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DIMENSIONALITY FROM OBSCURITY: REVISITING HISTORICAL SOURCES OF BIG TREE SIZE

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ABSTRACT.—Maximum tree dimensions are becoming increasingly sought-after information. However, scientific literature contains little on big trees, and champion tree registers often feature atypical individuals. Obscure historical sources can supplement estimates of maximum tree size. Many of these outlets are promotional and hence biased towards large trees. For example, a railroad company booklet contained a photograph of a white oak (*Quercus alba*) almost 7 feet in diameter, 125 feet tall, with a 100-foot wide crown. The *American Lumberman*, a trade journal from the early 20th Century, specialized in timber company narratives. Their articles are valuable for dimensioning trees because they often highlight "trophy" individuals like an oak from an Arkansas bottomland that scaled 10,000 board feet. Less commercially prominent taxa were sometimes mentioned, such as a persimmon (*Diospyros virginiana*) 108 inches in circumference and 120 feet tall from a pamphlet by Arkansas Commission of the Panama-Pacific International Exposition. Other potential sources include public land surveys, old journals, historical society memoirs (especially those before 1900), 19th Century state geology reports, and early soil surveys. Obscure historical resources benefit from their proximity to presettlement periods, but may also be affected by exaggeration, selection bias, or imprecise measurement and thus should be carefully evaluated.

Introduction

There are old-growth forests in eastern North America for which the trees are of very modest stature. For instance, the Cross Timbers region of Oklahoma and Texas is exemplified by post (*Quercus stellata*) and blackjack (*Quercus marilandica*) oak-dominated upland forests in which 200 to 500 yr old individuals rarely exceed 25 inches in diameter at breast height (DBH) and 50 feet tall (Therrell and Stahle 1998). Cliff faces and talus slopes also harbor very old (up to 1000 yr) and stunted northern white-cedars (*Thuja occidentalis*) (Kelly and others 1992). In addition to limiting tree size, harsh site conditions often restrict access and produce trees of poor form, thus greatly decreasing their economic value. This has helped protect some ancient forests from commercial exploitation, resulting in numerous examples of poor site old-growth surviving to modern times. Since many of these stands are largely untouched, they can act as suitable models for defining reference conditions. Unfortunately, virtually all accessible and productive eastern forests have experienced extensive logging and land clearing.

In recent decades, public land managers have invested considerable time and resources to the restoration of good sites to stands with old-growth-like attributes (for example, Vora 1994). To assist these efforts, a number of diagnostic old-growth features have been described (for example, Hunter 1989, Hunter and White 1997, Franklin and others 2002, Keddy and Drummond 1996, Rusterholz 1996). A fundamental characteristic of old-growth on good sites is an abundance of big trees (Martin 1992, Gaines and others 1997). However, the nature of tree dimensionality in old-growth leads to a number of critical questions. For example, if size is to be a defining factor in presettlement forest restoration, how big is big enough? Will dimensions gathered from modern forests correspond to those found in virgin landscapes? What are the best sources of maximum species dimensions, and how reliable are they?

A number of contemporary reports on big tree size are available. *American Forests* publishes a champion tree register listing native and naturalized tree species in the United States (American Forests 2003). In

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addition to this national register, other organizations like the Eastern Native Tree Society (ENTS) and many states have begun maintain their own champion lists. However, big tree registers often feature atypical (for example, multi-stemmed) individuals and are frequently incomplete. Furthermore, their scoring systems tend to favor open-grown individuals, which are architecturally different than trees from closed forests. With the possible exception of the ENTS database, there is also a degree of uncertainty in some of the dimensions of champion lists because of inadequate measurement techniques.

The scientific literature contains limited information on maximum tree dimensions. A number of journal publications provide data on big trees in some study areas (for example, Baldwin 1951, Bromley 1935, Jones 1997, Laughlin 1947, Lindsey and others 1961, Rood and Polzin 2003). May (1990) produced a list of big trees from the USDA Forest Service Forest Inventory and Analysis databases. May's forest survey sample is very extensive and inclusive, but since the FIA plots are systematically located, they will miss most of the biggest trees in the highly fragmented forests of the eastern United States. Other sources like silvics guides (for example, Folwells 1965) or dendrology textbooks (for example, Harlow and others 1979) report selected big trees, usually gathered from published national champion lists.

