LANDFIRE Biophysical Setting Model

Biophysical Setting: 4414280 West Gulf Coastal Plain Northern Calcareous Prairie

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field) **Date** 1/25/2007

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Vegetation Type
Upland Grassland/Herbaceous

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species
SCSC
SONU2
QUST
DAPU5
ECPU
ECPA
QUST
QUMU

Map Zone
44

Model Zone
☐ Alaska
☐ California
☐
☐ Great Basin
☐ Great Lakes
☐ Hawaii
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐
☐ Pacific Northwest
☑ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Geographic Range

The blackland region of AR occurs in the West Gulf Coastal Plain in Clark, Hempstead, Howard, Little River, Nevada, and Sevier Counties. Found in MZ37 in ECOMAP section 231E, subsection K.

Biophysical Site Description

This region is characterized by gently rolling topography. Blackland prairies and woodlands within this region do not occur contiguously. These communities are found in discrete areas where blackland soils have formed from calcareous substrates.

The surface rock in the blackland region belongs to the Upper Cretaceous formation. The types of rock or parent material that support blackland communities include Arkadelphia marl, Nacatoch sand, Saratoga chalk, Marlbrook marl, Annona chalk and Brownstown marl. The topography in the blackland region is gently rolling to nearly level with most slopes less than 12%. In some areas, such as Nacatoch Ravines NA and Saratoga Landing NA, slopes approach 50%. At White Cliffs NA a 50ft chalk cliffline soars above the Little River. The elevation in the blackland region ranges from 165ft above msl in the floodplains and streams to 800’ above msl on the ridge tops in the northern part of the region. Average elevations are between 300-600ft above msl (Roberts 1979).

Historically, blackland soils were characterized by a deep mantle of calcareous black soil high in organic matter that is found over a substrate of Cretaceous chalk or marl with variable amounts of sand, gravel, and acidic clay lenses. However, because blackland soil is prone to erosion, in areas that have been intensively managed the topsoil has eroded exposing olive-colored clayey subsoil. Severe erosion is common and areas

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are characterized by gullies, sometimes exceeding 35ft in depth, with exposed chalk or marl that is mostly unvegetated. Blackland soils vary from well-drained and moderately well-drained to poorly-drained clays, silty clays, silty clay loams, and fine sandy loams. The soils are normally excessively dry in summer and many have a high shrink-swell potential (Roberts 1979, Foti 1989a, Foti 1989b, USDA Soil Conservation Service 1987 and 1975). The prairies and sparse woodlands occur on the tight, high pH soils that are generally unfavorable to root penetration (vertisols or chalk hardpans), and in barrier-free landscapes that are prone to extensive and frequent fire.

The blackland soil and geology of Arkansas was largely described by Owen (1860) in his Geological Reconnaissance of the Middle and Southern Counties of AR. The counties where blackland soil occurs and through which Owen traveled include Sevier, Hempstead, Clark and Pike. The best exposed and developed Cretaceous formations he reported occurred in Hempstead County. In general he described the soils that cover Cretaceous strata as very rich, black, and fertile. Where blackland soil occurred on the tops of ridges in rolling country the soil was frequently eroded and exposed pure Cretaceous subsoil that was considerably less fertile. Where the bedrock surfaced the ground was also less fertile, but bois-d'arc and haw flourished even on these bare outcrops. Owen reported seeing fossils everywhere which he interestingly assumed remained from former freshwater lakes, ponds, and pools despite the marine qualities of some of the species. There is one mention of cretaceous limestone in a ravine about four miles from Paraclifty where coarse gravel partially covers the bedrock. This is the current location of the Ashgrove Cement plant. In Clark County Owen described rich woods surrounded by drier lands dominated by post oaks. In one region of Pike County (T8S R26W S4) white oaks were dominant on Cretaceous limestone and marl surface rock.

Vegetation Description

Early descriptions of the blackland region of AR by Thomas Nuttall, early settlers and the original land surveyors, provide some clues as to what the pre- and early settlement vegetation and landscape were like. Openings on ridges occurred within woodlands interspersed with tree-lined drainages. There were extensive areas with thin groundcover (prairies, probably grazed) and shrubby trees. Prairies and barrens occurred on thin calcareous soils over chalk and marl deposits.

