solidago ulmifolia* Woodland (CEGL003683, G2)
 - *Fraxinus americana* / *Physocarpus opulifolius* / *Carex pensylvanica* - *Allium cernuum* - (*Phacelia dubia*) Wooded Herbaceous Vegetation (CEGL008529, G2)
 - *Kalmia latifolia* / *Schizachyrium scoparium* / *Cladonia* spp. Shrub Herbaceous Vegetation (CEGL004238, G1)
 - *Photinia melanocarpa* - *Gaylussacia baccata* / *Carex pensylvanica* Shrubland (CEGL008508, G1?)
 - *Quercus stellata* / *Schizachyrium scoparium* - *Sorghastrum nutans* - *Pycnanthemum tenuifolium* - *Packera paupercula* Wooded Herbaceous Vegetation (CEGL006215, G1)
 - *Schizachyrium scoparium* - *Sorghastrum nutans* - *Aletris farinosa* - *Packera paupercula* Herbaceous Vegetation (CEGL004999, G1)
 - *Selaginella rupestris* - *Croton willdenowii* - *Cheilanthes tomentosa* - (*Allium cuthbertii*) Herbaceous Vegetation (CEGL004992, G1)
 - *Selaginella rupestris* - *Schizachyrium scoparium* - *Hylotelephium telephioides* - *Allium cernuum* Herbaceous Vegetation (CEGL004991, G2)

Alliances:

- (*Fraxinus americana*, *Juniperus virginiana*) / *Carex pensylvanica* - *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.3014)
- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Fraxinus americana* - *Carya glabra* - (*Juniperus virginiana*) Woodland Alliance (A.604)
- *Kalmia latifolia* - *Gaylussacia baccata* Shrubland Alliance (A.1050)
- *Saxifraga michauxii* Herbaceous Alliance (A.1621)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)
- *Schizachyrium scoparium* Shrub Herbaceous Alliance (A.1520)
- *Selaginella (tortipila, rupestris)* Herbaceous Alliance (A.1985)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch system, most examples covering a few acres.

Size: Most examples naturally cover a few acres, with a few examples up to 10 or more acres.

Adjacent Ecological Systems:

- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Oak Forest (CES202.886)
- Southern Appalachian Rocky Summit (CES202.327)

Adjacent Ecological System Comments: This system is surrounded by forest systems on deeper soils less influenced by bedrock, most typically Southern Appalachian Oak Forest (CES202.886). It is rarely associated with Southern Appalachian Granitic Dome (CES202.297) or Southern Appalachian Rocky Summit (CES202.327).

DISTRIBUTION

Range: This system occurs scattered in clusters in the Southern Blue Ridge and adjacent portions of the upper Piedmont and central Appalachians.

Divisions: 202:C

Nations: US

Subnations: GA?, MD?, NC, PA?, SC?, TN, VA

Map Zones: 54:C, 57:C, 59:C, 60:N, 61:C

TNC Ecoregions: 51:C, 52:C, 59:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723162#references

Description Author: M. Schafale, R. Evans, M. Pyne, S.C. Gawler

Version: 11 Oct 2004

Concept Author: M. Schafale, R. Evans, M. Pyne, S.C. Gawler

Stakeholders: East, Southeast

ClassifResp: Southeast

UPLAND GRASSLAND AND HERBACEOUS

CUMBERLAND WET-MESIC MEADOW AND SAVANNA (CES202.053)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous

CONCEPT

Summary: This system consists of open, prairie-like vegetation of the undissected portions of the Cumberland Plateau of Kentucky and adjacent Tennessee (Ecoregion 68a [Cumberland Plateau] of Griffith et al. (1998) and Woods et al. (2002); part of Subsection 221Hc of Keys et al. (1995)). Stands are dominated by grasses and forbs with scattered shrubby vegetation and, occasionally, trees. The scattered trees are mainly *Quercus bicolor*, *Quercus falcata*, *Quercus palustris*, *Nyssa sylvatica*, *Liquidambar styraciflua*, and *Acer rubrum* var. *trilobum* (Braun 1937). The primary dominant grass in the wetter phase is *Chasmanthium laxum* (Braun 1937). This vegetation was the predominant type here in the early 1800s and earlier and probably was maintained from burning by Native Americans.

Similar Ecological Systems:

- Eastern Highland Rim Prairie and Barrens (CES202.354)
- North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)
- Pennyroyal Karst Plain Prairie and Barrens (CES202.355)
- Western Highland Rim Prairie and Barrens (CES202.352)

DESCRIPTION

Environment: This system is found in an open, flat to gently rolling landscape which easily carries fire if maintained in a grassy condition.

Vegetation: Common grasses include *Andropogon glomeratus*, *Calamagrostis coarctata* (= *Calamagrostis cinnoides*) (southern), *Dichanthelium sphaerocarpon* var. *isophyllum* (= *Panicum polyanthes*), and *Dichanthelium scoparium* (= *Panicum scoparium*), plus, in drier transitions, *Panicum anceps*, *Schizachyrium scoparium*, *Sorghastrum nutans*, and locally *Andropogon gerardii*. Sedges are common, especially *Carex atlantica* (with var. *capillacea*), *Carex debilis* (with vars.), *Carex lurida* (with var. *gracilis*), *Rhynchospora capitellata*, *Rhynchospora glomerata*, *Scirpus cyperinus*, *Scirpus polyphyllus*, etc. Rushes are also common, especially *Juncus canadensis* and *Juncus marginatus* on drier sites (?); *Juncus effusus* (with var. *pylaei*) and *Juncus coriaceus* on wetter sites (?). Common ferns are *Lygodium palmatum*, *Thelypteris noveboracensis* and, in wetter places, *Athyrium filix-femina* ssp. *asplenioides* (= *Athyrium asplenioides*) and *Osmunda cinnamomea*. The most abundant herbs often include *Eupatorium fistulosum* and *Solidago rugosa*. Other typical species include *Agalinis purpurea*, *Aletris farinosa*, *Apios americana*, *Symphotrichum dumosum* (= *Aster dumosus*), *Doellingeria umbellata* (= *Aster umbellatus*), *Eupatorium pilosum*, *Eupatorium rotundifolium*, *Eupatorium perfoliatum* (richer soil?), *Linum striatum*, *Lobelia puberula*, *Lycopus virginicus*, *Platanthera ciliaris* (often in drier sites), *Potentilla simplex*, *Rhexia mariana* (less *Rhexia virginica*), *Viola primulifolia*, and *Vernonia noveboracensis* (southern). The subshrubby vine *Rubus hispidus* is also common. Regionally rare species (mostly increasing to the south) include *Bartonia paniculata*, *Gratiola pilosa*, *Helianthus angustifolius*, *Hypericum crux-andreae*, *Lobelia nuttallii*, *Dichanthelium dichotomum* var. *ensifolium* (= *Panicum ensifolium*), *Panicum rigidulum* var. *pubescens* (= *Panicum longifolium*) (locally abundant on finer soils), *Platanthera cristata* (typically in boggy forest transitions), *Polygala cruciata*, *Pycnanthemum verticillatum*?, *Rhynchospora globularis*, *Sabatia campanulata*?, *Stenanthium gramineum*, *Xyris torta*, etc. The most abundant woody species include *Acer rubrum* var. *trilobum* and *Rhus copallinum*; others include *Alnus serrulata*, *Photinia* spp. (*Photinia pyrifolia* (= *Aronia arbutifolia*), *Photinia melanocarpa* (= *Aronia melanocarpa*)), *Ilex opaca*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Lyonia ligustrina*, *Nyssa sylvatica*, *Oxydendrum arboreum*, *Pinus echinata*, *Quercus alba*, *Rhododendron* sp. (*Rhododendron cumberlandense*? (= *Rhododendron bakeri*?)), *Rubus* spp. (*Arguti* group), *Salix* spp. (*Salix humilis*, *Salix nigra*, *Salix sericea*), *Spiraea tomentosa* (local on finer textured soil?), and *Smilax glauca* (J. Campbell unpubl. data).

MEMBERSHIP

Associations:

- *Andropogon gerardii* - (*Sorghastrum nutans*) Kentucky Herbaceous Vegetation (CEGL004677, G1G2)

Alliances:

- *Andropogon gerardii* - (*Sorghastrum nutans*) Herbaceous Alliance (A.1192)

DISTRIBUTION

Range: This system is found in the Cumberland Plateau of Kentucky and adjacent Tennessee.

Divisions: 202:C

Nations: US

Subnations: KY, TN
Map Zones: 47:C
TNC Ecoregions: 50:C

SOURCES

References: Braun 1937, Campbell pers. comm., Griffith et al. 1998, Keys et al. 1995, Southeastern Ecology Working Group n.d., Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.792682#references

Description Author: M. Pyne, M. Evans, C. Nordman

Version: 17 Apr 2006

Concept Author: M. Pyne, M. Evans, C. Nordman

Stakeholders: Southeast

ClassifResp: Southeast

1430 EAST GULF COASTAL PLAIN BLACK BELT CALCAREOUS PRAIRIE AND WOODLAND (CES203.478)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Graminoid

Non-Diagnostic Classifiers: Herbaceous

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2430; ESLF 7143; ESP 1430

CONCEPT

Summary: This system includes natural grassland vegetation and associated wooded vegetation in a relatively small natural region (approximately 480 km (300 miles) long and 40-50 km (25-30 miles) wide) of Mississippi and Alabama north to a small part of southern Tennessee (Black Belt Subsection 231Ba of Keys et al. 1995; Blackland Prairie Ecoregion 65a of Griffith et al. 2001). This region, which generally derives its name from the nearly black, rich topsoil that developed over Selma Chalk, has long been noted as a distinct topographic region in the state of Mississippi (Lowe 1921). In Alabama, the formations on which this system primarily occurs are the Demopolis Chalk and the Mooreville Chalk (members of the Selma Group). In Tennessee, only Demopolis Chalk is mapped (Hardeman 1966). Examples occur over relatively deep soils (as opposed to "glades and barrens"), with circumneutral surface soil pH. Vegetation of this ecological system includes evergreen *Juniperus virginiana*-dominated forests and deciduous *Quercus*-dominated woodlands of varying densities, interspersed with native prairie-like grasslands. Much of the natural vegetation of the region has been converted to pasture and agricultural uses, but even old-field vegetation reflects the distinctive composition of the flora and ecological dynamics. In most cases individual prairie openings are small and isolated from one another, but were formerly more extensive prior to European settlement, forming a mosaic of grasslands and woodlands under frequent fire regimes. The flora has much in common with other prairies of the East Gulf Coastal Plains as well as the classic Midwestern prairies. Within this natural region, there are pockets of acidic soils which produce more typical pine-oak woodland or forest vegetation.

Classification Comments: "Blackland Prairies" occur in two discrete areas of the East Gulf Coastal Plain, the Jackson Prairie and the Black Belt. Of the approximately 100,000 acres of Blackland Prairies mapped during the general land surveys of the early and mid 1800s in Mississippi, probably less than 500 acres of prairie vegetation exists today, even if one considers grazed areas and vacant agricultural lands with a semblance of prairie species (R. Wieland pers. comm.). Almost all of the lands were converted to agriculture. Some of the lands are now reverting back to prairie after being abandoned. More recently, lands are being converted to fescue pasture; other abandoned lands have become cedar glades. The number of acres in good condition is probably less than 100.

DESCRIPTION

Environment: This system generally occurs on Cretaceous age chalk, marl and calcareous clay. This includes calcareous soils of the Sumter, Binnsville, and Demopolis series, described as beds of marly clay over Selma Chalk (including the Demopolis and Mooreville formations). The area has an average annual precipitation of 130-140 cm and a frost-free period of 200-250 days.

Vegetation: Vegetation of this ecological system includes evergreen *Juniperus virginiana*-dominated forests and deciduous *Quercus*-dominated woodlands of varying densities, interspersed with native prairie-like grasslands. Much of the natural vegetation of the region has been converted to pasture and agricultural uses, but even old-field vegetation reflects the distinctive composition of the flora and ecological dynamics. The oak woodlands typically contain *Quercus stellata*, *Quercus muehlenbergii*, and *Quercus marilandica*. Other woody components include *Quercus falcata*, *Carya alba*, *Carya glabra*, *Fraxinus americana*, *Celtis laevigata*, *Cercis canadensis* var. *canadensis*, *Crataegus engelmannii*, *Diospyros virginiana*, *Ilex decidua*, *Prunus angustifolia*, *Frangula caroliniana*, *Sideroxylon lycioides*, and *Ulmus alata*. Prairie forbs and grasses may persist in small openings and in edge situations in the more heavily forested areas. The presence of *Juniperus virginiana*-dominated zones may represent invasion by this species in the absence of sufficiently frequent or intense fire (DeSelm and Murdock 1993). Pines are generally absent, being inhibited by the higher surface soil pH. In the grass-dominated areas, *Schizachyrium scoparium* and *Sorghastrum nutans* are the principal herbs. Other herbaceous taxa include *Andropogon glomeratus*, *Andropogon virginicus*, *Bouteloua curtipendula*, *Panicum virgatum*, and *Schizachyrium scoparium*, with lesser amounts of *Paspalum floridanum*, *Setaria parviflora*, and *Sporobolus indicus* (exotic). Other common species include *Arnoglossum plantagineum*, *Symphytotrichum dumosum* (= *Aster dumosus*), *Symphytotrichum patens* (= *Aster patens*), *Crotalaria sagittalis*, *Dalea candida*, *Dalea purpurea*, *Desmanthus illinoensis*, *Desmodium ciliare*, *Dracopis amplexicaulis*, *Liatris aspera*, *Liatris squarrosa*, *Liatris squarrolosa*, *Neptunia lutea*, *Ratibida pinnata*, *Ruellia humilis*, *Silphium terebinthinaceum*, *Silphium trifoliatum* var. *latifolium*, and *Solidago nemoralis*. In depressions and drainages, *Andropogon gerardii* and/or *Panicum virgatum* will have greater importance (DeSelm and Murdock 1993). At this more mesic end of the continuum, invasion by woody plants is a more serious threat to the system. Moist, seepy inclusions within this system are often dominated by *Rhynchospora colorata* and *Scleria verticillata*; *Rhynchospora divergens*, *Lythrum alatum* var. *lanceolatum*, *Mitreola petiolata*, and *Mecardonia acuminata* also occur but much less frequently (A. Schotz pers. comm.).

Dynamics: In the presettlement landscape and throughout the nineteenth century, a combination of fire and grazing (first by native ungulates and then by free-ranging cattle) kept these sites open and grass-dominated. The Black Belt was one of the South's most

important agricultural areas before the American Civil War (Smith 1911). A long history of cultivation and disturbance has left few large, intact prairies remaining. With range enclosure and fire suppression increasing during the twentieth century, the dynamics of the landscape changed, and the coverage of fire-intolerant woody species increased. The formerly extensive system is now reduced to patches or its flora persists in pastures which are under more continuous grazing pressure than the former processes would have allowed. This has probably led to more uniformity of the vegetation and would favor some taxa over others. More study is needed.

MEMBERSHIP

Associations:

- *Juniperus virginiana* var. *virginiana* - (*Celtis laevigata*, *Prunus angustifolia*, *Sideroxylon lycioides*) Woodland (CEGL007747, G2)
- *Quercus stellata* - *Quercus muehlenbergii* / *Schizachyrium scoparium* - *Sorghastrum nutans* Black Belt Woodland (CEGL004670, G2G3)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Dalea candida* - *Liatris squarrosa* - (*Silphium terebinthinaceum*) Black Belt Herbaceous Vegetation (CEGL004664, G1)

Alliances:

- *Juniperus virginiana* Woodland Alliance (A.545)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

DISTRIBUTION

Range: This system is primarily restricted to the Black Belt (Subsection 231Ba) (Keys et al. 1995) or Blackland Prairie area (Ecoregion 65a) (Griffith et al. 2001). This region is primarily in Alabama and Mississippi, ranging north in a depauperate form to southern Tennessee (McNairy County). There are also outlying occurrences southwards in the Chunnenugee Hills and Red Hills (both of these parts of the Southern Hilly Coastal Plain - Ecoregion 65d), and Buhrstone/Lime Hills (Ecoregion 65q) of southern Alabama (in Washington, Wilcox, Monroe, and Clark counties). There are some limited examples in Ecoregion 65i (Fall Line Hills; e.g. Jones Bluff in Alabama) Apparently related vegetation in the Fort Valley Plateau of Houston and Bleckley(?) counties in the South Atlantic Coastal Plain of Georgia is not included here.

Divisions: 203:C

Nations: US

Subnations: AL, MS, TN

Map Zones: 46:C

TNC Ecoregions: 43:C

SOURCES

References: Comer et al. 2003, DeSelm and Murdock 1993, Griffith et al. 2001, Hardeman 1966, Keys et al. 1995, Lowe 1921

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.723108#references

Description Author: A. Schotz, R. Evans, M. Pyne

Version: 17 Jan 2006

Concept Author: A. Schotz, R. Evans, M. Pyne

Stakeholders: Southeast

ClassifResp: Southeast

1427 EAST GULF COASTAL PLAIN JACKSON PLAIN PRAIRIE AND BARRENS (CES203.353)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2427; ESLF 7140; ESP 1427

CONCEPT

Summary: This ecological system was locally dominant in the Jackson Purchase area of western Kentucky, extending into limited areas of adjacent Tennessee. This central region, called "the Barrens," has been historically subdivided from the rest of the Coastal Plain region of Kentucky (Davis 1923, Bryant and Martin 1988). A number of early reports mentioned extensive prairies in this region and also emphasized the importance of annual fires in maintaining these grasslands [see references in Bryant and Martin (1988)]. Interspersed among the extensive grasslands were likely scattered groves of oaks, especially those tolerant of frequent fires (M. Evans pers. comm.). Among the most frequent trees historically present in the entire region were *Quercus stellata*, *Quercus velutina*, and *Quercus marilandica* (Bryant and Martin 1988). With fire suppression, groves of trees rapidly expanded and largely replaced the prairies. In general, this system was found on "poorly consolidated Tertiary deposits" (Evans 1991), which are capped by loess, in the northern part of the Upper East Gulf ecoregion. High-quality examples would support a dense herbaceous layer dominated by tall grasses such as *Andropogon gerardii* and *Schizachyrium scoparium*, but the floristic composition of this type is poorly known since so few extant examples remain (M. Evans pers. comm.).

Classification Comments: The component associations of this system are poorly known since so few extant examples remain. The best remaining examples may be found in the West Kentucky Wildlife Management Area (M. Evans pers. comm.). This system extends, at least historically, into adjacent Henry County, TN, interpreted from the occurrence of several barrens plant species (M. Pyne pers. obs.). Related systems are known from Cretaceous gravels in the Western Highland Rim of Tennessee and from flat uplands of the Southeastern Highland Rim (this latter one includes wetter (xerohydric) barrens).

Similar Ecological Systems:

- Western Highland Rim Prairie and Barrens (CES202.352)

Related Concepts:

- Tallgrass Prairie (Evans 1991) Intersecting
- Wet Prairie (Evans 1991) Intersecting

DESCRIPTION

Environment: Soils are predominantly thin, well-drained, and gravelly. This system likely did not develop on the deeper loess soils of the region.

MEMBERSHIP

Associations:

- *Andropogon gerardii* - (*Andropogon glomeratus*, *Panicum virgatum*, *Sorghastrum nutans*) Herbaceous Vegetation (CEGL007705, G2?)
- *Andropogon gerardii* - (*Sorghastrum nutans*) Kentucky Herbaceous Vegetation (CEGL004677, G1G2)
- *Panicum virgatum* Seasonally Flooded Herbaceous Vegetation (CEGL004128, GNR)
- *Quercus alba* - *Quercus stellata* - *Quercus velutina* / *Schizachyrium scoparium* Woodland (CEGL002150, G2G3)
- *Quercus marilandica* / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland (CEGL002425, G3G4)
- *Quercus stellata* - *Quercus alba* - (*Quercus falcata*) / *Schizachyrium scoparium* Woodland (CEGL004217, G1)
- *Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland (CEGL002149, G2G3)
- *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391, G2G3)
- *Spartina pectinata* Western Kentucky Herbaceous Vegetation (CEGL004118, G1Q)

Alliances:

- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Andropogon gerardii* - (*Calamagrostis canadensis*, *Panicum virgatum*) Herbaceous Alliance (A.1191)
- *Andropogon gerardii* - (*Sorghastrum nutans*) Herbaceous Alliance (A.1192)
- *Panicum virgatum* Seasonally Flooded Herbaceous Alliance (A.1362)
- *Quercus alba* - *Quercus stellata* - *Quercus velutina* - (*Quercus falcata*) Woodland Alliance (A.613)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Spartina pectinata* Temporarily Flooded Herbaceous Alliance (A.1347)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)

DISTRIBUTION

Range: This system occurs in the Jackson Purchase area of western Kentucky, extending into limited areas of adjacent Tennessee.

Divisions: 203:C

Nations: US

Subnations: KY, TN?

Map Zones: 47:C

TNC Ecoregions: 43:C

SOURCES

References: Bryant and Martin 1988, Comer et al. 2003, Davis 1923, Evans 1991

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723159#references

Description Author: R. Evans and M. Evans, mod. M. Pyne

Version: 18 Apr 2006

Concept Author: R. Evans and M. Evans

Stakeholders: Southeast

ClassifResp: Southeast

1417 EASTERN HIGHLAND RIM PRAIRIE AND BARRENS (CES202.354)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

Diagnostic Classifiers: Herbaceous; Very Short Disturbance Interval; Graminoid

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2417; ESLF 7130; ESP 1417

CONCEPT

Summary: This system represents "The Barrens" of the Southeast Highland Rim of Tennessee. This is a distinctive part of the state and ecoregion (the "Dickson-Mountview-Guthrie" Soil Association of Elder and Springer 1978, Springer and Elder 1980). It includes a series of plant communities with open canopies, ranging from herbaceous-dominated barrens (some of which are maintained today by mowing instead of fire and grazing) through savanna and woodland types. Open ponds and other wetlands are scattered throughout the landscape. The variety of relatively open habitats which are present here include prairie-like areas, as well as savanna woodlands and upland depression ponds.

Classification Comments: Western Highland Rim Prairie and Barrens (CES202.352), Eastern Highland Rim Prairie and Barrens (CES202.354), Pennyroyal Karst Plain Prairie and Barrens (CES202.355), and Southern Ridge and Valley Patch Prairie (CES202.453) form a series of similar systems in the eastern Interior Highlands and adjacent Ridge and Valley.

Similar Ecological Systems:

- Cumberland Wet-Mesic Meadow and Savanna (CES202.053)
- Pennyroyal Karst Plain Prairie and Barrens (CES202.355)
- Southern Ridge and Valley Patch Prairie (CES202.453)
- Western Highland Rim Prairie and Barrens (CES202.352)

DESCRIPTION

Environment: These various barren communities occur on Fragiudult soils formed in Pleistocene loess over karstic Mississippian Limestone. Their topography is flat to gently sloping. Some proposed factors which have functioned to maintain their openness include the hardpan soils and fire (as well as natural and managed grazing, and modern anthropogenic factors such as mowing for hay, etc.). These barrens include a variety of systems whose primary presettlement environmental factors were specialized soils and extremes of hydrology, as influenced by fire and grazing. The prevalent soils within the polygon labeled "Dickson-Mountview-Guthrie" (D32 of Elder and Springer 1978, Springer and Elder 1980) are generally flatter, wetter, and more likely to have fragipans than adjoining units. Average conditions in the area of The Barrens can be summarized as follows (Wolfe 1996): January is typically the coldest month, with average high and low temperatures of 8.8Â° C (47.8Â° F) and 1.9Â° C (35.4Â° F), respectively. July is the warmest month, with average high and low temperatures of 31.3Â° C (88.3Â° F) and 18.9Â° C (66.0Â° F), respectively. Monthly mean temperatures range from 3.5Â° C (38.3Â° F) in January to 25.11Â° C (77.2Â° F) in July. The mean annual precipitation is 1438 mm (56.6 inches; Wolfe 1996, Pyne 2000). Precipitation is heaviest from November through May, averaging between 113 and 171 mm (4.4 to 6.7 in) per month. Rainfall is lightest during the months of June through October, with averages ranging from 83 mm (3.3 in) per month to a minor peak of 122 mm (4.8 in) in July.

Vegetation: Typical mesic grassland vegetation of the barrens of the southeastern Highland Rim of Tennessee is dominated by *Andropogon gerardii* along with *Schizachyrium scoparium*. Other graminoid species present include *Andropogon glomeratus*, *Calamagrostis coarctata*, *Panicum virgatum*, *Sorghastrum nutans*, and *Pteridium aquilinum*. Other dominants may include *Eurybia hemispherica* (= *Aster paludosus* ssp. *hemisphericus*), *Symphotrichum dumosum* (= *Aster dumosus*), *Helianthus angustifolius*, *Potentilla simplex*, *Solidago odora*, *Solidago rugosa*, and *Polytrichum commune*; found to a lesser extent are *Aristida purpurascens* var. *virgata* (= *Aristida virgata*), *Chasmanthium laxum*, *Dichanthelium aciculare* (= *Dichanthelium angustifolium*), *Dichanthelium dichotomum*, *Gymnopogon brevifolius*, *Panicum anceps*, *Panicum rigidulum*, and *Panicum verrucosum*. Woody species may include *Acer rubrum*, *Rhus copallinum*, *Rubus argutus*, and *Smilax glauca*. The Barrens contains a variety of natural, semi-natural, and managed openings which provide habitat for plants and animals which are unusual in the ecoregion, rare in the state, or globally rare. These include a variety of plants more at home in other ecoregions, most notably the Coastal Plain and the western prairies, including carnivorous plants and other specialized plants of ponds and other wetlands. In addition, globally rare endemic fish and disjunct amphibians and invertebrates call The Barrens their home.

