13080

Cross Timbers Oak Forest and Woodland

BpS Model/Description Version: Aug. 2020

Vegetation Type

Forest and Woodland

Map Zones

38, 43, 44

Geographic Range

This Biophysical Setting (BpS) lies in central parts of Texas, Oklahoma, and Kansas.

Biophysical Site Description

This BpS generally has sandy to loamy Ustalf soils that are moderately deep to shallow (NatureServe 2005). Moderate rainfall region with periodic severe drought (Johnson and Risser 1971, 1973). The vegetation occurs in bands across the landscape and is associated strongly with soil type. Available soil water (dictated by soil depth, texture, and topographic position) also has a major influence on vegetation.

Vegetation Description

Historical accounts describe post-replacement shrub-scrub (early coppice) areas of Cross Timbers in addition to open- and closed-canopy conditions. The Cross Timbers is an ecotone between prairie and eastern deciduous forests. The black-capped vireo’s (*Vireo atricapilla*) historic range was associated with the post-replacement Cross Timbers’ vegetation type. Washington Irving and others have described areas of Cross Timbers that were evidently mid-seral closed and possibly late-seral closed, because of their inability to penetrate the forest on horseback and their description of the branching present in those stands. Yet others describe stands within the Cross Timbers that were easily traversed via wagon. Based on historical accounts and limited analysis of General Land Office survey data, more closed-canopy conditions occurred on the landscape than might be expected for a frequent fire regime.

The vegetation is dominated by post oak (*Quercus stellata*) and, to a lesser extent, blackjack oak (*Q. marilandica*). In the eastern extent, hickory (*Carya* spp.) and black oak (*Q. velutina*) may be a constituent, with occasional elm (*Ulmus americana*), ash juniper (*Juniperus ashei*) on western extent, and eastern red-cedar (*J. virginiana*) in protected areas. In open conditions, the understory and canopy openings are dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and various annual and perennial forbs, with prevalence dictated by stand density and overstory canopy cover. In closed-canopy conditions, groundcover has little to no herbaceous cover and is dominated by oak leaf litter. Other important woody plants include chittamwood (*Bumelia lanuginosa*), roughleaf dogwood (*Cornus drummondii*), greenbrier (*Smilax* spp.), sumac (*Rhus* spp.), and poison ivy (*Toxicodendron radicans*). Dense structure is found from the lower to upper mid-story in closed-canopy conditions, with persistent branches composing much of structure along with numerous small- to medium-diameter stems. In the eastern extent, blueberry (*Vaccinium* spp.) may contribute to lower mid-story structure in closed-canopy stands. The Cross Timbers is generally found within a landscape matrix of tallgrass prairie and/or mixed-grass prairie in the western extents.

BpS Dominant and Indicator Species

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

Disturbance Description

This BpS is fire regime group I, with frequent surface fires. Fire frequency is considered to be similar to adjacent forested ecosystems. The limited information available on fire chronologies is supportive of this assumption. Fire regimes are assumed to be a result of both aboriginal and lightning origin. Fire history studies from southwest Missouri and southeast Oklahoma suggest a mean fire return interval of 3-4yrs. Major drought cycles occur at approximately 20-yr intervals and may influence periodic stand-replacement fire, depending on the season of fire. Fires have been reported to occur during and following drought periods. Mosaic fire or mixed-severity fire is thought to play some role associated with drought cycles when leaves and grass are the primary fuel for carrying a fire. Surface fires were primarily wind-driven fires in open (prairie) conditions over a fuel bed of predominantly grass, although occasionally surface fires might have occurred in leaf litter given dry conditions. Historical prairie fires have been noted to slow down or stop at the border of Cross Timbers vegetation, presumably when leaf moisture was high. Surface fire would penetrate or burn completely through late-seral open stands.

Fire Frequency

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

The size and connectedness of patches varies, from small patches of 200ac to landscape size of well over 100,000ac.

