

Appendix E. LANDFIRE Biophysical Setting Reference Conditions

441334

Ozark-Ouachita Mesic Hardwood Forest

Model Date: 02/28/07

Report Date: 10/23/07

Modelers		Reviewers	
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Vegetation Type

Forested

Map Zones

44

Geographic Range

This BPS primarily occurs in the Interior Low Plateau, southern Central Lowland, Ozark Plateaus, and Ouachita physiographic provinces. It includes parts of Missouri, Arkansas and Oklahoma.

Biophysical Site Description

This type is found on a wide range of topographic positions, including mixed mesophytic forests, seeps/springs and smaller riparian areas associated with intermittent and/or ephemeral streams. This system is found on primarily north and east facing aspects, toeslopes, small valley bottoms, as well as other protected slopes and ravines along intermittent and/or ephemeral streams. Distribution is influenced by local conditions affecting moisture, aspect, elevation and soil productivity. Closed conditions are multiple canopy usually late-seral forests. These systems are generally small, isolated, and/or disjunct and are generally "embedded" in a larger landscape matrix. These communities are maintained primarily through naturally occurring circumstances such as aspect, elevation, soil moisture conditions, and soil productivity, except for mortality or other disturbance-induced openings or gaps.

Vegetation Description

The vegetation is variable along moisture gradients, but includes (on more mesic sites) generally more fire-intolerant species such as red maple (*Acer rubrum*), sugar maple (*A. saccharum*) and other hardwood components. Mesic sites in mid and late seral stages tend to be closed forest with understories (sometimes more herbaceous than woody). This system is found on primarily north and east facing aspects, toeslopes, small valley bottoms, as well as other protected slopes and ravines along intermittent and/or ephemeral streams. Here, American beech (*Fagus grandifolia*) may be a major tree species with red and white oak (*Quercus alba*), sweetgum (*Liquidambar styraciflua*), American basswood (*Tilia americana*), cucumbertree (*Magnolia acuminata*), or other mesic tree species in upper canopies. In some situations, red, sugar, black (*A. nigrum*) and other maples may be present. Umbrella magnolia (*Magnolia tripetala*), blackgum (*Nyssa sylvatica*), American holly (*Ilex opaca*), grape arbors and woody vines may be

found in the midstory and understory. Vegetation associated primarily with riparian and seep/spring systems include strawberry bush (*Euonymus obovatus*), American hornbeam (*Carpinus caroliniana*), hophornbeam (*Ostrya virginiana*), and herbaceous obligates such as yellow ladyslippers (*Cypripedium pubescens*). American ginseng (*Panax quinquefolius*) may occur within the riparian areas or on benches on the steep mesic north slopes.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
FAGR	<i>Fagus grandifolia</i>	American beech
QURU	<i>Quercus rubra</i>	Northern red oak
ACSA3	<i>Acer saccharum</i>	Sugar maple
ACRU	<i>Acer rubrum</i>	Red maple
QUAL	<i>Quercus alba</i>	White oak
MAAC	<i>Magnolia acuminata</i>	Cucumber-tree

Disturbance Description

This BpS is fire regime group I primarily, but with lower frequency than drier types and primarily low intensity surface fire with occasional mosaic (mixed severity) or replacement fire. Mean fire return interval (MFI) is about 25 years with wide year-to-year and within-type variation related to moisture cycles, degree of sheltering, and proximity to more fire-prone types. Anthropogenic fire is considered and contributes to within-type MFI variation. Drought and moisture cycles play a strong role interacting with fire and insect and disease. Other natural disturbances may include wind and ice.

VDDT Fire Frequency Results

Severity	Avg FI	Min FI	Max FI	Percent of All Fires
Replacement	300	50	300	7
Moderate (Mixed)	125	20	150	16
Low (Surface)	26	5	35	77
All Fires	20			100

Scale Description

Landscape adequate in size to contain natural variation in vegetation and disturbance regime. Topographically complex areas can be relatively small (< 1000 acres). Larger landscapes up to a few thousand acres in size such as Black Fork, Rich, Fourche, Magazine, and Winding Stairs (OK) mountains.

Non-Fire Disturbances

Wind/Weather/Stress

Adjacency or Identification Concerns

This BpS was defined using NatureServe - Ozark-Ouachita Mesic Hardwood Forest (CES202.043), Ozark-Ouachita Seeps/Springs, South-Central Interior Small Stream and Riparian (202.706). Other types adjacent could include CES202.306 Ouachita Montane Oak Forest, and CES202.708 Ozark-Ouachita Dry-Mesic Oak Forest. This system includes the western mesophytic types (R8 Old-Growth Type).

