14140

Southern Appalachian Grass and Shrub Bald

BpS Model/Description Version: Aug. 2020

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|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |
| None | None | None | None |

Vegetation Type

Herbaceous

Map Zones

57

Geographic Range

On high Southern Appalachian Mountains, from 4600-6100ft (1415-1875m) elevation, with most examples from 5200-5800ft (1600-1780m) elevation (Mark 1958).

Biophysical Site Description

Heath balds could be mapped separately from grassy balds following the approach used in White et. al. (2001), "The distribution of heath balds in the Great Smoky Mountains." The distribution and classification of grassy balds (by presumed origin) is best documented in P. Gersmehl (1970): "A geographic approach to a vegetation problem: The case of the southern Appalachian grassy balds." Many of the current and historic balds are known to have been created by white settlers for high elevation pasture. These are not the subject of this Vegetation Dynamics Development Tool (VDDT) model, which is intended to model the presettlement landscape.

Vegetation Description

This ecological system consists of dense herbaceous and shrubland communities in the highest elevational zone of the southern Appalachians, generally above 1524m (5000ft) but occasionally to 1220m (4000ft), 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, 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). (NatureServe 2007).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| DACO | *Danthonia compressa* | Flattened oatgrass |
| RHCA8 | *Rhododendron catawbiense* | Catawba rosebay |
| CRATA | *Crataegus* | Hawthorn |
| RUBUS | *Rubus* | Blackberry |
| PIRU | *Picea rubens* | Red spruce |
| QURU | *Quercus rubra* | Northern red oak |

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

Disturbance Description

Sites may be disturbed by grazing, wind/weather and fire. Native grazing in the presettlement landscape was replaced by grazing of domesticated livestock by white settlers. Fire in grass balds can destabilize a persistent herbaceous cover by opening up the duff or thatch under the grass or sedge mat and promoting germination of woody plant seeds (Chris Ulrey, personal communication). In this sense, the role of fire in the grass bald may be the opposite of what is typical in fire disturbed ecosystems.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 278 | 55 |  |  |
| Moderate (Mixed) | 339 | 45 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 153 | 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

On Roan Mountain balds over 200ha. Elsewhere balds are much smaller, 1-8ha in the Great Smoky Mountains National Park (White and Sutter, 1999).

Adjacency or Identification Concerns

Adjacent to high elevation red oak, northern hardwoods, beech gap or spruce fir forest.

Heath balds are abruptly bounded by much taller forests and thus are easily mapped.

Issues or Problems

Both grass balds occur on less than one percent of the sites suitable for them (White and Sutter, 1999) and heath balds occur on 4-9% of the sites suitable for them (White, Wilds & Stratton, 2001). Forests occur on most of these sites. The model approaches these numbers, but does not achieve the low percents from the literature. This should be taken into account in applying the VDDT model to the mapped distribution of BpS 1414.

Native Uncharacteristic Conditions

Grassy balds which have been open and historically and perhaps prehistorically grass (*Danthonia compressa*) or sedge (*Carex* spp.) dominated are becoming shrubby and then forested in the absence of grazing, especially since the 1930s. High atmospheric nitrogen deposition (from pollution) may also be influencing the vegetation dynamics of balds (Weiss 1999, Stevens et al. 2004, and Nodvin et al. 1995). This Nitrogen deposition is about the highest found in the United States. Nitrogen deposition, especially in combination with higher atmospheric CO2 concentrations and warmer winter temperatures may be driving a more rapid transition from the grassy balds (Class A) to the shrubby open condition (Class C) and from shrubby open to late development open (Class D) (Sturm et al. 2005). The productivity of many ecosystems is Nitrogen limited, so the extended growing season and warmer temperatures associated with climate warming and the potential productivity gains from higher atmospheric CO2 availability are Nitrogen limited. In these high elevation systems, however the Nitrogen deposition may be facilitating higher productivity, which in the absence of grazing, speeds the transition from grassy to woody plant dominance. This may explain why the vegetation dynamics today is different from the modeled dynamics in pre-settlement times.