MEMBERSHIP

Associations:

- *Andropogon gerardii* - (*Andropogon glomeratus*, *Panicum virgatum*, *Sorghastrum nutans*) Herbaceous Vegetation (CEGL007705, G2?)
- *Andropogon gerardii* - *Schizachyrium scoparium* - (*Calamagrostis coarctata*, *Panicum virgatum*) Herbaceous Vegetation (CEGL007706, G2?)
- *Andropogon gerardii* - *Schizachyrium scoparium* - *Dichanthelium scoparium* - *Rhynchospora glomerata* Herbaceous Vegetation

(CEGL004006, G1)

- *Juniperus virginiana* var. *virginiana* / *Rhus copallinum* / *Schizachyrium scoparium* Woodland (CEGL007704, GNA)
- *Quercus (falcata, stellata)* / *Quercus marilandica* / *Gaylussacia (baccata, dumosa)* Woodland (CEGL004922, G2G3)
- *Quercus phellos* - *Quercus alba* / *Vaccinium fuscatum* - (*Viburnum nudum*) / *Carex (barrattii, intumescens)* Forest (CEGL007364, G2)
- *Quercus stellata* - (*Quercus coccinea*) / *Quercus marilandica* / *Vaccinium pallidum* - (*Vaccinium stamineum*) Woodland (CEGL004709, G2G3)
- *Schizachyrium scoparium* - *Andropogon (gyrans, ternarius, virginicus)* Herbaceous Vegetation (CEGL007707, G3?)
- *Schizachyrium scoparium* - *Calamagrostis coarctata* Herbaceous Vegetation (CEGL007708, GNRQ)
- *Schizachyrium scoparium* - *Panicum anceps* - *Panicum virgatum* - *Lespedeza capitata* - *Scleria* spp. Herbaceous Vegetation (CEGL004063, G1)

Alliances:

- *Andropogon gerardii* - (*Calamagrostis canadensis, Panicum virgatum*) Herbaceous Alliance (A.1191)
- *Andropogon gerardii* - (*Sorghastrum nutans*) Herbaceous Alliance (A.1192)
- *Juniperus virginiana* Woodland Alliance (A.545)
- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)
- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

SPATIAL CHARACTERISTICS

Spatial Summary: This system was the historic matrix system in a large region of five Tennessee counties of the southeastern Highland Rim. It is classed as a "large patch" system primarily due to its fragmentation by fire suppression, tree plantations, agriculture, and suburban development.

Adjacent Ecological Systems:

- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)

Adjacent Ecological System Comments: The depression ponds which occur within the landscape of Eastern Highland Rim Prairie and Barrens (CES202.354) are examples of the Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018); several depression pond associations particular to the Eastern Highland Rim are described. Small wet depressions in the Eastern Highland Rim Prairie and Barrens (CES202.354), which are not distinguished physiognomically or by canopy species, are included in the concept of Eastern Highland Rim Prairie and Barrens (CES202.354). These are akin to vernal pools or wet streamheads.

DISTRIBUTION

Range: This system is restricted to "The Barrens" of the southeastern Highland Rim of Tennessee (today primarily extant in Coffee, Franklin, and Warren counties, Tennessee).

Divisions: 202:C

Nations: US

Subnations: TN

Map Zones: 47:N, 48:C, 53:P

TNC Ecoregions: 44:C

SOURCES

References: Comer et al. 2003, Elder and Springer 1978, Pyne 2000, Springer and Elder 1980, Wolfe 1996

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723158#references

Description Author: M. Pyne, R. Evans, C. Nordman

Version: 27 Sep 2005

Concept Author: M. Pyne, R. Evans, C. Nordman

Stakeholders: Southeast

ClassifResp: Southeast

1418 PENNYROYAL KARST PLAIN PRAIRIE AND BARRENS (CES202.355)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2418; ESLF 7131; ESP 1418

CONCEPT

Summary: This system consists of open, prairie-like vegetation of the northwestern Highland Rim (Pennyroyal Plateau) of Tennessee and adjacent Kentucky (Ecoregion 71e [Western Pennyroyal Karst Plain] of Griffith et al. (1998) and Woods et al. (2002); part of Subsection 222Eh of Keys et al. (1995)). Stands are dominated by grasses and forbs with scattered shrubby vegetation and, occasionally, trees. The scattered trees are mainly *Quercus falcata* and *Quercus imbricaria*. The primary dominant grass is *Schizachyrium scoparium*, with some *Sorghastrum nutans* present. Other more mesic grasses (*Andropogon gerardii*, *Tripsacum dactyloides*) are restricted to ditches. The largest extant examples are presently found on Fort Campbell Military Reservation, Tennessee, where ecological burning and fires from live munitions use result in open herbaceous-dominated landscapes. This vegetation was the predominant type here in the early 1800s and probably originated from burning by Native Americans.

Classification Comments: Western Highland Rim Prairie and Barrens (CES202.352), Eastern Highland Rim Prairie and Barrens (CES202.354), Pennyroyal Karst Plain Prairie and Barrens (CES202.355), and Southern Ridge and Valley Patch Prairie (CES202.453) form a series of similar systems in the eastern Interior Highlands and adjacent Ridge and Valley.

Similar Ecological Systems:

- Cumberland Wet-Mesic Meadow and Savanna (CES202.053)
- Eastern Highland Rim Prairie and Barrens (CES202.354)
- Southern Ridge and Valley Patch Prairie (CES202.453)
- Western Highland Rim Prairie and Barrens (CES202.352)

Related Concepts:

- Limestone Prairie (Evans 1991) Finer
- Tallgrass Prairie (Evans 1991) Finer
- Wet Prairie (Evans 1991) Finer

DESCRIPTION

Environment: This system is found in an open rolling landscape which easily carries fire if maintained in a grassy condition.

Vegetation: Stands of this system are dominated by grasses and forbs with scattered shrubby vegetation trees. The scattered trees are mainly *Quercus falcata* and *Quercus imbricaria*. The primary dominant grass is *Schizachyrium scoparium*, with some *Sorghastrum nutans* present. Other more mesic grasses (*Andropogon gerardii*, *Tripsacum dactyloides*) are restricted to ditches. Other herbaceous components may include *Andropogon gyrans*, *Andropogon ternarius*, *Lespedeza capitata*, *Lespedeza virginica*, *Symphotrichum novae-angliae* (= *Aster novae-angliae*), *Sericocarpus linifolius* (= *Aster solidagineus*), *Coreopsis major*, *Coreopsis tripteris*, *Helianthus angustifolius*, *Helianthus hirsutus*, *Solidago juncea*, *Pycnanthemum tenuifolium*, *Pycnanthemum verticillatum* var. *pilosum* (= *Pycnanthemum pilosum*), and *Lobelia puberula*. In addition, *Rudbeckia subtomentosa*, *Prenanthes barbata*, and *Agalinis auriculata* (= *Tomanthera auriculata*) are rare plants found in some examples. Other typical woody species include *Cornus florida*, *Cercis canadensis*, *Prunus angustifolia*, *Ilex decidua*, *Rhus copallinum*, *Rosa carolina*, and *Symphoricarpos orbiculatus*.

MEMBERSHIP

Associations:

- *Schizachyrium scoparium* - (*Helianthus mollis*, *Helianthus occidentalis*, *Silphium trifoliatum*) Herbaceous Vegetation (CEGL007805, G2G3)

Alliances:

- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

DISTRIBUTION

Range: This system is found in the northern Highland Rim (Pennyroyal Plateau) of Tennessee and adjacent Kentucky.

Divisions: 202:C

Nations: US

Subnations: KY, TN

Map Zones: 47:C

TNC Ecoregions: 44:C

SOURCES

References: Comer et al. 2003, Griffith et al. 1998, Keys et al. 1995, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723157#references

Description Author: M. Pyne, R. Evans, C. Nordman

Version: 17 Apr 2006

Concept Author: M. Pyne, R. Evans, C. Nordman

Stakeholders: Southeast

ClassifResp: Southeast

1414 SOUTHERN APPALACHIAN GRASS AND SHRUB BALD (CES202.294)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Montane; Herbaceous; Graminoid

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2414; ESLF 7127; ESP 1414

CONCEPT

Summary: This ecological system consists of dense herbaceous and shrubland communities in the highest elevational zone of the southern Appalachians, generally above 1524 m (5000 feet) but occasionally to 1220 m (4000 feet), and at slightly lower elevations at its northern limit in Virginia and West Virginia, and in the Cumberland Mountains along the Virginia-Kentucky border. Vegetation consists either of dense shrub-dominated areas (heath balds) or dense herbaceous cover dominated by grasses or sedges (grassy balds). The combination of high-elevation, non-wetland sites and dense herbaceous or shrub vegetation without appreciable rock outcrop conceptually distinguishes this system from all others in the southern Appalachians. However, the widespread areas of degraded spruce-fir with grass and shrub cover and the invasion of grassy balds by trees blur the distinction somewhat. The presence of species characteristic of the southern Appalachians, such as *Menziesia pilosa*, *Saxifraga michauxii*, and *Paronychia argyrocoma*, distinguish this system from outcrop systems to the north (e.g., Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571)).

Classification Comments: Grassy balds and heath balds differ in a number of ways and are often recognized as distinct entities. Whether these need to be split out at the system level, rather than just at the association level, has been questioned (M. Schafale pers. comm.). This system occurs in settings similar to Southern Appalachian Rocky Summit (CES202.327) and might be broadened to encompass that system.

DESCRIPTION

Environment: This system generally occurs at elevations above 1524 m (5000 feet) but may range as low as 1220 m (4000 feet) in the Southern Blue Ridge. It is also of limited extent above 1035 m (3400 feet) in the Cumberland Mountains along the Virginia-Kentucky border. It occurs on broad ridgetops and narrow spur ridges. Elevation and orographic effects (winds cooling as they rise to create increased condensation) make the climate cool and wet, with heavy moisture input from fog as well as high rainfall. Convex slopes and exposure to wind offset the moisture input to some extent. Concentration of air pollutants has been implicated as an important anthropogenic stress in this elevational range in recent years. Soils range from shallow and rocky to fairly deep residual soils. Any kind of bedrock may be present, but most sites have erosion-resistant felsic igneous or metamorphic rocks, with slate and quartzite particularly frequent. The sites that support balds are not obviously different from similar sites that support spruce-fir forests, so the origin of these communities continues to be fodder for debate. Fire may be an important factor in some examples, whereas grazing and/or exposure to the elements may help maintain others.

Vegetation: Vegetation consists either of dense shrubs (heath balds or blackberry) or dense herbaceous cover dominated by grasses or sedges (grassy balds). Heath balds are most often dominated by *Rhododendron catawbiense*, but substantial examples are also dominated by *Rhododendron carolinianum*, *Kalmia latifolia*, or a mixture of shrubs. One large example, dominated by *Alnus viridis* ssp. *crispa*, is generally also regarded as related to the heath balds. Grassy balds are characteristically dominated by *Danthonia compressa* or *Carex* spp. Large areas have also become dominated by *Rubus allegheniensis* and by mixtures of native grasses with exotic pasture grasses. Most examples of grassy balds have some invading shrubs and trees, often dense enough to threaten the herbaceous vegetation. Heath balds may contain sparse stunted trees barely larger than the shrub canopy.

Dynamics: The dynamics that maintain and that created the communities in this system have been a major topic of debate, so far without resolution. Most grassy bald occurrences show a strong tendency to succeed to shrub or forest vegetation under present conditions, suggesting that some important maintenance process has been lost. Grazing by native herbivores (elk and bison) and periodic fire have both been suggested as natural mechanisms to keep out woody vegetation. Others have suggested that all grassy balds are of anthropogenic origin and were never ecologically stable. The most definitive grassy balds have been documented as present at the time of the first European settlement, making documentation of their origin impossible. The presence of shade-intolerant disjunct herb species in some suggests even greater age. Some areas of the spruce-fir system degraded by a combination of logging, slash fires, and grazing resemble grassy balds, but most do not. The universal cattle grazing in grassy balds by early settlers has further obscured their original character and evidence of processes.

Heath balds are more widely regarded as being created or maintained by fire. However, heavy organic accumulations in the soil suggest great age for some. Most show very limited tendency to succeed to forest, suggesting that the dense shrub layer is highly competitive and that only infrequent fire would be needed to maintain them. As with the grassy balds, spruce-fir forests burned in historical times do not usually develop vegetation identical to heath balds.

MEMBERSHIP

Associations:

- *Alnus viridis* ssp. *crispa* / *Carex pensylvanica* Shrubland (CEGL003891, G1)

- *Carex pensylvanica* Herbaceous Vegetation (CEGL004094, G1)
- *Danthonia compressa* - (*Sibbaldiopsis tridentata*) Herbaceous Vegetation (CEGL004242, G1)
- *Danthonia spicata* - *Solidago rugosa* ssp. *aspera* Herbaceous Vegetation (CEGL004760, GNA)
- *Kalmia latifolia* - *Gaylussacia (baccata, brachycera)* Cumberland Shrubland (CEGL008470, G3)
- *Kalmia latifolia* - *Gaylussacia baccata* - *Vaccinium angustifolium* - *Menziesia pilosa* Shrubland (CEGL003939, G2G3)
- *Kalmia latifolia* - *Rhododendron catawbiense* - (*Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum*) Shrubland (CEGL003814, G2G3)
- *Leiophyllum buxifolium* Dwarf-shrubland (CEGL003951, G1)
- *Minuartia groenlandica* - *Paronychia argyrocoma* - *Saxifraga michauxii* Herbaceous Vegetation (CEGL008509, G1)
- *Photinia melanocarpa* - *Gaylussacia baccata* / *Carex pensylvanica* Shrubland (CEGL008508, G1?)
- *Rhododendron carolinianum* - *Rhododendron catawbiense* - *Leiophyllum buxifolium* Shrubland (CEGL007876, G1)
- *Rhododendron carolinianum* Shrubland (CEGL003816, G2)
- *Rhododendron catawbiense* - *Pieris floribunda* Shrubland (CEGL004516, G1)
- *Rhododendron catawbiense* Shrubland (CEGL003818, G2)
- *Rubus allegheniensis* - *Rubus canadensis* / *Carex pensylvanica* Shrubland (CEGL003892, GNA)
- *Rubus canadensis* - (*Rubus idaeus* ssp. *strigosus*) / *Athyrium filix-femina* - *Solidago glomerata* Shrubland (CEGL003893, GNA)

Alliances:

- *Alnus viridis* Shrubland Alliance (A.929)
- *Carex pensylvanica* Herbaceous Alliance (A.1278)
- *Danthonia compressa* Herbaceous Alliance (A.1280)
- *Danthonia spicata* Herbaceous Alliance (A.1281)
- *Kalmia latifolia* - *Gaylussacia baccata* Shrubland Alliance (A.1050)
- *Leiophyllum buxifolium* Dwarf-shrubland Alliance (A.1063)
- *Rhododendron (catawbiense, carolinianum)* - *Kalmia latifolia* Shrubland Alliance (A.744)
- *Rubus allegheniensis* - *Rubus canadensis* Shrubland Alliance (A.930)
- *Saxifraga michauxii* Herbaceous Alliance (A.1621)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch to large-patch system, sometimes occurring as single patches, sometimes as complexes of small patches.

Size: Individual patches of both grassy bald and heath bald range from 10 acres or less, to occasional expanses of hundreds of acres. Heath balds sometimes occur as complexes of small patches on spur ridges. Separation rules will have a strong effect on the aggregate acreage of defined occurrences in these situations, but the largest occurrences are fairly contiguous.

Adjacent Ecological Systems:

- Central and Southern Appalachian Spruce-Fir Forest (CES202.028)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)
- Southern Appalachian Northern Hardwood Forest (CES202.029)
- Southern Appalachian Rocky Summit (CES202.327)
- Southern Appalachian Seepage Wetland (CES202.317)

Adjacent Ecological System Comments: This system is virtually always bordered by Southern Appalachian Northern Hardwood Forest (CES202.029) or Central and Southern Appalachian Spruce-Fir Forest (CES202.028). It may also contain embedded small patches of Southern Appalachian Rocky Summit (CES202.327) and Southern Appalachian Seepage Wetland (CES202.317).

DISTRIBUTION

Range: This system ranges from the Balsam Mountains and Great Smoky Mountains of North Carolina and Tennessee northward to Virginia and West Virginia. The system is also of limited extent in the Cumberland Mountains along the Virginia-Kentucky border. The current status in Georgia is open to question and was apparently never extensive in any case.

Divisions: 202:C

Nations: US

Subnations: GA, KY, NC, TN, VA, WV

Map Zones: 53:N, 57:C, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 59:C

SOURCES

References: Comer et al. 2003, DeSelm and Murdock 1993

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723195#references

Description Author: M. Schafale and R. Evans, mod. S.C. Gawler and M. Pyne

Version: 17 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

1419 SOUTHERN RIDGE AND VALLEY PATCH PRAIRIE (CES202.453)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous; Graminoid

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2419; ESLF 7132; ESP 1419

CONCEPT

Summary: This system is a collection of deep soil prairies and barrens found historically in the Coosa Valley of northwestern Georgia and adjacent Alabama and related areas including barrens at Oak Ridge, Tennessee. This system was formerly widespread, but is now found only in scattered and isolated remnants (DeSelm and Murdock 1993). Vegetation is typically prairie-like and may have supported scattered trees depending upon fire-return interval.

Classification Comments: Western Highland Rim Prairie and Barrens (CES202.352), Eastern Highland Rim Prairie and Barrens (CES202.354), Pennyroyal Karst Plain Prairie and Barrens (CES202.355), and Southern Ridge and Valley Patch Prairie (CES202.453) form a series of similar systems in the eastern Interior Highlands and adjacent Ridge and Valley.

Similar Ecological Systems:

- Eastern Highland Rim Prairie and Barrens (CES202.354)
- Pennyroyal Karst Plain Prairie and Barrens (CES202.355)
- Western Highland Rim Prairie and Barrens (CES202.352)

MEMBERSHIP

Associations:

- *Andropogon gerardii* - *Panicum (anceps, virgatum)* Herbaceous Vegetation (CEGL007931, G2?)
- *Panicum virgatum* - *Tripsacum dactyloides* Grand Prairie/Big Barrens Herbaceous Vegetation (CEGL004624, G2?)
- *Schizachyrium scoparium* - (*Helianthus mollis*, *Helianthus occidentalis*, *Silphium trifoliatum*) Herbaceous Vegetation (CEGL007805, G2G3)
- *Schizachyrium scoparium* - *Andropogon gerardii* - *Silphium terebinthinaceum* Coosa Valley Barren Herbaceous Vegetation (CEGL004757, G1)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - *Silphium* spp. Herbaceous Vegetation (CEGL007932, G2?)

Alliances:

- *Andropogon gerardii* - (*Sorghastrum nutans*) Herbaceous Alliance (A.1192)
- *Panicum virgatum* - *Tripsacum dactyloides* Herbaceous Alliance (A.1194)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

DISTRIBUTION

Range: This system occurs in the Coosa River valley of northwestern Georgia, Tennessee, and northeastern Alabama, and related areas including barrens at Oak Ridge, Tennessee.

Divisions: 202:C

Nations: US

Subnations: AL, GA, TN

Map Zones: 48:C, 53:P

TNC Ecoregions: 50:C

SOURCES

References: Comer et al. 2003, DeSelm and Murdock 1993

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723129#references

Description Author: M. Pyne and R. Evans

Version: 13 Jan 2003

Concept Author: M. Pyne and R. Evans

Stakeholders: Southeast

ClassifResp: Southeast

1416 WESTERN HIGHLAND RIM PRAIRIE AND BARRENS (CES202.352)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous; Deep Soil; Graminoid

FGDC Crosswalk: Vegetated, Herbaceous / Nonvascular-dominated, Herbaceous - grassland, Perennial graminoid grassland

National Mapping Codes: EVT 2416; ESLF 7129; ESP 1416

CONCEPT

Summary: This system includes open, fire-maintained vegetation (often called "barrens") on uplands in western Tennessee. Although the region is highly dissected, extensive areas formerly supported well-burned vegetation. Haywood (1959) noted extensive prairie in the southern portion of Land Between the Lakes, and DeSelm (1988) noted the existence of barrens remnants in the region. As noted by Shanks (1958) and described by DeSelm (1989), these barrens occur, at least in part, on Cretaceous gravels which cap either Mississippian limestone strata on hills in the Tennessee counties of Dickson, Hickman, Lewis, and Lawrence (these mapped in Miller et al. (1966)), as well as overtopping unconsolidated Tertiary materials in the Kentucky counties of Trigg, Lyon, Callaway, Livingston, and Marshall (MacDowell et al. 1981). The general terrain is flat to gently sloping. Shanks (1958) also specifically refers to barrens on "cherty residuum, elsewhere characterized by Planosols with impeded drainage." Some proposed factors which have functioned to maintain the openness of this system include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire. The same gravels are mapped in Land Between the Lakes (LBL), and this vegetation could be expected there (if all examples have not succeeded to woody vegetation due to lack of fire).

Classification Comments: Western Highland Rim Prairie and Barrens (CES202.352), Eastern Highland Rim Prairie and Barrens (CES202.354), Pennyroyal Karst Plain Prairie and Barrens (CES202.355), and Southern Ridge and Valley Patch Prairie (CES202.453) form a series of similar systems in the eastern Interior Highlands and adjacent Ridge and Valley.

Similar Ecological Systems:

- Cumberland Wet-Mesic Meadow and Savanna (CES202.053)
- East Gulf Coastal Plain Jackson Plain Prairie and Barrens (CES203.353)
- Eastern Highland Rim Prairie and Barrens (CES202.354)
- Pennyroyal Karst Plain Prairie and Barrens (CES202.355)
- Southern Ridge and Valley Patch Prairie (CES202.453)

DESCRIPTION

Environment: These barrens are developed on "cherty residuum, elsewhere characterized by Planosols with impeded drainage" (Shanks 1958).

Vegetation: Some stands may be in a woodland or fire-suppressed forest condition, dominated by dry-site oaks such as *Quercus marilandica*, *Quercus prinus*, and/or *Quercus stellata*. These trees would become more scattered under an appropriate fire regime. In the herbaceous layer of well-managed examples of this system, *Schizachyrium scoparium* is codominant along with a variable mixture of *Andropogon gyrans*, *Andropogon ternarius*, and/or *Andropogon virginicus*. Other dominant grasses may include *Dichanthelium aciculare* (= *Dichanthelium angustifolium*), *Gymnopogon brevifolius*, and *Dichanthelium dichotomum* var. *dichotomum* (= var. *ramulosum*). Other common species may include *Symphotrichum dumosum* (= *Aster dumosus*), *Sericocarpus linifolius* (= *Aster solidagineus*), *Coreopsis major*, *Eupatorium hyssopifolium*, *Eupatorium rotundifolium*, *Helianthus angustifolius*, *Liatris microcephala*, *Liatris spicata*, *Packera anonyma* (= *Senecio anonymus*), *Solidago juncea*, *Solidago odora*, *Chamaecrista fasciculata*, *Chamaecrista nictitans*, *Stylosanthes biflora*, *Lobelia puberula*, *Diodia teres*, *Potentilla simplex*, *Aristida longispica*, *Calamagrostis coarctata*, *Dichanthelium dichotomum*, *Sorghastrum nutans*, *Pteridium aquilinum*, and *Smilax glauca*.

Dynamics: Some proposed factors which have functioned to maintain the openness of this system include the droughty, gravelly soils and resulting stresses to vegetation, as well as fire. Fralish et al. (1999) noted that both post oak and chestnut oak woodlands are essentially the result of fire suppression in the barrens and historic savannas. In some areas, where the soils are particularly harsh (droughty, nutrient-poor, rocky), stands may retain an open aspect in the absence of fire.

MEMBERSHIP

Associations:

- *Quercus marilandica* / *Schizachyrium scoparium* - (*Helianthus mollis*, *Silphium asteriscus*, *Liatris aspera*) Woodland (CEGL004756, G2)
- *Quercus prinus* / *Smilax* spp. Forest (CEGL005022, G3G5)
- *Quercus stellata* / *Viburnum rufidulum* / *Schizachyrium scoparium* - (*Sorghastrum nutans*, *Helianthus eggertii*) Woodland (CEGL004686, G2G3)
- *Schizachyrium scoparium* - *Andropogon* (*gyrans*, *ternarius*, *virginicus*) Herbaceous Vegetation (CEGL007707, G3?)

Alliances:

- *Quercus prinus* - (*Quercus coccinea*, *Quercus velutina*) Forest Alliance (A.248)

- *Quercus stellata* - *Quercus marilandica* Woodland Alliance (A.625)
- *Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance (A.1198)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)

DISTRIBUTION

Range: This system is endemic to the western Highland Rim of Tennessee and possibly adjacent Kentucky.

Divisions: 202:C

Nations: US

Subnations: KY?, TN

Map Zones: 47:C, 48:C, 53:N

TNC Ecoregions: 44:C

SOURCES

References: Comer et al. 2003, DeSelm 1988, DeSelm 1989, Fralish et al. 1999, Haywood 1959, McDowell et al. 1981, Miller 1978, Miller et al. 1966, Shanks 1958

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723160#references

Description Author: C. Nordman, R. Evans, M. Pyne

Version: 17 Apr 2006

Concept Author: C. Nordman, R. Evans, M. Pyne

Stakeholders: Southeast

ClassifResp: Southeast

WOODY WETLANDS AND RIPARIAN

CENTRAL INTERIOR HIGHLANDS AND APPALACHIAN SINKHOLE AND DEPRESSION POND (CES202.018)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Lowland [Lowland]; Depressional [Pond]; Depressional [Sinkhole]; Muck; Mineral: W/ A-Horizon >10 cm

Non-Diagnostic Classifiers: Alkaline Water; Circumneutral Water; Forest and Woodland (Treed); Isolated Wetland [Partially Isolated]

CONCEPT

Summary: This system of ponds and wetlands is found in the Interior Highlands of the Ozark, Ouachita, and Interior Low Plateau regions, and ranges north from the southern and central Appalachians to the northern Piedmont regions. Stands occur in basins of sinkholes or other isolated depressions on uplands. Soils are very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry. Water depth may vary greatly on a seasonal basis and may be a meter deep or more in the winter. Some examples become dry in the summer. Soils may be deep (100 cm or more), consisting of peat or muck, with parent material of peat, muck or alluvium. Ponds vary from open water to herb-, shrub-, or tree-dominated. Tree-dominated examples typically contain *Quercus* species, *Platanus occidentalis*, *Fraxinus pennsylvanica*, *Acer saccharinum*, or *Nyssa* species, or a combination of these. In addition, *Liquidambar styraciflua* may be present in southern examples. *Cephalanthus occidentalis* is a typical shrub component. The herbaceous layer is widely variable depending on geography.