Historical sources from the 19th and early 20th Centuries can supplement dimensionality for many species. These resources tend to be obscure, often promotional, yet can be surprisingly informative. They also have the benefit of being from a period much closer to presettlement times. General Land Office (GLO) survey notes, promotional brochures, trade journal articles, and even postcards can provide at least qualitative information on the dimensions of big trees. This effort evaluates a number of examples of the forest giants mentioned in these outlets.

Methods

The information for this paper was developed in an effort to restore old-growth-like conditions to upland loblolly (*Pinus taeda*) and shortleaf (*P. echinata*) forests in southeastern Arkansas. Even though this study focused on pine old-growth, champion-sized hardwoods were frequently encountered while describing the reference conditions of this area (Bragg 2002, 2003). Arkansas GLO survey notes were transcribed from the compact disk archives they are stored in, entered into a spreadsheet, and then summarized to produce maximum tree diameters by surveyor tree identification. All other dimensional information was taken from captions, photographs, or articles.

Results

GLO Survey Notes

Table 1 lists the largest individuals from selected species used by GLO surveyors in the Ashley County, Arkansas area (Bragg 2003) and the national and state champion trees listed by American Forests (2003) and Arkansas Forestry Commission (2002), respectively. It should be noted that the GLO information in Table 1 came from a single county in Arkansas, and that some species (for example, *Betula nigra*, n = 11) had a very limited sample size.

Only a few species in the Ashley County GLO notes proved to be larger than the big tree lists. A pine (almost certainly loblolly) from the Ouachita River flatwoods had a larger diameter (72 inches) than either the current national champion loblolly pine (59.2 inches DBH) or the former state champion (58.6 inches DBH). The largest white oak (*Quercus alba*) (70 inches), pin oak (probably *Q. nigra* or *Q. phellos*) (78 inches), and baldcypress (*Taxodium distichum*) (144 inches) from the GLO records were bigger than the current Arkansas champions.

Other Government Publications

Concerned with a looming timber "famine" and severe environmental problems related to uncontrolled logging and land clearing, government agencies issued a number of advisory reports to Congress or the President in the latter parts of the 19th Century and the early 20th Century. Some of these volumes (for instance, Wilson 1902) contain historical photographs of impressively large trees. As an example, Ayres

Table 1.—Diameters of big trees extracted from the Ashley County GLO survey (Bragg 2003) and compared to current national and Arkansas champions.

Surveyor tree name	Probable species[a]	Ashley County GLO n[b]	Ashley County GLO max.	American Forests (2003)	AFC big trees (2002)[c]
			DBH (in.)		
Pine	*Pinus echinata* or *P. taeda*	2200	72	55.4[d]-59.2	35.7-58.6
White oak	*Quercus alba*	1167	80	121.6	73.2
Sweet gum	*Liquidambar styraciflua*	872	70	88.5	n/a[e]
Pin oak	*Q. phellos* or *Q. nigra*	675	78	82.4-91.0	74.2-75.4
Overcup oak	*Q. lyrata*	588	54	82.1	n/a
Black gum	*Nyssa sylvatica*	408	40	73.8	64.3
Red oak	*Q. falcata* or *Q. pagoda*	344	60	99.3-108.9	87.9-95.8
Pecan	*Carya illinoensis*	206	40	85.0	77.3
Cypress	*Taxodium distichum*	173	144	205.0	143.6
Persimmon	*Diospyros virginiana*	127	24	28.0	46.2
Holly	*Ilex opaca*	65	16	39.8	36.9
Dogwood	*Cornus florida*	61	12	36.3	19.4
Sassafras	*Sassafras albidum*	58	30	83.4	73.8
Tupelo gum	*Nyssa aquatica*	18	72	107.0	n/a
Water birch	*Betula nigra*	11	36	66.2	47.4

[a] Probable contemporary species name identified by the surveyor.
[b] Number of tree records from Ashley County GLO of this species.
[c] Unpublished list of state big trees maintained by the Arkansas Forestry Commission (AFC).
[d] Where two species are probable, both diameters are provided in the order listed.
[e] No current state champion.

and Ashe (1902) included a picture of men standing next to a chestnut (*Castanea dentata*) that may exceed 9 feet in diameter (fig. 1).

