14180

Pennyroyal Karst Plain Prairie and Barrens

BpS Model/Description Version: Aug. 2020

Update: 4/17/2018

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Vegetation Type

Herbaceous

Map Zones

47

Geographic Range

This system occurs in the northwestern Highland Rim (Pennyroyal Plateau) of Kentucky and Tennessee north of Nashville and extends north into Indiana just to the west of Louisville. Fort Campbell Military Reservation contains the largest extant examples, where ecological burning and fires from live munitions use result in open-herbaceous-dominated landscapes.

Biophysical Site Description

This system occurs in an open rolling Karst Plain landscapes which easily carries fire if maintained in a grassy condition. Bedrocks are the St. Louis or St. Genevieve, Upper Michigan limestones of the Meramecian Series including some of the area which forms the base of the Dripping Springs Escarpment. Sinkholes mostly range up to 200m wide and 10m deep, with some areas nearly sinkhole free while other areas have sinkholes up to 1600m wide and 60m deep with some sinkhole ponds and lakes. One sinkhole covers 3114ac (1261ha). Some sinkhole ponds were created by sinkhole plugging via agricultural erosion or human disturbance. The area exhibits well-developed underground drainage, low stream density, and soils quick to dry. Most upland streams have limited discharge with intermittent or ephemeral flow.

Vegetation Description

Grasses and forbs dominate with scattered shrubby vegetation and, occasionally, trees. Scattered trees include southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*) and shingle oak (*Quercus imbricaria*), White Ash, and Eastern Red Cedar. Little bluestem (*Schizachyrium scoparium*) and Indiangrass (*Sorghastrum nutans*) dominate the grasses with big bluestem (*Andropogon gerardii*), Eggert's Sunflower and eastern gamagrass (*Tripsacum dactyloides*). Other herbaceous components may include *Andropogon ternarius, Eryngium yuccifolium, Lespedeza capitata, Lespedeza virginica, Symphylotrichum novae-angliae* (= *Aster novae-angliae*), *Sericocarpus linifolius* (= *Aster solidagineus*), *Coreopsis major, Coreopsis tripteris, Helianthus angustifolius, Helianthus hirsutus, Solidago juncae, Pycnanthemum tenuifolium,* and *Pycnanthemum*. Other typical woody species include *Cornus florida, Cercis canadensis, Prunus americana, Rhus copalina*, and *Symphoricarpos orbiculatus*.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUFA | *Quercus falcata* |  |
| QUIM | *Quercus marilandica* |  |
| SCSC | *Schizachyrium scoparium* |  |
| SONU2 | *Sorghastrum nutans* | Indiangrass |
| ANGE | *Andropogon geradii* |  |
| LECU | *Lespedeza capitata* |  |
| HEHI2 | *Helianthus hirsutus* | Hairy sunflower |
| ERYS | *Eryngium yuccifolium* |  |

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

Disturbance Description

Much of the area supports crops and livestock production. Very few "original" presettlement barrens exist. These barrens originated by burning of forests by Native Americans. If not grazed or farmed, these barrens quickly grew into oak-dominated forests after settlement by Europeans and occur on soil that developed under forest vegetation.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 2 | 91 |  |  |
| Moderate (Mixed) | 73 | 2 |  |  |
| Low (Surface) | 21 | 7 |  |  |
| All Fires | 1 | 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 large patch system is found in mapzone 47 only.

Adjacency or Identification Concerns

In Kentucky, historic deep-soil barrens also occurred on the Eastern Highland Rim and in the Jackson Purchase.

Issues or Problems

Remnant prairies with native species that remain are relatively small. Agricultural practices involving row crop production and grazing heavily impact this region. Much of the area has been converted to non-native pastures (usually tall fescue) and row crop agricultural lands. Other large areas have succeeded to closed canopy forest through fire exclusion.

Native Uncharacteristic Conditions

The barrens of this area exhibit two types of uncharacteristic conditions. Agricultural changes converted much of the landscape for use as fields and for grazing; with fire suppression they grew up with woody vegetation. Today, in many areas, old pastures or agricultural fields have succeeded into areas dominated by eastern red cedar (*Juniperus virginiana*). It is not likely this would have been common in presettlement times. However, with fencerow habitats that encourage eastern red cedar survival being created in recent history, this has become the most common successional pathway.

