

13970

Nashville Basin Limestone Glade and Woodland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
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None	None	None	None

Vegetation Type

Steppe/Savanna

Map Zone

48

Geographic Range

This system is restricted to flat areas of Ordovician limestone in the Inner Nashville Basin of Tennessee, as well as limited and disjunct examples on flat limestones in Tennessee and Kentucky.

Biophysical Site Description

This system occurs on flat areas of Ordovician limestone in the Inner Nashville Basin of Tennessee (Ecoregion 71i of Griffith et al. (1998), EPA (2004); Subsection 222Ed of Keys et al. (1995), as well as a few disjunct occurrences in Kentucky. It encompasses a range of plant communities, including sparsely vegetated rock outcrops, annual *Sporobolus* spp.-dominated grasslands, *Schizachyrium scoparium*-dominated perennial grasslands, seasonally wet herbaceous washes and seeps, shrublands, as well as woodlands dominated by oaks (*Quercus stellata*, *Quercus muehlenbergii*) and *Juniperus virginiana*. The distribution and abundance of some of these vegetation types is primarily controlled by soil depth. Others (e.g. areas or zones dominated by perennial grasses and/or shrubs) are more subject to vagaries of disturbance and management. The thin soils often dry out during the summer and autumn, and then become saturated during the winter and spring.

Vegetation Description

The vegetation of this system includes sparsely vegetated rock outcrops, annual *Sporobolus* spp.-dominated grasslands, *Schizachyrium scoparium*-dominated perennial grasslands, seasonally wet herbaceous washes and seeps, shrublands, as well as woodlands dominated by *Juniperus virginiana* and oaks such as post oak (*Quercus stellata*) and chinquapin oak (*Quercus muehlenbergii*). In areas of shallower soils, the trees may occur as islands in a wider herbaceous-dominated or rocky area. The islands are found in microenvironments where the soil depth and available water are sufficient to support trees (e.g. cracks in the bedrock). Other woody plants associated with this system include, redbud (*Cercis canadensis*), winged elm (*Ulmus alata*), blue ash (*Fraxinus quadrangulata*). Characteristic shrubs include glade-privet (*Forestiera ligustrina*), fragrant sumac (*Rhus aromatica*), shrubby St. Johns-wort (*Hypericum frondosum*), and Carolina buckthorn (*Frangula caroliniana*). Other herbaceous taxa include big bluestem (*Andropogon gerardii*), sideoats grama (*Bouteloua curtipendula*), whorled rosinweed (*Silphium trifoliatum*), *Helianthus mollis*, *Grindelia lanceolata*, blazing-stars (*Liatris* spp.), diamond flowers (*Hedyotis*

nigricans), *Croton capitatus*, *Heliotropium tenellum*, false-pennyroyal (*Isanthus brachiatus*), Eastern Agave (*Manfreda virginica*), low wild-petunia (*Ruellia humilis*), limestone fameflower (*Talinum calcaricum*), widow's-cross (*Sedum pulchellum*), and wiry panicgrass (*Panicum flexile*). Tennessee coneflower (*Echinacea tennesseensis*) and Pyne's groundplum (*Astragalus bibullatus*) are completely endemic to this system. There are numerous other disjunct and near-endemic plants, including Tennessee milkvetch (*Astragalus tennesseensis*), Gattinger's prairie-clover (*Dalea gattingeri*), and Nashville Breadroot (*Pediomelum subacaule*) (Somers et al. 1986). Small-scale seepage areas and washes may contain split spikerush (*Eleocharis bifida*), Sunbells (*Nothoscordum bivalve*), Leafy prairie-clover (*Dalea foliosa*), *Isoetes butleri*, and Yellow star-grass (*Hypoxis hirsuta*). The reviewer also suggested that we add the following species: Scarlet Oak, White Ash, Osage Orange, Honey Locust and Hackberry.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
SCSC	<i>Schizachyrium scoparium</i>	Little bluestem
SPVA	<i>Sporobolus vaginiflorus</i>	Poverty dropseed
QUST	<i>Quercus stellata</i>	Post oak
JUVI	<i>Juniperus virginiana</i>	Eastern redcedar
BOCU	<i>Bouteloua curtipendula</i>	Sideoats grama
DAGA	<i>Dalea gattingeri</i>	Purpletassels
QUMU	<i>Quercus muehlenbergii</i>	Chinkapin oak
PESU5	<i>Pediomelum subacaule</i>	Whiterim scurfpea