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 | C | C | C | C | C | C | B | B | B | B |
| Shrub | 0.5-1.0 | C | C | C | C | C | C | B | B | B | B |
| Shrub | 1.0-3.0 | C | C | C | C | C | C | B | B | B | B |
| Shrub | >3.0 | C | C | C | C | C | C | B | B | B | B |
| Tree | 0-5 | C | C | C | C | C | C | B | B | B | B |
| Tree | 5-10 | D | D | D | D | D | D | E | E | E | E |
| Tree | 10-25 | D | D | D | D | D | D | E | E | E | E |
| Tree | 25-50 | D | D | D | D | D | D | E | E | E | E |
| Tree | >50 | D | D | D | D | D | D | E | E | 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 6 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| DACO | Danthonia compressa | Flattened oatgrass | Lower |
| CAREX | Carex | Sedge | Lower |

Description

This is the grass bald. Vegetation is herbaceous graminoid, predominantly native grasses and sedges (*Carex* spp.). The graminoid vegetation is thick and there is a significant thatch or duff layer of grass between the actively growing green leaves and the soil surface. This thick dominance of grasses and sedges provides a competitive advantage to the graminoids, and limits the ability for woody plant seeds to germinate.

Grazing has kept these sites open in the period from European settlement until the first half of the 20th century when land managing agencies acquired lands and grazing ceased. Since that time shrubs and then trees have encroached into the grassy balds, with the loss of grassy balds due to the invasion by shrubs and trees at about 1-2%/year (Lindsay & Bratton 1980). There is little evidence of charcoal in the soil; fire is difficult to ignite in the moist environment and the effect of fire has not enhanced an open grassy condition in several management trials (Barden 1978, Lindsay & Bratton 1979, Murdock 1986, White & Sutter 1999). Association of grassy balds with Native American use or the grazing of native large herbivores (Elk, Woodland Bison, and even Pleistocene megafauna) is a common factor in the explanation of the persistence of grassy balds in the pre-settlement landscape (Wells 1936, Wells 1937, Wiegl & Knowles 1999). This is incorporated into the VDDT model as lack of grazing (alternative succession) leading to class C.

Another factor in the distribution of the grassy balds is the association with high elevation springs (Wells 1936, Wells 1937) which could have attracted native grazers and native Americans, and were certainly an important factor in the selection of sites for livestock grazing by white settlers.

*Maximum Tree Size Class*  
None

Class B 12 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| RHCA8 | Rhododendron catawbiense | Catawba rosebay | Middle |
| RHMA4 | Rhododendron maximum | Great laurel | Middle |
| RHMI2 | Rhododendron minus | Piedmont rhododendron | Middle |
| KALA | Kalmia latifolia | Mountain laurel | Middle |

Description

Heath bald, dominated by heath shrubs. Heath balds occur on 4-9% of the sites suitable for them (White, Wilds & Stratton 2001). These sites tend to have some fire influence, and are found on ridges and may have scattered trees. Some sites were logged in the first half of the 20th century, then burned in intense logging slash fires. In the absence of any disturbance for an extended period, these balds may transition to other classes.

According to White, Wilds and Stratton (2001), "Heath balds are distinctive in structure and composition: they have a 1-2m tall evergreen canopy, deep leaf litter, very acidic A-horizons (Cain 1931), low species richness, and a mostly woody flora (ca. 15 woody species, 12 of which are in Ericaceae, and five herbaceous species; P. White unpublished). Dominants include *Rhododendron maximum, R. catawbiense, R. minus, Kalmia latifolia*, and *Leiophyllum buxifolium*. Heath balds are abruptly bounded by much taller forests and thus are easily mapped. Comparison of selected heath balds on 1930s and 1980s aerial photographs showed no changes in area (P. White unpublished); past studies have also treated these communities as stable (Whittaker 1956; Cain 1930b). There are almost no tree seedlings established in heath balds because of the dense evergreen canopy and the thick, acidic leaf litter. Productivity in heath balds is low (Whittaker 1961, 1962)."

Heath balds are distinctive in structure and composition in that they have a 1-2m tall evergreen canopy.