Adjacency or Identification Concerns

The BpS occurs adjacent to tallgrass or mixed prairie, or within in a landscape matrix with patches of prairie. Oaks encroach into prairie areas of the Cross Timbers without fire. The deep alluvial soils of the bottomlands are not included in this BpS.

Issues or Problems

Areas of Cross Timbers existed in fire shadows at the juncture of rivers or larger streams. In areas that were rocky, these areas may have limited fire influence and were essentially locked up on the landscape in late seral stages (Clark 2003; Clark and Hallgren 2004). These areas varied in canopy closure depending on soil type. Some of these protected areas may have had a high surface rock component with less canopy cover, and soil types with less rock may have been denser with near-complete canopy closure. Little information is available on disturbance and successional history in the Cross Timbers region. Also, lack of historical information makes determining the percentage of landscape in each class difficult.

Native Uncharacteristic Conditions

Comments

Succession Classes

**Mapping Rules**

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 15 Early Development 1 - All Structures

Upper Layer Lifeform Is Not the Dominant Lifeform

Initially, grasses are the dominant life form but are rapidly overtaken and shaded out (to some extent) by coppice regeneration. As long as grasses are dominant lifeform, the fire behavior fuel model is 3, but fire behavior fuel model 8 as the class moves toward the later years.

Indicator Species

Description

Oak reproduction (often coppice) to 15ft tall. Community of forbs and perennial grasses. More persistent on shallow soils. Openings may be small to extensive and have scattered live trees. Early on, bluestems are in the upper canopy but are overtaken by the coppice oak sprouts.

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

Class B 21 Mid Development 2 - Closed

Upper Layer Lifeform Is Not the Dominant Lifeform

There is an east-to-west decline in average tree height and diameter corresponding to a decreasing moisture gradient. Figures given reflect the central part of the range. As one goes farther west, trees may actually drop a height and size class for minimum and maximum height and size class. Trees do not move up a class going to the east.

Indicator Species

Description

Mid seral with closed-canopy sapling to pole-size oak with little or no herbaceous understory. Often coppice origin. Dense structure is found from the lower to upper mid-story in closed-canopy conditions, with persistent branches composing much of structure along with numerous small- to medium-diameter stems. In the eastern extent, *Vaccinium* spp. may contribute to lower mid-story structure in closed-canopy stands.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 29 Mid Development 1 - Open

Upper Layer Lifeform Is Not the Dominant Lifeform

There is an east-to-west decline in average tree height and diameter corresponding to a decreasing moisture gradient. Figures given reflect the central part of the range. As one goes farther west, trees may actually drop a height and size class for minimum and maximum height and size class. Trees do not move up a class going to the east.

Indicator Species

Description

Mid-seral woodland/savanna overstory with perennial grasses. Open and somewhat park-like, this class may have some smaller mid-story trees, but overall understory is dominated with little and big bluestem. More mesic sites may have switchgrass or other panic grass component.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class D 25 Late Development 1 - Open

Upper Layer Lifeform Is Not the Dominant Lifeform

There is an east-to-west decline in average tree height and diameter corresponding to a decreasing moisture gradient. Figures given reflect the central part of the range. As you go farther west may actually drop a height and size class for minimum and maximum height and size class. Trees do not move up a class going to the east.

Indicator Species

Description

Late-seral woodland/savanna oak overstory with perennial grasses. This class is open and park-like, with a tallgrass component of little and big bluestem. More mesic sites may have switchgrass or other panic grass component.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class E 10 Late Development 2 - Closed

Upper Layer Lifeform Is Not the Dominant Lifeform

There is an east-to-west decline in average tree height and diameter corresponding to a decreasing moisture gradient. Figures given reflect the central part of the range. As one goes farther west, trees may actually drop a height and size class for minimum and maximum height and size class. Trees do not move up a class going to the east.