Classification Comments: Many of these ponds have their geologic origin as a more-or-less complete karst collapse feature. Some of them may display this geologic origin in a more explicit manner, with definite walls and exposed limestone or dolomite at the surface ("sinkholes"). Others are more subtle, and exist as more gentle depressions, with no exposed surface geology ("depression ponds"). This includes the "sagponds" of northwestern Georgia and adjacent Alabama. More information is available from Jon Ambrose. It also includes sinkhole ponds of northern New Jersey (K. Strakosch-Walz pers. comm.) and ponds of the Ridge and Valley in Pennsylvania. These are very similar to Shenandoah sinkhole ponds of Virginia and are in Maryland as well (L. Sneddon pers. comm.).

Similar Ecological Systems:

- Southern Piedmont / Ridge and Valley Upland Depression Swamp (CES202.336)

Related Concepts:

- Depression Swamp (Evans 1991) Finer
- Sinkhole/Depression Marsh (Evans 1991) Finer
- Sinkhole/Depression Pond (Evans 1991) Finer

DESCRIPTION

Environment: Examples of this system occur in basins of sinkholes or other isolated depressions on uplands. Soils are very poorly drained, and surface water may be present for extended periods of time, rarely becoming dry. Water depth may vary greatly on a seasonal basis, and may be a meter deep or more in the winter. Some examples become dry in the summer. Soils may be deep (100 cm or more), consisting of peat or muck, with parent material of peat, muck or alluvium.

Vegetation: Ponds vary from open water to herb-, shrub-, or tree-dominated systems. Tree-dominated examples typically contain *Quercus* species, *Platanus occidentalis*, *Fraxinus pennsylvanica*, *Acer saccharinum*, or *Nyssa* species, or a combination of these. In addition, *Liquidambar styraciflua* may be present in southern examples. *Cephalanthus occidentalis* is a typical shrub component. The herbaceous layer is widely variable depending on geography.

Dynamics: Water depth may vary greatly on a seasonal basis, and may be a meter deep or more in the winter. Some examples become dry in the summer.

MEMBERSHIP

Associations:

- *Brasenia schreberi* Herbaceous Vegetation (CEGL004527, G4?)
- *Carex aquatilis* - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL008542, G1?)
- *Carex barrattii* Herbaceous Vegetation (CEGL007857, G1)
- *Carex comosa* - *Carex decomposita* - *Dulichium arundinaceum* - *Lycopus rubellus* Herbaceous Vegetation (CEGL002413, G3G4)
- *Cephalanthus occidentalis* - (*Salix nigra*, *Quercus lyrata*) Karst Depression Shrubland (CEGL008439, G1Q)
- *Cephalanthus occidentalis* / *Dulichium arundinaceum* Shrubland (CEGL007854, G1)
- *Cephalanthus occidentalis* / *Hibiscus moscheutos* ssp. *moscheutos* Depression Pond Shrubland (CEGL004742, G3?)
- *Cephalanthus occidentalis* / *Torreyochloa pallida* Shrubland (CEGL007855, G1?)
- *Ceratophyllum demersum* Herbaceous Vegetation (CEGL004528, GNR)
- *Dasiphora fruticosa* ssp. *floribunda* / *Rhynchospora capillacea* - *Scleria verticillata* Shrub Herbaceous Vegetation (CEGL006356,

G1)

- *Fraxinus pennsylvanica* - *Acer saccharinum* - *Quercus bicolor* / *Boehmeria cylindrica* Forest (CEGL006634, GNR)
- *Leersia oryzoides* - *Boehmeria cylindrica* - *Ranunculus flabellaris* Herbaceous Vegetation (CEGL006903, GNR)
- *Liquidambar styraciflua* - *Acer rubrum* / *Carex* spp. - *Sphagnum* spp. Forest (CEGL007388, G2Q)
- *Ludwigia peploides* Herbaceous Vegetation (CEGL007835, G4G5)
- *Nelumbo lutea* Herbaceous Vegetation (CEGL004323, G4?)
- *Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Nyssa aquatica* / *Cephalanthus occidentalis* Pond Forest (CEGL004712, G1?)
- *Nyssa biflora* / *Cephalanthus occidentalis* - *Lyonia lucida* Sagpond Forest (CEGL004116, G1G2)
- *Orontium aquaticum* - *Schoenoplectus subterminalis* - *Eriocaulon aquaticum* Herbaceous Vegetation (CEGL007859, G1)
- *Panicum hemitomon* - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL004126, G1)
- *Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044, GNA)
- *Platanus occidentalis* - *Fraxinus pennsylvanica* - *Ulmus americana* / *Cornus sericea* Forest (CEGL006901, G2G3)
- *Pontederia cordata* - *Sagittaria graminea* - *Sagittaria latifolia* Semipermanently Flooded Herbaceous Vegetation (CEGL004986, G1G2Q)
- *Quercus alba* - *Nyssa sylvatica* Sandstone Ridgetop Depression Forest (CEGL008440, G2Q)
- *Quercus alba* - *Nyssa sylvatica* Seasonally Flooded Forest [Provisional] (CEGL008473, GNR)
- *Quercus bicolor* - *Fraxinus pennsylvanica* / *Carex* spp. Forest (CEGL004422, G1G2)
- *Quercus lyrata* - *Quercus (palustris, phellos)* - *Liquidambar styraciflua* - (*Populus heterophylla*) Forest (CEGL004421, G2G3)
- *Quercus lyrata* / *Betula nigra* / *Pleopeltis polypodioides* ssp. *michauxiana* Forest (CEGL004975, G1)
- *Quercus lyrata* Pond Forest (CEGL004642, G1G3)
- *Quercus palustris* - (*Quercus bicolor*) / *Carex crinita* / *Sphagnum* spp. Forest (CEGL002406, G3?)
- *Quercus palustris* / *Panicum rigidulum* var. *rigidulum* - *Panicum verrucosum* - *Eleocharis acicularis* Herbaceous Vegetation (CEGL007858, G1)
- *Quercus palustris* Pond Forest (CEGL007809, G2)
- *Quercus phellos* - *Liquidambar styraciflua* / *Chasmanthium laxum* Cumberland Plateau Forest (CEGL008441, G3)
- *Quercus phellos* Seasonally Flooded Ozark Pond Forest [Provisional] (CEGL007402, GNR)
- *Saccharum baldwinii* - *Calamagrostis coarctata* - *Panicum rigidulum* - *Rhynchospora capitellata* Herbaceous Vegetation (CEGL004750, G2G3)
- *Scirpus cyperinus* - *Dulichium arundinaceum* / *Sphagnum* spp. Herbaceous Vegetation (CEGL004134, G1Q)
- *Scirpus cyperinus* - *Panicum rigidulum* - *Rhynchospora corniculata* - (*Dulichium arundinaceum*) Herbaceous Vegetation (CEGL004719, G2G3)
- *Sparganium americanum* - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150, G5)
- *Vaccinium macrocarpon* / *Pogonia ophioglossoides* Dwarf-shrubland (CEGL007856, G1Q)

Alliances:

- *Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance (A.316)
- *Brasenia schreberi* Permanently Flooded Herbaceous Alliance (A.1742)
- *Carex (flava, hystericina, interior, sterilis)* Saturated Shrub Herbaceous Alliance (A.1561)
- *Carex barrattii* Seasonally Flooded Herbaceous Alliance (A.1930)
- *Carex comosa* - (*Carex decomposita*) Semipermanently Flooded Herbaceous Alliance (A.1439)
- *Cephalanthus occidentalis* Seasonally Flooded Shrubland Alliance (A.988)
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
- *Dulichium arundinaceum* Seasonally Flooded Herbaceous Alliance (A.1398)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Leersia oryzoides* - *Glyceria striata* Seasonally Flooded Herbaceous Alliance (A.1399)
- *Liquidambar styraciflua* - (*Acer rubrum*) Seasonally Flooded Forest Alliance (A.321)
- *Ludwigia peploides* Semipermanently Flooded Herbaceous Alliance (A.1928)
- *Nelumbo lutea* Permanently Flooded Temperate Herbaceous Alliance (A.1671)
- *Nymphaea odorata* - *Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance (A.1984)
- *Nyssa (aquatica, biflora, ogeche)* Pond Seasonally Flooded Forest Alliance (A.324)
- *Orontium aquaticum* - (*Schoenoplectus subterminalis*) Permanently Flooded Herbaceous Alliance (A.1931)
- *Panicum hemitomon* Seasonally Flooded Temperate Herbaceous Alliance (A.1379)
- *Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance (A.1381)
- *Pontederia cordata* - *Peltandra virginica* Semipermanently Flooded Herbaceous Alliance (A.1669)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Alliance (A.1754)
- *Quercus alba* - (*Nyssa sylvatica*) Seasonally Flooded Forest Alliance (A.1996)
- *Quercus lyrata* - (*Carya aquatica*) Seasonally Flooded Forest Alliance (A.328)
- *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance (A.329)
- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)
- *Rhynchospora* spp. - *Panicum (rigidulum, verrucosum)* - *Rhexia virginica* Seasonally Flooded Herbaceous Alliance (A.1384)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance (A.1386)

- *Sparganium americanum* Seasonally Flooded Herbaceous Alliance (A.1388)
- *Typha (angustifolia, latifolia)* - (*Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance (A.1436)
- *Vaccinium macrocarpon* Saturated Dwarf-shrubland Alliance (A.1094)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- Eastern Highland Rim Prairie and Barrens (CES202.354)

DISTRIBUTION

Range: This system is found from the Ozark and Ouachita mountains east to the southern and central Appalachians and the northern Piedmont regions (?), including the unglaciated Interior Low Plateau and Ridge and Valley. It ranges from Missouri, West Virginia and Delaware south to Arkansas, Alabama and Georgia.

Divisions: 202:C

Nations: US

Subnations: AL, AR, DE, GA, IL, IN, KY, MD, MO, NC, NJ, OH, PA, TN, VA, WV

Map Zones: 44:C, 47:C, 48:C, 49:C, 53:C, 57:C, 59:N, 60:N, 61:C, 62:P, 64:P

TNC Ecoregions: 38:C, 39:C, 44:C, 50:C, 59:C, 61:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.722687#references

Description Author: M. Pyne, S. Menard, D. Faber-Langendoen

Version: 26 Jan 2006

Concept Author: M. Pyne, S. Menard, D. Faber-Langendoen

Stakeholders: East, Midwest, Southeast

ClassifResp: Midwest

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)**Land Cover Class:** Woody Wetland**Spatial Scale & Pattern:** Linear**Required Classifiers:** Natural/Semi-natural; Vegetated (>10% vasc.); Wetland**Diagnostic Classifiers:** Short (<5 yrs) Flooding Interval; Riparian Mosaic; Riverine / Alluvial; Graminoid**Non-Diagnostic Classifiers:** Lowland [Foothill]; Woody-Herbaceous; Broad-Leaved Deciduous Tree; Broad-Leaved Deciduous Shrub

CONCEPT

Summary: Examples of this riverscour-influenced system may occur on high-gradient and very high-gradient streams in the gorges of the Cumberland Plateau, the Cumberland Mountains, and the more rugged parts of the Ridge and Valley in Kentucky, Tennessee, and Alabama, and possibly in Georgia. The succession of woody plants (particularly trees) is retarded by the force of "flashy," high-velocity water traveling down the stream channels. This system may occur on flood-scoured acidic or calcareous bedrock, cobble, pebble, or sandbar substrates of sandstone, limestone, dolomite, and possibly other sedimentary and weakly metamorphosed geologies. The most distinctive parts of the system are dominated by shrubs, perennial grasses, and forbs. In some areas, a riparian woodland composed of *Betula nigra* and *Platanus occidentalis* may be a component association. Some common shrubs include *Alnus serrulata*, *Betula nigra*, *Cephalanthus occidentalis*, *Cornus amomum*, *Fothergilla major*, *Itea virginica*, *Salix caroliniana*, *Rhododendron arborescens*, *Toxicodendron radicans*, and *Juniperus virginiana* var. *virginiana*. Some grasses (typical of prairies) include *Andropogon gerardii*, *Sorghastrum nutans*, *Schizachyrium scoparium*, *Chasmanthium latifolium*, *Tripsacum dactyloides*, and/or *Panicum virgatum*. Forbs are diverse and variable from occurrence to occurrence. This system is affected by flood-scouring in some areas and deposition in others. There is typically a gradient from dry, nutrient-poor conditions upslope to moist and , relatively enriched conditions downslope. A variety of these conditions may exist at any one site. Some areas are prone to severe drought periods that may stress or kill some (particularly woody) vegetation. Flood-scouring is a powerful and ecologically important abrasive force along the riverbanks where this system is found.

Classification Comments: Examples of the system are sometimes called "scoured riverbank prairies," "riverside prairies," "linear prairies," "rivershore grasslands," or "scoured riverine bluff prairie." River systems where it is found include the Cumberland and its tributaries, the Obed, the Obey, Chickasaw Creek (Tennessee), the Cahaba (Alabama), the Red River Gorge (Kentucky), Rockcastle River (Kentucky), the Big South Fork of the Cumberland (Kentucky/Tennessee) and its tributaries, and many others.

Similar Ecological Systems:

- Central Appalachian Riparian (CES202.609)
- South-Central Interior Small Stream and Riparian (CES202.706)

DESCRIPTION

Environment: Examples may occur on high-gradient and very high-gradient streams in the gorges of the Cumberland Plateau, the Cumberland Mountains, and rugged parts of the Ridge and Valley, in Kentucky, Tennessee, and Alabama, and possibly in Georgia. The succession of woody plants (particularly trees) is retarded by the force of "flashy," high-velocity water traveling down the stream channels. This system may occur on flood-scoured acidic or calcareous bedrock, cobble, pebble, or sandbar substrates of sandstone, limestone, dolomite, and possibly other sedimentary and weakly metamorphosed geologies. It is presumably more extensive and better developed in materials derived from sandstone, where the erodibility creates more material circulating in the stream to create the sandbar/gravelbar areas where the system may occur in extensive patches, and where the extremely well-drained qualities of the coarse sediments further help to retard woody plant succession.

Vegetation: Examples of this system are typically dominated by shrubs, perennial grasses, and forbs. In some areas, a riparian woodland composed of *Betula nigra* and *Platanus occidentalis* may be a component association. Some common shrub component species include *Alnus serrulata*, *Betula nigra*, *Cephalanthus occidentalis*, *Cornus amomum*, *Fothergilla major*, *Itea virginica*, *Salix caroliniana*, *Rhododendron arborescens*, *Toxicodendron radicans*, and *Juniperus virginiana* var. *virginiana*. More southern examples may contain *Hydrangea quercifolia*, *Hypericum densiflorum*, and *Morella cerifera* (= *Myrica cerifera* var. *cerifera*). Some grasses and forbs include *Andropogon gerardii*, *Sorghastrum nutans*, *Schizachyrium scoparium*, *Chasmanthium latifolium*, *Tripsacum dactyloides*, *Panicum virgatum*, *Baptisia australis*, *Conoclinium coelestinum* (= *Eupatorium coelestinum*), *Coreopsis pubescens*, *Coreopsis tripteris*, *Elephantopus carolinianus*, *Helenium autumnale*, *Hydrocotyle* sp., *Ludwigia leptocarpa*, *Lycopus* spp., *Orontium aquaticum*, *Osmunda regalis* var. *spectabilis*, *Oxypolis rigidior*, *Phlox carolina*, *Pityopsis graminifolia* var. *latifolia*, *Rhynchospora colorata* (= *Dichromena colorata*), *Rudbeckia laciniata*, and *Vernonia gigantea*. Patches of *Carex torta* may be present in some examples. Distinctive shoals with *Hymenocallis coronaria* and *Justicia americana* may be present as well. Some of these species are typical of prairies, and thrive in the well-lit environment.

Dynamics: This system is prone to flooding in the upper regions and deposition in the topographically lower areas. There is typically a gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. It is prone to severe drought periods that may stress or kill some vegetation. Flood scouring is a powerful and ecologically important abrasive force along the riverbanks where this system is found. Soils in sandstone areas are rapidly drained Psamments, and may be

restricted to the narrow interstices of tightly packed boulders, or to small crevices in bedrock exposures. Within the system the various species are distributed patchily probably due to microsite conditions.

MEMBERSHIP

Associations:

- (*Salix caroliniana*, *Rhododendron arborescens*) - *Andropogon gerardii* - *Baptisia australis* - (*Solidago simplex* var. *randii*) Herbaceous Vegetation (CEGL008471, G2?)
- *Alnus serrulata* - *Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Hymenocallis coronaria* - *Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Hypericum densiflorum* - *Alnus serrulata* / *Jamesianthus alabamensis* - *Xyris tennesseensis* Shrubland (CEGL008494, G1G2)
- *Hypericum densiflorum* - *Alnus serrulata* / *Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Platanus occidentalis* - (*Betula nigra*, *Salix* spp.) Temporarily Flooded Woodland [Provisional] (CEGL003725, GNR)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Vallisneria americana* - (*Heteranthera dubia*) Riverine Herbaceous Vegetation (CEGL004333, G3G4)

Alliances:

- *Alnus serrulata* Temporarily Flooded Shrubland Alliance (A.943)
- *Andropogon gerardii* - (*Sorghastrum nutans*) Temporarily Flooded Herbaceous Alliance (A.1337)
- *Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)
- *Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)
- *Osmunda (cinnamomea, regalis)* Saturated Herbaceous Alliance (A.1692)
- *Platanus occidentalis* - (*Betula nigra*, *Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
- *Podostemum ceratophyllum* Permanently Flooded Herbaceous Alliance (A.1752)
- *Vallisneria americana* Permanently Flooded Temperate Herbaceous Alliance (A.1757)

DISTRIBUTION

Range: This system is found in the Cumberland Plateau, the Cumberland Mountains, and the more rugged parts of the Ridge and Valley, in Kentucky, Tennessee, and Alabama, and possibly in Georgia.

Divisions: 202:C

Nations: US

Subnations: AL, GA?, KY, TN, WV

Map Zones: 48:C, 53:C, 57:N

TNC Ecoregions: 50:C

SOURCES

References: Bailey and Coe 2001, Comer et al. 2003, NatureServe Ecology - Southeastern U.S. unpubl. data

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722671#references

Description Author: R. Evans, M. Pyne

Version: 17 Apr 2006

Concept Author: R. Evans, M. Pyne

Stakeholders: East, Midwest, Southeast

ClassifResp: Southeast

CUMBERLAND SEEPAGE FOREST (CES202.361)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Seepage-Fed Sloping [Mineral]; Broad-Leaved Tree

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

CONCEPT

Summary: This system of seepage-influenced, primarily forested wetlands is found in the Cumberland Plateau and Ridge and Valley regions of Alabama, Tennessee, West Virginia, and Kentucky. It is also found on the flat metasedimentary upland surfaces of Chilhowee Mountain, Tennessee. This area is part of the Southern Blue Ridge (TNC Ecoregion 51), but its ecological communities are similar to those of the Cumberlands. Examples most often occur in streamhead swales or on broad sandstone ridges where soils are sandy and saturated due to a combination of perched water table and seepage flow. Examples range in condition from open woodlands to forests, and some may lack a canopy and then will be dominated by shrubs or herbs. Typical woody species, when present, include *Acer rubrum*, *Nyssa sylvatica*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Ilex opaca* var. *opaca*, *Oxydendrum arboreum*, and *Kalmia latifolia*.

Classification Comments: Examples range in condition from open woodlands to forests, and some may lack a canopy and then will be dominated by shrubs or herbs.

Similar Ecological Systems:

- East Gulf Coastal Plain Northern Seepage Swamp (CES203.554)

DESCRIPTION

Environment: Examples occur in streamhead swales or on broad sandstone ridges. Soils are sandy and saturated due to a combination of perched water table and seepage flow.

Vegetation: Typical woody species, when present, include *Acer rubrum*, *Nyssa sylvatica*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Ilex opaca* var. *opaca*, *Oxydendrum arboreum*, and *Kalmia latifolia*. Some extreme southerly examples may contain *Nyssa biflora*. Some stands are more open due to fire frequency, windthrow, or other disturbance. These are more likely to contain noteworthy herbaceous plant species (e.g., *Platanthera* spp.).

MEMBERSHIP

Associations:

- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Osmunda cinnamomea* - *Chasmanthium laxum* - *Carex intumescens* / *Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum* / *Alnus serrulata* / *Calamagrostis coarctata* Saturated Woodland (CEGL003737, G2G3)
- *Alnus serrulata* - *Salix sericea* - *Rhododendron (catawbiense, maximum)* Saturated Shrubland [Placeholder] (CEGL004972, G4?)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Acer rubrum* Saturated Woodland Alliance (A.657)
- *Alnus serrulata* - *Salix sericea* - *Rhododendron (catawbiense, maximum)* Saturated Shrubland Alliance (A.1880)

DISTRIBUTION

Range: This systems is found in the Cumberland Plateau and Ridge and Valley regions of Alabama, Tennessee, West Virginia, and Kentucky. Related stands in the Interior Low Plateau of Kentucky ("Shawnee Hills") need to be provided for here or in a separate system.

Divisions: 202:C

Nations: US

Subnations: AL, KY, TN, WV

Map Zones: 48:C, 53:C, 57:C

TNC Ecoregions: 50:C, 51:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723153#references

Description Author: R. Evans and M. Pyne

Version: 17 Apr 2006

Concept Author: R. Evans and M. Pyne

Stakeholders: East, Southeast

ClassifResp: Southeast

EAST GULF COASTAL PLAIN LARGE RIVER FLOODPLAIN FOREST (CES203.489)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Forest and Woodland (Treed); Riverine / Alluvial [Brownwater]

CONCEPT

Summary: This system represents a geographic subset of Kuchler's (1964) Southern Floodplain Forest. Examples may be found along large rivers of the East and Upper East Gulf Coastal Plain, especially the Apalachicola, Alabama/Cahaba, Tombigbee, Pascagoula, and Pearl rivers, all of which ultimately drain into the Gulf of Mexico. Several distinct plant communities can be recognized within this system that may be related to the array of different geomorphologic features present within the floodplain. Some of the major geomorphic features associated with different community types include natural levees, point bars, meander scrolls, oxbows, and sloughs (Sharitz and Mitsch 1993). Vegetation generally includes forests dominated by bottomland hardwood species and other trees tolerant of flooding. However, herbaceous and shrub vegetation may be present in certain areas as well.

Classification Comments: In the Upper East Gulf Plain of Kentucky, this system is represented in the Ecoregions of Kentucky map (Woods et al. 2002) by the lower part of the Wabash-Ohio bottomlands (72a). In the lower Gulf Coastal Plain, this includes at least EPA (Omernik) Level IV ecoregions 65p and 75i (EPA 2004).

Similar Ecological Systems:

- Atlantic Coastal Plain Large River Floodplain Forest (CES203.066)
- East Gulf Coastal Plain Small Stream and River Floodplain Forest (CES203.559)

Related Concepts:

- Bottomland Forest (FNAI 1990) Intersecting
- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Floodplain Forest (FNAI 1990) Intersecting
- Floodplain Ridge/Terrace Forest (Evans 1991) Intersecting
- Floodplain Swamp (FNAI 1990) Intersecting
- Gravel/Cobble Bar (Evans 1991) Finer

DESCRIPTION

Environment: Examples of this system are generally forested with stands of bottomland hardwood species and other trees tolerant of flooding. Local composition varies depending upon actual position within the floodplain, disturbance history, and underlying soils and geology. Although most examples of this system may be thought of as acidic, some examples of this system flow through regions with sufficient calcareous influence to effect vegetation composition.

