

LANDFIRE Biophysical Setting Model

Biophysical Setting 3214280

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

Modeler 1 Mark Clark mclark@tnc.org **Reviewer**

Modeler 2 Maria maria_melnechuk@tnc.or **Reviewer**

Melnechuk g

Modeler 3 **Reviewer**

<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland	SCSC	32	☐ Alaska	☐ Northern Plains
Grassland/Herbaceous	SONU2		California	N-Cent. Rockies
<u>General Model Sources</u>	QUST		☐	☐
☒ Literature	DAPU5		☐ Great Basin	☐ Pacific Northwest
☒ Local Data	ECPU		☐ Great Lakes	☒ South Central
☒ Expert Estimate	ECPA		☐ Hawaii	☐ Southeast
	QUST		☐ Northeast	☐ S. Appalachians
	QUMU			☐ 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 <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 800ft 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

**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.

intensively managed the topsoil has eroded exposing olive-colored clayey subsoil. Severe erosion is common and areas 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 AR was largely described by Owen (1860) in his Geological Reconnaissance of the Middle and Southern Counties of Arkansas. 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 redcedar (*Juniperus virginiana*) and other woody species such as persimmon, white ash (*Fraxinus americana*), winged elm (*Ulmus alata*),

****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.**

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).

Blackland woodlands occur on dry to more mesic sites and consist of a fairly open canopy with a well-established herbaceous layer. In AR, 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 myristiciformis*) 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 AR, in addition to heavy grazing has resulted in the encroachment of eastern redcedar 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

****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.**

favorable herbaceous species.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

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

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

For MZ32 this model was adopted without changes from the same BpS in MZ44.

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

Vegetation Classes

Class A	50 %	<u>Indicator Species and Canopy Position</u>	<u>Structure Data (for upper layer lifeform)</u>												
Early Development 1 All Structure		SCSC	<table><tr><td></td><td><i>Min</i></td><td><i>Max</i></td></tr><tr><td><i>Cover</i></td><td>0 %</td><td>100 %</td></tr><tr><td><i>Height</i></td><td>Herb 0m</td><td>Herb >1.1m</td></tr><tr><td><i>Tree Size Class</i></td><td colspan="2">None</td></tr></table>		<i>Min</i>	<i>Max</i>	<i>Cover</i>	0 %	100 %	<i>Height</i>	Herb 0m	Herb >1.1m	<i>Tree Size Class</i>	None	
	<i>Min</i>	<i>Max</i>													
<i>Cover</i>	0 %	100 %													
<i>Height</i>	Herb 0m	Herb >1.1m													
<i>Tree Size Class</i>	None														
<u>Upper Layer Lifeform</u>		Upper													
☒ Herbaceous		SONU2													
☐ Shrub		Upper													
☐ Tree	<u>Fuel Model</u>	SILA3	☐ Upper layer lifeform differs from dominant lifeform.												
	3	Upper													
		DAPU5													
		Low-Mid													
<u>Description</u>															
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 (<i>Schizachyrium scoparium</i>) and Indian grass (<i>Sorghastum nutans</i>). Important associate grasses include dropseed (<i>Sporobolus clandestinus</i>), eastern gamma grass (<i>Tripsacum dactyloides</i>), bushy bluestem (<i>Andropogon glomeratus</i>) and three-awn grasses (<i>Aristida</i> spp.). Common forbs present are coneflowers (<i>Echinacea</i> spp.), prairie clovers (<i>Dalea</i> spp.), milkweeds (<i>Asclepias</i> spp.), compass plant (<i>Silphium laciniatum</i>), blazing stars (<i>Liatris</i> 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.															

**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.

Class B 4 %

Mid Development 1 Closed

Upper Layer Lifeform☐ Herbaceous☒ 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 redcedar and other woody species such as persimmon, white ash, winged elm, Carolina buckthorn, deciduous holly (*Ilex decidua*), flowering dogwood, Rough-leaved dogwood and rusty 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*), nutmeg 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, 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**

Year 51yrs+. Woody species from class B succeed to closed condition. Bois-d'arc was found on dry calcareous

**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.

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 eastern redcedar. Closed canopy with midstory of shade tolerant 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]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

	<i>Min</i>	<i>Max</i>
<i>Cover</i>	%	%
<i>Height</i>		
<i>Tree Size Class</i>		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **I**

Historical Fire Size (acres)

Avg 0

Min 0

Max 0

Sources of Fire Regime Data

- ☒ Literature
☐ Local Data
☒ Expert Estimate

Fire Intervals

	<i>Avg FI</i>	<i>Min FI</i>	<i>Max FI</i>	<i>Probability</i>	<i>Percent of All Fires</i>
<i>Replacement</i>	1500			0.00067	0
<i>Mixed</i>	7			0.14286	50
<i>Surface</i>	7			0.14286	50
<i>All Fires</i>	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 ☐ Native Grazing ☐ Other (optional 1)
☒ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

References

Albert, L. 1981. Five Thousand Years of Environmental Change in Southeastern Oklahoma. Oklahoma Archeological Survey No. 7.