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

Disturbance Description

Periodic droughts, fire, historic grazing, and ice storms all play a role in the dynamics of the system by restricting woody growth and maintaining the more open glade structure. Historic grazing by wild and domestic ungulate species represented a significant disturbance regime in the past. Regionally significant drought cycles lead to death or decline of *Juniperus*, as well as affecting the severity of other disturbance regimes. Fire carries best in zones or areas dominated by perennial grasses, which provide the most abundant and consistent fuel. This zone is also the most vulnerable to succession, with *Juniperus* and various native (and now exotic) shrubs occupying these areas in periods without disturbance.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	39	9		
Moderate (Mixed)	13	27		
Low (Surface)	5	64		
All Fires	3	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

Within its geographic range (primarily the Inner Nashville Basin of Tennessee (Ecoregion 71i of Griffith et al. 1998, and EPA 2004); Subsection 222Ed of Keys et al. 1995), collective acreage of 10s of 1000s of acres; however, glade complexes occur in patches throughout the range in areas of one to about a thousand acres in size.

Adjacency or Identification Concerns

This physiognomic complex grades into adjacent to dry-mesic oak forests and woodlands on deeper calcareous soils. Identification concerns include over-encroachment of glades by eastern redcedar on adjacent pastures or fields or other lands recovering from disturbance. Some of these may be dominated by exotic sericea (*Lespedeza cuneata*), and this may resemble native glade vegetation on aerial photos.

Issues or Problems

This is a physiognomic complex, including sparsely vegetated rock outcrops, annual *Sporobolus* spp. dominated grasslands, *Schizachyrium scoparium*-dominated perennial grasslands, seasonally wet herbaceous washes and seeps, shrublands, as well as woodlands dominated by oaks (*Quercus stellata*, *Quercus muehlenbergii*) and *Juniperus virginiana*.

Native Uncharacteristic Conditions

Over-encroachment of native redcedar species may occur today, with lack of fire/grazing. Other native and exotic woody species also encroach and increase canopy coverage, modifying fire behavior.

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	B	B	B	B	B	B	B	B	B	B
Shrub	0.5-1.0	B	B	B	B	B	B	B	B	B	B
Shrub	1.0-3.0	B	B	B	B	B	B	B	B	B	B
Shrub	>3.0	B	B	B	B	B	B	B	B	B	B
Tree	0-5	C	C	C	B	B	B	B	B	B	B
Tree	5-10	C	C	C	E	E	E	E	E	E	E
Tree	10-25	D	D	D	E	E	E	E	E	E	E
Tree	25-50	D	D	D	E	E	E	E	E	E	E
Tree	>50	D	D	D	E	E	E	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	34	Early Development 1 - All Structures
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SCSC	Schizachyrium scoparium	Little bluestem	Lower
SPVA	Sporobolus vaginiflorus	Poverty dropseed	Lower
BOCU	Bouteloua curtipendula	Sideoats grama	Lower
DAGA	Dalea gattingeri	Purpletassels	Lower

Description

Dominated by perennial and annual forbs, grasses, and sedges dominate but some oaks or cedars may be taller. The ground vegetation ranges to 1m (3ft) high by midsummer. Scattered stunted trees persist in fissures in the bedrock, increasing in height and frequency on deeper soil. Tree species include oak and redcedar seedlings. Mixed fires, surface fires, and replacement fires maintain this class. Periodic drought cycles also help maintain this class.

Maximum Tree Size Class

Seedling <4.5ft

Class B 6 Mid Development 1 - Closed

Minimum cover would be zero on outcroppings of bedrock, and maximum canopy would be 100%. Shrubs may dominate, with varying-stature redcedar. Height of dominant layer may be up to 2m.

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JUVI	Juniperus virginiana	Eastern redcedar	Upper
SCSC	Schizachyrium scoparium	Little bluestem	Lower
FOLI	Forestiera ligustrina	Upland swampprivet	Low-Mid
QUST	Quercus stellata	Post oak	Upper

Description

Class B biomass is dominated by grasses, forbs, and sedges, but there is a mid-seral closed canopy dominated by eastern redcedar of varying heights with shrubs. Isolated areas rarely affected by fire. Herbaceous layer persists but is overtopped by shrubs. Scattered hardwood saplings occur within shrub layer, and scattered stunted trees occur in the upper canopy.

Maximum Tree Size Class

Pole 5-9" DBH

Class C 18 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
SCSC	Schizachyrium scoparium	Little bluestem	Lower
ANGE	Andropogon gerardii	Big bluestem	Lower
SITE	Silphium terebinthinaceum	Silphium terebinthinaceum	Lower
QUMU	Quercus muehlenbergii	Chinkapin oak	All

Description

Mid-seral open canopy dominated by herbaceous layer of perennial grasses, forbs, and sedges. Shrub component occurs as cedar species and oak sprouts. Low-intensity, frequent fires maintain open structure. Tree species are scattered, but have developed some crown structure. Bedrock outcroppings remain open. Edaphic conditions determine species composition and arrangement. Likely represents greatest diversity among classes. Grazing regime from large ungulates would occur and maintains class. Replacement fires occur, and the lack of fire for causes a state transition.

