13400

Appalachian Shale Barrens

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Vegetation Type

Forest and Woodland

Map Zones

61

Geographic Range

This system is found in the Ridge and Valley from southern Pennsylvania and Maryland south to West Virginia and Virginia, map zone (MZ) 61. A few isolated occurrences are known from the metashales on the western toeslopes of the Blue Ridge in southwest Virginia and eastern Tennessee (MZ57), although application of this concept south of Virginia is uncertain. It is not attributed to Kentucky. These small-patch communities are considered endemic to western Virginia, eastern West Virginia, west-central Maryland, and south-central Pennsylvania; entirely within the Central Appalachian forest (#59) ecoregion as delineated by The Nature Conservancy.

Biophysical Site Description

This system encompasses the distinctive shale barrens of the north/central Appalachians at low to mid elevations where they are typically found on Devonian-aged shales. The aspect exposure and lack of soil create extreme conditions for plant growth. 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 support a high number of endemic plant species. This system is found at low to mid elevations in the north/central Appalachians. Most shale barrens occur between 305-610m (1000-2000ft) elevation and have a generally southern exposure. Slopes are steep and often undercut by a stream at the base. Soils are thin, with a layer weathered rock fragments covering the surface. The exposure and lack of soil create extreme conditions for plant growth. The steep, xeric slopes and friable nature of the shale create poorly vegetated hillsides of bare bedrock and loose channery visible from afar. 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. In Virginia, they occur at elevations from 300 to 850m (1,000 to 2,600ft). Habitats generally occur on steep (~ 30 degree) slopes with south to west aspects.

Vegetation Description

Vegetation is mostly classified as woodland but typically includes large open areas of sparse to no vegetation. Dominant trees are primarily open grown, stunted (10-15m tall) *Quercus montana* (= *Q. prinus),* *Pinus virginiana,* and *Carya glabra*.

Occurrences on higher-pH shales support trees such as *Juniperus virginiana* and *Fraxinus americana* along with the shrub *Rhus aromatica*. Shale barrens are strongly characterized by their open physiognomy and by a suite of uncommon and rare plants found almost exclusively in this habitat. Less common, densely graminoid-dominated variants occurring on steep spur ridge crests and mountain summits are sometimes referred to as “shale ridge balds.” Grasses and sedges common to most barrens include *Danthonia spicata, Schizachyrium scoparium, Carex pensylvanica,* and *Deschampsia flexuosa* var. *flexuosa*. Despite its xerophytic character, shale barrens can have a relatively high species richness (mean = 42 taxa / 100 m²; = 49 taxa / 400 m²).

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. 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 shale barrens in Virginia 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 boneset (*Brickellia eupatorioides* var. *eupatorioides*), hairy woodmint (*Blephilia ciliata*), and western wallflower (*Erysimum capitatum* var. *capitatum* in Bath and Alleghany Counties).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ARABI2 | *Arabis* | Rockcress |
| CLAL | *Clematis albicoma* | Whitehair leather flower |
| CLVI8 | *Clematis viticaulis* | Millboro leather flower |
| ERAL5 | *Eriogonum allenii* | Shalebarren buckwheat |
| QUPR2 | *Quercus prinus* | Chestnut oak |
| PIVI2 | *Pinus virginiana* | Virginia pine |
| JUVI | *Juniperus virginiana* | Eastern redcedar |
| FRAM2 | *Fraxinus americana* | White ash |

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

Disturbance Description

Continual undercutting of thick but relatively weak shale strata by streams maintain most shale barrens. Instability is the result of ongoing incision of thick but relatively weak shale strata by small to large streams, and continual mass wasting of the exposed substrates. Both the south to west aspects and shedding of rainwater by surficial shale fragments contribute to a xeric moisture regime with high summer soil temperatures and evaporation rates. Other natural disturbances are largely unimportant. The absence or sparseness of fuel makes fire relatively unimportant on the barrens themselves but is likely important in maintaining the adjacent pine and pine-oak dominated woodlands and limiting their encroachment along the barren-woodland edge. Likewise the “shale ridge bald” is maintained by edaphic conditions, but fire is likely important in limiting tree and shrub encroachment.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement |  |  |  |  |
| Moderate (Mixed) | 1022 | 100 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 1022 | 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

Shale barrens are considered small-patch communities. Sizes range from <1ac acre to 250ac+. Most are in the 5-75ac range. Many barrens occur in complexes with the steepest and most exposed south to west facing spur-ridges supporting shale barrens and these are surrounded by dry to xeric pine and pine-oak woodlands.