Issues or Problems

Tree Size Class: Medium 9-21"DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
QURU	Quercus rubra	Northern red oak	None

Description

65-80 years. Mature canopy sometimes reaching 100 feet in height. Dominant overstory species variable by location and stand history. More open (near-woodland) conditions dependent on fire frequency and intensity. Generally more oak dominated with white oak a common dominant. Late-seral open occurs occasionally as a result of landscape disturbances that do not result in stand replacement. This openness does not persist, but normally returns to a closed seral stage. Infrequent replacement fires and wind/weather/stress (300 year interval for each) are pathways back to A. Occasional surface fires (FRI = 25 years) maintain D.

Class E 50% Late1 - Closed

Structural Information

Upper Layer Lifeform: Tree
 Upper Layer Canopy Cover: 71 - 100%
 Upper Layer Canopy Height: Tree 10.1m - Tree 25m
 Tree Size Class: Medium 9-21"DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Middle
ACSA3	Acer saccharum	Sugar maple	Low-Mid
FAGR	Fagus grandifolia	American beech	Mid-Upper
MAAC	Magnolia acuminata	Cucumber-tree	False

Description

65-100+ years. Canopy generally more fire-intolerant species with minor amounts of oak species. Multi-canopied stands with tree gaps may include other hardwood species such as maples and American beech with well-developed lower layers containing many of the canopy species often with the vine component. Infrequent replacement fires and wind/weather/stress (300 year interval for each) are pathways back to A. Occasional surface fires (FRI = 25 years) maintain E. Mixed severity fires (FRI = 100 years) are a pathway to late-seral open conditions (D).

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441367

Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland

Model Date: 02/26/07

Report Date: 10/23/07

Modelers		Reviewers	
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Vegetation Type

Forest and Woodland

Map Zones

44

Geographic Range

This Biophysical Setting (BpS) is common in the Interior Highlands. More specifically, it is located in Arkansas, Oklahoma and southern Missouri, within the Ouachita and Boston Mountains, Arkansas River Valley, and the Salem and Springfield Plateaus. It typically occupies dry to dry mesic sites at elevations between 500 and 2500 feet. ECOMAP subsections where this Bps occurs include M231, 231G, M223A, 223A.

Biophysical Site Description

This BpS is found on drier sites primarily on south and west aspects or ridgetops. It is dominated by shortleaf pine (*Pinus echinata*), oaks (*Quercus* spp.), and hickories (*Carya* spp.). Open conditions describe a single canopy structure with no developed midstory. Closed conditions are multiple canopy species usually late-seral forests. Substrate is variable and includes sandstone, chert and shale.

Vegetation Description

Upland woodlands dominated by white oak (*Q. alba*), post oak (*Q. stellata*), red oaks (*Q. velutina* and *Q. rubra*), and shortleaf pine. Dogwood (*Cornus* spp.), small oaks, grasses, and blueberries (*Vaccinium* spp.) dominate the understory. Small, stand replacement fires, oak decline, and wind throw are the major, large-scale, stand replacement agents. The exact composition of the hardwoods is much more closely related to aspect and topographic factors than is the pine component. Historically, in the Missouri Ozarks forest types with a shortleaf pine component within this region included more than about 50 percent of the landscape, about 20 percent scrub forests, and 30 percent in open condition (Batek et al. 1999). On a pre-European landscape basis shortleaf pine was positively associated with fire frequency (Batek et al. 1999) and negatively associated with topographic roughness (Guyette and Kabrick 2003, Guyette et al. 2006). Characteristic herbs include little bluestem (*Schizachyrium scoparium*), longleaf woodoats (*Chasmanthium sessiliflorum*), goldenrod (*Solidago* spp.), beebalm (*Monarda* spp.), pale purple cone flower (*Echinacea pallida*).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIEC2	<i>Pinus echinata</i>	Shortleaf pine

QUST	Quercus stellata	Post oak
QURU	Quercus rubra	Northern red oak
QUVE	Quercus velutina	Black oak
QUMA3	Quercus marilandica	Blackjack oak
QUAL	Quercus alba	White oak

Disturbance Description

Fire is the primary disturbance process in this type. The fire regime is group 1, with high frequency low intensity surface fires averaging every 5 years. Replacement fires are infrequent, every 100 to 150 years. Mixed fire is very infrequent in open canopy conditions, but occurs more frequently in closed canopy (every 80 years in closed states). Seasonality helps define surface, mixed fire and stand replacement fire types. Mixed fires are slightly more frequent in closed late-seral stages. Stand replacement fires occurred mostly under drought conditions during the growing season. Late growing season fires under normal moisture conditions were for the most part surface fires. Historically, anthropogenic fire contributed significantly to all fire occurrences. Additional disturbance factors include wind/weather/stress, within stand competition and maintenance, and insect/disease outbreaks.