Maximum Tree Size Class

Medium 9-21"DBH

Class D	41	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUMU	Quercus muehlenbergii	Chinkapin oak	Mid-Upper
QUST	Quercus stellata	Post oak	Mid-Upper
SCSC	Schizachyrium scoparium	Little bluestem	Lower
SPVA	Sporobolus vaginiflorus	Poverty dropseed	Lower

Description

Late-seral open oak dominated canopy with a well-developed herbaceous layer of perennial grasses and forbs. Scattered shrub component occurs as redcedar, oak saplings and resprouts, and other shrubs including glade-privet. Tree species occur as widely-scattered oaks with well-developed crowns. Grazing regime from large ungulates would occur every 5yrs and maintains the class. Mixed and surface fires occur along with periodic droughts maintain the class. Senescence, drought stress, with insects and disease can be a replacement disturbance. The lack of fire can cause closure of the canopy.

Maximum Tree Size Class

Large 21-33"DBH

Class E	1	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JUVI	Juniperus virginiana	Eastern redcedar	All
QUST	Quercus stellata	Post oak	Mid-Upper
QUMU	Quercus muehlenbergii	Chinkapin oak	Mid-Upper
FOLI	Forestiera ligustrina	Upland swampprivet	Low-Mid

Description

Late-seral closed canopy dominated by shrub and tree layer of eastern redcedar. Widely scattered trees occur with stunted canopy growth due to competition of resources. Herbaceous layer largely reduced and extremely scattered. Bedrock layers are heavily encroached and may be completely covered in some areas. Mixed moves may open the stand. Wind/weather/stress events and replacement fires occurs.

Maximum Tree Size Class

Medium 9-21"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	20
Mid1:OPN	21	Late1:OPN	70
Mid1:CLS	21	Late1:CLS	70
Late1:OPN	71	Late1:OPN	999
Late1:CLS	71	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	19
Wind or Weather or Stress	Early1:ALL	Early1:ALL	0.05	20	No	0
Replacement Fire	Early1:ALL	Early1:ALL	0.05	20	Yes	0
Mixed Fire	Early1:ALL	Early1:ALL	0.05	20	No	0
Surface Fire	Early1:ALL	Early1:ALL	0.2	5	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	10
Replacement Fire	Mid1:OPN	Early1:ALL	0.04	25	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Native Grazing	Mid1:OPN	Mid1:OPN	0.15	7	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.2	5	No	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.01	100	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.01667	60	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:CLS	0.05	20	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	30
Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.003	333	Yes	0

Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.05	20	No	0
Mixed Fire	Late1:OPN	Late1:OPN	0.1	10	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.2	5	No	0
Native Grazing	Late1:OPN	Late1:OPN	0.2	5	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.013	77	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.02	50	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.05	20	Yes	0

References

Baskin, J.M. and C.C. Baskin. 1977. An undescribed cedar glade community in middle Tennessee. *Castanea* 42:140-145

Baskin, J.M. and C.C. Baskin. 1986. Distribution and geographical/evolutionary relationships of cedar glade endemics in Southeastern U.S. *ASB Bulletin* 33:138-154

Baskin, J.M. and C.C. Baskin. 1989. Cedar glade endemics in Tennessee and a review of their autecology. *Journal of the Tennessee Academy of Science* 64:63-74

Baskin, J.M. and C.C. Baskin. 1996. Bessey Picklesimer's little-known quantitative study on the vegetation of a cedar glade in the Central Basin of Tennessee. *Castanea* 61:25-37

Baskin, J.M. and C.C. Baskin. 1996. The *Grindelia lanceolata* plant community type in cedar glades of the Central Basin of Tennessee. *Castanea* 61:339-347

Baskin, J.M., E. Quarterman and C. Caudle. 1968. Preliminary checklist of the herbaceous vascular plants of cedar glades. *Journal of the Tennessee Academy of Science* 43:65-71.

Delcourt, H.R., P.A. Delcourt, G.R. Wilkins and E.N. Smith, Jr. 1986. Vegetational history of the cedar glades regions of Tennessee, Kentucky and Missouri during the past 30,000 years. *ASB Bull.* 33:128-137.

Freeman, C. P. 1933. Ecology of cedar glade vegetation near Nashville, TN. *Journal of the Tennessee Academy of Science* 8:143-228.

Harper, R.M. 1926. The cedar glades of middle Tennessee. *Ecology* 7:48-54.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Quarterman, E. 1950. Major plant communities of Tennessee cedar glades. *Ecology* 31:234-254.

Quarterman, E. 1986. Biota, ecology and ecological history of cedar glades. *ASB Bull.* 33:124-126.