Indicator Species

Description

Late-seral, closed-canopy oak-dominated overstory community. Little to no herbaceous cover and some shrub component. Varying from east to west. Dense structure is found from the lower to upper mid-story in closed-canopy conditions, with persistent branches composing much of structure along with numerous small- to medium-diameter stems. In the eastern extent, *Vaccinium* spp. may contribute to lower mid-story structure in closed canopy stands.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Model Parameters

Deterministic Transitions

Probabilistic Transitions

References

Abrams, M.D. 1992. Fire and the development of oak forests. BioScience 42:346-353.

Adams, D.E., R.C. Anderson and S.L. Collins. 1982. Differential response of woody and herbaceous species to summer and winter burning in an Oklahoma grassland. Southwestern Naturalist 27:55-61.

Agnew, B. 1975. Dodge Leavenworth Expedition of 1834. The Chronicles of Oklahoma 53:376.

Anderson, R.C. 1972. Prairie history, management and restoration in southern Illinois. 15-22. In: J. Zimmerman, ed. Proceedings Second Midwest Prairie Conf. Madison, WI.

Anderson, R.C. and L.E. Brown. 1986. Stability and instability in plant communities following fire. American Journal of Botany 73:364-368.

Axelrod, D.I. 1985. Rise of the grassland biome, central North America. Botanical Review 51:163-201.

Beilmann, A. and L. Brenner. 1951. The recent intrusion of forests in the Ozarks. Ann. Missouri Botanical Garden 38:261-282.

Bidwell, T.G. and D.M. Engle. 1992. Relationship of fire behavior to tallgrass prairie herbage production. Journal of Range Management 45:579-584.

Brown, James K. and Jane Kapler Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

Box, T.W. 1967. Brush, fire and West Texas rangeland. In: Proceedings of Tall Timbers Fire Ecology Conference 6:7-19.

Bragg, T.B. and L.C. Hulbert. 1976. Woody plant invasion of unburned Kansas bluestem prairie. Journal of Range Management 29:19-23.

Bruner, W.E. 1931. The vegetation of Oklahoma. Ecological Monographs 1:100-188.

Clark, S.L. 2003. Stand Dynamics of an Old-Growth Forest in the Cross Timbers of Oklahoma. Ph.D. Dissertation, Oklahoma State University, Stillwater, OK.

Clark, S.L. and S.W. Hallgren. 2004. Age estimation of Quercus marilandica and Q. stellata: applications for interpreting stand dynamics. Canadian Journal of Forest Research 34:1353-1358.

Clark, S.L. and S.W. Hallgren. 2004. Can oaks be aged from bud scars? Southwestern Naturalist 49:243-246.

Clark, S.L. and S.W. Hallgren. 2004. Dynamics of oak (Quercus marilandica and Q. stellata) reproduction in an old-growth Cross Timbers forest. Southeastern Naturalist 2:559-574.

Clark, S.L., S.W. Hallgren, D.M. Engle and D.W. Stahle. 2004. Fire Events Coupled with Settlement and Drought Influence Stand Dynamics in a Xeric Quercus forest. Journal of Applied Ecology. IN REVIEW.

Costello, D.F. 1969. The Prairie World. Crowell Co. New York, NY.

de Pourtales, C. In: Spaulding, G.F., ed. 1832. On the Western Tour with Washington Irving; The journal and Letters of Count de Pourtales. University of Oklahoma Press, Norman, OK.

Duck, L.G. and J.B. Fletcher. 1944. A survey of the game and fur bearing animals of Oklahoma. Oklahoma Game and Fish Commission. State Bulletin. No. 3, Oklahoma City, OK.

Dyksterhuis, E.J. 1948. The vegetation of the western cross timbers. Ecological Monographs 18:327-376.

Dyksterhuis, E.J. 1957. The savanna concept and its use. Ecology 38:435-442.

Engle, D.M., T.G. Bidwell and R.E. Masters. 1996. Restoring Cross Timbers ecosystems with fire. Trans. North American Wildlife and Natural Resources Conference 61:190-199.

