

1994

Growth Models of Loblolly and Shortleaf Pine Red-Cockaded Woodpeckers Nesting Trees

W. D. Hacker

Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University

W. G. Ross

Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University

David Kulhavy

Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University, dkulhavy@sfasu.edu

Follow this and additional works at: <http://scholarworks.sfasu.edu/forestry>

 Part of the [Forest Sciences Commons](#)

Tell us how this article helped you.

Recommended Citation

Hacker, W. D.; Ross, W. G.; and Kulhavy, David, "Growth Models of Loblolly and Shortleaf Pine Red-Cockaded Woodpeckers Nesting Trees" (1994). *Faculty Publications*. Paper 319.

<http://scholarworks.sfasu.edu/forestry/319>

This Article is brought to you for free and open access by the Forestry at SFA ScholarWorks. It has been accepted for inclusion in Faculty Publications by an authorized administrator of SFA ScholarWorks. For more information, please contact cdsscholarworks@sfasu.edu.

GENERAL NOTES

GROWTH MODELS OF LOBLOLLY AND SHORLEAF PINE RED-COCKADED WOODPECKER NESTING TREES

W. DAVID HACKER, WILLIAM G. ROSS, AND DAVID L. KULHAVY

*Texas Department of Transportation, Division of Environmental Affairs,
Austin, Texas 78701 (WDH) and College of Forestry, Stephen F. Austin State University,
Nacogdoches, Texas 75962 (WGR, DLK)*

The red-cockaded woodpecker (*Picoides borealis* Viellot) was originally found throughout the pine forest region of the southeastern United States (USFWS, 1985) but is now on the endangered species list (USFWS, 1993). Red-cockaded woodpeckers excavate nesting and roosting cavities exclusively in living pine trees. Because of the fragmented nature of stands containing suitable cavity trees in the southern United States, and particularly in the loblolly (*Pinus taeda* L.) and shortleaf (*P. echinata* Mill.) pine stands in the national forests in Texas, intensive management is needed. Information on cavity tree growth parameters is one of many aspects of red-cockaded woodpecker ecology that needs to be explored to devise adequate management plans. The objective of this note is to develop height growth models based on age of loblolly and shortleaf pine red-cockaded woodpecker nesting trees.

Following a series of tornadoes, wind thrown red-cockaded woodpecker nesting trees from the Angelina and Davy Crockett National Forests in Texas were subjected to stem analysis. The trees were broken off in a random fashion by the tornadoes. They were then pieced back together to allow the fallen loblolly and shortleaf pine trees to be cut at the root collar and sectioned at 61 centimeter intervals. A section was removed from the top of each log. These sections were then taken to the laboratory where they were sanded and growth rings

TABLE 1. Regression coefficients and asymptotic standard errors for the Chapman-Richards function parameters.

Species	Regression Coefficient	Asymptotic Std. Error	r ²
both species			
b ₁	113.557	5.818	.969
b ₂	0.015	0.002	
b ₃	-0.107	0.054	
loblolly pine			
b ₁	106.767	9.085	.962
b ₂	0.015	0.004	
b ₃	-0.147	0.093	
shortleaf pine			
b ₁	140.940	8.496	.976
b ₂	0.010	0.001	
b ₃	-0.206	0.039	

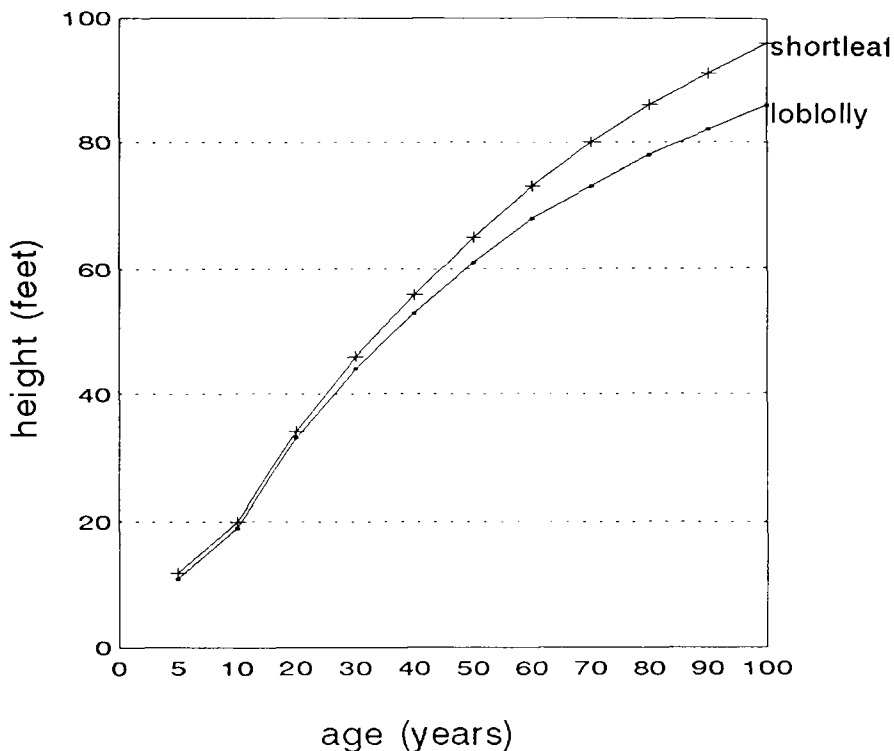


FIGURE 1. Relationship of height (feet) versus age (years) for loblolly pine and shortleaf pine.

counted and recorded. True heights within the bolts of wood were estimated using the technique recommended by Carmean (1972).

