13750

Eastern Serpentine Woodland

BpS Model/Description Version: Aug. 2020

Update: 4/19/2018

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Colleen Ryan | colleenryan@post.harvard.edu | None | None |
| None | None | None | None |
| None | None | None | None |

Vegetation Type

Forest and Woodland

Map Zones

60

Geographic Range

From NatureServe (2007): This system is widely scattered throughout the southern and central Appalachians and Piedmont, from Pennsylvania to North Carolina.

Biophysical Site Description

This system occurs in a variety of topographic settings, perhaps excluding only alluvial sites. The bedrock is serpentinite, dunite, or other ultramafic rocks. The soil has unusual and extreme chemical composition that includes strongly skewed calcium-to-magnesium ratios and often high levels of heavy metals such as chromium. Owing to a high level of toxic metals and a deficiency in nutrients, serpentine outcrops are ecologically unique and provide habitat for many plant species that grow nowhere else. The soil may be shallow and rocky, or deep, and is usually very clayey. Seepage may be present locally. (NatureServe (2007)

Vegetation Description

Vegetation is generally an open woodland of pines or xerophytic hardwoods. The dominant vegetation is more xerophytic and more open than the topographic setting, soil moisture, and climate would suggest, and contrasts strongly with adjacent vegetation on other kinds of rock. *Pinus rigida* and *Pinus virginiana* are frequent canopy dominants, but *Quercus marilandica, Quercus alba*, and *Quercus stellata* dominate some examples. There is generally not a well-developed understory. Shrubs may be sparse to dense. The herb layer is usually dense; grasses, including prairie elements such as *Schizachyrium scoparium, Andropogon gerardii*, and/or *Sorghastrum nutans*, usually dominate, but a number of forbs may be present. In the northern portion of this system's range in Pennsylvania and Maryland, *Phlox subulata* and the endemic *Symphyotrichum depauperatum* are characteristic; in the southern Appalachian portion of its range, *Packera plattensis, Hexastylis arifolia* var. *ruthii*, and *Thalictrum macrostylum* are characteristic. Often, paradoxical mixtures of xerophytic and mesophytic species are present, though the overall plant composition is characteristic of a drier setting. Disjunct species from drier regions and some endemic plant taxa are often present. (NatureServe 2007)

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUAL | *Quercus alba* | White oak |
| PIRI | *Pinus rigida* | Pitch pine |
| PIVI2 | *Pinus virginiana* | Virginia pine |
| ANGE | *Andropogon gerardii* | Big bluestem |
| QUMA3 | *Quercus marilandica* | Blackjack oak |
| SCSC | *Schizachyrium scoparium* | Little bluestem |
| SONU2 | *Sorghastrum nutans* | Indiangrass |

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

Disturbance Description

Although the unique soil chemistry is the crucial determining factor for this system, fire is generally a crucial process influencing species composition and vegetation structure. Without fire, vegetation can sometimes become dense enough to suppress or eliminate the distinctive herbaceous layer, as well as turning a distinctive savanna or woodland structure into dense forest. Southern pine beetles are an important factor in examples dominated by pines. (NatureServe 2007)

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 88 | 5 |  |  |
| Moderate (Mixed) | 57 | 8 |  |  |
| Low (Surface) | 5 | 87 |  |  |
| All Fires | 5 | 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

Small- to large-patch system, most examples covering a few dozen acres at most. The largest, in Maryland, is 2000ac. Most examples naturally cover a few to perhaps several dozen acres. A few in Pennsylvania and Maryland are 100-200ac, with one Maryland site covering 2000ac. (NatureServe 2007)

Adjacency or Identification Concerns

May be bordered by any other system appropriate for the region, often with abrupt boundaries at geologic contacts. Ultramafic rocks are often associated with mafic rocks such as amphibolite, so systems with basic soils are likely to be associated. (NatureServe 2007)

Issues or Problems

Native Uncharacteristic Conditions

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

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 4 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Middle |
| SCSC | Schizachyrium scoparium | Little bluestem | Middle |
| SONU2 | Sorghastrum nutans | Indiangrass | Middle |
| PIRI | Pinus rigida | Pitch pine | Upper |

Description

Open vegetation of grasses, forbs, shrubby oaks and/or pine seedlings. A replacement fire (~5yr probability) would maintain the system in this class.

Upper Layer Lifeform is not the dominant lifeform. Herbs and forbs (0-1m tall) may be dominant, with up to 100% canopy cover.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5"DBH

Class B 8 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIRI | Pinus rigida | Pitch pine | Upper |
| QUST | Quercus stellata | Post oak | Low-Mid |
| QUMA3 | Quercus marilandica | Blackjack oak | Low-Mid |

Description

Pine woodland, as described in Arabas (2000). Overstory is dominated by pitch pine (canopy closure 20-85%), with xeric oaks in the understory. Most (>75%) of the trees are <14cm DBH.