Ellsworth, H.L. 1832. A narrative of a tour of the Southwest in the year 1832. In: Williams, S.T. and B.D. Simison, eds. Washington Irving on the Prairie. 1937. American Book Co. New York, NY.

Elwell, H.M. 1970. Burning and 2,4,5-T on post and blackjack oak rangeland in Oklahoma. Oklahoma Agricultural Experiment Station, Stillwater, OK.

Engle, D.M. and J.F. Stritzke. 1995. Fire behavior and fire effects on eastern redcedar in hardwood leaf-litter fires. Int. J. Wildland Fire 5:135-141.

Foreman, C.T. 1947. The Cross Timbers. Star Printery. Muskogee, OK.

Gregg, J. 1844. in: Hanna. A. and W.H. Goetzman, eds. Commerce of the Prairies. J.B. Lippincott Co. Philadelphia, PA.

Grzybowski, J.A., D.H. Tazik and G.D. Schnell. 1994. Regional analysis of black-capped vireo breeding habits. Condor 96:512-544.

Hoagland, B.W. 2000. The vegetation of Oklahoma: a classification for landscape mapping and conservation planning. Southwestern Naturalist 45:385-420.

Hoagland, B.W., I.H. Butler, F.L. Johnson and S. Glenn. 1999. The Cross Timbers. In: R.C. Anderson, J.S. Fralish and J.M. Baskin (eds). Savannas, Barrens and Rock Outcrop Plant Communities of North America. Cambridge University Press, New York.

Irving, W. 1935. A Tour of the Prairies. Harlow Publ. Oklahoma City, OK. 252 pp.

Johnson, F.L. and P. G. Risser. 1971. Some vegetational-environment relationships in the upland forests of Oklahoma. Ecology 60:655-663.

Johnson, F.L. and P.G. Risser. 1973. Correlation analysis and annual ring index of central Oklahoma blackjack and post oak. American Journal of Botany 60:475-478.

Johnson, F.L. and P.G. Risser. 1975. A quantitative comparison between an oak forest and an oak savannah in central Oklahoma. Southwestern Naturalist 20:75-84.

Kennedy, R.K. 1973. An Analysis of Selected Oklahoma Upland Forest Stands Including Both Overstory and Understory Components. Ph.D. Dissertation, University of Oklahoma, Norman, OK.

Komarek, E.V. 1965. Fire ecology-Grasslands and man. In: Proceedings of the Annual Tall Timbers Fire Ecology Conference 4:169-220.

Komarek, E.V. 1974. Effects of fire on temperate forests and related ecosystems: Southeastern United States. 252-277. In: Kozlowski, T.T. and C.E. Ahlgren, eds. Fire and ecosystems. Academic Press, New York, NY.

Kuchler, A.W. 1974. A new vegetation map of Kansas. Ecology 55:586-604.

Masters, R.E., J.E. Skeen and J. Whitehead. 1995. Preliminary fire history of McCurtain County Wilderness Area and implications for red-cockaded woodpecker management 290-302. In: Kulhavy, D.L. and R. Costa, eds. Red-cockaded woodpecker: Species recovery, ecology and management Center for Applied Studies, Stephen F. Austin University, Nacogdoches, TX.

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

NatureServe. 2005. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 January 2005.

Powell, J. and D.P. Lowry. 1980. Oak (Quercus spp.) sprouts growth rates on a central Oklahoma shallow savanna range site. Journal of Range Management 33:312-313.

Penfound, W.T. 1962. The savanna concept in Oklahoma. Ecology 43:774-775.

Penfound, W.T. 1968. Influence of a wildfire in the Witchita Mountains Wildlife Refuge, Oklahoma. Ecology 49:1003-1006.

Rebertus, A.J. and B.R. Burns. 1997. The importance of gap processes in the development and maintenance of oak savannas and dry forests. Journal of Ecology 85:635-645.

Rice, E.L. and W.T. Penfound. 1959. The upland forests of Oklahoma. Ecology 40:593-608.