Figure 1.—Giant chestnut in the southern Appalachians, circa 1900 (picture from Ayres and Ashe (1902)).

Other potentially valuable government reports may include "working plans" developed by professional foresters for landowners to help them learn how to sustainably manage their forests. These reports (for example, Foster 1912, Olmsted 1902, Reed 1905) focus on the commercial aspects of forestry, but often contain valuable pictures, graphs, and tables of virgin timber.

Promotional Literature

A booklet produced by the St. Louis, Iron Mountain, and Southern Railway (SLIMSR) touting their Arkansas lands contained a photograph (fig. 2) of a white oak that was 6.8 feet in diameter, 125 feet tall, with a 100-foot wide crown (SLIMSR 1892). This booklet is a classic example of self-promotion since the SLIMSR was interested in selling as much of their timberland as possible. However, there is no evidence to suggest that the size of this white oak had been exaggerated or otherwise falsified.

Even though most historic photographs concentrate on commercial timber species, less prominent taxa are sometimes included. As an example, a pamphlet from the Arkansas Commission of the Panama-Pacific International Exposition contained an image of a persimmon (*Diospyros virginiana*) 108 inches

in circumference and 120 feet tall near Luxora, Arkansas (Hutchins 1915). While no crown width was reported in the caption, its other dimensions are easily as large as the current national champion (American Forests 2003).

Postcards were often used as a marketing tool. This compact medium of local features were inexpensively produced, and hence made popular advertisements. Two postcards from a recently published collection (Hanley 2000) showed massive oak logs cut from the Mississippi River bottomlands of eastern Arkansas. One included a caption describing a 12-foot log that scaled 2,160 board feet. Assuming the Doyle scale of sawtimber volume, it is possible to back-calculate a 58 inch small-end diameter for this log. While probably not typical of oak in the virgin forest, the soundness of these large sawlogs shows that it is possible to grow very large, quality hardwoods.