Anonymous. 1977. Clark County Cedar Barrens and Blackland Prairie. Arkansas Natural Heritage Commission Unpublished Site Report. 6 pp.

Arkansas Natural Heritage Commission. Arkansas Natural Community Abstract. Blackland Prairie.

Arkansas Natural Heritage Commission. 1977? Clark County Cedar Barrens and Blackland Prairie. Unpublished report.

Armstrong, R. 1957. Botanical Aspects of Massard Prairie, Arkansas. In Proceedings: Arkansas Academy of Science, volume 10: 44-57.

**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.

Bedient, P. and W. Huber. 1992. Hydrology and Floodplain Analysis. Addison-Wesley Publishing Company. Reading, Massachusetts. 692 pp.

Bradstock, R. et al. 1995. Fire and Conservation: Imperatives and Constraints on Managing for Diversity. In: Conserving Biodiversity: Threats and Solutions. Bradstock et al eds. Surrey Beatty and Sons, pp. 323-333.

Bridges, E. 1986. Proposal for a Pilot Ecological Inventory of Southwestern Arkansas.

Campbell, J.J.N., et al. 1991. Floristic and Historical Evidence of Fire Maintained, Grassy Pine-oak Barrens before Settlement in Southeastern Kentucky. In Proc: Fire and the Environment: Ecological and Cultural Perspectives. SE For. Exp. Sta.

Catling, P.M. and V.S. Engel. 1993. Systematics and distribution of *Hexalectris spicata* var *arizonica* (Orchidaceae). *Lindleyana* 8: 119-125.

Clubine, S. 1997. Herbicides and Burning for *Sericea lespedeza* Control. Native Warm –Season Grass Newsletter, volume 16(1). 4 pp.

Cole, M. 1990. Vegetation Management Guideline for White and Yellow Sweet Clover. Vegetation Management Guideline #23. In Illinois Nature Preserve Vegetation Management Manual. 3 pp.

Dane, C. 1929. Upper Cretaceous Formations of Southwestern Arkansas. Arkansas Geological Survey Bulletin #1. 215 pp.

Debruyckere, L., et. al. 1998. Grandview Prairie Master Plan. Unpublished report. Arkansas Game and Fish Commission, Little Rock. 21 pp.

Douglas, J. and J. Neal. 1986. Arkansas Birds: Their Distribution and Abundance. The University of Arkansas Press. Fayetteville. 402 pp.

Featherstonhaugh, G. 1835. Geologic Report of an Examination Made in 1834 of the Elevated Country Between the Missouri and Red Rivers. Ex-Doc. 152, 23rd Congress 2nd Session, volume IV. 97 pp.

Foti, T. and S. Glenn. 1990. The Ouachita Mountains Landscape at the Time of Settlement. In Proc.: Conference on Restoring Old Growth Forest in the Interior Highlands of Arkansas and Oklahoma. Winrock.

Foti, T. 1990a. Hopson Cemetery Blackland Prairie, Little River County, Arkansas, Site Report. Unpublished report.

Foti, T. 1990b. Saratoga Landing Blackland Prairie Ideal Basic Industries Tract, Howard County, Arkansas. Unpublished report.

Foti, T. 1990c. The Vegetation of Saratoga Landing Blackland Prairie. In Proceedings: Arkansas Academy of Science, volume 44: 40-43.

Foti, T. 1989a. Blackland Prairies of Southwestern Arkansas. In Proceedings: Arkansas Academy of

**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.

Science, volume 43: 23-28.

Foti, T. 1989b. Clark County Blackland Prairies, Clark County. Arkansas Natural Heritage Commission Unpublished Site Report. 2 pp.

Foti, T. 1987a. Blackland Prairie in Howard County. Unpublished report.

Foti, T. 1987b. Site Report: Blackland Prairie Sites in Arkansas. Unpublished Report Submitted to the Arkansas Natural Heritage Commission. 2 pp + tables and maps.

Foti, T. and S. Glenn. 1990. The Ouachita Mountains Landscape at the Time of Settlement. In Conference on Restoring Old-Growth Forest in the Interior Highlands of Arkansas and Oklahoma. Winrock International.