Sampled trees ranged in age from 77 years to 123 years with an average of 99 years and a standard deviation of 13.3 years. These trees ranged in height from 23.2 to 32.9 meters with a mean of 27.9 meters and a standard deviation of 3.0 meters. The stem analysis trees yielded 462 height-age pairs, of which, 179 were loblolly pine and 283 were shortleaf pine. Three trees were not used because heart rot rendered them useless. Because these trees were from nesting colonies of an endangered species, it was impossible to extract more data (barring another natural calamity).

A height growth model using the Chapman-Richards (1959, 1961) function:

$$Y = b_1 [1.0 - \text{EXP}(-b_2 * \text{Age})]^{1/(1-b_3)} \quad [1]$$

where: Y = Tree height (feet); b_i = parameters to be determined

produced an excellent fit ($r^2 = .969$) when applied to the entire data set. A plot of the residuals showed no adverse biases or trends. The same method was applied to the data by species. Regression coefficients, standard errors, and r^2 's for all regressions are shown in Table 1.

After inserting the regression coefficients from Table 1 into the Chapman-Richards function, the following equations resulted:

$$\text{loblolly pine Height} = 106.767 [1.0 - \text{EXP}(-0.015 * \text{Age})]^{0.872} \quad [2]$$

$$\text{shortleaf pine Height} = 140.940 [1.0 - \text{EXP}(-0.010 * \text{Age})]^{0.829} \quad [3]$$

When plotted, these models display curves (Fig. 1) that follow the growth patterns of trees

selected by red-cockaded woodpeckers for nesting. Because of the limited sample size, these models do not represent the universe of all loblolly and shortleaf pine cavity trees, but may be a useful reference for further studies.

LITERATURE CITED

- Carmean, W. H. 1972. Site index curves for upland oaks in the Central states. *Forest Sci.*, 18:102-120.
- Chapman, D. G. 1961. Statistical problems in population dynamics. Pp. 147-162, *in* Proceed. Fourth Berkeley symposium on mathematical statistics and probability (J. Neyman, ed.), Univ. Calif. Press, Berkeley, California.
- Richards, F. J. 1959. A flexible growth function for empirical use. *J. Exp. Bot.*, 10:290-300.
- U.S. Fish and Wildlife Service. 1985. Red-cockaded woodpecker recovery plan. U.S. Fish and Wildl. Serv., Atlanta, Georgia. 88 pp.
- U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants. U.S. Fish and Wildl. Serv., 50 CFR 17.11. 40 pp.

FIRST RECORD OF A NATIVE AMERICAN ELK
(*CERVUS ELAPHUS*) FROM TEXAS

RUSSELL S. PFAU

Department of Biology, Midwestern State University, Wichita Falls, TX 76308

Reported sightings of American elk in the 1800's (Bailey, 1905) indicate that this species inhabited certain regions of Texas, although there are no modern voucher specimens (Stangl et al., 1994) or fossil records (Dalquest and Schultz, 1992) to substantiate these claims. The first physical evidence of native *C. elaphus* from Texas is reported herein.

On 17 April 1993, the distal portion of a tibia (Fig. 1), identifiable as an adult *C. elaphus*, was found in a cutbank of a small tributary of Pony Creek, 11 km north-northeast of Seymour, Baylor County, Texas. The cutbank exposes fine clay sediments and three layers of gravel, each layer being about three inches thick. The tibia was at the base of the lowest gravel layer, two feet beneath the level of the surrounding flood plain.

The distal end of the tibia of *C. elaphus* differs from that of *Bison bison* in the following characters: longitudinal ridges (muscular lines) found on the posterior side of *B. bison* are absent in *C. elaphus*; a tuberosity present on the anterior side is positioned further from the distal end than in *B. bison* (Fig. 1A); the shaft in *C. elaphus* is more slender than that of *B. bison*.

A radiocarbon (mass spectrometer) date of 295 +/- 50 YBP (Beta Analytic, Inc. #62592) was obtained from a fragment of the bone. It is uncertain whether this specimen represents a member of a substantial population of elk that once lived in the area or only a wandering individual. There are many records of elk from Oklahoma, and a native population existed in the Wichita Mountains until 1881 (Stangl et al., 1992). It is quite possible, taking the wide ranging and migratory habits of this animal into account, that individuals occasionally wandered south from these areas. This specimen is housed in the Midwestern State University Collection of Fossil Vertebrates (MWSU 12946).

I wish to thank W. W. Dalquest and F. B. Stangl, Jr. for their help in preparing this manuscript and Jesse Rogers, Academic Vice President of Midwestern State University, for funding the age determination of the bone.