The absence of disturbance is also significant in movement to classes with closed canopy conditions. Native ungulate grazing may have played a small role in replacement where buffalo and elk concentrated, but fire generally maintained systems. Drought and moist cycles play a strong role interacting with both fire and native grazing.

VDDT Fire Frequency Results

Severity	Avg FI	Min FI	Max FI	Percent of All Fires
Replacement	345	100	300	1
Moderate (Mixed)	90	50	2000	5
Low (Surface)	5	2	10	93
All Fires	5			100

Scale Description

Topographically complex areas can be relatively small (< 1000 acres). Larger landscapes can be up to tens of thousand acres in size such as south slopes of the Ozark and Ouachita Mountains.

Non-Fire Disturbances

Insects/Disease

Wind/Weather/Stress

Competition or lack of seed source

Adjacency or Identification Concerns

The BpS was defined using NatureServe - Ozark-Ouachita Shortleaf Pine-oak Forest and Woodland. This BpS is the more dissected central and southern Ouachitas, Middle and Upper Boston Mountains and Current River Hills. In the Ouachitas this BpS is adjacent to dry oak on the ridgetops and the mesic oak in the lower elevations.

Issues or Problems

Native Uncharacteristic Conditions

Description

0-59 years. Mid-seral with closed canopy shortleaf and oak pole-sized trees with little or no herbaceous understory. Some woody understory development. > 70% canopy cover (crown closure estimate). Surface fire maintains this class and occurs every 20 years.

Competition/maintenance maintains class B (probability = .01). Mixed fire every 40 years transitions this class to a more open condition (class C). Replacement fire every 100 years and wind and ice storms every 200 years replace this class. Without fire this class succeeds to class E.

Class C 25%

Mid Development 1 - Open

Structural Information

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 0 - 70%

Upper Layer Canopy Height: Tree 5.1m - Tree 10m

Tree Size Class: Pole 5-9" DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUERC	Quercus	Oak	Mid-Upper
CARYA	Carya	Hickory	Mid-Upper
PIEC2	Pinus echinata	Shortleaf pine	Lower
ANDRO2	Andropogon	Bluestem	False

Description

0-59 years. Mid-development, open canopy shortleaf and oak mature sized trees with a mix of shrub sprouts and herbaceous understory. Oak-pine predominate overstory < 70% canopy cover. Surface fires (every 4 years) and mixed fires (every 140 years) maintain this class. This class succeeds to D with fire; without fire after 15 years this class succeeds to B (modeled as alternate succession).

Class D 45%

Late Development 1 - Open

Structural Information

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 0 - 70%

Upper Layer Canopy Height: Tree 10.1m - Tree 25m

Tree Size Class: Medium 9-21"DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUERC	Quercus	Oak	Upper
CARYA	Carya	Hickory	Upper
PIEC2	Pinus echinata	Shortleaf pine	Lower
ANDRO2	Andropogon	Bluestem	False

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Manage.* 59:56-67.

441507

Ozark Ouachita Shortleaf Pine Bluestem Woodland

Model Date: 02/28/07

Report Date: 10/23/07

Modelers		Reviewers	
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Vegetation Type

Woodland

Map Zones

44

Geographic Range

This BpS lies in the interior highlands and uplands of Arkansas, eastern Oklahoma, and southern Missouri. This BpS occurs in ECOMAP subsections M231A, 231G, M223A.

Biophysical Site Description

This BpS is common to the interior highlands and xeric upland sites to the south and west of the Mississippi River. In the highlands it occupies all but steep north slopes at all elevations. This vegetation type is found along sandstone ridges. Moisture regime is xeric to dry-mesic. This group also occurs on gently dissected upland cherty plains in Missouri (in addition to sandstone ridges). In the Missouri Ozarks, this type is primarily confined to gently to moderately sloping, upland plains and is distinguished from BpS 441367, which occurs on more steeply dissected ridges and steep southwest facing slopes. In Missouri and Oklahoma this system occurs on gently dissected upland cherty plains and sandstone ridges. The center of distribution would be the northern and western Ouachita Mountains. In the Ouachitas, the system occurs on the northern Hogback Ridges excluding the Novaculite areas to the south.