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

Class C 52 Mid Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIRI | Pinus rigida | Pitch pine | Upper |
| SCSC | Schizachyrium scoparium | Little bluestem | Low-Mid |
| ANGE | Andropogon gerardii | Big bluestem | Low-Mid |

Description

Pine savanna/grassland, as described in Arabas (2000). Overstory is dominated by pitch pine (canopy closure 0-40%), with a dense (75-100% canopy closure) understory dominated by grasses and forbs. Most (90%) of the trees are <14cm DBH.

Upper Layer Lifeform is not the dominant lifeform. Herb layer (<1m tall) has 75-100% canopy cover.

*Maximum Tree Size Class*  
Large 21-33"DBH

Class D 33 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIRI | Pinus rigida | Pitch pine | Mid-Upper |
| QUST | Quercus stellata | Post oak | Middle |
| QUMA3 | Quercus marilandica | Blackjack oak | Middle |
| PRSE2 | Prunus serotina | Black cherry | Middle |

Description

Oak-pine woodland, as described in Arabas (2000). Overstory composed of >50% pitch pine with DBH >14cm DBH and >35% xeric oaks and black cherry.

*Maximum Tree Size Class*  
Large 21-33"DBH

Class E 3 Late Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Mid-Upper |
| QUVE | Quercus velutina | Black oak | Mid-Upper |
| ACRU | Acer rubrum | Red maple | Middle |
| PRSE2 | Prunus serotina | Black cherry | Middle |

Description

Hardwood forest, as described in Arabas (2000). Overstory dominated by mature deciduous trees.

*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 | 5 |
| Mid1:OPN | 6 | Late1:OPN | 40 |
| Mid2:OPN | 6 | Late1:OPN | 40 |
| Late1:OPN | 41 | Late1:OPN | 999 |
| Late2:CLS | 51 | 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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.2 | 5 | Yes | 0 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid2:OPN | 0.01 | 100 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid2:OPN | 0.2 | 5 | Yes | 0 |
| Alternative Succession | Mid2:OPN | Mid1:OPN | 1 | 1 | Yes | 15 |
| Wind or Weather or Stress | Mid2:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Mid2:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Mixed Fire | Mid2:OPN | Mid1:OPN | 0.02 | 50 | Yes | 0 |
| Surface Fire | Mid2:OPN | Mid2:OPN | 0.2 | 5 | No | 0 |
| Alternative Succession | Late1:OPN | Late2:CLS | 1 | 1 | Yes | 50 |
| Wind or Weather or Stress | Late1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Late1:OPN | Mid2:OPN | 0.02 | 50 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.2 | 5 | No | 0 |
| Replacement Fire | Late2:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Surface Fire | Late2:CLS | Late2:CLS | 0.002 | 500 | No | 0 |
| Wind or Weather or Stress | Late2:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

References

Arabas, K.B. 2000. Spatial and temporal relationships among fire frequency, vegetation, and soil depth in an eastern North American serpentine barren. Journal of the Torrey Botanical Society 127:51-65.

Brooks, R. R. 1987. Serpentine and its vegetation: A multidisciplinary approach. Volume 1. Dioscorides Press, Hong Kong. 454 pp.

Harshberger, J. W. 1903. The flora of serpentine barrens of southeastern Pennsylvania. Bulletin of the Torrey Botanical Club 18:339-343.

Latham, R. 1993. The serpentine barrens of temperate eastern North America: Critical issues in the management of rare species and communities. Bartonia (supplement) 57:61-74.

Mansberg, L. and T. R. Wentworth. 1984. Vegetation and soils of a serpentine barren in western NC. Bulletin of the Torrey Botanical Club 111:273-286.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 08 June 2007.

Pennell, F. W. 1910. Flora of the Conowingo Barrens of southeastern Pennsylvania. Academy of Natural Science Philadelphia 62:541-584.

Pennell, F. W. 1912. Further notes on the flora of the Conowingo serpentine barrens of southeastern Pennsylvania. Proceedings of the Academy of Natural Science Philadelphia 64:520-539.

Pennell, F. W. 1929. On some critical species of the serpentine barrens. Bartonia 12:1-23.

Radford, A. E. 1948. The vascular flora of the olivine deposits of NC and Georgia. Journal of the Elisha Mitchell Scientific Society 64:45-106.

Wherry, E. T. 1963. Some Pennsylvania barrens and their flora. I. Serpentine. Bartonia 33:7-11.