MEMBERSHIP

Associations:

- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer rubrum* - *Gleditsia aquatica* - *Planera aquatica* - *Fraxinus profunda* Forest (CEGL002422, G3G5)
- *Acer saccharinum* - *Celtis laevigata* - *Carya illinoensis* Forest (CEGL002431, G3G4)
- *Acer saccharum* - *Carya cordiformis* / *Asimina triloba* Floodplain Forest (CEGL005035, G2)
- *Alternanthera philoxeroides* Herbaceous Vegetation (CEGL003858, GNA)
- *Betula nigra* - *Platanus occidentalis* / *Alnus serrulata* / *Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra* / *Salix nigra* / *Hypericum prolificum* - *Ampelopsis arborea* Forest (CEGL007794, G3?)
- *Brunnichia ovata* Vine-Shrubland (CEGL008446, G4?)
- *Catalpa bignonioides* - *Salix nigra* / *Brunnichia ovata* / *Eupatorium serotinum* Forest (CEGL008547, G2G3)
- *Cephalanthus occidentalis* / *Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905, G4)
- *Forestiera acuminata* - (*Planera aquatica*, *Cephalanthus occidentalis*) Shrubland (CEGL003911, G3?)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest (CEGL002427, G4G5)
- *Fraxinus pennsylvanica* - *Ulmus americana* / *Carpinus caroliniana* / *Boehmeria cylindrica* Forest (CEGL007806, G4?)
- *Gleditsia aquatica* - *Carya aquatica* Forest (CEGL007426, G3?)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua* - *Quercus (laurifolia, nigra)* - (*Pinus taeda*) / *Arundinaria gigantea* / *Carex abscondita* Forest (CEGL007732, G3G4)

- *Liquidambar styraciflua* - *Quercus pagoda* - *Carya* spp. / *Carpinus caroliniana* / *Carex* spp. Forest (CEGL007353, G3G4)
- *Nelumbo lutea* Herbaceous Vegetation (CEGL004323, G4?)
- *Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Nyssa aquatica* - *Fraxinus pennsylvanica* - *Taxodium distichum* / *Sabal minor* Forest (CEGL008463, GNR)
- *Nyssa aquatica* - *Nyssa biflora* Forest (CEGL007429, G4G5)
- *Nyssa aquatica* Forest (CEGL002419, G4G5)
- *Nyssa biflora* - *Acer rubrum* var. *rubrum* / *Lyonia lucida* Forest (CEGL007864, G3G4)
- *Nyssa biflora* - *Taxodium ascendens* / *Ludwigia pilosa* - *Bacopa caroliniana* Woodland (CEGL003735, G1?)
- *Nyssa biflora* / *Itea virginica* - *Cephalanthus occidentalis* Depression Forest (CEGL007434, G3G4)
- *Nyssa ogeche* - (*Nyssa biflora*, *Taxodium ascendens*) Forest (CEGL007392, G4)
- *Nyssa ogeche* - *Nyssa aquatica* Forest (CEGL007393, G3)
- *Pinus glabra* - *Quercus virginiana* - *Carya glabra* / *Carpinus caroliniana* / *Serenoa repens* Forest (CEGL004676, G2G3)
- *Platanus occidentalis* - *Liquidambar styraciflua* - (*Ulmus americana*) / (*Crataegus viridis*) Forest (CEGL007335, G3G4)
- *Polygonum* spp. - *Phanopyrum gymnocarpon* Seasonally Flooded Herbaceous Vegetation (CEGL008555, G4)
- *Populus deltoides* - *Salix caroliniana* Forest (CEGL007343, G4G5)
- *Populus deltoides* - *Salix nigra* / *Mikania scandens* Forest (CEGL007346, G4G5)
- *Populus deltoides* - *Salix nigra* Forest (CEGL002018, G3G4)
- *Populus deltoides* / *Acer negundo* / *Boehmeria cylindrica* Forest (CEGL007731, G3G5)
- *Quercus laurifolia* - *Quercus michauxii* - *Liquidambar styraciflua* / *Carpinus caroliniana* Forest (CEGL004678, G3G4)
- *Quercus lyrata* - *Carya aquatica* - (*Quercus texana*) / *Forestiera acuminata* Forest (CEGL002423, G3?)
- *Quercus lyrata* - *Carya aquatica* Forest (CEGL007397, G4G5)
- *Quercus lyrata* - *Liquidambar styraciflua* Forest (CEGL008583, G3G4)
- *Quercus michauxii* - *Quercus shumardii* - *Liquidambar styraciflua* / *Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus nigra* - *Quercus pagoda* - *Carya myristiciformis* / *Cercis canadensis* Forest (CEGL004770, G3?)
- *Quercus pagoda* - *Quercus nigra* / *Halesia diptera* - *Ilex decidua* / *Chasmanthium sessiliflorum* - *Dicliptera brachiata* Forest (CEGL007354, G4?)
- *Quercus phellos* - *Quercus nigra* - *Liquidambar styraciflua* Mississippi River Alluvial Plain Forest (CEGL007915, G4G5)
- *Quercus shumardii* - *Quercus michauxii* - *Quercus nigra* / *Acer barbatum* - *Tilia americana* var. *heterophylla* Forest (CEGL008487, G3)
- *Quercus texana* - *Celtis laevigata* - *Ulmus (americana, crassifolia)* - (*Gleditsia triacanthos*) Forest (CEGL004619, G4G5)
- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899, G4?)
- *Salix nigra* / (*Clethra alnifolia*, *Morella cerifera*) / *Nyssa aquatica* Successional Forest (CEGL007411, GNA)
- *Salix nigra* Forest (CEGL002103, G4)
- *Salix nigra* Large River Floodplain Forest (CEGL007410, G3G5)
- *Taxodium distichum* - *Fraxinus pennsylvanica* - *Quercus laurifolia* / *Acer rubrum* / *Saururus cernuus* Forest (CEGL007719, G3G4)
- *Taxodium distichum* - *Nyssa ogeche* Forest (CEGL003841, G3G4)
- *Taxodium distichum* / *Lemna minor* Forest (CEGL002420, G4G5)
- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150, G5)
- *Zizaniopsis miliacea* Coastal Plain Slough Herbaceous Vegetation (CEGL004139, G4?)

Alliances:

- *Acer negundo* Temporarily Flooded Forest Alliance (A.278)
- *Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance (A.316)
- *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)
- *Acer saccharum* - *Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)
- *Alternanthera philoxeroides* Semipermanently Flooded Herbaceous Alliance (A.2015)
- *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance (A.280)
- *Brunnichia ovata* Temporarily Flooded Vine-Shrubland Alliance (A.2002)
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
- *Decodon verticillatus* Seasonally Flooded Shrubland Alliance (A.990)
- *Forestiera acuminata* Semipermanently Flooded Shrubland Alliance (A.1012)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*, *Acer rubrum*) Temporarily Flooded Forest Alliance (A.287)
- *Nelumbo lutea* Permanently Flooded Temperate Herbaceous Alliance (A.1671)
- *Nymphaea odorata* - *Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance (A.1984)
- *Nyssa (aquatica, biflora, ogeche)* Floodplain Seasonally Flooded Forest Alliance (A.323)
- *Nyssa (aquatica, biflora, ogeche)* Pond Seasonally Flooded Forest Alliance (A.324)
- *Nyssa aquatica* - (*Taxodium distichum*) Semipermanently Flooded Forest Alliance (A.345)
- *Nyssa biflora* - *Taxodium ascendens* Semipermanently Flooded Woodland Alliance (A.655)
- *Platanus occidentalis* - (*Fraxinus pennsylvanica*, *Celtis laevigata*, *Acer saccharinum*) Temporarily Flooded Forest Alliance (A.288)
- *Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance (A.1881)

- *Populus deltoides* Temporarily Flooded Forest Alliance (A.290)
- *Quercus (laurifolia, phellos)* Seasonally Flooded Forest Alliance (A.327)
- *Quercus (michauxii, pagoda, shumardii) - Liquidambar styraciflua* Temporarily Flooded Forest Alliance (A.291)
- *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.292)
- *Quercus lyrata - (Carya aquatica)* Seasonally Flooded Forest Alliance (A.328)
- *Quercus virginiana* Temporarily Flooded Forest Alliance (A.57)
- *Salix caroliniana* Temporarily Flooded Shrubland Alliance (A.946)
- *Salix nigra* Seasonally Flooded Forest Alliance (A.334)
- *Salix nigra* Temporarily Flooded Forest Alliance (A.297)
- *Taxodium distichum - Nyssa (aquatica, biflora, ogeche)* Seasonally Flooded Forest Alliance (A.337)
- *Taxodium distichum* Semipermanently Flooded Forest Alliance (A.346)
- *Typha (angustifolia, latifolia) - (Schoenoplectus spp.)* Semipermanently Flooded Herbaceous Alliance (A.1436)
- *Zizaniopsis miliacea* Seasonally Flooded Temperate Herbaceous Alliance (A.1395)

DISTRIBUTION

Range: East and Upper East Gulf Coastal Plain, especially the Apalachicola, Alabama, Tombigbee, Pascagoula, and Pearl rivers, all of which ultimately drain into the Gulf of Mexico.

Divisions: 203:C

Nations: US

Subnations: AL, FL, GA, KY, MS, TN

Map Zones: 46:C, 47:C, 55:C

TNC Ecoregions: 43:C, 53:C

SOURCES

References: Comer et al. 2003, EPA 2004, Kuchler 1964, Sharitz and Mitsch 1993, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723097#references

Description Author: R. Evans and A. Schotz

Version: 27 Sep 2005

Concept Author: R. Evans and A. Schotz

Stakeholders: Southeast

ClassifResp: Southeast

EAST GULF COASTAL PLAIN NORTHERN SEEPAGE SWAMP (CES203.554)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Seepage-Fed Sloping

Non-Diagnostic Classifiers: Forest and Woodland (Treed); Broad-Leaved Deciduous Tree

CONCEPT

Summary: This wetland system of the East Gulf Coastal Plain consists of forested wetlands in acidic, seepage-influenced habitats. These are mostly deciduous forests (and less commonly herbaceous communities) generally found at the base of slopes or other habitats where seepage flow is concentrated. Resulting moisture conditions are saturated or even inundated. The vegetation is characterized by *Nyssa sylvatica*, *Nyssa biflora*, and *Acer rubrum*. Examples occur in portions of the Coastal Plain north of the range of *Persea palustris* and *Magnolia grandiflora*. *Magnolia virginiana* is of less value as a differential species. To the south this system grades into Southern Coastal Plain Seepage Swamp and Baygall (CES203.505), where evergreen species are of much greater importance in the canopy and understory. Due to excessive wetness, these habitats are normally protected from fire except those which occur during extreme droughty periods. These environments are prone to long-duration standing water and tend to occur on highly acidic, nutrient-poor soils.

Classification Comments: Some authors have treated *Persea palustris* (of wetlands) and *Persea borbonia* (of uplands) as one taxon under a broadly conceived *Persea borbonia*. We recognize two distinct taxa, following Kartesz (1999) and Weakley (2005).

Similar Ecological Systems:

- Cumberland Seepage Forest (CES202.361)
- Piedmont Seepage Wetland (CES202.298)
- Southern Coastal Plain Seepage Swamp and Baygall (CES203.505)

DESCRIPTION

Vegetation: The vegetation is characterized by *Nyssa sylvatica*, *Nyssa biflora*, and *Acer rubrum*. The canopies of stands are primarily deciduous-dominated. Stands in the southern part of the system's range may contain *Magnolia virginiana*, particularly in the understory. This system occurs north of the range of *Persea palustris* and *Magnolia grandiflora*, and these species will be lacking from stands.

Dynamics: Due to excessive wetness, these habitats are normally protected from fire except those which occur during extreme droughty periods. These environments are prone to long-duration standing water and tend to occur on highly acidic, nutrient-poor soils.

MEMBERSHIP

Associations:

- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Rhododendron canescens* - *Viburnum nudum* var. *nudum* / *Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Magnolia virginiana* - *Nyssa biflora* / *Oxydendrum arboreum* / *Viburnum nudum* var. *nudum* Forest (CEGL008552, G3?)
- *Nyssa biflora* - *Liquidambar styraciflua* / *Magnolia virginiana* / *Hamamelis virginiana* - *Viburnum nudum* Forest (CEGL008477, G2G3)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Saturated Herbaceous Alliance (A.1451)
- *Magnolia virginiana* - *Nyssa biflora* - (*Quercus laurifolia*) Saturated Forest Alliance (A.378)
- *Nyssa biflora* - *Acer rubrum* - (*Liriodendron tulipifera*) Saturated Forest Alliance (A.351)

DISTRIBUTION

Range: This system is found in the East Gulf Coastal Plain portions of western Kentucky and Tennessee, northern Mississippi, northwestern and central Alabama, and southern Illinois.

Divisions: 203:C

Nations: US

Subnations: AL, IL, KY, MS, TN

Map Zones: 46:C, 47:C, 49:?

TNC Ecoregions: 43:C

SOURCES

References: Comer et al. 2003, Kartesz 1999, Weakley 2005

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723050#references

Description Author: R. Evans and M. Pyne

Version: 27 Sep 2005

Concept Author: R. Evans and M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

EAST GULF COASTAL PLAIN SMALL STREAM AND RIVER FLOODPLAIN FOREST (CES203.559)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Intermittent Flooding; Forest and Woodland (Treed); Riverine / Alluvial [Brownwater]

CONCEPT

Summary: This is a predominantly forested system of the East Gulf Coastal Plain associated with small brownwater rivers and creeks. In contrast to East Gulf Coastal Plain Large River Floodplain Forest (CES203.489), it has fewer major geomorphic floodplain features typically associated with large river floodplains. Those features that are present tend to be smaller and more closely intermixed with one another, resulting in less obvious vegetational zonation. Bottomland hardwood tree species are typically important and diagnostic, although mesic hardwood species are also present in areas with less inundation, such as upper terraces and possibly second bottoms. As a whole, flooding occurs annually, but the water table usually is well below the soil surface throughout most of the growing season. Areas impacted by beaver impoundments are also included in this system.

Classification Comments: This is primarily a linear system, with some variability as to the size type of the associations included within it. Most are temporarily flooded, with the possible addition of smaller-scale seasonally flooded features such as beaver-created herbaceous wetlands and shrub-dominated features. It is confined to floodplains or terraces of streams and creeks. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. These landscapes usually encompass a variety of habitats resulting from natural hydrological spatial patterns (i.e., meander scars, sloughs, old depressions, and/or oxbows are present).

Similar Ecological Systems:

- East Gulf Coastal Plain Large River Floodplain Forest (CES203.489)
- East Gulf Coastal Plain Tidal Wooded Swamp (CES203.299)

Related Concepts:

- Bottomland Forest (FNAI 1990) Intersecting
- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Floodplain Forest (FNAI 1990) Intersecting
- Floodplain Ridge/Terrace Forest (Evans 1991) Intersecting
- Floodplain Swamp (FNAI 1990) Intersecting
- Gravel/Cobble Bar (Evans 1991) Intersecting
- Riparian Forest (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: This system is associated with small brownwater rivers and creeks of the East Gulf Coastal Plain. It is confined to floodplains or terraces of streams and creeks. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. These landscapes usually encompass a variety of habitats resulting from natural hydrological spatial patterns (i.e., meander scars, sloughs, gravel bars, old depressions, and/or oxbows are present). Most component associations are temporarily flooded, with the possible addition of smaller-scale seasonally flooded features such as beaver-created herbaceous wetlands and shrub-dominated features. Some larger examples of this system include the Escambia, the Yellow (Alabama, Florida), the Choctawhatchee, the Chattahoochee, and the Flint rivers.

Vegetation: Examples of this system may include a number of different plant communities, each with distinctive floristic compositions. Drew et al. (1998) described vegetation attributable to this systems as including the following species: *Carya glabra*, *Magnolia grandiflora*, *Quercus virginiana*, *Liquidambar styraciflua*, *Acer barbatum*, *Fraxinus americana*, *Fraxinus caroliniana*, *Celtis laevigata*, *Sabal minor*, *Sebastiania fruticosa*, *Serenoa repens*, and *Itea virginica*. Smaller-scale features may be dominated by shrubs (*Cephalanthus occidentalis*, *Decodon verticillatus*) and/or perennial and annual herbs.

MEMBERSHIP

Associations:

- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Rhododendron canescens* - *Viburnum nudum* var. *nudum* / *Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474, G4)
- *Betula nigra* - *Platanus occidentalis* / *Alnus serrulata* / *Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra* / *Salix nigra* / *Hypericum prolificum* - *Ampelopsis arborea* Forest (CEGL007794, G3?)

- *Cephalanthus occidentalis* / *Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Chamaecyparis thyoides* / *Magnolia virginiana* - *Cliftonia monophylla* / *Orontium aquaticum* - *Sphagnum* spp. Forest (CEGL007151, G2G3)
- *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905, G4)
- *Fagus grandifolia* - *Carya* spp. / (*Acer negundo*, *Magnolia macrophylla*, *Tilia americana* var. *heterophylla*) Temporarily Flooded Forest (CEGL004745, G3G4)
- *Fagus grandifolia* - *Magnolia grandiflora* - *Quercus michauxii* - *Quercus nigra* / *Rhododendron canescens* Forest (CEGL004965, G2G3)
- *Glottidium vesicarium* - *Lindernia dubia* Sandbar Herbaceous Vegetation (CEGL008498, G3G4)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua* - *Liriodendron tulipifera* / *Onoclea sensibilis* Forest (CEGL007329, G4)
- *Liquidambar styraciflua* - *Quercus (laurifolia, nigra)* - (*Pinus taeda*) / *Arundinaria gigantea* / *Carex abscondita* Forest (CEGL007732, G3G4)
- *Ludwigia peploides* Herbaceous Vegetation (CEGL007835, G4G5)
- *Myriophyllum heterophyllum* Herbaceous Vegetation (CEGL008457, G4)
- *Nelumbo lutea* Herbaceous Vegetation (CEGL004323, G4?)
- *Nyssa aquatica* Forest (CEGL002419, G4G5)
- *Pallavicinia lyellii* - *Sphagnum* sp. Nonvascular Vegetation (CEGL004779, G4?)
- *Panicum virgatum* - *Panicum rigidulum* var. *elongatum* - *Polygonum hydropiperoides* Herbaceous Vegetation (CEGL004921, G3?)
- *Pinus elliotii* var. *elliotii* / *Cliftonia monophylla* - *Cyrilla racemiflora* Woodland (CEGL003638, G2G3Q)
- *Pinus glabra* - *Quercus (laurifolia, michauxii, nigra)* / *Carpinus caroliniana* ssp. *caroliniana* / *Sabal minor* Forest (CEGL007544, G3G4)
- *Pinus taeda* - *Liquidambar styraciflua* - *Nyssa biflora* Temporarily Flooded Forest (CEGL004606, G4)
- *Pinus taeda* - *Quercus hemisphaerica* / *Osmanthus americanus* / *Ilex glabra* Woodland (CEGL003619, G2)
- *Pinus taeda* Temporarily Flooded Forest (CEGL007142, G4?)
- *Platanus occidentalis* - *Liquidambar styraciflua* - (*Ulmus americana*) / (*Crataegus viridis*) Forest (CEGL007335, G3G4)
- *Polygonum (hydropiperoides, punctatum)* - *Leersia (lenticularis, virginica)* Herbaceous Vegetation (CEGL004290, G4?)
- *Polygonum* spp. - *Phanopyrum gymnocarpon* Seasonally Flooded Herbaceous Vegetation (CEGL008555, G4)
- *Pontederia cordata* - *Peltandra virginica* Semipermanently Flooded Herbaceous Vegetation [Placeholder] (CEGL004291, GNR)
- *Quercus laurifolia* - *Quercus michauxii* - *Liquidambar styraciflua* / *Carpinus caroliniana* Forest (CEGL004678, G3G4)
- *Quercus laurifolia* / *Carpinus caroliniana* / *Justicia ovata* Forest (CEGL007348, G4?)
- *Quercus nigra* - *Magnolia virginiana* - *Taxodium distichum* Forest (CEGL004978, G3?)
- *Quercus pagoda* - *Quercus nigra* / *Halesia diptera* - *Ilex decudua* / *Chasmanthium sessiliflorum* - *Dicliptera brachiata* Forest (CEGL007354, G4?)
- *Quercus phellos* - *Quercus nigra* - *Quercus alba* / *Chasmanthium (laxum, sessiliflorum)* Forest (CEGL004771, G3G4)
- *Quercus shumardii* - *Quercus michauxii* - *Quercus nigra* / *Acer barbatum* - *Tilia americana* var. *heterophylla* Forest (CEGL008487, G3)
- *Quercus virginiana* - (*Pinus taeda*) / (*Sabal minor*, *Serenoa repens*) Forest (CEGL007039, G3G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, GNR)
- *Salix nigra* Forest (CEGL002103, G4)
- *Scirpus cyperinus* Seasonally Flooded Southern Herbaceous Vegetation (CEGL003866, G4)
- *Taxodium distichum* - *Fraxinus pennsylvanica* - *Quercus laurifolia* / *Acer rubrum* / *Saururus cernuus* Forest (CEGL007719, G3G4)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Alnus serrulata* Saturated Shrubland Alliance (A.1014)
- *Alnus serrulata* Seasonally Flooded Shrubland Alliance (A.994)
- *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance (A.280)
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
- *Chamaecyparis thyoides* Saturated Forest Alliance (A.196)
- *Decodon verticillatus* Seasonally Flooded Shrubland Alliance (A.990)
- *Fagus grandifolia* - *Magnolia grandiflora* Forest Alliance (A.369)
- *Fagus grandifolia* Temporarily Flooded Forest Alliance (A.284)
- *Juncus effusus* Seasonally Flooded Herbaceous Alliance (A.1375)
- *Lindernia dubia* - *Glottidium vesicarium* - *Eupatorium serotinum* Temporarily Flooded Herbaceous Alliance (A.2008)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*, *Acer rubrum*) Temporarily Flooded Forest Alliance (A.287)
- *Ludwigia peploides* Semipermanently Flooded Herbaceous Alliance (A.1928)
- *Myriophyllum heterophyllum* Permanently Flooded Herbaceous Alliance (A.2003)
- *Nelumbo lutea* Permanently Flooded Temperate Herbaceous Alliance (A.1671)
- *Nyssa aquatica* - (*Taxodium distichum*) Semipermanently Flooded Forest Alliance (A.345)

- *Panicum virgatum* Temporarily Flooded Herbaceous Alliance (A.1343)
- *Pinus elliottii* Saturated Temperate Woodland Alliance (A.574)
- *Pinus glabra* - *Quercus (laurifolia, michauxii, nigra)* Temporarily Flooded Forest Alliance (A.431)
- *Pinus taeda* - *Liquidambar styraciflua* - *Nyssa biflora* Temporarily Flooded Forest Alliance (A.433)
- *Pinus taeda* - *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.437)
- *Pinus taeda* Woodland Alliance (A.526)
- *Platanus occidentalis* - (*Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum*) Temporarily Flooded Forest Alliance (A.288)
- *Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance (A.1881)
- *Pontederia cordata* - *Peltandra virginica* Semipermanently Flooded Herbaceous Alliance (A.1669)
- *Quercus (laurifolia, phellos)* Seasonally Flooded Forest Alliance (A.327)
- *Quercus (michauxii, pagoda, shumardii)* - *Liquidambar styraciflua* Temporarily Flooded Forest Alliance (A.291)
- *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.292)
- *Quercus virginiana* Temporarily Flooded Forest Alliance (A.57)
- *Salix caroliniana* Temporarily Flooded Forest Alliance (A.296)
- *Salix nigra* Temporarily Flooded Forest Alliance (A.297)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance (A.1386)
- *Sphagnum* spp. - *Pallavicinia lyellii* Saturated Nonvascular Alliance (A.1823)
- *Taxodium distichum* - *Nyssa (aquatica, biflora, ogeche)* Seasonally Flooded Forest Alliance (A.337)

DISTRIBUTION

Range: This system is found in the East Gulf Coastal Plain, from the coast northward and inland to the extent of unconsolidated sediments in Kentucky.

Divisions: 203:C

Nations: US

Subnations: AL, FL, GA, KY, MS, TN

Map Zones: 46:C, 55:C

TNC Ecoregions: 43:C, 53:C

SOURCES

References: Comer et al. 2003, Drew et al. 1998

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723045#references

Description Author: M. Pyne and R. Evans

Version: 18 Apr 2006

Concept Author: M. Pyne and R. Evans

Stakeholders: Southeast

ClassifResp: Southeast

MISSISSIPPI RIVER BOTTOMLAND DEPRESSION (CES203.490)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Forest and Woodland (Treed); Riverine / Alluvial [Brownwater]; Needle-Leaved Tree; Broad-Leaved Deciduous Tree

CONCEPT

Summary: This system represents semipermanently flooded to saturated depressional areas of the lower Mississippi River Alluvial Valley.

Related Concepts:

- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: Examples of this system are found in depressions and backswamps of the lower Mississippi River Alluvial Valley. These areas have a distinctly longer hydroperiod than other parts of the landscape.

Vegetation: Typical and characteristic trees in examples of this system include *Acer rubrum* var. *drummondii*, *Carya aquatica*, *Fraxinus profunda*, *Gleditsia aquatica*, *Nyssa aquatica*, *Nyssa biflora*, *Planera aquatica*, *Quercus lyrata*, *Quercus palustris*, *Salix nigra*, and *Taxodium distichum*. Some characteristic shrubs include *Cephalanthus occidentalis*, *Cornus foemina*, *Decodon verticillatus*, *Forestiera acuminata*, *Itea virginica*, and *Planera aquatica*. Herbs are uncommon, but *Ludwigia peploides*, *Sagittaria lancifolia*, *Ceratophyllum* spp., *Elodea* spp., *Potamogeton* spp., and *Lemna minor* may be found.

MEMBERSHIP

Associations:

- *Acer rubrum* - *Gleditsia aquatica* - *Planera aquatica* - *Fraxinus profunda* Forest (CEGL002422, G3G5)
- *Cephalanthus occidentalis* / *Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905, G4)
- *Forestiera acuminata* - (*Planera aquatica*, *Cephalanthus occidentalis*) Shrubland (CEGL003911, G3?)
- *Gleditsia aquatica* - *Carya aquatica* Forest (CEGL007426, G3?)
- *Ludwigia peploides* Herbaceous Vegetation (CEGL007835, G4G5)
- *Nyssa aquatica* - *Nyssa biflora* Forest (CEGL007429, G4G5)
- *Nyssa aquatica* Floodplain Forest (CEGL007389, GNR)
- *Nyssa aquatica* Forest (CEGL002419, G4G5)
- *Planera aquatica* Forest (CEGL007394, G4?)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Vegetation (CEGL004725, G4?)
- *Quercus lyrata* - *Quercus palustris* / *Acer rubrum* var. *drummondii* / *Itea virginica* - *Cornus foemina* - (*Lindera melissifolia*) Forest (CEGL004778, G2?)
- *Salix nigra* / (*Clethra alnifolia*, *Morella cerifera*) / *Nyssa aquatica* Successional Forest (CEGL007411, GNA)
- *Salix nigra* / *Sagittaria lancifolia* Forest (CEGL007436, G4?)
- *Taxodium distichum* - (*Nyssa aquatica*) / *Forestiera acuminata* - *Planera aquatica* Forest (CEGL002421, G3G5)
- *Taxodium distichum* - *Nyssa aquatica* - *Acer rubrum* / *Itea virginica* Forest (CEGL007422, G4?)
- *Taxodium distichum* / *Lemna minor* Forest (CEGL002420, G4G5)
- *Taxodium distichum* / *Planera aquatica* - *Forestiera acuminata* Lakeshore Woodland (CEGL007909, GNR)

Alliances:

- *Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance (A.316)
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
- *Decodon verticillatus* Seasonally Flooded Shrubland Alliance (A.990)
- *Forestiera acuminata* Semipermanently Flooded Shrubland Alliance (A.1012)
- *Ludwigia peploides* Semipermanently Flooded Herbaceous Alliance (A.1928)
- *Nyssa* (*aquatica*, *biflora*, *ogeche*) Floodplain Seasonally Flooded Forest Alliance (A.323)
- *Nyssa aquatica* - (*Taxodium distichum*) Semipermanently Flooded Forest Alliance (A.345)
- *Planera aquatica* Seasonally Flooded Forest Alliance (A.326)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Alliance (A.1754)
- *Quercus lyrata* - (*Carya aquatica*) Seasonally Flooded Forest Alliance (A.328)

- *Salix nigra* Seasonally Flooded Forest Alliance (A.334)
- *Taxodium distichum* - (*Taxodium ascendens*) Seasonally Flooded Lakeshore Woodland Alliance (A.652)
- *Taxodium distichum* - *Nyssa* (*aquatica*, *biflora*, *ogeche*) Seasonally Flooded Forest Alliance (A.337)
- *Taxodium distichum* Semipermanently Flooded Forest Alliance (A.346)

DISTRIBUTION

Range: This system is found in the Mississippi Alluvial Plain from southern Illinois south to Mississippi and Louisiana.