Vegetation Description

This BpS represents woodlands of the Ouachita and Ozark Mountains region of Arkansas, adjacent Oklahoma, and southern Missouri in which shortleaf pine (*Pinus echinata*) is the canopy dominant, and the understory is characterized by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and other prairie elements. In the northern part of this geographic area shortleaf pine, xeric oaks and some hickory dominate the overstory with a high percentage of oak on steep north slopes and on post oak (*Quercus stellata*) flats. Associated species include post oak, blackjack oak (*Q. marilandica*), mockernut hickory (*Carya alba*) on drier sites and to the west black hickory (*C. texana*). Pine is often emergent on upper slopes. Stand density increases with available moisture. Various bluestems (*Andropogon* spp.) often dominate the understory.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIEC2	<i>Pinus echinata</i>	Shortleaf pine
ANDRO2	<i>Andropogon</i>	Bluestem

Disturbance Description

This BpS is fire regime group I, with frequent surface fires. Area fire frequency is 3-4 year mean fire interval (range = 1-12 years) (Masters et al. 1995). Replacement and mixed severity fires are infrequent, every 100 to 1000 years. Stand replacement fires occurred mostly under extreme drought conditions during the growing season. Other disturbance factors that played a smaller role include ice storms, wind events, insect infestations, and species competition for resources. Native ungulate grazing may have played a small role in replacement where buffalo and elk concentrated, but fire generally maintained systems. Drought and moist cycles play a strong role interacting with both fire and native grazing.

VDDT Fire Frequency Results

Severity	Avg FI	Min FI	Max FI	Percent of All Fires
Replacement	1000			
Moderate (Mixed)	1000			
Low (Surface)	2			100
All Fires	2			100

Scale Description

Landscape adequate in size to contain natural variation in vegetation and disturbance regime. Topographically uniform areas can be relatively large (> 1000 acres).

Non-Fire Disturbances

Insects/Disease

Wind/Weather/Stress

Competition or lack of seed source

Adjacency or Identification Concerns

In the Ouachita Mountains the adjacent community would be oak dominated north slope forests. Outside the Ouachita Mountains the adjacent community would be oak-hickory-pine forest. This system is primarily confined to gently to moderately sloping, upland plains of prairie flora which also distinguishes this system from the shortleaf pin-oak woodland (BpS 441367).

Issues or Problems

Native Uncharacteristic Conditions

Comments

z44 reviewer:Paul Nelson: pwnelson@fs.fed.us.

For zone 44, this model was adapted from the Rapid Assessment Pine Bluestem (R5PIBS) model by Susan Hooks and Ron Masters. To adapt the model to zone 44 minor changes were made to the description and the VDDT model.

Succession Classes

Class A 15%

Early1 - All Structures

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441304

Ozark-Ouachita Dry-Mesic Oak Forest

Model Date: 02/28/07

Report Date: 10/23/07

Modelers		Reviewers	
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Betty Crump	bcrump@fs.fed.us		

Vegetation Type

Forested

Map Zones

44

Geographic Range

This BpS primarily occurs in the Interior Low Plateau, southern Central Lowland, Ozark Plateaus, and Ouachita physiographic provinces. It includes parts of Missouri, Arkansas and Oklahoma. This system is found on toeslopes and in valley bottoms, as well as on north-facing and other protected slopes and ravines.

Biophysical Site Description

This type is found on a wide range of topographic positions, including drier sites and mixed mesophytic forests. Distribution is nonetheless influenced by local conditions affecting moisture and fertility. Generally, from east to west, that distribution becomes more and more limited in extent and more dependent on very favorable habitat conditions. Drier sites (often oak dominated) represent approximately 75% of the total type while less than 25% of the type is represented as the most mesic sites in the upland landscape. Open conditions describe a single canopy structure with no developed midstory. Closed conditions are multiple canopy usually late-seral forests. In Missouri this type is typically on protected slopes and benches overlaying the Gasconade formation or Eminence-Poosi dolomite, though it may be found on exposed lower slopes. Soils are well drained, with gravel and boulders of chert, dolomite, or sandstone at or near the soil surface.