Foti, T., X. Li, M. Blaney, and K. Smith. 1994. A Classification System for the Natural Vegetation of Arkansas. In Proceedings of the Arkansas Academy of Science, volume 48: 50-62.

Gill A. and R. Bradstock. 1995. Extinction of Biota by fires. In: Conserving Biodiversity: Threats and Solutions. Bradstock et al eds. Surrey Beatty and Sons, pp. 309-322.

Gleason, H. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada, volume 3, New York Botanical Garden. 589 pp.

Guyette and McGinnes. 1982. Fire History in an Ozark Glade. In Proc.: Mo. Acad. Sci. 16.

Guyette, R. and B.E. Cutter. 1991. Tree-ring Analysis of Fire History of a Post Oak Savanna in the Missouri Ozarks. Nat. Areas J. 11(2).

Hammel, P. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeast Region, Chapel Hill, NC. 437 pp.

Harper, R. 1914. Phytogeographical Notes on the Coastal Plain of Arkansas. The Plant World, volume 17(2): 36-48.

Hoelscher, J. 1983. Soil Survey of Clark County, Arkansas. United States Department of Agriculture, Soil Conservation Service. 264 pp. + maps.

Hunter, C. 1995. Wildflowers of Arkansas. Ozark Society Foundation. 296 pp.

Hunter, C. 1989. Trees, Shrubs, and Vines of Arkansas. Ozark Society Foundation. 207 pp.

Hutchinson, M. 1988. A Guide to Understanding, Interpreting, and Using the Public Land Survey Field Notes in Illinois. Natural Areas Journal, volume 8(4): 245-255.

Hutchinson, M. 1985. A report of an Inventory to Locate Potential Natural Areas in Southwestern Arkansas. Natural Land Institute, Unpublished Report. 19 pp.

Johnson, F.L. and G. Schenll. 1985. Wildland Fire History and the Effects of Fire on Vegetative

**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.

Communities at Hot Springs National Park, Arkansas. Rep. To: National Park Service.

Kreeter, S.D. 1994. Dynamics and Spatial Patterns of a Virgin Old-growth Hardwood-pine Forest in the Ouachita Mountains, Oklahoma, from 1896-1994.

Ladd, D. 1991. Reexamination of the Role of Fire in Missouri Oak Woodlands. In Proc: Oak Woods Management Workshop.

Lee, J. 19???. Appearance of the Ouachita and Red River Valleys to Early Europeans. Arkansas Archaeological Society, number 141: 4-5.

Leidolf, A. and S. McDaniel. 1998. A Floristic Study of Black Prairie Plant Communities at Sixteen Section Prairie, Oktibbeha County, MS.

Lottinville, S. (ed). 1980. A Journal of Travels in the Arkansas Territory During the Year of 1819 by Thomas Nuttall. University of Oklahoma Press. Norman. 361 pp.

MacRoberts, B. and M. MacRoberts. 1997. Historical Notes on Louisiana Prairies: Changes in Prairie Flora in Half a Century. Phytologia, volume 82(2): 65-72.

Masters, R.E., et al. 1994. Preliminary fire history of McCurtain County Wilderness Area and implications for red-cockaded woodpecker management.

Masters, R.E., et al. 1993. Effects of Timber Harvest and Periodic Fire on Soil Chemical Properties in the Ouachita Mountains. So. J. App. For. 17(3).

Mitch, W. and J.G. Gosselink. 1993. Wetlands. Van Nostrand Reinhold. New York. 722 pp.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons. New York. 547 pp.

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

Oliver, C. 1981 Forest Development in North America Following Major Disturbances. Pp 153-168 In Forest Ecology and Management.

Owen D. 1860. Second Report of a Geological Reconnaissance of the Middle and Southern Counties of Arkansas Made During the Years 1859 and 1860. C. Sherman and Son, Printers. Philadelphia. 55 pp.

Pell, B. 1983. Clark County Blackland Prairie, Clark County, Arkansas. Site Abstract. Unpublished Report. 1 page + maps.

Pyne, S. 1982. Fire in America: A Cultural History of Wildland and Rural Fire. Princeton University Press. Princeton, New Jersey. 654 pp.

Ray, H. 19???. Historical Review of Prairie and Savannah Areas of the Ozark and Ouachita Highlands. Soil Conservation Service, Fayetteville, Arkansas. Unpublished report. 7 pp.

**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.

Riskind, D. and O. Collins. 1975. The Blackland Prairie of Texas: Conservation of Representative Climax Remnants. In M. K. Wali (ed.) *Prairie: A Multiple View*. Pp. 361-367.