Divisions: 203:C

Nations: US

Subnations: AR, IL, KY, LA, MO, MS, TN

Map Zones: 45:C

TNC Ecoregions: 42:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.723096#references

Description Author: T. Foti and R. Evans, mod. M. Pyne

Version: 18 Apr 2006

Concept Author: T. Foti and R. Evans

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

MISSISSIPPI RIVER HIGH FLOODPLAIN (BOTTOMLAND) FOREST (CES203.196)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Riverine / Alluvial [Brownwater]

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

CONCEPT

Summary: "High bottomlands" are often temporarily flooded on older Holocene point bars and natural levees, with flooding less frequent than every five years. Wetland functions are primarily driven by precipitation and are classed as floodplain flats in a hydrogeomorphic classification (Klimas et al. 2004). They are flooded less frequently than adjacent riparian floodplains or low floodplains. These floodplains are of particular conservation interest because they have been cleared to a greater extent than riparian or low floodplains because of the reduced flooding of these sites. Also, flood control levees protect many of these sites, and with protection from levees, almost all sites are cleared. Thus, most wetlands remaining in large bottomland areas are riparian or low bottomlands, and the species, communities and other characteristics of high bottomlands have been essentially lost. Wildlife agency partners generally would like to see this distinction recognized. Because many of these sites are adjacent to uplands or non-flooded hydroxic flatwoods, both of which have a relatively high fire frequency, and high floodplains are relatively dry, they have a much higher typical fire frequency than lower bottomlands. Therefore, under pre-development conditions, they would have been more open and had a higher ground layer diversity than other floodplain systems.

Similar Ecological Systems:

- Lower Mississippi River Flatwoods (CES203.193)
- Mississippi River Low Floodplain (Bottomland) Forest (CES203.195)
- Mississippi River Riparian Forest (CES203.190)

Related Concepts:

- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Floodplain Ridge/Terrace Forest (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: These "high bottomlands" are often temporarily flooded on older Holocene point bars and natural levees, with flooding less frequent than every five years. Wetland functions are primarily driven by precipitation and are classed as floodplain flats in a hydrogeomorphic classification (Klimas et al. 2004). They are flooded less frequently than adjacent riparian floodplains or low floodplains.

Vegetation: Typical dominant trees in stands of this system include *Liquidambar styraciflua*, *Quercus laurifolia*, *Quercus michauxii*, *Quercus nigra*, *Quercus pagoda*, *Quercus phellos*, *Quercus shumardii*, *Quercus texana*, and *Carya* spp. Southern examples may contain *Quercus virginiana* and/or *Magnolia grandiflora*, northern ones may contain *Quercus palustris*. Wetter inclusions may contain *Quercus lyrata*. Some stands which lack these species may exhibit dominance by *Fraxinus pennsylvanica*, *Ulmus americana* and *Celtis laevigata*. *Gleditsia triacanthos* may also be a component. *Ulmus crassifolia* may be more commonly found west of the Mississippi River. Some small trees and shrubs include *Cornus florida*, *Ilex decidua*, *Ilex opaca* var. *opaca*, *Viburnum dentatum*, and *Carpinus caroliniana*. Southern stands may contain *Sabal minor*. The perennial graminoid bamboo *Arundinaria gigantea* ssp. *gigantea* may dominate the shrub stratum of some forests, or it may form non-forested stands called "canebrakes." *Vitis rotundifolia*, *Ampelopsis arborea*, and *Campsis radicans* are common vines.

Dynamics: Regeneration of remaining examples today are typified by small gap regeneration or large patch regeneration in tornado tracks, but originally, fire may have opened larger patches in which regeneration occurred.

MEMBERSHIP

Associations:

- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest (CEGL002427, G4G5)
- *Fraxinus pennsylvanica* - *Ulmus crassifolia* - *Celtis laevigata* Forest (CEGL004618, GNR)
- *Liquidambar styraciflua* - *Quercus pagoda* - *Carya* spp. / *Carpinus caroliniana* / *Carex* spp. Forest (CEGL007353, G3G4)
- *Quercus laurifolia* - *Quercus nigra* Mississippi River Alluvial Plain Forest (CEGL007916, GNR)
- *Quercus michauxii* - *Quercus shumardii* - *Liquidambar styraciflua* / *Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda* / *Isoetes* spp. Forest (CEGL002101, G2G3)

- *Quercus phellos* - (*Quercus lyrata*) / *Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)
- *Quercus phellos* - (*Quercus similis*) - *Ulmus crassifolia* Forest (CEGL007921, GNR)
- *Quercus phellos* - *Quercus nigra* - *Liquidambar styraciflua* Mississippi River Alluvial Plain Forest (CEGL007915, G4G5)
- *Quercus texana* - *Celtis laevigata* - *Ulmus (americana, crassifolia)* - (*Gleditsia triacanthos*) Forest (CEGL004619, G4G5)
- *Quercus virginiana* - *Celtis laevigata* - *Quercus pagoda* / *Sabal minor* Forest (CEGL004648, G2)
- *Quercus virginiana* - *Quercus nigra* - *Liquidambar styraciflua* / *Ilex opaca* var. *opaca* / *Viburnum dentatum* Forest (CEGL007476, G2G3)
- *Quercus virginiana* - *Quercus pagoda* - *Magnolia grandiflora* / *Cornus florida* / *Sanicula* sp. Forest (CEGL007469, G2G3)
- *Vitis rotundifolia* - *Ampelopsis arborea* - *Campsis radicans* Vine-Shrubland (CEGL004620, GNA)

Alliances:

- *Arundinaria gigantea* Temporarily Flooded Shrubland Alliance (A.795)
- *Celtis laevigata* - *Ulmus crassifolia* Temporarily Flooded Forest Alliance (A.283)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Quercus (michauxii, pagoda, shumardii)* - *Liquidambar styraciflua* Temporarily Flooded Forest Alliance (A.291)
- *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.292)
- *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance (A.329)
- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)
- *Quercus virginiana* - *Celtis laevigata* - *Quercus pagoda* Temporarily Flooded Forest Alliance (A.376)
- *Quercus virginiana* - *Quercus nigra* Saturated Forest Alliance (A.379)
- *Quercus virginiana* - *Quercus pagoda* Forest Alliance (A.375)
- *Vitis rotundifolia* - *Ampelopsis arborea* - *Campsis radicans* Seasonally Flooded Vine-Shrubland Alliance (A.993)

SPATIAL CHARACTERISTICS

Size: Large patch.

Adjacent Ecological Systems:

- Lower Mississippi River Flatwoods (CES203.193)
- Mississippi River Low Floodplain (Bottomland) Forest (CES203.195)

DISTRIBUTION

Range: This system is found in the Mississippi Alluvial Plain from southern Illinois south to Mississippi and Louisiana.

Divisions: 203:C

Nations: US

Subnations: AR, IL, KY, LA, MO, MS, TN

Map Zones: 45:C

TNC Ecoregions: 42:C

SOURCES

References: Southeastern Ecology Working Group n.d.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.768761#references

Description Author: T. Foti and M. Pyne

Version: 18 Apr 2005

Concept Author: T. Foti and M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

MISSISSIPPI RIVER LOW FLOODPLAIN (BOTTOMLAND) FOREST (CES203.195)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Riverine / Alluvial [Brownwater]

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

CONCEPT

Summary: "Low bottomlands" are usually seasonally flooded in backswamps, with flooding more frequent than every five years, usually more frequently than every two years, generally by still water that may be impounded behind natural levees, and are classed as Low Gradient Riverine Backwater wetlands in hydrogeomorphic classifications. Low bottomlands occur along the Mississippi River and its tributaries in the Mississippi River Alluvial Plain ecoregion. Prolonged flooding dominates this system, and its duration is greater than in the adjacent Mississippi River Riparian Forest. Overcup oak is the characteristic dominant species. Soils are clayey with poor internal drainage.

Similar Ecological Systems:

- Mississippi River High Floodplain (Bottomland) Forest (CES203.196)
- Mississippi River Riparian Forest (CES203.190)--Flooding is of lower duration.

Related Concepts:

- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: "Low bottomlands" are usually seasonally flooded in backswamps, with flooding more frequent than every five years, usually more frequently than every two years, generally by still water that may be impounded behind natural levees, and are classed as Low Gradient Riverine Backwater wetlands in hydrogeomorphic classifications (Klimas et al. 2004).

Dynamics: Changes in soils and vegetation of this system are much slower than in the adjacent Mississippi River Riparian Forest. Regeneration is through small treefall gaps or large tornado tracks.

MEMBERSHIP

Associations:

- *Quercus lyrata* - *Carya aquatica* - (*Quercus texana*) / *Forestiera acuminata* Forest (CEGL002423, G3?)
- *Quercus lyrata* - *Liquidambar styraciflua* / *Forestiera acuminata* Forest (CEGL002424, G4?)
- *Quercus texana* - *Quercus lyrata* Forest (CEGL007407, G3G4)

Alliances:

- *Quercus lyrata* - (*Carya aquatica*) Seasonally Flooded Forest Alliance (A.328)
- *Quercus texana* - (*Quercus lyrata*) Seasonally Flooded Forest Alliance (A.331)

SPATIAL CHARACTERISTICS

Size: Large patch.

Adjacent Ecological Systems:

- Mississippi River High Floodplain (Bottomland) Forest (CES203.196)
- Mississippi River Riparian Forest (CES203.190)

Adjacent Ecological System Comments: Flooding is of lower duration in riparian forests and soil deposition is often more rapid, leading to rapid vegetation changes.

DISTRIBUTION

Range: This system is found in the Mississippi Alluvial Plain from southern Illinois south to Mississippi and Louisiana.

Divisions: 203:C

Nations: US

Subnations: AR, IL, KY, LA, MO, MS, TN

Map Zones: 45:C

TNC Ecoregions: 42:C

SOURCES

References: Klimas et al. 1981, Southeastern Ecology Working Group n.d.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.768395#references

Description Author: T. Foti and M. Pyne

Version: 17 Feb 2005

Concept Author: T. Foti, M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

MISSISSIPPI RIVER RIPARIAN FOREST (CES203.190)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Riverine / Alluvial [Brownwater]

Non-Diagnostic Classifiers: Forest and Woodland (Treed)

CONCEPT

Summary: This system is comprised of "riverfront" Associations, generally temporarily (but rarely seasonally) flooded on point bars and natural levees adjacent to the river that formed them, with flooding more frequent than every five years, by flowing water directly from the stream. They occur along the lower Mississippi River and its tributaries in the Mississippi River Alluvial Plain ecoregion. They are classed as Low Gradient Riverine Overbank wetlands in a hydrogeomorphic classification. Flooding is of lower duration than on adjacent backswamps where water is impounded behind riverfront natural levees. Flooding is of longer duration than on adjacent high bottomlands that are typically temporarily flooded. Soils are typically sandier than those of low bottomlands. Giant cane (*Arundinaria gigantea*) is a common understory in these forests on natural levees and higher point bars, and may become dominant after thinning or removal of overstory. Willow and cottonwood sandbars may have an open-canopy (woodland-type) structure.

Similar Ecological Systems:

- Mississippi River High Floodplain (Bottomland) Forest (CES203.196)
- Mississippi River Low Floodplain (Bottomland) Forest (CES203.195)

Related Concepts:

- Riparian Forest (Evans 1991) Broader

DESCRIPTION

Environment: Stands of this system are generally temporarily (but rarely seasonally) flooded on point bars and natural levees adjacent to the river that formed them, with flooding more frequent than every five years, by flowing water directly from the stream. They are classed as Low Gradient Riverine Overbank wetlands in a hydrogeomorphic classification (Klimas et al. 2004). Flooding is of lower duration than on adjacent backswamps where water is impounded behind riverfront natural levees. Flooding is of longer duration than on adjacent high bottomlands that are typically temporarily flooded. Soils are typically sandier than those of low bottomlands.

Vegetation: Some of the most typical and characteristic tree species found in stands of this system include *Acer negundo*, *Acer saccharinum*, *Platanus occidentalis*, *Populus deltoides*, and *Salix nigra*. Other trees may include *Celtis laevigata*, *Carya illinoensis*, *Fraxinus pennsylvanica*, *Gleditsia triacanthos*, *Liquidambar styraciflua*, *Quercus nigra*, *Quercus pagoda*, *Quercus texana*, *Ulmus americana*, and *Ulmus crassifolia*. In addition, *Quercus virginiana* may be present within its range. *Arundinaria gigantea* ssp. *gigantea* is a common understory component in these forests on natural levees and higher point bars, and may become dominant after thinning or removal of the overstory.

Dynamics: Often on sites with rapid soil deposition and, therefore, with rapid development of vegetation from low-diversity willow- and cottonwood-dominated communities to more diverse communities dominated by sycamore, pecan, sugarberry, green ash or Nuttall oak. Regeneration is through small treefall gaps or large tornado tracks.

MEMBERSHIP

Associations:

- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer saccharinum* - *Celtis laevigata* - *Carya illinoensis* Forest (CEGL002431, G3G4)
- *Acer saccharinum* - *Ulmus americana* Forest (CEGL002586, G4?)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Carya illinoensis* - *Celtis laevigata* - *Ulmus (americana, crassifolia)* Mississippi River Alluvial Plain Forest (CEGL007912, G2G3)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest (CEGL002427, G4G5)
- *Platanus occidentalis* - *Fraxinus pennsylvanica* - *Celtis laevigata* - (*Liquidambar styraciflua*) Forest (CEGL007913, G4)
- *Populus deltoides* - *Salix nigra* / *Mikania scandens* Forest (CEGL007346, G4G5)
- *Populus deltoides* - *Salix nigra* Forest (CEGL002018, G3G4)
- *Quercus laurifolia* - *Quercus nigra* Mississippi River Alluvial Plain Forest (CEGL007916, GNR)
- *Quercus texana* - *Celtis laevigata* - *Ulmus (americana, crassifolia)* - (*Gleditsia triacanthos*) Forest (CEGL004619, G4G5)
- *Quercus virginiana* - *Celtis laevigata* - *Quercus pagoda* / *Sabal minor* Forest (CEGL004648, G2)
- *Quercus virginiana* - *Quercus nigra* - *Liquidambar styraciflua* / *Ilex opaca* var. *opaca* / *Viburnum dentatum* Forest (CEGL007476, G2G3)
- *Quercus virginiana* - *Quercus pagoda* - *Magnolia grandiflora* / *Cornus florida* / *Sanicula* sp. Forest (CEGL007469, G2G3)
- *Salix nigra* / (*Clethra alnifolia*, *Morella cerifera*) / *Nyssa aquatica* Successional Forest (CEGL007411, GNA)

Alliances:

- *Acer negundo* Temporarily Flooded Forest Alliance (A.278)
- *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)
- *Arundinaria gigantea* Temporarily Flooded Shrubland Alliance (A.795)
- *Carya illinoensis* - (*Celtis laevigata*) Temporarily Flooded Forest Alliance (A.282)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Platanus occidentalis* - (*Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum*) Temporarily Flooded Forest Alliance (A.288)
- *Populus deltoides* Temporarily Flooded Forest Alliance (A.290)
- *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.292)
- *Quercus virginiana* - *Celtis laevigata* - *Quercus pagoda* Temporarily Flooded Forest Alliance (A.376)
- *Quercus virginiana* - *Quercus nigra* Saturated Forest Alliance (A.379)
- *Quercus virginiana* - *Quercus pagoda* Forest Alliance (A.375)
- *Salix nigra* Seasonally Flooded Forest Alliance (A.334)

SPATIAL CHARACTERISTICS

Size: Large patch.

Adjacent Ecological Systems:

- Mississippi River Low Floodplain (Bottomland) Forest (CES203.195)

DISTRIBUTION

Range: This system is found in the Mississippi Alluvial Plain from southern Illinois south to Mississippi and Louisiana.

Divisions: 203:C

Nations: US

Subnations: AR, IL, KY, LA, MO, MS, TN

Map Zones: 45:C

TNC Ecoregions: 42:C

SOURCES

References: Klimas et al. 1981, Southeastern Ecology Working Group n.d.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.768386#references

Description Author: T. Foti and M. Pyne

Version: 30 Jan 2006

Concept Author: T. Foti, M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

1457 SOUTH-CENTRAL INTERIOR / UPPER COASTAL PLAIN WET FLATWOODS (CES203.480)

CLASSIFIERS

Classification Status: Standard

Primary Division: Gulf and Atlantic Coastal Plain (203)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

Diagnostic Classifiers: Forest and Woodland (Treed); Extensive Wet Flat; Broad-Leaved Deciduous Tree

Non-Diagnostic Classifiers: Isolated Wetland [Partially Isolated]

FGDC Crosswalk: Vegetated, Tree-dominated, Open tree canopy, Deciduous open tree canopy

National Mapping Codes: EVT 2457; ESLF 9126; ESP 1457

CONCEPT

Summary: This system represents predominantly wet flatwoods of limited areas of the most inland portions of the East Gulf Coastal Plain in western Kentucky, as well as related broad, flat areas of the western Interior Low Plateau. This part of the Coastal Plain is referred to as the Jackson Purchase or "Jackson Plain." Flatwoods have long been recognized as a distinctive subdivision within this region (Davis 1923, Bryant and Martin 1988). Examples in the Pennyroyal Plain (of the western Interior Low Plateau) have been known for many years and referred to as "pondywoods" or "crawfishy land" (Chester et al. 1995). They are also known from the Shawnee Hills of Kentucky, on Periglacial lakebeds (M. Evans pers. comm. 2006). They tend to be confined to relatively small areas near the eastern flank of the region where loess deposits thin out. Unlike South-Central Interior / Upper Coastal Plain Flatwoods (CES203.479) of the same general region (which is typified by complex microtopography), this system occupies broad flats underlain by fragipans. These fragipans impede the downward migration of water, resulting in wet conditions for portions of the year. Fire was an important natural process in this system, probably maintaining relatively open-canopied stands (M. Evans pers. comm.). Stands are dominated by hardwood trees, including *Quercus* spp., *Liquidambar styraciflua*, *Carya* spp., and *Acer rubrum* (Chester et al. 1995). Related wet flatwoods are apparently present in the Moulton Valley of Alabama and these are provisionally placed here.

Classification Comments: The primary range of this system is limited areas of the "Jackson Purchase" or "Jackson Plain" of Kentucky and possibly related areas in adjacent western Tennessee, as well as related broad, flat areas of the western Interior Low Plateau. According to Bryant and Martin (1988) the "Flatwoods" portion of the Jackson Purchase (which is primarily where the "Wet Flatwoods" are located in that area) occupies less than 2% of the total area, but localized occurrences could have been present in other parts of the region. These apparently related wet flatwoods in the western end Moulton Valley of Alabama are found in northeastern Franklin and extreme western Lawrence counties, from 10 to 20 km east of Russellville. More information is needed.

Similar Ecological Systems:

- South-Central Interior / Upper Coastal Plain Flatwoods (CES203.479)

Related Concepts:

- Flatwoods (Evans 1991) Intersecting

DESCRIPTION

Environment: These flatwoods have long been recognized as the primary vegetation type of a distinctive subdivision within the Upper East Gulf Coastal Plain region (Davis 1923, Bryant and Martin 1988), as well as related areas of the western Interior Low Plateau. Within the "Jackson Plain" portion of the Upper East Gulf Coastal Plain, these flatwoods tend to be confined to relatively small areas near the eastern flank of the "Jackson Plain" region where the loess deposits thin out. Unlike drier Post Oak Flatwoods of these areas (which are typified by microtopographic variation), this system occupies broad flats underlain by fragipans. These fragipans impede the downward migration of water resulting in wet conditions for portions of the year. Fire is probably relatively infrequent in this system (M. Evans pers. comm.). In the Pennyroyal Plain, this system occurs on upland flats and depressions with poor drainage, underlain by limestone; soils include Robertsville silt loam (Chester et al. 1995) and Henry silt loam (M. Evans pers. comm.).

Vegetation: Stands are typically dominated by *Quercus pagoda*, *Quercus palustris*, *Quercus michauxii*, *Quercus alba*, *Liquidambar styraciflua*, *Carya* spp., *Acer rubrum*, and *Nyssa sylvatica*. Most stands of this system have been severely altered or destroyed, and the characteristic herbs are poorly known. *Campsis radicans* may be found. *Quercus phellos* and/or *Quercus lyrata* may also be present in stands of this system (M. Evans pers. comm.).

Dynamics: Most historic occurrences have been cleared, drained and tiled, and remaining sites are small and degraded. Fire was an important natural process in this system probably maintaining relatively open-canopied stands (M. Evans pers. comm.).

MEMBERSHIP

Associations:

- *Quercus falcata* Flatwoods Forest (CEGL004412, G2?)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda* / *Isoetes* spp. Forest (CEGL002101, G2G3)
- *Quercus phellos* - (*Quercus lyrata*) / *Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)

Alliances:

- *Quercus falcata* Forest Alliance (A.243)
- *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance (A.329)

- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland (CES203.482)

DISTRIBUTION

Range: The primary range of this system is limited areas of the "Jackson Purchase" or "Jackson Plain" of Kentucky and possibly related areas in adjacent western Tennessee, as well as related broad, flat areas of the western Interior Low Plateau. It is assumed to cross the Ohio River into adjacent Indiana.

Divisions: 203:C

Nations: US

Subnations: AL?, IL?, IN?, KY, TN

Map Zones: 46:?, 47:C, 48:C, 49:?, 53:N

TNC Ecoregions: 43:C, 44:C

SOURCES

References: Bryant and Martin 1988, Chester et al. 1995, Comer et al. 2003, Davis 1923, Evans 1991, Hendricks et al. 1991, M. Evans pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.723106#references

Description Author: R. Evans and M. Evans, mod. M. Pyne

Version: 18 Apr 2006

Concept Author: R. Evans and M. Evans, mod. M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

SOUTHERN AND CENTRAL APPALACHIAN BOG AND FEN (CES202.300)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Woody Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Shrubland (Shrub-dominated); Seepage-Fed Sloping [Mineral]; Seepage-Fed Sloping [Peaty]

Non-Diagnostic Classifiers: Graminoid

CONCEPT

Summary: This system consists of wetlands associated with flat sites in the Southern Blue Ridge, central Appalachians, Cumberland Mountains, and possibly upper Piedmont and adjacent Ridge and Valley. These sites occur at elevations below 1220 m (4000 feet) in poorly drained bottomlands on soils which are often saturated and mucky. Wetness results from a combination of groundwater input, seepage from adjacent slopes, rainfall and impeded drainage. The amount of seepage water input is variable among examples.

Vegetation is at least partially open, with herbaceous-dominated areas as well as shrub thickets and often forested zones. Vegetation is a complex of zones or patches with a mix of physiognomies. The wettest areas have herbaceous vegetation dominated by *Carex* spp., usually with abundant *Sphagnum*. Scattered trees and shrubs may be present in the herbaceous zones. Most examples also have a dense shrub zone around the edges. Some examples have forest zones as well, around the edges or as a matrix in which numerous small herbaceous openings are embedded. Characteristic tree species are *Tsuga canadensis*, *Acer rubrum*, *Nyssa sylvatica*, and *Pinus rigida*. Characteristic shrubs include *Rhododendron maximum*, *Alnus serrulata*, *Viburnum nudum* var. *cassinoides*, *Viburnum nudum* var. *nudum*, and *Toxicodendron vernix*.

Classification Comments: This system includes communities locally known as both bogs and fens. The typical distinction between bogs as rainwater-fed wetlands and fens as groundwater-fed is blurred in these systems. Deep weathering of rock in this unglaciated region may make the groundwater more acidic and mineral-poor than in northern fens. Higher rainfall in the southern Appalachians than in adjacent regions may make the role of rainfall greater than in other regions, even where groundwater input occurs. Except for the few examples with clear calcareous groundwater input, the vegetation and flora are more characteristic of northern bogs than of northern fens. However, because of the confusion of the role of groundwater and rainwater, all of these wetlands are placed in the same system.

This system is distinguished from Southern Appalachian Seepage Wetland (CES202.317) by patterns of flora and vegetation. Though both systems have heterogeneous and variable vegetation, they share few or no associations. The setting also differs, with Southern and Central Appalachian Bog and Fen (CES202.300) occurring on flat sites such as valley bottoms, where impeded drainage is important, while the seeps occur on sloping sites where water flow is freer and more groundwater flow is needed to create a wetland.

Similar Ecological Systems:

- Southern Appalachian Seepage Wetland (CES202.317)

DESCRIPTION

Environment: This system occurs in patches in flat valley bottoms, usually on the outer edges of stream floodplains at elevation below 1220 m (4000 feet). The soil is saturated most or all of the year, at least in the wettest parts, and may be very mucky. Although sites rarely flood, wetness results from a combination of groundwater input, rainfall, seepage from adjacent slopes, and impeded drainage. The groundwater is usually highly acidic and low in dissolved bases, but one or a few examples have somewhat calcareous water input because groundwater flows through mafic rock substrates. Overland flow and stream flooding are presumably only rare events. The geologic substrate is usually alluvium. Often, but not always, there is an adjacent slope with a seep at its base or some visible microtopographic feature, such as a stream levee or ridge, that impedes water drainage out of the area. Some occurrences have substantial microtopography of abandoned stream channels or ridge-and-swale systems that pond water in low areas.

Vegetation: Vegetation is a complex of zones or patches with a mix of physiognomies. The wettest areas have herbaceous vegetation dominated by *Carex* spp., usually with abundant *Sphagnum*. Scattered trees and shrubs may be present in the herbaceous zones. Most examples also have a dense shrub zone around the edges. Some examples have forest zones as well, around the edges or as a matrix in which numerous small herbaceous openings are embedded. Characteristic tree species are *Tsuga canadensis*, *Acer rubrum*, *Nyssa sylvatica*, and *Pinus rigida*. Characteristic shrubs include *Rhododendron maximum*, *Alnus serrulata*, *Viburnum nudum* var. *cassinoides*, *Viburnum nudum* var. *nudum*, and *Toxicodendron vernix*. A number of plant species are shared with northern bogs, including some that are disjunct long distances and occur in the south only in bogs. Other species are narrow endemics, such as *Sarracenia rubra* ssp. *jonesii*. In the more southern examples, some species are shared with bog communities in the Coastal Plain. The very rare richer fen examples have very distinctive vegetation, sharing a number of species with northern rich fens.