Vegetation Description

The vegetation is variable along moisture gradients, but includes (on more mesic sites) generally more fire-intolerant species such as red maple (*Acer rubrum*), sugar maple (*Acer saccharum*) and other hardwood components. On drier sites, white oak (*Quercus alba*), red oaks (*Quercus rubra*), and other fire-tolerant hardwood species are dominant. Drier sites are generally more open than mesic sites and may have up to 15% pine canopy cover. At these sites the canopy is open enough to support mixed grasses, sedges and forbs but not warm season grasses. In Missouri, this type occupies dry-mesic conditions associated with deeper soils of leeward, north- and east-facing hill and mountain shoulders to the toe of the slope. Mesic sites in mid and late seral stages tend to be closed forest with understories (sometimes more herbaceous than woody). American beech (*Fagus grandifolia*) may be the dominant tree species with codominants of red oak (*Quercus rubra*), sweetgum (*Liquidambar styraciflua*), basswood (*Tilia* spp.), cucumbertree

(*Magnolia accuminata*), or other mesic tree species. In some situations, sugar maple is dominant. Other characteristic overstory species include *Nyssa sylvatica*, *Pinus echinata*, *Quercus coccinea*, *Fraxinus americana*, and *Carya cordiformis*. Herbaceous cover is moderate to abundant (20-80% cover) and is often dominated by *Desmodium nudiflorum*, *Amphicarpaea bracteata*, *Cimicifuga racemosa*, *Desmodium glutinosum*, and *Polystichum acrostichoides*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUAL	<i>Quercus alba</i>	White oak
QURU	<i>Quercus rubra</i>	Northern red oak
ACSA3	<i>Acer saccharum</i>	Sugar maple
ACRU	<i>Acer rubrum</i>	Red maple
FAGR	<i>Fagus grandifolia</i>	American beech
PIEC2	<i>Pinus echinata</i>	Shortleaf pine

Disturbance Description

This BPS is fire regime group I primarily, but with lower frequency than drier types and primarily low intensity surface fire with occasional mosaic (mixed severity) or replacement fire. Mean fire return interval (MFI) is about 20 years with wide year-to-year and within-type variation related to moisture cycles, degree of sheltering, and proximity to more fire-prone types. Anthropogenic fire is considered and contributes to within-type MFI variation. Native ungulate grazing may have played a small role in replacement where buffalo and elk concentrated, but fire generally maintained systems. Drought and moist cycles play a strong role interacting with both fire and native grazing. Other natural disturbances may include wind, ice, and mortality from insect and disease.

VDDT Fire Frequency Results

Severity	Avg FI	Min FI	Max FI	Percent of All Fires
Replacement	200	50	300	6
Moderate (Mixed)	90	20	150	13
Low (Surface)	15	5	35	81
All Fires	12			100

Scale Description

Landscape adequate in size to contain natural variation in vegetation and disturbance regime. Topographically complex areas can be relatively small (< 1000 acres). Larger landscapes up to several thousand acres in size.

Non-Fire Disturbances

Wind/Weather/Stress

Adjacency or Identification Concerns

This BpS is topographically adjacent to the wetter type (441334) downslope and the drier type (441364) on ridgetops depending on local conditions affecting moisture, aspect, elevation and soil productivity.

Issues or Problems

Native Uncharacteristic Conditions

Comments

Collaboration and suggested edits from Doug Zollner, Ron Masters, Paul Nelson, Tom Foti, Susan Hooks, Steve Osborne, Bruce Davenport and others.

Succession Classes

Class A 5%

Early1 - All Structures

Structural Information

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 31 - 100%

Upper Layer Canopy Height: Tree 0m - Tree 5m

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

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ACRU	Acer rubrum	Red maple	Upper
QUAL	Quercus alba	White oak	Upper
QURU	Quercus rubra	Northern red oak	Upper
PRSE2	Prunus serotina	Black cherry	False

Description

0-14 years. Sprouts, seedlings, saplings of major overstory species in gaps and openings created or maintained by wind/weather/stress, aboriginal or lightning-caused stand replacement fire and insect/disease. Both fire-tolerant and intolerant species present. Fire is the only disturbance used in the model. The 15 year FRI for this class is made up of two types of fire - replacement fire with a FRI of 40 years and surface fire with a FRI of 25 years. With disturbance this class will succeed to class C. Without fire for 10 years this class will succeed to class B.