Risser, P.G. and E.L. Rice. 1970. Phytosociological analysis of Oklahoma upland forest species. Ecology 52:940-945.

Roe, S.A. 1998. The Vegetation of a Tract of Ancient Cross Timbers in Osage County, Oklahoma. M.S. Thesis, Oklahoma State University, Stillwater, OK. 86 pp.

Rossen, J.F. 1994. Quercus stellata growth and stand characteristics in the Quercus stellata Quercus marilandica forest type in the cross timbers region of central Oklahoma. In: Henderson, D. and L.D. Hedrick, eds. Proceedings of the North American Conference on Savannas and Barrens. Illinois State University, Normal IL.

Russell, F.L. and N.L. Fowler. 1999. Rarity of oak saplings in savannas and woodlands of the eastern Edwards Plateau, TX. Southwestern Naturalist 44:31-41.

Russell, F.L. and N.L. Fowler. 2002. Failure of adult recruitment in Quercus buckleyi populations on the Eastern Edwards Plateau, Texas. American Midland Naturalist 148:201-217.

Sapsis, D.B. and J.B. Kauffman. 1991. Fuel consumption and fire behavior associated with prescribed fire in sagebrush ecosystems. Northwest Science 65:173-179.

Schulz, C.A. and D.M. Leslie. 1992. Autumn and winter bird populations in herbicide-treated cross timbers in Oklahoma. The American Midland Naturalist 127:215-223.

Schulz, C.A., D.M. Leslie, R.L. Lochmiller and D.M. Engle. 1992. Herbicide effects on cross timbers breeding birds. Journal of Range Management 45:407-411.

Schmidt, Kirsten M., James P. Menakis, Colin C. Hardy, Wendel J. Hann and David L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Shutler, A. and B. Hoagland. 2004. Presettlement vegetation in the cross timbers, Carter County, Oklahoma, 1871. Oklahoma Academy of Science. 84:IN PRESS.

Stahle, D.W. and J.G. Hehr. 1984. Dendroclimatic Relationships of post oak across a precipitation gradient in the southcentral United States. Annals of the Association of American Geographers 74:561-573.

Stahle, D.W., J.G. Hehr, G.G. Hawks, M.K. Cleaveland and J.R. Baldwin. 1985. Tree-ring chronologies of the southcentral United States. Tree-Ring Laboratory and Office of the State Climatologists, University of Arkansas, Fayetteville, AR. 128 pp.

Stahle, D.W. and P.L. Chaney. 1994. A predictive model for the location of ancient forests. Natural Areas Journal 14:151-158.

Smeins, F. 1994. Cross timbers-Texas-Little bluestem-post oak. SRM 732. 107-108. In: Shiftlet, T.N., ed. Rangeland Cover Types of the United States. Soc. Range Management, Denver, CO.

Stein, H.F. and R.F. Hill eds. 1993. The Culture of Oklahoma. University of Oklahoma Press. Norman, OK.

Stroud, H.A. 1968. Conquest of the Prairies. Texan Press. Waco, TX.

Tharpe, B.C. 1923. Ecologic investigations in the Red River Valley. University of Texas Bulletin 2327:89-155

Tharpe, B.C. 1926. Structure of Texas vegetation east of the 98th meridian. University of Texas Bulletin 2606:1-172.

Trollope, W.S.W. 1984. Fire in savannah. 151-175. In: Booysen, P. de V. and N.M. Tainton, eds. Ecological Effects of Fire in South African Ecosystems. Springer-Verlag, New York, NY.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/.

Weaver, J.E. and F.E. Clements. 1938. Plant Ecology. 2nd ed. McGraw Hill. New York, NY. 601 pp.

White, A.S. 1986. Prescribed burning for oak savanna restoration in central Minnesota. Res. Pap. NC-266, USDA Forest Service, Washington, DC. 12.pp.

Wright, H.A. and A.W. Bailey. 1982. Fire Ecology. John Wiley and Sons, New York, NY. 501 pp.