Dynamics: The natural dynamics of this system are not well known and are subject to debate. The factors that created and naturally maintain this system are unclear. Most examples show a strong tendency at present for shrubs and trees to increase in density in the open areas, threatening to eliminate the characteristic herb species. This suggests that an important process has been altered or lost. One hypothesis is that bogs are an ephemeral feature developing from abandoned beaver ponds. Another hypothesis is that they result from a narrow combination of moisture and nutrient conditions, which have been widely altered in an obscure way that has changed ecosystem stability. The cattle grazing that was nearly universal in examples of this system in the past appears to have delayed woody

succession but may also have altered the natural characteristics. Fire is sometimes considered as a factor, but most examples do not appear flammable enough to burn. Besides woody encroachment, bogs may be altered by changes in adjacent drainage, such as entrenchment by streams.

MEMBERSHIP

Associations:

- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Osmunda cinnamomea* - *Chasmanthium laxum* - *Carex intumescens* / *Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Alnus serrulata* - *Kalmia carolina* - *Rhododendron catawbiense* - *Spiraea alba* / *Carex folliculata* - *Lilium grayi* Shrubland (CEGL003915, G1G2)
- *Alnus serrulata* - *Lindera benzoin* / *Scutellaria lateriflora* - *Thelypteris noveboracensis* Shrubland (CEGL003909, G2?)
- *Alnus serrulata* - *Rhododendron arborescens* / *Sarracenia oreophila* - *Rhynchospora rariflora* Shrubland (CEGL003914, G1)
- *Alnus serrulata* - *Rhododendron viscosum* - *Rhododendron maximum* / *Juncus gymnocarpus* - *Chelone cuthbertii* Shrubland (CEGL003916, G1G2)
- *Alnus serrulata* - *Viburnum nudum* var. *nudum* - *Chamaedaphne calyculata* / *Woodwardia areolata* - *Sarracenia rubra* ssp. *jonesii* Shrubland (CEGL003918, G1)
- *Alnus serrulata* / *Sanguisorba canadensis* - *Parnassia grandifolia* - *Helenium brevifolium* Shrubland (CEGL003917, G1)
- *Carex (atlantica, echinata, leptalea, lurida)* - *Solidago patula* Herbaceous Vegetation (CEGL004156, G1)
- *Carex atlantica* - *Rhynchospora alba* - *Parnassia asarifolia* / *Sphagnum warnstorffii* Herbaceous Vegetation (CEGL004157, G1)
- *Carex atlantica* - *Solidago patula* var. *patula* - *Lilium grayi* / *Sphagnum bartlettianum* Herbaceous Vegetation (CEGL004158, G1)
- *Carex echinata* - *Solidago uliginosa* - *Sparganium erectum* ssp. *stoloniferum* - *Epilobium leptophyllum* Herbaceous Vegetation [Provisional] (CEGL008534, G2?)
- *Carex gynandra* - *Platanthera clavellata* - *Drosera rotundifolia* - *Carex ruthii* - *Carex atlantica* / *Sphagnum* spp. Herbaceous Vegetation (CEGL007697, G2)
- *Carex gynandra* - *Scirpus cyperinus* - *Eriophorum virginicum* - *Osmunda cinnamomea* Herbaceous Vegetation (CEGL007771, G1?Q)
- *Carex leptalea* - *Parnassia grandifolia* - *Rhynchospora alba* Herbaceous Vegetation (CEGL004997, G1)
- *Carex stricta* - *Caltha palustris* - *Oxypolis rigidior* - *Symphyotrichum puniceum* Herbaceous Vegetation (CEGL008461, G1?)
- *Cladium mariscoides* - *Sanguisorba canadensis* / *Sphagnum subsecundum* Herbaceous Vegetation (CEGL004167, G1)
- *Picea rubens* - (*Tsuga canadensis*) / *Rhododendron maximum* Saturated Forest (CEGL006277, G2?)
- *Pinus rigida* / *Toxicodendron vernix* / *Gaylussacia baccata* / *Symplocarpus foetidus* Woodland (CEGL003667, G1)
- *Pinus strobus* - *Acer rubrum* / *Spiraea alba* var. *latifolia* / *Sanguisorba canadensis* Woodland (CEGL004994, G1)
- *Rhododendron (maximum, catawbiense)* - *Ilex collina* - *Salix sericea* / *Carex trisperma* - *Eriophorum virginicum* Shrubland (CEGL003913, G1)
- *Rhododendron maximum* / *Sphagnum* spp. Shrubland (CEGL003849, G2G3Q)
- *Spiraea alba* var. *latifolia* - *Cornus racemosa* / *Calamagrostis canadensis* - *Sanguisorba canadensis* - *Carex scoparia* Shrub Herbaceous Vegetation (CEGL006249, G1)
- *Tsuga canadensis* - *Acer rubrum* - (*Liriodendron tulipifera*, *Nyssa sylvatica*) / *Rhododendron maximum* / *Sphagnum* spp. Forest (CEGL007565, G2)

Alliances:

- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Alnus serrulata* - *Salix sericea* - *Rhododendron (catawbiense, maximum)* Saturated Shrubland Alliance (A.1880)
- *Alnus serrulata* - *Spiraea* spp. / *Sanguisorba canadensis* Saturated Shrub Herbaceous Alliance (A.3026)
- *Alnus serrulata* Saturated Shrubland Alliance (A.1014)
- *Carex (atlantica, echinata)* - *Eriophorum virginicum* - *Rhynchospora capitellata* - *Solidago patula* Saturated Herbaceous Alliance (A.1450)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Saturated Herbaceous Alliance (A.1451)
- *Carex lurida* - *Carex leptalea* - (*Carex atlantica*, *Carex interior*, *Parnassia grandifolia*) Saturated Herbaceous Alliance (A.1452)
- *Carex ruthii* - *Carex gynandra* Saturated Herbaceous Alliance (A.1898)
- *Cladium mariscoides* Saturated Herbaceous Alliance (A.1447)
- *Picea rubens* Saturated Forest Alliance (A.198)
- *Pinus rigida* Saturated Woodland Alliance (A.580)
- *Pinus strobus* - *Acer rubrum* Saturated Woodland Alliance (A.582)
- *Tsuga canadensis* - *Acer rubrum* Saturated Forest Alliance (A.447)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch system, from one to several acres in size.

Size: Occurs as small patches, from about one acre to several acres. The largest examples are swamp forest-bog complexes that may cover 10 or more acres. Except for the small openings in the swamp forest-bog complexes, bog and fen patches tend to occur singly or in small clusters only.

Adjacent Ecological Systems:

- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Northern Hardwood Forest (CES202.029)

Adjacent Ecological System Comments: Usually associated with Southern and Central Appalachian Cove Forest (CES202.373).

DISTRIBUTION

Range: This system ranges from the southern Appalachians of northern Georgia and South Carolina north to Maryland and Pennsylvania. It is also found in the Cumberland Mountains of Kentucky.

Divisions: 202:C

Nations: US

Subnations: GA, KY, MD, NC, PA, SC, TN, VA, WV?

Map Zones: 48:N, 53:C, 54:C, 57:C, 59:C, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 52:?, 59:C

SOURCES

References: Comer et al. 2003, M. Evans pers. comm.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723191#references

Description Author: M. Schafale and R. Evans, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

HERBACEOUS WETLAND

INTERIOR LOW PLATEAU SEEPAGE FEN (CES202.346)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Seepage-Fed Sloping

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated)

CONCEPT

Summary: This system accommodates small-scale, herbaceous-dominated seepage areas found in limited areas of the Interior Low Plateau of Tennessee, Kentucky and possibly Ohio. It is most frequent in the Western Highland Rim of Tennessee (Lewis, Cheatham, and Williamson counties). There are also rare occurrences of this system in the Eastern Highland Rim of Tennessee and related limited areas of Kentucky and possibly Ohio (D. Minney pers. comm. 2006). These features have been generally known as "seepage fens" and are fed by mineral-rich groundwater. Examples are associated with stream drainages but are generally not affected by stream-related hydrology. Soils contain a thin organic layer over limestone gravel, over a less permeable layer of more solid rock. The vegetation is dominated by herbaceous plants. Characteristic species include *Carex atlantica*, *Carex lurida*, *Carex leptalea* ssp. *harperi*, *Parnassia grandifolia*, *Juncus brachycephalus*, *Rudbeckia fulgida* var. *umbrosa*, *Cardamine bulbosa*, *Impatiens capensis*, *Juncus coriaceous*, *Juncus effusus*, *Lobelia puberula*, *Lobelia cardinalis*, *Oxypolis rigidior*, *Phlox glaberrima*, *Rhynchospora capitellata*, *Scirpus atrovirens*, *Scirpus cyperinus*, *Solidago patula* var. *patula*, and *Thelypteris palustris* var. *pubescens*. Woody species include *Alnus serrulata*, *Salix humilis*, *Salix caroliniana*, *Cornus amomum*, and *Acer rubrum*, which may invade the herbaceous seep. *Xyris tennesseensis* is endemic to this system and occurs in 50% or more of its occurrences.

Classification Comments: This system is a small-patch system, originally described from a small region. Its range has been expanded to include a greater geographic scope.

Similar Ecological Systems:

- North-Central Appalachian Seepage Fen (CES202.607)
- Ozark-Ouachita Fen (CES202.052)

Related Concepts:

- *Carex lurida* (*hystericina*?) - *Carex leptalea* - *Rhynchospora capillacea* Alkaline Seep (Minney 2000) Undetermined
- Calcareous Seep (Evans 1991) Finer

DESCRIPTION

Environment: These features are fed by mineral-rich groundwater. Stands occur on the sideslopes of hills in narrow valleys, bases of bluffs, rock ledges, and terraces of streams and rivers, where the soil or substrate is saturated by calcareous groundwater seepage. Examples are associated with stream drainages but are generally not affected by stream-related hydrology. The parent material is a mixture of gravel and dolomite with fragments of deeply weathered bedrock present or colluvium over bedrock. Soils contain a thin organic layer over limestone gravel, over a less permeable layer of more solid rock.

Vegetation: The vegetation is dominated by herbaceous plants. Characteristic species include *Carex atlantica*, *Carex lurida*, *Carex leptalea* ssp. *harperi*, *Parnassia grandifolia*, *Juncus brachycephalus*, *Rudbeckia fulgida* var. *umbrosa*, *Cardamine bulbosa*, *Impatiens capensis*, *Juncus coriaceous*, *Juncus effusus*, *Lobelia puberula*, *Lobelia cardinalis*, *Oxypolis rigidior*, *Phlox glaberrima*, *Rhynchospora capitellata*, *Scirpus atrovirens*, *Scirpus cyperinus*, *Solidago patula* var. *patula*, and *Thelypteris palustris* var. *pubescens*. Woody species include *Alnus serrulata*, *Salix humilis*, *Salix caroliniana*, *Cornus amomum*, and *Acer rubrum*. Some stands in southern Ohio may lack *Parnassia* (D. Minney pers. comm. 2006).

MEMBERSHIP

Associations:

- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Carex lurida* - *Carex leptalea* - *Parnassia grandifolia* - *Juncus brachycephalus* - (*Xyris tennesseensis*) Herbaceous Vegetation (CEGL004161, G1)

Alliances:

- *Alnus serrulata* Saturated Shrubland Alliance (A.1014)
- *Carex lurida* - *Carex leptalea* - (*Carex atlantica*, *Carex interior*, *Parnassia grandifolia*) Saturated Herbaceous Alliance (A.1452)

DISTRIBUTION

Range: This system is found in limited areas of the Interior Low Plateau of Tennessee, Kentucky and possibly Ohio, including primarily the Western Highland Rim region of Tennessee (Ecoregion 71f of Griffith et al. (1998), EPA (2004); Subsection 222Eg of Keys et al. (1995)).

Divisions: 202:C

Nations: US

Subnations: KY, OH?, TN

Map Zones: 47:C, 48:C, 53:C

TNC Ecoregions: 44:C

SOURCES

References: Comer et al. 2003, EPA 2004, Griffith et al. 1998, Keys et al. 1995, Minney pers. comm.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723164#references

Description Author: M. Pyne

Version: 17 Apr 2006

Concept Author: M. Pyne

Stakeholders: Midwest, Southeast

ClassifResp: Southeast

SOUTHERN APPALACHIAN SEEPAGE WETLAND (CES202.317)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Herbaceous Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Seepage-Fed Sloping

Non-Diagnostic Classifiers: Herbaceous; Isolated Wetland [Partially Isolated]

CONCEPT

Summary: This system consists of seepage-fed wetlands in the southern Appalachians on gentle slopes, with substantial seepage flow. Vegetation is variable, both within and among examples, but lacks vegetation characteristic of bogs or floodplains. This is a small-patch system occurring over a wide elevational range, nearly to the highest peaks, but is generally lacking from flat valley bottoms.

Classification Comments: This system is fairly heterogeneous, covering a broad range of environments and vegetation, but without apparent breaks. At one extreme, the system contains rich, low-elevation, forb-dominated seeps closely related floristically to cove forests; at the other extreme, it contains acidic, sedge- and moss-dominated, bog-like, high-elevation seeps. This system is distinguished from Southern and Central Appalachian Bog and Fen (CES202.300) by occurrence in sloping settings rather than flat valley bottoms, with more rapid flow of water, and by lack of dominance by the characteristic bog or fen flora (though some of it may be present). The only other systems with wetland systems within its range, floodplains and upland pools, are more distinct floristically as well as associated with very different landforms.

Similar Ecological Systems:

- North-Central Appalachian Seepage Fen (CES202.607)
- Piedmont Seepage Wetland (CES202.298)
- Southern and Central Appalachian Bog and Fen (CES202.300)

DESCRIPTION

Environment: This system occurs in small patches where seepage creates saturated soil conditions permanently or seasonally. Wetness may vary substantially over short distances in response to amounts of seepage, flow, and pooling by topography or impermeable substrate. The system occurs over a wide elevational range, nearly to the highest peaks. Landforms are usually concave slopes but may be convex slopes or even ridgetop gaps. This system is almost never found on flat valley bottoms, though it may be found on the edge of them. Soils may be muck or coarse boulders but are usually saturated mineral soils. They may be residual or colluvial and deep or shallow. The most extensive and wettest examples occur at elevations above 1525 m (5000 feet), where cool temperatures and high rainfall make more water available. In Kentucky, this system consists of streamhead seepages on Pine and Cumberland mountains.

Vegetation: Vegetation consists of a series of forested and open associations united by presence of wetland flora but lack of floodplain species and most bog species. Vegetation consists of a series of forested and open associations united by presence of wetland flora but lack of floodplain species and most bog species. Some tree cover by mesophytic species is usually present, but often only by trees rooted on the edge of adjacent systems. Shrubs may be sparse, or may form dense zones around the edge. Shrub species are mostly mesophytic rather than obligate wetland species. The herb layer is generally well-developed, and is usually dominated either by characteristic forbs such as *Impatiens capensis*, *Impatiens pallida*, *Monarda didyma*, *Chelone* spp., and *Rudbeckia triloba*, or by *Carex* spp. *Sphagnum* may occur in a minority of examples.

Dynamics: The presence of seepage is the primary determinant of this system. Long-term droughts that affect seepage flow presumably have an effect, but this has not been documented. Canopy dynamics are not well known and potentially may vary substantially over short distances in response to wetness. Wetness may limit recruitment of most tree and shrub seedlings to drier microsites, making canopy gaps persist longer than in adjacent forests and creating a more open canopy. Fire may penetrate from the adjacent forest systems, but only in the driest conditions are they likely to be intense enough to have much effect within this system. Seeps are fairly permanent features of the landscape, but may potentially be created, destroyed, or changed in extent because of changes in groundwater flow, stream entrenchment or headward erosion, mass movement on slopes, or long-term climatic cycles. Examples are often left undisturbed when surrounding forests are logged. Effects of logging on water infiltration or surface flow may have significant indirect effects.

MEMBERSHIP

Associations:

- *Alnus serrulata* - *Lindera benzoin* / *Scutellaria lateriflora* - *Thelypteris noveboracensis* Shrubland (CEGL003909, G2?)
- *Calamagrostis cainii* - *Carex ruthii* - *Parnassia asarifolia* / *Sphagnum* spp. Herbaceous Vegetation (CEGL007877, G1Q)
- *Carex gynandra* - *Platanthera clavellata* - *Drosera rotundifolia* - *Carex ruthii* - *Carex atlantica* / *Sphagnum* spp. Herbaceous Vegetation (CEGL007697, G2)
- *Diphylleia cymosa* - *Saxifraga micranthidifolia* - *Laportea canadensis* Herbaceous Vegetation (CEGL004296, G3)
- *Glyceria striata* - *Carex gynandra* - *Chelone glabra* - *Symphytotrichum puniceum* / *Sphagnum* spp. Herbaceous Vegetation

(CEGL008438, G2G3)

- *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata* var. *humilis* Herbaceous Vegetation (CEGL004293, G3)
- *Schoenoplectus robustus - Juncus gerardii - Hordeum jubatum - Atriplex patula* Herbaceous Vegetation (CEGL006234, G1)

Alliances:

- *Alnus serrulata* Saturated Shrubland Alliance (A.1014)
- *Carex ruthii - Carex gynandra* Saturated Herbaceous Alliance (A.1898)
- *Diphylleia cymosa - Saxifraga micranthidifolia* Saturated Herbaceous Alliance (A.1688)
- *Impatiens (capensis, pallida) - Monarda didyma* Saturated Herbaceous Alliance (A.1690)
- *Schoenoplectus robustus* Semipermanently Flooded Herbaceous Alliance (A.1434)
- *Symphotrichum puniceum - Vernonia noveboracensis - Solidago (patula, rugosa)* Saturated Herbaceous Alliance (A.2016)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch system, from less than one to no more than several acres in size, potentially surrounded by a number of different systems.

Size: Occurs as small patches, most less than one acre in size. The largest patches at high elevations are several acres. Patches occasionally occur in complexes but more often occur singly.

Adjacent Ecological Systems:

- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Grass and Shrub Bald (CES202.294)
- Southern Appalachian Northern Hardwood Forest (CES202.029)

Adjacent Ecological System Comments: This system may be embedded in a variety of other systems. Most common are Southern Appalachian Northern Hardwood Forest (CES202.029) and Southern and Central Appalachian Cove Forest (CES202.373).

DISTRIBUTION

Range: This system ranges throughout the southern Appalachians, from northern Georgia and South Carolina north through Virginia, and westward into Tennessee, Kentucky, and West Virginia.

Divisions: 202:C

Nations: US

Subnations: GA, KY, NC, SC, TN, VA, WV?

Map Zones: 53:N, 57:C, 60:N, 61:C

TNC Ecoregions: 50:C, 51:C, 59:?

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.723181#references

Description Author: M. Schafale and R. Evans, mod. S.C. Gawler

Version: 17 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

MIXED UPLAND AND WETLAND

SOUTH-CENTRAL INTERIOR LARGE FLOODPLAIN (CES202.705)

CLASSIFIERS

Conf.: 2 - Moderate

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Mixed Upland and Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

Non-Diagnostic Classifiers: Floodplain; Forest and Woodland (Treed); Herbaceous

CONCEPT

Summary: This floodplain system is found in the Interior Highlands as far west as eastern Oklahoma, as well as throughout the Interior low Plateau, Cumberland, Southern Ridge and Valley, and Western Allegheny Plateau, and lower elevations of the Southern Blue Ridge. Examples occur along large rivers or streams where topography and alluvial processes have resulted in a well-developed floodplain. A single occurrence may extend from river's edge across the outermost extent of the floodplain or to where it meets a wet meadow or upland system. Many examples of this system will contain well-drained levees, terraces and stabilized bars, and some will include herbaceous sloughs and shrub wetlands resulting, in part, from beaver activity. A variety of soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates in combination with different flooding regimes that creates the mix of vegetation. Most areas, except for the montane alluvial forests, are inundated at some point each spring; microtopography determines how long the various habitats are inundated. Although vegetation is quite variable in this broadly defined system, examples may include *Acer saccharinum*, *Platanus occidentalis*, *Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed, but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.). This system likely floods at least once annually and can be altered by occasional severe floods. Impoundments and conversion to agriculture can also impact this system.

Classification Comments: Montane alluvial forests may be difficult to place within this system because they share traits with both this system and Southern and Central Appalachian Cove Forest (CES202.373), at least in the southern Appalachians. This split from Central Appalachian Floodplain (CES202.608) may appear somewhat arbitrary but is based on our knowledge of the Freshwater Systems classification. This system grades into Western Great Plains Floodplain (CES303.678) in the Crosstimbers region of east-central Oklahoma as eastern cottonwood (*Populus deltoides*) and willows (*Salix* spp.) become more dominant.

Similar Ecological Systems:

- Central Appalachian Floodplain (CES202.608)
- South-Central Interior Small Stream and Riparian (CES202.706)
- Southern Piedmont Large Floodplain Forest (CES202.324)
- Southern Piedmont Small Floodplain and Riparian Forest (CES202.323)
- Western Great Plains Floodplain (CES303.678)

Related Concepts:

- Bottomland Hardwood Forest (Evans 1991) Intersecting
- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Coastal Plain Slough (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Floodplain Ridge/Terrace Forest (Evans 1991) Intersecting
- Floodplain Slough (Evans 1991) Intersecting
- Riparian Forest (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: This system inhabits broad floodplains along large creeks and rivers that are usually inundated for at least part of each year.

Vegetation: Vegetation varies quite widely, encompassing shrubby and herbaceous communities, as well as forested communities with a wide array of canopy types. Examples may include *Acer saccharinum*, *Platanus occidentalis*, *Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.).

Dynamics: Flooding dynamics are an important factor in the development and maintenance of this system.

MEMBERSHIP

Associations:

- (*Diospyros virginiana*, *Platanus occidentalis*) / *Eupatorium serotinum* - *Diodia virginiana* Herbaceous Vegetation (CEGL003910,

GNA)

- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer rubrum* var. *trilobum* - *Fraxinus pennsylvanica* / *Carex crinita* - *Peltandra virginica* Forest (CEGL004420, G1)
- *Acer saccharinum* - *Betula nigra* / *Cephalanthus occidentalis* Forest (CEGL007810, G3Q)
- *Acer saccharinum* - *Celtis laevigata* - *Carya illinoensis* Forest (CEGL002431, G3G4)
- *Acer saccharinum* - *Ulmus americana* Forest (CEGL002586, G4?)
- *Acer saccharum* - *Carya cordiformis* / *Asimina triloba* Floodplain Forest (CEGL005035, G2)
- *Alnus serrulata* - *Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Cephalanthus occidentalis* / *Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Fagus grandifolia* - *Quercus* spp. - *Acer rubrum* - *Juglans nigra* Forest (CEGL005014, G2G3)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest (CEGL002427, G4G5)
- *Hypericum densiflorum* - *Alnus serrulata* / *Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Juglans nigra* / *Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua* - *Liriodendron tulipifera* - (*Platanus occidentalis*) / *Carpinus caroliniana* - *Halesia tetraptera* / *Amphicarpaea bracteata* Forest (CEGL007880, GNR)
- *Liquidambar styraciflua* - *Quercus michauxii* - *Carya laciniosa* / *Fagus grandifolia* - (*Aesculus flava*) Forest (CEGL007702, G2G3Q)
- *Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Platanus occidentalis* - *Acer saccharinum* - *Juglans nigra* - *Ulmus rubra* Forest (CEGL007334, G4)
- *Platanus occidentalis* - *Betula nigra* - *Celtis laevigata* - *Fraxinus pennsylvanica* / *Arundinaria gigantea* Temporarily Flooded Forest (CEGL007999, G3?)
- *Platanus occidentalis* - *Fraxinus pennsylvanica* - *Quercus imbricaria* Forest (CEGL007339, G2Q)
- *Platanus occidentalis* - *Liriodendron tulipifera* - *Betula (alleghaniensis, lenta)* / *Alnus serrulata* - *Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Populus deltoides* - *Salix nigra* Forest (CEGL002018, G3G4)
- *Quercus michauxii* - *Quercus shumardii* - *Liquidambar styraciflua* / *Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus nigra* - *Quercus (alba, phellos)* Forest (CEGL004979, G3?)
- *Quercus palustris* - (*Fraxinus nigra*) / *Lindera benzoin* / *Carex bromoides* Forest (CEGL007399, GNR)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda* / *Isoetes* spp. Forest (CEGL002101, G2G3)
- *Quercus phellos* - (*Quercus lyrata*) / *Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)
- *Quercus stellata* - *Quercus marilandica* - *Quercus falcata* / *Schizachyrium scoparium* Sand Woodland (CEGL002417, G2)
- *Quercus stellata* / (*Danthonia spicata*, *Croton willdenowii*) Woodland (CEGL005057, G1)
- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899, G4?)
- *Salix nigra* Forest (CEGL002103, G4)
- *Salix nigra* Large River Floodplain Forest (CEGL007410, G3G5)
- *Taxodium distichum* / *Lemna minor* Forest (CEGL002420, G4G5)
- Tennessee Valley Impoundment Mudflat Sparse Vegetation (CEGL004049, GNR)

Alliances:

- *Acer negundo* Temporarily Flooded Forest Alliance (A.278)
- *Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance (A.316)
- *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)
- *Acer saccharum* - *Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)
- *Alnus serrulata* Temporarily Flooded Shrubland Alliance (A.943)
- *Arundinaria gigantea* Temporarily Flooded Shrubland Alliance (A.795)
- *Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
- *Eupatorium serotinum* - *Diodia virginiana* Temporarily Flooded Herbaceous Alliance (A.2017)
- *Fagus grandifolia* Temporarily Flooded Forest Alliance (A.284)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Juglans nigra* Forest Alliance (A.1932)
- *Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)
- Non-tidal Mud Flat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance (A.1878)
- *Nymphaea odorata* - *Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance (A.1984)
- *Osmunda (cinnamomea, regalis)* Saturated Herbaceous Alliance (A.1692)
- *Platanus occidentalis* - (*Fraxinus pennsylvanica*, *Celtis laevigata*, *Acer saccharinum*) Temporarily Flooded Forest Alliance (A.288)
- *Platanus occidentalis* - (*Liquidambar styraciflua*, *Liriodendron tulipifera*) Temporarily Flooded Forest Alliance (A.289)
- *Populus deltoides* Temporarily Flooded Forest Alliance (A.290)

- *Quercus (michauxii, pagoda, shumardii) - Liquidambar styraciflua* Temporarily Flooded Forest Alliance (A.291)
- *Quercus (phellos, nigra, laurifolia)* Temporarily Flooded Forest Alliance (A.292)
- *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329)
- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)
- *Quercus stellata - Quercus marilandica* Woodland Alliance (A.625)
- *Salix caroliniana* Temporarily Flooded Shrubland Alliance (A.946)
- *Salix nigra* Temporarily Flooded Forest Alliance (A.297)
- *Taxodium distichum* Semipermanently Flooded Forest Alliance (A.346)

SPATIAL CHARACTERISTICS

Size: Examples can range in size from very small (<1 acre) to hundreds of acres in larger floodplain areas.