Class B 25%

Mid1 - Closed

Structural Information

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 71 - 100%

Upper Layer Canopy Height: Tree 5.1m - Tree 10m

Tree Size Class: Pole 5-9" DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ACRU	Acer rubrum	Red maple	Upper
ACSA3	Acer saccharum	Sugar maple	Upper
QUAL	Quercus alba	White oak	Lower

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Interior Highlands Dry Oak Woodland and Glade

Model Date: 02/28/06

Report Date: 10/23/07

Modelers		Reviewers	
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Vegetation Type

Woodland

Map Zones

44

Model Splits or Lumps

This BpS is lumped with: 1363, 1312

Geographic Range

Interior Highlands, including portions of southern Illinois, southern Missouri, northern and west-central Arkansas, and eastern Oklahoma. This vegetation type is represented in map zone 44 sections of Arkansas in 223A, M223A, 231G, and M231A. Important ecoregions in Missouri include the White River Hills, Osage River Hills, Gasconade River Hills, Meramec River Hills and Current River Hills subsections, especially where these subsections transected the Central Plateau Subsection.

Biophysical Site Description

Soils are well to somewhat excessively drained, shallow to moderately deep with an extremely acid to moderately acid soil reaction in areas underlain by chert, sandstone and igneous rock while neutral to basic in areas underlain by dolomite or limestone. Also, occurs on novaculite formations in the Ouachita Mountains of Arkansas. These occupy moderately dissected to deeply dissected borders of undulating plains, especially those regions bordering the Central Plateau Subsection of the Ozark Highlands in Missouri. This vegetation type occupies ridgetops and south-to-west-facing slope aspects throughout the Arkansas and Missouri Ozarks and Arkansas and Oklahoma Ouachita Mountains in the absence of shortleaf pine (*Pinus echinata*). Elevation ranges between 600 and 2500 feet throughout its range in Arkansas. The moisture regime is adequate to allow tree and shrub seedling establishment in the absence of fire. Elevations range from 1,700 to 1,000 feet in the St. Francois Mountains Subsection, and between 1,500 feet to as low as 400 feet along the southeastern portion of the Ozarks Plateau. Precipitation ranges from 40 to 45 inches fairly evenly distributed over the growing season. Descriptions include all dry woodland types, dolomite glades, sandstone glades and igneous glades described in Nelson (2005); CES202.692, CES202.691, CES202.707 in the Terrestrial Ecological Systems of the Great Lakes Region. In Arkansas, this vegetation type occupies sandstone, shale, chert, and novaculite glade systems. In Missouri, this type is typically on exposed upper slopes and summits overlaying Roubidoux sandstone or Upper Gasconade dolomite. Soils are rapidly draining with frequent occurrence of chert gravel or boulders at or near the surface.

Vegetation Description

Historic range of variability: Mixed oak, and hickory without pine in Arkansas, and to a lesser extent some shortleaf pine locally within its narrower range, formed a dominant open canopy ranging from as low as 30% (less than 10% in expansive, open glades of southwest Missouri) to as high as 80%. Understory is generally sparse with an abundant ground layer of perennial grasses and forbs. The understory consisted of variable-age oak regeneration and some scattered shrubs. Densities vary widely depending on the random nature of historical ignition sources (30-60 for open canopy and 61-90 for closed canopy). Highly diverse groundcover vegetation consisting of many flammable forbs interspersed in warm season grasses left this fuel type susceptible to rapid drying, moderate fire spread rates and area coverage. Post oak (*Quercus stellata*) and black oak (*Q. velutina*) codominate with incursions of blackjack oak (*Q. marilandica*) and shortleaf pine in acidic soils formed by chert, sandstone and igneous substrates. In Arkansas, post oak codominates with blackjack oak and black hickory (*Carya texana*) with incursions of black oak. Dominant shrub species include farkleberry (*Vaccinium arboreum*) and winged elm (*Ulmus alata*) along with oak and hickory regeneration. Understory vegetation includes brakenfern (*Pteridium* spp.), beggarticks (*Desmodium* spp.), poverty oatgrass (*Danthonia spicata*), and bush clover. Chinkapin oak (*Q. muehlenbergii*) and post oak codominate on soils underlain by dolomite/limestone -- especially in association with dolomite glades.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUST	<i>Quercus stellata</i>	Post oak
QUMA	<i>Quercus macnabiana</i>	<i>Quercus macnabiana</i>
ANGE	<i>Andropogon gerardii</i>	Big bluestem
SCHIZ4	<i>Schizachyrium</i>	Little bluestem
VAAR	<i>Vaccinium arboreum</i>	Farkleberry
CATE9	<i>Carya texana</i>	Black hickory

