# CHARACTERIZATION OF AN OLD-GROWTH FOREST IN THE CROSS TIMBERS OF OKLAHOMA

**S.L. Clark and S.W. Hallgren[1]**

## INTRODUCTION

Many cross timbers forests in central Oklahoma were neither extensively logged nor farmed and may contain some of the largest tracts of old-growth forests, particularly those dominated by oak, in eastern North America (Therrell and Stahle 1998). We studied a 90 ha old-growth forest in Osage County, Oklahoma which is one of the few designated forest preserves in the cross timbers. Our objectives were (1) to examine changes in species composition and structure across a topo-edaphic gradient and (2) to determine how well these stands conform to traditional models of old-growth stand structure.

## MATERIALS AND METHODS

We delineated three stands based primarily on aspect and elevation, sampled overstory and understory tree species, and evaluated site characteristics in randomly placed 0.3 ha plots in each stand. We used detrended correspondence analysis (DCA) to identify important gradients in species composition and canonical correspondence analysis (CCA) to determine if measured site characteristics could help explain such gradients. We fit the negative exponential and rotated sigmoid curves to the diameter distributions for *Quercus stellata* in each stand using least-squares regression. Distributions of estimated total and exposed crown area by diameter class were predicted from regression equations using measurements from a subset of *Q. stellata* trees.

## RESULTS AND DISCUSSION

*Q. stellata* dominated in all stands and *Q. marilandica* was the second most common overstory tree. *Juniperus virginia* was relatively rare as an overstory tree, but appeared to be increasing in abundance, particularly in the most open stand. The DCA and CCA revealed a moisture gradient along the first axis. More mesic tree species, such as *Q. velutina* and *Q. shumardii*, had the lowest scores along the first axis, while more xeric species, such as *Q. stellata* and *J. virginiana*, had the highest scores. Sandy soil texture and northeasterly slope positions were associated with more mesic forest species. Neither the negative exponential nor the rotated sigmoid curve accurately described the diameter distributions in any stand ($R^2$<0.95). The primary deviations from the models were the constant or increasing abundance from small to large saplings. The stands did not show equal allocation of growing area among size classes, but tended to have bimodal distributions with reduced crown area in the mid-diameter classes. These stands may exhibit natural population structures different than those of shade tolerant species growing in mesic forests, for which previously developed models of old-growth structure have been developed. However, deviations from models of balanced stand structure may be the result of recent fire disturbances.

## ACKNOWLEDGMENTS

This research was partially supported by the U.S. Army Corps of Engineers (contract DACW42-02-P-0043). We are grateful to The Wilderness Society for their support through the Gloria Barren Scholarship. The Nature Conservancy provided technical assistance and allowed access to the study site.

## LITERATURE CITED

Therrell, M.D.; Stahle, D.W. 1998. A predictive model to locate ancient forests in the Cross Timbers of Osage County, Oklahoma. Journal of Biogeography. 25: 847-854.

[1] Graduate Research Fellow and Associate Professor, Department of Forestry, Oklahoma State University, Stillwater, OK 74078, respectively.

*Citation for proceedings:* Spetich, Martin A., ed. 2004. Upland oak ecology symposium: history, current conditions, and sustainability. Gen. Tech. Rep. SRS–73. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 311 p.