Adjacency or Identification Concerns

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. "Central Appalachian Shale Barrens" (sensu VDNH) are the "core" concept. The southern range limit is considered to be north of the New River in the Ridge and Valley of Virginia. The bluestone shale barrens of West Virginia are placed in this system even though many of the endemic plants are not present there; the same is true at the northern periphery of this system in Pennsylvania, as well as the barrens found on the metashales of the western Blue Ridge south of the James River in Virginia to eastern Tennessee.

Issues or Problems

Native Uncharacteristic Conditions

Comments

Copenheaver et al. (2009) note the potential of these types to convert to tree dominated with lack of fire.

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 | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | 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 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | UN | UN | C | C | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 25-50 | UN | UN | UN | UN | UN | UN | UN | 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 61 Early Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CAPE6 | Carex pensylvanica | Pennsylvania sedge | Lower |
| DASP2 | Danthonia spicata | Poverty oatgrass | Lower |
| SCHIZ4 | Schizachyrium | Little bluestem | Lower |
| ERAL5 | Eriogonum allenii | Shalebarren buckwheat | Lower |

Description

Bare ground to sparsely vegetated with herbs, lasting several decades. These are self-sustaining communities limited by resources. The only disturbance is shale sloughing. There is a constant movement of the surface layer, with a major event happening infrequently.

*Maximum Tree Size Class*  
None

Class B 25 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CAPE6 | Carex pensylvanica | Pennsylvania sedge | Lower |
| DASP2 | Danthonia spicata | Poverty oatgrass | Lower |
| JUVI | Juniperus virginiana | Eastern redcedar | Upper |
| RHAR4 | Rhus aromatica | Fragrant sumac | Upper |

Description

Herb layer is increasing in density, with a few seedlings of trees (*Juniperus*) and/or shrubs (*Rhus*). *Quercus* spp. and Virginia and Pitch pine may be present. These are self-sustaining communities limited by edaphic site conditions. The only disturbance is sloughing which results in Class A.

Upper Layer Lifeform is not the dominant lifeform. Scattered trees among shrubs, but dominated by herbaceous species.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class C 14 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUPR2 | Quercus prinus | Chestnut oak | Upper |
| PIVI2 | Pinus virginiana | Virginia pine | Upper |
| JUVI | Juniperus virginiana | Eastern redcedar | Upper |
| CAGL8 | Carya glabra | Pignut hickory | Upper |

Description

Still predominantly an herbaceous system, but a few woody stems are encroaching if no sloughing has occurred. Fuel can accumulate over time to create islands of fuel which can carry fire around the barren edge and spotting into the barrens - Mixed Fire to Class B. Surface fires would be nonexistent because of a lack of fuel. Sloughing will occur on average over several decades and move areas to Class A. Herbaceous layer is still prevalent as tree crown closure is low.

Upper Layer Lifeform is not the dominant lifeform. Herbaceous layer is dominant in terms of biomass

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

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:OPN | 0 | Mid1:OPN | 50 |
| Mid1:OPN | 51 | Late1:OPN | 100 |
| Late1:OPN | 101 | Late1:OPN | 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** |
| Optional 1 | Early1:OPN | Early1:OPN | 0.02 | 50 | Yes | 0 |
| Optional 1 | Mid1:OPN | Early1:OPN | 0.02 | 50 | Yes | 0 |
| Mixed Fire | Late1:OPN | Mid1:OPN | 0.0067 | 149 | Yes | 0 |
| Optional 1 | Late1:OPN | Early1:OPN | 0.0133 | 75 | Yes | 0 |

Optional Disturbances

Optional 1: sloughing

References

Copenheaver, C.A., Predmore, S.A. and Askamit, D.N., 2009. Conversion of Rare Grassy Openings to Forest: Have These Areas Lost Their Conservation Value? Natural Areas Journal, 29(2), pp.133-139.