Blackland prairie flora typically consists of 3-6ft tall grasses and a diverse mix of forbs which flower at various times throughout the growing season. The flora is dominated by little bluestem (Schizachyrium scoparium) and Indian grass (Sorghastum nutans). Important associate grasses include dropseed (Sporobolus clandestinus), eastern gamma grass (Tripsacum dactyloides), bushy bluestem (Andropogon glomeratus) and three-awn grasses (Aristida spp.). Common forbs present are goldenrods (Solidago spp.), asters (Aster spp.), sunflowers (Helianthus spp.), evening primrose (Oenothera biennis), coneflowers (Echinacea spp.), prairie clovers (Dalea spp.), milkweeds (Asclepias spp.), compass plant (Silphium laciniatum), blazing stars (Liatris spp.) and many others (Roberts 1979, Foti 1989a, Foti 1989b, Zollner and Simon 1997).

Post and chinquapin oaks (Q. muehlenbergii) grew on ridges with thin soil over marl and chalk. Post oaks were also found either dense or in savanna-like stands over fragipans where the soil was poorly drained. Bois-d'arc (Maclura pomifera) was found on dry calcareous ridges with dense thickets of sumac, persimmon (Diospyros virginiana) and greenbriar (Smilax spp.) (Hutchinson 1985).

Degraded blackland prairies show increased abundance of eastern red cedar (Juniperus virginiana) and other woody species such as persimmon, white ash (Fraxinus americana), winged elm (Ulmus alata), Carolina buckthorn (Rhamnus caroliniana), deciduous holly (Ilex decidua), flowering dogwood (Cornus florida) and rusty blackhaw (Viburnum rufidulum) due to intensive grazing and long-term fire suppression (Roberts 1979, Foti 1989a, Foti 1989b, Zollner and Simon 1997).

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Blackland woodlands occur on dry to more mesic sites and consist of a fairly open canopy with a well-established herbaceous layer. In Arkansas, dry calcareous woodlands are dominated by chinquapin oak (Quercus muhlenbergii) with sedges (Carex spp.), grasses (Graminae spp.) and various forbs dominating the herbaceous layer. Shumard's oak (Quercus shumardii) and nutmeg hickory (Carya myrsticformis) with sedges and grasses in the herbaceous layer dominate mesic woodlands.

Disturbance Description

The blackland region of southwest AR has a long history of human habitation. Humans have dramatically changed the landscape according to how they use natural resources for their livelihood. Prior to European settlement, native Americans dwelled in small camps and villages throughout the blackland region. They repeatedly burned the landscape to clear the woodlands for ease in hunting and probably defense. They farmed portions of the bottoms and planted bois d'arc trees, prized for their strength and flexibility (Young and Hofmann 1995, Sabbo 1992).

Fire is the most important ecological process maintaining the distribution, composition, and diversity of blackland prairie, woodland, and forest communities. The prevalence of fire on the Gulf Coastal Plain has been well documented (Albert 1981, Pyne 1982, Foti and Glenn 1990). An examination of Arkansas Forestry Commission records indicate a prevalence of lightning ignited fires occurring from mid-July through October (Foti and Glenn 1990). Historically, fires occurred both naturally and anthropogenically in the region. Anthropogenic fires could have occurred in any season but early records of aboriginal burning reference September through December (Young and Hoffman 1995, Lottinville 1980).

Climate and fire played a role in the distribution of the blackland prairie communities. Fires were more frequent and intense during droughts, and lead to prairie expansion by eliminating or reducing woody species. During droughts, fires may have crept farther into the lowland blackland communities, reducing the density of woody species, and shifting the composition toward herbaceous wet-mesic and wet prairie species. During periods of high soil moisture, fires were probably not as frequent or intense, enabling woody vegetation to increase in distribution (Roberts 1979).

The season of fires also shifts species composition within communities. In woodland communities, pine and cedar are most susceptible to fall fires, while hardwoods are generally most susceptible to spring fires. In prairie communities, spring burns appear to stimulate grasses, while fall fires stimulate forb species (Pyne 1982).

The lack of fire in the blackland prairies and woodlands of southwest Arkansans, in addition to heavy grazing has resulted in the encroachment of eastern red cedar and other woody vegetation, and a decline in herbaceous vegetation density and extent (Roberts 1979).