*Maximum Tree Size Class*  
None

Class C 8 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CRATA | Crataegus | Hawthorn | Middle |
| RUBUS | Rubus | Blackberry | Middle |
| SOAM3 | Sorbus americana | American mountain ash | Middle |
| DACO | Danthonia compressa | Flattened oatgrass | Lower |

Description

Shrub bald or grassy bald encroached with shrubs. Shrubs and then trees have encroached into the grassy balds, the loss due to invasion by shrubs and trees ~1-2%/year (Lindsay & Bratton 1980, Lindsay & Bratton 1979). *Alnus viridis* ssp. *crispa* represents a special case shrubland on Roan Mountain only, this class C is designed to cover the shrubs invading grassy balds at a variety of sites and might not work well for the *Alnus viridis* ssp. *crispa* shrubland found on Roan Mountain.

*Maximum Tree Size Class*  
None

Class D 8 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QURU | Quercus rubra | Northern red oak | Upper |
| FAGR | Fagus grandifolia | American beech | Upper |
| PIRU | Picea rubens | Red spruce | Upper |
| DACO | Danthonia compressa | Flattened oatgrass | Lower |

Description

Open forest with a grassy understory along ridges or especially near trails on ridges (Wells, 1936). This vegetation is documented from the 1930s along the edges of grassy balds and trails near grassy balds (Wells 1936, Lindsay & Bratton 1979). Without grazing, closed forests have developed on these sites (see figure 9a [class D] and Figure 9b in Lindsay & Bratton 1979); this has been applied in the Vegetation Dynamics Development Tool (VDDT) model as a lack of grazing (alternative succession). Option1, human clearing, was used to show the activities of Native Americans to use firewood for fuel at summer camps and to open areas to attract large game and improve hunting opportunities.

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

Class E 66 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIRU | Picea rubens | Red spruce | Upper |
| ABFR | Abies fraseri | Fraser fir | Upper |
| QURU | Quercus rubra | Northern red oak | Mid-Upper |

Description

This closed forest is the dominant vegetation covering most of the land area in this model. The actual balds are sort of an anomaly in an otherwise forested landscape. Disturbances are infrequent. Option1, human clearing, was used to show the activities of Native Americans to use firewood for fuel at summer camps and to open areas to attract large game. Also fire and wind is a factor in opening up these forests (Ramseur 1976).

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

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Early1:ALL | 999 |
| Mid1:OPN | 1 | Late1:OPN | 20 |
| Mid1:CLS | 21 | Mid1:CLS | 999 |
| Late1:OPN | 21 | Late1:OPN | 999 |
| Late1:CLS | 21 | 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** |
| Replacement Fire | Early1:ALL | Mid1:OPN | 0.007 | 143 | Yes | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.02 | 50 | No | 0 |
| Alternative Succession | Early1:ALL | Mid1:OPN | 0.03 | 33 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.005 | 200 | No | 0 |
| Replacement Fire | Mid1:OPN | Mid1:OPN | 0.008 | 125 | No | 0 |
| Native Grazing | Mid1:OPN | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Alternative Succession | Mid1:CLS | Late1:OPN | 0.004 | 250 | Yes | 0 |
| Alternative Succession | Mid1:CLS | Late1:CLS | 0.004 | 250 | Yes | 0 |
| Native Grazing | Mid1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.005 | 200 | No | 0 |
| Replacement Fire | Mid1:CLS | Mid1:CLS | 0.008 | 125 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:CLS | 0.02 | 50 | No | 0 |
| Replacement Fire | Late1:OPN | Mid1:CLS | 0.003 | 333 | Yes | 0 |
| Optional 1 | Late1:OPN | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.007 | 143 | No | 0 |
| Native Grazing | Late1:OPN | Late1:OPN | 0.02 | 50 | No | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.06 | 17 | Yes | 0 |
| Replacement Fire | Late1:CLS | Mid1:CLS | 0.002 | 500 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Optional 1 | Late1:CLS | Mid1:OPN | 0.004 | 250 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:CLS | 0.05 | 20 | No | 0 |

Optional Disturbances

Optional 1: Clearing by Native Americans

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