Adjacent Ecological Systems:

- Western Great Plains Floodplain (CES303.678)

Adjacent Ecological System Comments: This system grades into Western Great Plains Floodplain (CES303.678) in the Crosstimbers region of east-central Oklahoma as eastern cottonwood (*Populus deltoides*) and willows (*Salix* spp.) become more dominant.

DISTRIBUTION

Range: This system ranges from the Ozarks, Arkansas River Valley, and Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau.

Divisions: 202:C; 205:C

Nations: US

Subnations: AL, AR, GA, IL, IN, KY, MO, NC, OH, OK, PA, SC?, TN, VA, WV

Map Zones: 32:P, 37:P, 38:?, 43:C, 44:C, 47:C, 48:C, 49:C, 53:C, 57:C, 60:N, 61:C, 62:C

TNC Ecoregions: 32:P, 37:C, 38:C, 39:C, 44:C, 49:C, 50:C, 51:C

SOURCES

References: Comer et al. 2003, Woods et al. 2002

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.722955#references

Description Author: S. Menard, M. Pyne, R. Evans, R. White

Version: 17 Jan 2006

Concept Author: S. Menard, M. Pyne, R. Evans, R. White

Stakeholders: East, Midwest, Southeast

ClassifResp: Midwest

SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN (CES202.706)

CLASSIFIERS

Conf.: 2 - Moderate

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Mixed Upland and Wetland

Spatial Scale & Pattern: Linear

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

Non-Diagnostic Classifiers: Forest and Woodland (Treed); Stream terrace (undifferentiated)

CONCEPT

Summary: This system is found throughout the Interior Low Plateau, Southern Ridge and Valley, Western Allegheny Plateau, and lower elevations of the Southern Blue Ridge. Examples occur along small streams and floodplains with low to moderately high gradients. There may be little to moderate floodplain development. Flooding and scouring both influence this system, and the nature of the landscape prevents the kind of floodplain development found on larger rivers. This system may contain cobble bars with adjacent wooded vegetation and rarely have any marsh development, except through occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include *Platanus occidentalis*, *Acer rubrum* var. *trilobum*, *Betula nigra*, *Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum*, *Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.

Classification Comments: This system is closely related to Central Appalachian Riparian (CES202.609) but has been distinguished based on the precepts of the Freshwater Systems classification. This system has been divided from Central Appalachian Riparian roughly by the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian Riparian. In contrast to floodplain systems, this system has little to no floodplain development. In comparison with South-Central Interior Large Floodplain (CES202.705), this system typically has somewhat higher gradients, is sometimes rocky, and may experience flash floods. Stands from somewhat larger rivers have been placed here if the river lacks substantial floodplain development (e.g., the Ocoee gorge of Tennessee).

Similar Ecological Systems:

- Central Appalachian Riparian (CES202.609)
- Cumberland Riverscour (CES202.036)--is essentially a more extreme and local variant of this broader concept, found in the major rivers of the Cumberland Plateau and related areas of Tennessee, Kentucky, and adjacent states.
- Ozark-Ouachita Riparian (CES202.703)--is the Ozark-Ouachita equivalent of this system.
- South-Central Interior Large Floodplain (CES202.705)

Related Concepts:

- Alluvial Forest (Evans 1991) Intersecting
- Bottomland Hardwood Forest (Evans 1991) Intersecting
- Bottomland Hardwood Swamp (Evans 1991) Intersecting
- Bottomland Marsh (Evans 1991) Intersecting
- Coastal Plain Bottomland Hardwood Forest (Evans 1991) Intersecting
- Cypress/Tupelo Swamp (Evans 1991) Intersecting
- Floodplain Ridge/Terrace Forest (Evans 1991) Intersecting
- Floodplain Slough (Evans 1991) Intersecting
- Gravel/Cobble Bar (Evans 1991) Finer
- Riparian Forest (Evans 1991) Intersecting
- Shrub Swamp (Evans 1991) Intersecting

DESCRIPTION

Environment: Found along fairly high-energy streams and rivers with steep banks, this system is subject to frequent flooding and can even be subject to scouring depending upon the substrate.

Vegetation: There is wide variation in vegetation depending upon the frequency of the flooding cycle (more frequent flooding creates a better environment for forbs and shrubs, less frequent may create a better environment for the establishment of trees). Typical tree species may include *Platanus occidentalis*, *Acer rubrum* var. *trilobum*, *Betula nigra*, *Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum*, *Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.

Dynamics: Flooding and seed propagule dispersal caused by flooding events are the two most important processes affecting this system. The two processes vary widely depending upon size of stream, upstream land use and topography, presence or absence of invasive exotics that may displace native community types, etc.

MEMBERSHIP

Associations:

- *Acer negundo* - (*Platanus occidentalis*, *Populus deltoides*) Forest (CEGL004690, G4)
- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Osmunda cinnamomea* - *Chasmanthium laxum* - *Carex intumescens* / *Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum* - *Nyssa sylvatica* / *Rhododendron canescens* - *Viburnum nudum* var. *nudum* / *Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata* - *Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Alnus serrulata* Interior Shrubland (CEGL003894, G4?)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra* - *Platanus occidentalis* / *Alnus serrulata* / *Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra* - *Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex crinita* - *Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392, G2)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Fagus grandifolia* - *Quercus alba* / *Kalmia latifolia* - *Rhododendron canescens* - *Symplocos tinctoria* Forest (CEGL008551, G3?)
- *Fagus grandifolia* - *Quercus* spp. - *Acer rubrum* - *Juglans nigra* Forest (CEGL005014, G2G3)
- *Hymenocallis coronaria* - *Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Juncus effusus* - *Chelone glabra* - *Scirpus* spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433, G4?)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua* - *Liriodendron tulipifera* - (*Platanus occidentalis*) / *Carpinus caroliniana* - *Halesia tetraptera* / *Amphicarpaea bracteata* Forest (CEGL007880, GNR)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Paulownia tomentosa* Woodland (CEGL003687, GNA)
- *Pinus taeda* - *Liriodendron tulipifera* / *Lindera benzoin* / *Carex crinita* Forest (CEGL007546, GNA)
- *Platanus occidentalis* - *Betula nigra* - *Salix (caroliniana, nigra)* Woodland (CEGL003896, G4G5)
- *Platanus occidentalis* - *Celtis laevigata* - *Liriodendron tulipifera* / *Lindera benzoin* - *Arundinaria gigantea* / *Amphicarpaea bracteata* Forest (CEGL008429, G3G4Q)
- *Platanus occidentalis* - *Liquidambar styraciflua* / *Carpinus caroliniana* - *Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis* - *Liriodendron tulipifera* - *Betula (alleghaniensis, lenta)* / *Alnus serrulata* - *Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Polygonum (hydropiperoides, punctatum)* - *Leersia (lenticularis, virginica)* Herbaceous Vegetation (CEGL004290, G4?)
- *Quercus alba* - (*Liriodendron tulipifera*, *Liquidambar styraciflua*) / *Calycanthus floridus* / *Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, GNR)
- *Salix nigra* - *Platanus occidentalis* Forest (CEGL004626, G5)
- *Schizachyrium scoparium* - *Schoenoplectus americanus* - *Juncus marginatus* - *Eupatorium serotinum* Herbaceous Vegetation (CEGL008496, G2)
- *Sparganium americanum* - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143, G3)
- *Vitis rotundifolia* - *Ampelopsis arborea* - *Campsis radicans* Vine-Shrubland (CEGL004620, GNA)

Alliances:

- *Acer negundo* Temporarily Flooded Forest Alliance (A.278)
- *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance (A.348)
- *Alnus serrulata* Saturated Shrubland Alliance (A.1014)
- *Alnus serrulata* Temporarily Flooded Shrubland Alliance (A.943)
- *Arundinaria gigantea* Temporarily Flooded Shrubland Alliance (A.795)
- *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance (A.280)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Saturated Herbaceous Alliance (A.1451)
- *Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)
- *Fagus grandifolia* - *Quercus rubra* - *Quercus alba* Forest Alliance (A.229)
- *Fagus grandifolia* Temporarily Flooded Forest Alliance (A.284)
- *Juncus effusus* Seasonally Flooded Herbaceous Alliance (A.1375)
- *Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*, *Acer rubrum*) Temporarily Flooded Forest Alliance (A.287)
- *Osmunda (cinnamomea, regalis)* Saturated Herbaceous Alliance (A.1692)
- *Paulownia tomentosa* Woodland Alliance (A.609)
- *Pinus taeda* - *Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434)
- *Platanus occidentalis* - (*Betula nigra*, *Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
- *Platanus occidentalis* - (*Fraxinus pennsylvanica*, *Celtis laevigata*, *Acer saccharinum*) Temporarily Flooded Forest Alliance

(A.288)

- *Platanus occidentalis* - (*Liquidambar styraciflua*, *Liriodendron tulipifera*) Temporarily Flooded Forest Alliance (A.289)
- *Podostemum ceratophyllum* Permanently Flooded Herbaceous Alliance (A.1752)
- *Polygonum* spp. (section *Persicaria*) Seasonally Flooded Herbaceous Alliance (A.1881)
- *Salix caroliniana* Temporarily Flooded Forest Alliance (A.296)
- *Salix nigra* Temporarily Flooded Forest Alliance (A.297)
- *Schizachyrium scoparium* Temporarily Flooded Herbaceous Alliance (A.1346)
- *Sparganium americanum* Seasonally Flooded Herbaceous Alliance (A.1388)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest Alliance (A.171)
- *Vitis rotundifolia* - *Ampelopsis arborea* - *Campsis radicans* Seasonally Flooded Vine-Shrubland Alliance (A.993)

SPATIAL CHARACTERISTICS

Spatial Summary: Small, linear patch.

Size: Can be quite long but never very wide.

DISTRIBUTION

Range: This system ranges from the Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau. There would be limited and peripheral presence in the Upper East Gulf Coastal Plain.

Divisions: 202:C; 203:C

Nations: US

Subnations: AL, GA, IL, IN, KY, NC, OH, PA, SC, TN, VA

Map Zones: 46:P, 47:C, 48:C, 49:C, 53:C, 57:C, 60:N, 61:P, 62:C

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722954#references

Description Author: S. Menard, M. Pyne, R. Evans, R. White, D. Faber-Langendoen

Version: 17 Apr 2006

Concept Author: S. Menard, M. Pyne, R. Evans, R. White, D. Faber-Langendoen

Stakeholders: East, Midwest, Southeast

ClassifResp: Midwest

SPARSELY VEGETATED

CENTRAL INTERIOR ACIDIC CLIFF AND TALUS (CES202.689)

CLASSIFIERS

Conf.: 2 - Moderate

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Non-Diagnostic Classifiers: Talus (Landform); Acidic Soil; Cliff (Landform)

CONCEPT

Summary: This system is found primarily in the Interior Highlands, including the Ozarks, Ouachita, and Interior Low Plateau ecoregions, extending marginally north and west along the Missouri and Mississippi rivers. Sandstone outcrops and talus ranging from moist to dry typify this system. It is typically sparsely vegetated; however, on moister sites with more soil development, several fern species and sedges (*Carex* spp.) can establish. Wind and water erosion are the major dynamic processes influencing this system.

Classification Comments: In Kentucky, this system covers the sandstone cliffs of the Shawnee Hills (Interior Low Plateau). In Illinois, one exemplary example is the "Garden of the Gods" in the Shawnee National Forest.

Related Concepts:

- Dry Sandstone Cliff (Evans 1991) Intersecting
- Moist Sandstone Cliff (Evans 1991) Intersecting

DESCRIPTION

Environment: Sandstone outcrops and talus ranging from moist to dry typify this system.

Vegetation: This system is typically sparsely vegetated; however, on moister sites with more soil development, several fern species and sedges (*Carex* spp.) can establish. Some taxa that could be present include *Ribes cynosbati*, *Deschampsia flexuosa*, *Dryopteris marginalis*, and *Dennstaedtia punctilobula*, as well as *Carex interior*, *Carex lurida*, *Carex leptalea*, *Parnassia grandifolia*, *Rhynchospora capillacea*, *Osmunda cinnamomea*, *Rhynchospora capitellata*, *Heuchera parviflora* var. *puberula*, and *Xyris jupicai* on wetter sites.

Dynamics: Wind and water erosion are the major dynamic processes influencing this system.

MEMBERSHIP

Associations:

- (*Carex interior*, *Carex lurida*) - *Carex leptalea* - *Parnassia grandifolia* - *Rhynchospora capillacea* Herbaceous Vegetation (CEGL002404, G2G3)
- (*Hydrangea arborescens*, *Ribes cynosbati*) / *Deschampsia flexuosa* - *Dryopteris marginalis* - *Dennstaedtia punctilobula* Shrubland (CEGL007820, G2?)
- Chert Ozark Dry Cliff Sparse Vegetation (CEGL002285, G3?)
- Chert Ozark Moist Cliff Sparse Vegetation (CEGL002288, G2G3)
- Igneous Ozark Dry Cliff Sparse Vegetation (CEGL002286, G4)
- Igneous Ozark Moist Cliff Sparse Vegetation (CEGL002289, G4Q)
- Igneous Ozark Talus Sparse Vegetation (CEGL005203, G4)
- *Osmunda cinnamomea* - *Rhynchospora capitellata* - *Heuchera parviflora* var. *puberula* - *Xyris jupicai* Herbaceous Vegetation (CEGL007837, G1Q)
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045, G4G5)
- Sandstone Interior Highlands Talus Sparse Vegetation (CEGL002309, G4G5)
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287, G4G5)

Alliances:

- (*Hydrangea* spp., *Philadelphus* spp.) / *Heuchera* spp. Shrubland Alliance (A.1905)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Saturated Herbaceous Alliance (A.1451)
- *Carex lurida* - *Carex leptalea* - (*Carex atlantica*, *Carex interior*, *Parnassia grandifolia*) Saturated Herbaceous Alliance (A.1452)
- Lowland Talus Sparsely Vegetated Alliance (A.1847)
- Open Cliff Sparsely Vegetated Alliance (A.1836)

DISTRIBUTION

Range: This system is found primarily in the Interior Highlands, including the Ozark, Ouachita, and Interior Low Plateau ecoregions. It extends marginally into the Central Tallgrass Prairie Ecoregion along the Missouri and Mississippi rivers.

Divisions: 202:C

Nations: US

Subnations: AR, IA?, IL, IN, KY, MO, TN

Map Zones: 43:P, 44:C, 47:C, 48:C, 49:C, 53:C

TNC Ecoregions: 36:C, 38:C, 39:C, 44:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.722970#references

Description Author: S. Menard, T. Foti, R. Evans, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: S. Menard, T. Foti, R. Evans

Stakeholders: East, Midwest, Southeast

ClassifResp: Midwest

CENTRAL INTERIOR CALCAREOUS CLIFF AND TALUS (CES202.690)

CLASSIFIERS

Conf.: 2 - Moderate

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

CONCEPT

Summary: This system is found primarily in non-Appalachian portions of the Central Interior Division. It ranges from the Ouachitas east to the Cumberlands and north into the Western Allegheny Plateau and Lake states. Limestone and dolomite outcrops and talus distinguish this system. Examples range from moist to dry and from sparsely to moderately well-vegetated. Woodland species such as *Thuja occidentalis* can establish along the ridgetops. Understory species can range from grassland species such as *Andropogon gerardii* on drier slopes to more mesic species in areas with higher moisture and more soil development. Wind and water erosion along with fire are the primary natural dynamics influencing this system.

Classification Comments: Similar examples in the driftless region of Minnesota, Wisconsin, Iowa and Illinois should be considered part of Paleozoic Plateau Bluff and Talus (CES202.704).

Similar Ecological Systems:

- North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)
- Paleozoic Plateau Bluff and Talus (CES202.704)
- Southern Interior Calcareous Cliff (CES202.356)--includes circumneutral cliff and talus communities from southern Virginia south.
- Southern Interior Sinkhole Wall (CES202.357)

Related Concepts:

- Dry Limestone Cliff (Evans 1991) Finer
- Moist Limestone Cliff (Evans 1991) Finer

DESCRIPTION

Environment: Limestone and dolomite outcrops and talus distinguish this system.

Vegetation: Examples range from moist to dry and from sparsely to moderately well-vegetated. Woodland species such as *Thuja occidentalis* can establish along the ridgetops. Understory species can range from grassland species such as *Andropogon gerardii* on drier slopes to more mesic species in areas with higher moisture and more soil development.

Dynamics: Wind and water erosion along with fire are the primary natural dynamics influencing this system.

MEMBERSHIP

Associations:

- (*Hydrangea arborescens*, *Toxicodendron radicans*) / *Heuchera americana* - (*Dichanthelium depauperatum*, *Woodsia obtusa*) Shrubland (CEGL004395, GNR)
- *Acer saccharum* - *Tilia americana* - *Fraxinus americana* / *Ostrya virginiana* / *Geranium robertianum* Woodland (CEGL005058, G3G5)
- *Adiantum capillus-veneris* - *Boehmeria cylindrica* - *Lobelia siphilitica* Herbaceous Vegetation (CEGL004728, G2G3)
- *Andropogon gerardii* - *Chasmanthium latifolium* - *Amsonia tabernaemontana* var. *salicifolia* Herbaceous Vegetation (CEGL004739, G2G3)
- *Cystopteris bulbifera* - *Asplenium rhizophyllum* Ozark Sparse Vegetation [Provisional] (CEGL008486, GNR)
- *Hydrangea arborescens* / *Heuchera* (*americana* var. *hirsuticaulis*, *villosa* var. *arkansana*) - *Aquilegia canadensis* Shrubland (CEGL007819, G3?)
- *Impatiens pallida* - *Cystopteris bulbifera* - *Adoxa moschatellina* - (*Chrysosplenium iowense*, *Aconitum noveboracense*) Herbaceous Vegetation (CEGL002387, G2)
- Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291, G4G5)
- Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292, G4G5)
- Limestone - Dolostone Talus Sparse Vegetation (CEGL002308, G4G5)
- *Rhus aromatica* - *Celtis tenuifolia* / *Carex eburnea* Shrubland (CEGL004393, G3)
- *Schizachyrium scoparium* - *Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation (CEGL002245, G3G4)
- *Schizachyrium scoparium* - *Sporobolus compositus* var. *compositus* - *Rudbeckia fulgida* var. *fulgida* Wooded Herbaceous Vegetation (CEGL004078, G2)
- Small Eroding Bluffs Midwestern Sparse Vegetation (CEGL002315, GNR)
- *Thuja occidentalis* / *Carex eburnea* - *Pellaea atropurpurea* Woodland (CEGL002596, G2G3)
- *Thuja occidentalis* Cliff Woodland (CEGL002451, G3)

Alliances:

- (*Hydrangea* spp., *Philadelphus* spp.) / *Heuchera* spp. Shrubland Alliance (A.1905)
- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)

- *Adiantum capillus-veneris* Saturated Herbaceous Alliance (A.1683)
- *Andropogon gerardii* - (*Sorghastrum nutans*) Temporarily Flooded Herbaceous Alliance (A.1337)
- *Cystopteris bulbifera* - *Asplenium rhizophyllum* Sparsely Vegetated Alliance (A.1834)
- *Impatiens pallida* - *Cystopteris bulbifera* - *Adoxa moschatellina* Herbaceous Alliance (A.1598)
- *Juniperus virginiana* - *Rhus aromatica* Shrubland Alliance (A.1049)
- Lowland Talus Sparsely Vegetated Alliance (A.1847)
- Open Cliff Sparsely Vegetated Alliance (A.1836)
- *Schizachyrium scoparium* - *Bouteloua curtipendula* Herbaceous Alliance (A.1225)
- Small Eroding Bluffs Sparsely Vegetated Alliance (A.1872)
- *Thuja occidentalis* Woodland Alliance (A.544)
- *Tilia americana* - *Fraxinus americana* - (*Acer saccharum*) Woodland Alliance (A.628)

DISTRIBUTION

Range: This system is found primarily in non-Appalachian portions of the Central Interior Division.

Divisions: 201:?: 202:C; 205:P

Nations: US

Subnations: AR, IA, IL, IN, KY?, MI, MN, MO, NY, OH, OK, PA, TN, WI

Map Zones: 41:?, 42:P, 43:P, 44:C, 47:C, 48:C, 49:P, 50:C, 51:C, 52:C, 53:C, 57:N, 59:N, 60:N, 61:C, 62:C, 63:C, 64:C

TNC Ecoregions: 36:C, 38:C, 39:C, 44:C, 45:C, 46:C, 47:?, 48:C, 49:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUId=ELEMENT_GLOBAL.2.722969#references

Description Author: S. Menard, mod. J. Drake

Version: 18 Jul 2006

Concept Author: S. Menard

Stakeholders: East, Midwest, Southeast

ClassifResp: Midwest

CUMBERLAND ACIDIC CLIFF AND ROCKHOUSE (CES202.309)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Diagnostic Classifiers: Cliff (Substrate); Acidic Soil

CONCEPT

Summary: This sandstone cliff system is found in the Cumberland Plateau and Mountain regions of the southeastern United States. Examples are extremely steep or vertical rock faces exposed along bluffs often associated with rivers. Aspect is variable but best developed south and west. Vascular plants, lichens, and nonvascular plants are all infrequent due to the lack of crevices capable of accumulating soil, the highly acidic nature of the bedrock, and the frequent weathering and erosion of the substrate. These cliffs are also prone to harsh climatic conditions; frequent disturbances include drought stress and wind and storm damage. As a result, examples are characterized by sparse herbaceous cover and few, if any, trees. Vegetation consists of scattered individuals of *Asplenium montanum*, *Silene rotundifolia*, and other species rooted in crevices and erosion pockets. In some parts of its range, this system is the primary or sole habitat for rare endemic species, such as *Minuartia cumberlandensis* and *Ageratina luciae-brauniae*. This system includes a mosaic of cavelike features (often called "rockhouses") and associated sandstone box canyons in the western Appalachian foothills regions of Kentucky, Alabama, West Virginia, and possibly southeastern Ohio. Where present, the rockhouses are a prominent and diagnostic feature of the system.

Classification Comments: It is unclear whether or not this system should range into the Interior Low Plateau. Also debatable is whether or not wet and dry cliffs should be included as well as the number of different physical settings possible. See also Southern Appalachian Montane Cliff and Talus (CES202.330).

Similar Ecological Systems:

- Southern Appalachian Montane Cliff and Talus (CES202.330)

Related Concepts:

- Dry Sandstone Cliff (Evans 1991) Intersecting
- Moist Sandstone Cliff (Evans 1991) Intersecting

DESCRIPTION

Environment: The rockhouses are the most unique and diagnostic feature of the system. These unusual geologic features are created by spray and rock-cracking from seasonal flowing waterfalls at the heads of canyons amidst thick layers of sandstone from the Pennsylvanian geologic period. The ceiling of the rockhouse may be 50 m tall, and they can be as much as 100 m deep (A. Weakley pers. comm. 2006). They require sufficient flowing water and freezing and thawing to weather the thick beds of sandstone. These conditions seem to be restricted to the western margin of the Appalachian Plateau.

Vegetation: Examples of this system usually include a vegetational mosaic that includes hemlock bluffs, sandstone cliffs, or overhangs near the base of a cliff (often with a sandy area beneath the overhang which is shaded and protected from direct rainfall, as well as gladelike vegetation at the horizontal portion of the cliffs). The rockhouses in the southern parts of the range are habitats for rare vascular plant species such as *Minuartia cumberlandensis* and *Ageratina luciae-brauniae* and sometimes support populations of rare nonvascular plants as well.

MEMBERSHIP

Associations:

- *Asplenium montanum* - *Heuchera parviflora* var. *parviflora* - *Silene rotundifolia* Sparse Vegetation (CEGL004392, G3G4)
- *Heuchera parviflora* var. *parviflora* - *Trichomanes boschianum* - *Thalictrum mirabile* - (*Ageratina luciae-brauniae*, *Solidago albopilosa*) Herbaceous Vegetation (CEGL004301, G2)
- *Osmunda cinnamomea* - *Rhynchospora capitellata* - *Thalictrum mirabile* Cumberland Seepage Cliff Herbaceous Vegetation (CEGL008432, G1G2Q)
- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Schizachyrium scoparium* - *Danthonia sericea* - *Liatris microcephala* - (*Eurybia surculosa*) Wooded Herbaceous Vegetation (CEGL004061, G3)

Alliances:

- (*Quercus stellata*, *Quercus marilandica*) / *Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Asplenium montanum* Sparsely Vegetated Alliance (A.1831)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Saturated Herbaceous Alliance (A.1451)
- *Pinus virginiana* Forest Alliance (A.131)
- *Vittaria appalachiana* - *Heuchera parviflora* Saturated Herbaceous Alliance (A.1696)

DISTRIBUTION

Range: This system occurs in a limited area of the Cumberland Plateau of northern Alabama, northwestern Georgia, eastern

Kentucky, eastern Tennessee, West Virginia, and possibly southwestern Virginia. It may occur in southeastern Ohio (Rockhouse 349) and in western Pennsylvania.

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, OH?, PA?, TN, VA?, WV

Map Zones: 46:C, 47:C, 48:C, 53:C, 57:C, 62:?

TNC Ecoregions: 50:C

SOURCES

References: Comer et al. 2003, Weakley pers. comm.

