14170

Eastern Highland Rim Prairie and Barrens

BpS Model/Description Version: Aug. 2020

Update: 4/16/2018

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Vegetation Type

Herbaceous

Map Zones

48

Geographic 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). This is a small part of Subsection 223Eb (USFS) and EPA Level IV Ecoregion 71g.

Biophysical Site Description

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 8.8º C (47.8º F) and 1.9º C (35.4º F), respectively. July is the warmest month, with average high and low temperatures of 31.3º C (88.3º F) and 18.9º C (66.0º F), respectively. Monthly mean temperatures range from 3.5º C (38.3º F) in January to 25.11º C (77.2º F) in July. The mean annual precipitation is 1438mm (56.6in; Wolfe 1996, Pyne 2000). Precipitation is heaviest from November through May, averaging between 113 and 171m (4.4 to 6.7in) per month. Rainfall is lightest during the months of June through October, with averages ranging from 83m (3.3in) per month to a minor peak of 122m (4.8in) in July.

Vegetation Description

Stands may vary in physiognomy from savanna-grasslands to oak-dominated woodlands and forests. Many stands are in a forested condition today due to lack of fire. Typical mesic grassland vegetation of the barrens of the southeastern Highland Rim of Tennessee is dominated by big bluestem (*Andropogon gerardii*), along with little bluestem (*Schizachyrium scoparium*) and Indian grass (*Sorghastrum nutans*). Other graminoid species present include bushy bluestem (*Andropogon glomeratus*), Nuttall's reedgrass *Calamagrostis coarctata*, and switchgrass (*Panicum virgatum*). Other dominants may include *Eurybia hemispherica* (= *Aster paludosus* ssp. h*emisphericus*), *Symphyotrichum dumosum* (= *Aster dumosus*), *Helianthus angustifolius, Potentilla simplex, Solidago odora, Solidago rugosa, Pteridium aquilinum*, and *Polytrichum commune.* Two noteworthy fire-tolerant wetland species are Barratt's sedge (*Carex barrattii*) and maidencane (*Panicum hemitomon*). Woody species may include the relatively fire-tolerant oaks *Quercus stellata, Quercus alba,* and *Quercus marilandica*, along with *Quercus falcata, Acer rubrum, Rhus copallinum, Rubus argutus*, and *Smilax glauca*. Some plants and animals which are found here 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.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUAL | *Quercus alba* | White oak |
| ANGE | *Andropogon gerardii* | Big bluestem |
| SONU2 | *Sorghastrum nutans* | Indiangrass |
| PAVI2 | *Panicum virgatum* | Switchgrass |
| LIATR | *Liatris* | Blazing star |
| LECA8 | *Lespedeza capitata* | Roundhead lespedeza |
| QUST | *Quercus stellata* | Post oak |
| VACCI | *Vaccinium* | Blueberry |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Past fire and grazing constitute the major dynamic processes for this BpS. Fires were frequent (potentially on a 5yr return interval, [Guyette 2005?] documented over last ~370yrs), primarily of human origin, occurring in late summer to early autumn. Forestry activities (including planting of off-site Loblolly Pine, which is not truly native to the region) and fire suppression have led to the current forested condition with solar intensity as low as 10%. The current persistence of prairies, shrublands, and grassy-woodland/savannas is largely dependent on contemporary management regimes.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 18 | 33 |  |  |
| Moderate (Mixed) | 34 | 17 |  |  |
| Low (Surface) | 12 | 50 |  |  |
| All Fires | 6 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

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. Most of the naturally vegetated portion of Arnold Air Force Base (ca. 40,000ac) is occupied by this system.

Adjacency or Identification Concerns

The depression ponds which occur within the landscape of ~Eastern Highland Rim Prairie and Barrens (1417) are regarded as examples of the ~Central Interior Highlands and Appalachian Sinkhole and Depression Pond (ESLF 9160); Small wet depressions in the ~Eastern Highland Rim Prairie and Barrens (1417), which are not distinguished physiognomically or by canopy species, are included in the concept of ~Eastern Highland Rim Prairie and Barrens (1417). (These are akin to vernal pools or wet streamheads). These small wet depressions with extensive herbaceous vegetation (e.g. *Carex, Juncus*, and *Panicum* species) certainly would have burned during drier periods.

Issues or Problems

Within current prairies many of the native common plant species still occur, lack of natural disturbance regimes impact herbaceous species competition and abundance. The vegetation tends to be driven either to grassland herbaceous (partly by mowing) or closed-canopy forest, leading to the loss of the natural woodland-savanna matrix.

Native Uncharacteristic Conditions

The woodlands, savannas, and prairies are often grown up in woody vegetation (e.g. red maple, sweetgum, oaks, and hickory) due to fire suppression. White oak, post oak, and to a lesser extent blackjack oak woodlands and forests often “fill in” with less fire tolerant species (e.g. southern red oak, scarlet oak, red maple, sweetgum, blackgum, etc.), resulting in a closed canopy forest.