Almost no information exists on the role of extirpated or extant grazers and browsers on blackland prairie and woodland communities. In general, grazing animals like bison and elk historically played a significant role in the composition of prairie communities. Native grazers typically moved into recently burned areas, selecting tender grass sprouts, and possibly shifting the prairie vegetation composition toward forb species. Areas were grazed intensively for short periods and then allowed to rest for many years while the grazing animals moved to other areas. Native browsers reduced woody growth which favored herbaceous species.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Today eastern red cedar forest or Bois'd Arc Woodland may occur in fire-suppressed areas.

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Scale Description

Large patch

Issues/Problems

Widespread conversion to non-native pasture and hay meadow. Degraded blackland prairies often display increased abundance of non-native introduced pasture species such as tall fescue (Festuca arundinacea), bermuda grass (Cynodon dactylon), black medic (Medicago lupulina), clovers (Trifolium spp.), and yellow and white sweet clover (Melilotus spp.). Much of the blacklands show areas of extensive and intensive erosion and in places no top soils remains.

Comments

This model was developed for MZ44 and was later adopted for MZ37 without changes.

Vegetation Classes

Class A 50 %

Early Development 1 All Structures

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

3

Indicator Species and Canopy Position

SCSC Upper
SONU2 Upper
SILA3 Upper
DAPU5 Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Herb 0m	Herb >1.1m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0-100yrs. Blackland prairie flora typically consists of 3-6ft tall grasses and a diverse mix of forbs which flower at various times throughout the growing season. Blackland prairie flora is dominated by little bluestem (Schizachyrium scoparium) and Indian grass (Sorghastum nutans). Important associate grasses include dropseed (Sporobolus clandestinus), eastern gamma grass (Tripsacum dactyloides), bushy bluestem (Andropogon glomeratus), and three-awn grasses (Aristida spp.). Common forbs present are coneflowers (Echinacea spp.), prairie clovers (Dalea spp.), milkweeds (Asclepias spp.), compass plant (Silphium laciniatum), blazing stars (Liatris spp.) and many others (Roberts 1979, Foti 1989a, Foti 1989b, Zollner and Simon 1997). Mixed fires every four years maintain the class. The lack of fire for 15yrs moves the class to B.

Class B 4 %

Mid Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Fuel Model

Indicator Species and Canopy Position

SCSC Lower
SONU2 Lower
JUVI Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

16-50yrs. This class occurs through alternate succession from class A. Degraded blackland prairies show increased abundance of eastern red cedar and other woody species such as persimmon, white ash, winged elm, Carolina buckthorn, deciduous holly (Ilex decidua), flowering dogwood, Rough-leaved dogwood and rusty

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

blackhaw due to intensive grazing and long-term fire suppression (Roberts 1979, Foti 1989a, Foti 1989b, Zollner and Simon 1997). Mixed fires every 20yrs maintain the class. Rare weather/stress events (every 100yrs) and replacement fires (every 50yrs) move the class back to A.

Class C 45 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species and Canopy Position

QUST
Upper
QUMU
Upper
SCSC
Lower
SONU2
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Tree 0m	Tree 25m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

101yrs+. Post oak, shumard's oak, chinkapin oak, shortleaf pine (Pinus echinata), nutneg hickory, and bur oak (Quercus macrocarpa) are the dominant tree species. Open savanna with grassy understory, including a diverse understory as in class A, including, little bluestem, and Indian grass, dropseed (Sporobolus spp.), eastern gamma grass, bushy bluestem, and three-awn grasses (Roberts 1979, Foti 1989a, Foti 1989b, Zollner and Simon 1997). Wind/weather stress events (every 100yrs) move the class to A. Surface fires every four years maintain the class.

Class D 1 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species and Canopy Position

JUVI
Upper
FRAM2
Upper
DIVI
Upper
CACH3
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	71 %	100 %
Height	Tree 0m	Tree 25m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

51yrs+. Woody species from class B succeed to closed condition. Bois-d'arc was found on dry calcareous ridges with dense thickets of sumac, persimmon (Diospyros virginiana) and greenbriar (Smilax spp.) (Hutchinson 1985). On xeric to dry-mesic soils, may be almost pure astern red cedar. Closed canopy with midstory of shade tollerant species. Sparse herbaceous layer, sometimes only Carex cherokeensis. Wind/weather/stress events (every 100yrs) and replacement fires (every 50yrs) take the class to A.

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

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Description

Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	1500			0.00067	0
Mixed	7			0.14286	50
Surface	7			0.14286	50
All Fires	3			0.28638	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.