Disturbance Description

Frequent surface fires promoted an open understory dominated by a groundcover of grasses and forbs. Drought-prone glade and other shallow or bedrock natural communities remained open for longer periods following fire or severe drought disturbance, especially glades. Stand replacement fires likely occurred during extreme drought but were limited in extent. Frequent fire dominated this vegetation group through surface fires associated with productive grass fuels and cycles of moisture and drought. Native ungulate grazing may have played a small role in replacement where buffalo and elk concentrated, but fire generally maintained systems. Drought and moist cycles play a strong role interacting with both fire and native grazing. Wind, tornados and ice storms affected stands less frequently, ranging in size from ten acres to thousands of acres. Historically, variable fire and native herbivore grazing patterns maintained a wide diversity of variably aged layers of oaks and shrubs among a uniform grass/forb groundcover.

VDDT Fire Frequency Results

Severity	Avg FI	Min FI	Max FI	Percent of All Fires
Replacement	37	10	100	13
Moderate (Mixed)	90	10	50	5
Low (Surface)	6	2	7	81

All Fires	5			100
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Scale Description

Dry oak/bluestem woodland occurred over much of the Ozark Highlands Section of Missouri and Arkansas (include other states). Analysis of historic vegetation shows that this vegetation type ranges from small patches (<ten acres) across more deeply dissected, topographically complex subsections to matrix-sized patches (>1,000 acres) within the remaining geographic range where landforms were more gently dissected. In the aggregate, this vegetation type likely exceeded 5 million acres across the Ozarks Landscape.

Non-Fire Disturbances

Wind/Weather/Stress

Native Grazing

Adjacency or Identification Concerns

This vegetation group can be modeled and mapped as distinct from the dry to dry-mesic oak-hickory woodlands or forests primarily based on the topographic roughness of the landscape and proximity to surrounding oak savanna, prairie and White River glades and other glade types. Another distinct breaking point between this and dry-mesic oak/pine woodlands is the dominance or strong presence of warm season grasses, generally south and west-facing aspects and only moderate dissection of the landscape (ranging from gently dissected plains to moderately steep hills). This vegetation type feathers out in portions of the most deeply dissected Ozarks Section, especially around and east of the Current River in Missouri. Uncharacteristic current conditions: much reduced groundcover diversity due to overgrazing, scattered remnant herbs and grasses suppressed beneath dense second growth stands of increased black oak, red cedar (*Juniperus virginiana*), hickory, red oak, lowbush blueberry (*V. angustifolium*), aromatic sumac (*Rhus aromatica*). These conditions are pervasive throughout all classes. Also, observations of native grazing bison and elk in certain enclosed refuges suggests that they played an important role in shaping and modifying the character of woodlands, in conjunction with fire effects. Uncharacteristic red oak, scarlet oak (*Q. coccinea*), white oak and red cedar along with shrubs aromatic sumac, lowbush blueberry and buckbrush (*Symphoricarpos occidentalis*) dominate in 5-9 inch or larger mid story canopy. Canopy is near 100% closed. Fuel model 9.

Issues or Problems

This type is mapped partly as the mosaic bluestem #39 and 45 on Bailey's map and #45 of the Oak-Hickory zone in Kuchler's Potential Natural Vegetation Groups. The Historical Vegetation Project of the Missouri Geographic Resources Center at University of Missouri, Columbia mapped this as open woodland across the Ozarks with as much as 35 to 50% covering the Ozark Highlands. For the most part, dominant grasses and forbs were the primary available fuel that dictated fire behavior. This former fuel type is mostly converted to deciduous artifact leaf litter today under an essentially closed canopy cover. Modeling attributes to map the spatial extent of this vegetation group should focus on southwest aspects, dry rocky soils, glade occurrences and association with coarse-scale historic vegetation models from UMC for shrublands, barrens and open woodlands. Larger patches of this group (1,000 acres or greater) are strongly associated with gentle to moderate undulations associated with dissected landscapes less than 150 feet in elevation change. These decrease in cover as landscapes become more deeply dissected with greater elevation changes. With respect to the coarser-scale grouping of alliances, the

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