Comments

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | UN | UN | UN | UN | UN | B | B | B | UN | UN |
| Shrub | 0.5-1.0 | UN | UN | UN | UN | UN | B | B | B | UN | UN |
| Shrub | 1.0-3.0 | UN | UN | UN | UN | UN | B | B | B | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | B | B | B | UN | UN |
| Tree | 0-5 | UN | UN | C | C | C | C | UN | UN | UN | UN |
| Tree | 5-10 | UN | UN | C | C | C | C | UN | UN | UN | UN |
| Tree | 10-25 | UN | UN | D | D | D | D | E | UN | UN | UN |
| Tree | 25-50 | UN | UN | D | D | D | D | E | UN | UN | UN |
| Tree | >50 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 42 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SCSC | Schizachyrium scoparium | Little bluestem | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |

Description

Grassland class. Dominated by big bluestem, Indiangrass, little bluestem, sunflowers (*Helianthus* spp.) and goldenrods (*Solidago* spp.), and switchgrass. Shrub and tree species are relatively infrequent and, if present, constitute <10% cover in the area. Numerous forbs such as blazingstars (*Liatris* spp.), rattlesnake master (*Eryngium yuccifolium*), wild quinine (*Parthenium integrifolium*), among many others, are present. Fuel complexes consisted of short- and tall-grass prairie forbs and shrubs with moderate levels of woody seedling recruitment or resprouts (e.g. oaks and hickory species). This system is composed of fuel models 1 and 3.

*Maximum Tree Size Class*  
None

Class B 8 Mid Development 1 - Closed

Upper Layer Lifeform is not the dominant lifeform

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACRU | Acer rubrum | Red maple | Mid-Upper |
| LIST2 | Liquidambar styraciflua | Sweetgum | Mid-Upper |
| QUFA | Quercus falcata | Southern red oak | Upper |
| RUAR2 | Rubus argutus | Sawtooth blackberry | Low-Mid |

Description

This class represents a shrubby prairie with emergent trees. Grass and forb species remain the same as in class A. Examples of this class are likely to be a variable mixture of shrubs and emergent trees. Shrub cover may exceed tree cover. Shrub species include climbing rose (*Rosa setigera*), blackberry (*Rubus argutus*), Prairie willow (*Salix humilis*), winged sumac (*Rhus copallinum*), persimmon (*Diospyros virginiana*), with oak and hickory saplings (*Quercus* spp., *Carya* spp.) The fuel model in this class starts at 1 and 3.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 11 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUST | Quercus stellata | Post oak | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SCSC | Schizachyrium scoparium | Little bluestem | Upper |

Description

This class represents a young savanna/prairie complex. This system is similar to a Late Open state, except with widely spaced younger trees (e.g. *Quercus alba* and *Quercus stellata*). Grass and forb species remain the same as in class A. Shrub species include climbing rose (*Rosa setigera*), Prairie willow (*Salix humilis* vars.), and winged sumac (*Rhus copallinum*). The fuel models in this class are 1 and 3.

*Maximum Tree Size Class*  
Very Large >33"DBH

Class D 31 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUST | Quercus stellata | Post oak | Upper |
| QUAL | Quercus alba | White oak | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Lower |
| SCSC | Schizachyrium scoparium | Little bluestem | Lower |

Description

This class represents a savanna/prairie complex. Coverage of grasses and forbs may exceed that of trees. Shrubs are very limited. This system is similar to an Early development state, except with widely dispersed open-grown trees (i.e., *Quercus alba* and *Quercus stellata*) with significant DBH. Grass and forb species remain the same as in classes A and C. Shrub species include climbing rose (*Rosa setigera*), Prairie willow (*Salix humilis* vars.), winged sumac (*Rhus copallinum*).

*Maximum Tree Size Class*  
Very Large >33"DBH

Class E 8 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUFA | Quercus falcata | Southern red oak | Mid-Upper |
| ACRU | Acer rubrum | Red maple | Middle |
| VACCI | Vaccinium | Blueberry | Lower |

Description

This class represents closed canopy forest and oak litter-blueberry (*Vaccinium* spp.) dominated woodlands. Older white oak and post oak remain co-dominant, with younger individuals of southern red oak, scarlet oak, red maple, and sweetgum filling in and closing up the understory, and eventually reaching the canopy and filling in the gaps between the older trees. These trees will ultimately dominate the canopy as the older trees senesce and die. Vaccinium, Rhododendron, and seedlings of less fire tolerant species comprise the shrub layer. Sourwood and blackgum are also common. Other shrub species include climbing rose (*Rosa setigera*), Prairie willow (*Salix humilis* vars.), and winged sumac (*Rhus copallinum*).

*Maximum Tree Size Class*  
Very Large >33"DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 14 |
| Mid1:OPN | 15 | Late1:OPN | 59 |
| Mid1:CLS | 15 | Late1:OPN | 59 |
| Late1:OPN | 60 | Late1:OPN | 999 |
| Late1:CLS | 60 | Late1:CLS | 999 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Alternative Succession | Early1:ALL | Mid1:CLS | 1 | 1 | Yes | 13 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 10 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.0067 | 149 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.05 | 20 | No | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.2 | 5 | No | 0 |
| Alternative Succession | Mid1:CLS | Late1:CLS | 1 | 1 | Yes | 20 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.02 | 50 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.066 | 15 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 20 |
| Wind or Weather or Stress | Late1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.05 | 20 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.2 | 5 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.02 | 50 | No | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.05 | 20 | Yes | 0 |

References

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