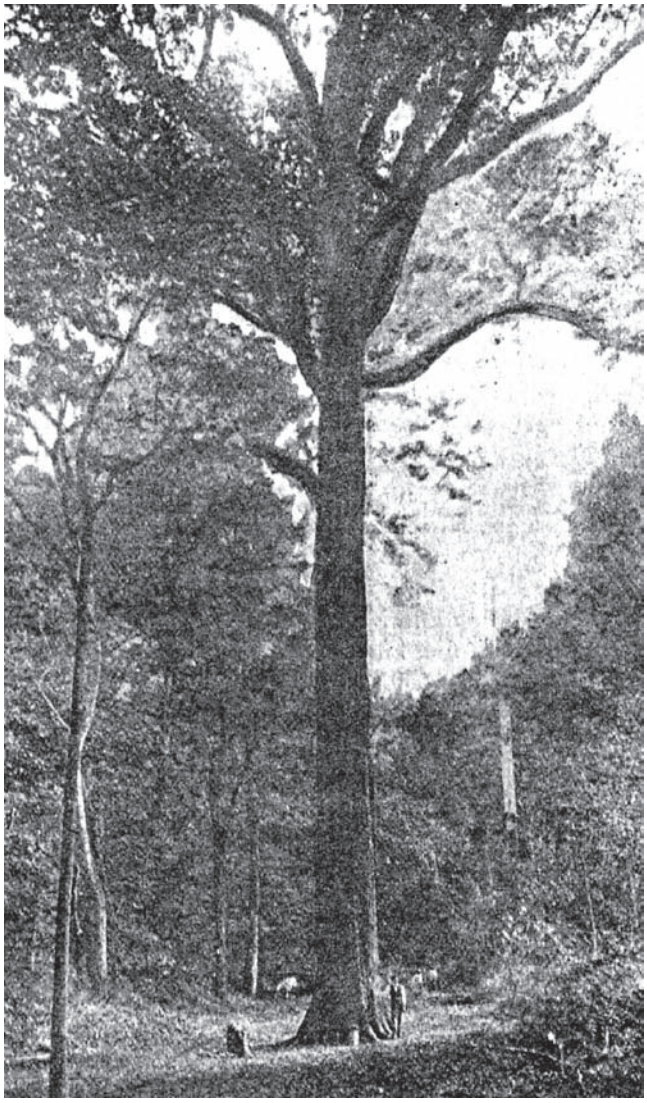

Figure 2.—A large white oak on the lands of the St. Louis, Iron Mountain, and Southern Railway (picture from SLIMSR (1892)).

Early Journals

The *American Lumberman*, a trade journal from the early 20th Century, specialized in timber company narratives. *American Lumberman* articles usually included photographs of mill staff, products, equipment, and forestlands. Their descriptions are valuable in dimensioning large trees because many highlight "trophy" individuals. For instance, a single red oak (*Quercus falcata* or *Quercus pagoda*) from an Arkansas bottomland was estimated to scale 10,000 board feet (Doyle) (Anonymous 1909). Other brief notes on big hardwoods are sprinkled throughout this magazine, including an Indiana white oak log 88 feet long and nearly 4 feet in diameter at the butt, with very little taper (Anonymous 1903a) and an Ohio walnut (probably *Juglans nigra*) that yielded a 75-foot long clear bole 8 feet in diameter at the base (Anonymous 1903b).

Another helpful feature of *American Lumberman* photographs is that many were geographically referenced. According to its accompanying caption, the red oak from the preceding paragraph was located in section 31 of township 6 south, range 14 west, Grant County, Arkansas. Many stands are located even more precisely than this, sometimes down to a 40-acre parcel.

Other old periodicals can contain useful big tree information. *Garden and Forest*, one of the earliest forestry journals, would occasionally publish captioned photographs of large trees like the American beech (*Fagus grandifolia*) in Figure 3. An accompanying article (Sargent 1895) stated that this beech had a circumference of 9.5 feet at 6 feet above the ground and a crown spread over 130 feet wide. Assuming a conservative height of 80 feet, this tree had a "bigness index" of approximately 470 points, besting the current national champion by almost 10% (American Forests 2003). Langtree (1867) described very large hardwoods in the presettlement forests of Arkansas, including cottonwood (probably *Populus deltoides*) that reached 6 feet in diameter and bottomland oaks greater than 4 feet in diameter. Leech (1939) described an eastern white pine (*Pinus strobus*) cut from the virgin forests of Alger County, Michigan. This five-forked pine was 7.5 feet in diameter on the stump and yielded sixteen logs 16 feet long and a 12-foot long butt log.

Figure 3.—A massive American beech from South Hingham, Massachusetts. This individual scored a "bigness index" of 470 (picture from Sargent (1895)).

The JSTOR and *Making of America* online archives have also provided new venues for tree dimensionality. JSTOR's botany and ecology collection of key scientific journals includes volumes that date back well into the 19th Century. These old journals often documented peoples' travels and experiences in a format that would not be considered by most modern technical outlets. For example, a well-traveled former land surveyor named Jonathan T. Campbell imprecisely described an oak near Rockville, Indiana that "…was over six hundred years old…[and] between six and seven feet in diameter…" (Campbell 1885, p. 843). Campbell also reported very large sycamore (*Platanus occidentalis*) and a water elm (possibly *Planera aquatica* or some species of *Ulmus*) five feet in diameter along the Wabash River bottom. Another historical reference, adapted from an early silvics text by D.J. Browne, mentions a white oak estimated to be "twenty-four to twenty-seven feet in circumference at the smallest part of the trunk." (presumably, above the buttress) (Anonymous 1837, p. 345).