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 | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | B | B | B | B | B | B | B | B | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | C | C | C | C | C | C | C | C | D | D |
| Tree | 10-25 | C | C | C | C | C | C | C | C | D | D |
| Tree | 25-50 | UN | UN | UN | UN | UN | UN | UN | UN | D | D |
| Tree | >50 | UN | UN | UN | UN | UN | UN | UN | UN | D | D |

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 72 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Nam** | **Common Name** | **Canopy Position** |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |
| ERYU | Eryngium yuccifolium | Button eryngo | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SCSC | Schizachyrium scoparium | Little bluestem | Upper |

Description

Grassland class. Dominated by little bluestem, big bluestem, Indiangrass, and switchgrass. Numerous forbs such as *Helianthus spp*. (*sunflower genus*), prairie clovers (*Petalostemum* spp.), and coneflowers (*Echinacea pallida* and *Ratibida pinnata*), among many others, were present. Shrub and tree species are relatively infrequent and, if present, constitute <10% cover in the area. Fuel complexes consisted of short- or tall-grass prairie forbs and shrubs with little or no tree regeneration.

*Maximum Tree Size Class*  
None

Class B 4 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SCSC | Schizachyrium scoparium | Little bluestem | Lower |
| ROSE2 | Rosa setigera | Climbing rose | Middle |
| SAHU2 | Salix humilis | Prairie willow | Upper |
| RHUS | Rhus | Sumac | Upper |

Description

This class represents a shrubby prairie. Grass and forb species remain the same as in class A. Shrub species include climbing rose (*Rosa setigera*), prairie rose (*Rosa caroliniana*), leadplant (*Amorpha canescens*), Prairie willow (*Salix humilis*), smooth sumac (*Rhus glabra*), winged sumac *(Rhus copalina*), rough dogwood (*Cornus drummondii*), persimmon (*Diospyros virginiana*), eastern redcedar (*Juniperus virginiana*), oak saplings (*Quercus* spp.), and Eggert's Sunflower (*Helianthus eggertii*). The fuel model in this class starts at a 3; however, with increased leaf litter and canopy closure, the fuel model moves to a 2. In some areas eastern redcedar (*Junipeurs virginiana*) become dominant. These areas can act much like a fuel model 7 if the cedars become engaged in a crown fire. Mixed fires (every 3yrs) and surface fires (every 20yrs) maintain the class.

*Maximum Tree Size Class*  
None

Class C 20 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUST | Quercus stellata | Post oak | Upper |
| QUMA3 | Quercus marilandica | Blackjack oak | Upper |
| QUFA | Quercus falcata | Southern red oak | Upper |
| SCSC | Schizachyrium scoparium | Little bluestem | Lower |

Description

This class is often dominted by post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), and Southern red oak (*Quercus falcata*) with little bluestem (*Schizachyrium scoparium*), white ash (*Fraxiunus americana*), persimmon, shingle oak (*Quercus imbricaria*), winged elm (*Ulmus alata*), black oak (*Quercus velutina*), eastern redcedar (*Juniperus virginiana*), and redbud (*Cercis candadensis*). Trees in this class will range from 3-20m tall. The oak trees especially will increase in DBH in the open instead of increasing in height.

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

Class D 4 Late Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUST | Quercus stellata | Post oak | Upper |
| FAGR | Fagus grandifolia | American beech | None |

Description

In the absence of fire, this forest will become dominated by white oak (*Quercus alba*), post oak (*Quercus stellata*), and more mesic species such as beech (*Fagus gradifolia*). In the early stages of this class, the vegetation is composed of a thick stand of saplings, which will thin and become more open under the canopy with time. As this forest matures, it becomes increasingly difficult for fire to carry and return stands to an open canopy condition.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 3 |
| Mid1:CLS | 4 | Late1:OPN | 19 |
| Late1:OPN | 20 | Late1:OPN | 999 |
| Late2:CLS | 20 | Late2: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** |
| Native Grazing | Early1:ALL | Early1:ALL | 0.17 | 6 | No | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.95 | 1 | Yes | 0 |
| Alternative Succession | Mid1:CLS | Late2:CLS | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.05 | 20 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.333 | 3 | No | 0 |
| Alternative Succession | Late1:OPN | Late2:CLS | 1 | 1 | Yes | 20 |
| Wind or Weather or Stress | Late1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:OPN | Mid1:CLS | 0.01 | 100 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.2 | 5 | No | 0 |
| Replacement Fire | Late2:CLS | Mid1:CLS | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late2:CLS | Late1:OPN | 0.015 | 67 | Yes | 0 |
| Surface Fire | Late2:CLS | Late2:CLS | 0.1 | 10 | No | 0 |

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