Robbins, L.E., and R.L. Myers. 1992. Seasonal Effects of Prescribed Burning in Florida: A review. Tall Timbers Res., Inc. Misc. Pub. No. 8.

Roberts, J. 1979. The Arkansas Blackland Region. Unpublished Report to the Arkansas Natural Heritage Commission. 69 pp.

Rogers, D., et al. 1985. Black Belt Community Profile. Alabama Natural Diversity Inventory.

Rudis, V.A. and T.V. Skinner. Fire's Importance in South Central U.S. Forests: Distribution of Fire Evidence.

Rykiel, E and T. Cook. 1986. Hardwood-Redcedar Clusters in the Post Oak Savanna of Texas. *The Southwestern Naturalist*, vol. 31(1). Pp. 73-78.

Sabbo, G. 1992. Paths of Our Children: Historic Indians of Arkansas. Arkansas Archeological Survey Popular Series, No. 3. 144 pp.

Schauwecker, T. 1996. A Comparison of Blackland Prairie Relicts in Mississippi and Arkansas. Thesis. Mississippi State, MS.

Simon, S. and D. Zollner. 1997. Fire Summary Report for Terre Noire Natural Area 1997 Prescribed Burn. Unpublished report. The Nature Conservancy. 4 pp.

Simon, S. and D. Zollner. 2001. White Cliffs Natural Area Ecological Restoration Plan. Unpublished report. The Nature Conservancy. 19 pp.

Skiles, A. Arkansas Climate Atlas. AR. Energy Office.

Smith, E. 1994. Keys to the Flora of Arkansas. University of Arkansas Press, Fayetteville. 363 pp.

Smith, E. 1988. An Atlas and Annotated List of the Vascular Plants of Arkansas 2nd ed. 489 pp.

Sparks, J.C. 1996. Growing-Season and Dormant-Season Fire Behavior and Effects on Vegetation in the Ouachita Mountains, Arkansas. OSU-Thesis. Pp. 186.

The Nature Conservancy. 1981. Natural Heritage Program Model Operations Manual. Section 3.7.

Thompson, G. 1976. Arkansas and Reconstruction: The Influence of Geography, Economics, and Personality. J. P. Shenton (ed.). National University Publications.

Tucker, G. _____. Columbus Prairie Natural Area. Unpublished Report to the Arkansas Natural Heritage Commission. 19 pp.

USDA Soil Conservation Service. 1987. Soil Survey of Clark and Hot Springs Counties, Arkansas. 266 pp.

**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.

USDA Soil Conservation Service. 1979. Soil Survey of Hempstead County, Arkansas. 127 pp.

USDA Soil Conservation Service. 1975. Soil Survey of Howard County, Arkansas. 75 pp.

USDA Soil Conservation Service. 1975. Soil Survey of Lafayette, Little River, and Miller Counties, Arkansas. 177 pp.

Weakley, A., K. Patterson, S. Landaal, M. Pyne and others (compilers). 1998. International Classification of Ecological Communities: Terrestrial Vegetation of the Southeastern United States. Working draft of March 1998. The Nature Conservancy, Southeast Regional Office, Southern Conservation Science Department, Community Ecology Group. Chapel Hill, NC.

Weaver, J. 1968. Prairie Plants and their Environment. A Fifty Year Study in the Midwest. University of Nebraska Press. Lincoln. 276 pp.

White, J. 1978. Illinois Natural Inventory Technical Report. University of Illinois Department of Landscape Architecture. Champaign. 426 pp.

Williams, D. 1994. Grandview Plantation Ecological Evaluation. Unpublished report. The Nature Conservancy – Arkansas Field Office, Little Rock, AR. 4 pp.

Wills, M. and H. Irwin. 1961. Roadside flowers of Texas. University of Texas Press, Austin, TX.

Young, G. and M. Hoffman (eds). 1995. The Expedition of Hernando De Soto West of the Mississippi, 1541-1543. Proceedings of the De Soto Symposium 1988, 1990, and 1993.

Zollner, D. and S. Simon. 1997. Grandview Prairie Ecosystem Restoration Project. Project proposal. The Nature Conservancy – Arkansas Field Office, Little Rock. 12 pp.

Zollner, D. and S. Simon. 1998. Grandview Prairie Wildlife Management Area and Conservation Education Center Ecological Assessment and Baseline Community Monitoring Plan and Budget. Project proposal. The Nature Conservancy – Arkansas Field Office, Little Rock. 4 pp.

Zollner D. and S. Simon. 1998. Fire Summary Report and Post Burn Monitoring for Terre Noire Natural Area 1998 Prescribed Burn. Unpublished report. The Nature Conservancy. 6 pp.

****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.**