Discussion

Historical information sources are valuable additions to the data available on the maximum dimensions of tree species in eastern North America, but they must be viewed cautiously. One concern is that they may be more fiction than fact, and since they were described many decades ago, there is very little chance of ever validating a claim. However, exaggeration is not simply a historical phenomena, as it is not uncommon to find modern statements that cannot be supported. Second, the accuracy and reliability of the dimensions reported are unclear, as rarely was any mention made of how the measurements were taken. Even the observations made by professionals trained in some aspects of mensuration (like land surveyors) can be imprecise.

GLO notes can prove very useful in developing maximum tree diameter information. However, it is important to recognize some of the limitations of GLO notes (Bragg 2003). First, tree species identifications are sometimes vague, making the notes unavailable for a number of taxa. Second, witness and line trees were not selected for their size, but rather to facilitate the surveying process. Hence, there may be biases against very large trees or understory taxa that rarely reached sufficient size for scribing. Finally, diameter was estimated rather than measured using techniques inconsistent with current forestry standards.

Many historical outlets are promotional and biased toward large trees, but so long as exaggerated reports are avoided, this propensity is advantageous. A classic example of a fraudulent claim would be the rail car-sized produce commonly used in tongue-in-cheek postcards (even to this day). The use of "boosterism" arose from the desire of interested parties to sell and settle their lands, or to increase their prominence. Hence, when it came time to take expensive pictures, the photographer would often be led to particularly large (trophy) individuals. Fortunately, since people, horses, or other familiar objects were usually placed in the image as well, a de facto scale was provided to ensure claims of tree size are not too unbelievable (although even historical photographers were capable of doctoring images). The proclivity for showcasing the biggest of the trees, while detrimental for determining average or typical stand conditions, can help define maximum size.

Other potentially valuable but rarely used sources of big tree size include historical society memoirs (especially those dating to before 1900), early state geology reports, and possibly the first soil surveys. In reality, any reliable source that dates back a century or more could prove useful because of how much closer in time they were to virgin conditions. It is also likely that, almost without exception, these giants still represent underestimates of maximum tree size.

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Literature Cited

American Forests. 2003. **National register of big trees.** [online]. Available: http://www.americanforests.org/resources/bigtrees/register.php

Anonymous. 1837. **American forest trees.** The North American Review. 44: 334-361.

Anonymous. 1903a. **A forest leviathan.** American Lumberman. February 7, 1903 issue: 14.

Anonymous. 1903b. **That big walnut tree.** American Lumberman. March 7, 1903 issue: 15.

Anonymous. 1909. **Rise, progress and resources of the Bluff City Lumber Company, Pine Bluff, Ark. and the Clio Lumber Company, Clio, Ark.** American Lumberman. July 17, 1909 issue: 67-114.

Arkansas Forestry Commission. 2002. **Native champion trees of Arkansas.** Unpublished table. Little Rock, AR: Arkansas Forestry Commission. 5 p.

Ayres, H.B.; Ashe, W.W. 1902. **Forests and forest conditions in the southern Appalachians**. In: Wilson, J., comp. Message from the President of the United States transmitting a report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the southern Appalachian region. Washington, DC: Government Printing Office: 45-60.

Baldwin, H.I. 1951. **A remnant of old white pine-hemlock forest in New Hampshire.** Ecology. 32: 750-752.

Bragg, D.C. 2002. **Reference conditions for old-growth pine forests in the Upper West Gulf Coastal Plain.** Journal of the Torrey Botanical Society. 129: 261-288.

Bragg, D.C. 2003. **Natural presettlement features of the Ashley County, Arkansas area**. American Midland Naturalist. 149: 1-20.

Bromley, S.W. 1935. **The original forest types of southern New England.** Ecological Monographs. 5: 61-89.

Campbell, J.T. 1885. **Age of forest trees.** American Naturalist. 19: 838-844.

Foster, J.H. 1912. **Forest conditions in Louisiana.** Bull. 114. Washington, DC: U.S. Department of Agriculture, Forest Service. 39 p.

Fowells, H.A. (compiler) 1965. **Silvics of forest trees of the United States.** Agric. Handb. 271. Washington, D.C.: U.S. Department of Agriculture, Forest Service. 762 p.