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723185#references

Description Author: R. Evans, mod. M. Pyne

Version: 17 Apr 2006

Concept Author: R. Evans

Stakeholders: East, Midwest, Southeast

ClassifResp: Southeast

SOUTHERN APPALACHIAN MONTANE CLIFF AND TALUS (CES202.330)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Moss/Lichen (Nonvascular); Cliff (Substrate)

CONCEPT

Summary: This system consists of steep to vertical or overhanging rock outcrops (and related steep talus slopes) of the Southern Blue Ridge and adjacent parts of other ecoregions. It occurs on lower slopes, usually in river gorges or bluffs. The sparse vegetation is limited to plants growing on bare rock, small ledges, and crevices. Vegetation is primarily bryophytes, lichens, and herbs, with sparse trees and shrubs rooted in deeper soil pockets and crevices.

Classification Comments: This system is distinguished from other rock outcrops by a combination of low topographic position, vertical orientation, large amount of bare rock, and absence of specialized environments such as exfoliated granite, limestone or dolomite, and spray from waterfalls. In contrast, Southern Appalachian Rocky Summit (CES202.327) occurs in high topographic positions; they have more horizontal rock but may have some substantial vertical surfaces. Southern and Central Appalachian Mafic Glade and Barrens (CES202.348) are more horizontally oriented and have much more vegetation cover. Southern Appalachian Granitic Dome (CES202.297) may have steep portions but has smooth, unfractured rock surfaces with soil largely confined to mats adhering to the rock surface. The division of rock outcrop systems may be too fine and warrant combining some; however, each system has distinctive characteristics of structure and some distinctive flora.

The primary variation within this system, which could be the basis for further subdivision, is the distinction between mafic and felsic rock. The distribution north and west needs review. See also Cumberland Acidic Cliff and Rockhouse (CES202.309).

Similar Ecological Systems:

- Appalachian Shale Barrens (CES202.598)
- Cumberland Acidic Cliff and Rockhouse (CES202.309)
- Southern and Central Appalachian Mafic Glade and Barrens (CES202.348)
- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Rocky Summit (CES202.327)
- Southern Appalachian Spray Cliff (CES202.288)
- Southern Piedmont Cliff (CES202.386)

Related Concepts:

- Dry Sandstone Cliff (Evans 1991) Intersecting
- Moist Sandstone Cliff (Evans 1991) Intersecting

DESCRIPTION

Environment: This system occurs on steep rock outcrops on lower slopes and occasionally higher in topographically sheltered sites. River gorges are probably the most common landforms, with bluffs of more open river valleys or meandering rivers also common. The substrate is mostly bare bedrock, which is steep to vertical or overhanging. Most examples are on felsic metamorphic rock such as gneiss or schist, a smaller number on mafic metamorphic rock or felsic or mafic igneous rock. [Examples may occur on any kind of rock except limestone and dolomite, with felsic metamorphic rock the most common in the Southern Blue Ridge and sandstone the most common in the Cumberland Mountains. Mafic metamorphic rocks form a less common but important fraction of examples, along with some more extreme rocks such as quartzite.] The physical structure of cliffs of metamorphic rock is usually irregular, with some ledges and crevices. [Sedimentary rocks often form more vertical cliffs, but with bedding planes and joints forming deep crevices that provide rooting sites.] Moisture levels vary drastically over short distances. Seepage of groundwater from adjacent soils or through rock fractures often creates permanently or seasonally flooded microsites, while lack of soil makes other portions extremely dry. In less sheltered topography, slope aspect affects overall moisture levels to some degree. Rock or soil chemistry appears to be the most important factor affecting different associations on sites that have the physical structure to belong to this system. Elevation may also be an important factor causing variation, though few examples are known at high elevation.

Vegetation: Vegetation is sparse. Bryophytes and lichens may cover portions of the open rock. Vascular plants are limited to sparse rooting sites in soil pockets, ledges, and crevices. Some of these microsites may be deep enough to support shrubs or even stunted trees, while most support only herbs. The woody plants are usually species from surrounding forests, and may be mesophytic or xerophytic. The herbs include a suite of rock outcrop specialists such as *Saxifraga michauxii*, *Hylotelephium telephioides*, *Asplenium montanum*, and *Polypodium* spp. Mafic rock outcrops have an additional suite of specialist herbs, a number of them rare. Herbs from the surrounding forest are often also present and may make up a significant fraction of the flora.

Dynamics: The dynamics of this system have received little study. Most cliff communities are probably stable over long periods of time, with fine-scale disturbances affecting microsites. Rock falls, slides, and other mass movement are rare, but represent catastrophic disturbance to part or all of a cliff, and may be important in the long term for keeping cliffs open. Animal movements may be locally important. Fire probably has little effect on cliffs, which have too little vegetation to carry fire and which tend to occur in topography

that is not conducive to fire spread. Because of the limited natural disturbance and the fragility of soil and vegetation, human disturbance by trampling edges and by climbing may be particularly destructive.

MEMBERSHIP

Associations:

- (*Hydrangea arborescens*) / *Heuchera villosa* - *Asplenium trichomanes* - *Thalictrum clavatum* / *Conocephalum conicum* Shrubland (CEGL008435, G2)
- (*Hydrangea arborescens*) / *Heuchera villosa* - *Dicentra eximia* - *Campanula divaricata* Shrubland (CEGL008546, G2)
- (*Hydrangea arborescens*, *Toxicodendron radicans*) / *Heuchera americana* - (*Dichanthelium depauperatum*, *Woodsia obtusa*) Shrubland (CEGL004395, GNR)
- *Asplenium montanum* - *Heuchera villosa* Felsic Cliff Sparse Vegetation (CEGL004980, G3G4)
- *Carya glabra* - *Fraxinus americana* - *Quercus prinus* / *Ostrya virginiana* / *Philadelphus hirsutus* Woodland (CEGL004995, G2)
- *Parthenocissus quinquefolia* / *Dicentra eximia* Sparse Vegetation (CEGL004454, G2G3Q)
- *Physocarpus opulifolius* / *Campanula divaricata* - *Tradescantia subaspera* - (*Packera plattensis*) Sparse Vegetation (CEGL004759, G1?)
- *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387, G4?)

Alliances:

- (*Hydrangea* spp., *Philadelphus* spp.) / *Heuchera* spp. Shrubland Alliance (A.1905)
- *Asplenium montanum* Sparsely Vegetated Alliance (A.1831)
- *Fraxinus americana* - *Carya glabra* - (*Juniperus virginiana*) Woodland Alliance (A.604)
- Lowland Talus Sparsely Vegetated Alliance (A.1847)
- *Physocarpus opulifolius* Sparsely Vegetated Alliance (A.1837)
- *Umbilicaria mammulata* Nonvascular Alliance (A.1827)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch system, most examples covering a few acres. Examples tend to occur as isolated small patches or occasional small clusters.

Size: Most examples naturally cover an acre or less. A few occur as complexes of closely associated patches, but the aggregate size is still small. Size is somewhat ambiguous for this system, in that vertical surfaces may be as extensive as horizontal surfaces.

Adjacent Ecological Systems:

- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)
- Southern Appalachian Montane Pine Forest and Woodland (CES202.331)
- Southern Appalachian Oak Forest (CES202.886)
- Southern Appalachian Spray Cliff (CES202.288)

Adjacent Ecological System Comments: This system is surrounded by forest systems on deeper soils less influenced by bedrock, most typically Southern and Central Appalachian Cove Forest (CES202.373), Southern Appalachian Oak Forest (CES202.886), or various floodplain forest systems. Southern Appalachian Low Mountain Pine Forest (CES202.332) or Southern Appalachian Montane Pine Forest and Woodland (CES202.331) may sometimes adjoin.

DISTRIBUTION

Range: Scattered throughout the Southern Appalachians and incidentally into adjacent ecoregions, from northern Alabama and Georgia through Virginia.

Divisions: 202:C

Nations: US

Subnations: GA, KY, NC, SC, TN, VA, WV?

Map Zones: 48:?, 53:P, 54:C, 57:C, 59:C, 60:N, 61:C

TNC Ecoregions: 50:?, 51:C, 52:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723173#references

Description Author: M. Schafale and R. Evans

Version: 18 Apr 2006

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

SOUTHERN APPALACHIAN ROCKY SUMMIT (CES202.327)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Large patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Diagnostic Classifiers: Rock Outcrops/Barrens/Glades

CONCEPT

Summary: This system represents treeless rock outcrops of the southern Appalachian Mountains, primarily in western North Carolina and eastern Tennessee. Outcrops may be vertical to horizontal, rugged or fractured rock outcrops of peaks, ridgetops, upper slopes, and other topographically exposed locations (Schafale and Weakley 1990). Higher elevation examples occur from 1200 to 2030 m in elevation; other examples may be found at elevations of 305 m (1000 feet) or lower on foothills. These outcrops occur on felsic to mafic rocks and are distinguished from surrounding systems by the prevalence of bare or lichen-encrusted rocks. The vegetation component of this system is generally characterized by a mixture of low-growing lifeforms, especially lichens, mosses, and short-statured forbs. Less commonly, graminoids and low shrubs are encountered. Species common to all outcrop vegetation types include *Carex misera*, *Saxifraga michauxii*, and *Vaccinium corymbosum* (Wiser and White 1999).

Classification Comments: The primary variation within this system, which could be the basis for further subdivision, is the distinction between low and high elevation. High-elevation rocky summits may have a unique biogeographic history of having been adjacent to alpine tundra that existed in the region during the Pleistocene and of now providing a refugium for some of its flora. Their climate is substantially different from the lower elevation examples. However, their structure and the dynamics that results from it are probably similar.

This system could eventually be broadened to include Central Appalachian Montane Rocky Bald (CES202.597) (S. Gawler pers. comm.).

Similar Ecological Systems:

- Southern and Central Appalachian Mafic Glade and Barrens (CES202.348)
- Southern Appalachian Granitic Dome (CES202.297)
- Southern Appalachian Montane Cliff and Talus (CES202.330)
- Southern Piedmont Cliff (CES202.386)
- Southern Piedmont Glade and Barrens (CES202.328)
- Southern Piedmont Granite Flatrock and Outcrop (CES202.329)

Related Concepts:

- High Elevation Rocky Summit (Schafale and Weakley 1990) Finer
- Low Elevation Rocky Summit (Schafale and Weakley 1990) Finer

DESCRIPTION

Environment: This system occurs on rugged rock outcrops on peaks, ridgetops, upper slopes, and other topographically exposed landforms. Elevations may range from nearly the highest in the region (1200-2030 m), down to 305 m (1000 feet) or lower on foothills. The rock outcrops are irregular, with substantial horizontal surfaces, as well as often vertical surfaces, and generally with fractures. This structure allows soil accumulation in local pockets, sometimes to fair depth, even though most of the substrate is bare rock. Bedrock may be a variety of types. Erosion-resistant rocks such as felsic gneisses and schists or quartzite are most common, but mafic rocks such as amphibolite are also important substrates. Granite and granitic gneiss sometimes form rocky summits, but more often form the smoother outcrops that support Southern Appalachian Granitic Dome (CES202.297) or Southern and Central Appalachian Mafic Glade and Barrens (CES202.348). Moisture conditions are generally quite dry due to lack of soil but may be heterogeneous. Local deep crevices may accumulate water funneled from bare rock. Seepage is occasionally present but is usually minor. Climate varies substantially with elevation and has a strong effect on variation within the system. Higher elevation sites have high rainfall and receive substantial additional moisture from fog and rime ice.

Vegetation: Vegetation is sparse or patchy, with substantial expanses of lichen-covered or bare rock. Mosses are usually present but often do not have substantial cover. A suite of typical rock outcrop herbs, including *Saxifraga michauxii*, *Carex misera*, *Paronychia argyrocoma*, *Heuchera villosa*, *Krigia montana*, and *Hylotelephium telephioides* (= *Sedum telephioides*), is usually present, along with more widespread herbs of open areas such as *Danthonia spicata*, *Danthonia compressa*, *Schizachyrium scoparium*, *Potentilla canadensis*, and *Houstonia caerulea*. High-elevation examples have an additional suite of herbs, which include some northern disjunct species such as *Minuartia groenlandica*, *Sibbaldiopsis tridentata*, *Trichophorum caespitosum*, and *Huperzia selago*. A suite of narrow endemic herbs is also characteristic of many high-elevation examples. Herbs of the adjacent forests may be present in small numbers. Shrubs and stunted trees are usually present in patches, where crevices or deeper soil accumulations are present. A few shrubs, such as *Leiophyllum buxifolium*, are largely limited to this system, but most are widespread species of dry forests and woodlands. Shrubs in the Ericaceae family are particularly prominent. Wiser and White (1999) found that in high-elevation rocky summits, less than 1/3 of the flora was limited to rock outcrop sites.

Dynamics: The dynamics of this system have received little study. Most rocky summit sites are probably stable over long periods of

time, but variations in the always stressful environment may disturb and change vegetation. The role of crevices and soil in depressions as the primary rooting site makes for a relatively stable pattern of plant distribution and potentially long-lived individuals. This is in contrast to the shallow soil mats predominating in granitic domes. Between disturbances, accumulation of soil and succession of vegetation to greater woody abundance may occur. Fire may naturally be uncommon or fairly common. The topographically high location of this system would make it likely that fires would spread into it, though the sparse fuels would allow only patchy burning. Fires have been indicated to be important in preventing dense woody growth from encroaching on open outcrops in at least some instances. Rock falls or other mass movement are rare, but may be important in creating rock outcrops and keeping them open in the long term. Periodic drought is probably a significant disturbance. Animals and freeze-thaw action may be important disturbances at a local scale. Because of the fragility of soil and vegetation, human disturbance by trampling edges and by climbing may be particularly destructive.

MEMBERSHIP

Associations:

- *Hudsonia montana* - *Leiophyllum buxifolium* Dwarf-shrubland (CEGL003948, GH)
- *Saxifraga michauxii* - *Carex misera* - *Calamagrostis cainii* Herbaceous Vegetation (CEGL004278, G1)
- *Saxifraga michauxii* - *Carex misera* - *Danthonia spicata* - *Krigia montana* Herbaceous Vegetation (CEGL004279, G2)
- *Saxifraga michauxii* - *Carex misera* - *Oclemena acuminata* - *Solidago glomerata* Herbaceous Vegetation (CEGL004277, G1)
- *Saxifraga michauxii* - *Cheilanthes lanosa* - *Hylotelephium telephioides* Herbaceous Vegetation (CEGL004989, G1)
- *Saxifraga michauxii* Herbaceous Vegetation (CEGL004524, G3?)
- *Schizachyrium scoparium* - *Saxifraga michauxii* - *Coreopsis major* Herbaceous Vegetation (CEGL004074, G1)

Alliances:

- *Leiophyllum buxifolium* Dwarf-shrubland Alliance (A.1063)
- *Saxifraga michauxii* Herbaceous Alliance (A.1621)

SPATIAL CHARACTERISTICS

Adjacent Ecological Systems:

- Central and Southern Appalachian Spruce-Fir Forest (CES202.028)
- Southern and Central Appalachian Mafic Glade and Barrens (CES202.348)
- Southern Appalachian Grass and Shrub Bald (CES202.294)
- Southern Appalachian Northern Hardwood Forest (CES202.029)

DISTRIBUTION

Range: This system is found at a variety of elevations in the southern Appalachian Mountains, primarily in western North Carolina and eastern Tennessee.

Divisions: 202:C

Nations: US

Subnations: GA, NC, SC, TN

Map Zones: 53:N, 57:C

TNC Ecoregions: 51:C

SOURCES

References: Comer et al. 2003, Schafale and Weakley 1990, Wisser and White 1999

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723176#references

Description Author: M. Schafale, mod. M. Pyne

Version: 18 Apr 2006

Concept Author: M. Schafale

Stakeholders: Southeast

ClassifResp: Southeast

SOUTHERN APPALACHIAN SPRAY CLIFF (CES202.288)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Diagnostic Classifiers: Cliff (Substrate)

CONCEPT

Summary: This system consists of rock outcrops that are kept wet by spray from waterfalls, primarily in the Southern Blue Ridge, and possibly elsewhere in the southern Appalachians region. The rocks are often densely or moderately covered with bryophytes or algae. The sparse vascular vegetation is limited to plants growing on bare rock, small ledges and crevices.

Classification Comments: This system is distinguished from all others in its range by its being kept wet by spray. Other outcrop systems, especially Southern Appalachian Montane Cliff and Talus (CES202.330), may have local wet areas created by seepage but will be dominated by dry microsites. Other interpretations of this system are that it could be combined with other cliff systems of the Appalachians.

Similar Ecological Systems:

- Southern Appalachian Montane Cliff and Talus (CES202.330)

Related Concepts:

- Moist Sandstone Cliff (Evans 1991) Broader

DESCRIPTION

Environment: Occurs on rock outcrops adjacent to waterfalls, where spray from the falls keeps the rock wet for long periods. Outcrops are usually near vertical, but horizontal surfaces at the base, boulder piles, and grottos are also common. The rock may be of any type, and the substrate may occasionally be saprolite rather than hard rock. Soil is limited to accumulations in crevices and on ledges. The rock may be permanently wet or may be wet seasonally when stream flow is high. Wetness is constant enough that this system may be considered a wetland, though some of the impacts of soil saturation do not occur. Seepage often makes portions of the rock wetter than areas covered just by spray. The typical topographic setting, in narrow gorges or enclosed valleys, makes for high local humidity and moderated temperature fluctuations.

Vegetation: Vegetation is usually a mix of growth forms and may be very patchy. Bryophytes, both mosses and liverworts, are often dense. Vascular vegetation may be sparse, but some examples are dense. Characteristic rock outcrop herbs such as *Saxifraga michauxii*, *Asplenium montanum*, and *Heuchera* spp. are usually present, along with some herbs of moist forests and seeps, such as *Galax urceolata*, *Thalictrum clavatum*, *Houstonia serpyllifolia*, *Circaea alpina*, and *Impatiens capensis*. A few examples are grassy. Examples on basic rock or with basic seepage have additional calciphilic herbs. A number of rare species, especially mosses, liverworts, and ferns but also including some forbs, grasses, and sedges, may be present. Shrubs and trees are usually present, at least on edges and often also rooted in crevices and ledges. *Rhododendron maximum*, *Kalmia latifolia*, and *Tsuga canadensis* are among the most frequent. Woody vines may also be prominent.

Dynamics: The dynamics of this system have received little study. The spray cliff environment is probably unusually stable, with its sheltered topographic position limiting wind influence, dryness, and extreme temperatures. Most individual plants are probably long-lived. The presence of tropical disjunct bryophytes and ferns at some spray cliffs supports the idea of a very stable, moderate environment. Droughts affect streamflow and must affect moisture levels, but most streams large enough to support spray cliffs will probably never dry up. Occasional rock falls and scouring related to flash floods represent catastrophic disturbances to all or part of occurrences. Because of the fragility of the vegetation and soil, along with the attractiveness of waterfalls, human disturbance can be very significant.

MEMBERSHIP

Associations:

- *Vittaria appalachiana* - *Heuchera parviflora* var. *parviflora* - *Houstonia serpyllifolia* / *Plagiochila* spp. Herbaceous Vegetation (CEGL004302, G2)

Alliances:

- *Vittaria appalachiana* - *Heuchera parviflora* Saturated Herbaceous Alliance (A.1696)

SPATIAL CHARACTERISTICS

Spatial Summary: Small-patch system, most examples covering less than one acre. Examples tend to occur as isolated small patches.

Size: Most examples naturally cover well less than one acre, and well-developed and diverse examples may be as small as 100 square meters. Complexes of multiple patches are almost never found. Size is somewhat ambiguous for this system, in that vertical surfaces may be as extensive as horizontal surfaces.

Adjacent Ecological Systems:

- Southern and Central Appalachian Cove Forest (CES202.373)
- Southern Appalachian Montane Cliff and Talus (CES202.330)

Adjacent Ecological System Comments: This system is usually surrounded by mesic forest systems, including Southern and Central Appalachian Cove Forest (CES202.373). Some may be associated with Southern Appalachian Montane Cliff and Talus (CES202.330) on drier rock exposures.

DISTRIBUTION

Range: This system occurs scattered throughout the southern Appalachians and incidentally into adjacent ecoregions, from northern Alabama and Georgia through Virginia.

Divisions: 202:C

Nations: US

Subnations: AL, GA, KY, NC, SC, TN, VA, WV?

Map Zones: 48:?, 53:C, 57:C, 60:N, 61:C

TNC Ecoregions: 50:?, 51:C, 52:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723200#references

Description Author: M. Schafale and R. Evans

Version: 12 Oct 2004

Concept Author: M. Schafale and R. Evans

Stakeholders: East, Southeast

ClassifResp: Southeast

SOUTHERN INTERIOR CALCAREOUS CLIFF (CES202.356)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Diagnostic Classifiers: Cliff (Substrate)

CONCEPT

Summary: This system encompasses calcareous cliffs of the Southern Ridge and Valley and adjacent areas of the Cumberland Plateau with a few disjunct localities in the southern Appalachians. This system includes vertical to near-vertical rock faces of limestone and dolomite. These cliffs are typically dry but may contain relatively small embedded seepage patches. Both wet and, more commonly, dry expressions are included. Due to harsh edaphic conditions, including verticality, these cliffs are nearly unvegetated, however, *Asplenium ruta-muraria* and *Pellaea atropurpurea* may be characteristic plants. Some cliffs have scattered *Thuja occidentalis* trees which may be very old (>800 years) and genetically diverse. This system also covers a narrow zone of vegetation, often herbaceous, at the horizontal cliff top where growing conditions are harsh and often gladelike.

Similar Ecological Systems:

- Central Interior Calcareous Cliff and Talus (CES202.690)
- North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)

Related Concepts:

- Dry Limestone Cliff (Evans 1991) Intersecting
- Moist Limestone Cliff (Evans 1991) Intersecting

DESCRIPTION

Environment: This system includes vertical to near-vertical rock faces of limestone and dolomite. These cliffs are typically dry but may contain relatively small embedded seepage patches. Both wet and, more commonly, dry expressions are included. Disjunct examples in the southern Appalachians attributed to this system include Hot Springs and Linville Caverns area. It presumably includes both the Bull Cave and Calf Cave area in the Smokies.

Vegetation: Due to harsh edaphic conditions, including verticality, these cliffs are nearly unvegetated, however, *Asplenium ruta-muraria* and *Pellaea atropurpurea* may be characteristic plants. Some cliffs have scattered *Thuja occidentalis* trees which may be very old (>800 years) and genetically diverse. This system also covers a narrow zone of vegetation, often herbaceous, at the horizontal cliff top where growing conditions are harsh and often gladelike.

MEMBERSHIP

Associations:

- *Asplenium ruta-muraria* - *Pellaea atropurpurea* Sparse Vegetation (CEGL004476, G3G4)
- *Rhus aromatica* - *Celtis tenuifolia* / *Carex eburnea* Shrubland (CEGL004393, G3)
- *Schizachyrium scoparium* - *Sporobolus compositus* var. *compositus* - *Rudbeckia fulgida* var. *fulgida* Wooded Herbaceous Vegetation (CEGL004078, G2)
- *Thuja occidentalis* / *Carex eburnea* - *Pellaea atropurpurea* Woodland (CEGL002596, G2G3)
- *Thuja occidentalis* Limestone Seepage Woodland (CEGL003675, G2G3Q)

Alliances:

- (*Juniperus virginiana*) / *Schizachyrium scoparium* - (*Bouteloua curtipendula*) Wooded Herbaceous Alliance (A.1919)
- *Asplenium ruta-muraria* - *Pellaea atropurpurea* Sparsely Vegetated Alliance (A.1832)
- *Juniperus virginiana* - *Rhus aromatica* Shrubland Alliance (A.1049)
- *Thuja occidentalis* Saturated Woodland Alliance (A.583)
- *Thuja occidentalis* Woodland Alliance (A.544)

DISTRIBUTION

Range: This system is found in the Southern Ridge and Valley and adjacent areas of the Cumberland Plateau with a few disjunct localities in the southern Appalachians.

Divisions: 202:C

Nations: US

Subnations: AL, KY, NC, TN, VA

Map Zones: 48:C, 53:C, 57:C, 60:N, 61:N

TNC Ecoregions: 50:C, 51:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723156#references

Description Author: R. Evans, C. Nordman, M. Pyne
Version: 18 Apr 2006
Concept Author: R. Evans, C. Nordman, M. Pyne

Stakeholders: East, Southeast
ClassifResp: Southeast

SOUTHERN INTERIOR SINKHOLE WALL (CES202.357)

CLASSIFIERS

Classification Status: Standard

Primary Division: Central Interior and Appalachian (202)

Land Cover Class: Barren

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland

Diagnostic Classifiers: Cliff (Substrate); Alkaline Soil

CONCEPT

Summary: This system represents vertical shaft sinkholes and the characteristic vegetation associated with their steep walls in the southern Ridge and Valley and adjacent Interior Low Plateau regions of the southeastern United States. Related examples in the Southern Blue Ridge are also covered here. Examples are normally dominated by *Cystopteris bulbifera* and *Asplenium rhizophyllum* or the liverwort *Dumortiera hirsuta*.

Similar Ecological Systems:

- Central Interior Calcareous Cliff and Talus (CES202.690)--may be in effect a subset of CES202.690.

Related Concepts:

- Moist Limestone Cliff (Evans 1991) Broader

MEMBERSHIP

Associations:

- *Cystopteris bulbifera* - (*Asplenium rhizophyllum*) Sparse Vegetation (CEGL004394, GNR)
- *Cystopteris bulbifera* / *Dumortiera hirsuta* Sinkhole Wall Sparse Vegetation (CEGL004988, G1)

Alliances:

- *Cystopteris bulbifera* - *Asplenium rhizophyllum* Sparsely Vegetated Alliance (A.1834)

DISTRIBUTION

Range: This system is found in the Southern Ridge and Valley and adjacent Interior Low Plateau regions of the southeastern United States and the Southern Blue Ridge, with rare and limited occurrences in the Upper East Gulf Coastal Plain.

Divisions: 202:C

Nations: US

Subnations: AL, KY, MS, NC, TN

Map Zones: 46:P, 47:C, 48:C, 53:C, 57:C

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C

SOURCES

References: Comer et al. 2003

Full References:

See www.natureserve.org/explorer/servlet/NatureServe?searchSystemUid=ELEMENT_GLOBAL.2.723155#references

Description Author: R. Evans and C. Nordman

Version: 13 Dec 2002

Concept Author: R. Evans and C. Nordman

Stakeholders: Southeast

ClassifResp: Southeast