Franklin, J.F.; Spies, T.A.; Van Pelt, R.; and others. 2002. **Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir as an example.** Forest Ecology and Management. 155: 399-423.

Gaines, G.; Arndt, P.; Croy, S.; and others. 1997. **Guidance for conserving and restoring old-growth forest communities on national forests in the southern region.** For. Rep. R8-FR 62. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 118 p.

Hanley, S.G. 2000. **Arkansas at work: 1900-1925.** Charleston, SC: Arcadia Publishing. 128 p.

Harlow, W.M.; Harrar, E.S.; White, F.M. 1979. **Textbook of dendrology. 6th ed.** New York: McGraw-Hill Book Co. 510 p.

Hunter, M.L. 1989. **What constitutes an old-growth stand?** Journal of Forestry. 87: 33-35.

Hunter, M.L.; White, A.S. 1997. **Ecological thresholds and the definition of old-growth forest stands.** Natural Areas Journal. 17: 292-296.

Hutchins, R.M. 1915. **Timber resources.** In: Keeley, J.F., ed. Arkansas and her resources. Little Rock, AR: Little Rock Publishing Company: 18-19.

Jones, R.H. 1997. **Status and habitat of big trees in Congaree Swamp National Monument.** Castanea. 62: 22-31.

Keddy, K.A.; Drummond, C.G. 1996. **Ecological properties for the evaluation, management, and restoration of temperate deciduous forest ecosystems.** Ecological Applications. 6: 748-762.

Kelly, P.E.; Cook, E.R.; Larson, D.W. 1992. **Constrained growth, cambial mortality, and dendrochronology of ancient *Thuja occidentalis* on cliffs of the Niagara Escarpment: an eastern version of bristlecone pine?** International Journal of Plant Science. 153: 117-127.

Langtree, C. 1867. **Arkansas—its advantages to immigrants.** Debow's Review. 3: 68-73.

Laughlin, K. 1947. **Big trees of the Midwest.** American Midland Naturalist. 37: 788-796.

Leech, C.A. 1939. **Pictures of Michigan lumbering.** Michigan History Magazine. 23: 337-349.

Lindsey, A.A.; Petty, R.O.; Sterling, D.K.; Van Asdall, W. 1961. **Vegetation and environment along the Wabash and Tippecanoe Rivers.** Ecological Monographs. 31: 105-156.

Martin, W.H. 1992. **Characteristics of old-growth mixed mesophytic forests.** Natural Areas Journal. 12: 127-135.

May, D.M. 1990. **Big trees of the Midsouth forest survey.** Res. Note SO-359. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 17 p.

Olmsted, F.E. 1902. **A working plan for forest lands near Pine Bluff, Arkansas.** Bull. No. 32. Washington, D.C.: U.S. Department of Agriculture, Bureau of Forestry. 48 p.

Reed, F.W. 1905. **A working plan for forest lands in central Alabama.** Bull. No. 68. Washington, D.C.: U.S. Department of Agriculture, Forest Service. 71 p.

Rood, S.B.; Polzin, M.L. 2003. **Big old cottonwoods.** Canadian Journal of Botany. 81: 764-767.

Rusterholz, K.A. 1996. **Identification and protection of old growth on state-owned land in Minnesota**. In: Davis, M.B., ed. Eastern old-growth forests: prospects for rediscovery and recovery. Washington, DC: Island Press: 233-244.

Sargent, C.S. 1895. **The winter aspect of trees**. Garden and Forest. 8: 121, 125.

SLIMSR. 1892. **Arkansas: an accurate and reliable description of the State of Arkansas for the information of the farmer, the home-seeker, and the investor.** St. Louis, MO: Woodward and Tiernan Printing Co. 37 p.

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.

Vora, R.S. 1994. **Integrating old-growth forest into managed landscapes: a northern Great Lakes perspective.** Natural Areas Journal. 14: 113-123.

Wilson, J. (comp.). 1902. **Message from the President of the United States transmitting a report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the southern Appalachian region.** Washington, DC: Government Printing Office. 210 p.